Partners in Flight

North American Landbird Conservation Plan

Part 2. Conservation Issues

www.partnersinflight.org

Signed and approved by

United States: Partners in Flight Council
Canada: Partners in Flight Canada National Working Group
Mexico: Comisión Nacional pare el Conocimiento y Uso de la Biodiversidad (CONABIO) y Comité Mexicano de la Iniciativa para la Conservación de las Aves en América del Norte (ICAAN-NABCI)

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Front Cover: The Painted Bunting is on Partners in Flight's Continental Watch List because of troubling declines throughout its range and multiple threats, including continued trapping for the caged-bird trade in Mexico and Cuba. Photo © Tom Vezo

Back Cover: The Mountain Bluebird is a Stewardship Species of shrubland habitats in the Intermountain West Biome. The mullein on which this bluebird is perched is one of many invasive plant species threatening the integrity of native bird habitats. Photo © Marie Read

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Spotted Owl © Mike Danzenbaker

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We also deeply appreciate the contributions of all individuals who reviewed species assessment scores at various geographic scales over the past decade. Without this thorough review and evaluation from hundreds of experts, this Plan simply would not have been possible. We are especially grateful to the Rocky Mountain Bird Observatory, which has supported the database with substantial staff time over the past decade.

The Prairie Warbler, one of 101 species identified in this Plan on Partners in Flight's continental Watch List, breeds in disturbance-dependent habitats in eastern North America and migrates to the West Indies in winter.

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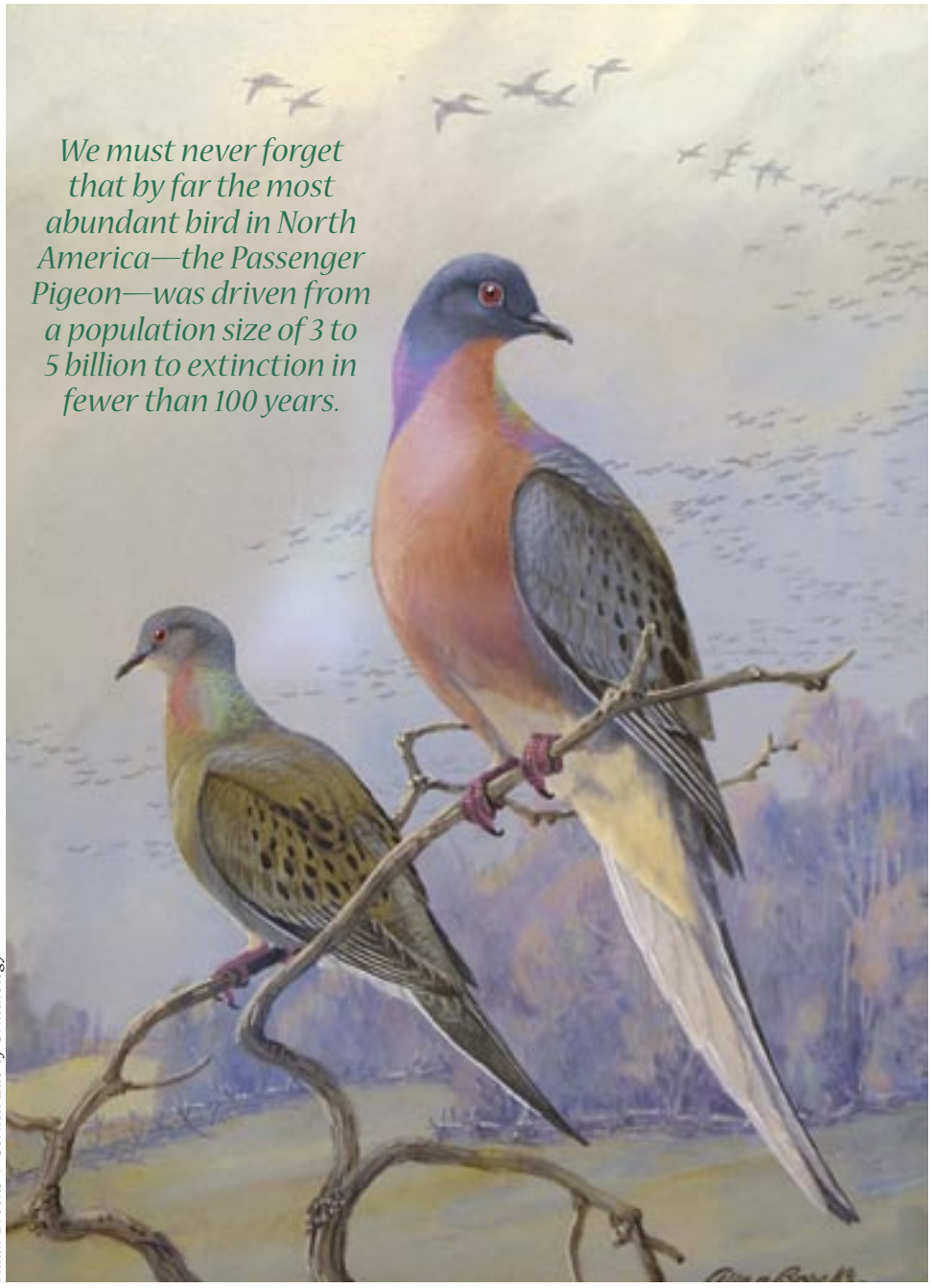

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Partners in Flight Mission

· Helping species at risk ·

· Keeping common birds common ·

· Voluntary partnerships for birds, habitats, and people ·

Part 2. Conservation Issues and Recommendations

Partners in Flight recognizes that there are important differences in habitats, conservation issues, and appropriate strategies for action among the various regions of the continent. We cannot produce a simple prescription for landbird habitat conservation on a continental scale. Conservation plans have, in fact, already been written for many parts of North America (linked at www.partnersinflight.org). Collectively, these plans provide an excellent blueprint for meeting the conservation needs of North American landbirds.

This part of the Plan constitutes a summary of issues that affect landbirds across large areas of the U.S. and Canada. It illustrates the interconnectedness of all regions of North America and highlights the roles that each portion of the continent has to play in bird conservation.

For convenience of presentation, we have placed Species of Continental Importance (Table 1) into the Avifaunal Biomes that were defined for purposes of selecting Stewardship Species (p. 15). This presentation is not intended to promote Avifaunal Biomes as new conservation planning units. Nonetheless, we do intend that Species of Continental Importance be considered for the appropriate level of conservation in these areas, along with species of regional conservation concern. Presentation on an Avifaunal Biome basis also highlights species that should be considered in planning at smaller scales within these regions, in order to meet the continental-scale goals set out in this Plan. Moreover, taking an overview of conservation issues at a geographic scale between those of the region and the continent may provide insight into issues on which neighboring planning units can work together fruitfully.

Each Avifaunal Biome section follows the model of regional conservation plans, defining habitats that are essential for Species of Continental Importance, and identifying activities which are paramount to conserving that biome's characteristic avifauna. Sections also portray overarching themes across the continent and among biomes. Issues presented in Part 1 such as monitoring, management recommendations, and patterns of threat, also are mentioned where appropriate.

For the purpose of a continental summary, we have assigned each Species of Continental Importance to a broad habitat category (see Boxes 6 and 7). These are very general and do not indicate specific habitat needs of individual species. They are used here for organizing purposes and to connect some general messages in the text to species listed in each Avifaunal Biome.

To facilitate integration with other bird conservation initiatives, we identified 42 Watch List and 25 additional Stewardship Species that are associated with wetland habitats (including riparian) in all or part of their range (see Appendix C). These species can benefit from conservation projects in wetland habitats, including those under the North American Wetlands Conservation Act.

BOX 6

Habitats included in the Avifaunal Biome tables

Major Habitat Category	Habitat Types Included
Tundra	Arctic tundra, alpine tundra
Shrub/successional	Early successional forest, forest edge, eastern North American climax shrub, taiga-tundra transition
Western shrublands	Western climax shrub communities, shrubsteppe, chaparral, desert scrub, shrubby grassland, montane shrub
Riparian	Shrub and woodland associated with watercourses in the arid West
Wetland	Marsh, swamp, bog, wet grass, wet shrub (except riparian), coastal marsh
Tropical hardwood	Tropical hardwoods, mangrove
Woodland	Open short-stature forest, Pinyon-Juniper, oak-juniper, oak savannah
Coniferous forest	All types, including pine, fir, spruce, cedar. All ages (young to mature). Applied to birds that use habitats embedded within coniferous forests (gaps, stream edge, wet forest, bogs)
Deciduous forest	All types, including maple, oak, hickory, beech, aspen, birch. All ages (young to mature). Applied to birds that use habitats embedded within deciduous forests (gaps, stream edge, wet forest, bogs)
Mixed forest	As above, but for mixed deciduous forest-coniferous forests (including western pine-oak communities). Also applied to forest bird species that use a variety of coniferous or deciduous habitats (including riparian)
Grassland	Tallgrass, shortgrass, and mixed grass communities; open agricultural types, especially pasture
Various	Applied to species that range or forage widely over a variety of the habitats listed above

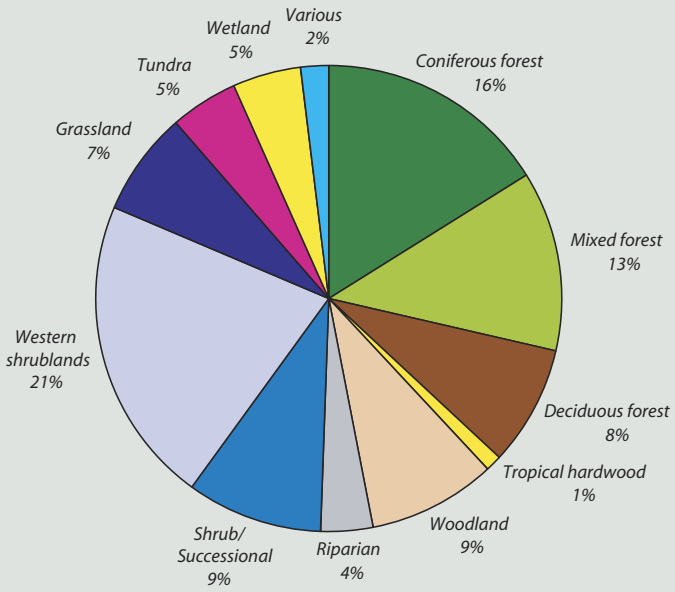
Just as habitats are not confined to single regions of the continent, there are broad landbird conservation issues that affect more than just one biome. The following is a summary of many issues found in regional plans that cross biomes. Readers are referred to individual regional plans for details, including literature citations.

- *Habitat loss, degradation, and fragmentation:* These affect all native bird habitats, especially in areas where human populations or agricultural development are highest. Many birds do best when breeding or wintering within very large blocks of habitat. Particularly prominent are losses of grasslands and degradation of coastal wetlands in the East, shrublands in coastal areas of the Pacific, riparian in the Southwest, shrublands in the Intermountain West, and prairies in the heart of the continent.
- *Forestry and forest management:* Continentwide; major effects are anticipated from ongoing logging operations in Northern Forest, Pacific, and Intermountain West biomes. Lack of forest management is an issue in some Eastern forests.
- *Fire management strategies:* These affect a variety of grassland, shrub, and forest habitats. Of particular concern is fire suppression within coniferous and mixed forests in the Eastern, Intermountain West, and Southwestern biomes, and altered fire regimes in intermountain shrublands and remnant tallgrass prairie.
- *Wetland issues:* Conversion of wetlands for agricultural production, drainage, water diversions, and the alteration of hydrologic regimes affect mangrove forests and coastal marshes in the East, while in the West, issues primarily concern riparian areas and interior basins. In the Prairie biome, both wetland basin and riparian issues are of concern.
- *Exotic or invasive species:* These affect most portions of the continent but may be most critical in shrubsteppe in the Intermountain West, mixed grasslands of the Prairie biome, and riparian areas of the Southwest.
- *Resource extraction and energy industry issues:* These include mountaintop mining in the Eastern biome, hydro-electric and water storage development in the Prairie, Intermountain West, and Southwestern biomes, oil and gas development in many areas, and wind-farm development in the Prairie and Eastern biomes.
- *Livestock grazing management:* Grazing affects habitats in many areas of the continent, including the Prairies, Intermountain West, and Southwest.
- *Climate change:* This has been identified as an issue for birds primarily in far northern latitudes and alpine areas, but has the potential to affect many more birds through changes in precipitation patterns, loss of coastline habitats, and effects of weather on migration routes.
- *Contaminants and pesticides:* Acid precipitation affects the Eastern and Northern Forest biomes, and pesticides affect broad areas in most biomes. Accumulation of highly dispersive pollutants is a rapidly growing concern in the Arctic.
- *Lack of information:* This affects the management of all bird species but may be most crucial when population trends are unknown (see p. 27), especially in the Arctic, Northern Forest, and Southwestern biomes. Research is needed on basic ecology of poorly known species and habitats, such as thorn forest in southern Texas and Mexico.

For readers wishing to delve deeper into the conservation issues for landbirds in any particular portion of the continent, we encourage you to consult the appropriate regional plan (www.partnersinflight.org).

BOX 7

Habitat associations among the 192 landbird Species of Continental Importance



ARCTIC AVIFAUNAL BIOME

The Arctic Avifaunal Biome includes three Bird Conservation Regions (BCRs, Fig. 9) and covers areas north of the tree line in Canada and Alaska, as well as Alaska's west coast and the Aleutian and Bering Sea islands. Alaska and adjacent Canada support the most species in this biome (Fig. 16a). Habitat consists largely of vegetated and rocky tundra, with some shrubs and ecotones with treed areas adjacent to Northern Forest BCRs.

The Arctic Avifaunal Biome is home to relatively few species, many of them with circumpolar distribution. Few are year-round residents. Most species breeding in this region are short-distance migrants, and many winter along the northern Pacific Coast and across the northern U.S. and southern Canada (Fig. 16b).

The Arctic is relatively pristine and is not under immediate widespread threat of human development, although local areas may be heavily affected, particularly by industrial oil and gas development and mining. Most Arctic-nesting landbirds, however, winter in human-populated parts of North America, particularly in the U.S., where habitat loss and degradation is far more severe than in the Arctic. Whereas this biome has only two Species of Continental Importance in need of Management, both apparently have undergone severe population declines. The number of species in the Arctic requiring Long-term Planning is small, but these represent a large proportion of the breeding landbirds in the biome.

