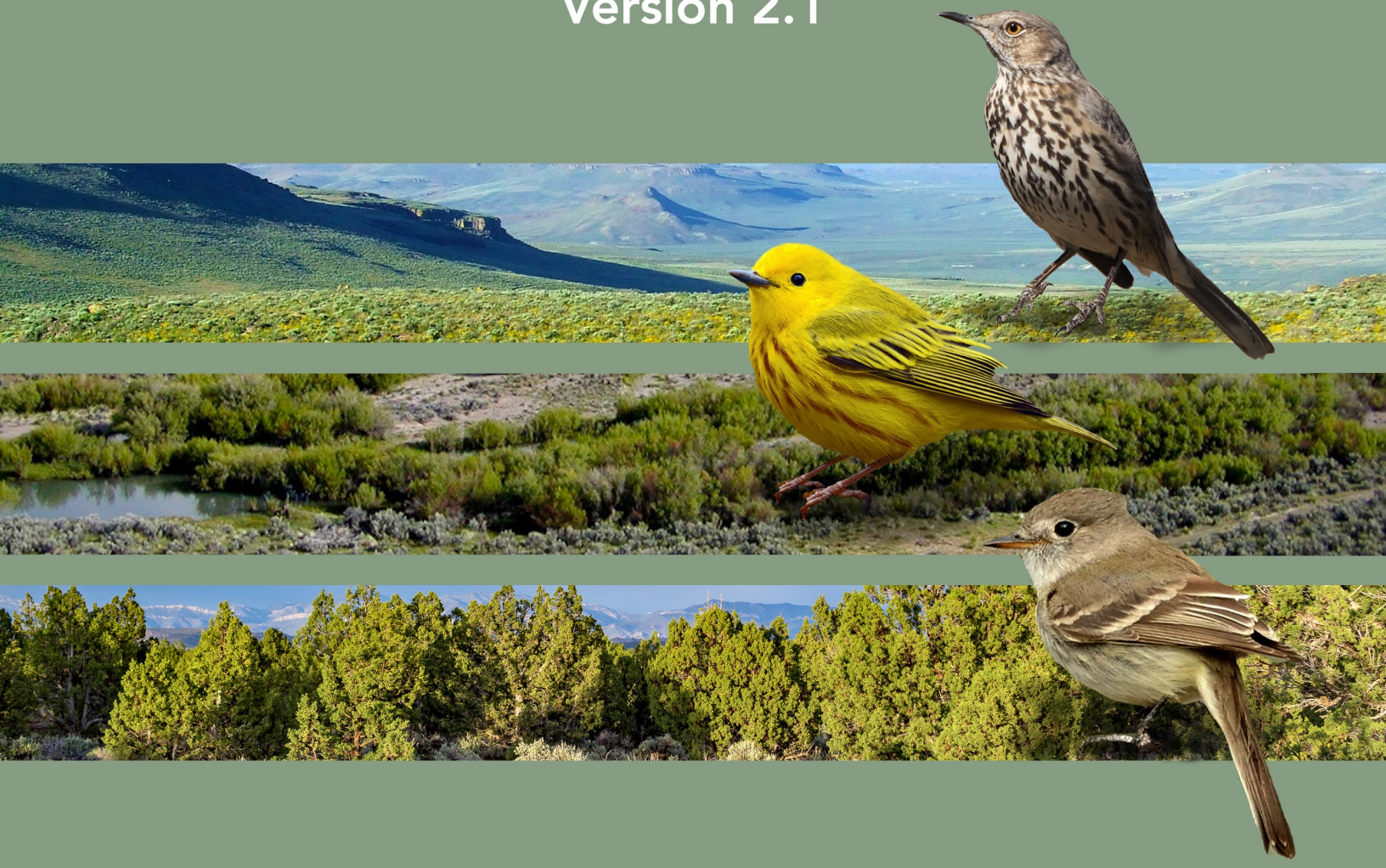
Conservation Strategy for Landbirds in Sagebrush-Steppe and Riparian Habitats of Eastern Oregon and Washington

Version 2.1



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AMERICAN BIRD CONSERVANCY

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Prepared for:

Oregon-Washington Partners in Flight

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Executive Summary

High elevation sagebrush-steppe habitat by Aaron Holmes

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

Recommendations included in this document are presented to assist the planning efforts and habitat management actions of land managers, and stimulate monitoring and research to support landbird conservation. Progress towards biological objectives presented here will support the recovery of significantly depleted populations, direct conservation for an array of desired bird-habitat conditions in priority habitats, and promote the long-term persistence of healthy populations of native bird species well-distributed across their historic ranges. 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 populations of landbirds.

The Environment, Birds, and Conservation Issues

The Columbia Plateau and Great Basin regions of eastern Oregon and Washington include mostly mid-elevation (1,200 - 2,000 m), non-forest cover types with some juniper and riparian woodlands. The planning unit covered by this document encompasses several ecoregions including the Owyhee Uplands, Northern Great Basin (sometimes referred to as Basin and Range), and High Lava Plains in Oregon, the Palouse Prairie in Washington, and the Columbia Basin in Washington and Oregon (Franklin and Dyrness 1973). Geographic boundaries are not rigorously defined, but are dependent on the presence of our priority habitats. For the purposes of consistency with the Interior Columbia Basin Ecosystem Management Plan (ICBEMP; ICMIET 2014), we use the boundaries of their Northern Great Basin and Owyhee Uplands Ecological Reporting Units (ERUs) (Wisdom et al. 2000) for our ecoregions of the same name.

However, we separate their Columbia Plateau ERU into three ecoregions: Columbia Basin in Oregon and Washington, High Lava Plains in Oregon, and Palouse Prairie in Washington. We also extend a narrow portion of the Columbia Basin ecoregion up the Okanagan Valley to the Canadian border into what is part of the ICBEMP Northern Glaciated Mountains ERU (Figure 1). We hereafter refer to the geography covered by this plan as eastern Oregon and Washington, although we exclude forested parts of the Blue Mountains and Northern Glaciated Mountains.

There are approximately 129 regularly breeding landbird species in this region (Altman and Holmes 2000). There are no endemic landbird species, but several species are dependent upon sagebrush-steppe vegetation. These include the sagebrush-steppe obligates: Greater Sage-Grouse, Sagebrush Sparrow, Sage Thrasher, and Brewer's Sparrow.

Other, non-obligate species primarily confined to this region within Oregon and Washington include Burrowing Owl, Swainson's Hawk, Ferruginous Hawk, Loggerhead Shrike, Long-billed Curlew, Sharp-tailed Grouse, Upland Sandpiper, and Black-throated Sparrow.

Landbird conservation issues are diverse, and vary in scale from local land use decisions to changes in ecological processes at landscape scales. Most of the challenges of landbird conservation arise either directly or indirectly from conflicts with the human footprint that result in habitat changes and alteration of natural ecological processes.

For many migratory species, issues occurring outside the geographic scope of this document are also likely affecting their breeding populations, perhaps even more significantly than local or regional issues. Some of the primary conservation issues for landbirds and their habitats in eastern Oregon and Washington include habitat fragmentation, changes to historic wildfire regimes, changes to hydrology, intensive livestock grazing, invasive plant species, and climate change.

Goals and Process

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

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

Bluebunch wheatgrass native steppe by Aaron Holmes

The process described above can be implemented in conjunction with other land management priorities to best meet multiple objectives. These actions will likely provide added support for the prevention of listing of landbird species as threatened or endangered.

When this ecosystem-driven conservation strategy is fully implemented at large geographic scales, the aggregated effect will be the creation of landscapes that should function to conserve all landbird species and communities.

Priority Habitats

Two habitat types and one habitat category that includes several habitat types were considered to be priorities in this document:

- Sagebrush-Steppe
- Riparian
- Unique Habitats, including aspen stands, mesic meadows (which have largely been converted to agricultural fields), and juniper woodland

Focal Species

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 focal bird species as indicators of habitat components and determines current and desired conditions, recommends prescribed habitat 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.

Our strategy for achieving ecologically functional habitats for landbirds is described through the habitat requirements of 19 focal species. By managing for a suite of species representative of important habitat components, many other species

and elements of biodiversity will also be conserved. The following landbird focal species were selected based on their degree of association with important habitat attributes of various habitat types in eastern Oregon and Washington (Table 1).

Table 1. Focal landbird species and their associations with key habitat attributes of sagebrush-steppe, riparian, and unique habitats of eastern Oregon and Washington. Asterisks denote species that are not present in all subregions (see Tables 4-6 for details).

Habitat Subtype	Habitat Attribute	Focal Species
SAGEBRUSH-STEPPE		
Steppe	*native bunchgrass cover*	Grasshopper Sparrow
Sagebrush	*sagebrush cover*	Brewer's Sparrow
	large unfragmented patches of Wyoming big sagebrush	Sagebrush Sparrow
	mesic areas with mountain big sagebrush	Green-tailed Towhee
	sagebrush height	Sage Thrasher
Steppe-shrubland	*interspersion of tall shrubs and openings*	Loggerhead Shrike
	bare ground cover	Horned Lark
Shrubland	*ecotonal edges of herb, shrub, and tree habitats*	Lark Sparrow
	upland, sparsely vegetated desert scrub	Black-throated Sparrow*
Juniper-steppe	*savannah with scattered mature juniper trees*	Mountain Bluebird
RIPARIAN		
Woodland	*large snags, particularly cottonwood*	Lewis's Woodpecker
	large canopy trees	Bullock's Oriole
	subcanopy cover	Yellow Warbler
	dense shrub cover	Yellow-breasted Chat
Shrubland	*shrub density*	Willow Flycatcher
	shrubs interspersed with herbaceous patches	Lazuli Bunting
UNIQUE HABITATS		
Aspen stands	*large trees and snags with regeneration*	Red-naped Sapsucker*
Agricultural fields	*mesic conditions*	Bobolink*
Juniper woodland	*mature juniper with regeneration*	Gray Flycatcher*

Loggerhead Shrike by James Livaudais

Biological Objectives and Habitat Strategies

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

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

The types of biological objectives presented include:

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

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

Implementation

Because of the diversity of landbird species and habitat types of eastern Oregon and Washington, conservation will require a complex array of conditions within variable landscape patterns. Implementation will also likely require the need for areas that function naturally with limited or no management intervention (e.g., some federal lands), and areas where desired landbird habitat conditions will need to be achieved by incorporating a wide range of habitat management and restoration

activities within a working landscape of various land uses (e.g., agriculture, livestock grazing, recreational, etc.).

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

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

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

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

- Maintain existing areas of moderate- to high-quality sagebrush-steppe and riparian vegetation, and actively manage to promote their resilience and resistance.
- Enhance size and connectivity of existing high-quality sagebrush-steppe and riparian habitat patches (i.e., reduce fragmentation).
- Avoid or minimize further degradation of sagebrush-steppe and riparian habitat (e.g., reduce, eliminate, or better manage livestock grazing; promote natural fire and hydrological regimes).
- Restore habitats where possible by replacing invasive grasses and forbs (in sagebrush-steppe), exotic trees and shrubs (in riparian), and/or planting sagebrush (in shrublands).
- Maintain or promote multiple vegetation layers in riparian woodlands, and preserve all large tracts of cottonwood gallery forest regardless of understory.
- Minimize or discontinue use of pesticides wherever possible.
- Remove juniper trees where they encroach upon historic sagebrush-steppe habitat; maintain historic areas of juniper savannah and woodlands.

Monitoring, Research, and Adaptive Management

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

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

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

Short-eared Owl, a PIF "Common Species in Steep Decline," by Frank Lospalluto

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, and landscape-oriented partnerships.

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. Bird Conservation Regions (BCRs) are desirable ecological units for the planning, delivery, and tracking of bird conservation, and have been identified and described under the North American Bird Conservation Initiative (*nabci-us.org/resources/bird-conservation-regions/*).

Migratory Bird Joint Ventures

Under the vision of NABCI, Migratory Bird Joint Venture partnerships 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 and 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 of Joint Ventures to address "all-bird, all-habitat" conservation.

There are currently 22 Joint Venture partnerships within North America, including the Intermountain West Joint Venture (IWJV; *www.iwjv.org*), which encompasses the geographic scope of this document. The focus of the IWJV is on empowering partnerships to enhance delivery of science-based habitat conservation. The primary ways in which the IWJV partnership is advancing landbird conservation are through the development of habitat and population objectives for selected priority landbird species as part of their Implementation Plan (IWJV 2013), and through support of habitat protection, management, and restoration activities by diverse partners, with a strong focus on private lands and Farm Bill programs and practices. They also provide decision support tools to inform management decisions (e.g., HABPOPS database; *www.data.pointblue.org/partners/iwjv/*), and continue to play a key role in the delivery of the Sage Grouse Initiative (*www.sagegrouseinitiative.com*).

In recent years, with the emergence of NABCI, Joint Ventures are being viewed as an important delivery mechanism for the conservation of all birds and their associated habitats. 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 and habitat objectives in the Desired Characteristics for Habitat Joint Venture Partnerships put forth by PIF (Andres et al. 2020).

Sage Thrasher by Michael J Thompson

Purpose and Scope

Purpose

This document is intended to support both the development of conservation or management plans, and the implementation of on-the-ground habitat management activities that have the potential to benefit breeding bird populations in sagebrush-steppe, riparian, and unique habitat types of eastern Oregon and Washington (we hereafter refer to this geography as eastern Oregon and Washington, although this plan excludes forested parts of the Blue Mountains and Northern Glaciated Mountains; see Figure 1). 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. It is assumed that users of this document already have an interest in managing for bird habitat or bird populations as one of several objectives that land managers must typically balance. The purpose of this document is to provide those interested in landbird conservation with information and recommendations on:

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

Mountain big sagebrush with native grass understory by Aaron Holmes

Version 2.1

This document is an update of *Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington* (Altman and Holmes 2000). Among PIF bird conservation plans nationally, one of the unique features of Version 1.0 of the Oregon-Washington PIF bird conservation plans is 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 2.1, the biological objectives for habitat attributes and their focal species are updated where needed based on new data. It is hoped that the presentation of these types of quantitative biological objectives will not only stimulate conservation action on the ground, but also stimulate data collection and analyses to test the models and professional judgment used to develop the objectives.

HABPOPS

The Habitats and Populations Strategies (HABPOPS; *data.pointblue.org/partners/iwjv/)* database is a planning tool developed by the Intermountain West Joint Venture, American Bird Conservancy, and Point Blue Conservation Science to explore the probable effects that habitat management actions may have on sagebrush-associated bird populations. The HABPOPS tool is a Microsoft Access database that combines estimates of current habitat extent and condition with the best available empirical data regarding species occupancy rates and density to derive population estimates at relatively large scales (Bird Conservation Region or state). It requires input parameters of the state, Bird Conservation Region, habitat association, condition of the habitat, and acreage before and after a given management action, and it outputs predicted abundance of five sagebrush-associated bird species. It relies on several qualitative assumptions; thus, its best use is to estimate magnitudes of change before and after restoration actions or other habitat change rather than to derive specific point estimates of abundance (D. Casey pers. comm.). This tool can help land managers develop restoration targets and then provide abundance metrics for evaluating outcomes with bird monitoring data.

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

Brewer's Sparrow by vagabond54

Gray Flycatcher on nest by Aaron Holmes

Vital Rates of North American Landbirds

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

Integration with Other Plans

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

- Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004) and the updated Continental Plan (Rosenberg et al. 2016)
- State Wildlife Action Plans (WDFW 2015, ODFW 2016) (Sidebar: *Integration with State Wildlife Action Plans*)
- Intermountain West Joint Venture Implementation Plan (IWJV 2013) (Sidebar: *Integration with Intermountain West Joint Venture Implementation Plan*)
- The Nature Conservancy (TNC) Ecoregional Assessments - The Columbia Plateau Ecoregional Assessment: A Pilot Effort in Ecoregional Conservation (TNC 1999)
- Interior Columbia Basin Ecosystem Management Plan (Wisdom et al. 2000, ICBIET 2014)

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

Lark Sparrow by James Livaudais

Integration with State Wildlife Action Plans

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

In particular, we envision extensive integration with the most comprehensive land management plans for the region, the Interior Columbia Basin Ecosystem Management Plan (ICBEMP), which was developed in 2003 and revised in 2014 (ICBIET 2014), and Greater Sage-Grouse plans (e.g., BLM 2015, 2019). It is anticipated that biological objectives and conservation strategies described in this document and future versions will be integrated not only with ICBEMP, but also with other ongoing and future conservation planning in eastern Oregon and Washington, to provide functioning ecosystems for the region's diverse array of landbird species. Some examples of how this integration can or has been used include:

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

Yellow Warbler by James Livaudais

Integration with the Intermountain West Joint Venture Implementation Plan

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

Birds and Habitats

Because breeding landbirds occur in all of the habitats and conditions that support wintering and migratory landbirds, there is an underlying assumption that habitat management for breeding birds will likely support most, if not all, of the habitat needs of all landbirds occurring in these habitat types. Although only the conservation of landbirds during the breeding season is emphasized, factors that operate outside the breeding season may adversely affect their populations. This is particularly true for migratory birds subject to habitat changes and other factors on their wintering grounds and/or during migration that may impact the abundance and health of breeding populations. There is no attempt to address the extensive breadth of those issues in this document, although there is significant emerging science on the need for full life cycle

Full Life Cycle Conservation of Migratory Birds

Conservation of migratory birds requires actions that provide habitat and promote healthy populations throughout the year. Habitat conditions in one season can affect the reproduction and survival of migratory birds in subsequent seasons. For example, the quality of winter habitat can affect the timing of migration, leading to decreased survival or reproductive success (e.g., Sillett and Holmes 2002; Norris et al. 2004; Rockwell et al. 2012, 2017).

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 rates during migration may be up to 15 times higher for some species than during the relatively stable breeding or overwintering periods (Berlanga et al. 2010). Yet we know little about migration routes or the hazards they face, including anthropogenic threats such as windows, tall lighted structures, wind turbines, indiscriminate pesticide use, and unrestrained cats.

For migratory bird conservation to be effective and efficient, we need to know how, where, and when these migratory animals travel, and need to implement appropriate conservation actions throughout their life cycle. Thus, full life cycle conservation for migratory birds - geographic linking of individuals or populations between different stages of the annual cycle (breeding, migration and winter) - has become an essential component of landbird conservation (Marra et al. 2011).

conservation of migratory birds (e.g., Martin et al. 2007, Faaborg et al. 2010, Hostetler et al. 2015) (Sidebar: *Full Life Cycle Stewardship of Migratory Birds*).

Until specific limiting factors have been identified for each migratory bird species, appropriate conservation actions on the breeding grounds are considered to be a stewardship responsibility of a natural resource shared with many other countries and peoples (Altman and Hagar 2007). Bird conservation partners are encouraged to seek opportunities to develop international partnerships and projects to support conservation of shared migratory landbirds (Berlanga et al. 2010).
A few landbird species are not directly addressed in this document because they already have species-specific conservation strategies and/or recovery plans. This includes two ESA federally delisted species with recovery plans (Bald Eagle and Peregrine Falcon), and Greater Sage-Grouse, which has been the focus of significant conservation research and planning efforts throughout the Intermountain West (e.g., Connelly et al. 2000, 2011; Miller et al. 2011; USFWS 2013, 2013; BLM 2019; NRCS 2015; Finch et al. 2016; Chambers et al. 2017; and the Sage Grouse Initiative [*www.sagegrouseinitiative.com*]). However, existing recommendations for management and conservation of these species has great significance for the conservation of other landbirds. For example, designated areas for management and conservation of the Greater Sage-Grouse are an important opportunity for the conservation of other sagebrush-obligate species such as Brewer's Sparrow, Sage Sparrow, and Sage Thrasher. However, managing for Greater Sage-Grouse may not adequately conserve the entire suite of sagebrush-associated songbirds (Sidebar: *Greater Sage-Grouse as an Umbrella Species*).

This conservation plan does not include conifer forests and associated habitats in the Cascade, Blue, Ochoco, Okanagan, Selkirk, and Klamath Mountain Ranges. These habitats are the predominant and priority habitats in other ecoregions, and are fully covered in two other PIF plans: *Conservation of Landbirds and Associated Habitats and Ecosystems*

in the East Cascade Mountains of Oregon and Washington (Altman and Stephens 2022) and *Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington* (Altman and Bresson 2017) (available at: *www.avianknowledgenorthwest.net/resources/conservation-plans/or-wa-pif-plans/*).

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

Horned Lark by James Livaudais

Greater Sage-Grouse as an Umbrella Species

Rangeland conservation actions in the western U.S. are currently largely driven by Greater Sage-Grouse habitat needs, with designated Priority Areas for Conservation (PACs) as the primary prioritization guideline. However, many other priority bird species are reliant on the sagebrush-steppe ecosystem.

Greater Sage-Grouse has been put forward as an umbrella species, such that if the PAC system protects adequate portions of the landscape for sage-grouse, then other co-occurring species reliant on sagebrush-steppe habitat will also be largely protected (e.g., Rich and Altman 2001, Rich et al. 2005, Rowland et al. 2006, Hanser and Knick 2011, Copeland et al. 2014). This can be successful if other priority species have high overlap in distribution and large- and fine-scale ecological requirements with the umbrella species.

Some studies have shown that sagebrush-obligate songbirds are relatively well-protected by management focused on sage-grouse (Donnelly et al. 2017), but for species with less overlap, such as Horned Lark or Sagebrush Sparrow, this may not be adequate (Rowland et al. 2006, Timmer et al. 2019).

In addition, much of the range of other sagebrush-obligate focal species lies outside of the current range of the sage-grouse (IWJV 2013, A. Holmes pers. comm.). For example, in Wyoming sage-grouse PACs provided better protection than equally sized random areas for only 12 of 52 bird species examined (Carlisle et al. 2018b), and indices of sage-grouse abundance were not predictive of co-occurring sagebrush songbird abundance (Carlisle and Chalfoun 2020). While studies are somewhat equivocal on how well efforts to protect Greater Sage-Grouse habitat will benefit all sagebrush-associated songbirds, adequate conservation of other at-risk sagebrush birds will likely require additional action outside of the PACs.

The Environment

Sagebrush-steppe habitat by Aaron Holmes

The Columbia Plateau and Great Basin regions of eastern Oregon and Washington include mostly mid-elevation (1,200 – 2,000 m), non-forest cover types with some juniper and riparian woodlands. The planning unit covered by this document encompasses several ecoregions including the Owyhee Uplands, Northern Great Basin (sometimes referred to as Basin and Range), and High Lava Plains in Oregon, the Palouse Prairie in Washington, and the Columbia Basin in Washington and Oregon (Franklin and Dyrness 1973). Geographic boundaries are not rigorously defined, but are dependent on the presence of our priority habitats.

For the purposes of consistency with the Interior Columbia Basin Ecosystem Management Plan (ICBEMP), we use the boundaries of their Northern Great Basin and Owyhee Uplands Ecological Reporting Units (ERUs) (Wisdom et al. 2000) for our ecoregions of the same name. However, we separate their Columbia Plateau ERU into three ecoregions: Columbia Basin in Oregon and Washington, High Lava Plains in Oregon, and Palouse Prairie in Washington. We also extend a narrow portion of the Columbia Basin ecoregion up the Okanagan Valley to the Canadian border into what is part of the ICBEMP Northern Glaciated Mountains ERU (Figure 1).

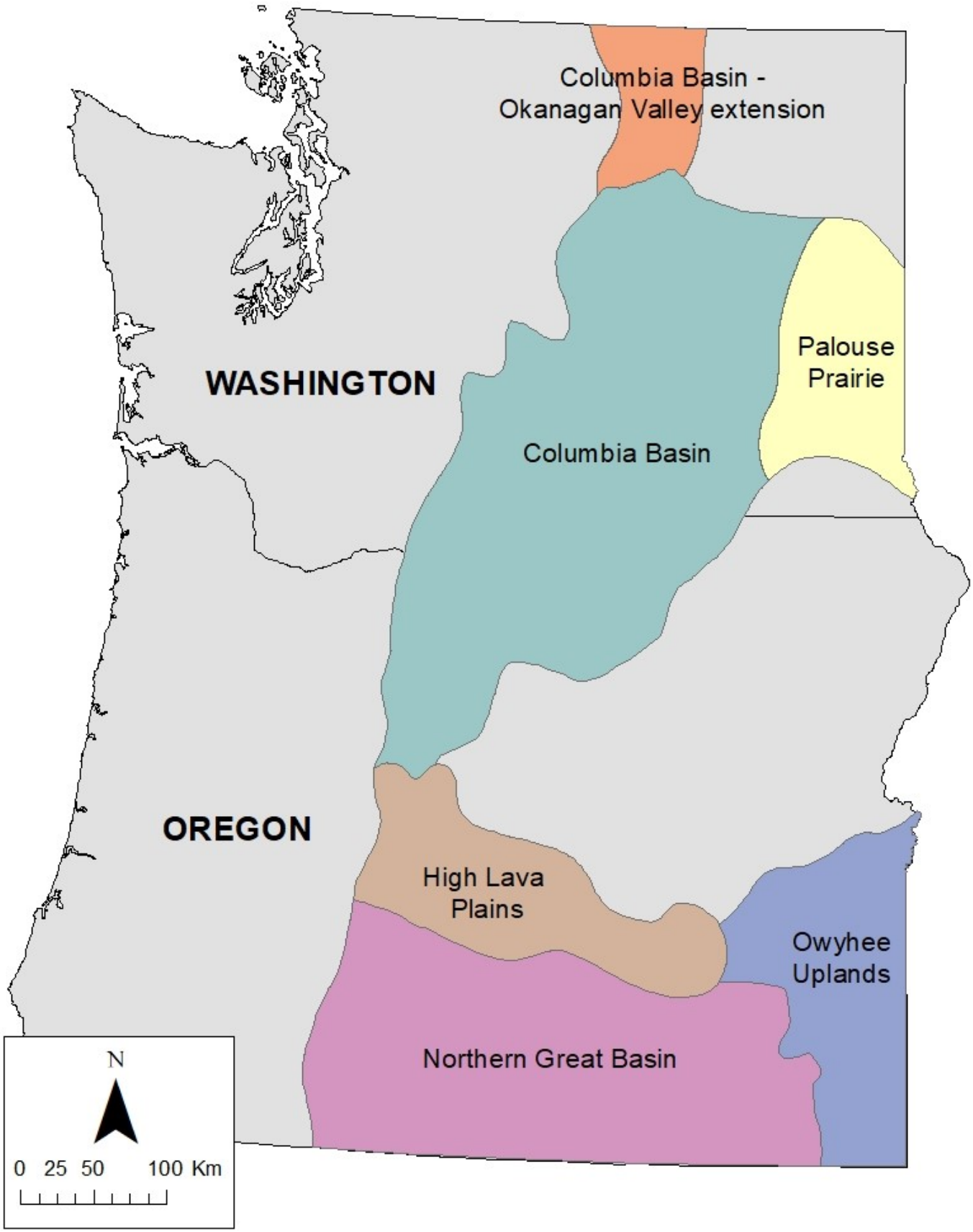
We hereafter refer to this geography as eastern Oregon and Washington, although this plan excludes forested parts of the Blue Mountains and Northern Glaciated Mountains.

Ecoregions

The geography of this conservation plan includes a large area of eastern Oregon and Washington (Figure 1). Many similarities in habitats, management practices, and land uses are common to the entire area. However, environmental and anthropogenic differences exist within several relatively distinct geographic areas. This provides an opportunity to establish biological objectives at smaller geographic scales where appropriate. Throughout this document, we refer to the following five subregions within eastern Oregon and Washington (Figure 1):

- Columbia Basin
- High Lava Plains
- Northern Great Basin
- Owyhee Uplands
- Palouse Prairie

Figure 1. Location of the portions of eastern Oregon and Washington within the Great Basin Bird Conservation Region (BCR 9) covered in this document. Subregions include the Owyhee Uplands, Northern Great Basin, and High Lava Plains of Oregon, the Palouse Prairie of Washington, and the Columbia Basin of Oregon and Washington. Ecoregion boundaries presented here are meant as general guidelines; areas covered by this document depend on the presence of our priority habitats.



Physical Features

Eastern Oregon and Washington includes a vast landscape of arid and semi-arid habitats that begins in the rain shadow of the Cascade Mountains and extends east to cover most of the non-forested portions of these states. The region is characterized by a relatively uniform underlying geology dominated by thick flows of basalt lava that are punctuated in localized areas by volcanic ash flows and deposits of volcanic tuffs and rhyolite. The uniform bedrock of the region has been faulted and uplifted, cut by rivers and eroded by wind, water, and glaciers to produce a diverse landscape encompassing considerable topographic relief. Within this landscape there are desert mountain ranges, low rolling hills, riverine valleys, broad basins containing permanent lakes and seasonal playas, sand dunes, plateaus, and expansive plains. Many of the current features present in the region date only from the Pleistocene epoch or one million years before present. This is a relatively new landscape that is continuing to change and be altered by natural processes.