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One of relatively few Arctic-breeding passerines, the Harris's Sparrow is perhaps most vulnerable within its small wintering range in the south-central U.S..

The most pressing landbird conservation issue for this region is the lack of population monitoring (Fig. 15). Not a single Species of Continental Importance in this Avifaunal Biome has adequate trend information (Table 2). Habitat degradation along migration corridors and in wintering ranges, as well as climate change, accumulation

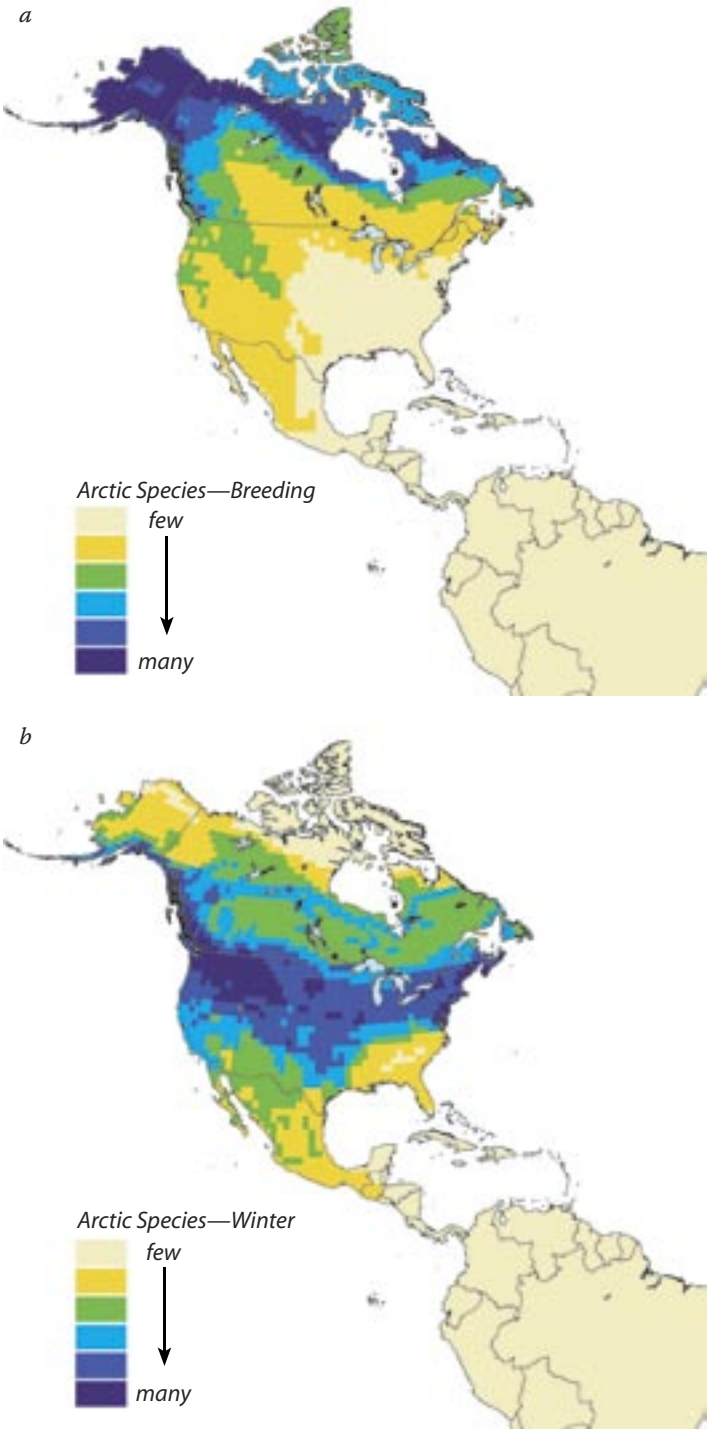

Figure 16. Number of species (a) during the breeding season and (b) during winter in each lat-long block, weighted by the percent of total population of each species breeding within the Arctic Avifaunal Biome.

of contaminants, and industrial mining and oil and gas development in the Arctic, may be having effects that are going undetected due to lack of information on population status. Most information on population status comes from winter counts (especially Christmas Bird Counts), which are subject to many biases and require better analysis and evaluation to produce more reliable trend results.

Primary Habitats

TUNDRA

There are separate issues facing birds in arctic versus alpine tundra. The low elevation tundra list includes two Watch List Species, McKay's Bunting and Short-eared Owl (Table 2), and most of the additional Stewardship Species. The threat to McKay's Bunting results from its extremely small population size and the potential for unintentional release of exotic mammalian predators (e.g., rats) on the two islands on which these buntings breed. Stewardship is the most important ecosystem-level conservation need for the tundra habitat. Climate change may affect species in low elevation areas through rises in sea level, changes in surface hydrology, and increases in shrub habitats. Species in alpine areas may be affected by climate change through restriction and fragmentation of habitat as a result of trees and shrubs moving up slope.

SHRUB/SUCCESSIONAL

Species in this region that use shrublands, consisting primarily of transitional habitat between tree line and tundra, include Harris's Sparrow, Smith's Longspur, Hoary Redpoll, and Willow Ptarmigan. While not under threat by direct human alteration, transitional habitats in the Arctic are prime candidates to be strongly affected by climate change. Harris's Sparrow is also biome-restricted on its wintering grounds in the Prairies, and climate change may affect this species more than most transitional breeding species.

Conservation Issues

- Lack of information on population status of most Arctic landbirds.
- Introduction of mammalian predators to islands.
- Habitat degradation in wintering areas of many Arctic-breeding species.
- Industrial mining and oil and gas development leading to loss and fragmentation of habitats and increased concentration of nest predators.
- Accumulation of contaminants, particularly persistent organic pollutants (e.g., PCBs, DDT, dioxins,

Table 2. Species of Continental Importance in the Arctic Avifaunal Biome: BCRs 1, 2, 3

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Management					
Harris's Sparrow	86%	0%	Shrub/successional	Increase 100%	Mo2,3
Short-eared Owl	13%	<1%	Tundra	Increase 100%	Mo3
Long-term Planning & Responsibility					
McKay's Bunting	100%	>99%	Tundra	Maintain/Increase	Mo1,3
Smith's Longspur	57%	0%	Shrub/successional	Maintain/Increase	Mo2,3
Snowy Owl*	100%	2%	Tundra	Maintain	Mo2,3
Snow Bunting*	100%	4%	Tundra	Maintain	Mo2,3
Hoary Redpoll*	100%	6%	Shrub/successional	Maintain	Mo2,3
Lapland Longspur*	>99%	<1%	Tundra	Maintain	Mo2,3
Rough-legged Hawk*	99%	<1%	Tundra	Maintain	Mo2,3
Rock Ptarmigan*	99%	78%	Tundra	Maintain	Mo1,3
Gyrfalcon*	97%	11%	Tundra	Maintain	Mo2,3
Peregrine Falcon*	76%	4%	Various	Maintain	Mo2,3
Willow Ptarmigan*	76%	19%	Shrub/successional	Maintain	Mo1,3

[1] Species are sorted by Action Category (Immediate Action, Management, Planning & Responsibility), then by decreasing % of global population that occurs in the biome (by greater of breeding or winter population). Species highlighted in yellow are Watch List species, with at least 10% of their global population in this biome. Species in green (in species or % population columns) are Stewardship Species, with ≥75% of their population in this biome.

[2] Monitoring Need (this assessment addresses only the adequacy of long-term population trend monitoring at the continental scale): Mo1=no trend data, Mo2=imprecise trends, Mo3=inadequate northern coverage.

*For these species, % of Population is for Western Hemisphere. All others are % of Global Population.

and mercury), that migrate north from temperate and tropical areas on global winds that lead to the Arctic.

- Climate change resulting in widespread changes in availability and distribution of habitats.

Recommended Actions

- Develop BCR-level plans for the Canadian portion of this Avifaunal Biome, and support implementation of plans in Alaskan portion.
- Conduct critical analysis to determine suitability of Christmas Bird Counts for monitoring Watch List, Stewardship, and other Arctic-nesting species during the nonbreeding season.
- Remove introduced populations of rats, foxes, and other nonnative mammalian predators and ungulates from islands in the Aleutian and Bering seas, and protect these islands from future introductions.
- Evaluate evidence of decline in Harris's Sparrow, and if robust, conduct research into causes.
- Incorporate landbird monitoring into existing waterfowl and shorebird monitoring programs in the region where feasible and appropriate.
- Conduct research on Hall and St. Matthew Islands to determine population status, limiting factors, and potential threats to McKay's Bunting. Prevent introduction of rats and other exotic predators.

The Hoary Redpoll, one of several Arctic species with populations also in the Old World, rarely reaches populated areas of southern Canada and the northern U.S., even in winter.

- Determine cause of Short-eared Owl decline where it has been documented, and determine population status in the Arctic.
- Model projected changes in habitat that may result from climate change to determine degree of threat to priority species.
- Assess the threats of increasing accumulation of contaminants, particularly on priority raptor species.

NORTHERN FOREST AVIFAUNAL BIOME

The Northern Forest Avifaunal Biome is by far the largest and comprises six BCRs (Fig. 9). About 80% of the land area in this region is forested, with most of the remainder consisting of tundra and wetland. Of the forest cover, about half is boreal coniferous. There also are extensive areas of noncommercial, open forests in the northern taiga (small trees, shrubs, and muskeg). Northern deciduous and mixed forests predominate in the Great Lakes and Maritimes, and in the western boreal plains.

This area is a veritable "Neotropical migrant factory," representing the core breeding range for more than 75% of Canada's warblers and a similar percentage of thrushes, vireos, and flycatchers. An estimated 90% of the birds in this region migrate out for the winter. Migration corridors in the U.S., and wintering areas extending as far south as northern South America, are crucial habitats for these birds (See Box 3, p. 8). Species characteristic of the Northern Forest region breed mostly in Canada (Fig. 17a), and they winter in the Pacific and Eastern Biomes as well as Mexico and throughout Central America and northern South America (Fig. 17b).

Population trend data for most species characteristic of this region are lacking in the northern portion of the biome (Fig. 15c). Migration monitoring and Christmas Bird Counts may be the best means of getting information from broad areas of the biome in the near term. For the longer term, breeding season monitoring suitable to remote areas needs to be developed and implemented across the region. Many parts of this region are subject to a variety of development pressures, including forestry, energy, and other industrial activities. Where soils and climate are suitable, agriculture, recreational, and urban development occur, particularly along the southern edge of the zone and from the Great Lakes eastward.

Despite increased forestry and other industrial activity in the boreal, northern portions of the region are relatively little affected by humans to date, whereas wintering areas of many boreal species (often in Central America) are relatively restricted in size and have been heavily modified in habitat. The major conservation issues for the region include effects on birds of human land use, degradation and loss of wintering habitat, potential effects of climate change, and acid precipitation.

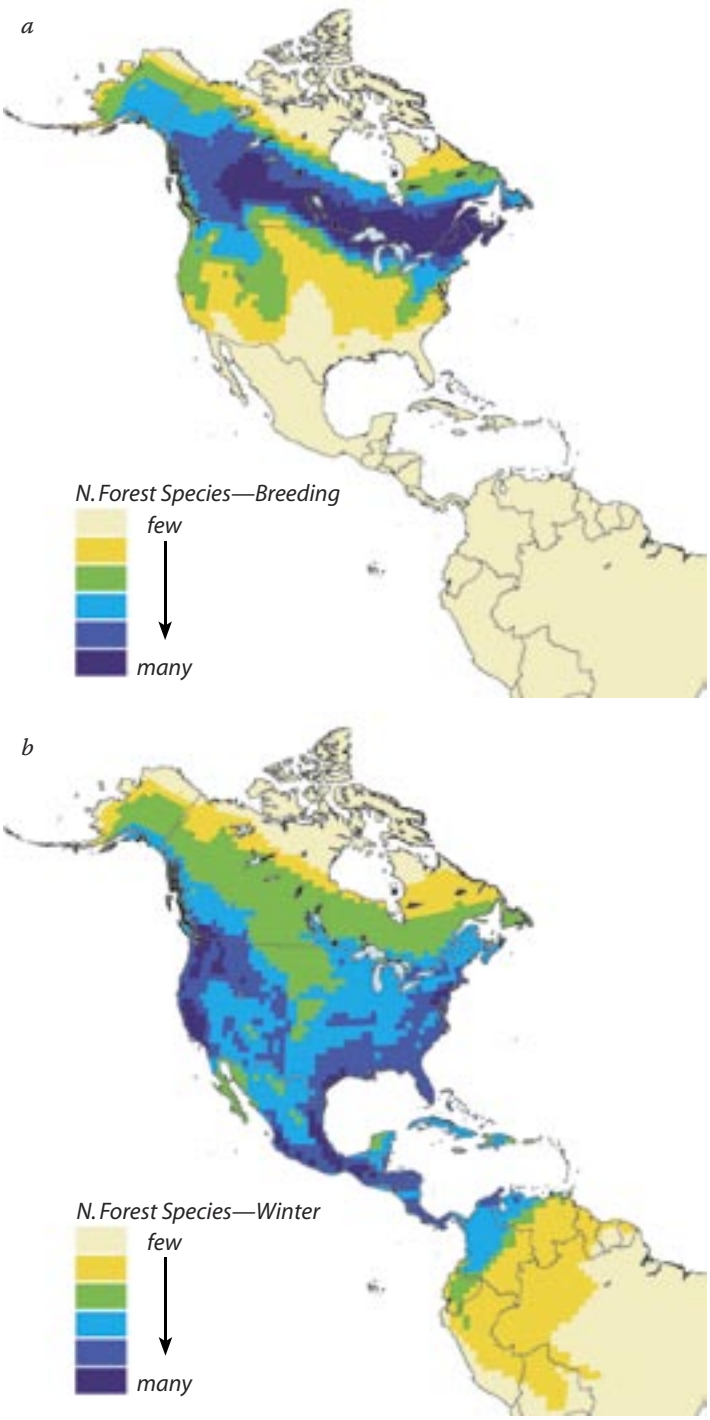

Figure 17. Number of species (a) during the breeding season and (b) during winter in each lat-long block, weighted by the percent of total population of each species breeding within the Northern Forest Avifaunal Biome.

Several Watch List Species are restricted to specific habitats, some of them very limited in extent. Kirtland's Warbler, the Watch List Species most at risk in this region, is found only in large patches of young jack-pine forest. Bicknell's Thrush uses dense and stunted conifers at high elevation and sometimes is found in regenerating industrial forest. While the scrubby habitat used

Table 3. Species of Continental Importance in the Northern Forest Avifaunal Biome: BCRs 4, 6–8, 12, 14

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Immediate Action					
Kirtland's Warbler	100%	0%	Coniferous forest	Recovery Plans	**
Bicknell's Thrush	95%	0%	Coniferous forest	Maintain/Increase	**
Golden-winged Warbler	76%	0%	Shrub/successional	Increase 100%	**
Management					
Bay-breasted Warbler	>99%	0%	Coniferous forest	Increase 50%	Mo2,3
Connecticut Warbler	99%	0%	Coniferous forest	Maintain	Mo3
Canada Warbler	97%	0%	Mixed forest	Increase 50%	Mo3
Chestnut-sided Warbler	93%	0%	Shrub/successional	Maintain	**
Boreal Chickadee	92%	92%	Coniferous forest	Maintain	Mo2,3
Rusty Blackbird	89%	1%	Coniferous forest	Increase 100%	Mo2,3
Olive-sided Flycatcher	61%	0%	Coniferous forest	Increase 100%	Mo3
Blue Grouse	18%	18%	Coniferous forest	Increase 100%	Mo2
Harris's Sparrow	14%	<1%	Shrub/successional	Increase 100%	Mo2,3
Wood Thrush	13%	0%	Mixed forest	Increase 50%	**
Long-term Planning & Responsibility					
Palm Warbler	>99%	<1%	Wetland	Maintain	Mo2,3
Cape May Warbler	>99%	<1%	Coniferous forest	Maintain	Mo2,3
Yellow-bellied Flycatcher	>99%	0%	Coniferous forest	Maintain	Mo3
Tennessee Warbler	>99%	0%	Mixed forest	Maintain	Mo3
Philadelphia Vireo	99%	0%	Mixed forest	Maintain	Mo2,3
White-throated Sparrow	99%	1%	Mixed forest	Maintain	Mo3
Spruce Grouse	98%	98%	Coniferous forest	Maintain	Mo2,3
Mourning Warbler	98%	0%	Shrub/successional	Maintain	Mo3
Northern Shrike	96%	26%	Shrub/successional	Maintain	Mo2,3
Blackburnian Warbler	96%	0%	Mixed forest	Maintain	**
Alder Flycatcher	94%	0%	Shrub/successional	Maintain	Mo3
Black-backed Woodpecker	94%	94%	Coniferous forest	Maintain	Mo2,3
Magnolia Warbler	94%	0%	Mixed forest	Maintain	Mo3
Swamp Sparrow	94%	<1%	Wetland	Maintain	Mo3
Yellow-bellied Sapsucker	93%	<1%	Mixed forest	Maintain	Mo2,3
Nashville Warbler	92%	<1%	Mixed forest	Maintain	**
Black-throated Green Warbler	92%	0%	Mixed forest	Maintain	Mo2,3
Gray Jay	91%	91%	Coniferous forest	Maintain	Mo3
Lincoln's Sparrow	91%	<1%	Wetland	Maintain	Mo3
Blue-headed Vireo	90%	0%	Mixed forest	Maintain	Mo2,3
Nelson's Sharp-tailed Sparrow	49%	<1%	Wetland	Maintain	Mo2
Bohemian Waxwing*	98%	55%	Coniferous forest	Maintain	Mo2,3
White-winged Crossbill*	97%	86%	Coniferous forest	Maintain	Mo2,3
Pine Grosbeak*	90%	88%	Coniferous forest	Maintain	Mo3
Smith's Longspur	39%	0%	Shrub/successional	Maintain/Increase	Mo2,3

[1] Species are sorted by Action Category (Immediate Action, Management, Planning & Responsibility), then by decreasing % of global population that occurs in the biome (by greater of breeding or winter population). Species highlighted in yellow are Watch List species, with at least 10% of their global population in this biome. Species in green (in species or % population columns) are Stewardship Species, with ≥90% of their population in this biome.

[2] Monitoring Need (this assessment addresses only the adequacy of long-term population trend monitoring at the continental scale): Mo1=no trend data, Mo2=imprecise trends, Mo3=inadequate northern coverage.

*For these species, % of Population is for Western Hemisphere. All others are % of Global Population.

**Long-term population trend monitoring is generally considered adequate but some issues, such as bias, may not have been accounted for.

by Smith's Longspur seems widespread, this species occupies only a narrow transitional zone between the northern forest and tundra. Conservation action directed at breeding areas of these species will do little for other Species of Continental Importance. In contrast, action directed at their wintering areas (Neotropical woodland and native grassland in the south central U.S.) should prove beneficial to a variety of species.

Primary Habitats

CONIFEROUS FOREST

The largest group of Species of Continental Importance in the biome uses coniferous forest (Table 3). Most of these species require better trend information, especially from areas not currently covered by the Breeding Bird Survey. These species vary widely in preference for age and density of forest, degree of association with wet areas, and tolerance of deciduous or mixed forests. Boreal coniferous forest is not critically imperiled, and most boreal forest bird species are abundant and widespread. Nonetheless, this group includes many Neotropical migrant species that have undergone periods of notable decline.

MIXED FOREST

A somewhat smaller group of species is associated with mixed and deciduous forest, including Wood Thrush and Yellow-bellied Sapsucker. Forests at the border between the Northern Forest Avifaunal Biome and the Prairies, including Aspen Parkland and the fringe of the boreal forest proper, are rapidly being lost to agriculture and other development. Additional concerns about habitat are associated with forestry and energy-sector activities, which are important issues for species that use mature to old-growth deciduous and mixed woodlands.

SHRUB/SUCCESSIONAL

Shrub-nesting species using deciduous or coniferous forests, such as Mourning and Chestnut-sided warblers, may find additional new habitat resulting from the regeneration of disturbed forests. However, some species dependent on specific types of shrub habitat may not benefit from industrial forestry activities. Four of the seven shrub/successional Species of Continental Importance in this biome have suffered moderate to severe population declines.

WETLAND

Wetlands are represented by Swamp Sparrow, and by Nelson's Sharp-tailed Sparrow, which also uses grassland. Palm Warbler is characteristic of northern bogs with a few shrubs or trees. A subset of the boreal coniferous species group is associated with wet areas, including Rusty Blackbird and, in the eastern portion of its range, Canada Warbler. Both are Watch List Species that have undergone severe declines. Problems may lie primarily in the wintering areas, and there is a possibility that large numbers of Rusty Blackbirds may be killed as part of blackbird control aimed at other species. Further, there is widespread evidence of wetlands drying in interior and south-central Alaska and northern Yukon Territory. This is thought to be the result of climate change and could be a growing issue for wetland species like the Rusty Blackbird. Bog habitats are affected by peat extraction and logging operations, but only in some portions of the Avifaunal Biome. Each of the Species of Continental Importance associated with wetlands needs monitoring in areas north of BBS coverage.

© Kevin Karlson

Requiring mature conifers for breeding and mature lowland rainforest in winter, the Bay-breasted Warbler is among the most vulnerable of the suite of Northern Forest warblers that migrate to the Neotropics.

Conservation Issues

- Largescale forestry activities, resulting in habitat fragmentation, change in tree-species and age composition, use of pesticides, degradation of forest riparian areas, and fire suppression.

- Energy exploration, mining, hydro-electric development, and other industries, resulting in habitat fragmentation, increased road access, and use of contaminants.
- Agriculture and urban development (limited to southern portions of the region).
- Degradation and loss of wintering and migration habitats affecting species that breed in northern forests.
- Lack of information on climate change effects on distributions of high elevation and sub-arctic species, northward retreat of boreal forests, drying of wetlands, and replacement of conifers by deciduous tree species.
- Acid precipitation affecting vegetation and causing reduction in calcium-rich prey needed for reproduction.

Recommended Actions

- Promote "best practices" guidelines for industry that call for maintaining a mosaic of habitats across this Avifaunal Biome, sufficient in area and forest structure, to maintain healthy populations of all components of the Northern Forest avifauna.
- Develop plans for Northern Forest BCRs that do not yet have them.
- Develop improved monitoring for species with a large portion of their range north of the BBS-coverage area.

© Mike Danzenbaker

The Rusty Blackbird is experiencing precipitous declines, partly due to a loss of forested wetlands on its southeastern U.S. wintering grounds.

© Gary Rosenberg

Canada's tremendous stewardship responsibility to conserve its characteristic avifauna is illustrated by the Spruce Grouse, one of 30 species with 90% or more of its Western Hemisphere breeding population in the Northern Forest.

- Investigate declines in boreal species for which data come from only a small portion of the breeding range, and conduct research on causes of declines.
- Determine importance and limits of the recently expanded Canadian range of the Golden-winged Warbler. Continue research on effects of forestry practices on this species to guide management in the northern portions of its range.
- Continue research and management directed at Kirtland's Warbler and Bicknell's Thrush (U.S. and Canadian recovery efforts).
- Expand efforts to identify, protect, restore, and manage critical winter habitats for priority species in Mexico and the rest of Latin America and the Caribbean.
- Determine status of Smith's Longspur populations and winter habitat availability.
- Conduct research on the importance to migratory species of distribution and quality of stopover habitats south of the Northern Forest.
- Create new partnerships to coordinate conservation actions in nations where birds of the Northern Forest biome winter and through which they migrate.

PACIFIC AVIFAUNAL BIOME

The Pacific Avifaunal Biome is made up of three BCRs (Fig. 9) that extend from south-coastal Alaska south to northern Baja California in Mexico. This region encompasses the Pacific coastline of Canada and the U.S., including coastal archipelagos. Dominating the northern portion of the landscape are the magnificent coniferous rainforests, including Sitka and other spruces, western hemlock, red cedar, Douglas fir, coastal redwood, and giant sequoia. These forests have been greatly altered in recent decades. In the southern half of the region, dry pine forests, oak woodlands, chaparral, and coastal scrub support a large number of endemic species. These habitats have been extensively altered and lost due to human encroachment. Important riparian habitats occur throughout the biome, particularly in the southern portion and in montane wet meadows throughout.

The Pacific Avifaunal Biome has a distinct group of species that is concentrated along the coast, both in the breeding and wintering seasons (Fig. 18a, b). Many are resident year round, while others breed here and winter in western Mexico (Fig. 18b). This biome also is very important for northern breeding species that winter in the moderate climate along the Pacific coast. Large populations of raptors such as Red-tailed Hawk, American Kestrel, and Northern Harrier winter in the interior valleys where agriculture dominates. The majority of the wintering populations of Fox Sparrow (western races) and Golden-crowned Sparrow occur in this biome.

Overall, the species in this region have relatively high breeding season threats (Fig. 5), and a high proportion of Watch List Species occur here (Fig. 10a). The main conservation issues for birds in the region are related to effects of forest management (e.g., timber harvest, fire suppression), loss of wetlands and riparian woodlands, and urban/residential/agricultural encroachment into oak, chaparral, and coastal scrub habitats. Lowland and coastal habitats are heavily encroached upon by urban development and agriculture, as are the former grasslands of the Central Valley of California.

There are Watch List and Stewardship Species representative of all the major terrestrial habitats in the Pacific Biome, but the greatest number of these species can be placed in two major groups: those associated with moist coniferous forests and those associated with drier oak

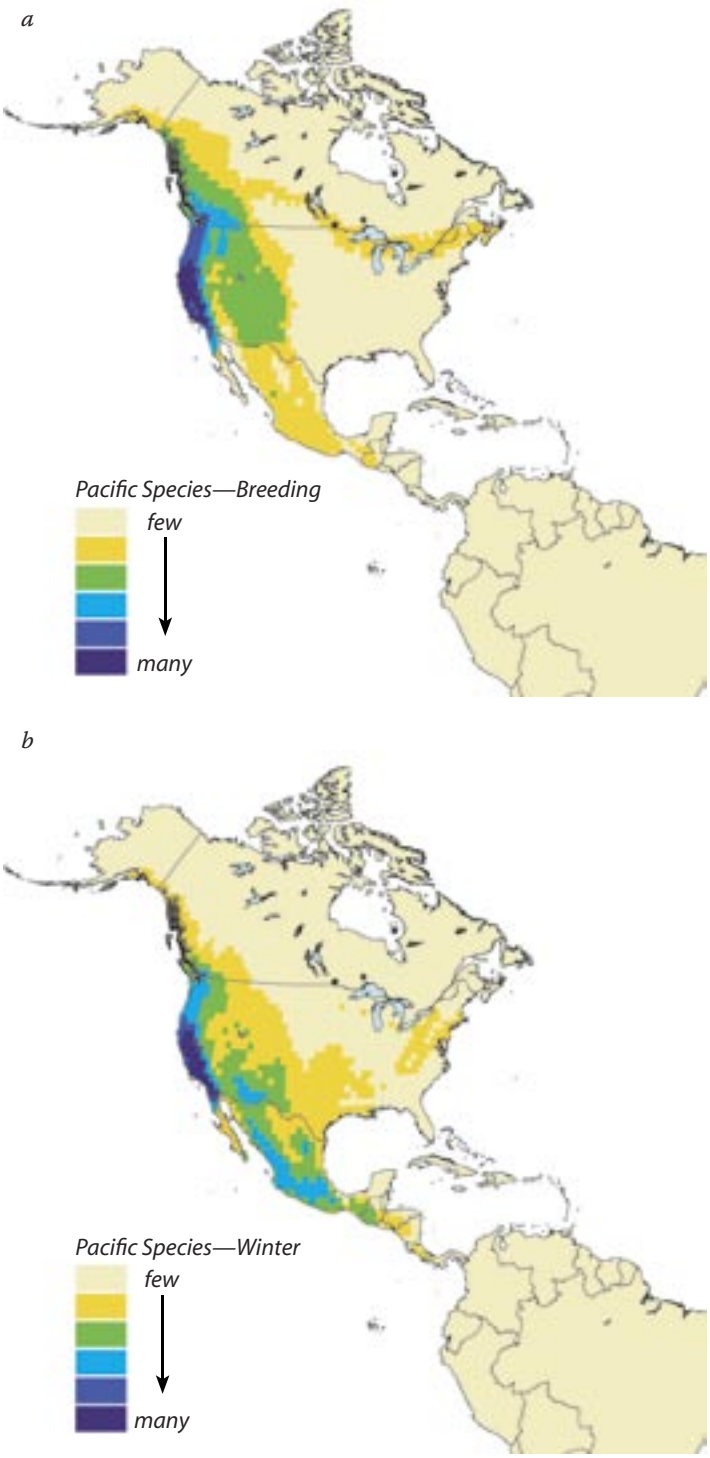

Figure 18. Number of species (a) during the breeding season and (b) during winter in each lat-long block, weighted by the percent of total population of each species breeding within the Pacific Avifaunal Biome.

woodland, chaparral, and/or other scrub habitats. More specifically, mature coniferous forest and oak habitats stand out as supporting the most Species of Continental Importance.