In this arid landscape, riparian and wetland habitats have special importance and provide significant biodiversity to the region. The geography of this document contains two very different types of river systems, one which has direct connections to the Pacific Ocean and in many instances still supports anadromous fish populations, and the other which contains only internally drained streams and is one of the defining characteristics of the hydrographic Great Basin. Throughout the region, rivers flow through varied terrain including glacially carved gorges, river-carved canyons, and broad valleys, adding considerable diversity to the riparian habitats present. River basins divide the landscape into large geographic divisions, which act to segment wildlife populations and species distributions.

Vegetation

A thorough description of the historic and current vegetation in this region is beyond the scope of this document. The information presented below is an overview of the principal features of the vegetation and plant associations that provide habitat for landbirds. More detailed accounts have been described in several sources including Daubenmire (1970), Franklin and Dyrness (1973), Dobler et al. (1996), and Quigley and Arbelbide (1997).

Mountain big sagebrush by Aaron Holmes

Pre-European Settlement

The landscape at the time of European settlement was dominated by sagebrush-steppe vegetation communities (Daubenmire 1970), dissected by riparian corridors, pockets of wetlands, and grasslands, in particular the Palouse Prairie. The most prominent habitat in the sagebrush-steppe was sagebrush shrublands with a bunchgrass understory. Intermixed in the sagebrush habitat were western juniper woodlands (typically confined to ridges and rocky soil habitats) and montane shrublands which transitioned to extensive aspen forests found on the highest mountain ranges in the region. In the Great Basin, internally drained basins containing alkaline soils were dominated by salt desert scrub vegetation. These habitats were relatively barren when compared to the lusher sagebrush-bunchgrass habitats. Specialized habitats defined by unique soils, hydrology, or the combination of soils and vegetation, occurred in localized areas throughout the region. The dominant ecological process that affected vegetation across the region was wildfire ignited by lightning as well as some Native American burning practices. Irregular and spotty wildfires created a landscape patchwork of stand ages in sagebrush-steppe that was interspersed with grasslands and other small, unique ecological communities (Paige and Ritter 1999).

Sagebrush-steppe communities were mostly co-dominated by shrubs and perennial bunchgrasses with a microbiotic crust of lichens and mosses on the surface of the soil. Dominant shrubs were sagebrush of several species and subspecies: basin, Wyoming, and mountain big sagebrush; low sagebrush; and early, rigid, threetip and black sagebrush (Table 2). Bitterbrush also was important in many sagebrush-steppe communities. Bunchgrasses were largely dominated by four species: bluebunch wheatgrass, Idaho fescue, needle and thread grass, and Sandberg's bluegrass.

Soils, climate, and topography acted to separate out distinct plant communities that paired sagebrush species with specific bunchgrasses across the landscape.

Riparian vegetation is quite restricted in the arid intermountain west, but is nonetheless an important habitat component. It is characterized by a mosaic of plant communities occurring at irregular intervals along streams, and dominated singularly or in some combination by grasses and forbs, shrub thickets, and mature forests with tall deciduous trees. Common shrubs in riparian zones included several species of willow, red-osier dogwood, hackberry, mountain alder, Woods' rose, snowberry, and currant (Table 2). Herbaceous understories were very diverse, but typically included several species of sedges along with many dicot species. In pre-settlement times, riparian habitats were found at all elevations and on all stream gradients; they were the lifeblood for most wildlife species with upwards to 80% of all wildlife species dependent upon these areas at some time in their lifecycle (Thomas 1979). Many riparian habitats were maintained by beaver activity which was prominent throughout the west. Beaver-dammed streams created pools that harbored fish and other species; dams also reduced flooding and diversified and broadened the riparian habitat. The other important ecological process which affected riparian areas was natural seasonal flooding that redistributed sediments and established new sites for riparian vegetation to become established.

Microbiotic crust by Aaron Holmes

Table 2. Native vegetation characteristic of sagebrush-steppe, riparian, and unique habitats of eastern Oregon and Washington.

Habitat	Tree Species	Common Shrubs	Common Herbaceous Plants
Sagebrush and Sagebrush-Steppe		big sagebrush, low sagebrush, bitterbrush, saltbush	bluebunch wheatgrass, needle-and-thread grass, Idaho fescue, Sandberg's bluegrass, bottlebrush squirreltail, Indian ricegrass
Riparian	cottonwood, tall willows, aspen, water birch	snowberry, wild rose, red-osier dogwood, hackberry, mountain alder, willow, currant	northern bedstraw, fescue, sticky geranium, water leaf, parsnip, sedges, rushes, mannagrass, tufted hairgrass
Juniper	western juniper	big sagebrush, low sagebrush, bitterbrush	bluebunch wheatgrass, needle-and-thread grass, Idaho fescue, bottlebrush squirreltail
Salt Desert Scrub		greasewood, shadscale, winterfat, budsage, spiny hopsage	Indian ricegrass, needle-and-thread, bottlebrush squirreltail

Western juniper woodlands were relatively restricted in their distribution in this region. They occurred mainly on ridges where fire was infrequent, but their associated understories of sagebrush and bunchgrasses were almost as diverse as the shrub-dominated communities so common across the landscape. Within the sagebrush-steppe landscape there were also alkaline basins, many of which contained large lakes during wetter pluvial times, where extensive salt desert scrub communities occurred. This characteristic Great Basin vegetation contained numerous shrubs in the shadscale group, including greasewood which has a very wide ecological amplitude, being equally at home in seasonally flooded playas and on dunes or dry hillsides. Salt desert scrub communities contained surprisingly diverse flora and provided habitat for many wildlife species.

Current Vegetation

Vegetative natural communities in eastern Oregon and Washington have undergone changes with the advent of European settlement in the last 150 years. Native sagebrush-steppe communities have been diminished both in extent and condition. Principal factors impacting vegetation have been livestock overgrazing, invasion and dominance of non-native plants, and extensive conversion to agriculture (Wisdom et al. 2000). Other contributing factors included human development, sagebrush eradication programs, and changes in fire regimes (Paige and Ritter 1999). In eastern Washington, nearly 60% of the native sagebrush-steppe has been converted to agriculture (Dobler et al. 1996). Even in extant sagebrush-steppe, what appears to be a natural landscape dominated by an "ocean of sagebrush" is actually a considerably altered ecosystem that compositionally and functionally differs from prior conditions. These changes have affected wildlife with many bird species continuing to decline long after the worst of the habitat impacts have ceased.

Grassland ecosystems that were prominent in the Columbia Basin ecoregion have suffered the greatest losses of any habitats in eastern Oregon and Washington (Kagan et al. 1999). The Palouse Prairie has been identified as one of the most endangered ecosystems in the United States (Noss et al. 1995). Land conversion and livestock grazing coupled with the rapid spread of exotic cheatgrass and crested wheatgrass and a resulting change in the natural fire regime has significantly altered much

of the grassland habitat. The second-most set of impacted ecosystems in the region are the valley bottomlands that originally were a mix of riparian vegetation, Basin wildrye meadows, and rich sagebrush-steppe. Land conversion, grazing, and hydrologic alteration has removed much of the native vegetation from these bottomlands, and altered the streams so substantially that most are no longer in proper functional condition.

While these losses are significant, perhaps of even more concern are changes that have occurred throughout the mostly sagebrush-dominated portion of this ecosystem. Grazing, exotic plant species, and altered fire regimes have impacted this ecosystem to such extent that it is difficult to find stands which are still in relatively natural condition. The greatest changes are the reduction of bunchgrass cover in the understory and an increase in sagebrush cover. Soil compaction is also a significant factor in heavily grazed lands affecting water percolation, runoff, and soil nutrient content. Western juniper woodlands have greatly expanded their range, now occupying much more of the sagebrush ecosystem than in pre-European settlement times. The reasons for the expansion are complex and include interactions between climate change and changing land use, but fire suppression and grazing have also played a prominent role in this dramatic shift in vegetation composition and structure. Losses have been less dramatic and extensive in salt desert scrub ecosystems and in montane shrublands and aspen forests where grazing, mining, and altered hydrology have been the primary threats.

Riparian areas have been extensively impacted within eastern Oregon and Washington, and undisturbed riparian systems are now rare (Knutson and Naef 1997). Impacts have been greatest at low elevations and in valleys where agricultural conversion, altered stream channel morphology, and water withdrawal have played significant roles in changing the character of streams and associated riparian areas. Losses in lower elevations include large areas once dominated by cottonwoods that contributed considerable structure to riparian habitats. In higher elevations, stream degradation occurred with the trapping of beaver in the early 1800s, which began the gradual unraveling of stream function that was greatly accelerated with the introduction of livestock grazing. Woody vegetation has been extensively suppressed by grazing in some areas, many of which continue to be grazed. Herbaceous vegetation has also been highly altered with the introduction of Kentucky bluegrass that has spread to many riparian areas, forming a sod at the exclusion of other herbaceous species. The implications of riparian area degradation and alteration are wide-ranging for bird populations that utilize these habitats for nesting, foraging, and cover. Secondary effects which impact insect populations have reduced or altered potential food resources for birds as well.

Native steppe with needle-and-thread grass by Aaron Holmes

Sagebrush shrubland and mountains by Aaron Holmes

Land Use

The vast sagebrush-steppe ecosystem of western North America has been highly impacted by human activities such as agriculture, urban and rural development, energy extraction, and livestock grazing, and it only occupies about half of its historical distribution (Knick et al. 2003). Post-European settlement land use has primarily been open-range grazing by livestock and agriculture, which began with land clearing in the late 1800s. Both continue to be the dominant land uses in eastern Oregon and Washington, particularly since damming of the Columbia River in the 1930s provided irrigation water to areas previously unsuitable for agriculture. Grazing continues to varying degrees, particularly on large tracts of federal lands (Quigley and Arbelbide 1997) in the Northern Great Basin, High Lava Plains, and Owyhee Uplands ecoregions.

Within the ERUs of the ICBEMP, the greatest conversion to agriculture has been in the Columbia Plateau and High Lava Plains subregions, where nearly half of the land base has been converted to agriculture (Wisdom et al. 2000). Approximately 6 million hectares of sagebrush-steppe have been converted to wheat fields, row crops, and orchards in the interior Columbia Basin (Quigley and Arbelbide 1997, Wisdom et al. 2000). In Washington's Columbia Basin, over 65% of the sagebrush has been lost, primarily as a result of conversion to agriculture (Earnst and Holmes 2012). Native grassland communities of the Palouse Prairie that once covered extensive areas of southeastern Washington have also largely been converted to cropland and remain as only a few isolated remnants (Black et al. 1998). Agriculture now occupies over 10% of the Owyhee Uplands ERU, but the Northern Great Basin ERU remains relatively free of agriculture. The relatively low percentage of land conversion in the Owyhees and Northern Great Basin is deceiving because impacts are concentrated in low elevation valleys and thus have disproportionately and significantly affected valley bottom grasslands, shrublands, and cottonwood-dominated riparian areas.

Agricultural land uses include dry land wheat farms, alfalfa, and other row crops in the Columbia Basin, intensive irrigated agricultural row crop production in the Columbia Basin and the High Lava Plains, and irrigated agriculture associated with livestock production (alfalfa and hay) in all ecoregions.

Grazing occurs across the geography of this plan, but is more prominent in the Northern Great Basin and the Owyhee Uplands, where it is the dominant land use on private and public lands. In addition to grazing and agriculture, there has been patchy, permanent losses of sagebrush-steppe habitat due to urban and rural residential growth. These losses are most obvious in central Oregon near the Bend-Redmond area, and in southeastern Washington in the Tri–cities area.

Conservation Issues and Opportunities

Landbird conservation faces numerous obstacles, either directly or indirectly, arising from conflicts with human economic issues. The principal post-settlement conservation issues affecting bird populations include habitat loss and fragmentation resulting from conversion to agriculture or energy development; and habitat degradation and alteration from livestock grazing, invasion of exotic vegetation, and alteration of historic fire regimes. Conversion of sagebrush-steppe and riparian habitats to other land uses adversely affects landbirds in two ways: 1) native habitat is in most instances permanently lost, and 2) remaining habitat is isolated and embedded in a highly fragmented landscape of multiple land uses, particularly agriculture. Fragmentation resulting from human development, or unusually severe fires fueled by non-native grasses, can have several negative effects on landbirds. These include insufficient patch size for area-dependent species, and increases in edges and adjacent hostile landscapes, which can result in reduced productivity through increased nest predation (e.g., Vander Haegen et al. 2002), brood parasitism, and reduced pairing success of males. Additionally, fragmentation of sagebrush-steppe and riparian habitats has likely altered the dynamics of dispersal and immigration necessary for maintenance of some populations at a regional scale. Habitat loss and fragmentation play an important part in the decline of sagebrush bird populations (Knick et al. 2003).

Steppe habitat dominated by exotic annual grass by Aaron Holmes

Invasion by Exotic Plants

A substantial portion of the Wyoming big sagebrush in eastern Oregon and Washington has been converted to exotic annual grasslands dominated by cheatgrass or crested wheatgrass (Mac et al. 1998, Knick et al. 2003, Chambers et al. 2007). Annual grasslands have increased eight-fold in area from 1990-2020 in the Great Basin, mostly replacing sagebrush shrublands and desert scrub (Smith et al. 2022). Suring et al. (2005) estimated that 58% of the remaining sagebrush in the western U.S. is at moderate to high risk of exotic grass invasion. Differences in structure between non-native annual grasses, which tend to grow more densely and evenly, and native bunchgrasses, which grow in clumps interspersed with bare ground or cryptobiotic soil crust, affect habitat suitability for shrubland and grassland birds (Earnst and Holmes 2012, Rockwell et al. 2021). Dominance by dense-growing exotic grasses also changes understory fuel loads and shifts fire cycles toward more frequent, severe, and large fires (Young and Evans 1973, Whisenant 1990, Baker 2011). Exotic grass invasion has decreased fire return intervals in sagebrush ecosystems from a pre-European estimate of 30 to >100 years to 5–15 years (Knick et al. 2005). Once established, these altered fire regimes tend to maintain grassland habitat structure and preclude reestablishment of native sagebrush-steppe plant communities (Whisenant 1990, Pellant and Hall 1994, Pyke 2000, West 2000, Bradley et al. 2018).

Grazing

The legacy of livestock grazing in eastern Oregon and Washington has had widespread and severe impacts on vegetation structure and composition. One of the most severe impacts in sagebrush-steppe has been the way livestock facilitates the spread of exotic plants (e.g., Bock et al. 2007), or the purposeful conversion of native sagebrush-steppe communities to exotic grasses for cattle forage (e.g., Reynolds and Trost 1980, Rogler and Lorenz 1983). Grazing can also directly alter habitat structure, preventing recruitment of woody vegetation, which can reduce habitat suitability for sagebrush-associated birds (Braun et al. 1976, Reynolds and Rich 1978, Martin and Carlson 1998, VerCauteren and Gillihan 2004). However, at least one study found no effect on Brewer's Sparrow abundance between season-long and rest-rotation grazing systems, but the researchers did not compare to ungrazed systems (Golding and Dreitz 2017). Responses are often species-specific, and depend on grazing intensity, but many studies have shown little effect or positive effects of well-managed grazing on grassland-associated birds (Saab et al. 1995, Harrison et al. 2010, Lusk and Koper 2013, Golding and Dreitz 2017; but see Johnson et al. 2011), and if appropriately implemented it could be compatible with bird conservation goals. In contrast, riparian habitats are detrimentally affected by most grazing practices tested to date, especially for bird species dependent on understory composition and structure (Kauffman et al. 1983, Kauffman and Krueger 1984, Taylor 1986, Saab et al. 1995, Krueper et al. 2003, Martin and McIntyre 2007, Earnst et al. 2012). In riparian habitat, the complete removal, rather than seasonal removal, of livestock has been shown to have positive effects on riparian-obligate bird species within several years (Krueper et al. 2003, Earnst et al. 2005, Nelson et al. 2011).

Juniper Expansion

In the Intermountain West, conifer trees have increased their percent cover by up to 600% since the 1800s, with two-thirds of this expansion altering the structure of previously treeless sagebrush-steppe habitat (Miller and Tausch 2001; Miller et al. 2008, 2011). Mountain big sagebrush communities, which are typically found at higher elevation, more mesic areas, have been particularly impacted; western juniper woodlands in these communities have increased five- to 10-fold in both area and density in the past 150 years (Gedney et al. 1999; Miller et al.

Juniper encroachment into sagebrush habitat by Aaron Holmes

2005, 2008; Johnson and Miller 2006). This includes 2.6 million ha of juniper in Oregon alone (Azuma et al. 2005). Juniper encroachment has likely been exacerbated by decreased fire return intervals due to overgrazing and fire suppression practices (Miller et al. 2000). While this may benefit birds of conservation concern that depend on juniper woodlands, it reduces habitat suitability for sagebrush-associated birds, many of which are also of conservation concern, including Greater Sage-Grouse. Conifer removal to restore sagebrush-steppe habitat is a common and ongoing management technique expected to continue in the future, particularly in sage-grouse PACs (Reinhardt et al. 2020). It is important that managers understand potential ecological trade-offs for wildlife of both juniper expansion outside of its historical range and juniper removal treatments (see Appendix B).

Other

Other conservation issues affecting landbird populations and their habitats in eastern Oregon and Washington include:

- water management – stream channelization, dams, diversions, and irrigation,
- changes in hydrology resulting in increased salinity (plants in these communities are not adapted to high levels of salinity),
- urban, rural residential, or energy development, and associated powerline and road density,
- exotic plant seedings for erosion control or livestock forage,
- outdoor cats (feral and domestic), and
- resource competition from aggressive non-native competitors (e.g., European Starlings that compete for cavity nest sites).

Climate Change

Research has indicated that birds are impacted by climate change in a variety of ways, both directly such as distributional changes, and indirectly by altering food supply or timing of reproduction or migration, thus affecting overall fitness (e.g., Visser et al. 1998, Visser and Both 2005). One of the greatest concerns is the potential for unsynchronized responses of vegetation and birds to a changing climate that results in settlement (residency or movement) in marginal or unsuitable habitat where resources are deficient.

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 grassland and aridland habitats show intermediate levels of vulnerability; over 55% of grassland species and 40% of aridland species continent-wide have medium to high vulnerability to climate change (NABCI 2010). They are expected to face pressure particularly due to drought and high summer temperatures, which may alter habitat suitability, increase susceptibility to invasion by nonnative plants, and exacerbate current bird population declines (NABCI 2010). Climate change is predicted to worsen ongoing habitat degradation, fragmentation, and loss in sagebrush habitats (Knick et al. 2003; Buseck et al. 2004; Bradley 2009, 2010; Hethcoat and Chalfoun 2015), although big sagebrush in the coldest regions may respond positively to a longer growing season (Adler

Willow riparian patch in a sagebrush landscape by Aaron Holmes

et al. 2018). Long-distance migrants, and especially aerial insectivores, may additionally face challenges around the timing of food availability throughout their migratory range (NABCI 2010).

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

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

For those interested in further investigation, there is a significant and growing body of information on climate change 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).

Grasshopper Sparrow by James Livaudais

Opportunities

Despite extensive habitat loss and conversion from historic plant communities, opportunities exist for restoration and enhancement of these areas to provide quality landbird habitat. Because most land ownership in non-forested portions of eastern Oregon and Washington is large areas of publicly managed rangelands and private grazing lands or agriculture, a significant part of landbird conservation in this region will be to address issues within the context of public rangeland policy,

planning, and regulations. This habitat-based landbird conservation strategy does not include the politically based strategies needed to address these issues. However, it does provide potential language and recommendations in the form of biological objectives that could be used to develop public policy regulations to support landbird conservation. Several large tracts of sagebrush-steppe in eastern Washington and much of eastern Oregon are under state or federal ownership where the public can participate in the process of land management decisions. Federal agencies such as the Bureau of Land Management (BLM) also are active in land exchanges to acquire important areas for conservation. In addition, programs are in place on federal lands to restore altered riparian and associated upland habitats with native species and natural ecological processes.

Meeting the goal of healthy landbird populations in eastern Oregon and Washington begins with the maintenance and restoration of properly functioning sagebrush-steppe and riparian ecosystems. Currently, considerable emphasis is being placed on restoration of these habitats to some semblance of pre-settlement conditions (as they were in approximately 1850). It is important to recognize that habitat alterations during restoration activities may temporarily or permanently displace landbird species currently using those areas. However, most degraded habitats tend to support habitat generalist species that are usually widespread, fairly common, and not of high conservation concern. Because of the degree of loss and degradation of these ecosystems, restoration in many areas will be a long-term process. The vision and practical realities of this process are described in the Biological Objectives section later on in this document. Restoration of sagebrush-steppe is still very much a fledgling field, and complete restoration of degraded or converted sagebrush-steppe may not be feasible. Conservation efforts must therefore concentrate on existing sagebrush-steppe that can be permanently protected and managed through easement, acquisition, or land trusts. Agricultural conversion has been concentrated in sagebrush-steppe areas of arable, deep soil, which support greater abundance of some sagebrush-steppe passerines than other soil types (Vander Haegen et al. 2000). Because of this, conservation efforts should potentially be focused in deep soil communities.

Conservation also may be appropriate on some agricultural lands (e.g., Grasshopper Sparrows on Conservation Reserve Program lands). Several government outreach and incentive programs, many of which resulted from the 1996 Farm Bill, provide opportunities to accomplish this. The Conservation Reserve Program (CRP), administered by the U.S. Department of Agriculture, is the largest-scale effort restoring or creating perennial grassland habitat in the American West. It is a voluntary program that pays farmers to take lands out of production to achieve conservation objectives, including providing wildlife habitat. CRP sites can be planted with both native and nonnative species, but a study found that survival of 1,377 bird nests in CRP was equal to or greater than nests in sagebrush-steppe and was similar between CRP planted with native versus exotic grasses (Vander Haegen et al. 2015). CRP is providing grassland and shrubland habitat at a large spatial scale unlikely to be achieved otherwise in landscapes that are dominated by privately owned farmland (Vander Haegen et al. 2015). By 2006, approximately 600,000 ha of former agricultural lands in Washington had been converted to perennial grasses, forbs, and shrubs under the CRP (USDA 2007). However, establishing sufficient sagebrush cover will be key to maximizing the benefit of CRP grasslands to shrubland birds in sagebrush-steppe ecosystems (Vander Haegen et al. 2015).

Working Lands for Wildlife (WLFW) is another program that uses Farm Bill resources to create conservation easements that proactively reduce new development and fragmentation in sensitive habitats or migration corridors (NRCS 2021). The extent of these easements has increased in sagebrush-steppe ecosystems since WLFW became a USDA Natural Resources Conservation Service (NRCS) priority, particularly in the Sage Grouse Initiative in Greater Sage-Grouse habitat. WLFW also works with landowners to promote livestock grazing practices that are compatible with bird conservation goals, and process-based riparian restoration on working lands (NRCS 2021).

The Process

Conceptual Approach

The two primary goals for bird conservation under the PIF initiative are keeping common birds common and helping species at risk, through voluntary partnerships (Rosenberg et al. 2016). Planning to meet 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 2021), 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 entire 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 objective of conservation of biodiversity, increasingly desired as a societal and ecological goal, cannot be achieved on a species-by-species basis (Franklin 1993).

Red-naped Sapsucker by Frank Lospalluto

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 and Holmes 2000, Altman and Alexander 2012, Altman and Bresson 2017, Altman and Stephens 2022, Rockwell et al. 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."

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).

The use of a suite of focal species, rather than a single focal species, provides a more efficient and 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. This hybrid approach of using both vulnerable and representative species (i.e., priority and focal, respectively), should provide a solid framework for achieving broad-scale conservation of all landbirds in priority habitats throughout the region (Stephens et al. 2019). Species are much easier to monitor than ecological processes and can be readily used both as indicators of functional

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 ecoregion. 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 actions or restoration, the absence of these species during monitoring does not necessarily indicate the opposite (i.e., 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

Mountain big sagebrush habitat by Aaron Holmes

ecological processes and as metrics of conservation progress (Temple and Wiens 1989, Hutto 1998, Chase and Geupel 2005, Stephens et al. 2019).

Components of the Process

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

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

Priority Habitats

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

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

Two habitat types and one habitat category that includes several habitat types were selected as priority habitats:

- Sagebrush-Steppe
- Riparian
- Unique Habitats (including aspen stands, agricultural fields which have largely replaced mesic meadows, and juniper woodland)

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

Habitat Attributes

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

Habitat Attributes

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

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

Focal Species

Focal species were selected based on a combination of factors including focal species in the previous Oregon-Washington PIF bird conservation plan for this region (Altman and Holmes 2000), focal species designated in other conservation planning (e.g., Wisdom et al. 2000), and the following criteria:

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

When more than one species could potentially be a good focal species for a particular habitat attribute, preference was given to priority species, responsibility species, and/or species for which more knowledge exists about its life history and ecology to provide the information for setting biological objectives. One example is Lewis's Woodpecker, which is not regularly occurring throughout the

region and occurs in relatively low densities where it does occur, but is a high priority species and has been studied relatively extensively.

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

Integration of Priority and Responsibility Species

Many PIF partner agencies and organizations have prioritized bird species for conservation based on factors such as small populations, limited distribution, declining population trends, or threats to habitat. An assumption of the focal species approach is that a suite of focal species can cover the habitat requirements of priority bird species. However, some priority species are such unique ecological specialists that this is not always true (e.g., Stephens et al. 2019). Additionally, most agencies and organizations have historically used priority species, and there is established interest in tracking conservation of these species. In order to account for the conservation of these species, priority species were either designated as focal species with biological objectives, 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 One Piece of Ecosystem Conservation*).

Rock Wren by James Livaudais

Priority Species Represent 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 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 our priority habitats and their occurrence on one of the following lists:

- USFWS Birds of Conservation Concern (USFWS 2021)
- Interagency Special Status and Sensitive Species Program (ISSSSP 2021) of the USFS Region 6 and OR/WA BLM (*www.fs.fed.us/r6/sfpnw/issssp/agency-policy/)*
- Oregon Conservation Strategy Species (ODFW 2016)
- Washington Conservation Strategy Species (WDFW 2015)

Lewis's Woodpecker by Frank Lospalluto

- PIF North American Landbird Conservation Plan Species of Continental Importance for the Intermountain West Avifaunal Biome, Red and Yellow Watch Lists, and Common Species in Steep Decline (Rosenberg et al. 2016)

As part of the goal of keeping common birds common, PIF has traditionally stressed the importance of stewardship species, which highlights geographic areas with a high percentage of a species' population. This implies a level of responsibility to be good stewards of species where there is a high responsibility for the species based on population size, and that conservation actions taken in these areas will have the greatest effect on the species' overall population. Herein, responsibility species are those designated as PIF Regional Stewardship Species (i.e., those with >25% of their global population breeding in BCR 9 and a regional threats-to-breeding score >1; PIF 2021). Responsibility species were recognized and designated as focal species with biological objectives if appropriate, or integrated where appropriate as species to benefit from conservation actions directed towards focal species (Appendix A).

Sagebrush-steppe habitat by Aaron Holmes

Biological Objectives

Quantitative habitat and population objectives (collectively referred to as biological objectives) are the cornerstone of this document. Habitat and population objectives were established based on the premise that specific, measurable, achievable, realistic objectives with a timeline for birds and associated habitat attributes are required for effective landbird conservation. Conservation partners are encouraged to use the population and habitat objectives as a numerical context within which to stimulate and gauge the local and regional perspective of their conservation actions. The biological objectives are not regulatory, nor do they represent the policies or recommendations of any specific agency or organization (Sidebar: *Quantitative Biological Objectives*). Establishing quantitative biological objectives serves several purposes, including providing:

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

Quantitative Biological Objectives

It is important to recognize that the biological objectives in this document have been established solely for the promotion of landbird conservation. They are not tempered by societal or economic concerns or by the conservation concerns of other wildlife or natural resource values. Integration of those factors is important, but outside the scope of this document. It will be important for people historically steeped in regulatory enactments such as the Endangered Species Act or National Environmental Policy Act, to think outside the regulatory paradigm that associates quantitative objectives with compliance and consequences of non-compliance, and recognize the different purpose and value of the biological objectives presented herein.