Two other habitats are noteworthy because they support a diverse assemblage of birds and/or significant regional

Table 4. Species of Continental Importance in the Pacific Avifaunal Biome: BCRs 5, 15, 32

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Immediate Action					
Island Scrub-Jay	100%	100%	Western shrublands	Maintain/Increase	Mo1
Tricolored Blackbird	91%	65%	Wetland	Increase 100%	Mo2
California Condor	59%	59%	Various	Recovery Plan	**
Spotted Owl	40%	40%	Coniferous forest	Recovery Plans	**
Management					
Oak Titmouse	99%	99%	Woodland	Increase 50%	**
Wrentit	97%	97%	Western shrublands	Increase 50%	**
Nuttall's Woodpecker	96%	96%	Woodland	Maintain/Increase	**
California Thrasher	95%	95%	Western shrublands	Increase 50%	Mo2
Hermit Warbler	94%	0%	Coniferous forest	Maintain/Increase	**
Blue Grouse	75%	75%	Coniferous forest	Increase 100%	Mo2
Rufous Hummingbird	61%	0%	Western shrublands	Increase 100%	**
Black-chinned Sparrow	44%	<1%	Western shrublands	Increase 50%	Mo2
Black Swift	29%	0%	Various	Increase 50%	Mo2
Lewis's Woodpecker	4%	25%	Riparian	Maintain/Increase	Mo2
Willow Flycatcher	24%	0%	Riparian	Increase 50%	**
Band-tailed Pigeon	22%	18%	Mixed forest	Increase 100%	Mo2
Olive-sided Flycatcher	15%	0%	Coniferous forest	Increase 100%	Mo3
White-throated Swift	10%	4%	Various	Increase 100%	Mo2
Long-term Planning & Responsibility					
Yellow-billed Magpie	100%	100%	Woodland	Maintain/Increase	**
Allen's Hummingbird	98%	4%	Western shrublands	Maintain/Increase	Mo2
Mountain Quail	96%	96%	Western shrublands	Maintain/Increase	**
Pacific-slope Flycatcher	91%	0%	Mixed forest	Maintain	**
Chestnut-backed Chickadee	90%	90%	Coniferous forest	Maintain	**
Golden-crowned Sparrow	12%	85%	Western shrublands	Maintain	Mo3
Lawrence's Goldfinch	84%	29%	Woodland	Maintain/Increase	Mo2
Red-breasted Sapsucker	78%	77%	Mixed forest	Maintain	Mo3
White-headed Woodpecker	73%	73%	Coniferous forest	Maintain	Mo2
Varied Thrush	33%	72%	Coniferous forest	Maintain	Mo3
Black-throated Gray Warbler	69%	0%	Mixed forest	Maintain	**
Bald Eagle	60%	39%	Wetland	Maintain	Mo3
California Towhee	55%	55%	Western shrublands	Maintain	**
Steller's Jay	54%	54%	Coniferous forest	Maintain	**
Western Scrub-Jay	53%	53%	Western shrublands	Maintain	**
Fox Sparrow	8%	52%	Western shrublands	Maintain	Mo3
Flammulated Owl	25%	0%	Mixed forest	Maintain/Increase	Mo1
Winter Wren*	26%	50%	Coniferous forest	Maintain	Mo3
California Gnatcatcher	17%	17%	Western shrublands	Recovery Plan	Mo1
Costa's Hummingbird	15%	6%	Western shrublands	Maintain/Increase	Mo2

[1] Species are sorted by Action Category (Immediate Action, Management, Planning & Responsibility), then by decreasing % of global population that occurs in the biome (by greater of breeding or winter population). Species highlighted in yellow are Watch List species, with at least 10% of their global population in this biome. Species in green (in species or % population columns) are Stewardship Species, with ≥50% of their population in this biome.

[2] Monitoring Need (this assessment addresses only the adequacy of long-term population trend monitoring at the continental scale): Mo1=no trend data, Mo2=imprecise trends, Mo3=inadequate northern coverage.

*For this species, % of Population is for Western Hemisphere. All others are % of Global Population.

**Long-term population trend monitoring is generally considered adequate but some issues, such as bias, may not have been accounted for.

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The Lawrence's Goldfinch is one of 10 Watch List species with 80% or more of its global breeding population restricted to the Pacific Avifaunal Biome. High threats to habitats from human development in this region take on an added urgency due to this extremely high stewardship responsibility.

populations. Riparian habitats are a high conservation priority for both reasons, especially within the southern portions of the region (i.e., southwestern Oregon and all of California). Perhaps the most specialized species in the biome are birds of the highly threatened and limited coastal scrub habitat of California.

Primary Habitats

CONIFEROUS FOREST

Coniferous rainforests are the flagship habitats of the Pacific Biome. These highly productive and intensively managed forests are sustained by a mild maritime climate and abundant precipitation. In old-growth forests, there are trees over 60 m tall, multi-layered canopies and subcanopies, shrubby understories, and forest floors carpeted with mosses and ferns. A figurehead species in coniferous forest, because of its endangered status and close association with old-growth forests, is the Spotted Owl. These forests also support Watch List and regional specialist species like Hermit Warbler, Band-tailed Pigeon, and Rufous Hummingbird.

WOODLAND

Oak habitats (savannahs and woodlands) occur where people want to live. These habitats have become highly fragmented and increasingly degraded or lost due to human development (urban, residential, and agricultural), encroachment of coniferous forest and invasion of exotic species, and lack of oak regeneration. A relatively recent and dramatic threat, especially in California, is Sudden Oak Death Syndrome. Oak habitats also have the highest percentage of Species of Continental Importance in the biome with declining trends, including Oak Titmouse. In addition to declines, there have been regional extirpations, including the Western Bluebird from Vancouver Island, British Columbia, White-breasted Nuthatch from western Washington, Lewis's Woodpecker from western Washington and Oregon, and Blue-gray Gnatcatcher from several locations in California.

RIPARIAN

Riparian woodland and shrub habitats are perhaps the most critical habitats overall because of the diversity of birds they support and their importance to migrating birds. In the Pacific Biome, these habitats are most evident in southwestern Oregon and California where they are dominated by deciduous canopies of cottonwood, ash, willow, and/or alder. Habitat has been reduced in extent and quality from numerous factors including flood control, channelization, dredging, clearing for agriculture, and exotic species. Consequently, populations of several species, such as Bell's Vireo, Yellow-billed Cuckoo, and

© Mike Danzenbaker

Allen's Hummingbird is one of a suite of breeding species endemic to California's threatened oak and chaparral habitats. Most individuals migrate to central Mexico during the nonbreeding season.

Willow Flycatcher in California, have suffered population declines and extirpations resulting in state or federal listing status. Other highly characteristic riparian species such as Yellow Warbler and Warbling Vireo have suffered from habitat loss and cowbird parasitism.

WESTERN SHRUBLANDS

The majority of California's human population lives in the coastal region where coastal shrub and chaparral habitats are the dominant feature of the landscape. These are relatively dry habitats characterized by a dense shrub layer. Most of these habitats occur along the coast, but some chaparral can be found in the interior and in montane environments. Although these habitats are limited in extent, they support a suite of specialized species and are highly threatened. Primary conservation issues are habitat loss and fragmentation. The endangered California Gnatcatcher epitomizes these habitats, which support other Watch List Species including Wrentit, California Thrasher, Black-chinned Sparrow, and Mountain Quail. Farther north in the biome, shrub habitat is associated with higher elevations, riparian areas, and cleared forest. Habitat for species such as Rufous Hummingbird is important here.

© Marie Read

The Red-breasted Sapsucker is a characteristic breeding species of the temperate rainforests of the northern Pacific Coast, migrating only as far as the southern Pacific Coast in winter.

Conservation Issues

- Loss and fragmentation of remaining mature coniferous forest through commercial forestry, especially on public lands.
- Other forest-management issues, including fire suppression, prescribed fire, and recreation.
- Loss of riparian forest and shrub.
- Urban and residential development, especially in oak, chaparral, and coastal scrub habitats.
- Forest health, especially in pine forest and oak woodlands.
- Loss and contamination of freshwater wetlands.
- Exotic species, both plants and animals.

Recommended Actions

- Incorporate scientifically sound bird conservation objectives into forest management (public and private lands) through policy and planning.
- Conduct restoration and management of riparian, pine, oak, chaparral, and coastal scrub habitats to support native conditions, processes, and species.
- Secure conservation status for highest-priority wetland, riparian, oak, chaparral, and coastal scrub habitats.
- Work with local and regional planners in designing bird-friendly human communities.
- Focus species-specific conservation efforts on specialized, declining, and regionally extirpated species such as Black Swift, Tricolored Blackbird, Olive-sided Flycatcher, Lewis's Woodpecker, and Burrowing Owl.

INTERMOUNTAIN WEST AVIFAUNAL BIOME

The Intermountain West Avifaunal Biome is composed of three of the largest BCRs south of the boreal forest (Fig. 9). Extensive mountain ranges and broad basins produce large elevational gradients that create a complex and variable environment. From low elevation Great Basin woodland and shrublands to alpine tundra, this biome spans five life zones. This region is known for its coniferous forest, pinyon-juniper woodland, and cold semidesert shrubsteppe. Many of the West's most important wetland complexes are also found here. Although these habitats still cover large expanses, most have been changed significantly by anthropogenic forces. A large percent of this area is in public ownership in both Canada and the U.S.

The Intermountain West is the center of distribution for many western birds. Over half of the biome's Species of Continental Importance (Table 5) have 75 percent or more of their population here (Fig. 19a). Many breeding species from this biome migrate to winter in central and western Mexico or in the Southwestern biome (Fig. 19b). Threats and/or declining trends face Species of Continental Importance that use coniferous forest, pinyon-juniper woodland, shrubsteppe, and riparian habitats. About half of these species are not adequately monitored.

California Condors have been reintroduced to the southern part of this avifaunal biome. Habitat for condors must be extensive, relatively undisturbed, and provide sources of large carrion such as mule deer. Condor populations today are highly managed and will undoubtedly remain so, although it is gratifying to return this extirpated species to western skies.

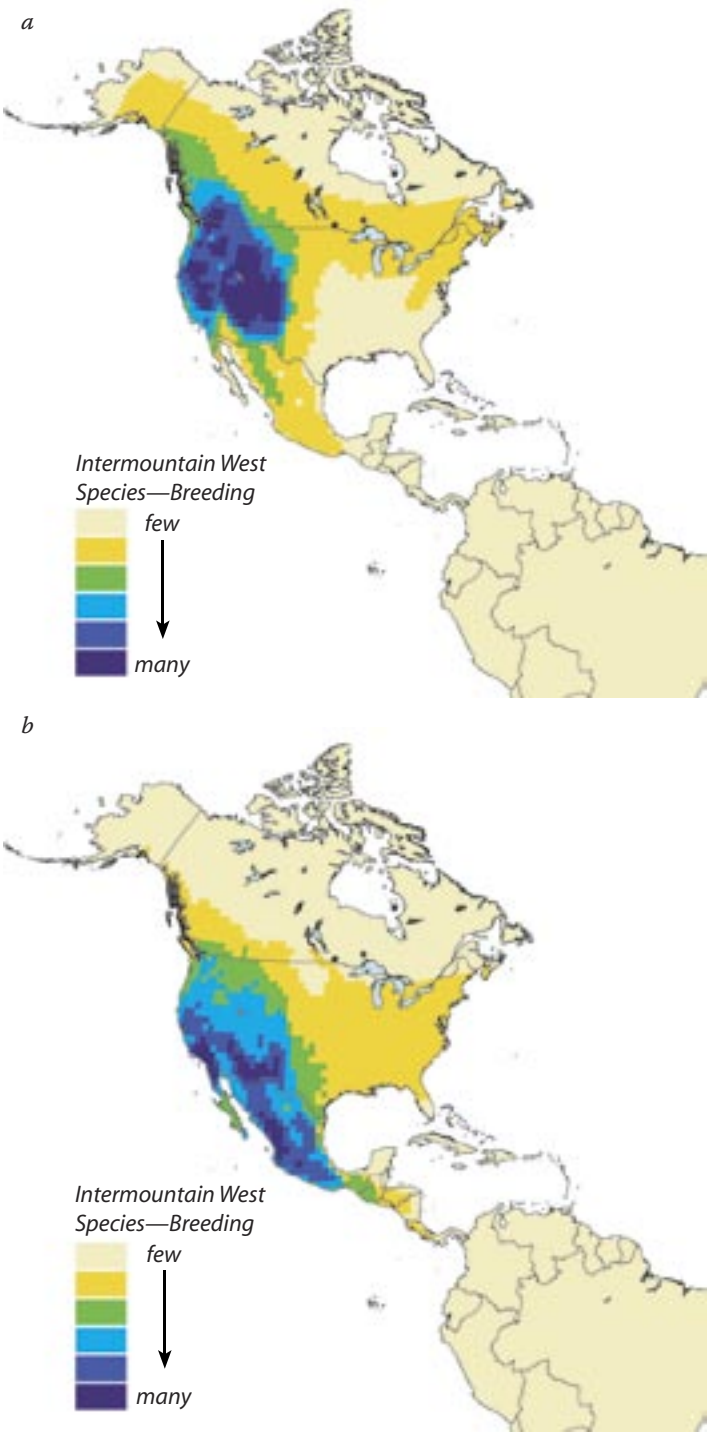

Figure 19. Number of species (a) during the breeding season and (b) during winter in each lat-long block, weighted by the percent of total population of each species breeding within the Intermountain West Avifaunal Biome.

Primary Habitats

CONIFEROUS FOREST

Forest types of the Intermountain West include Ponderosa pine, lodgepole pine, interior Douglas-fir, interior cedar hemlock, mixed conifer, spruce-fir, and whitebark pine, among others. Several suites of coniferous forest bird species can be identified due to the many forest types included in this category. White-headed Woodpecker, Lewis's Woodpecker, Flammulated Owl, and Cassin's Finch need open, dry, old Ponderosa pine forests that historically were maintained by low intensity fires. Williamson's Sapsucker, Olive-sided Flycatcher, and Spotted Owl are found in mixed conifer and/or spruce-fir forest types. Clark's Nutcracker is characteristic of whitebark pine forests. Williamson's Sapsucker is found in larch-dominated stands in the northern part of the region. Logging and fire suppression have changed the age class, structure, tree density, and species composition of these forests with negative consequences for many birds.

Table 5. Species of Continental Importance in the Intermountain West Avifaunal Biome: BCRs 9, 10, 16

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Immediate Action					
Gunnison Sage-Grouse	100%	100%	Western shrublands	Increase 100%	**
Greater Sage-Grouse	80%	80%	Western shrublands	Increase 100%	Mo2
Bendire's Thrasher	45%	6%	Western shrublands	Increase 100%	Mo2
California Condor	41%	41%	Various	Recovery Plan	**
Spotted Owl	20%	20%	Coniferous forest	Recovery Plans	**
Management					
Brewer's Sparrow	94%	1%	Western shrublands	Increase 100%	**
Pinyon Jay	92%	92%	Woodland	Increase 100%	**
Lewis's Woodpecker	87%	52%	Riparian	Maintain/Increase	Mo2
Cassin's Finch	86%	61%	Coniferous forest	Maintain	**
Willow Flycatcher	46%	0%	Riparian	Increase 50%	**
White-throated Swift	38%	<1%	Various	Increase 100%	Mo2
Rufous Hummingbird	36%	0%	Western shrublands	Increase 100%	**
Black Swift	29%	0%	Various	Increase 50%	Mo2
Olive-sided Flycatcher	21%	0%	Coniferous forest	Increase 100%	Mo3
Swainson's Hawk	15%	0%	Grassland	Maintain/Increase	**
Grace's Warbler	14%	0%	Mixed forest	Increase 50%	**
Long-term Planning & Responsibility					
Black Rosy-Finch	100%	>99%	Tundra	Maintain/Increase	Mo2
Brown-capped Rosy-Finch	100%	99%	Tundra	Maintain/Increase	Mo2
Sage Thrasher	99%	31%	Western shrublands	Maintain	**
Gray Flycatcher	96%	0%	Woodland	Maintain	Mo2
Calliope Hummingbird	95%	0%	Western shrublands	Maintain/Increase	Mo2
Red-naped Sapsucker	95%	9%	Mixed forest	Maintain	**
Williamson's Sapsucker	94%	15%	Coniferous forest	Maintain	Mo2
Green-tailed Towhee	92%	2%	Western shrublands	Maintain	**
Clark's Nutcracker	89%	89%	Coniferous forest	Maintain	**
Dusky Flycatcher	86%	0%	Western shrublands	Maintain	**
Sage Sparrow	83%	35%	Western shrublands	Maintain	**
Mountain Bluebird	76%	35%	Western shrublands	Maintain	**
Gray Vireo	68%	0%	Woodland	Maintain	Mo2
Virginia's Warbler	62%	0%	Woodland	Maintain/Increase	Mo2
Flammulated Owl	40%	0%	Coniferous forest	Maintain/Increase	Mo1
White-headed Woodpecker	27%	27%	Coniferous forest	Maintain	Mo2
McCown's Longspur	21%	<1%	Grassland	Maintain/Increase	**

[1] Species are sorted by Action Category (Immediate Action, Management, Planning & Responsibility), then by decreasing % of global population that occurs in the biome (by greater of breeding or winter population). Species highlighted in yellow are Watch List species, with at least 10% of their global population in this biome. Species in green (in species or % population columns) are Stewardship Species, with ≥75% of their population in this biome.

[2] Monitoring Need (this assessment addresses only the adequacy of long-term population trend monitoring at the continental scale): Mo1=no trend data, Mo2=imprecise trends, Mo3=inadequate northern coverage.

**Long-term population trend monitoring is generally considered adequate but some issues, such as bias, may not have been accounted for.

DECIDUOUS FOREST

Aspen forest is a declining habitat type, threatened by fire suppression and resulting conifer succession, overgrazing/browsing by cattle and elk, and timber harvest. Few bird species are limited to aspen but many reach their highest breeding densities here. Cavity nesters predominate, with Red-naped Sapsuckers and Mountain Bluebirds being the Stewardship Species of greatest concern.

WOODLAND

Pinyon-Juniper woodlands are especially characteristic of the southern portion of the Intermountain West. This

habitat supports the largest nesting-bird species list of any upland vegetation type in the West (Beidleman 2000). Pinyon Jay, Gray Vireo, and Gray Flycatcher are Species of Continental Importance in this habitat. Degradation of pinyon-juniper has been widespread and continuous since European settlement. Pinyon pines, in particular, have suffered marked recent declines. Conversion to grassland has had mixed results for livestock and minimal value to most wildlife. On the other hand, fire suppression has allowed juniper to encroach into sagebrush and grasslands.

WESTERN SHRUBLANDS

Shrub-nesting species comprise the largest number of Species of Continental Importance in this biome. The sagebrush "sea" was once a major feature of the open expanses of the West. Conversion for agriculture, invasion of nonnative grasses, overgrazing of grasses and forbs, development, sagebrush eradication, and changes in fire regimes have caused considerable loss and degradation of habitat, with subsequent declines of associated bird populations. Cheatgrass has invaded about half of the existing sagebrush habitat. Shrubsteppe was identified as the highest priority habitat for conservation based on trends in bird populations and habitat in the Interior Columbia Basin (Saab and Rich 1997, Paige and Ritter 1999). Greater Sage-Grouse, Gunnison's Sage-Grouse, Sage Sparrow, Sage Thrasher, Brewer's Sparrow, and Green-tailed Towhee are Species of Continental Importance in shrubsteppe. Montane shrublands embedded in forests provide many species with valuable food and cover. These may be critical to western hummingbirds during migration. Dusky Flycatcher, Virginia's Warbler, Calliope Hummingbird, Green-tailed Towhee, Rufous Hummingbird, and Mountain Bluebird are Species of Continental Importance here.

Breeding only on alpine peaks of the Intermountain West, the Brown-capped Rosy-Finch has one of the smallest populations and ranges of any North American landbird.

The Swainson's Hawk undergoes among the longest migrations of any North American raptor. Although still a common breeder in the dry grasslands of the Intermountain West, this species is subject to poisoning on its southern South American wintering grounds.

RIPARIAN

Riparian habitats support the highest bird diversity of any western habitat type, while being one of the rarest. Black Swift, Rufous Hummingbird, Willow Flycatcher, Lewis's Woodpecker, and Calliope Hummingbird are found in various riparian habitats throughout the Intermountain West. Characteristics of riparian habitat vary widely depending on the matrix and elevation, from cottonwood gallery forests to willow thickets to spruce-fir forests. Riparian areas are sensitive to disturbance and have been substantially degraded by development of many types, including de-watering and alteration of water flows, road construction, invasion of nonnative species, logging, severe overgrazing, and recreation.

TUNDRA

Alpine tundra is a specialized, fragile habitat type. It is easily disturbed and takes decades to recover. Livestock grazing, mining, recreation, and global climate change are affecting this habitat. Black and Brown-capped rosy-finches are two alpine tundra specialists, both on the Watch List. As global climate change progresses, the extent of alpine habitats will be reduced, eliminating these birds from all but the highest mountain tops.

Conservation Issues

- Inappropriate livestock grazing, which has changed the structure and composition of fragile grassland and shrublands.
- Invasion of exotic plants, especially affecting sagebrush and riparian habitats.
- Change in natural fire intensity and frequency through decades of fire-suppression, affecting both forest and shrubland habitats.
- Logging practices affecting forest structure and composition, especially for mature-forest and cavity-nesting species.
- Continued degradation of riparian habitat.
- Conversion of sagebrush and pinyon-juniper habitats through agriculture, suburban development, and land management practices.
- Water diversion, alteration of stream flows, and spring development.
- Recreational off-road vehicle use.

Recommended Actions

- Manage dry Ponderosa pine forest to restore historic characteristics. In general for other forest types, retain old-growth stands and snags, thin dense stands of younger trees, and restore the role of fire. Write Best Management Practices for this forest type.

Denny Mallory © Cornell Lab of Ornithology

A characteristic species of the vast coniferous forests of the Intermountain West, the Williamson's Sapsucker is potentially threatened by fire-suppression and timber-harvest policies in this region.

Greg W. Lasley © Cornell Lab of Ornithology

The Sage Sparrow is one of several species closely associated with Intermountain West sagebrush habitats, which are highly threatened by conversion, overgrazing, invasive grasses, and changing fire regimes.

- Retain large, mature tracts of pinyon-juniper; ensure supply of seed-producing pinyon pine. Write Best Management Practices for this woodland type.
- Maintain/promote growth of native grasses and forbs in shrubsteppe. Prevent large scale wildfire that results in cheatgrass invasion or destroys high value sagebrush. Restore with native plant species following disturbance. Maintain water quality and quantity and vegetation in embedded springs, seeps, and riparian areas. Restore degraded habitats and habitats that have been converted to nonnative grasslands.
- Protect high quality riparian habitat. Manage and restore degraded stretches. Control or reduce the extent of invasive Russian olive and salt cedar, as appropriate. Restore natural flows and flooding regimes. Protect known Black Swift colonies.
- Work with the forest industry, ranchers, municipalities, and recreation associations to restore degraded habitats across the region.
- Protect existing alpine habitat from disturbance.

SOUTHWEST AVIFAUNAL BIOME

The Southwest Avifaunal Biome is composed of five BCRs that encompass an area from the Texas hill country to the deserts of the U.S. and Mexico (Fig. 9). Geography and natural environmental forces have combined to create a high diversity of habitats within this area, most adapted to little rainfall and periodic drought. Habitats in this region can be very broadly categorized as coniferous/mixed forest, shrubland, woodland, thorn forest, grassland, and riparian. This diversity has created a high number of habitat specialists.

Similar conservation issues affect landbirds in the southwestern U.S. and northwest Mexico. Both countries share responsibility for over half the Watch List Species with small populations or restricted ranges. Although the present version of this Plan covers only the U.S. portion of this Avifaunal Biome, clearly conservation of this diverse region will require international partnerships. Results of the species assessment of Mexican birds and full participation of Mexico in hte next version of the Plan will highlight these needs.

In winter, birds of this biome are typically resident or migrate only short distances to Mexico and northern Central America (Fig. 20a, b). In addition, this area is important in winter to breeding birds of the Prairie and Intermountain West biomes. The pattern for most landbird species in this region is one of small population size (Fig. 2), narrow distributions in all seasons (Fig. 3 and 4), high threats (Fig. 5 and 6), and declining population trends (Fig. 7a). Watch List Species with multiple causes for concern are spread across many habitats here. However, the majority of Watch List Species with small populations or limited distributions are found within coniferous forest or riparian areas, whereas the majority of Watch List Species with declining trends or high threats are riparian or grassland birds. Southwestern shrub and woodland birds exhibit high habitat specialization. Thirty-seven Species of Continental Importance have inadequate population trend information.

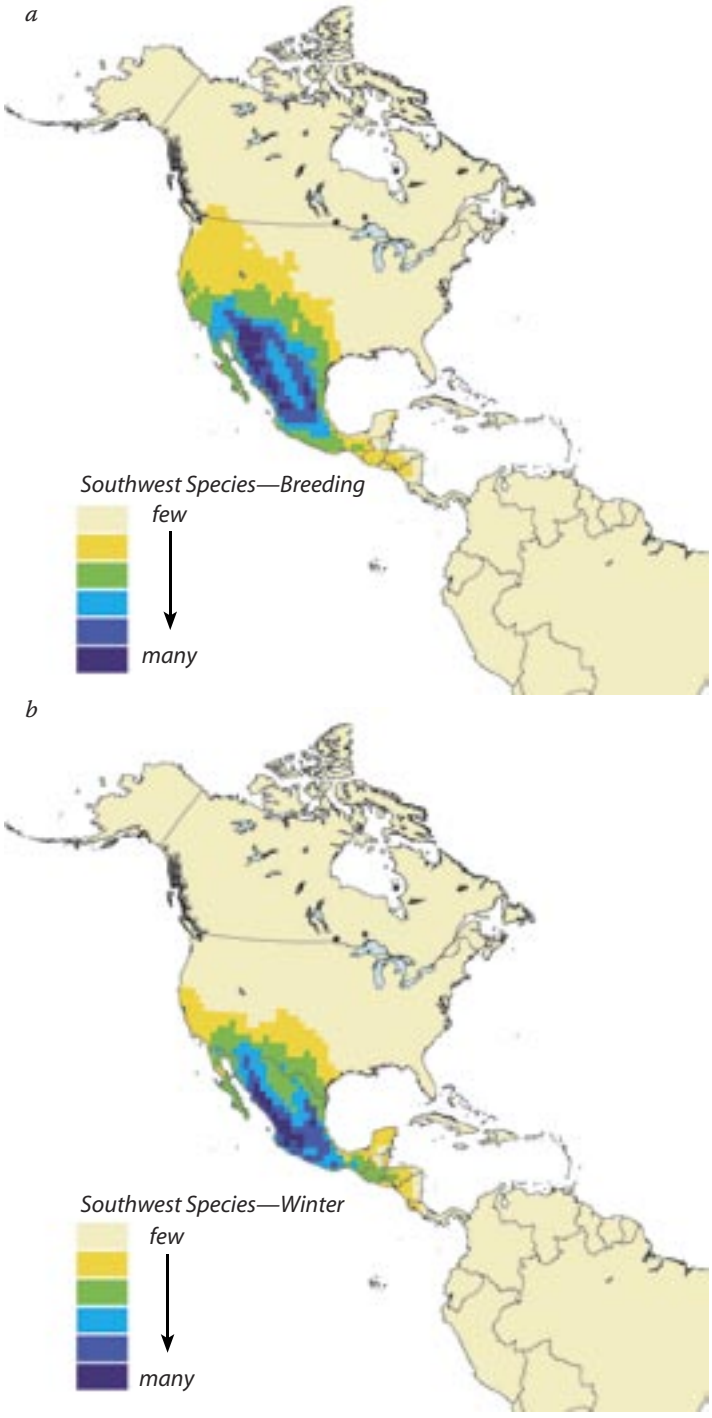

Figure 20. Number of species (a) during the breeding season and (b) during winter in each lat-long block, weighted by the percent of total population of each species breeding within the Southwest Avifaunal Biome.