The quantitative biological objectives are what we think the birds need based on current knowledge, and are intended to stimulate conservation action in the trajectory of an objective, not provide the expectation of a rigid threshold or benchmark with accompanying consequences. Furthermore, the biological objectives are based on the premise that a quantitative target is more likely to stimulate conservation action than a descriptive, qualitative target that does not provide a numerical context for the desired outcome or means of tracking progress towards it. Simply stated, most land managers want to know the measurable parameters - how much, where, and by when - in order to plan and implement bird conservation actions in an effective and integrated manner with other objectives, and perhaps just as importantly to have a context within which to track their progress towards objectives.

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

Habitat Objectives

Several types of habitat objectives at different scales are presented in the document. At the regional scale, quantitative habitat objectives are presented for two priority habitats, including the extent of sagebrush-steppe and riparian habitats to maintain or restore on the landscape. At smaller scales (i.e., sites), prescriptive habitat objectives are presented as measurable targets for specific habitat attributes such as canopy cover, tree or snag size, and understory shrub or herbaceous cover. These were derived from an evaluation of bird-habitat relationship data in the scientific literature and determination of the most optimal targets. Three factors were paramount in setting these prescriptive, quantitative, site-level objectives for habitat attributes:

- means (rather than minimums) of available data were used because they are more likely to provide adequate conditions for maintaining populations,
- a range of values were often used to represent the plasticity of a species' relationship with a habitat attribute, and to acknowledge the historical range of variation that likely occurred for many habitat attributes, and
- 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 sites).

Unless otherwise indicated, data on population abundance or density were used to establish habitat objectives that indicate good habitat suitability. This assumes that healthy, viable populations occur 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.

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 (e.g., maintain, increase by 50%, increase by 100%) to reverse population declines to achieve abundance levels of near the beginning of the BBS in 1968 (Rich et al. 2004), and these objectives were updated in 2016 (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. The establishment of continental landbird population objectives was conceptually based on the model of the North American Waterfowl Management Plan in which population objectives have proven to be a valuable tool for stimulating conservation actions

and for measuring the success of those actions. There is inherent value in having quantitative objectives for bird populations as part of bird conservation. Some of these valuable uses include:

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

Bottom-up habitat-based regional assessments to establish landbird population objectives have not been completed for the geography of this document. Herein, population objectives were established for species based on the PIF Continental Plan (Rosenberg et al. 2016). Additionally, for species susceptible to Brown-headed Cowbird brood parasitism, population objectives were set to maintain low levels of parasitism.

Habitat Strategies

Habitat strategies are provided as examples of management actions that may be used to support the habitat objectives or enhance conservation relative to a habitat attribute or focal species. They are presented as general recommendations for the habitat type, and also for each focal species to support achieving the specific habitat conditions or attributes that species represents. The habitat strategies can be institutionalized into management practices or implemented on an opportunistic basis within the broader context of ecosystem management. The recommendations include only some of a variety of potential appropriate actions. Land managers should consult with ecologists and scientists from other disciplines to ascertain appropriate habitat conservation actions to prescribe for specific areas. These individuals also can be a valuable source of information for additional habitat management actions to achieve the biological objectives.

Black-throated Sparrow by Frank Lospalluto

The Birds

Species Composition

We considered 129 native landbird species to be highly associated breeding species in all or parts of sagebrush-steppe, riparian, and unique habitats of eastern Oregon and Washington (Altman and Holmes 2000). There are no endemic landbird species (i.e., species unique to this region). Although sagebrush-steppe habitat supports relatively few species of landbirds (Rotenberry and Wiens 1978, Wiens et al. 1986), several species are dependent upon this vegetation type such that they are found nowhere else in Oregon and Washington. These include the sagebrush-steppe obligates: Greater Sage-Grouse, Sagebrush Sparrow, Sage Thrasher, and Brewer's Sparrow. Other, non-obligate species primarily confined to this region within Oregon and Washington include Burrowing Owl, Swainson's Hawk, Ferruginous Hawk, Loggerhead Shrike, Long-billed Curlew, Sharp-tailed Grouse, Upland Sandpiper, and Black-throated Sparrow.

In contrast to sagebrush-steppe, riparian habitat typically supports the greatest diversity of landbird species (Knopf et al. 1988, Dobkin 1994, Saab et al. 1995). There are several species dependent on riparian habitats (e.g., Bullock's Oriole, Willow Flycatcher, Yellow-breasted Chat, Yellow Warbler) in this region. However, most of these species also occur in riparian habitats elsewhere in Oregon and Washington.

Bird-Habitat Relationships

An essential component for establishing biological objectives and recommending appropriate habitat strategies to support the biological objectives is an understanding of the relationships between landbird species and their habitats. The most recent synthesis of this knowledge is the book Wildlife Habitats and Species Associations in Oregon and Washington (Johnson and O'Neil 2001), and two state-level bird-focused books: Marshall et al. (2006) 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.

Sagebrush Sparrow by Frank Lospalluto

Landbird Population Trends

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

The Breeding Bird Survey (BBS) (Robbins et al. 1986, Sauer et al. 2017) is the primary source of population trend information for North American landbirds since 1968 (*www.pwrc.usgs.gov/bbs/index.cfm*) (Sidebar: *The Breeding Bird Survey: A Source for Landbird Population Trends*). Extensive habitat

changes prior to that time undoubtedly affected bird populations, but there are no quantitative data to document them. Attempts to assess the extent of bird population changes prior to the BBS have been documented through an examination of historical habitats at the time of European settlement (approximately 1850), and knowledge of bird-habitat relationships (Wisdom et al. 2000). Where available (mostly for sagebrush-associated birds), this information is presented under each focal species account in the Biological Objectives section. In an older analysis of neotropical migratory birds within the Interior Columbia Basin, most species identified as being of "high management concern" were sagebrush-steppe species (Saab and Rich 1997).

The Breeding Bird Survey: A Source for Landbird Population Trends

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

There is no standard population trend analysis of BBS data specifically for the geographic scope of this document. The portion of eastern Oregon and Washington covered by this plan occurs within the much larger BBS Great Basin Physiographic Region.

However, trend estimates for the broader Great Basin do provide some level of understanding for bird populations in eastern Oregon and Washington. In the Great Basin, BBS data for the 123 of 129 landbird species considered highly associated with the priority habitats in this document with sufficient data indicate that about the same number of species have long-term increasing population trends (n = 43) than declining population trends at the $p = 0.10$ level (n = 40) (PIF 2021).

Among focal, priority, and responsibility species, 15 have experienced significant ($p = 0.05$) recent (1993-2019) or long-term (1968-2019) declining population trends while nine have increasing population trends (Table 3; Sauer et al. 2020). Six of nine focal species for sagebrush-steppe habitats have experienced recent or long-term declines, but none have significantly increased (Table 3). Other priority landbird species may be experiencing population declines, but lack sufficient data for statistical confidence (e.g., Virginia's Warbler, Yellow-billed Cuckoo, Sharp-tailed Grouse).

Long-billed Curlew by James Livaudais

Table 3. Breeding Bird Survey (BBS) long-term and recent population trends and overall percent population change for focal, priority, and responsibility species in sagebrush-steppe, riparian, and unique habitats of Bird Conservation Region (BCR) 9 – Great Basin. Annual BBS Trends give annual percent population change based on BBS data for two different time periods. Total Population Change gives positive or negative percent of a species' population lost or gained from 1968 to 2019 based on the BBS trend. Red indicates a statistically significant declining trend, and green indicates a statistically significant increasing trend (i.e., 95% confidence interval does not overlap zero). N/A indicates that there are insufficient data for a credible trend estimate (red credibility measure; Sauer et al. 2020).

Focal Species	Annual BBS Trend Recent (1993-2019)	Annual BBS Trend Long-term (1968-2019)	Total Long-term Population Change
SAGEBRUSH-STEPPE			
Grasshopper Sparrow	-2.65	-0.04	-2
Loggerhead Shrike	0.73	-0.85	-35
Sagebrush Sparrow	0.66	-1.35	-50
Green-tailed Towhee	-1.14	-0.03	-2
Brewer's Sparrow	-2.34	-0.59	-26
Sage Thrasher	-1.59	-0.45	-21
Lark Sparrow	-0.92	0.57	34
Black-throated Sparrow	-3.87	0.58	34
Mountain Bluebird	-0.51	0.18	10
Horned Lark	-0.90	-1.35	-50
RIPARIAN			
Lewis's Woodpecker	-0.56	-1.22	-47
Bullock's Oriole	0.57	0.51	30
Yellow Warbler	-0.36	-0.35	-16
Yellow-breasted Chat	0.73	0.56	33
Willow Flycatcher	-0.35	-0.99	-40
Lazuli Bunting	1.28	1.38	101
UNIQUE HABITATS			
Red-naped Sapsucker	-3.79	-1.43	-52
Bobolink	n/a	n/a	n/a
Gray Flycatcher	0.46	2.25	211

Additional Priority and Responsibility Species	Annual BBS Trend Recent (1993-2019)	Annual BBS Trend Long-term (1968-2019)	Total Long-term Population Change
Ash-throated Flycatcher	2.21	1.72	139
Bald Eagle	6.74	5.73	1614
Bank Swallow	0.58	0.05	3
Black Swift	-5.20	-4.02	-88
Brewer's Blackbird	-1.75	-1.20	-46
Broad-tailed Hummingbird	-0.28	0.19	10
Burrowing Owl	0.49	-0.77	-33
California Quail	3.29	0.99	65
Calliope Hummingbird	-0.20	-0.45	-21
Cassin's Finch	-0.07	0.57	34
Common Nighthawk	-1.00	-0.61	-27
Dusky Flycatcher	-1.25	-0.60	-26
Ferruginous Hawk	1.38	1.04	69
Golden Eagle	-0.37	0.16	8
Greater Sage-Grouse	0.2	-1.72	-59
Long-billed Curlew	0.76	0.86	55
Long-eared Owl	n/a	n/a	n/a
MacGillivray's Warbler	-0.40	-0.73	-31
Mountain Quail	2.40	0.63	38
Northern Harrier	-0.45	-0.12	-6
Peregrine Falcon	n/a	n/a	n/a
Pinyon Jay	-2.28	-2.14	-67
Prairie Falcon	1.75	1.63	128
Rock Wren	-2.66	0.08	4
Rufous Hummingbird	-1.57	-1.66	-57
Sandhill Crane	0.11	1.14	78
Sharp-tailed Grouse	n/a	n/a	n/a
Short-eared Owl	-1.07	-1.14	-44
Swainson's Hawk	2.06	2.06	183
Upland Sandpiper	n/a	n/a	n/a
Virginia's Warbler	n/a	n/a	n/a
White-throated Swift	-0.82	0.09	5
Wilson's Warbler	-0.58	-0.99	-40
Yellow-billed Cuckoo	n/a	n/a	n/a

Focal Species

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

Sagebrush-Steppe

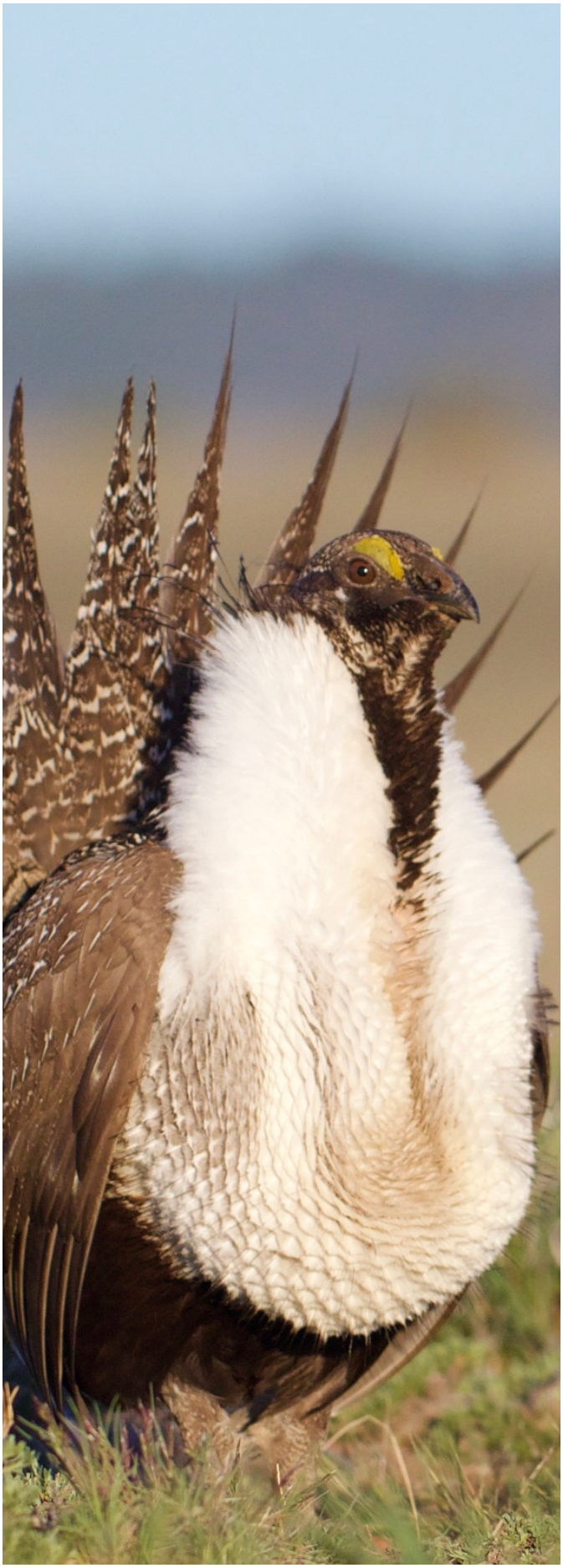
We use the term sagebrush-steppe as encompassing both grasslands (steppe) and shrublands dominated by sagebrush or other shrub species. However, much of our emphasis is on sagebrush habitats, particularly big sagebrush communities. Among sagebrush-steppe habitat types, big sagebrush has several obligate or near-obligate bird species, and probably has been adversely impacted more than the other types. Other forms of sagebrush, such as low sagebrush, are generally of less value to songbirds and less threatened than big sagebrush communities (Paige and Ritter 1999) – however, low sagebrush is very important to Greater Sage-Grouse populations.

In steppe and steppe-shrubland, the conditions include native bunchgrass cover, interspersion of tall shrubs and openings, and areas of bare ground. In sagebrush, the overall desired condition is expansive areas of high-quality sagebrush with a diverse understory of native grasses and forbs. More specific desired conditions include large unfragmented patches of sagebrush, and sufficient sagebrush cover and height. In shrublands, desired conditions include ecotonal edge habitats between shrubs, trees, and herbaceous openings; and upland, sparsely vegetated desert scrub habitats. In juniper-steppe, the desired condition is the presence of scattered mature juniper trees (i.e., savannah).

Table 4. Habitat attributes and associated landbird focal species for conservation of sagebrush-steppe habitats in eastern Oregon and Washington.

Habitat Subtype	Habitat Attribute	Focal Species
SAGEBRUSH-STEPPE		
Steppe	native bunchgrass cover	Grasshopper Sparrow
Sagebrush	sagebrush cover	Brewer's Sparrow
	large unfragmented patches of Wyoming big sagebrush	Sagebrush Sparrow
	mesic areas with mountain big sagebrush	Green-tailed Towhee
	sagebrush height	Sage Thrasher
Steppe-shrubland	interspersion of tall shrubs and openings	Loggerhead Shrike
	bare ground cover	Horned Lark
Shrubland	ecotonal edges of herb, shrub, and tree habitats	Lark Sparrow
	upland, sparsely vegetated desert scrub	Black-throated Sparrow*
Juniper-steppe	savannah with scattered mature juniper trees	Mountain Bluebird

* Present in the Columbia Basin (but not Palouse Prairie portion), Northern Great Basin, and Owyhee Uplands subregions only.



Greater Sage-Grouse by Tom Reichner

Two landbird species considered high priority species in this region by several federal and state agencies, Greater Sage-Grouse and Sharp-tailed Grouse, are not explicitly included in this conservation plan. Currently, several government agencies and other organizations are working specifically on conservation of these species. We refer the reader to the detailed conservation objectives and management strategies already developed for these species (e.g., Saab and Marks 1992, Weddell 1992, Giesen and Connelly 1993, WDFW 1995, McDonald 1998, Ulliman et al. 1998, Wisdom et al. 2000, Connelly et al. 2020) for Sharp-tailed Grouse; see Sidebar: *Greater Sage-Grouse Conservation* for Greater Sage-Grouse). It is hoped that agencies and organizations attempting to implement landbird conservation generally or grouse conservation specifically will fully avail themselves of the existing resources for both species.

Greater Sage-Grouse Conservation

Greater Sage-Grouse is a high-profile, at-risk bird which is often proposed as an umbrella species for other sagebrush-associated wildlife. It has been the focus of unprecedented conservation research and planning efforts throughout the Intermountain West (e.g., Connelly 1982; Hanf et al. 1994; WDFW 1995; IDFG 1997; Connelly et al. 2000, 2011; Wisdom et al. 2000; Stiver et al. 2006; Miller et al. 2011; USFWS 2013; BLM 2015; NRCS 2015; USFWS 2015; Finch et al. 2016; Chambers et al. 2017; the Sage Grouse Initiative [*www.sagegrouseinitiative.com*]). Concern over the species' population status has resulted in a petition for listing under the U.S. Endangered Species Act at least seven times (Stiver 2011), which the USFWS designated as warranted but precluded in 2010 (USFWS 2010). Reevaluation of this designation helped to stimulate more than 1.2 million ha of additional conservation benefitting sage-grouse, and in 2015 the decision was made not to list Greater Sage-Grouse as threatened or endangered (USFWS 2015). Efforts to conserve sagebrush landscapes in the western U.S. are currently largely driven by Greater Sage-Grouse habitat needs, with designated Priority Areas for

Conservation (PACs) as the primary prioritization guideline (USFWS 2015). Conservation investments are being directed to areas that support abundant sage-grouse populations with the assumption that this will also benefit many other sagebrush-associated taxa (NRCS 2015, USFWS 2015). The same threats facing sage-grouse are also linked to declines in songbirds: conifer expansion (Knick and Connelly 2011, Knick et al. 2014), changes to historic fire regimes (Martin and Carlson 1998, Knick et al. 2005), intensive grazing (Reynolds and Trost 1981, VerCauteren and Gillihan 2004, Earnst et al. 2012), invasion with exotic annual grasses (Earnst and Holmes 2012, Rockwell et al. 2021), and energy development (Gilbert and Chalfoun 2011, Mutter et al. 2015). Range overlap among songbirds and sage-grouse during the breeding season is extensive but has proven to be a poor predictor of co-occurrence and co-abundance (Rich et al. 2005, Carlisle and Chalfoun 2020; but see Donnelly et al. 2017). While Greater Sage-Grouse appears to be a good umbrella species for some sagebrush obligates, this may not be the case for all sagebrush associates (Rowland et al. 2006, Carlisle et al. 2018b, Timmer et al. 2019), especially when their ecological requirements at smaller scales do not overlap as much as at landscape scales.

Greater Sage-Grouse require large blocks of unfragmented sagebrush-steppe habitat with moderate sagebrush cover (10-30%) (Altman and Holmes 2000), which should also benefit other sagebrush-associated birds. Modelled abundance of several sagebrush songbirds nearly doubled after a threshold of 40% sagebrush cover at the landscape scale was reached (Donnelly et al. 2017). Another modelling study found that at large spatial scales, the percent of suitable habitat overlapping Greater Sage-Grouse PACs was highest for Brewer's Sparrow at 51%, followed by Sagebrush Sparrow at 41% (Zeller et al. 2021). At the nest-site scale, Brewer's Sparrow and Greater Sage-Grouse select for similar habitat attributes, except that Brewer's Sparrow prefers more vigorous nest shrubs (Barlow et al. 2020).

Herbaceous composition and structure are particularly important aspects of Greater Sage-Grouse habitat requirements (Connelly et al. 2000). Sage-grouse consume a wide diversity of native understory herbaceous plants (Connelly et al. 2000, Pennington et al. 2016), and herbaceous structure is important to both nest survival (Doherty et al. 2014) and brood-rearing (Connelly et al. 2000, Beck et al. 2012). Habitat recommendations for the breeding season suggest an understory height >18 cm (7 in) and cover of ≥15% at arid sites and ≥25% at mesic sites (Connelly et al. 2000). A diversity of native forbs is likely to benefit some sagebrush-obligate birds, such as Sagebrush Sparrow and Sage Thrasher, which in Idaho are more abundant at sagebrush sites with native vs. exotic herbaceous understory composition (Rockwell et al. 2020).

Greater Sage-Grouse are particularly sensitive to encroachment by trees, and will abandon otherwise suitable habitat if just a few trees per acre (i.e., 4% canopy cover) become established (Baruch-Mordo et al. 2013). For this reason, conifer removal – either mechanical or via prescribed burning – has become a widespread vegetation management tool. This represents an ecological trade-off, generally benefitting sagebrush-associated species while reducing suitable habitat for juniper-associated species (e.g., Noson et al. 2006, Crow and van Riper 2010, Holmes et al. 2017, Magee et al. 2019, Zeller et al. 2021; see Appendix B). Incorporating habitat requirements of juniper woodland species should be considered in conifer removal prioritization (Zeller et al. 2021), and managers should consider implementing juniper removal only where it is encroaching into historic sagebrush-steppe habitat.

Land managers also sometimes mow Greater Sage-Grouse-occupied areas to remove shrubs and increase herbaceous plant growth needed for grouse brood-rearing habitat. However, this management action should be undertaken with caution, as complete loss of nesting habitat for sagebrush-obligate songbirds has been observed at sites mowed for sage-grouse (Carlisle et al. 2018a). Thus, while widespread protection of large continuous blocks of sagebrush-steppe habitat with diverse native understory will likely benefit many sagebrush bird species, some specific habitat management actions to benefit Greater Sage-Grouse could negatively affect nontarget species of conservation concern if implemented indiscriminately or across large spatial extents.

Riparian

Riparian systems include the vegetative structure (primarily shrubs and trees, but also herbaceous ground cover) influenced by the hydrology of a nearby aquatic system. In riparian woodland, desired conditions include the presence of snags, large canopy trees, subcanopy foliage, a dense shrub understory, and large, structurally diverse patches of habitat (Table 5). In riparian shrubland, which can be an early successional or permanent condition depending upon hydrology, desired conditions include sufficient shrub density and shrub-herbaceous interspersion (Table 5).

Unique Habitats

Landbird conservation also is directed towards three unique habitats and associated focal species in eastern Oregon and Washington (Table 6). This category was used to capture a wide range of habitat types that are important for landbird conservation for one or more of the following reasons:

- small to large contiguous patches that occur in narrow elevational or ecological windows (e.g., aspen stands),
- ephemeral in occurrence and distribution dependent on anthropogenic factors and hydrology (e.g., mesic agricultural fields), or
- priority landbird species highly associated with these habitats that are not focal species in the other priority habitat types (e.g., juniper woodland).

Yellow-breasted Chat by Frank Lospalluto

Table 5. Habitat attributes and associated landbird focal species for conservation of riparian habitats in eastern Oregon and Washington.

Habitat Subtype	Habitat Attribute	Focal Species
RIPARIAN		
Woodland	large snags, particularly cottonwood	Lewis's Woodpecker
	large canopy trees	Bullock's Oriole
	subcanopy cover	Yellow Warbler
	dense shrub cover	Yellow-breasted Chat
Shrubland	shrub density	Willow Flycatcher
	shrubs interspersed with herbaceous patches	Lazuli Bunting

Table 6. Habitat attributes and associated landbird focal species for conservation of unique habitats in eastern Oregon and Washington. Species are not present as regular breeders in all five subregions (CB = Columbia Basin, HLP = High Lava Plains, NGB = Northern Great Basin, OW = Owyhee Uplands, PP = Palouse Prairie).

Habitat Subtype	Habitat Attribute	Focal Species	Relevant Subregions
UNIQUE HABITATS			
Aspen stands	*large trees and snags with regeneration*	Red-naped Sapsucker	HLP, NGB, OW
Agricultural fields	*mesic conditions*	Bobolink	CB, PP, NGB, OW
Juniper woodland	*mature juniper with regeneration*	Gray Flycatcher	HLP, NGB, OW

Priority Species

There are 42 priority landbird species identified by primary bird conservation partners that are regularly breeding species in sagebrush-steppe, riparian, and unique habitats of eastern Oregon and Washington (Table 7). Lewis's Woodpecker is the only species identified as priority in all six lists that were reviewed. Black Swift, Bobolink, Greater Sage-Grouse, and Mountain Quail are considered priorities in five of the six lists. Among the 42 species, 12 are focal species in this document and 10 are responsibility species.

Responsibility Species

There are 13 species with a relatively large percent of their population in BCR 9, and thus considered to be a high stewardship responsibility for landbird conservation partners in this region (Table 8). Eleven of the 13 also are focal or priority species, including six species - Brewer's Sparrow, Gray Flycatcher, Green-tailed Towhee, Lewis's Woodpecker, Sage Thrasher, and Sagebrush Sparrow - that are both focal and priority species. It is important to recognize that BCR 9 includes substantial area outside of eastern Oregon and Washington within the broader Great Basin of the western U.S. Thus, most of the high responsibility species have the majority of their populations outside of the relatively small region covered by this document.

Pinyon Jay by James Livaudais

Table 7. Landbirds designated as priority bird species by primary bird conservation partners, and that are regularly breeding species in sagebrush-steppe, riparian, and unique habitats of eastern Oregon and Washington.

	USFWS BCC[1]	ISSSSP[2]	WDFW[3]	ODFW[4]	PIF Cont. Plan[5]
Ash-throated Flycatcher		WA			
Bald Eagle		OR, WA	S		
Bank Swallow					SD
Black Swift	√	OR			Y
Black-throated Sparrow		WA			
Bobolink	√	OR, WA		BM, NBR	Y
Brewer's Blackbird					CON, SD
Brewer's Sparrow		WA		CP	
Broad-tailed Hummingbird	√				
Burrowing Owl		WA	C	BM, CP, NBR	
Calliope Hummingbird	√				
Cassin's Finch	√				CON, Y
Common Nighthawk				CP	CON, SD
Ferruginous Hawk		WA	T	BM, CP, NBR	
Golden Eagle			C		
Grasshopper Sparrow		OR		CP	SD
Gray Flycatcher		WA			
Greater Sage-Grouse		OR, WA	T	BM, NBR	CON, Y
Green-tailed Towhee		WA			
Horned Lark					CON, SD
Juniper Titmouse				NBR	
Lewis's Woodpecker	√	OR, WA	C	BM, CP	CON, Y
Loggerhead Shrike			C	BM, CP, NBR	CON, SD
Long-billed Curlew		WA		BM, CP, NBR	
Long-eared Owl	√				Y
Mountain Quail		WA	SGCN	NBR	CON, Y
Northern Harrier	√				
Peregrine Falcon			S	NBR	
Pinyon Jay	√				CON, Y
Rufous Hummingbird	√				Y
Sage Thrasher	√	WA	C		
Sagebrush Sparrow		WA	C	CP	
Sandhill Crane (Greater subspecies)		WA	E	NBR	
Sharp-tailed Grouse (Columbian subspecies)		WA (OR)	E	(BM)	
Short-eared Owl	√	WA	SGCN		SD
Swainson's Hawk				BM, CP, NBR	
Upland Sandpiper		OR	E	BM	
Virginia's Warbler	√				Y
Willow Flycatcher				NBR	
Wilson's Warbler					SD
Yellow-billed Cuckoo (Western populations)	T		C	T	

[1] USFWS Bird Species of Conservation Concern (√) in BCR 9, or federally threatened (T). No species here are listed as endangered under the Endangered Species Act for Region 1 (USFWS 2021).

[2] Interagency Special Status and Sensitive Species Program of the USFS Region 6 and OR/WA BLM (ISSSSP 2021; *www.fs.fed.us/r6/sfpnw/issssp/agency-policy/);* text in column displays whether species is considered sensitive in OR, WA, or both.

[3] Species of Greatest Conservation Need (SGCN) in the Washington State Wildlife Action Plan; SGCN species can additionally be endangered (E), threatened (T), sensitive (S), or a candidate species for listing (C) in the state of Washington (WDFW 2015).

[4] Species of Greatest Conservation Need in the Oregon State Wildlife Action Plan; text displays whether the species is considered sensitive in the Blue Mountains (BM), Columbia Plateau (CP), and/or Northern Basin and Range (NBR) ecoregions (ODFW 2016), or whether the species is threatened (T) in Oregon (ODFW 2016).

[5] Partners in Flight Continental Landbird Conservation Plan (Rosenberg et al. 2016). Y = Yellow Watch List, CON = Species of Continental Concern in BCR 9, and SD = Common Species in Steep Decline.