Primary Habitats

MIXED AND CONIFEROUS FORESTS

Coniferous forests of the southwestern mountains are important not only to breeding birds, but serve also as the primary migratory corridor for western hummingbirds and many other migrating birds from the Intermountain West and Pacific biomes. These forests support more breeding species lacking trend data than any other habitat in the Southwest. These forests include pine-oak mixed forest as well as higher elevation mixed-conifer. Timber harvest, inappropriate livestock grazing, and changes in fire regimes have affected birds such as Montezuma Quail, Spotted Owl, Arizona Woodpecker, and Red-faced Warbler. The Thick-billed Parrot used

Table 6. Species of Continental Importance in the Southwest Avifaunal Biome: BCRs 20, 33–36

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Immediate Action					
Golden-cheeked Warbler	100%	0%	Woodland	Recovery Plan	Mo1
Baird's Sparrow	0%	95%	Grassland	Increase 100%	**
Colima Warbler	94%	7%	Mixed forest	Maintain/Increase	Mo1
Black-capped Vireo	94%	3%	Western shrublands	Recovery Plan	Mo1
Thick-billed Parrot	90%	53%	Mixed forest	Poss. Reintroduction	Mo1
Bendire's Thrasher	51%	85%	Western shrublands	Increase 100%	Mo2
Bell's Vireo	63%	0%	Riparian	Increase 100%	**
Red-crowned Parrot	50%	50%	Woodland	Increase 100%	Mo1
Spotted Owl	33%	33%	Mixed forest	Recovery Plans	**
Tricolored Blackbird	2%	33%	Wetland	Increase 100%	Mo2
Green Parakeet	24%	24%	Woodland	Increase 50%	Mo1
Management					
Lucy's Warbler	98%	12%	Woodland	Maintain/Increase	**
Verdin	89%	89%	Western shrublands	Maintain	**
Cassin's Sparrow	63%	86%	Grassland	Maintain	**
Brewer's Sparrow	<1%	86%	Western shrublands	Increase 100%	**
Black-throated Sparrow	72%	83%	Western shrublands	Maintain	**
Scaled Quail	82%	82%	Grassland	Increase 50%	**
Pyrrhuloxia	80%	80%	Western shrublands	Maintain	**
Black-chinned Sparrow	45%	76%	Western shrublands	Increase 50%	Mo2
Varied Bunting	67%	16%	Riparian	Increase 50%	Mo1
Five-striped Sparrow	63%	63%	Western shrublands	Increase 50%	Mo1
Montezuma Quail	55%	55%	Mixed forest	Increase 50%	Mo1
Sprague's Pipit	0%	51%	Grassland	Increase 100%	**
White-throated Swift	24%	51%	Various	Increase 100%	Mo2
Grace's Warbler	50%	22%	Mixed forest	Increase 50%	**
Painted Bunting	46%	1%	Western shrublands	Increase 100%	**
Audubon's Oriole	32%	32%	Riparian	Maintain/Increase	Mo1
Hermit Warbler	<1%	22%	Mixed forest	Maintain/Increase	**
Elegant Trogon	21%	21%	Mixed forest	Increase 50%	Mo1
Lewis's Woodpecker	1%	17%	Riparian	Maintain/Increase	Mo2
Swainson's Hawk	15%	0%	Grassland	Maintain/Increase	**
Band-tailed Pigeon	12%	13%	Mixed forest	Increase 100%	Mo2
Long-term Planning & Responsibility					
Abert's Towhee	>99%	>99%	Riparian	Maintain/Increase	Mo2
Black-tailed Gnatcatcher	96%	96%	Western shrublands	Maintain	Mo2
Gambel's Quail	95%	95%	Western shrublands	Maintain	**
Crissal Thrasher	94%	94%	Western shrublands	Maintain	Mo2
Red-faced Warbler	92%	25%	Coniferous forest	Maintain/Increase	Mo1
Le Conte's Thrasher	89%	89%	Western shrublands	Maintain/Increase	Mo2
Cactus Wren	82%	82%	Western shrublands	Maintain	**
Canyon Towhee	79%	79%	Western shrublands	Maintain	**
Rufous-winged Sparrow	78%	78%	Western shrublands	Maintain/Increase	Mo1
Curve-billed Thrasher	78%	78%	Western shrublands	Maintain	Mo2
Black-crested Titmouse	77%	77%	Woodland	Maintain	Mo1
Lucifer Hummingbird	76%	2%	Western shrublands	Maintain	Mo1

(continued)

Table 6. Species of Continental Importance in the Southwest Avifaunal Biome: BCRs 20, 33–36 (continued)

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Scott's Oriole	76%	43%	Woodland	Maintain	**
Yellow-headed Blackbird	1%	75%	Wetland	Maintain	Mo2
Green-tailed Towhee	1%	75%	Western shrublands	Maintain	**
Phainopepla	75%	3%	Woodland	Maintain	Mo2
Gray Vireo	23%	73%	Western shrublands	Maintain	Mo2
Elf Owl	73%	16%	Woodland	Maintain/Increase	Mo1
Lawrence's Goldfinch	14%	66%	Western shrublands	Maintain/Increase	Mo2
Costa's Hummingbird	62%	59%	Western shrublands	Maintain/Increase	Mo2
Arizona Woodpecker	56%	56%	Mixed forest	Maintain/Increase	Mo1
McCown's Longspur	0%	43%	Grassland	Maintain/Increase	**
Virginia's Warbler	38%	0%	Mixed forest	Maintain/Increase	Mo2
Black-capped Gnatcatcher	31%	31%	Western shrublands	Maintain/Increase	Mo1
Flammulated Owl	26%	22%	Mixed forest	Maintain/Increase	Mo1
Thick-billed Kingbird	21%	12%	Riparian	Maintain/Increase	Mo1

[1] Species are sorted by Action Category (Immediate Action, Management, Planning & Responsibility), then by decreasing % of global population that occurs in the biome (by greater of breeding or winter population). Species highlighted in yellow are Watch List species, with at least 10% of their global population in this biome. Species in green (in species or % population columns) are Stewardship Species, with ≥75% of their population in this biome.
[2] Monitoring Need (this assessment addresses only the adequacy of long-term population trend monitoring at the continental scale): Mo1=no trend data, Mo2=imprecise trends, Mo3=inadequate northern coverage.
**Long-term population trend monitoring is generally considered adequate but some issues, such as bias, may not have been accounted for.

pine-oak forests in Arizona prior to the 1930's, but is now extirpated from the U.S. It still is resident, however, 80 km south of the border in Mexico.

WESTERN SHRUBLANDS

These can be placed into four general types—Chihuahuan, Mojave, Sonoran desert shrubland, and shrublands in the Edwards Plateau—each of which supports different bird communities. In the Chihuahuan Desert, most of the Species of Continental Concern are Stewardship Species with adequate trend data. In contrast, Species of Continental Importance in the Sonoran and Mojave deserts are primarily Watch List Species and have poor or no trend data. These shrublands are important for Intermountain West shrub migrants and winterers as well as resident species. In some areas, these habitats are under heavy pressure from suburban development. In the Sonoran Desert, the protection and regeneration of columnar cacti and retention of large patches of shrubland are crucial to conservation of species such as Bendire's Thrasher and Rufous-winged Sparrow. Altered fire regimes in some shrublands have had a negative impact on Black-capped Vireo and Black-chinned Sparrow.

WOODLAND

Ashe juniper/oak woodland on the Edwards Plateau in Texas supports the Golden-cheeked Warbler, the most highly restricted Watch List Species in the region. Farther west, some woodlands may be composed of tall shrubs rather than trees. Three quarters of all Species of Continental Importance in southwestern woodlands have poor to no trend data. Alterations in fire regimes and other land-use decisions have resulted in high habitat fragmentation, affecting birds such as Elf Owl.

Thorn forests, primarily in Mexico but also bordering the Rio Grande or Rio Bravo along the border with Texas, are under heavy pressure from pollution and conversion for agricultural and residential development. Species of Continental Importance breeding in this habitat are all Watch List Species and none have reliable trend data. Little is known about this habitat compared with others in the Southwest. The Red-crowned Parrot is legally designated as an endangered species in Mexico (DOF 2002) and is in need of Immediate Action (Macias Caballero et al. 2000). We estimate that as much as 50 percent of its remaining world population now occurs in the U.S.

GRASSLAND

Grasslands support the highest number of Species of Continental Importance with declining trends in any southwestern habitat type. These grasslands have as much value for their support of Prairie Biome breeding species during migration and winter as they do for breeding birds (Fig. 21b). Due to the nomadic nature of grassland species it is important to maintain large patches of high-quality grasslands across all BCRs in the Southwest in order to accommodate grassland birds through time. Impacts to these grasslands include historical overgrazing, altered fire regimes, shrub encroachment, and

eradication of prairie-dog colonies. Desert grasslands are important to such grassland specialists as Swainson's Hawk, Sprague's Pipit, Baird's Sparrow, and McCown's Longspur.

RIPARIAN

Riparian woodlands support the highest diversity of landbird species of all habitats in this avifaunal biome. Riparian areas may be found within all of the above habitat types. Although they may not carry water year-round, riparian corridors are critical to many northern-breeding Neotropical migrants as well as breeding or wintering Species of Continental Importance in this region. Riparian Species of Continental Importance in the southwest are all Watch List Species. Those species with primary distributions in Mexico have poor monitoring data, and so may be of even greater concern than we realize. The retention or regeneration of riparian forests with the re-creation of natural flooding regimes hold high value for breeding species such as Bell's Vireo and Thick-billed Kingbird. Invasive exotic plants are a major problem in many areas. Wetlands in the region are largely restricted to riparian areas, so the health of riparian areas is critical to the maintenance of wetlands.

Conservation Issues

- Changes in natural fire intensity and frequency.
- Alteration of hydrologic regimes, including greatly increased demands for water by rapidly growing urban and suburban areas, construction of dams and loss of regular flooding, river channelization, invasion of exotic plant species, and xerification.
- Grazing management (including overgrazing and prairie-dog eradication) in all habitats.
- Forest and woodland management (including changes in structure and age class composition, timber harvest, and suburban development).
- Agricultural or suburban development in thorn forest, Sonoran shrubland, and grasslands.
- Habitat fragmentation in all habitats through suburban development, habitat conversion, catastrophic fire, or other means.
- Shrub encroachment in grasslands.

Recommended Actions in the United States

- Continue research and management for the listed Golden-cheeked Warbler and Black-capped Vireo, and support for reintroduction or natural recolonization of Thick-billed Parrot.
- Conduct monitoring in the following southwestern habitats: thorn forest, coniferous forests, woodlands, Sonoran and Mojave shrublands, and riparian. Additionally, conduct basic habitat research in thorn forest.
- Reintroduce or mimic intermittent flooding regimes on major rivers.
- Institute habitat-conserving livestock grazing practices wherever grazing occurs.
- Continue community-growth planning in high-development areas near Austin, San Antonio, Brownsville-McAllen, El Paso-Las Cruces, and the Tucson-Phoenix area.
- Develop community-involved, well planned fire management strategies in woodlands, grasslands, and coniferous forests.
- Maintain many patches of high-quality grasslands distributed throughout the entire region.

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Although causes of its steep decline are not well known, the Bendire's Thrasher is in need of immediate conservation attention to protect its small global population in the arid shrublands of the Southwest.

PRAIRIE AVIFAUNAL BIOME

The seven BCRs of the Prairie Avifaunal Biome cover the center of the U.S. and extend into southern Canada (Fig. 9). This biome historically comprised North America's extensive native grasslands, ranging along a precipitation gradient from shortgrass prairies and sagebrush plains in the West to tallgrass prairies and prairie-oak savannahs in the East. The prairies were studded with numerous wetlands associated with glacial depressions, large river systems, and playas. Fire, the major element of disturbance, interacted with historical grazing, topography, wetland distribution, and drought cycles to maintain a great complexity of prairie ecotypes within a deceptively homogeneous sea of grass.

Landbird species that breed in this Biome (Fig. 21a) winter primarily in the Southwestern and Eastern Biomes and throughout Mexico (Fig. 21b), though a few migrate into South America. The Prairie Biome provides wintering habitat for many Arctic species. Almost 40% of the species that are on the PIF continental Watch List as a result of declining trends or high threats breed in this biome. Not surprisingly, birds associated with grasslands are the most threatened, both during the breeding season and in winter. The precipitous population declines of birds in this region (Fig. 7a) contrast strongly with the other continental patterns of vulnerability (Figs. 2–6). All but one of this biome's Species of Continental Importance have declining or uncertain population trends. Although most species breeding in this biome are widespread, a few have highly restricted ranges. Monitoring is needed for many of the Prairie's Species of Continental Importance, including the prairie grouse, which have poor or no BBS coverage, as well as those species from the Northern Forest and Arctic that winter here.