Table 8. Landbird species with a high regional responsibility for conservation based on the percent of their range-wide population in Bird Conservation Region 9 (BCR 9 – Great Basin) (i.e., PIF Regional Stewardship Species; PIF 2021), which includes parts of eastern Oregon and Washington. The second and third columns display which birds are also focal and/or priority species in this document.

Responsibility Species	% Population in BCR 9	Focal	Priority
Brewer's Blackbird	27.1		√
Brewer's Sparrow	57.2	√	√
California Quail	27.0		
Calliope Hummingbird	31.6		√
Cassin's Finch	36.9		√
Gray Flycatcher	68.8	√	√
Green-tailed Towhee	28.2	√	√
Lazuli Bunting	29.4	√	
Lewis's Woodpecker	46.7	√	√
Pinyon Jay	39.9		√
Rock Wren	27.2		
Sage Thrasher	64.0	√	√
Sagebrush Sparrow	73.0	√	√

Population Estimates

Population size is an important metric in assessment of a species conservation status and its response to natural or anthropogenic changes to its habitat. Within PIF, the Avian Conservation Assessment Database includes population size as one of several factors considered in the prioritization of species (PIF 2021). Although sufficient habitat is essential for bird conservation, habitat conservation does not necessarily equate to bird conservation. Habitat conservation efforts still require an assessment of bird populations, the ultimate measure and currency of bird conservation. This concept is currently receiving increasing emphasis among bird conservation partners as a means of quantitatively accounting for the response of bird populations to investments in habitat conservation.

Population estimates have been developed for all bird species in North America at the continental level. Population estimates for landbirds were originally published in the PIF Continental Plan (Rich et al. 2004), and later updated in the PIF Population Estimates Database (PIF 2020) with new data and to address some of the recommendations of Thogmartin et al. (2006). The estimates were derived from a process described in Blancher et al. (2007) using abundance counts from BBS data. The population estimates were further stepped down to smaller geographic scales (i.e., states, BCRs, states within BCRs) to provide a starting point for dialogue on the setting of regional population objectives through regional assessments (Rosenberg et al. 2016). Although this top-down approach does not account for the known disproportionate sampling of habitats by the BBS, it does illustrate differences in the relative degrees of magnitude among species' population sizes, and provides a point of discussion for initiating the dialogue on the impacts of actions on landbird populations. Further, as mentioned above, eastern Oregon and Washington comprises a relatively small portion of the Great Basin Bird Conservation Region (BCR 9). Population estimates using the process stepped down from the continental population estimates are provided for focal, priority, and responsibility species in Table 9.

Lazuli Bunting by James Livaudais

Green-tailed Towhee by Frank Lospalluto

Table 9. Population estimates of focal, priority, and responsibility species in all of the U.S. and Canada, Bird Conservation Region 9 (BCR 9), and Oregon and Washington portions of BCR 9, stepped down from Partners in Flight continental population estimates (PIF 2020). Percent columns indicate percent of the total U.S./Canada population in that region. Blank cells indicate no BBS data are available for that species and geography.

Common Name	USA/CAN	BCR 9		BCR 9 Oregon		BCR 9 Washington	
	Pop. Est.[1]	Pop. Est.[1]	%[2]	Pop. Est.[1]	%[2]	Pop. Est.[1]	%[2]
Mountain Quail	250,000	19,000	7.7	4,700	1.9		
California Quail	3,400,000	1,600,000	46.2	290,000	8.7	610,000	18.2
Greater Sage-Grouse	430,000			0	0.0		
Sharp-tailed Grouse	760,000	1,600	0.2				
Common Nighthawk	22,000,000	3,000,000	13.9	680,000	3.1	240,000	1.1
Black Swift	89,000	2,700	3.0			2,200	2.5
Broad-tailed Hummingbird	8,800,000	780,000	8.9				
Rufous Hummingbird	22,000,000	1,700,000	7.8	140,000	0.7	750,000	3.5
Calliope Hummingbird	4,500,000	1,400,000	31.6	58,000	1.3	240,000	5.4
Sandhill Crane							
Upland Sandpiper							
Golden Eagle	63,000			0	0.0	0	0.0
Northern Harrier	820,000	140,000	17.2	32,000	3.9	18,000	2.2
Bald Eagle	200,000			0	0.0	0	0.0
Swainson's Hawk	820,000	94,000	11.4	6,000	0.7	11,000	1.3
Ferruginous Hawk	110,000	18,000	16.8	2,900	2.6	130	0.1
Burrowing Owl	990,000	60,000	6.0	5,400	0.5	710	0.1
Long-eared Owl	150,000	18,000	12.2	2,800	1.8	6,500	4.3
Short-eared Owl	600,000	69,000	11.5	16,000	2.6	3,600	0.6
Lewis's Woodpecker	82,000	38,000	46.7	4,400	5.4	14,000	17.4
Red-naped Sapsucker	2,000,000	270,000	13.8	2,500	0.1	48,000	2.4
Red-naped Sapsucker	2,000,000	270,000	13.8	2,500	0.1	48,000	2.4
Peregrine Falcon	72,000					0	0.0
Ash-throated Flycatcher	6,800,000	350,000	5.0	57,000	0.8	1,100	0.0

Common Name	USA/CAN	BCR 9		BCR 9 Oregon		BCR 9 Washington	
	Pop. Est.[1]	Pop. Est.[1]	%[2]	Pop. Est.[1]	%[2]	Pop. Est.[1]	%[2]
Willow Flycatcher	8,100,000	880,000	10.9	150,000	1.9	240,000	3.0
Gray Flycatcher	2,900,000	2,000,000	68.8	570,000	19.8	3,000	0.1
Loggerhead Shrike	4,600,000	710,000	15.5	130,000	2.8	9,700	0.2
Pinyon Jay	760,000	310,000	40.5	11,000	1.4		
Horned Lark	100,000,000	14,000,000	14.1	1,100,000	1.1	1,600,000	1.6
Bank Swallow	7,900,000	1,100,000	13.7	53,000	0.7	360,000	4.5
Juniper Titmouse	290,000	38,000	13.0	220	0.1		
Rock Wren	3,400,000	1,100,000	33.0	300,000	9.0	59,000	1.8
Mountain Bluebird	5,600,000	1,300,000	23.2	320,000	5.7	110,000	2.0
Sage Thrasher	6,400,000	4,100,000	64.1	760,000	12.0	69,000	1.1
Cassin's Finch	3,200,000	1,200,000	37.1	200,000	6.3	130,000	4.1
Grasshopper Sparrow	33,000,000	410,000	1.2	20,000	0.1	250,000	0.8
Black-throated Sparrow	31,000,000	7,200,000	23.1	220,000	0.7		
Lark Sparrow	11,000,000	1,200,000	11.0	66,000	0.6	33,000	0.3
Brewer's Sparrow	17,000,000	9,600,000	57.2	1,600,000	9.7	220,000	1.3
Sagebrush Sparrow	5,400,000	3,900,000	73.0	240,000	4.4	29,000	0.5
Green-tailed Towhee	4,800,000	1,400,000	28.3	350,000	7.4		
Yellow-breasted Chat	15,000,000	370,000	2.5	46,000	0.3	29,000	0.2
Bobolink	10,000,000	55,000	0.5	12,000	0.1	8,700	0.1
Bullock's Oriole	6,900,000	1,600,000	22.5	150,000	2.1	410,000	6.0
Brewer's Blackbird	23,000,000	6,400,000	27.3	1,200,000	5.3	1,000,000	4.4
Virginia's Warbler	900,000	15,000	1.7				
Yellow Warbler	93,000,000	3,000,000	3.3	270,000	0.3	380,000	0.4
Wilson's Warbler	81,000,000	440,000	0.5	26,000	0.0	190,000	0.2
Lazuli Bunting	6,500,000	1,900,000	29.5	400,000	6.2	220,000	3.4

[1] Population estimates are heavily rounded.

[2] Estimates of percent population are likely more accurate than population estimates, which are heavily rounded (P. Blancher pers. comm.)

Biological Objectives

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

- a mosaic of native sagebrush-steppe habitats with areas of steppe with variable grass heights, sagebrush shrublands with varying shrub cover and height, and minimal exotic annual grasses,
- large patches of structurally complex riparian habitat, with robust multi-layered native vegetation (canopy, subcanopy, shrub, and herbaceous layers), and
- appropriate proportions of juniper savannah and woodland within the sagebrush-steppe landscape.

Secondly, habitat objectives are presented for 19 focal species and their associated habitat attributes at the site scale to promote the desired conditions and structural components to support landbird conservation within each habitat type. Lastly, population objectives are presented for the 19 focal species as the ultimate bird conservation metric to assess focal species status, following the PIF Continental Landbird Conservation Plan (Rosenberg et al. 2016).

In the following sections, biological objectives are described for each focal species and associated habitat attribute presented in Tables 4-6. Preceding these, there are brief comments about the habitat or species, and a listing of primary habitat associations for each species. This is followed by habitat and population objectives, and recommended habitat strategies to achieve the objectives. The habitat strategies are species-specific recommendations independent of the more general habitat strategies presented for each habitat type. Assumptions and data sources upon which the biological objectives are based are stated, along with suggestions for research or monitoring to address priority information needs. Examples of priority and responsibility species most likely to benefit from habitat management or restoration for each focal species are presented in Appendix A.

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

Mountain big sagebrush with native grass understory by Aaron Holmes

SAGEBRUSH-STEPPE

Wyoming big sagebrush habitat by Aaron Holmes

Sagebrush-steppe is the dominant habitat within the geography of this document. The steppe component is scattered in small patches, but historically dominated the relatively large Palouse Prairie in eastern Washington. Sagebrush-steppe is a xeric habitat characterized by shrubs, especially sagebrush, or co-dominated by shrubs and perennial bunchgrasses. The most common shrub species in this region is big sagebrush (which has several subspecies, including basin, Wyoming, and mountain big sagebrush), and several sagebrush-obligate bird species are closely associated with it. Other types of sagebrush and other shrub species can be locally dominant. Generally, the species of sagebrush or shrub is less important to landbirds than its height, foliage density, cover, and distribution across the landscape (Paige and Ritter 1999). In a sagebrush-steppe understory, one or more perennial bunchgrass species are usually dominant. Additionally, a broad diversity of forbs are important herbaceous components, although cover of those species has been greatly diminished by a long-term history of livestock grazing and invasive competitors. A summary of the habitat features important to sagebrush-steppe landbirds is presented in Appendix C.

Conservation Issues

- there are a substantial number of obligate and semi-obligate landbird species; thus, threats to the habitat jeopardize the persistence of these species
- extensive permanent habitat conversions of sagebrush-steppe (e.g., approximately 60% of sagebrush-steppe in Washington [Dobler et al. 1996]) to other uses (e.g., agriculture, urbanization)

- fragmentation of remaining patches of moderate to good quality sagebrush-steppe habitat
- habitat degradation from intensive grazing and invasion of exotic plants, particularly annual grasses such as cheatgrass, and woody vegetation such as Russian olive
- loss and degradation of properly functioning sagebrush-steppe ecosystems due to encroachment by urban and residential development
- most of the remaining sagebrush-steppe in Washington is in private ownership (54%; WDFW 2015)
- best sites for healthy sagebrush communities (deep soils, relatively mesic conditions) are also best for agricultural productivity; thus, past losses and potential future losses are great
- loss of big sagebrush communities to brush control
- loss and reduction of cryptogamic crusts, which help maintain ecological integrity of sagebrush-steppe communities
- conversion of Conservation Reserve Program (CRP) lands back to cropland
- hostile landscapes, particularly those in proximity to agricultural and residential areas may have high density of nest parasites (Brown-headed Cowbirds) and domestic predators (cats), and may be subject to high levels of human disturbance
- agricultural practices that cause direct or indirect mortality and/or reduce bird productivity
- departures from historic fire regimes, either suppression or uncharacteristically severe wildfire
- invasion and seeding of crested wheatgrass which reduces habitat suitability
- expansion of juniper woodlands into historic sagebrush-steppe habitats

Regional Habitat Objectives

- Strive for "no net loss" of sagebrush-steppe habitat (i.e., discourage loss and conversion of habitat, but when unavoidable, mitigate with equal or greater restoration efforts).
- Maintain existing areas of moderate- to high-quality sagebrush-steppe vegetation, and actively manage to promote their sustainability.
- Initiate actions to enhance size and connectivity of existing quality sagebrush-steppe patches (i.e., reduce fragmentation).
- Initiate actions to avoid or minimize further degradation of sagebrush-steppe habitat (e.g., reduce, eliminate or better manage livestock grazing).
- Initiate actions to improve quality of degraded sagebrush-steppe habitat through appropriate management (see Habitat Strategies throughout the plan).
- Maintain cryptogamic crusts where they occur, and seek ecologically appropriate sites for restoration to ensure proper functioning native plant communities.

Mountain big sagebrush habitat by Aaron Holmes

- Maintain sites dominated by native vegetation and initiate actions to prevent spread of exotic vegetation.

- Encourage restoration of agricultural lands to native cover types through acquisition, easement, or incentive programs.

- Increase habitat for grassland-associated species by managing non-native grasslands (e.g., agricultural lands, inactive grasslands such as CRP and fallow fields) as suitable habitat where ecologically appropriate (i.e., where viable landbird populations can be maintained).

Where ecologically appropriate in large patches of sagebrush habitat (e.g., watershed, Greater Sage-Grouse management unit, etc.), initiate actions to maintain or provide:

- >50% of the landscape in a mid- to late-seral stage with shrub cover >15%,

- at least one contiguous tract >400 ha (1,000 ac) with high-quality conditions (see Sagebrush Sparrow species account), and

- <10% of the landscape as hostile habitat (e.g., developed areas with human habitation, intensively managed agricultural lands).

Assumptions/Rationale: "No net loss" includes permanent conversion or degradation that compromises the ecological integrity of the habitat and/or reduces its suitability for our focal species. Natural events (e.g., wildfire) and some restoration activities (e.g., prescribed fire) that result in short-term "loss" are not considered here. Hostile habitat should not exceed 10% in order to minimize potential impacts of fragmentation and adverse human-related effects (disturbance from increased activity, residences where feral cats and dogs are an issue).

Monitoring BBS trends provides a coarse means of assessing progress of conservation actions relative to populations with a known baseline. This is not intended to replace monitoring that should occur to track progress at specific locations where conservation actions occur. The objective for reversing declining BBS trends assumes that actions to improve habitat will occur throughout the geography of this document, and the success of those actions will be reflected through increased abundance of declining species on randomly located BBS routes. The objective to reverse declining population trends also assumes that conservation actions on the breeding grounds will positively affect landbird populations. This is not necessarily the case for migratory birds subject to other adverse impacts during migration and/or on the wintering grounds. When conservation actions do not result in a positive population response by a species, efforts should be made to assess the appropriateness of the conservation actions and/or the likelihood of factors outside of the breeding grounds negatively affecting populations.

Conservation Strategies

These general recommendations are presented to support conservation of landbirds in sagebrush-steppe habitat. Specific recommendations are also provided for focal species in each species account.

Acquisition/Restoration:

- Support partnerships that seek to acquire and/or restore native sagebrush-steppe habitat (e.g., TNC, State, BLM and private partnerships in the Moses Coulee/Beezley Hills area, Douglas County, Washington).

- Develop conservation agreements with private landowners to enhance the quality of sagebrush-steppe habitat.

- Seek to maximize contiguous area of sagebrush-steppe and thus minimize fragmentation. The larger the area, the greater the likelihood of maintaining populations of area-sensitive and large territory species such as Sagebrush Sparrow and Greater Sage-Grouse.

- Use native species and local seed sources in restoration.

- Restore areas that were seeded in crested wheatgrass.

Timing of Activities:

- In agricultural lands, minimize or avoid field operations and recreational activities (e.g., ATV riding adjacent to fields) during the breeding season (April 15 - July 15).

Mowing/Harvesting/Burning: Mowing/haying affects grassland birds directly and indirectly. It may reduce height and cover of herbaceous vegetation, destroy active nests, kill nestlings and fledglings, cause nest abandonment, and increase nest exposure and predation levels (Bollinger et al. 1990). Studies of Grasshopper Sparrow have indicated higher densities and nest success in areas not mowed until after July 15 (Shugart and James 1973, Warner 1992).

- Delay mowing, haying, or harvesting of grass-dominated fields as long as possible, preferably until after July 15.

- Space mowing or haying frequency as widely as possible to increase the probability of successful nesting.

- In lower elevation, xeric areas with high cheatgrass fuel loads (primarily parts of the Columbia Basin subregion), fire suppression should be considered when fire threatens large patches of sagebrush (Holmes and Geupel 1998).

- Managing wildfire is very different in higher elevation mountain sagebrush where a lack of fire promotes juniper expansion, compared to lower elevation and more xeric communities where increased fire is facilitating conversion to exotic annual grasslands (A. Holmes pers. comm.).

Tilling: Tilling (disking, planting, cultivation) of agricultural fields may destroy active nests and cause mortality to nestlings or fledglings, particularly if the initial tilling is in May and birds have already initiated nesting in the residue of the field from the previous year. Minimum or no tilling will also increase foraging opportunities by providing habitat for insect prey.

Black-throated Sparrow by Frank Lospalluto

- Where possible, use no-till practices or conduct tilling prior to April 15 or after July 15.

Grazing: Poorly managed grazing may negatively affect habitat by altering plant species composition, reducing residual vegetation, inhibiting vegetation recruitment, and facilitating encroachment of noxious weeds. Grazing may not adversely impact vegetation if relatively light pressure is rotated between pastures and deferred on an annual and seasonal basis. Where this ideal grazing regime is not possible, lighter grazing pressure is the key element.

- Implement grazing practices that are consistent with growth of native plants and forbs. This may include increasing rest cycles in rest-rotation systems, and/or deferring grazing until bunchgrasses have begun to cure.
- Manage livestock numbers or time on rangeland to maintain the ecological integrity of the plant community through fencing exclusions or time management.
- Exclude livestock grazing from relatively pristine areas.

Insecticides/Herbicides: Use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce vegetative cover and indirectly affect the insect food base.

- Minimize or discontinue use of pesticides wherever possible.
- Practice procedures in Integrated Pest Management (described in ORS 634.122) for reduced destruction of non-target insects.
- Encourage biological controls rather than chemical controls wherever possible.
- Treatments should be followed by restoration activities.
- Limit the application of herbicides to invasive non-native species, and use in conjunction with habitat enhancement projects which include long-term solutions to control future invasions.

Livestock grazing in sagebrush habitat by Shanna Dewey

Uncultivated Areas: Uncultivated areas (e.g., inter-agriculture circles) provide habitat diversity within large expanses of cultivation. Some species may use uncultivated areas as refugia or as nesting habitat (A. Holmes unpubl. data).

- Provide uncultivated herbaceous areas within or adjacent to cultivated fields to provide habitat diversity and potential nesting habitat for some landbirds.
- Avoid spraying or mowing uncultivated herbaceous vegetation within or adjacent to cultivated fields (e.g., fence rows, roadsides, and untillable land such as rocky soils).
- Establish healthy stands of desirable native vegetation adjacent to irrigated fields to avoid the spread of noxious weeds.

Prioritization: All actions to acquire, maintain, enhance, or subsidize lands for bird conservation should consider the following factors:

- proximity to large contiguous tracts of good quality sagebrush-steppe
- proximity to populations of target priority/focal species
- sites free of or most resistant to exotic grass invasion or dominance (i.e., higher moisture regime, >30 cm [12 in]/year)
- benefit to multiple sagebrush-steppe species
- risk of habitat loss to development or conversion to unsuitable habitat
- quality of the habitat, both current and potential
- compatibility of current and projected adjacent land uses
- uniqueness of the site in a local and regional context
- likelihood of securing the land for conservation

Focal Species

For sagebrush-steppe species, information about changes in historical source habitats from the ICBEMP terrestrial vertebrate habitat analyses are presented where available (Wisdom et al. 2000, ICMIET 2014). For all species, "ecologically appropriate" refers to the potential vegetation of the site, considering hydrology, soils, topography, and natural ecosystem processes. For all species, monitoring BBS trends provides a coarse means of assessing progress of conservation actions relative to populations with a known baseline. This is not intended to replace monitoring that should occur to track progress at specific locations where conservation actions occur. The objective for stable or increasing BBS trends assumes that actions to improve habitat will occur throughout the geography of this document, and the success of those actions will be reflected through increased abundance of focal species on randomly located BBS routes.

Low elevation sagebrush habitat by Aaron Holmes

GRASSHOPPER SPARROW

(Ammodramus savannarum)

Habitat Subtype: steppe

Habitat Attribute: native bunchgrass cover in steppe

Grasshopper Sparrow by James Livaudais

Species comments:

According to the ICBEMP terrestrial vertebrate habitat analyses, historical source habitats for Grasshopper Sparrow within the geography of this document occurred primarily along the eastern portions of the Columbia Plateau ERU and the northern portion of the Owyhee Uplands with a small amount in the Northern Great Basin (Wisdom et al. 2000). Within this core of historical habitat, the current amount of source habitat has been reduced dramatically from historical levels by 91% in the Columbia Plateau and 85% in the Owyhee Uplands (Wisdom et al. 2000). Grasshopper Sparrow may have expanded its range in eastern Washington from historical occurrence only in southeastern corner of the state (Jewett et al. 1953). It is a semi-colonial nester. Mean territory size is about 0.8 ha (2 ac) (VerCauteren and Gillihan 2004). Breeding populations in Oregon are often erratic, appearing in one area for a few years, then disappearing again (Marshall et al. 2006).

Primary habitat associations:

- native perennial bunchgrass with low shrub cover and patchy bare ground (Holmes and Geupel 1998, (Holmes and Miller 2010, Earnst and Holmes 2012, BCOR 2018)
- also occupies agricultural grasslands (e.g., hayfields, pastures, CRP) with intermediate grass height (Ruth 2015)
- can occupy sagebrush-bunchgrass habitat, but abundance negatively associated with shrub cover and density, sagebrush cover and density, open ground, and number of sagebrush stems >2.5 cm (Holmes and Geupel 1998)
- less abundant in depleted sagebrush and sagebrush with exotic cheatgrass understory (Vander Haegen et al. 2000, Holmes and Miller 2010, Earnst and Holmes 2012)
- more common in bunchgrass grasslands than any other cover type; in habitats with shrubs, more common in sagebrush–bunchgrass than in sagebrush–cheatgrass, which tends to have more sagebrush cover and less bunchgrass cover (Earnst and Holmes 2012)
- completely avoids areas with >35% shrub cover (VerCauteren and Gillihan 2004, BCOR 2018)
- present in most CRP lands older than five years in southeastern Washington (M. Denny pers. comm.)
- positively associated with percent cover perennial grass (Vander Haegen et al. 2000)
- needs some elevated perches (taller grass or forb stalks) for singing perches (Marshall et al. 2006), but negatively associated with density of tall live or dead grass (Davis 2004)
- nest density decreased, but population density was not significantly affected, by increased cattle stocking rates in northeastern Oregon (Johnson et al. 2011)
- abundance decreases with increasing amounts of wooded edge surrounding a grassland patch (Greer et al. 2016)
- abundance was lower for 7 years after a large-scale, severe wildfire in the Columbia Basin, south-central Washington (Earnst et al. 2009)

Conservation Issues:

- conversion of bunchgrass habitat to agriculture
- alteration of bunchgrass habitat from intensive grazing, altered fire regimes, and exotic grass and forb invasions (Quigley et al. 1996, USFWS 2006)
- shrub encroachment on grasslands from overgrazing and fire suppression
- vulnerable because of high use of agricultural habitats (e.g., CRP) which are unreliable from year to year
- use of agricultural habitats and nearby lands may make Grasshopper Sparrow vulnerable to pesticide effects on productivity or insect prey base (Martin et al. 2000, Mineau and Whiteside 2013)
- early season mowing of hayfields and similar agricultural lands may result in nesting failure and reduced productivity
- area-sensitive (Herkert 1994, Johnson 2001); large tracts of habitat are more likely to support populations (Davis 2004, BCOR 2018), and they respond negatively to increased amount of edge (Greer et al. 2016)

Habitat Objectives:

Where ecologically appropriate, initiate actions in native grasslands to maintain or provide the following conditions:

- native bunchgrass cover >15% and comprising >60% of the total grass cover
- moderate height herbaceous layer 10-30 cm (4-12 in.) high
- low shrub cover (1-5%), and mostly native
- some bare ground required, but <25% cover

Manage non-native and agricultural grasslands (e.g., CRP) as potential habitat within the following conditions:

- grass-forb cover >90%
- shrub cover <10%
- variable grass heights between 15-46 cm (6-18 in.)

Where ecologically appropriate at the landscape level, provide conditions described above in patches >40 ha (100 ac) or multiple smaller patches >12 ha (30 ac) within a mosaic of suitable grassland conditions.

Population Objectives:

- Stabilize: slow rate of decline by 45-60% by 2026. Rate of decline for 2016-2026 should be 45-60% less than long-term decline.
- Achieve stable population with no more than 10-25% loss of 2016 population by 2046.

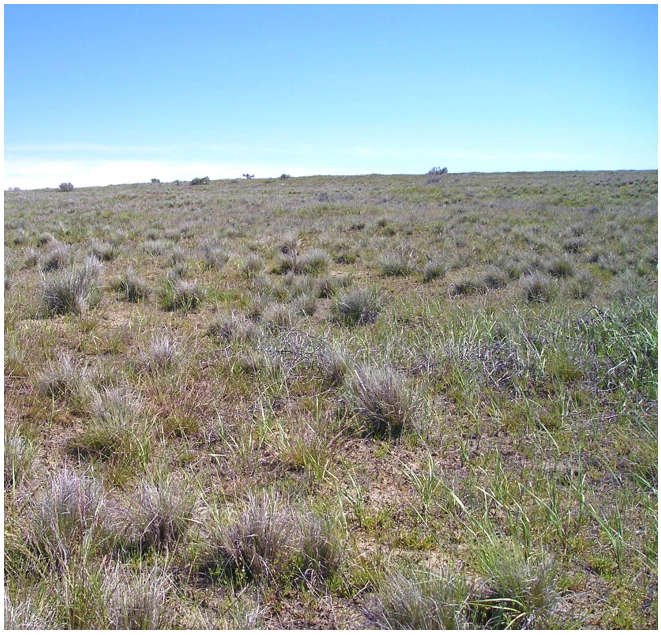
Assumptions/Rationale:
The objective for native bunchgrass cover and in steppe grasslands is based on Holmes and Geupel (1998) and Holmes and Miller (2010). Objective for shrub cover is based on VerCauteren and Gillihan (2004), Holmes and Miller (2010), and BCOR (2018). The objective for grass height is based on BCRs 17 and 18 (VerCauteren and Gillihan 2004 and BCOR 2018). Objective for bare ground cover is based on Whitmore (1981), Bock and Webb (1984), and BCOR (2018). The objectives for agricultural grasslands are from westside habitats (Altman 1999). A diverse community of native bunchgrasses and forbs provides nesting cover and insect and seed food resources. Blocks of habitat >100 acres can provide for at least 20 pairs, which may be sufficient to maintain a small population for this potentially area-sensitive species (see Conservation Issues) even if area is not linked with other Grasshopper Sparrow populations. Despite relatively stable trends, Grasshopper Sparrow use of agricultural grasslands makes it vulnerable when changes in agricultural practices occur. Population objective is based on the PIF Continental Plan (Rosenberg et al. 2016).

Habitat Strategies:

- High priority areas for grassland and Grasshopper Sparrow conservation are the Palouse Prairie and Columbia Basin subregions.
- Restore grasslands whenever possible to native bunchgrass cover.
- Eliminate, defer, or actively manage grazing intensity to maintain appropriate grass cover; this may include fall and winter grazing (but not spring and summer), and/or rotational systems where some fields not grazed at all.
- Avoid placing agricultural grass fields adjacent to or near native bunchgrass habitat where birds may be pulled into agricultural fields that potentially function as population sinks.
- Seek to provide the largest tracts of suitable habitat possible (minimum patch size 12 ha or 30 ac; BCOR 2018).
- Delay mowing of suitable habitat until after July 15.
- Where treatments are occurring in grasslands (e.g., burning, mowing, chemical applications), leave adjacent untreated areas to maintain a population until treated areas become suitable habitat again.

Information needs:

1. Data are needed on all aspects of nesting ecology in this region, including differences between native grassland, exotic grassland, and CRP lands.
2. Data are needed on whether grazing and cowbird parasitism impacts productivity and, if so, in what landscape and land use context.
3. Is Grasshopper Sparrow as area-sensitive in native habitats? If so, what are the conditions under which productive populations can be maintained?
4. Do pesticides have lethal and/or sublethal effects on adults and nestlings, and if so how does this affect populations?