Primary Habitats

GRASSLAND

Grasslands, the dominant habitat in this biome, are of three distinct types: tallgrass, mixed-grass, and shortgrass. In the drier western portion of the Region, contiguous shortgrass tracts of significant size still persist, due largely to the continued dominance of ranching as a land use. However, habitat quality and fragmentation emerge as problems for grassland birds. More than 99 percent of the original tallgrass prairie has been converted for agricultural or urban use. The degree of loss of mixed-grass prairie lies between these extremes. Wetland drainage,

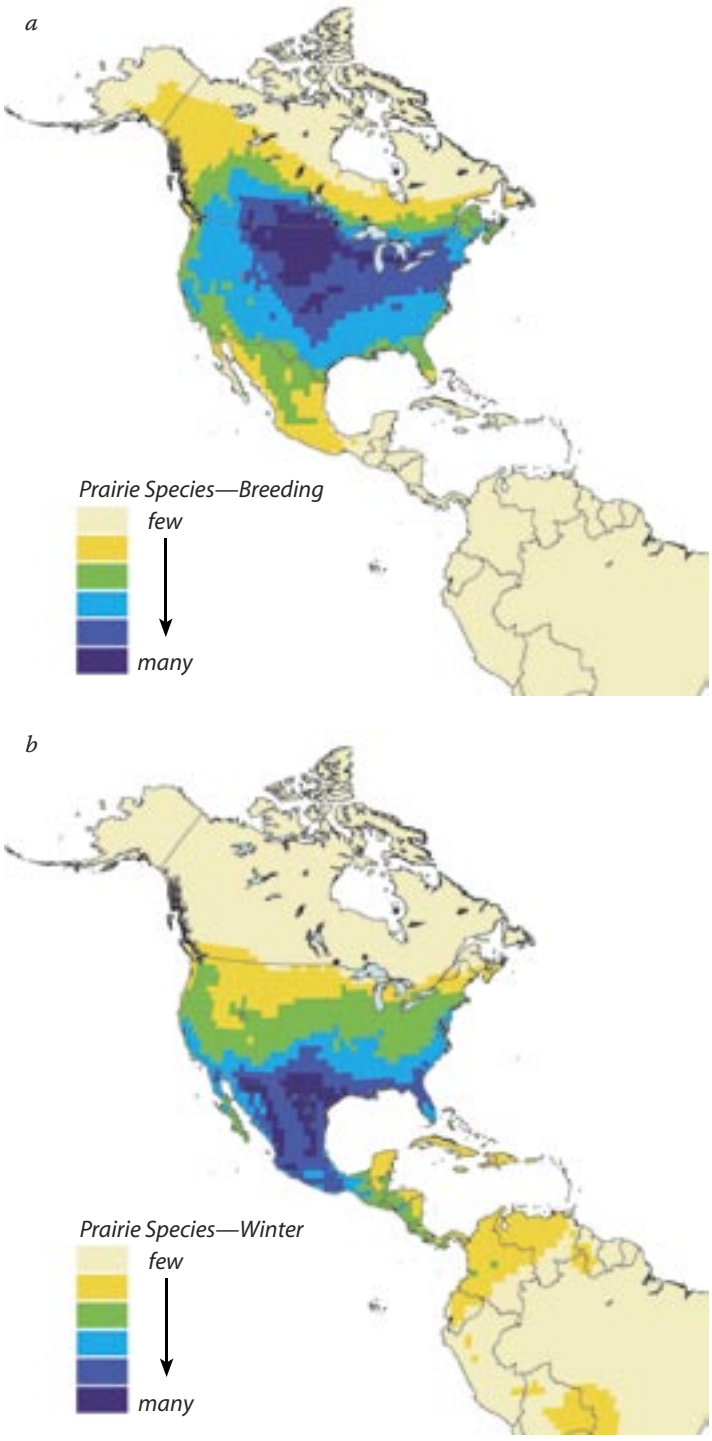

Figure 21. Number of species (a) during the breeding season and (b) during winter in each lat-long block, weighted by the percent of total population of each species breeding within the Prairie Avifaunal Biome.

wetland degradation, changes in the fire disturbance regime, and woody invasion have further reduced the array of grass habitats available. On wetter western rangelands, new practices of repeated burning to support successive cattle rotations now threaten Greater Prairie-Chicken in the core of its range.

Table 7. Species of Continental Importance in the Prairie Avifaunal Biome: BCRs 11, 17–19, 21–23

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Immediate Action					
Lesser Prairie-Chicken	100%	100%	Western shrublands	Increase 100%	**
Baird's Sparrow	>99%	5%		Increase 100%	**
Greater Prairie-Chicken	97%	97%	Grassland	Increase 100%	Mo2
Henslow's Sparrow	63%	18%	Grassland	Increase 100%	Mo2
Greater Sage-Grouse	20%	20%	Western shrublands	Increase 100%	Mo2
Bell's Vireo	14%	0%		Increase 100%	**
Golden-winged Warbler	10%	0%	Shrub/successional	Increase 100%	**
Management					
Chestnut-collared Longspur	99%	23%	Grassland	Maintain	**
Harris's Sparrow	0%	97%	Shrub/successional	Increase 100%	Mo2,3
Sprague's Pipit	96%	18%	Grassland	Increase 100%	**
Lark Bunting	95%	31%	Grassland	Maintain	**
Grasshopper Sparrow	83%	6%	Grassland	Maintain	**
Dickcissel	80%	0%	Grassland	Increase 50%	**
Red-headed Woodpecker	69%	39%	Woodland	Increase 100%	**
Swainson's Hawk	68%	0%	Grassland	Maintain/Increase	**
Painted Bunting	39%	0%	Shrub/successional	Increase 100%	**
Rusty Blackbird	<1%	28%	Deciduous forest	Increase 100%	Mo2,3
Willow Flycatcher	16%	0%		Increase 50%	**
Scaled Quail	13%	13%	Grassland	Increase 50%	**
Short-eared Owl	6%	12%	Grassland	Increase 100%	Mo3
Blue-winged Warbler	10%	0%	Shrub/successional	Increase 50%	**
Long-term Planning & Responsibility					
Smith's Longspur	0%	99%	Grassland	Maintain/Increase	Mo2,3
Sharp-tailed Grouse	86%	86%	Western shrublands	Maintain	Mo2
American Tree Sparrow	0%	85%	Shrub/successional	Maintain	Mo2,3
McCown's Longspur	79%	57%	Grassland	Maintain/Increase	**
Mississippi Kite	77%	0%	Woodland	Maintain	Mo2
Nelson's Sharp-tailed Sparrow	51%	0%	Wetland	Maintain	Mo2
Lapland Longspur *	0%	99%	Grassland	Maintain	Mo2,3

[1] Species are sorted by Action Category (Immediate Action, Management, Planning & Responsibility), then by decreasing % of global population that occurs in the biome (by greater of breeding or winter population). Species highlighted in yellow are Watch List species, with at least 10% of their global population in this biome. Species in green (in species or % population columns) are Stewardship Species, with ≥75% of their population in this biome.

[2] Monitoring Need (this assessment addresses only the adequacy of long-term population trend monitoring at the continental scale): Mo1=no trend data, Mo2=imprecise trends, Mo3=inadequate northern coverage.

*For this species, % of Population is for Western Hemisphere. All others are % of Global Population.

**Long-term population trend monitoring is generally considered adequate but some issues, such as bias, may not have been accounted for.

Breeding birds in grassland habitats are primarily short-distance migrants, and several, such as Chestnut-collared Longspur, Lark Bunting, and McCown's Longspur, overwinter in the southern portions of the biome. Other prairie-breeding species, such as Baird's Sparrow and Sprague's Pipit, winter primarily in the Southwest Avifaunal Biome. Tallgrass and mixed-grass prairies are important for migrating and wintering Watch List Species, including open country birds from the Northern Forest and Arctic biomes, such as Lapland and Smith's longspurs. Within the Prairie Biome, most of the Species of Continental Importance in need of monitoring occur in grassland habitats.

The Grassland Bird Conservation Area (GBCA) model presented in a number of PIF Physiographic Area plans (Fitzgerald et al. 1998) has since been substantially modified for use in landscapes with less available habitat. Because of its requirements for large blocks of heterogeneous grassland within its range, the Greater Prairie-

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With its shrinking population restricted to a small area of arid shortgrass, the Lesser Prairie-Chicken is among the most vulnerable landbirds of the Prairie Avifaunal Biome. Along with its "greater" cousin, this area-sensitive bird is a focal species for immediate conservation action.

Chicken serves as an umbrella species for planning and implementation of tallgrass-prairie bird conservation. With attention to wetland enhancement and microhabitat management within tracts, modified GBCAs should also meet the needs of Short-eared Owl, Grasshopper Sparrow, Henslow's Sparrow, Nelson's Sharp-tailed Sparrow, and Dickcissel.

Similar GBCA models for Greater Sage-Grouse, Chestnut-collared Longspur, Lesser Prairie-Chicken, and Scaled Quail might drive conservation for all birds of sagebrush plains, northern shortgrass prairie, southern shortgrass/shinnery, and southern arid grassland, respectively.

In the eastern tallgrass portion of the region, restoration of native prairie is an important conservation strategy. Management of extensive reclaimed surface mines in Illinois and Indiana also provides great potential for grassland birds. In the western portion—and in general throughout the region—a focus on management to improve the quality of existing grassland is appropriate. In fact, this may be the main strategy in the Canadian portion where grasslands are still reasonably widespread. Attention to native prairie vegetative diversity and structure should be coupled with an effort to restore ecological process, e.g., management to recreate more complex hydrology or more variation in livestock grazing pressure.

SHRUB/SUCCESSIONAL AND WOODLAND

Shrubland habitats often occur as ecotones between grasslands and woodlands and provide habitat for Sharp-tailed Grouse, Scaled Quail, Willow Flycatcher, Bell's Vireo, Golden-winged Warbler, Blue-winged Warbler, American Tree Sparrow, Harris's Sparrow, and Painted Bunting. Landscape analysis and models to identify appropriate areas for maintaining dynamic ecotones will serve the needs of species dependent on savannah habitats, such as Mississippi Kite, Swainson's Hawk, and Red-headed Woodpecker.

WETLANDS

Prairie potholes in the northwestern portion of the biome provide breeding habitat for the majority of North American dabbling ducks. An additional array of prairie wetland types throughout the biome provide critical breeding, migration, and wintering habitat for vast numbers of waterfowl, waterbirds, and shorebirds. The hydrologic characterisitics associated with wetland depressions, playas, and riparian systems also shape the mosaic of grassland types important to breeding landbirds. Prioritized restoration of quality wetlands with attention to microhabitat issues is important to the conservation of species like Nelson's Sharp-tailed Sparrow. Riparian vegetation undoubtedly provided important stopover habitat in the past, and riparian forests and shrubland corridors may be even more critical today to landbird migrants in need of cover and nutrition in an otherwise hostile sea of urbanization and agriculture.

Conservation Issues

- Massive historical losses of tallgrass prairie and other grasslands have compromised entire ecosystems.
- Expanding urbanization continues to fragment remaining grassland, savannah, and shrubby transitional habitats.
- Wetland drainage, stream alteration, and agricultural pattern tiling have radically altered the hydrology that historically shaped a complex mosaic of prairie types that supported a diversity of prairie birds.
- Invasion of nonnative grasses and woody vegetation has resulted largely from fire suppression and altered livestock grazing regimes. Problems include red cedar in mixed-grass prairie, reed-canary grass in wet prairies and sedge meadows, cheatgrass in sagebrush, an overabundance of shin-oak in shinnery, cool-season grasses and shrubs in tallgrass areas, and brome and crested wheatgrass in northern mixed-grass.
- Grazing practices that lead to overuse, loss of range health, or lack of heterogeneity reduce the habitat value of a large proportion of the remaining grassland cover.

- Shelterbelts in grasslands provide travel corridors and cover for mammalian predators and both nest and perch sites for avian predators, in strong contrast to historical grasslands which lacked such structure.
- Wind-energy farms on grassland sites reduce habitat available to grasslands birds. Many grassland-nesting species avoid areas surrounding wind towers or other structures. These structures also pose an unmeasured threat to migrating birds
- New strategies of intensive livestock grazing, employing multiple spring burns and continuous rotations of livestock, threaten the Greater Prairie-Chicken in the core of its range in eastern Kansas.

Recommended Conservation Actions

- In tallgrass prairie areas, use scale-appropriate Grassland Bird Conservation Area models to achieve conservation objectives for suites of grassland birds. Current research suggests that success with GBCA models also depends on attention to local habitat issues, monitoring, and appropriate adaptive management.
- In short- and mixed-grass prairie, use fire and livestock grazing to create a heterogeneous mixture of grassland conditions. Aggressive control of woody vegetation encroachment should avoid herbicidal methods where possible.
- Reintroduce and maintain prairie-dog colonies in short and mixed-grass prairie.
- Within the range of Lesser Prairie-Chicken, the needs of this species should drive grassland bird conservation.
- Institute appropriate rest-rotation livestock grazing across the landscape to produce a mosaic of grass pastures.
- Increase the percentage of area-appropriate native grasses and forbs in Conservation Reserve Program (U.S.) and Green Cover (Canada) formulas. Promote late mowing and grazing of Green Cover in northern mixed grass. Promote late mowing of hayfields.
- Restore riparian woodland corridors, floodplain forests, and streamside buffers in the eastern portion of the biome; buffer wetland basins and prairie streams with appropriate grassy strips and restore wide, braided river channels without trees in the west.
- Using landscape models and strategic biological planning, restore wetland basins and surrounding grasslands to mirror past hydrologic patterns.
- Create source populations of woodland birds by focusing on the expansion of existing patches of forests within landscapes that are at least 70 percent forested. Where savannah-type habitats exist, create or maintain patches of 800-ha blocks of habitat.
- Develop placement recommendations for wind energy and other high towers which are appropriate for the conservation of grassland birds.
- Support landscape-level, ecosystem-based habitat strategies for waterfowl that also benefit the entire grassland/wetland landbird suites.

Greg W. Lasley © Cornell Lab of Ornithology

Although still fairly widespread and abundant, the Grasshopper Sparrow is declining steeply within the core of its range in the Prairie Avifaunal Biome.

EASTERN AVIFAUNAL BIOME

The Eastern Avifaunal Biome is made up of ten BCRs (Fig. 9) that stretch from the upper St. Lawrence River and Southern New England south to Florida and the Gulf Coast and west to the edge of the prairies. Much of this biome was once covered by either eastern deciduous or southeastern longleaf pine forests. Notable exceptions include areas of subtropical grasslands in Florida and the western Gulf coastal plain, the narrow strip of coastal salt marsh from Maine to Texas, coastal mangrove forests in Florida, and small areas of pine barrens, high-elevation coniferous forest, and freshwater wetlands. Large portions of this region have been converted to agriculture, plantation forestry, or urban development, with smaller areas affected by mountaintop mining. Not surprisingly, the major conservation issues in this region are related to effects of such conversions on bird habitats.

The vast majority of continentally important breeding birds in the Eastern Biome (Table 8) are Neotropical migrants. The breeding avifauna of the Eastern Biome (Fig. 22a) shifts in winter to the extreme southeastern U.S. and Gulf Coast west to Texas, south through eastern Mexico, the Greater Antilles, Central America, and into South America (Fig. 22b). Much of the southeastern portion of the biome also provides winter habitat for declining Species of Continental Importance from the Northern Forest and Prairie Biomes. Northeastern portions of the biome provide wintering areas for some Arctic Biome species. Forest-associated birds comprise the largest group of Species of Continental Importance that breed in this biome. Birds with poor trend data are primarily restricted to longleaf pine and coastal habitats.