Low elevation needle and thread grass by Aaron Holmes

Grasshopper Sparrow by James Livaudais

BREWER'S SPARROW

(Spizella breweri)

Habitat Subtype: sagebrush

Habitat Attribute: sagebrush cover

Brewer's Sparrow by James Livaudais

Species comments:

Historical source habitats for Brewer's Sparrow occurred throughout most of the three ERUs within the geography of this document (Wisdom et al. 2000). Declines in source habitats were moderately high in the Columbia Plateau (39%), but relatively low in the Owyhee Uplands (14%) and Northern Great Basin (5%). However, declines in big sagebrush (e.g., 50% in the Columbia Plateau ERU), which is likely higher quality habitat, are masked by an increase in juniper sagebrush (>50% in the Columbia Plateau ERU), which is likely reduced quality habitat (Wisdom et al. 2000). Can comprise >50% of the breeding bird community in sagebrush-steppe habitats (Rotenberry and Wiens 1980). Territory sizes are typically 0.2-0.6 ha (0.5-1.4 ac), but occasionally as large as 2 ha (5 ac) in low quality habitat (VerCauteren and Gillihan 2004). Brewer's Sparrows typically forage by gleaning from leaves of sagebrush and other shrubs.

Primary habitat associations:

- sagebrush associate where sagebrush cover is abundant, especially big sagebrush
- can occupy desert shrub communities where sagebrush is not abundant (T. Rich pers. comm.)
- source habitats considered in the Interior Columbia Basin include two structural stages of big sagebrush and mountain big sagebrush: open canopy, low-medium shrub, and closed canopy, low-medium shrub; the closed herbaceous structural stage of big sagebrush; juniper sagebrush; and mountain mahogany (Wisdom et al. 2000)
- in Wyoming, common in early successional juniper woodland with low canopy and high shrub cover (Pavlacky and Anderson 2004)
- abundance positively associated with bare ground and shrub cover (VerCauteren and Gillihan 2004), particularly big sagebrush (Dobler et al. 1996)
- abundance increased with increasing cover of big sagebrush up to 10%; then abundance steady between 10-20% cover of big sagebrush (Dobler et al. 1996)
- nests often placed low in large, dense shrubs (usually sagebrush) (VerCauteren and Gillihan 2004)
- prefers areas that have not been recently burned (VerCauteren and Gillihan 2004)
- in mountain big sagebrush habitats in Nevada, Brewer's Sparrow density was still reduced compared to unburned areas 8-9 years post-fire (with ~10% shrub cover), but density recovered 11-14 years post-fire (at ~18% shrub cover), and increased 19-20 years post-fire (at nearly 30% shrub cover) (Holmes and Robinson 2013)
- patchy interspersion of clumped sagebrush with small openings preferred over contiguous dense sagebrush, which probably provides too much cover
- at the nest-site scale, taller, more vigorous shrubs with greater branching density increased probability of nest-site selection (Barlow et al. 2020)

- nest patches have greater sagebrush cover, total foliage, and horizontal and vertical habitat heterogeneity (Rotenberry and Wiens 1980, Chalfoun and Martin 2007, 2009, Vander Haegen 2007, Harrison and Green 2010)
- evidence for preferred forb and grass cover is equivocal, with some studies concluding a positive response to herbaceous cover (Paczek and Krannitz 2005, Ruehmann et al. 2011), a negative response to forbs (Barlow et al. 2020) or herbs (Peterson and Best 1985), a positive response to forbs and negative response to grasses (VerCauteren and Gillihan 2004), or an inconsistent response to herbaceous cover among years (Harrison and Green 2010)
- impact of well-managed grazing may be minimal. In Wyoming, grass height and cover (both native and invasive) did not strongly influence probability of nest-site selection (Barlow et al. 2020), and in Montana, no difference in abundance between sites grazed continually all year versus sites grazed for only 2 –3 months (Golding and Dreitz 2017)

Conservation Issues:

- removal of sagebrush below 10% cover adversely affects populations, although species is persistent where incomplete loss of sagebrush creates patchy islands of habitat (Peterson and Best 1987)
- not as sensitive to fragmentation as Sagebrush Sparrow (i.e., will occur in smaller patches but most abundant in larger patches) (Knick and Rotenberry 1995), but sensitive to sagebrush cover (i.e., will use small patches of sagebrush if cover and height are adequate)
- nest success higher in continuous landscapes compared to fragmented ones (Vander Haegen et al. 2002, Vander Haegen 2007) or near agricultural edges (Knight et al. 2014); fragmented areas of sagebrush-steppe may act as population sinks (Vander Haegen 2007)
- significantly less abundant on poor condition sites, suggesting an affinity for less disturbed communities that approach climax conditions (Vander Haegen et al. 2000)
- vulnerable to Brown-headed Cowbird parasitism where habitat alteration provides habitat for cowbirds (Rich 1978); parasitism rates are higher in fragmented landscapes (Vander Haegen 2007)
- vulnerable to trampling of nests by cattle
- needs tall sagebrush with high shrub cover, and low grass and litter cover; thus, continuous cheatgrass cover is detrimental
- cheatgrass cover can also increase fire frequency to the point where shrub regeneration is insufficient to provide suitable habitat (VerCauteren and Gillihan 2004)
- may be sensitive to oil and natural gas development; abundance decreased with increased well density (Gilbert and Chalfoun 2011) and within 100 m of roads with low traffic volume (Ingelfinger and Anderson 2004) in Wyoming

Habitat Objectives:

Where ecologically appropriate, initiate actions in sagebrush habitat to maintain or provide the following conditions:

- mean cover sagebrush 10-45%
- mean height sagebrush 45-100 cm (18-40 in.)
- vigorous sagebrush shrubs with high foliage and branching density
- mean native herbaceous cover >10% with <10% cover of non-native annual grasses
- mean open ground cover (includes bare and/or cryptogamic crust) >20%

Where ecologically appropriate at the landscape level, provide suitable habitat conditions described above in patches >8 ha (20 ac).

Population Objectives:

- **Maintain stable or increasing population trends over the next 10 years.**

Assumptions/Rationale:
Ideal sites would have loamy soils, <30% slope, and <30% rock cover (Short 1984). The objectives for cover of sagebrush, open ground, rock surface, and percent slope are based on Short (1984), T. Rich (pers. comm.), VerCauteren and Gillihan (2004), and Holmes and Altman (2015). The objective for sagebrush height is based on VerCauteren and Gillihan (2004) and Holmes and Altman (2015) and vigor is based on Barlow et al. (2020). Blocks of habitat >8 ha (20 ac) can provide for several pairs, which may be sufficient to maintain a small population even if area is not linked with other Brewer's Sparrow populations.

Habitat Strategies:

- Maintain conditions in areas relatively free from cheatgrass by minimizing soil disturbance from grazing.
- Fire suppression should occur where there is a risk of permanent sagebrush loss; one study found abundance increased relative to unburned areas but not until 19-20 years post-fire when shrub cover reached almost 30% (Holmes and Robinson 2013).
- Maintain >40% sagebrush cover on the landscape (i.e., percentage of sagebrush shrubland occurring within a 16.6-km^2 area); above this threshold, modelled abundances nearly doubled (Donnelly et al. 2017).
- Limit habitat fragmentation from roads, natural gas and oil extraction, and other development.
- May benefit from appropriately managed CRP lands (i.e., CRP grasslands with a well-developed sagebrush component); nest success and seasonal reproductive success were similar between CRP and native sagebrush-steppe (Vander Haegen et al. 2015).
- Mechanical removal of juniper in areas where it was not historically present resulted in more than doubling the abundance of Brewer's Sparrow in southeastern Oregon (Holmes et al. 2017).

Information Needs:

1. Data are needed on all aspects of Brewer's Sparrow nesting ecology in this region, particularly the relationship to livestock grazing and pesticide use.
2. Assessment of factors contributing to poor nest success.
3. Assessment of the viability of small populations in habitat fragments versus those in large contiguous blocks of habitat.
4. What role, if any, does cryptogamic crust play in Brewer's Sparrow ecology?

Brewer's Sparrow by James Livaudais

Sagebrush Sparrow by James Livaudais

SAGEBRUSH SPARROW

(Artemisiospiza nevadensis)

Habitat Subtype: sagebrush

Habitat Attribute: large, unfragmented patches of Wyoming big sagebrush

Species comments:

The now-defunct "Sage Sparrow" was split into two species in 2013; the species occupying eastern Oregon and Washington is the Sagebrush Sparrow. Historical source habitats for Sagebrush Sparrow occurred throughout most of the three ERUs within the geography of this document (Wisdom et al. 2000).

Declines in source habitats were moderately high in the Columbia Plateau (40%), but relatively low in the Owyhee Uplands (13%) and Northern Great Basin (7%). However, declines in big sagebrush (e.g., 50% in the Columbia Plateau ERU), which is likely higher quality habitat, are masked by an increase in juniper sagebrush (>50% in the Columbia Plateau ERU), which is likely reduced quality habitat. Within the entire Interior Columbia Basin, over 48% of watersheds show moderately or strongly declining trends in source habitats for this species (Wisdom et al. 2000). Mean territory size is about 0.8 ha (2 ac) (VerCauteren and Gillihan 2004). Sagebrush Sparrows often forage on the ground.

Primary habitat associations:

- xeric areas of sagebrush habitat where Wyoming big sagebrush and/or basin big sagebrush is dominant (A. Holmes pers. comm.), or salt desert scrub with co-dominant sagebrush and greasewood (Holmes and Altman 2015)
- area-sensitive; prefers large patches of unfragmented habitat with lots of sagebrush-steppe on the surrounding landscape (Vander Haegen et al. 2000)
- affinity for loamy soil communities with a dense shrub layer, particularly big sagebrush (Vander Haegen et al. 2000)
- patchy interspersion of clumped sagebrush with small openings preferred over contiguous dense sagebrush (Petersen and Best 1985, Wiens et al. 1986)
- prefers big sagebrush with high shrub cover, low grass and litter cover (Knick and Rotenberry 1995, Dobler et al. 1996)
- most studies report a negative association with densely growing annuals such as cheatgrass and a preference for native herbaceous understory (Dobler et al. 1996, Shapiro and Associates 1996, Holmes and Geupel 1998), although some suggest indifference to understory composition (Earnst and Holmes 2012)
- in Idaho, most abundant in sagebrush with primarily native understory, and absent from sagebrush sites dominated by exotic crested wheatgrass (Rockwell et al. 2021)
- rarely occurs on slopes (T. Rich pers. comm.)

Conservation Issues:

- sensitive to fragmentation (Knick and Rotenberry 1995); nests only in relatively large blocks of sagebrush-steppe (Vander Haegen et al. 2000), percentage of pairs fledging young is lower in fragmented landscapes, and fragmented areas of sagebrush-steppe may act as population sinks (Vander Haegen 2007)

- livestock grazing and altered fire regimes that promote invasion by cheatgrass or crested wheatgrass likely reduces suitable habitat (Martin and Carlson 1998)
- vulnerable to Brown-headed Cowbird parasitism where habitat alteration provides habitat for cowbirds (Rich 1978)
- nests early, so abundance may not be well-reflected by BBS in portions of their range
- may be sensitive to oil and natural gas development; abundance decreased with increased well density (Gilbert and Chalfoun 2011), road density (Mutter et al. 2015), and within 100 m of roads with low traffic volume (Ingelfinger and Anderson 2004) in Wyoming

Habitat Objectives:

Where ecologically appropriate, initiate actions to maintain or provide a sagebrush- dominated shrub canopy with the following conditions:

- mean sagebrush cover, particularly patchily distributed Wyoming big sagebrush, 15-32%
- mean sagebrush height 45-100 cm tall (18-40 in.)
- high foliage density in sagebrush shrubs
- mean native herbaceous cover >10%, with a diversity of native grasses and forbs and <10% cover of non-native annual grasses
- mean herb height < 10 cm (4 in.)
- mean open ground cover (includes bare and/or cryptogamic crust) >10%

Where ecologically appropriate at the landscape level, provide suitable habitat conditions described above in patches >400 ha (1,000 ac).

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.

Assumptions/Rationale:
The objectives for sagebrush cover was based on Holmes and Altman (2015). The objectives for litter, open ground, and herbaceous cover were based on Peterson and Best (1995). The objective for sagebrush height was based on Holmes and Altman (2015) and herb height was based on VerCauteren and Gillihan (2004). A diverse community of native bunchgrasses and forbs provides nesting cover and insect and seed food resources. The objective for contiguous blocks of habitat >400 ha (1,000 ac) is based on modeling of species-area relationships in the Columbia Basin of eastern Washington which indicates that Sagebrush Sparrow is most likely to occur on tracts of this size (M. Vander Haegen unpub. data).

Habitat Strategies:

- Maintain or restore large patches of sagebrush habitat.
- Minimize or eliminate cover of annual grasses, and provide mix of open ground and perennial grasses (Shapiro and Associates 1996).
- Maintain >50% of annual vegetative herbaceous growth of perennial bunchgrasses to persist throughout the following season (Saab et al. 1995).
- On grazed lands use a rest-rotation or deferred-management scheme.
- Fire suppression should occur where there is potential loss of sagebrush.
- Maintain >40% sagebrush cover on the landscape (i.e., percentage of sagebrush shrubland occurring within a 16.6-km^2 area) - above this modelled abundance nearly doubled (Donnelly et al. 2017).
- Limit habitat fragmentation from roads, natural gas and oil extraction, and other development.

Information Needs:

1. Data are needed on all aspects of Sagebrush Sparrow nesting ecology, especially area requirements to maintain source populations.

GREEN-TAILED TOWHEE

(Pipilo chlorurus)

Habitat Subtype: sagebrush

Habitat Attribute: mesic areas with mountain big sagebrush

Green-tailed Towhee by James Livaudais

Species comments:
Green-tailed Towhees are ground-foragers; when not perching to sing, they spend most of their time on the ground or in thick cover (Marshall et al. 2006). Mean territory size in sagebrush-steppe habitat in Utah was 0.9 ha (2.2 ac) (n = 7; Dotson 1971).

Primary habitat associations:

- sagebrush at higher elevations (typically >1500 m) in more mesic conditions (Holmes and Altman 2015)
- transition zone between sagebrush and other higher elevation shrub species, especially mountain snowberry (Knopf et al. 1990; A. Holmes pers. comm.), bitterbrush and *Ceanothus* spp. (T. Rich pers. comm.)
- shrubland dominated by mountain big sagebrush or open woodland (Dobbs et al. 2012, Holmes and Altman 2015)
- in Northern Great Basin, breeds in brushy slopes of desert mountain ranges, with scattered juniper or aspen trees, and substantial shrubs, particularly mountain-mahogany or snowbrush (Marshall et al. 2006)
- in Steens Mountains of Oregon, most common in areas with more sagebrush cover and intermediate juniper cover, as opposed to dense juniper stands with reduced shrub cover (Noson et al. 2006)
- in Wyoming, associated with open juniper woodland with taller scattered trees, more grass cover, and moderate shrub cover (Pavlacky and Anderson 2004)
- prefers well-developed shrub layer (Fleishman and Dobkin 2009) with high shrub diversity (Wiens and Rotenberry 1981, Sedgwick 1987, Knopf et al. 1990)
- abundance declines with increasing tree density (Holmes and Altman 2015)
- nests often located in patches containing multiple shrub species, especially mountain snowberry (Holmes and Altman 2015)

Conservation Issues:

- habitat alteration that reduces shrub cover and diversity
- conversion of sagebrush habitat to grasslands for livestock grazing or energy development (Braun et al. 1976)

Habitat Objectives:

Where ecologically appropriate, initiate actions in sagebrush habitat to maintain or provide the following conditions:

- shrub cover 25-40%, primarily mountain big sagebrush

- shrub height 70-130 cm (28-51 in.)
- maintain a high diversity of shrub species
- mean herbaceous cover 25%

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.

Assumptions/Rationale:
Habitat objectives for shrub cover and height based on Holmes and Altman (2015). Objective for herb cover based on (Reinkensmeyer et al. 2007).

Habitat Strategies:

- Prevent encroachment of trees into shrublands and open woodlands. Mechanical removal of juniper resulted in more than doubling the abundance of Green-tailed Towhee in southeastern Oregon (Holmes et al. 2017).
- Preserve and restore sagebrush habitat, especially in higher elevation mesic areas and along ecotonal edges with a diversity of other shrub species.

Information Needs:

1. Data are needed on all aspects of Green-tailed Towhee nesting ecology in this region, especially reproductive success and effects of brood parasitism.
2. Impacts of human activities on breeding habitat are not well known.
3. Data are also needed on post-fledging behavior, survival, and dispersal.
4. Other aspects of demography with major information gaps include survivorship of birds among different age and sex classes during different seasons.

Green-tailed Towhee habitat with 40% shrub cover by Aaron Holmes.

SAGE THRASHER

(Oreoscoptes montanus)

Habitat Subtype: sagebrush
Habitat Attribute: sagebrush height

Sage Thrasher by James Livaudais

Species comments:
Historical source habitats for Sage Thrasher occurred throughout most of the three ERUs within the geography of this document (Wisdom et al. 2000). Declines in source habitats were moderately high in the Columbia Plateau (40%), but relatively low in the Owyhee Uplands (15%) and Northern Great Basin (5%). However, declines in big sagebrush (e.g., 50% in the Columbia Plateau ERU), which is likely higher quality habitat, are masked by an increase in juniper sagebrush (>50% in the Columbia Plateau ERU), which is likely reduced quality habitat (Wisdom et al. 2000). Territories are typically 0.4-1.8 ha (1-4.5 ac) (VerCauteren and Gillihan 2004).

Primary habitat associations:

- sagebrush obligate typically found in shrubland or open woodland habitats dominated by big sagebrush (VerCauteren and Gillihan 2004, Holmes and Altman 2015)
- abundance positively correlated with shrub cover, bare ground, and horizontal habitat heterogeneity; negatively correlated with grass cover (Wiens and Rotenberry 1981, VerCauteren and Gillihan 2004)
- prefers lower grass and litter cover, and greater cover of sagebrush on the landscape scale (Millikin et al. 2020)
- in Idaho, most abundant in sagebrush with primarily native understory, and absent from sagebrush sites dominated by exotic crested wheatgrass (Rockwell et al. 2020)
- in WA and BC, preferred flatter areas farther from natural and anthropogenic habitat edges (Millikin et al. 2020)
- tall, dense clumps of shrubs needed for nest sites (Reynolds and Rich 1978, Rich 1978, VerCauteren and Gillihan 2004)
- particularly appropriate sites might be those with shallow and loamy sandy soil types (Vander Haegen et al. 2000)

Conservation Issues:

- conversion of native sagebrush habitat to crested wheatgrass or cheatgrass (e.g., for grazing or post-fire) makes habitat unsuitable (Reynolds and Trost 1980, 1981)
- significantly less abundant on poor condition sites, suggesting an affinity for less disturbed communities that approach climax conditions (Vander Haegen et al. 2000)
- not area-limited in eastern Washington: exhibited positive relationship with fragmentation, nested in small (<10 ha) sagebrush-steppe fragments in an agricultural matrix, and was not impacted by cowbird parasitism (Vander Haegen and Walker 1999, Vander Haegen et al. 2000). However, in Idaho where sagebrush-steppe fragmentation is due to fire and cheatgrass invasion, negatively associated with fragmentation (Knick and Rotenberry 1995). In British Columbia and Washington, avoided habitat edges (Millikin et al. 2020); and in Washington, habitat fragmentation greatly reduced nest success and productivity (Vander Haegen et al. 2002, Vander Haegen 2007)
- may be sensitive to oil and natural gas development; abundance decreased with

increased road density (Mutter et al. 2015) in Wyoming

- in Idaho, recognizes and rejects Brown-headed Cowbird eggs, thus may be less vulnerable to parasitism (Rich and Rothstein 1985)
- in Idaho, livestock grazing reduced nesting densities (Reynolds and Rich 1978)

Habitat Objectives:

Where ecologically appropriate, initiate actions in sagebrush habitat to maintain or provide the following conditions:

- mean cover of big sagebrush 17-40%, clumped rather than dispersed
- mean height of sagebrush 55-135 cm (22-53 in), with patches of shrubs on the taller end of that spectrum
- high foliage density in taller sagebrush shrubs
- mean native herbaceous cover 5-20%, with <10% cover of non-native annual grasses
- mean herb height <5 - 15 cm (<2 – 6 in.)
- mean bare ground cover >10%
- <10% cover of other shrubs such as spiny hopsage, budsage

Where ecologically appropriate at the landscape level, maintain patches of suitable habitat >16 ha (40 ac) to enhance likelihood of small populations.

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.

Assumptions/Rationale:
The objectives for sagebrush height and cover are based on Holmes and Altman (2015). Objectives for herb and bare ground cover, and herb height, based on VerCauteren and Gillihan (2004). A diverse community of native bunchgrasses and forbs provides nesting cover and insect and seed food resources. Blocks of habitat >16 ha (40 ac) may be sufficient to maintain a small population even if area is not linked with other Sage Thrasher populations.

Habitat Strategies:

- Fire suppression should occur where there is the potential permanent loss of sagebrush via conversion to annual grasses. Sage Thrasher likely benefits from occasional fires that prevent juniper encroachment.
- Maintain >50% of annual vegetative herbaceous growth of perennial bunchgrasses to persist throughout the following season (Saab et al. 1995).
- On grazed lands use a rest-rotation or deferred-management scheme; grazing is detrimental when it results in decreased shrub cover or increased annual grasses (VerCauteren and Gillihan 2004).
- Emphasize conservation on higher elevation sites (> 600m); possible benefits due to increased moisture and growth at higher elevations (Shapiro and Associates 1996).
- Emphasize conservation of sites with unbroken shrub cover rather than those fragmented by grasslands or croplands (VerCauteren and Gillihan 2004).
- Benefits from >40% sagebrush cover on the landscape (i.e., percentage of sagebrush shrubland occurring within a 16.6-km^2 area) - above this modelled abundances nearly doubled (Donnelly et al. 2017).

Information Needs:

1. Data are needed on all aspects of Sage Thrasher nesting ecology in this region, particularly their response to livestock grazing.
2. Assess the viability of small populations in fragments of habitat, particularly in agricultural landscapes, versus those in large contiguous blocks.
3. Assess the response (both in abundance and productivity) to various levels of grazing.

LOGGERHEAD SHRIKE

(Lanius lodovicianus)

Habitat Subtype: steppe-shrubland

Habitat Attribute: interspersion of tall shrubs and openings

Loggerhead Shrike by James Livaudais

Species comments:

Historical source habitats for Loggerhead Shrike included all three ERUs within the geography of this document (Columbia Plateau, Northern Great Basin, and Owyhee Uplands; as in Wisdom et al. 2000). Within this core of historical habitat, declines in source habitats occurred in the Columbia Plateau (25%), and Owyhee Uplands (13%), and an increase occurred in the Northern Great Basin (11%). However, declines in big sagebrush (e.g., 50% in the Columbia Plateau ERU), which likely is higher quality habitat, are masked by an increase in juniper sagebrush (>50% in Columbia Plateau ERU), which may be lower quality habitat for this species (Wisdom et al. 2000). There have been noticeable declines in the Lower Columbia Basin and very low recruitment into populations throughout southeastern Washington (M. Denny pers. comm.). Shrikes are unique among passerines in their ability to kill vertebrate prey. Territory sizes range from 4.5-16 ha (11-40 ac) (VerCauteren and Gillihan 2004).

Primary habitat associations:

- open habitat with interspersion of tall woody shrubs (e.g., big sagebrush, bitterbrush) or trees (e.g., juniper) for nesting and open ground for foraging (Holmes and Altman 2015)
- deep, sandy soils (Vander Haegen et al. 2000)
- salt scrub and black greasewood communities in the Great Basin (G. Ivey pers. comm.)
- nests predominantly in sagebrush (Woods and Cade 1996, Holmes and Geupel 1998) or juniper (R. Gerhardt unpubl. data)
- abundance positively associated with density of big sagebrush (Dobler et al. 1996, Humple and Holmes 2006)
- late seral big sagebrush or antelope bitterbrush within a mosaic of openings and patches of tall shrubs in Washington (Poole 1992)
- nests in shrubs 1-2 m tall (3-6 ft) (Woods and Cade 1996); tallest shrubs important as fledgling roost sites (Leu 1995)
- in Oregon, nest success not associated with nest height (Nur et al. 2004)
- foraging success decreases with increasing amount of cheatgrass cover (Leu 1995)
- a fire resulting in areas of fragmented shrub cover embedded in a complex of mostly annual grasslands reduced population abundance by 50% and significantly lowered nest success (Humple and Holmes 2006)

Conservation issues:

- habitat loss from conversion to agriculture (BCOR 2018)
- habitat loss from frequent fires in cheatgrass-dominated sites (i.e., fires that reduce shrub cover and promote conversion of nesting habitat to grassland) (Humple and Holmes 2006); in mountain big sagebrush habitats in northwestern Nevada, Loggerhead Shrike only occurred at unburned sites, not at burned sites up to 20 years post-fire (Holmes and Robinson 2013)
- an Oregon study found nest success to be poor over many years, suggesting that productivity

may play a role in regional population declines (Humple and Holmes 2006)

- low productivity in degraded sagebrush-steppe habitat (Holmes and Geupel 1998), and in small remnant patches of fragmented sagebrush-steppe (Humple and Holmes 2006)
- long-term heavy grazing may ultimately reduce prey habitat and degrade the vegetation structure for nesting and roosting
- foraging sites, particularly for young birds, need to have open ground (bare and/or cryptogamic crusts) or little vegetative cover (Leu 1995); invasion of exotic annual grasses, particularly cheatgrass, has been detrimental
- may suffer sublethal effects (e.g., reduced reproductive output) from certain insecticides (Anderson and Duzan 1978, Yosef 1996)
- use of insecticides (e.g., for grasshopper control) may reduce prey base (Yosef 1996, BCOR 2018)

Habitat Objectives:

Where ecologically appropriate, initiate actions in steppe-shrubland habitat to maintain or provide the following conditions:

- late-seral big sagebrush or bitterbrush, with patches of tall shrubs or juniper trees (mean height of shrubs >1 m [39 in.])
- 5 - 15% tall shrub cover (non-rabbitbrush)
- herbaceous cover <20% and dominated by native species
- mix of short <10 cm (4 in) and tall >20 cm (8 in.) grasses
- mean open ground cover (includes bare and/or cryptogamic crusts) >20%

Population Objectives:

- Stabilize: low rate of decline by 45-60% by 2026. Rate of decline for 2016-2026 should be 45-60% less than long-term decline.
- Achieve stable population with no more than 10-25% loss of 2016 population by 2046.

Assumptions/Rationale:
Objectives for shrub height were based on Poole (1992), Leu (1995), and Woods and Cade (1996). The other objectives were based on Poole (1992), VerCauteren and Gillihan (2004), and BCOR (2018). The objectives are most likely to be achieved in a big sagebrush site with deep soils, where growing conditions are more suitable for tall shrubs (>1 m). Population objective is based on the PIF Continental Plan (Rosenberg et al. 2016).

Habitat Strategies:

- Maintain sites with patches of tall shrubs and patches of open ground.
- Prevent further loss and degradation of sagebrush-steppe habitat to exotic grass and agriculture (Marshall et al. 2006).
- Consider fire control measures to protect remaining tall sagebrush communities in at-risk and fragmented landscapes (Humple and Holmes 2006).
- Avoid insecticide spraying during the breeding season in shrike nesting habitat.
- Where habitat degradation is extensive and exotic grass cover is dominant, light grazing may provide open foraging habitat and reduce fuel loads at risk from fire, which would severely reduce sagebrush cover (Holmes and Geupel 1998), but sustained grazing will reduce habitat suitability.

Information Needs:

1. Nesting studies similar to that of Poole (1992), Holmes and Geupel (1998), Woods and Cade (1996), and Humple and Holmes (2006) are needed in other sagebrush-steppe communities throughout the High Lava Plains, Northern Great Basin, and Owyhee Uplands.
2. Data are especially needed on post-fledging and overwinter survivorship to assess whether these contribute to population declines; some studies have suggested that winter mortality is high (Yosef 1996).

HORNED LARK

(Eremophila alpestris)

Habitat Subtype: steppe-shrubland
Habitat Attribute: bare ground cover

Horned Lark by James Livaudais

Species comments:
Horned Lark is an open-country generalist, using open country as breeding and wintering sites throughout most of the United States and Canada. Breeding habitat includes annual grasslands, perennial grasslands, dwarf sagebrush, big sagebrush, and salt desert scrub (Holmes and Altman 2015). It can also breed in agricultural areas, inhabiting bare ground, recently cut hayland, and fields of row crop stubble (Vercauteren and Gillihan 2004). Population densities can be high in heavily grazed areas where it can be one of the few local breeding species (VerCauteren and Gillihan 2004). Territory sizes range from 0.3–5.1 ha (0.7–12.6 ac) (VerCauteren and Gillihan 2004).

Primary habitat associations:

- prefers shortgrass prairie with extensive bare ground. In eastern Oregon this includes grasslands, mixed grass-sagebrush, large areas of cheatgrass or crested wheatgrass, herbaceous openings amid sagebrush, plowed fields, and some agricultural lands such as dryland wheat and ryegrass fields (Gilligan et al. 1994)
- more common in bunchgrass grasslands than any other cover type; in habitats with shrubs, more common in sagebrush–bunchgrass than in sagebrush–cheatgrass, which tends to have more sagebrush cover and less bunchgrass cover (Earnst and Holmes 2012)
- positively associated with percent cover perennial bunchgrass, negatively associated with cheatgrass (Vander Haegen et al. 2000)
- abundance greater in grasslands with short vegetation (Davis 2004)
- bare ground required for nesting
- in British Columbia, nests were more exposed (greater bare ground, rock, and lichen/moss cover), with minimal nest concealment, but this did not affect nest success (MacDonald et al. 2016)
- little to no woody vegetation preferred, although can be common in areas of scattered short shrubs (<25% cover) or open juniper woodlands
- little to no use of CRP lands because vegetation is typically too tall and dense
- may be edge-sensitive; density is higher towards grassland interiors than along roads (VerCauteren and Gillihan 2004) and prefers patches with less edge:area ratio (Davis 2004)
- increased steadily for 7 years post-fire and had higher post-fire mean abundance after a large-scale, severe wildfire in the Columbia Basin, south-central Washington (Earnst et al 2009)

Conservation Issues:

- conversion of suitable agricultural habitat to non-suitable agricultural lands (Marshall et al. 2006)
- females and nests may be vulnerable to trampling by livestock (Marshall et al. 2006) – but a study in Oregon showed that stocking rates did not significantly affect nest success (Johnson et al. 2012)
- pesticide use may contribute to reproductive failures (Marshall et al. 2006)

- especially vulnerable to mortalities by vehicle collision due to their propensity to forage along roads (Marshall et al. 2006), particularly when flocking in winter

Habitat Objectives:

- Short herbaceous layer <4 cm (1.5 in.) tall, primarily native perennial bunchgrasses, and in patches rather than evenly dispersed
- Extensive bare ground (>15% cover) with minimal litter
- Shrub cover 0-20% (<5% may be preferred, but up to 20% acceptable if low sagebrush)

Population Objectives:

- Stabilize: slow rate of decline by 45-60% by 2026. Rate of decline for 2016-2026 should be 45-60% less than long-term decline.
- Achieve stable population with no more than 10-25% loss of 2016 population by 2046.

Assumptions/Rationale:
Objective for shrub cover based on VerCauteren and Gillihan (2004) and Holmes and Altman (2015). Objectives for bare ground and litter cover based on VerCauteren and Gillihan (2004) and Rockwell et al. (2022). Objective for herb height based on VerCauteren and Gillihan (2004). Population objective is based on the PIF Continental Plan (Rosenberg et al. 2016).

Habitat Strategies:

- Appropriate light-pressure grazing can maintain preferred low height and density of herbaceous vegetation (VerCauteren and Gillihan 2004).
- Prescribed burning to reduce woody vegetation can create habitat for 0-2 years post-burn (VerCauteren and Gillihan 2004), and possibly longer (Earnst et al. 2009).
- Avoid insecticides (e.g., for grasshopper control) over large areas. Consider limiting use to the interface of agricultural lands and rangelands (VerCauteren and Gillihan 2004).

Information Needs:

1. Data are needed on all aspects of nesting ecology in this region, including causes of nest failure, impacts of livestock grazing, and productivity in different habitat types (e.g., native vs. exotic grasslands, agricultural lands, etc.)
2. Data are also needed on adult and juvenile survival.

Horned Lark nesting habitat with substantial bare ground by Aaron Holmes

Lark Sparrow by James Livaudais

LARK SPARROW

(Chondestes grammacus)

Habitat Subtype: shrubland

Habitat Attribute: ecotonal edges of herb, shrub, and tree habitats

Species comments:

Historical source habitats for Lark Sparrow occurred throughout all three ERUs within the geography of this document (Wisdom et al. 2000). Within this core of historical habitat, declines in source habitats were most evident for the Columbia Plateau; over 72% of the watersheds had moderate or strongly declining trends, and source habitat has been reduced from historical levels by 49%. Relatively stable trends are apparent for source habitats in the Northern Great Basin and Owyhee Uplands (1% and 16% declines, respectively (Wisdom et al. 2000). Mean territory size is 1.4-3.6 ha (3.5-9 ac) (VerCauteren and Gillihan 2004).

Primary habitat associations:

- nests placed on bare ground, but requires some shrub presence such as sagebrush or bitterbrush (Holmes and Geupel 1998, VerCauteren and Gillihan 2004)
- prefers savannah or shrubland with moderate shrub cover and bare ground (Holmes and Geupel 1998, VerCauteren and Gillihan 2004), and less grass and litter cover (VerCauteren and Gillihan 2004)
- uses areas with some herbaceous ground cover, containing or adjacent to scattered shrubs or trees (Martin and Parrish 2000)
- in eastern Oregon, associated with sagebrush-steppe; often adjoining grasslands, cultivated lands, or open juniper woodlands (Marshall et al. 2006)
- can occupy sites that are heavily disturbed by grazing (VerCauteren and Gillihan 2004)
- does not occupy exotic cheatgrass grasslands (Holmes and Geupel 1998)
- in Oklahoma, more nests were found in moderately or heavily grazed pastures compared to ungrazed, and grazing level did not appear to impact nest success (Lusk et al. 2003)
- increased in abundance in the short-term before decreasing to below pre-fire abundance 7 years after a large-scale, severe wildfire in the Columbia Basin, south-central Washington (Earnst et al 2009).

Conservation Issues:

- degradation of native habitat through exotic weed invasions (Martin and Parrish 2000)
- conversion of sagebrush-steppe to agricultural crops is detrimental (Marshall et al. 2006)
- grasshopper control measures (insecticides) may reduce prey base and negatively affect Lark Sparrow abundance (Paige and Ritter 1999)
- long-term fire suppression in some locations alters the patterns of natural plant succession allowing communities to grow to dense stands, thereby reducing preferred edge habitat (Martin and Parrish 2000)
- while some fire may help maintain edges used by Lark Sparrows, they will abandon nesting grounds where fire reduces shrub structure and area becomes dominated by dense exotic weeds (Martin and Parrish 2000)

- susceptible to Brown-headed Cowbird parasitism, which is of special concern given affinity for grazed/disturbed habitat

Habitat Objectives:

- Where ecologically appropriate, initiate actions in shrubland habitat to maintain or provide the following conditions:
- edge habitat within a mosaic of vegetation types (i.e., open woodland, grassland, and/or sagebrush-steppe) where no type exceeds 50% of the cover of the area
- >10% shrub cover, shrubs 1-2 m (40-80 in.) tall
- 40-80% cover of grasses and other vegetation, <15 cm (6 in.) tall
- mean open ground cover (includes bare and/or cryptogamic crust) >20%

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.

Assumptions/Rationale:
Objectives for shrub and herb cover and height developed from VerCauteren and Gillihan (2004).

Habitat Strategies:

- To prevent degradation of sagebrush-steppe through invasion of cheatgrass and other annuals, eliminate or minimize grazing induced soil disturbance on sites where native herbaceous vegetation still dominates.
- A moderate level of grazing (or patch-burn grazing, a management technique that mimics natural disturbance; Holcomb et al. 2014) may provide the preferred sparse to moderate vegetative cover.
- Use exotic weed control and replant with native perennials to restore degraded habitat.
- Limit widespread application of insecticides on landscapes with suitable habitat.

Information Needs:

1. Data are needed on all aspects of Lark Sparrow nesting ecology and habitat relationships in shrublands.
2. Studies addressing impacts of cowbird parasitism in the context of landscape characteristics and grazing.

Mountain big sagebrush habitat with herbs, shrub, and trees by Aaron Holmes

BLACK-THROATED SPARROW

(Amphispiza bilineata)

Habitat Subtype: shrubland

Habitat Attribute: upland, sparsely vegetated desert scrub

Black-throated Sparrow by Frank Lospalluto

Species comments:

Historical source habitats for Black-throated Sparrow were localized within the three ERUs within the geography of this document, mostly in the southern portion of the Owyhee Uplands and Northern Great Basin ERUs, and in an area of the Columbia Plateau ERU in south-central Washington (Wisdom et al. 2000).

Within this core of historical habitat, declines in source habitats were most evident for the Columbia Plateau; source habitat has been reduced from historical levels by 43%.

Relatively stable trends are apparent for source habitats in the Northern Great Basin and Owyhee Uplands (6% and 14% declines, respectively) (Wisdom et al. 2000).

Black-throated Sparrow has been a study species for physiological adaptations to the stresses of desert habitats in other parts of its range (Johnson et al. 2002), and it does not need to drink water (Smyth and Bartholomew 1966). *Amphispiza bilineata deserticola* is the subspecies found in Oregon and Washington (Johnson et al. 2002).

Primary habitat associations:

- upland desert scrub
- dry rocky hillside slopes with sparse vegetative cover and scattered low-growing shrubs
- in Oregon, breeds in boulder-strewn, sparsely vegetated deserts, especially south slopes of desert basins (Ryser 1985)
- occurs in areas of scattered sagebrush, shadscale, saltbush, and greasewood (Ryser 1985, Marshall et al. 2006)
- nests placed low in thick shrubs (Marshall et al. 2006)
- in New Mexico, uses a wide variety of plant species as nesting substrate, and nest success was negatively associated with vegetative cover above nests and shrub density within 5m (Kozma et al. 2017)

Conservation Issues:

- habitat alteration due to livestock grazing and off-road vehicle use (Marshall et al. 2006)
- dry years may greatly lower productivity, which could make this species vulnerable to drought associated with climate change (Johnson et al. 2002)
- cowbird parasitism is higher in areas with more tall perches (e.g., woody vegetation >4 m), and can lower reproductive success (Johnson and van Riper 2004)
- degradation of desert shrub habitat from exotic weed invasions

- invasion and seeding with crested wheatgrass reduces habitat suitability

Habitat Objectives:

Where ecologically appropriate, initiate actions in upland desert scrub habitat to maintain or provide the following conditions:

- shrub cover <20%, evenly spaced
- shrubs and small trees 1–3 m tall
- herbaceous cover <25% with <15 % in non-native annual grass cover
- mean open ground cover (includes bare and/or cryptogamic crusts) >40%

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.

Assumptions/Rationale:

Objective for woody vegetation height from Johnson et al. (2020).

Habitat Strategies:

- Use exotic weed control and shrub planting where ecologically appropriate to restore habitat.

Information Needs:

1. Data are needed on all aspects of Black-throated Sparrow nesting ecology, especially the effect of annual variation in precipitation and impact of cowbird parasitism.
2. Habitat relationships are not well understood either.
3. Detailed studies needed on annual survival, including age-, sex-, and season-specific survival.

High density Black-throated Sparrow habitat despite substantial invasive cheatgrass cover by Aaron Holmes

MOUNTAIN BLUEBIRD

(Sialia currucoides)

Habitat Subtype: juniper-steppe

Habitat Attribute: savannah with scattered mature juniper trees

Mountain Bluebird by James Livaudais

Species comments:

Mountain Bluebirds are secondary cavity-nesters, but they will also nest in crevices in rocks and boulders.

Primary habitat associations:

- savannah conditions with open grassland and scattered trees and snags (Johnson and Dawson 2019)
- open woodlands or ecotonal edges between junipers and sagebrush-steppe (Gillihan 2006, Johnson and Dawson 2019)
- ground cover mostly short herbaceous vegetation (Johnson and Dawson 2019)
- in central Oregon, breeding abundance highest in old-growth juniper; also common in sagebrush-steppe juniper with sufficient older trees or snags (Reinkensmeyer et al. 2007)
- needs decadent juniper trees and associated cavities
- in central Oregon, also uses sagebrush shrubland and grassland in winter (Reinkensmeyer et al. 2008)
- not sensitive to shrub cover as long as there is a relatively open stand with at least some older juniper trees or snag with cavities

Conservation Issues:

- conversion of juniper savannah to denser juniper woodland through fire suppression
- loss of isolated mature juniper trees from cutting to create open grazing areas and trampling of roots by cattle seeking shade, or stand-replacing fire
- grazing that maintains lower-density herbaceous understory may be compatible with Mountain Bluebird habitat, but grazing that prevents regeneration of juniper may be detrimental (Johnson and Dawson 2019)
- open standing pipes, particularly white PVC pipe used to mark mining claims (millions scattered across the American West), can kill birds that enter them prospecting for nest sites and are unable to get out. In Nevada, Mountain Bluebird was one of the most common species found dead in such pipes (Johnson and Dawson 2019)
- nest boxes placed along roadside fences likely increase risk of vehicle collisions

Habitat Objectives:

Where ecologically appropriate, initiate actions in juniper-steppe to maintain or provide the following conditions:

- isolated, mature juniper trees with a density of >4 live trees, and >2 standing dead snags per ha (2.5 ac)

- mean juniper canopy cover <5%
- herbaceous cover 5-15%, short-statured
- shrub cover 0-30%

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.

Assumptions/Rationale:

Objectives are based on Johnson and Dawson (2019), Gillihan (2006), Reinkensmeyer et al. (2007, 2008), Magee et al. (2019), A. Holmes (pers. comm.), and T. Rich (pers. comm.).

Habitat Strategies:

- Can benefit from juniper thinning treatments, especially when tree retention within the treatment area is prescribed (Magee et al. 2019).
- Promote historical fire regimes or conduct low-intensity prescribed burning to prevent conversion of savannah conditions to denser shrubland or woodland.
- Reduce use of insecticides near nesting areas (Gillihan 2006).
- Remove or cover bollards and open pipes used to mark mining claims, support gates, etc.

Information Needs:

1. More data are needed on the effect of anthropogenic factors, such as grazing or pesticide use, on site occupancy and reproductive success.
2. Little is known about habitat use during the non-breeding season, migratory connectivity, individual flexibility in migratory behavior, degree of winter nomadism, etc.

Mountain Bluebird by Frank Lospalluto

Willow riparian habitat in a sagebrush landscape by Aaron Holmes

Conservation Issues

- habitat loss due to numerous factors such as riverine recreational developments, inundation from impoundments, cutting and spraying for eased access to water courses, gravel mining, etc.

- habitat alteration from 1) hydrological diversions and control of natural flooding regimes (e.g., dams) resulting in reduced stream flows and reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc.; and 2) stream bank stabilization which narrows the stream channel, reduces the flood zone, and reduces extent of riparian vegetation

- habitat degradation from livestock overgrazing which can widen channels, raise water temperatures, reduce understory cover, etc.

- habitat degradation from conversion of native riparian shrub and herbaceous vegetation to invasive exotics such as reed canary grass, purple loosestrife, perennial pepperweed, salt cedar, indigo bush, and Russian olive

- fragmentation and loss of large tracts necessary for area-sensitive species, such as the extirpated Yellow-billed Cuckoo

- hostile landscapes, particularly those in proximity to agricultural and residential areas, may have high densities of nest parasites (Brown-headed Cowbird), exotic nest competitors (European Starling), and domestic predators (cats), and be subject to high levels of human disturbance

- high energetic costs associated with competitive interactions with European Starlings for cavities may reduce reproductive success of cavity-nesting species such as Lewis' Woodpecker, Downy Woodpecker, and Tree Swallow, even when the outcome of competition is successful for these native species

- recreational disturbances (e.g., ORVs), particularly during nesting season, and particularly in high-use recreation areas

Regional Habitat Objectives

- Maintain "no net loss" of riparian habitat (i.e., discourage loss and conversion of habitat, but when unavoidable, mitigate with equal or greater restoration efforts).

- Maintain existing areas of moderate- to high-quality riparian habitat comprised of native species in naturally occurring diversity.

- Actively manage to sustain quality riparian habitat and to prevent invasion by exotic vegetation.

- Initiate actions to increase high-quality riparian habitat through restoration of degraded riparian habitat (see Conservation Strategies below).

- Maintain all tracts of contiguous cottonwood gallery forest >50 acres, regardless of understory composition.

- Maintain multiple vegetation layers and all age classes (e.g., seedlings, saplings, mature, and decadent plants) in riparian woodlands.

- Initiate actions to increase size (width and length) and connectivity of existing riparian patches (i.e., reduce fragmentation) through restoration and acquisition efforts.

- Reduce the presence of Russian olive trees where native vegetation (e.g., willows) is ecologically appropriate through a long-term restoration strategy that considers timing of actions (outside breeding season) and the need to maintain some areas of existing habitat until native vegetation can provide suitable habitat.

- At the landscape level, seek to maintain or restore >30% of the historical extent of each riparian system to conditions that support healthy (source) populations of appropriate focal species.

Assumptions/Rationale: "No net loss" includes permanent conversion or degradation that compromises the ecological integrity of the habitat and/or reduces its suitability for our focal species. Natural events (e.g., flooding) and some restoration activities that result in short-term "loss" are not considered here.

Conservation Strategies

These general recommendations are presented to support conservation of landbirds in riparian habitat. Specific recommendations are also provided for focal species in each species account.

Acquisition/Restoration:

- Support partnerships that seek to acquire and/or restore riparian habitat (e.g., TNC, State, BLM and private partnerships in the Moses Coulee/ Beezley Hills area, Douglas County, Washington).

- Develop conservation agreements with private landowners to enhance the quality of riparian habitat.

- Seek to maximize contiguous area of riparian habitat, and thus minimize fragmentation. The larger the area, the greater the likelihood of maintaining populations of area-sensitive and large territory species.

- Use native species and local seed sources in restoration.

Management:

- Leave upland buffer zones of uncultivated and unharvested areas adjacent to riparian habitats to protect the stream and increase habitat for area-sensitive bird species.

- Discourage Brown-headed Cowbird use with habitat modifications (e.g., taller grass heights).

- Conduct removal of exotic species (e.g., Russian olive, reed canary grass) at appropriate times (i.e., outside of the landbird breeding season, April 15 – August 1).

Hydrology:

- Restore hydrological regimes where possible or initiate actions to mimic natural flooding events (e.g., time dam releases to flood according to typical annual cycles).

- Avoid or prohibit stream and bank channelization projects that result in the destruction of floodplain vegetation.

- Where restoration of natural hydrological regimes is not possible, establish horticultural restoration projects (plantings) of multiple species of shrubs and trees to mimic natural vegetation diversity and structure.

Pesticides/Herbicides: Use of insecticides can reduce the insect food base for many bird species. Use of herbicides can reduce vegetative cover and indirectly affect the insect food base.

- Use Integrated Pest Management (IPM) practices or non-spraying in low human use areas (e.g., mosquito spraying).

- Encourage biological controls rather than chemical controls wherever possible.

- Applications should be by hand if practical to target appropriate species (e.g., noxious weeds).

Yellow-breasted Chat nest on hatch day by Sarah Rockwell

- Applications on lands adjacent to riparian areas should avoid environmental conditions where the riparian zone may be threatened.

- Limit the application of fertilizers, pesticides and herbicides in the riparian zone to invasive non-native species (e.g., reed canary grass) in conjunction with habitat enhancement projects which include long-term solutions such as planting trees and shrubs to eventually shade out future infestations.

Grazing:

- Complete removal (i.e., exclusion) of livestock grazing in the riparian zone is the best option for maintaining riparian habitat health.

- Where complete livestock removal is not possible, limit grazing intensity to levels that maintain the integrity of native species composition and health; this level may vary from site to site.

- Where complete livestock removal is not implemented, fall short-term light to moderate grazing (<30% use) is better than summer season-long and summer short-term, and may be most compatible with maintaining willow-dominated riparian habitat; thus, grazing should occur during vegetation dormancy (fall, winter, early spring) and not during the landbird breeding season (April 15 – August 1).

- Permanently exclude livestock grazing from riparian areas that have low recovery potential, are already badly degraded, or are critically important to bird populations.

- Consider retirement of grazing allotments when they come up for renewal, especially where habitat degradation is occurring and/or where cowbirds are common.

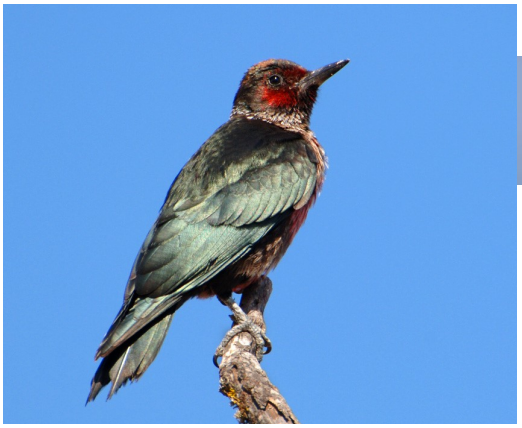
Recreation:

- Minimize timing and extent of human recreation in important riparian bird habitat during the nesting season.

Bullock's Oriole by James Livaudais

Focal Species

For all species, "ecologically appropriate" refers to the potential vegetation of the site, considering hydrology, soils, topography, and natural ecosystem processes. Also for all species, monitoring BBS trends provides a coarse means of assessing progress of conservation actions relative to populations with a known baseline. This is not intended to replace monitoring that should occur to track progress at specific locations where conservation actions occur. The objective for stable or increasing BBS trends assumes that actions to improve habitat will occur throughout the geography of this document, and that the success of those actions will be reflected through increased abundance of focal species on randomly located BBS routes.



LEWIS'S WOODPECKER

(Melanerpes lewis)

Habitat Subtype: woodland

Habitat Attribute: large snags, particularly cottonwoods

Lewis's Woodpecker by James Livaudais

Species comments:

According to the ICBEMP terrestrial vertebrate habitat analyses, historical source habitats for Lewis's Woodpecker occurred in most watersheds of the three ERUs within our planning unit (Wisdom et al. 2000). Within this core of historical habitat, declines in source habitats have been strongly reduced from historical levels, including 97% in the Columbia Plateau and 95% in the Owyhee Uplands. Within the entire Interior Columbia Basin, overall decline in source habitats for this species was the greatest among 91 species of vertebrates analyzed (Wisdom et al. 2000). Lewis's Woodpeckers can but do not typically excavate their own cavities; thus, nest trees are usually in an advanced state of decay (Bock 1970, Marshall et al. 2006). Unlike most other woodpeckers, this species forages mainly as an aerial insectivore (Bock 1970, Vierling et al. 2020). Adult survival may be an important factor in population growth potential, and they likely have high dispersal ability (Abele et al. 2004, Vierling et al. 2020).

Primary habitat associations:

- riparian cottonwood or aspen communities with open canopy structure (Bock 1970)
- large-diameter dead or dying trees in advance stages of decay (Bock 1970, Marshall et al. 2006)
- in the Blue Mountains, 72% of nests were in cottonwood, 12% in ponderosa pine, 10% in juniper, 4% in willow, and 2% in fir (Thomas 1979)
- in the Rocky Mountains, brushy understory preferred (Abele et al. 2004)
- in riparian aspen forest in Idaho, nest trees were larger in diameter than random trees and nest sites had more trees, fewer woody stems, and less bare ground within 11.3m than random sites (Newlon and Saab 2011)
- in various forest types in British Columbia, nest trees were associated with higher decay class, higher density of nearby suitable cavities, higher total basal area of large trees, and greater tree canopy cover (Zhu et al. 2012)

Conservation Issues:

- currently low breeding populations in riparian cottonwood throughout eastern Oregon and Washington
- lack of cottonwood recruitment due to grazing or altered hydrology
- habitat suitability highly dependent upon food supply (i.e., insect abundance in riparian habitat) (Bock 1970, Saab and Vierling 2001)
- grazing in riparian areas may eliminate brushy undergrowth, important for insect productivity
- management practices may eliminate snags that are important for nest cavities
- salvage of snags and scarred trees in burns upslope from riparian areas may reduce suitability of riparian habitat

- lack of mast food resources may limit overwinter survival (Abele et al. 2004)

- nest predation may be limiting in human-altered riparian cottonwood forest in an agricultural landscape, resulting in sink populations (Saab and Vierling 2001)

Habitat Objectives:

Where ecologically appropriate, initiate actions in riparian woodland to maintain or provide the following conditions:

- >2 snags/ha (0.8/ac) >41 cm (16 in.) dbh

- >2 trees/ha (0.8/ac) >53 cm (21 in.) dbh; especially cottonwoods

- tree canopy cover 10-40%

- shrub cover 30-80%

Where cornfields occur within 1.6 km (1 mi) of suitable riparian habitat, and Lewis's Woodpeckers are known or suspected to winter, leave corn unharvested through winter, or if harvested, leave stubble through winter.

Population Objectives:

- Reverse Decline: slow rate of decline by 60-75% by 2026. Rate of decline for 2016- 2026 should be 60-75% less than long-term decline.

Assumptions/Rationale:
Biological objectives for snags, trees, canopy cover, and shrub cover are slightly modified from Thomas et al. (1979), Galen (2003), Galen (1989), and Sousa (1983). The objective regarding cornfields is to provide a suitable winter mast source, essential for year-round presence of Lewis's Woodpeckers (e.g., Tashiro-Vierling 1994). Existing reproductively viable populations can function as sources for individuals to recruit into new areas. The initial riparian woodland sites targeted for population expansion should have mature cottonwood trees or young trees that can mature in the next 25 years, and be ecologically appropriate to manage for canopy and shrub cover conditions. Snag or dead limb creation may be useful where the other conditions are available but nest sites are the limiting factor. Population objective is based on the PIF Continental Plan (Rosenberg et al. 2016).

Habitat Strategies:

- Eliminate or minimize pesticide spraying within territories of nesting pairs, which may reduce insect prey base.

- Retain fire-burned trees when they occur in proximity to suitable riparian habitat.

- Retain standing dead or diseased trees where they occur, and manage for long-term snag recruitment.

- Where snags are a limiting factor, initiate appropriate snag creation activities (e.g., fungal inoculations, girdling, topping) to provide nest cavity sites.

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

- Avoid or minimize brush control of the riparian understory.

- Eliminate or manage livestock grazing in the riparian zone, and promote natural hydrological regimes, to ensure recruitment and succession of young cottonwoods.

Information Needs:

1. Data are needed on all aspects of Lewis's Woodpecker nesting ecology in riparian woodlands in this region (some aspects fairly well known in other geographies and habitat types).

2. Additional data needed on reproductive success, adult and juvenile survival, and population limiting factors in general.

Bullock's Oriole by James Livaudais

BULLOCK'S ORIOLE

(Icterus bullockii)

Habitat Subtype: woodland

Habitat Attribute: large canopy trees

Species comments:

Bullock's Orioles create hanging pendulum nests that are 10-40 cm (3.9-15.7 in) deep (Flood et al. 2016). In some areas, they nest semi-colonially (Pleasants 1979); for example, in California one study found 20% of pairs nesting in the same tree as another pair (Williams 1988). Size of the defended territory is variable and may depend on food availability (Pleasants 1979).