Primary Habitats

DECIDUOUS AND CONIFEROUS FOREST

The most imperiled Watch List and Stewardship Species are or were birds of the original bottomland-hardwood or southeastern pine forests that require conditions that are rare or absent today. While protection and restoration of remnant bottomland forests of the Southeast is probably too late for Ivory-billed Woodpecker and Bachman's Warbler, such efforts are critical for Swallow-tailed Kite and Cerulean, Prothonotary, and Swainson's warblers. Similarly, survival of the endangered Red-cockaded Woodpecker depends on continued intensive management of remnant longleaf pine forests (especially using fire); these forests also support a group of specialized species including Bachman's Sparrow and Brown-headed Nuthatch, as well as Red-headed Woodpeckers and wintering Henslow's Sparrows.

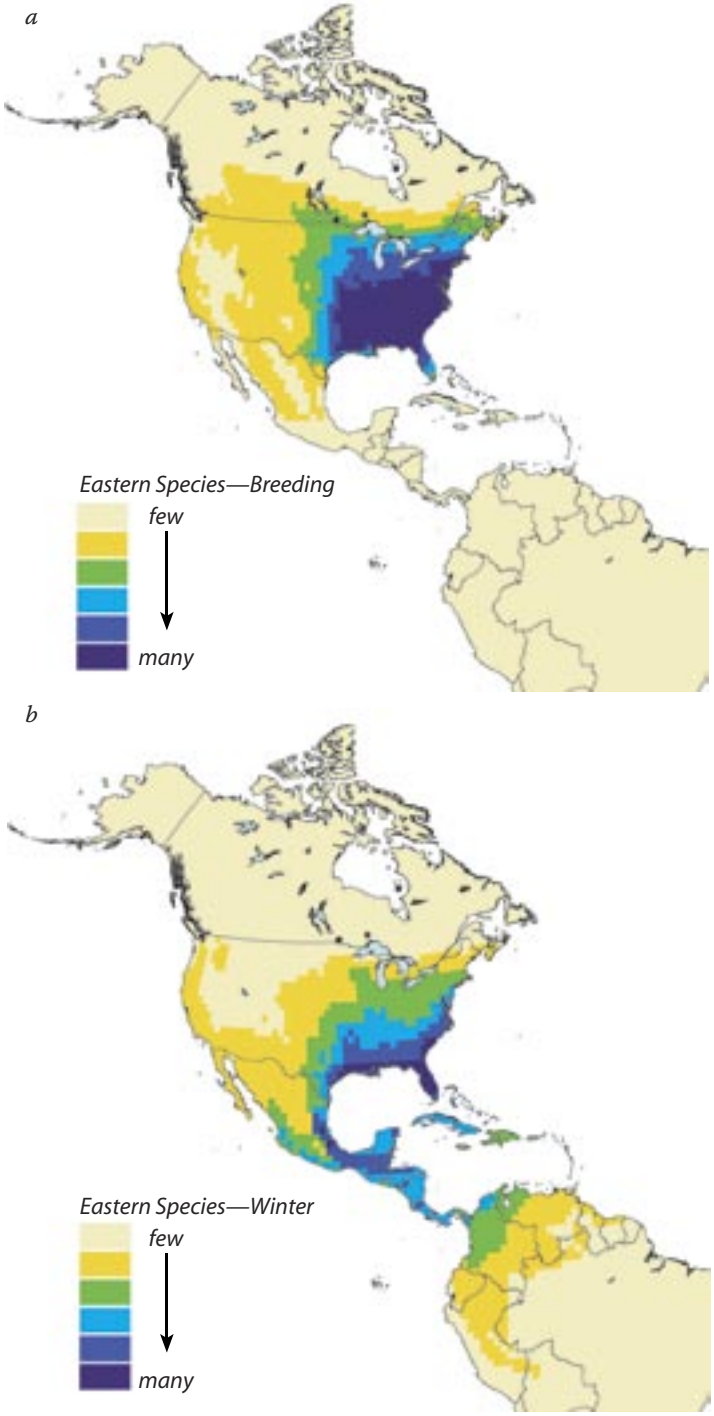

Figure 22. Number of species (a) during the breeding season and (b) during winter in each lat-long block, weighted by the percent of total population of each species breeding within the Eastern Avifaunal Biome.

The largest group of Species of Continental Importance inhabits mature deciduous forests, especially the vast oak-hickory dominated forests of the Appalachian high-

lands. Although no species in this group is critically imperiled, many are suffering population declines. Watch List and Stewardship Species representing this diverse community include Wood Thrush and Cerulean, Worm-eating, Kentucky, and Hooded warblers. Many declining forest birds are associated with dense understory conditions created by local disturbance; such conditions have become less common due to lack of forest management and overbrowsing by white-tailed deer. The Cerulean Warbler is among the most specialized and threatened birds of the deciduous forest and is in need of focused conservation attention throughout its range. Outside of the breeding season, coastal forests and woodlands along the Great Lakes, Atlantic Ocean, and Gulf of Mexico are crucial as migratory stops for Neotropical migrants from the Eastern, Prairie, and Northern Forest Biomes.

SHRUB/SUCCESSIONAL

Shrub habitats are associated with larger-scale disturbances, especially those created by forest succession, farmland abandonment, beaver activity, and, to a lesser extent, fire and weather events. In addition, areas of pitch-pine woodland and pine-barrens habitat, probably representing the "original" habitat for many shrub-nesting birds, continue to support high densities of high-priority species. In a class by itself, Florida Scrub-Jay is the flagship species for Florida's unique and endangered fire-dependent oak-scrub habitat. Many other shrub-nesting species have undergone declines, including Golden-winged, Blue-winged, and Prairie warblers, Painted and Indigo buntings, White-eyed Vireo, and Eastern Towhee. Many of these trends are consistent with regionwide trends in land use, particularly farm abandonment, control of beavers, and for-

Table 8. Species of Continental Importance in the Eastern Avifaunal Biome: BCRs 13, 24–31, 37

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Immediate Action					
Red-cockaded Woodpecker	100%	100%	Coniferous forest	Recovery Plan	Mo2
Ivory-billed Woodpecker	100%	0%	Mixed forest	Locate	**
Florida Scrub-Jay	100%	100%	Shrub/successional	Recovery Plan	**
Bachman's Warbler	100%	0%	Deciduous forest	Locate	**
Bachman's Sparrow	100%	100%	Coniferous forest	Increase 100%	Mo2
Saltmarsh Sharp-tailed Sparrow	100%	100%	Wetland	Increase 100%	Mo2
Henslow's Sparrow	35%	83%	Grassland	Increase 100%	Mo2
Golden-winged Warbler	14%	0%	Shrub/successional	Increase 100%	**
Swallow-tailed Kite	3%	0%	Deciduous forest	Increase 100%	Mo2
Management					
Brown-headed Nuthatch	>99%	>99%	Coniferous forest	Increase 50%	**
Worm-eating Warbler	>99%	0%	Deciduous forest	Maintain/Increase	Mo2
Prairie Warbler	99%	26%	Shrub/successional	Increase 50%	**
Prothonotary Warbler	98%	0%	Deciduous forest	Increase 50%	**
Kentucky Warbler	98%	0%	Deciduous forest	Increase 50%	**
Eastern Towhee	95%	97%	Shrub/successional	Maintain	**
Cerulean Warbler	97%	0%	Deciduous forest	Increase 100%	**
Blue-winged Warbler	89%	0%	Shrub/successional	Increase 50%	**
Brown Thrasher	43%	86%	Shrub/successional	Maintain	**
Chuck-will's-widow	84%	13%	Mixed forest	Maintain	**
Wood Thrush	83%	0%	Deciduous forest	Increase 50%	**
Rusty Blackbird	<1%	70%	Deciduous forest	Increase 100%	Mo2,3
Red-headed Woodpecker	30%	60%	Mixed forest	Increase 100%	**
Dickcissel	19%	0%	Grassland	Increase 50%	**
Painted Bunting	16%	3%	Shrub/successional	Increase 100%	**
Willow Flycatcher	13%	0%	Shrub/successional	Increase 50%	**
Sprague's Pipit	0%	13%	Grassland	Increase 100%	**
Mangrove Cuckoo	5%	5%	Tropical hardwood	Increase 50%	Mo1
White-crowned Pigeon	3%	3%	Tropical hardwood	Increase 100%	Mo1

(continued)

Table 8. Species of Continental Importance in the Eastern Avifaunal Biome: BCRs 13, 24–31, 37 (continued)

Species[1]	% Breeding Population	% Winter Population	Primary Habitat	Continental Population Objective	Monitoring Need[2]
Long-term Planning & Responsibility					
Seaside Sparrow	100%	>99%	Wetland	Maintain/Increase	Mo2
Hooded Warbler	>99%	0%	Deciduous forest	Maintain	**
Nelson's Sharp-tailed Sparrow	0%	>99%	Wetland	Maintain	Mo2
Swainson's Warbler	99%	0%	Deciduous forest	Maintain	**
Yellow-throated Warbler	98%	28%	Deciduous forest	Maintain	**
Acadian Flycatcher	98%	0%	Deciduous forest	Maintain	**
Louisiana Waterthrush	94%	0%	Deciduous forest	Maintain	**
Pine Warbler	92%	91%	Coniferous forest	Maintain	**
White-eyed Vireo	86%	36%	Shrub/successional	Maintain	**
Carolina Wren	83%	83%	Deciduous forest	Maintain	**
White-throated Sparrow	<1%	83%	Shrub/successional	Maintain	Mo3
Red-shouldered Hawk	83%	64%	Deciduous forest	Maintain	**
Red-bellied Woodpecker	81%	81%	Deciduous forest	Maintain	**
Indigo Bunting	79%	0%	Shrub/successional	Maintain	**
Yellow-throated Vireo	77%	0%	Deciduous forest	Maintain	**
Antillean Nighthawk	<1%	0%	Shrub/successional	Maintain/Increase	Mo1

[1] Species are sorted by Action Category (Immediate Action, Management, Planning & Responsibility), then by decreasing % of global population that occurs in the biome (by greater of breeding or winter population). Species highlighted in yellow are Watch List species, with at least 10% of their global population in this biome. Species in green (in species or % population columns) are Stewardship Species, with ≥75% of their population in this biome.
[2] Monitoring Need (this assessment addresses only the adequacy of long-term population trend monitoring at the continental scale): Mo1=no trend data, Mo2=imprecise trends, Mo3=inadequate northern coverage.
**Long-term population trend monitoring is generally considered adequate but some issues, such as bias, may not have been accounted for.

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The Brown-headed Nuthatch is one of several species endemic year-round to the pine forests of the southeastern U.S.

est succession. Managing for shrub-nesting birds often is compatible with actions to conserve American Woodcock (*Scolopax minor*) and other game species. These habitats are also important for migrating birds from the Eastern and Northern Forest Biomes and provide wintering habitat in the southeastern U.S.

WETLANDS

The band of coastal salt marsh on the edge of the Eastern Biome supports the entire world populations of Saltmarsh Sharp-tailed and Seaside sparrows, as well as the entire wintering population of Nelson's Sharp-tailed Sparrow. Although most coastal marshes are federally protected, specific conditions required by breeding sparrows, often found in unprotected marsh ecotones, are not necessarily provided by management activities directed at shorebirds or waterfowl. These sparrows are also very poorly monitored and require targeted surveys to determine status and trends. Freshwater wetlands also provide habitat for priority landbird species, especially shrubby wetlands resulting from beaver activity in forested regions.

GRASSLAND

Existence of the now-extinct race of Greater Prairie-Chicken (Heath Hen) argues that there were historical grasslands in the East (Askins 1993). Grassland birds

in the Eastern Avifaunal Biome today depend on agricultural landscapes and other artificial habitats such as reclaimed strip mines and airfields. The rapidly declining Henslow's Sparrow is of highest continental concern within this group of wetland species.

TROPICAL HARDWOOD

In Florida, coastal mangrove swamps are the primary habitat for Mangrove Cuckoo and White-crowned Pigeon. This tropical habitat is an extension of mangroves found throughout the Caribbean basin. In Florida, this specialized habitat is highly threatened by development outside Everglades National Parks and a few smaller protected areas. This habitat is also important for migrating and wintering warblers, providing a "tropical" wintering area within the U.S.

Conservation Issues

- Urban development and human population growth are the largest threats to bird habitats, causing loss and fragmentation of forests, primarily in coastal and valley regions.
- Maturation of forest throughout the East has resulted in lack of successional habitats as well as reduction in disturbance-generated forest structure such as shrubby understory. These conditions are exacerbated by lack of forest management on public lands and by overbrowsing by white-tailed deer.
- Mountaintop-removal-valley-fill mining in the southern Appalachians threatens to remove up to 20 percent of diverse mixed-mesophytic and oak-hickory forests critical to Cerulean Warblers and other high-priority forest species.
- Changing and intensifying agricultural practices reduce habitat suitability for grassland birds.

Recommended Actions

- Implement U.S. Endangered Species Recovery Plan objectives for Florida Scrub-Jay and Red-cockaded Woodpecker.
- Protect and restore bottomland-hardwood forest tracts large enough to support populations of Swallow-tailed Kite, Cerulean Warbler, and Swainson's Warbler; follow models of Mississippi Valley and Southeastern Coastal Plain initiatives.
- Support comprehensive forest planning on all public lands, incorporating needs and objectives to reverse declines of Cerulean Warbler and other priority bird species.
- Implement conservation measures to enhance reproduction and survival of salt-marsh sparrows, including protection and restoration of high-marsh ecotones, control of invasive phragmites, and management of water levels.
- Enhance habitat conditions for breeding Henslow's Sparrow and other grassland birds through agricultural incentive programs, and appropriate management on Department of Defense lands, public airfield properties, and other public lands.
- Identify, protect, and enhance critical breeding sites for Golden-winged Warbler, especially in areas where Blue-winged Warblers are absent or where hybridization is minimal.
- Manage adequate acreage of shrub communities to reverse declines of priority bird species, including protection of natural barrens and proper management of power line corridors; link objectives with those of American Woodcock, Northern Bobwhite, and other game species.
- Search for extant populations of Ivory-billed Woodpecker or Bachman's Warbler using modern acoustic monitoring and GIS techniques.

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Although still common, the Eastern Towhee is one of many disturbance-dependent, shrub-nesting species showing precipitous population declines throughout the Eastern Avifaunal Biome.