Primary habitat associations:

- open woodlands, especially riparian areas with large cottonwoods, sycamores, and willows (Flood et al. 2016)
- in Oregon, nests primarily in openly spaced cottonwoods, maples, and other tall broadleaf trees on the edges of streams and fields (Marshall et al. 2006)
- nests in locust and Russian olive trees in the Columbia Basin of southeast Washington (M. Denny pers. comm.)
- most numerous in association with the presence of human disturbance and altered stream corridors near Portland, OR (Poracsky et al. 1992)
- significant positive relationships with simple landscapes of cottonwood forest and agriculture, and smaller patch sizes and increasing edge habitat on the South Fork Snake River in Idaho (Saab 1999)
- along the Blitzen River, more abundant in riparian habitats that had been grazed less often (Taylor 1986)

Conservation Issues:

- reduction in cottonwood gallery forest due to factors such as harvest, altered hydrological regimes, lack of recruitment, etc.
- poor recruitment of young cottonwoods due to factors such as overgrazing and suppression from aggressive non-native plants
- may be vulnerable to pesticide use that reduces insect prey base or causes direct toxicity (Marshall et al. 2006)
- grazing may reduce habitat suitability (Taylor 1986)

Habitat Objectives:

Where ecologically appropriate, initiate actions in riparian woodland to maintain or provide the following conditions:

- mean canopy tree height >10.7 m (35 ft)
- canopy cover 30-60%
- young (recruitment) sapling trees >10% cover in the understory

Population Objectives:

- **Maintain stable or increasing population trends over the next 10 years.**

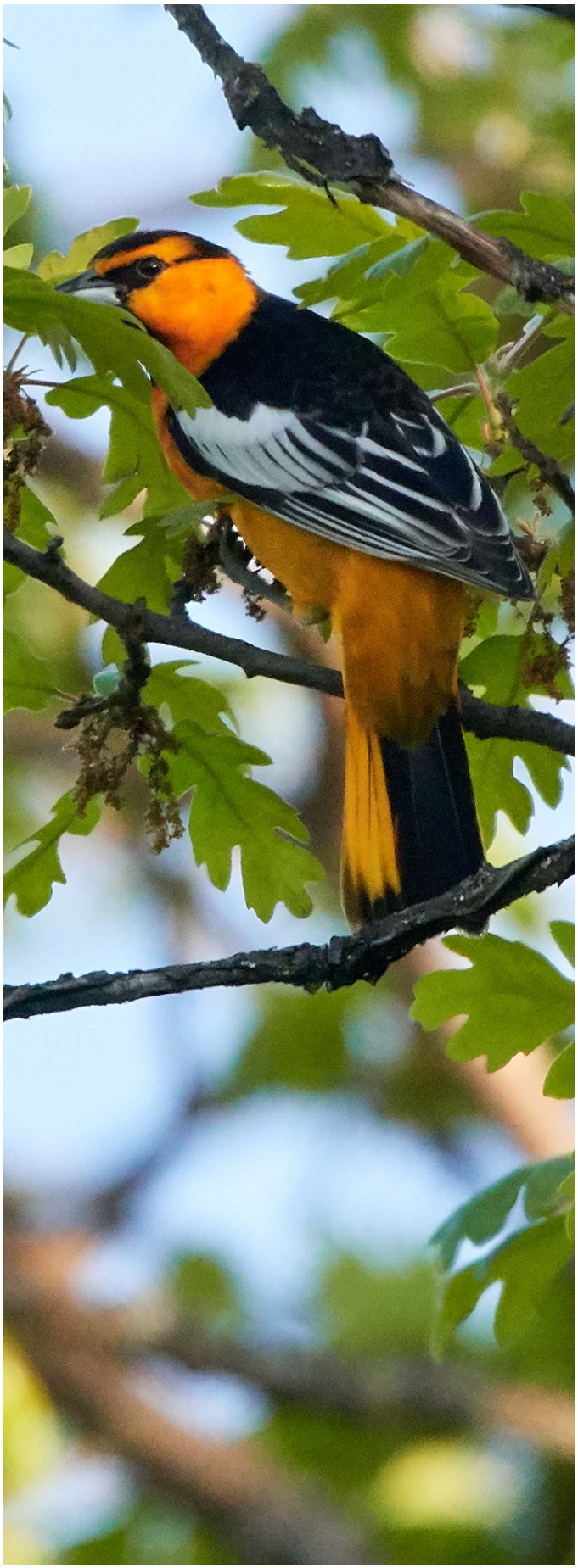
Assumptions/Rationale:
The objective for tree height is based on (Schaefer 1976). The objective for canopy closure was subjectively determined based on the collective experience of several experts in the field, as well as the knowledge that Bullock's Oriole prefers a somewhat open canopy. The objective for sapling trees is based on the need for recruitment trees to maintain suitability of the habitat over time. It is assumed that if large canopy trees, especially cottonwood, are available for nesting and cover, food resources are not limiting.

Habitat Strategies:

- Optimal sites for conservation are where cottonwood gallery trees are ecologically appropriate as the climax successional stage, such as low gradient, broad floodplain systems.
- Retain all large cottonwood trees.
- Use mechanical or other means to remove invasive plants in the understory that inhibit growth and development of young (recruitment) trees.
- Reduce or limit pesticide use near riparian areas.

Information Needs:

1. Data are needed on all aspects of Bullock's Oriole nesting ecology and habitat relationships in this region.
2. Does patch size or other landscape characteristics affect abundance or reproductive success?
3. What are the thresholds of canopy cover that determine abundance and reproductive success?



Bullock's Oriole by Frank Lospalluto

YELLOW WARBLER

(Setophaga petechia)

Habitat Subtype: woodland

Habitat Attribute: subcanopy cover

Yellow Warbler by James Livaudais

Species comments:

The subspecies *S. p. morcomi* breeds east of the Cascades (Marshall et al. 2006).

Primary habitat associations:

- riparian obligate or near-obligate in either shrubland or woodlands
- prefers structurally complex habitat (Sanders and Edge 1998)
- particularly common in riparian dominated by willow or cottonwood, but will accept various plant associations, including aspen (Marshall et al. 2006)
- mostly occurs above 300 m (900 ft) and below 1,460 m (4,800 ft) in Columbia Basin of southeast Washington (M. Denny pers. comm.)
- willow volume most important variable for nesting habitat; not detected in southeastern Oregon where willow volume < 1,187 m^3/ha and greatly reduced in abundance where willow volume < 5,000 m^3/ha (Sanders 1995)
- most abundant in continuous willow, low numbers in discontinuous willow, and absent from herbaceous community (Sanders 1995)
- on the Blitzen River, abundance positively correlated with willow shrub volume and negatively correlated with grazing (Taylor 1986)
- nest sites at Malheur National Wildlife Refuge occurred more in isolated patches or small areas of willows adjacent to open habitats or large, dense thickets (i.e., scattered cover) rather than in the dense thickets themselves (Radke 1984)
- in cottonwood forest in Idaho, abundance positively related to increasing distance to nearest cottonwood patch neighbor versus close cottonwood neighbors; and a dense shrub layer versus an open subcanopy (Saab 1999)
- in cottonwood forest in Idaho, significant positive relationships with increasing landscape heterogeneity with rivers and wetlands versus relatively simple landscapes; and decreasing patch size with increasing edge (edge associate), including residential areas (Saab 1999)

Conservation Issues:

- extensive grazing in riparian zone that reduces understory structure (Taylor and Littlefield 1986, Sanders and Edge 1998, Earnst et al. 2005, 2012)
- primary host species for Brown-headed Cowbird brood parasitism
- channelization for flood control and agriculture reduces the extent of the riparian zone

Habitat Objectives:

Where ecologically appropriate, initiate actions in riparian shrub habitat to maintain or provide the following conditions:

- >70% cover in the shrub and subcanopy layer, with subcanopy layer contributing >40% of the total

- >70% of the cover in the shrub and subcanopy layer comprised of native species

At the landscape level, provide aforementioned habitat conditions within sites that contain:

- high degree of deciduous riparian heterogeneity within or among wetland, shrub, and woodland patches

- <10% hostile habitat (agricultural lands with moderate to heavy grazing pressure or other areas supporting cowbird populations)

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.

- Maintain cowbird parasitism rates below 10% within specific-study areas.

Assumptions/Rationale:
Maintaining >70% subcanopy and shrub cover will ensure some large continuous patches; it may also allow for some herbaceous vegetation to support other species. The objectives for cover were modified from Schroeder (1982). This species is highly susceptible to cowbird parasitism, therefore it is appropriate to maintain cowbird parasitism at low levels (<10%). Even if habitat is highly suitable for Yellow Warbler, cowbird parasitism can be a principal factor affecting productivity. Additionally, reduced suitability of habitat in the landscape for cowbirds without habitat conditions suitable for Yellow Warbler is ineffective. Thus, conservation requires habitat management for both Yellow Warbler and Brown-headed Cowbird.

Habitat Strategies:

- Target areas for conservation can include residential or urban areas that provide suitable habitat if it can be documented that levels of predation from domestic or human-associated predators are not excessive.

- Eliminate or manage livestock grazing in riparian areas to ensure complete development of all vegetation layers (Earnst et al. 2005, Earnst et al. 2012).

- Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).

- Manage at the landscape level to discourage cowbird use of riparian areas (i.e., discourage short-grass areas, maintain taller grass heights).

Information Needs:

1. Data are needed on all aspects of Yellow Warbler nesting ecology in this region, especially the impact of Brown-headed cowbird parasitism in different landscape contexts.

Yellow Warbler by Frank Lospalluto

YELLOW-BREASTED CHAT

(Icteria virens)

Habitat Subtype: woodland

Habitat Attribute: dense shrub cover

Yellow-breasted Chat by Frank Lospalluto

Species comments:

Populations are mostly isolated and disjunct throughout the Northern Great Basin (M. Denny pers. comm.). Yellow-breasted Chats are noisy and prolific singers, sometimes even singing at night.

Primary habitat associations:

- in eastern Oregon, occupies dense riparian thickets of willow, dogwood, and mountain alder, sometimes with an open canopy tree overstory, although this is not required in arid landscapes (Marshall et al. 2006)
- nests mostly in rose, elderberry, and hawthorn in Columbia Basin (M. Denny pers. comm.)
- in cottonwood forest in Idaho, abundance had the most significant positive relationship with increasing residential areas and high edge contrast; nearest cottonwood patch neighbor versus distant cottonwoods; increasing shrub cover and density versus an open subcanopy; and increasing herbaceous ground cover versus more litter ground cover (Saab 1999)
- mean cover on territories in the Willamette Valley, Oregon: herb 39.8%, shrub 40.7%, tree 19.1% (n = 11) (B. Altman unpubl. data)
- on the Trinity River in northern California, 91% of nests over four years (n = 44) were found in invasive Himalayan blackberry, with the remainder in willows or skunkbush (Rockwell et al. unpub. data). Mean shrub cover at randomly selected points within territories was 60-72% (Rockwell and Stephens 2018).

Conservation Issues:

- reduction in riparian corridor width due to agriculture or other human activities (Marshall et al. 2006)
- extensive grazing in riparian zone that reduces understory structure (Sedgwick and Knopf 1987, Forrester et al. 2017)
- primary host species for Brown-headed Cowbird

Habitat Objectives:

Where ecologically appropriate, initiate actions in riparian woodland to maintain or provide the following conditions:

- patchy shrub layer (i.e., woody vegetation 1-4 m [3-12 ft] tall), with shrub cover 30-80% and several scattered herbaceous openings
- canopy tree (i.e., woody vegetation >4 m [12 ft] tall) cover <20%

At the landscape-level, provide the aforementioned habitat conditions at sites that are:

- >1 km (0.6 mi) from urban/residential areas
- >5 km (3 mi) from high-use cowbird areas (e.g., feed lots, stables)

Population Objectives:

- **Maintain stable or increasing population trends over the next 10 years.**
- **Maintain cowbird parasitism rates below 10%.**

Assumptions/Rationale:
The objectives for shrub and tree cover are based on one field season of data in the Willamette Valley (B. Altman unpubl. data). The landscape-level objectives are provided to minimize the negative impact of predation from feral and other predators associated with human habitation (e.g., cats, California Scrub-Jays), and parasitism from Brown-headed Cowbirds. They were subjectively derived based on the professional expertise of several people. This species is highly susceptible to cowbird parasitism; therefore, it is appropriate to maintain cowbird parasitism at low levels (<10%).

Habitat Strategies:

- Preserve or restore riparian habitat with a dense shrub layer, and increase width of existing riparian zones through alteration of hydrological regimes, plantings, etc.
- Discourage channelization of streams, creeks, and rivers, which reduces extent of floodplain riparian habitat.
- Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).
- Eliminate or manage livestock grazing in riparian areas to ensure complete development of understory.
- Reduce potential impacts of cowbird parasitism by discouraging activities and management that results in attracting cowbirds (e.g., aggregations of livestock).

Information Needs:

1. Data are needed on all aspects of Yellow-breasted Chat nesting ecology and habitat relationships in this region.
2. Can riparian shrub habitat within an agricultural landscape context (i.e., a landscape with suitable cowbird habitat) support viable populations? If so, what habitat or anthropogenic factors are important?

Yellow-breasted Chat by James Livaudais

WILLOW FLYCATCHER

(Empidonax traillii)

Habitat Subtype: shrubland
Habitat Attribute: shrub density

Willow Flycatcher by Frank Lospalluto

Species comments:
There are currently only very disjunct populations throughout desert riparian habitat, mostly above 305 m (1,000 ft) in eastern Oregon and Washington (M. Denny pers. comm.). It is a relatively late-arriving migrant in this region. *Empidonax traillii adastus* is the subspecies that breeds in eastern Oregon and Washington.

Primary habitat associations:

- riparian shrub obligate where dense patches of shrubs, especially willows, are interspersed with openings
- occurred almost exclusively at sites with most shrub volume; absent from most transects with reduced shrub volume (Blitzen River, southeastern Oregon; Taylor 1986)
- most abundant on sites with least amount of grazing pressure (Taylor 1986)
- most abundant in continuous mesic shrub association versus discontinuous mesic shrub and herbaceous xeric shrub (Bear and Silvies valleys, southeastern Oregon; Sanders and Edge 1998)
- most abundant where willow volume >5,000 m^3/ha and absent when willow volume <1,187 m^3/ha (Sanders and Edge 1998)
- also forages in cattail marshes adjacent to willow habitat (Sedgwick 2000)
- prefers areas of wet soils (J. Ballard pers. comm.)

Conservation Issues:

- loss and degradation of riparian shrub habitat from altered hydrological regimes
- excessive and/or improper grazing resulting in poor recruitment of shrub layer vegetation (Taylor and Littlefield 1986, Earnst et al. 2012)
- nest disturbance and/or destruction from grazing animals
- frequent host species for Brown-headed Cowbird

Habitat Objectives:

Where ecologically appropriate, initiate actions in riparian habitat to maintain or provide the following conditions:

- dense patches of native vegetation in the shrub layer >10 m^2 in size and interspersed with openings of herbaceous vegetation
- native shrub layer cover 40-80% across the area of suitable habitat
- shrub layer height >1 m (3 ft) high
- canopy cover <30%

Provide site conditions as described above:

- in areas of suitable habitat >2 ha (5 ac), but preferably in patches >8 ha (20 ac)
- within a landscape matrix with <10% hostile habitat (agricultural lands with moderate to heavy grazing pressure or other areas supporting cowbird populations).

At the landscape level, provide the aforementioned habitat conditions at sites that are:

- >1 km (0.6 mi) from urban/residential areas
- >5 km (3 mi) from high-use cowbird areas

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.
- Maintain cowbird parasitism rates below 10% within specific study areas.

Assumptions/Rationale:
This species is highly susceptible to cowbird parasitism, therefore it is appropriate to maintain cowbird parasitism at low levels (<10%). Even if habitat is highly suitable for Willow Flycatcher, cowbird parasitism can be a principal factor affecting productivity. Conversely, reduced suitability of habitat in the landscape for cowbirds without habitat conditions suitable for Willow Flycatcher is ineffective. Thus, conservation requires both habitat and cowbird management. Biological objectives for shrub patch size, cover, and height were based on multiple sources including Taylor (1986), Sanders and Edge (1998), and B. Altman (unpubl. data).

Habitat Strategies:

- Preserve or restore riparian shrub habitat, and increase width of riparian zone by planting willows and other riparian shrubs in areas with adequate hydrology.
- Discourage channelization of streams, creeks, and rivers which reduces the extent of riparian floodplain and shrub habitat.
- Reduce potential impacts of cowbird parasitism by discouraging activities and management that results in attracting cowbirds near riparian areas (e.g., aggregations of livestock).
- Eliminate willow cutting and herbicide spraying in riparian zone (Taylor and Littlefield 1986).

Where herbicide control of riparian exotic shrubs and trees (e.g., Russian olive) is occurring within known nesting habitat, consider the following actions:

- conduct treatment outside the breeding season,
- treat patches on a staggered rotation to allow some habitat to remain for breeding; treat remaining patches when previously treated patches approach habitat suitability,
- let treated areas decompose naturally without mechanical assistance to maintain structure and allow for continued use, and
- use mechanical removal in smaller areas of treated patches to assist in recolonization by desired species through planting/seedings.

Eliminate or reduce cattle grazing in riparian zones within appropriate timing and duration guidelines.

Information Needs:

1. Data are needed on all aspects of Willow Flycatcher nesting ecology and habitat relationships in this region.
2. Does landscape context or adjacent land use impact nesting success?
3. In agricultural landscapes, are cowbirds an important factor in determining productivity?

Lazuli Bunting by James Livaudais

LAZULI BUNTING

(Passerina amoena)

Habitat Subtype: shrubland

Habitat Attribute: shrubs interspersed with herbaceous patches

Species comments:
According to the ICBEMP terrestrial vertebrate habitat analysis, historical source habitats for Lazuli Bunting were broadly distributed throughout the three ERUs in our planning unit, but usually contained <25% of the ERU as source habitat (Wisdom et al. 2000). Within the entire Interior Columbia Basin, the trend in source habitats from historical to current periods was negative to strongly negative for nearly 60% of the watersheds. All of the ERUs within our planning unit had negative to strongly negative trends in source habitats (Wisdom et al. 2000).

Primary habitat associations:

- not a breeder at low elevations in desert riparian habitat; mainly breeds above 335 m (1,100 ft) (M. Denny pers. comm.)
- in Northern Great Basin, isolated pairs nest in healthy riparian corridors with dense rose, willow, and cottonwood (M. Denny pers. comm.)
- can also nest in sagebrush habitat where ravines and small drainages provide tall shrubs, such as bitterbrush, for nest sites

Conservation Issues:

- habitat loss from altered hydrological regimes
- habitat degradation from overgrazing or brush control
- frequent host species for Brown-headed Cowbird

Habitat Objectives:

Where ecologically appropriate, initiate actions in riparian habitat to maintain or provide the following conditions:

- interspersion of shrub patches and herbaceous openings where neither is <25% or >70% of the cover of the area

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.
- Maintain cowbird parasitism rates below 10% within specific study areas.

Assumptions/Rationale:
Biological objectives for shrub and herbaceous cover were subjectively derived based on the professional expertise of various people. This species is highly susceptible to Brown-headed Cowbird parasitism, therefore it is appropriate to maintain cowbird parasitism at low levels (<10%).

Habitat Strategies:

- Eliminate livestock grazing in riparian zones or effectively manage grazing outside of the breeding season only.

- Prohibit brush removal within 30 m (100 ft) of the riparian zone.

- Reduce potential impacts of cowbird parasitism by discouraging activities and management that results in attracting cowbirds near riparian areas (e.g., aggregations of livestock).

Where herbicide control of riparian exotic shrubs and trees (e.g., Russian olive) is occurring within known nesting habitat, consider the following actions:

- conduct treatment outside the breeding season,

- treat patches on a staggered rotation to allow some habitat to remain for breeding; treat remaining patches when treated patches approach habitat suitability,

- let treated areas decompose naturally without mechanical assistance to maintain structure and allow for continued use, and

- use mechanical removal in smaller areas of treated patches to assist in recolonization by desired species through planting/seedings.

Information Needs:

1. Data are needed on all aspects of Lazuli Bunting nesting ecology and habitat relationships in this region.

2. Can riparian shrub habitat within an agricultural landscape context (i.e., a landscape with suitable cowbird habitat) support reproductively viable populations?

   If so, what habitat or anthropogenic factors are important to reproductive success?

Lazuli Bunting by Agnieszka Bacal

Yellow-billed Cuckoo

Yellow-billed Cuckoo has been extirpated as a breeding species in this region; the last confirmed breeding in Washington was in the 1930s, and in Oregon, the 1940s (Littlefield 1988). This species is one of the most sensitive to riparian corridor width, preferring large riparian deciduous forest tracts that are structurally diverse and dominated by a tall overstory of cottonwood and an understory or midstory of willow. In California, it is considered to require a minimum patch size of 16.8 ha with at least 3 ha of closed-canopy broadleaf forest, a minimum riparian corridor width of 100m, and optimal habitat is >80 ha and >580 m wide (Gaines 1974; Laymon and Halterman 1985, 1987; Halterman 1991).

Such large tracts of riparian habitat simply do not occur in this region any longer. While re-establishing breeding populations of Yellow-billed Cuckoo in eastern Oregon and Washington is a conservation goal, it is currently too rare to be useful as a focal species. It is mentioned here because it would be an indicator of the restoration of large areas of structurally diverse riparian habitat (i.e., riparian corridor width >100m, in habitat patches >40 ha, with distinct canopy, subcanopy, and understory vegetation layers with >20% cover in each layer) (Altman and Holmes 2000).

Population objectives are to establish a breeding population (>10 pairs) of Yellow-billed Cuckoos along the Owyhee River in the next 10 years (by 2032), and two other populations in eastern Oregon and/or Washington in the next 25 years (by 2047).

Yellow-billed Cuckoo by James Livaudais

UNIQUE HABITATS

Juniper woodland by Aaron Holmes

Focal Species

For all species, "ecologically appropriate" refers to the potential vegetation of the site, considering hydrology, soils, topography, and natural ecosystem processes. Also for all species, monitoring BBS trends provides a coarse means of assessing progress of conservation actions relative to populations with a known baseline. This is not intended to replace monitoring that should occur to track progress at specific locations where conservation actions occur.

The objective for stable or increasing BBS trends assumes that actions to improve habitat will occur throughout the geography of this document, and the success of those actions will be reflected through increased abundance of focal species on randomly located BBS routes.

Aspen stand by Aaron Holmes

RED-NAPED SAPSUCKER

(Sphyrapicus nuchalis)

Habitat Subtype: aspen stands

Habitat Attribute: large trees and snags with regeneration

Red-naped Sapsucker by Klamath Bird Observatory

Species comments:
Former nest cavities of Red-naped Sapsucker are used by secondary cavity nesters, and the sap wells that it drills are used by a variety of other wildlife. In the Columbia Basin of southeastern Washington, it is a rare migrant, and not present as a breeding species (M. Denny pers. comm.). In the Blue Mountains of Oregon and Washington, estimated territory size is 4 ha (10 ac) (Thomas et al. 1979).

Primary habitat associations:

- large dead and decaying trees in riparian habitats, especially mature aspen and coniferous forest mixed with aspen, as well as cottonwoods and alders (Marshall et al. 2006)
- deciduous woodlands, often associated with willows which are used for sap wells (Daily 1993, Walters 1996)
- at Hart Mountain Refuge, southeastern Oregon, >90% of nests were in live or dead aspen with heartwood decay (Dobkin et al. 1995)
- characteristics of nest sites at Hart Mountain Refuge include: mean nest tree height 14.6 m, mean nest tree dbh 27.4 cm, mean canopy cover 76%, and mean distance to edge 19.8 m (Dobkin et al. 1995)
- on the east slope Cascades in Washington, nests were in cottonwood and willow (Wahl et al. 2005)
- prefer higher elevations in the Great Basin region (T. Rich pers. comm.)

Conservation Issues:

- lack of recruitment of young aspen due to livestock grazing and fire suppression
- reduced presence of large aspen trees and snags due to limited replacement
- encroachment of conifer trees into aspen stands
- competition for nest cavities with European Starling

Habitat Objectives:

Where ecologically appropriate, initiate actions in aspen habitat to maintain or provide the following conditions:

- >4 trees and >4 snags/ha (1.5/ac) >12 m (39 ft) in height and >24 cm (10 in) dbh
- canopy cover 40-80%; either clumped with patches and openings or relatively evenly distributed
- >10% cover of saplings in the understory to provide adequate representation of younger seral stages for replacement

Where ecologically appropriate at the landscape level, initiate actions in aspen habitat to maintain or provide some areas with natural (e.g., fire) or mechanical disturbance regimes to ensure proper successional development.

Population Objectives:

- Maintain existing populations within aspen stands, and maintain stable or increasing population trends over the next 10 years.

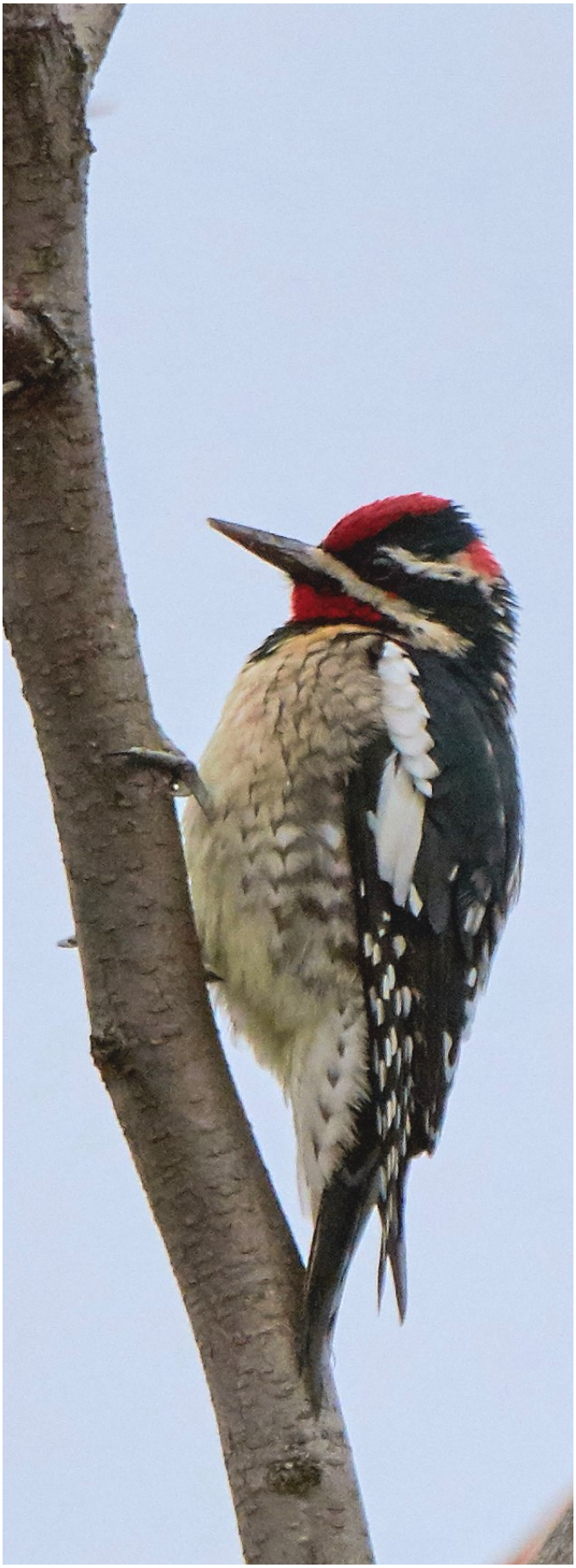
Assumptions/Rationale:
Biological objectives for canopy cover, sapling cover, and size and abundance of trees and snags were based on Dobkin et al. (1995) and professional judgement.

Habitat Strategies:

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

Information Needs:

1. Data are needed on all aspects of Red-naped Sapsucker nesting ecology in this region.
2. What are the conditions associated with successful use of prescribed fire to restore aspen stands?



Red-naped Sapsucker by Frank Lospalluto

BOBOLINK

(Dolichonyx oryzivorus)

Habitat Subtype: agricultural fields or meadows

Habitat Attribute: mesic conditions and annual herbaceous growth

Bobolink by James Livaudais

Species comments:

The largest breeding population west of the Great Plains, at Malheur National Wildlife Refuge, is believed to be stable (Wittenberger 1978, Marshall et al. 1996). There were at one time estimated to be <1,000 breeding individuals in Oregon (Marshall et al. 1996) and <300 in Washington (<100 at Toppenish and <200 in the Okanogan River Valley; M. Denny pers. comm.). Bobolinks are ground-nesters that are vulnerable to early mowing or burning of agricultural fields. They are frequently polygynous (Marshall et al. 2006).

Primary habitat associations:

- wet meadows, irrigated agriculture herbaceous fields (e.g., hayfields, grain fields), and emergent wetlands (Smith et al. 1997, Marshall et al. 2006)
- broad-leaf forbs important for nesting cover (e.g., clover, false lupine, potentilla) which also produce caterpillars for feeding nestlings (G. Ivey pers. comm.)
- presence or adjacency of water and/or riparian habitat (wet meadows) is critically important (Marshall et al. 1996, Smith et al. 1997)
- at Malheur National Wildlife Refuge, dependent upon annual growth of vegetation (Wittenberger 1978)

Conservation Issues:

- vulnerable because of limited populations in both states, particularly Washington
- vulnerable because of dependence upon agricultural habitats which have unreliable suitability from year to year
- vulnerable to low water years, in which they have lower abundance and fledging success (Marshall et al. 2006)
- colonization of new areas can be problematic due to high site fidelity
- agricultural practices (e.g., timing of mowing/ harvesting, chemical applications) may interfere with reproductive success
- many populations on private land
- requires mesic conditions; dry upland conditions in herbaceous agricultural fields are not suitable habitat

Habitat Objectives:

Where appropriate to maintain or attempt to expand local colonies (i.e., in proximity to existing colonies), initiate actions in agricultural herbaceous fields to maintain or provide the following conditions:

- mesic conditions with an herbaceous mix of broad-leaf forbs such as clover, alfalfa, false lupine, and potentilla

Where appropriate, initiate actions to provide habitat in proximity to existing colonies such that suitable habitat is doubled in extent in areas of existing colonies.

Population Objectives:

- Reverse Decline: slow rate of decline by 60-75% by 2026. Rate of decline for 2016- 2026 should be 60-75% less than long-term decline.

Assumptions/Rationale:
Appropriate areas at which to try to expand colonies are potential habitat in proximity to existing colonies, because high site fidelity and existing small populations preclude the likelihood of establishment of colonies at other locations. Population objective is based on the PIF Continental Plan (Rosenberg et al. 2016).

Habitat Strategies:

- Optimal sites for conservation would include seasonally flooded meadows with or without adjacent or interspersed riparian shrub (e.g., willow) habitat.

- Coordinate conservation efforts with private landowners or those that lease agricultural lands on refuges where Bobolinks occur; this may include conservation easements or agreements, practicing favorable management practices, or providing economic incentives.

- Avoid mowing or harvesting in known colony sites until after July 15.

- Avoid flooding suitable fields during the breeding season.

- Remove residue of previous year's herbaceous growth in nesting habitat prior to nesting season through burning, mowing, grazing, etc. to stimulate new growth (Wittenberger 1978).

- Plant false lupine and other broad-leaf forbs.

- Develop partnerships with private land owners through Natural Resources Conservation Service (NRCS) or North American Wetlands Conservation Act (NAWCA) projects.

Information Needs:

1. Annual monitoring of population sizes at all known breeding sites.

2. Inventory of all potential habitat in proximity to known populations.

3. Is there any impact of cowbird parasitism on populations?

4. Where Russian olive is encroaching on riparian habitat adjacent to colonies, is there increased predation from corvids attracted to the Russian olive?

Bobolink by Derek Robertson

GRAY FLYCATCHER

(Empidonax wrightii)

Habitat Subtype: juniper woodlands

Habitat Attribute: mature juniper with regeneration

Gray Flycatcher by James Livaudais

Species comments:
Eastern Oregon has some of the highest densities reported from the species' breeding range, according to BBS data from Crook and Harney counties (Marshall et al. 2006). It is not present as a breeding species in the Columbia Basin of southeast Washington except on Hanford Reservation and Waluke Slope, Columbia NWR (M. Denny pers. comm.). It forages for insects from shrubs or branches low in trees. Territories approximately 3-5 ha (7.4-12.4 ac) (Schlossberg and Sterling 2013).

Primary habitat associations:

- primarily associated with arid woodlands and shrublands, particularly western juniper woodlands (Ryser 1985) and the interface of open woodlands and sagebrush-steppe (Schlossberg and Sterling 2013)
- also nests in mature big sagebrush, especially were basin big sagebrush occurs with Wyoming big sagebrush, bitterbrush shrublands with a significant big sagebrush component, and open woodlands of juniper and mountain mahogany with big sagebrush components
- in sagebrush-steppe, most common where big sagebrush grows to 2 m or more and in dry washes or valleys as opposed to terraces and ridges (Downes 2006, Altman & Woodruff 2012)
- in big sagebrush in Oregon and Washington, abundance increases with shrub height and cover and decreases with annual grass cover, and generally found above 1500 m elevation (Altman and Woodruff 2012)
- in Oregon, abundant where western juniper has invaded former sagebrush shrubland (Sabol 2005)
- in southwestern Wyoming, prefers greater overstory tree cover and sapling density (Pavlacky and Anderson 2001)
- in northern Nevada, abundant in mountain big sagebrush with or without western juniper (Holmes 2010)
- throughout the West, mixed responses to grazing in sagebrush habitats: a positive response in shadscale/Indian ricegrass and Nevada bluegrass/sedge, but a negative response in big sagebrush/bluebunch wheatgrass (Saab et al. 1995)
- requires some bare ground (Johnson 1963)

Conservation Issues:

- decline in mature and old-growth juniper
- grazing practices that reduce shrub density (Gillihan 2006)
- juniper is being targeted for burning and mechanical removal for fuels reduction and restoration of sagebrush-steppe. Greater Sage-

Grouse PACs, where the majority of conifer removal efforts are occurring (Reinhardt et al. 2020), encompass 37% of Gray Flycatcher suitable habitat across the Intermountain West (Zeller et al. 2021)

- conversion of juniper and sagebrush habitat to crested wheatgrass or other exotic grasses also reduces suitable habitat

- increasing fire frequency and severity that reduces shrub and tree density could decrease habitat suitability; in mountain big sagebrush habitats in northwestern Nevada, Gray Flycatcher density still only averaged 17% of that of unburned sites 19-20 years post-fire (Holmes and Robinson 2013)

- pesticide use may reduce insect prey populations

- fairly intolerant of human disturbance, such as from residential development (Gillihan 2006)

- may be frequent host species for Brown-headed Cowbird (Schlossberg and Sterling 2013)

Habitat Objectives:

Where ecologically appropriate within the historical range of juniper woodland, initiate actions to maintain or provide the following conditions:

- mature and old-growth juniper trees with 5 trees/ha (2/ac) >53 cm (21 in) dbh

- >10% cover of saplings in the understory to provide for replacement trees

Population Objectives:

- Maintain stable or increasing population trends over the next 10 years.

- Maintain cowbird parasitism rates below 10% within specific study areas.

Assumptions/Rationale:
The objective for juniper tree size was subjectively determined based on the collective experience of several experts. This species is highly susceptible to Brown-headed Cowbird parasitism, therefore it is appropriate to maintain cowbird parasitism at low levels (<10%).

Habitat Strategies:

- Retain and protect mature shrublands, old-growth juniper trees in an open woodland condition, and snags where populations of Gray Flycatcher occur within the historical range of this habitat type (i.e., practice juniper removal only where it is encroaching into historic sagebrush-steppe habitat). Incorporating habitat requirements of juniper-associated species should be considered in conifer removal prioritization efforts (Zeller et al. 2021).

- Create small openings within juniper woodlands (Latta et al. 1999).

- Prevent or limit conversion of juniper to crested wheatgrass or other exotic annual grasslands.

- Avoid insecticide use, adopt IPM (Integrated Pest Management) practices, and/or limit insecticide use to periods outside of the breeding season (Gillihan 2006).

Information Needs:

1. Data are needed on all aspects of Gray Flycatcher nesting ecology and habitat relationships, including the impact of cowbird parasitism which one Oregon study found to be substantial (Friedmann et al. 1977).

2. Differences in demographic parameters between birds nesting in juniper woodlands vs. sagebrush-steppe (Schlossberg and Sterling 2013).

Prairie Falcon by Frank Lospalluto

Cliffs and Rimrock

Several raptor species rely on cliffs and rocky outcrops for nest sites (e.g., Prairie Falcon, Golden Eagle). We did not select any raptors as focal species because they are difficult to monitor (i.e., they have low detectability in standard bird monitoring methods such as point counts), making measuring their response to management more challenging. Further, cliffs and rimrock are not likely to be a good target for management actions to increase habitat availability or suitability (although where woody encroachment is reducing the openness of cliffs, manual removal and/or fire after the nesting season to maintain an open character may benefit nesting raptors; Altman and Holmes 2000). Nevertheless, cliffs and rimrock are important habitat features on sagebrush-steppe landscapes and thus are highlighted here. Many raptors also require large areas of undeveloped native sagebrush-steppe habitat (although it some cases this can include irrigated hayfields), with low sparse vegetation and healthy prey populations (i.e., small mammals, birds, reptiles), near potential cliff nest sites (Marshall et al. 2006). Conversion of native grasslands and sagebrush-steppe to agriculture, as well as increased pesticide use, may adversely affect prey populations (Altman and Holmes 2000). Some nesting raptors are sensitive to human disturbance, so it is recommended to prohibit construction activities such as blasting and operation of heavy equipment within 800 m, as well as recreational activities within 500 m, of nest sites during the breeding season (Holthuijzen et al. 1990, Richardson and Miller 1997).

Mountain Mahogany

The extent of mountain mahogany in this region is extremely limited, and little is known about its importance to wildlife. However, there are concerns about the loss of old-growth mahogany and lack of recruitment of young mahogany, so this issue should be acknowledged. This habitat type may be important to some priority birds, such as Virginia's Warbler, but this species has not been confirmed to breed in Oregon (Marshall et al. 2006). The population of Virginia's Warbler that occurs in eastern Oregon and Washington is minimal and peripheral to the species' range, but a search effort in the late 1990s revealed some birds, often occurring in mountain mahogany groves (Marshall et al. 2006). At this time, we do not have any recommendations other than to suggest monitoring and research on mountain mahogany and Virginia's Warbler or other mahogany-associated birds, to determine habitat relationships and conservation issues, as well as develop biological objectives and appropriate management strategies.

Mountain mahogany stand by Aaron Holmes

Implementation

Juniper removal via hand-cutting by Aaron Holmes

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 land ownership in eastern Oregon and Washington, 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., agriculture, grazing, recreational), including private lands.

Management and restoration goals will need to be carefully designed and coordinated among various landowners and land management agencies and organizations to ensure efficiency and cost-effectiveness, and to integrate the diverse values and goals of land managers and landowners with those 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

Avoiding Square Pegs and Round Holes: Be Ecologically Appropriate

As part of the planning and implementation process, it is essential to understand the ecological capacity or "potential native vegetation" of the site to support particular habitat conditions or bird species. This includes a suite of biotic and abiotic factors that cannot be manipulated such as soil type, aspect, slope, local weather, etc. For example, some managers may not realistically be able to achieve a certain grass height and percent cover given their specific site characteristics. Managers should consider whether habitat objectives for the herbaceous layer are appropriate for a specific site, and know that many songbird species are flexible in these requirements. Still, 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 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 juniper woodland. Some current woodlands in the sagebrush-steppe ecosystem were historically shrubland or grassland habitats where western juniper has encroached in the absence of fire. These sites, although potentially meeting habitat conditions for juniper woodland -associated bird species, are degraded and converted sagebrush-steppe habitat. They should be targeted for management and restoration of sagebrush-steppe 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 remaining sagebrush shrubs are still healthy, and restoration can result in rapid recovery of sagebrush-steppe habitat attributes when the juniper 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 shrub cover for Sagebrush Sparrow and Sage Thrasher is in direct conflict with the objective of maintaining more open grassland for Grasshopper 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.

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

Biologist walking through sagebrush-steppe by Aaron Holmes

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 and/or high-quality sagebrush-steppe and riparian sites,
- restoration of degraded habitats, 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.

Researcher collecting post-fire vegetation data by Aaron Holmes

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-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, and the Intermountain West Joint Venture geography includes the regions of

eastern Oregon and Washington covered by this plan. It is widely recognized that conservation actions on public lands alone will be insufficient to meet many pressing conservation needs (Noss and Peters 1995, Knight 1999). In recognition of this, a variety of U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) programs are available to assist private landowners with their conservation needs. The following primarily financial assistance programs, while not a comprehensive list, are the principal programs available:

The **Wildlife Habitat Incentives Program (WHIP)** is a voluntary program for people who want to develop and improve wildlife habitat primarily on private lands. It provides both technical assistance and cost-share payments to help establish and improve fish and wildlife habitat. Participants who own or control land agree to prepare and implement a wildlife habitat development plan. NRCS offers participants technical and financial assistance for the establishment of wildlife habitat development practices. In addition, if the landowner agrees, cooperating State wildlife agencies and nonprofit or private organizations may provide expertise or additional funding to help complete a project.

The **Conservation Technical Assistance (CTA)** program assists land-users, communities, units of state and local government, and other Federal agencies in planning and implementing conservation systems. The purpose of the program is to reduce erosion, improve soil and water quality, improve and conserve wetlands, enhance fish and wildlife habitat, improve air quality, improve pasture and range condition, reduce upstream flooding, and improve woodlands.

The **Conservation Reserve Program (CRP)** aims to reduce soil erosion, protect our ability to produce food and fiber, reduce sedimentation in streams and lakes, improve water quality, establish wildlife habitat, and enhance forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost-sharing is provided to establish the vegetative cover.

Working Lands for Wildlife (WLFW) uses Farm Bill resources to create conservation easements that proactively reduce new development and fragmentation in sensitive habitats or migration corridors (WLFW 2021). The extent of these easements has increased in sagebrush-steppe ecosystems since WLFW became a NRCS priority, particularly through the Sage Grouse Initiative (SGI). WLFW also works with landowners to promote livestock grazing practices that are compatible with bird conservation goals and process-based riparian restoration on working lands (WLFW 2021).

Burrowing Owl by Albert Beukhof

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) and Integrated Monitoring in Bird Conservation Regions (*www.birdconservancy.org/what-we-do/science/monitoring/imbcr-program/*) 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]*).

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

Sagebrush Sparrow nest by Aaron Holmes

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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Appendices

Appendix A. Species to Benefit.

Species to benefit tables include focal, priority, and responsibility species that have strong breeding season habitat associations with the habitat types and/or habitat attributes listed here, and would likely benefit from management or restoration directed towards the focal species and associated habitat attribute. The potential benefit is only appropriate if the site is within the range of the species to benefit, is large enough to meet the species' area requirements, and other specific habitat attributes or conditions required by the species are also available or being managed for. The species to benefit list is a source for species to use as surrogates when the focal species is not appropriate for a specific site due to range, habitat conditions, elevation, etc. Designations: **CAPS and bold** = focal species for a different habitat attribute in the same habitat type; CAPS = focal species in a different habitat type; lower case = priority or responsibility species not already designated as a focal species.

Green-tailed Towhee by James Livaudais

SAGEBRUSH-STEPPE

	Steppe	Sagebrush				Steppe-Shrubland		Shrubland		Juniper-Steppe
Habitat Attribute	native bunchgrass cover	sagebrush cover	large unfragmented patches of Wyoming big sagebrush	mesic areas with mountain big sagebrush	sagebrush height	interspersion of tall shrubs and openings	bare ground cover	ecotonal edges of herb, shrub, and tree habitats	upland, sparsely vegetated desert scrub	savannah with scattered mature juniper trees
Focal Species	GRSP	BRSP	SABS	GTTO	SATH	LOSH	HOLA	LASP	BTSP	MOBL
Species to Benefit	**HOLA** buow lbcu noha seow	**LASP LOSH SABS SATH** grsg	**BRSP SATH LASP LOSH** grsg	**BRSP LASP LOSH SATH**	**BRSP LASP LOSH SABS** grsg	**LASP MOBL SATH** buow feha	buow feha goea lbcu pefa swha	**LOSH MOBL** buow	**HOLA LASP LOSH** coni rowr	**GRFL LOSH** atfl swha

ATFL = Ash-throated Flycatcher, BRSP = Brewer's Sparrow, BTSP = Black-throated Sparrow, BUOR = Burrowing Owl, CONI = Common Nighthawk, FEHA = Ferruginous Hawk, GOEA = Golden Eagle, GRFL = Gray Flycatcher, GRSG = Greater Sage-Grouse, GRSP = Grasshopper Sparrow, GTTO = Green-tailed Towhee, HOLA = Horned Lark, LASP = Lark Sparrow, LBCU = Long-billed Curlew, LOSH = Loggerhead Shrike, MOBL = Mountain Bluebird, NOHA = Northern Harrier, PEFA = Peregrine Falcon, ROWR = Rock Wren, SABS = Sagebrush Sparrow, SATH = Sage Thrasher, SEOW = Short-eared Owl, SWHA = Swainson's Hawk.

RIPARIAN

	Woodland				Shrubland	
Habitat Attribute	large snags, particularly cottonwood	large canopy trees	subcanopy cover	dense shrub cover	shrub density	shrubs interspersed with herbaceous patches
Focal Species	LEWO	BUOR	YEWA	YBCH	WIFL	LAZB
Species to Benefit	RNSA atfl	**LEWO** **YBCH** **YEWA** baea	**LAZB** wiwa	**WIFL** **YEWA**	**LEWO** **YBCH** **YEWA**	GTTO LASP

ATFL = Ash-throated Flycatcher, BAEA = Bald Eagle, BUOR = Bullock's Oriole, GTTO = Green-tailed Towhee, LASP = Lark Sparrow, LAZB = Lazuli Bunting, LEWO = Lewis's Woodpecker, RNSA = Red-naped Sapsucker, WIFL = Willow Flycatcher, WIWA = Wilson's Warbler, YBCH = Yellow-breasted Chat, YBCU = Yellow-billed Cuckoo, YEWA = Yellow Warbler.

UNIQUE HABITATS

	Aspen stands	Agricultural fields	Juniper woodland
Habitat Attribute	large trees and snags with regeneration	mesic conditions	mature juniper with regeneration
Focal Species	RNSA	BOBO	GRFL
Species to Benefit	MOBL LEWO	lbcu seow	MOBL atfl bthu juti pija viwa

ATFL = Ash-throated Flycatcher, BOBO = Bobolink, BTHU = Broad-tailed Hummingbird, GRFL = Gray Flycatcher, JUTI = Juniper Titmouse, LBCU = Long-billed Curlew, LEWO = Lewis's Woodpecker, MOBL = Mountain Bluebird, PIJA = Pinyon Jay, RNSA = Red-naped Sapsucker, SEOW = Short-eared Owl, VIWA = Virginia's Warbler.

Appendix B. Predicted response of select bird species to juniper removal treatment.

Results from scientific literature on whether a bird species' occupancy and/or abundance is likely to increase or decrease after juniper removal treatments. Species in bold are focal species in this document. Sources with an asterisk (*) also found increases in reproductive success. Sources column notes when evidence for a response was weak in a particular study.

Species	Response to juniper removal	Sources
Brewer's Sparrow	Increase	Barton and Holmes 2004, Noson et al. 2006, Crow and van Riper 2010, Holmes et al. 2017, Zarri and Martin 2021*, Zeller et al. 2021
Bushtit	Increase	Crow and Van Riper 2010
Grasshopper Sparrow	Increase	not studied, but likely because avoids woody vegetation - BCOR 2018
Greater Sage-Grouse	Increase	Baruch-Mordo et al. 2013, Frey et al. 2013, Sanford et al. 2017, Severson et al. 2017a and 2017b, Olsen et al. 2021
Lark Sparrow	Increase	Holmes et al. 2017 (weak evidence), Magee et al. 2019
Sage Thrasher	Increase	Noson et al. 2006, Holmes et al. 2017 (weak evidence), Zarri and Martin 2021*
Sagebrush Sparrow	Increase	Zeller et al. 2021
Spotted Towhee	Increase	Holmes et al. 2017 (weak evidence)
Vesper Sparrow	Increase	Barton and Holmes 2004, Noson et al. 2006, Holmes et al. 2017, Zarri and Martin 2021
Western Bluebird	Increase	Magee et al. 2019
Blue-gray Gnatcatcher	mixed response	Studies equivocal: Magee et al. 2019 suggests increase, but Barton and Holmes 2004 suggests decrease
Green-tailed Towhee	mixed response	Studies equivocal: Reinkensmeyer 2000, Barton and Holmes 2004, Noson et al. 2006 (if juniper cover >33%), and Holmes et al. 2017 suggest increase. Noson et al. 2006 (if juniper cover <33%), and Zarri and Martin 2021 suggest decrease.
Mountain Bluebird	mixed response	Studies equivocal: Magee et al. 2019 suggests increase, but Reinkensmeyer et al. 2007 suggests decrease
Ash-throated Flycatcher	Decrease	Magee et al. 2019
Broad-tailed Hummingbird	Decrease	Magee et al. 2019
Brown-headed Cowbird	Decrease	Crow and Van Riper 2010
Chipping Sparrow	Decrease	Barton and Holmes 2004, Crow and Van Riper 2010, Holmes et al. 2017 (weak evidence), Zarri and Martin 2021
Clark's Nutcracker	Decrease	Magee et al. 2019
Dark-eyed Junco	Decrease	Barton and Holmes 2004, Holmes et al. 2017 (weak evidence), Zarri and Martin 2021
Gray Flycatcher	Decrease	Crow and van Riper 2010, Holmes et al. 2017, Magee et al. 2019, Zeller et al. 2021
Juniper Titmouse	Decrease	Zeller et al. 2021 (surprisingly, most other sources cited in this section do not mention Juniper Titmouse – many were conducted in areas they do not regularly occupy)
Mountain Chickadee	Decrease	Barton and Holmes 2004, Holmes et al. 2017 (weak evidence), Magee et al. 2019
Pinyon Jay	Decrease	Magee et al. 2019, Boone et al. 2021, Zeller et al. 2021
Virginia's Warbler	Decrease	Magee et al. 2019
White-breasted Nuthatch	Decrease	Magee et al. 2019
White-crowned Sparrow	Decrease	Zarri and Martin 2021

Appendix C. Summary of habitat features important to sagebrush-steppe birds of eastern Oregon and Washington.

Species in bold are focal species in this document; species in italics are priority species. All focal species are also priority species except for Lark Sparrow.

Habitat Condition

Species	native perennial grassland	open patchy shrubs	burrows	large patches sagebrush	dense sagebrush cover	tall shrubs	native herb under-story	ecotone (herb/ shrub/ tree)	desert scrub	mature juniper trees	bare ground	grass nest cover
Black-throated Sparrow		✓							✓			
Brewer's Sparrow		✓		✓	✓	✓					✓	✓
Burrowing Owl	✓	✓	✓					✓			✓	
Ferruginous Hawk	✓	✓						✓		✓	✓	
Grasshopper Sparrow	✓	✓										✓
Greater Sage-Grouse	✓	✓		✓	✓	✓	✓	✓			✓	✓
Green-tailed Towhee		✓		✓	✓	✓		✓				✓
Horned Lark	✓								✓		✓	✓
Lark Sparrow	✓	✓					✓	✓		✓		✓
Loggerhead Shrike		✓		✓	✓	✓		✓		✓	✓	
Long-billed Curlew	✓	✓									✓	
Mountain Bluebird		✓				✓		✓		✓		
Sage Thrasher		✓		✓	✓	✓		✓			✓	✓
Sagebrush Sparrow				✓	✓	✓					✓	✓
Sharp-tailed Grouse	✓	✓		✓	✓	✓	✓	✓				✓
Short-eared Owl	✓	✓										✓
Swainson's Hawk	✓	✓						✓		✓	✓	
Vesper Sparrow	✓	✓										✓
Western Meadowlark	✓	✓										✓

Appendix D. Habitat relationships of focal species in sagebrush-steppe, riparian, and unique habitats of eastern Oregon and Washington.

Habitat Subtype	Habitat Attribute	Focal Species	Habitat Relationships/Biological Objectives			
			Vegetation Composition	Vegetation Structure	Patch Size	Special Considerations
SAGEBRUSH-STEPPE						
Steppe	native bunchgrass cover	Grasshopper Sparrow	native bunchgrasses	bunchgrass cover >15% and >60% of total grass cover; herb cover >90% and 10-30 cm tall; shrub cover 1-5%; <25% bare ground	>40 ha (100 ac)	large patches better, exotic grass detrimental, vulnerable in agricultural lands to mowing, spraying, etc.
Sagebrush	sagebrush cover	Brewer's Sparrow	big sagebrush	sagebrush cover 10-45% and patchy; sagebrush height 45-100 cm; herb cover >10% with non-native herb cover <10%; open ground cover >20%	>8 ha (20 ac)	not area-sensitive, but sensitive to sage cover; vulnerable to cowbirds and parasitism higher in fragmented habitat
	large unfrag-mented sage-brush patches	Sagebrush Sparrow	Wyoming big sage-brush	sagebrush cover 15-32%; sagebrush height 45-100 cm; herb cover >10% and mostly native; herb height <10 cm; open ground cover >10%	>400 ha (1,000 ac)	area-sensitive, needs large blocks; patchy sagebrush preferred over contiguous dense sagebrush; vulnerable to cowbirds
	mesic areas with mountain big sagebrush	Green-tailed Towhee	mountain big sage-brush, mountain snow-berry, snowbrush, mountain mahogany	shrub cover 27-40%, shrub height 70-130 cm; high shrub diversity, mean herb cover 25%		Often nests in patches containing multiple shrub species; often found in transition zone between sagebrush and higher elevation shrub species
	sagebrush height	Sage Thrasher	big sagebrush, spiny hopsage, budsage	sagebrush cover 17-40%; other shrub cover <10%; sagebrush height 55-135 cm; herb cover 5-20% with <10% annual grass; herb height <5-15 cm; bare ground cover >10%	>16 ha (40 ac)	less area-sensitive ; not impacted by cowbirds; high moisture sites with tall shrubs
Steppe-shrubland	interspersion of tall shrubs and openings	Loggerhead Shrike	sagebrush, bitterbrush	patchy shrubs >1 m tall; 5-15% tall shrub cover; herb cover <20% and mostly native; mix of short (<10 cm) and tall (>10 cm), but mostly short; open ground cover >30%		prey base may be affected by pesticides; needs low ground cover; exotic grass detri-mental
	bare ground	Horned Lark	native bunchgrasses	short herbs <4 cm tall, primarily native bunchgrasses, patchy distribution; bare ground >15%; shrub cover <5%		compatible with moderate to heavy grazing; prescribed burning can also maintain low vegetation; avoid insecticides
Shrubland	ecotonal edges of herbs, shrubs, and trees	Lark Sparrow	sagebrush, bitterbrush	edge habitat with mosaic of vegetation layers where none exceeds 50% cover; >10% shrub cover, shrub height 1-2m; open ground cover >20%		dry upland sites with minimal exotic grass cover; vulnerable to cowbirds; otherwise less sensitive to grazing
	sparsely vegetat-ed desert scrub	Black-throated Sparrow	shadscale, spiny hop-sage, budsage	shrub cover <20%, evenly spaced; shrubs and small trees 1-3m tall; herb cover <25% with non-native cover <15%; open ground cover >40%		dry upland sites with minimal exotic grass cover

Juniper-steppe	scattered mature juniper trees	Mountain Bluebird	juniper	mature juniper trees at >4 live trees and >2 snags per ha; mean canopy cover 5%; short-statured herb layer with 5-15% cover; shrub cover <10%		open standing pipes should be covered to prevent mortality of birds that enter them prospecting for nest sites
RIPARIAN						
Woodland	large snags	Lewis's Woodpecker	cottonwood	2 snags/ha >41 cm dbh; >2 trees/ha >53 cm dbh; canopy cover 10-40%; shrub cover 30-80%		depends on robust shrub layer for insect food supply; higher nest depredation rates in fragmented habitat
	large canopy trees	Bullock's Oriole	cottonwood	mean canopy tree height >10.7m; canopy cover 30-60%; recruitment of sapling trees >10% cover in understory		not area-sensitive; positive response to edge
	subcanopy cover	Yellow Warbler	willow, cottonwood	>70% cover in shrub and subcanopy with subcanopy >40% of total; >70% subcanopy and shrub cover in native species; landscape habitat heterogeneity		highly vulnerable to cowbird parasitism; grazing reduces understory structure
	dense shrub cover	Yellow-breasted Chat	willow, snowberry, wild rose	patchy shrub layer 1-4 m tall; shrub cover 30-80%; scattered herbaceous openings; canopy cover <20%		highly vulnerable to cowbird parasitism; grazing reduces understory structure
Shrubland	shrub density	Willow Flycatcher	willow	dense shrub patches >10 m^2; native shrub cover 40-80%; shrub height >1 m; scattered herbaceous openings; canopy cover <30%	> 8 ha	highly vulnerable to cowbird parasitism; grazing reduces understory structure
	interspersion of shrubs and herbs	Lazuli Bunting	willow, snowberry, red-osier dogwood	interspersion of shrubs and herbaceous openings where neither is <25% or >70% cover		highly vulnerable to cowbird parasitism
UNIQUE HABITATS						
Aspen stands	large trees and snags with regeneration	Red-naped Sapsucker	aspen	>4 live trees and >4 snags/ha that are >12 m tall and >24 cm DBH; canopy cover 40-80%; >10% cover of aspen saplings in understory		natural (fire) or managed (prescribed burning, thinning, etc.) disturbance needed at landscape level to maintain successional development of aspen stands
Agricultural fields	mesic conditions	Bobolink	clover, alfalfa, false lupine, potentilla	mesic conditions with a diversity of broad-leaf forbs		vulnerable because of dependence upon agricultural habitats which have unreliable suitability from year to year, and timing of mowing/harvesting/chemical applications may interfere with nesting
Juniper woodland	mature juniper with regeneration	Gray Flycatcher	juniper, big sagebrush, bitterbrush	mature juniper at >5 trees/ha that are >53 cm DBH; >10% juniper sapling cover in understory		balance maintenance and restoration of juniper woodland in its historical range with juniper removal in areas where it encroaches on sagebrush-steppe