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STATUS OF 10 BIRD SPECIES OF CONSERVATION CONCERN IN US FISH & WILDLIFE SERVICE REGION 6

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STATUS OF 10 BIRD SPECIES OF CONSERVATION CONCERN IN US FISH & WILDLIFE SERVICE REGION 6



Final Report to:

United States Fish & Wildlife Service, Region 6
Denver, Colorado

By

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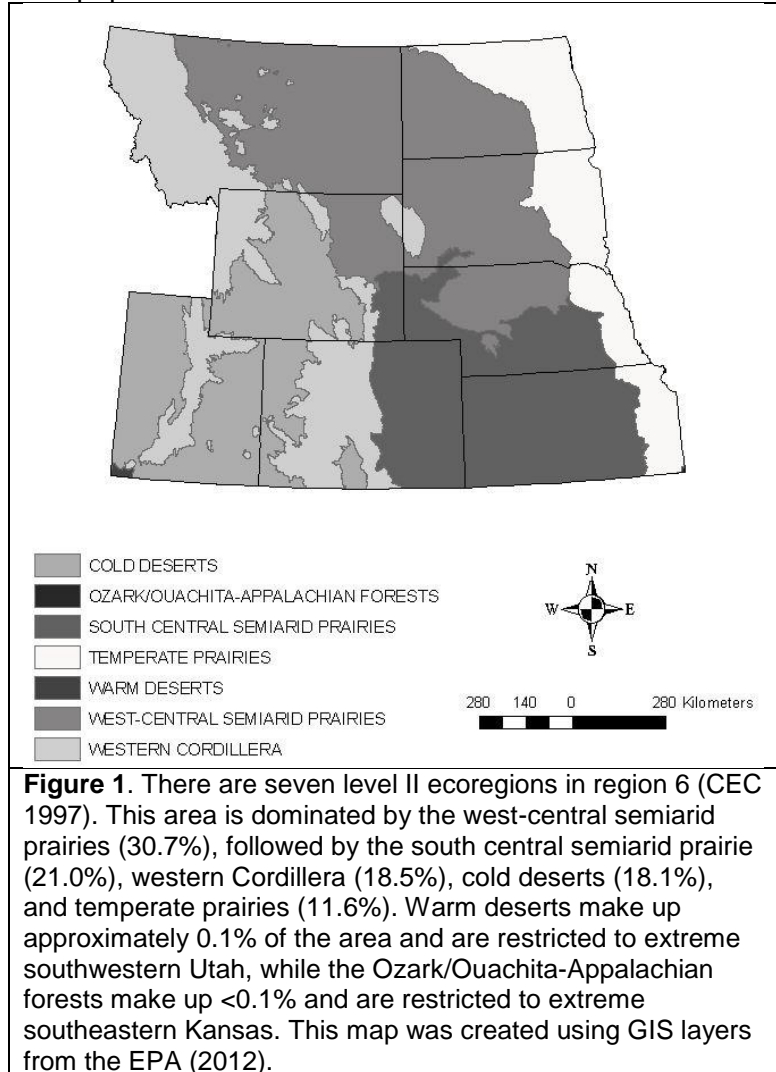
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Introduction

All native migratory birds in the United States and Canada are protected by the Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. §§ 703 – 712). Three additional countries have signed this act, including Mexico (1936), Japan, and Russia (1976). Although these avian species are protected, permits for direct take can be issued for activities such as depredation, salvage and scientific collection (USFWS 2012a). However the USFWS currently lacks the ability to assess the potential consequences of these increases on the vast majority of birds protected under the Migratory Bird Treaty Act. Consequently, there is an urgent need to summarize the current population status, data limitations, and the potential impacts of increased direct take on relevant populations and subpopulations.

USFWS Region 6 includes the states of North Dakota, South Dakota, Montana, Wyoming, Colorado, Utah, Nebraska, and Kansas (USFWS 2008a; Figure 1). Collectively, these states include approximately 1,921,019 km² or approximately 20% of the land mass of the continental United States. Seven of the 52 level II ecoregions occur in Region 6 (CEC 1997, Fig. 1). This region is dominated by prairies (63.3%), followed by montane habitats exemplified by the western Cordillera (18.5%) and cold deserts (18.1%). Region 6 is home to a diverse avifauna, with 335 species recorded in North Dakota (Faanes and Stewart 1982), 394 species in Wyoming (Wyoming Game and Fish Department 1998), 427 species recorded in Montana (Montana Audubon 2012), 433 species in South Dakota (South Dakota Ornithologists' Union 2011), 448 species in Utah (Utah Birds Records Committee 2012), 455 species in Nebraska (Nebraska Ornithologists' Union 2012), 472 species in Kansas (Kansas Ornithological Society 2011), and 491 species in Colorado (Colorado Field Ornithologists 2012). Region 6 is subject to multiple stressors including habitat fragmentation, conversion and destruction, energy development, and climate change that could potentially affect the avifauna of this region.

The Prairie Pothole region of the northern Great Plains includes portions of Iowa, Minnesota, North Dakota, South Dakota, Montana, Manitoba, Saskatchewan, and Alberta and historically consisted of approximately 10% wetlands (Mitsch and Gosselink 2007). However, well over half of the wetlands have subsequently been drained (Leitch 1989), and many of the remaining wetlands have been degraded by sedimentation, eutrophication, and contamination



with agricultural chemicals (Euliss et al. 1999). Other habitats in Region 6 have likewise been reduced in extent. For example, approximately 40% of the sagebrush has already been lost (Connelly et al. 2004) and the vast majority of the remaining sagebrush has been heavily modified. Tallgrass prairies are even more threatened with only 4% of the original tallgrass prairie remaining (Steinauer and Collins 1996).

Energy development in this region could potentially have a negative impact on some bird species. Some species, for example, avoid not only tall structures such as wind turbines but also the associated power lines and roads (Pruett et al. 2009). Some studies have noted that wind farms may be particularly problematic for long-lived species such as raptors (e.g., Carrete et al. 2009); other scientists have developed tools to minimize the impact of wind farms on these species (Baisner et al. 2010). However, it is worth noting that at least one study has found no relationship between environmental impact assessments and avian mortality (Ferrer et al. 2012).

Changes in the distribution and phenology of many organisms were observed as the earth warmed by 0.6 ± 0.2 °C during the 20th century (Hughes 2000, Butler 2003, Parmesan 2006, Lafferty 2009). During the 20th century, the climate generally became warmer and wetter in the Prairie Pothole region, with minimum daily temperatures warming by 1 °C and average precipitation increasing by 9% (Millett et al. 2009). The number of extremely cold days (i.e. when temperatures dip below 0 °F or -17.8 °C) in western Montana has declined and now terminates 20 days earlier (Pederson et al. 2010). In region 6, changes in arrival dates of migratory birds in South Dakota have been linked to warming temperatures (Swanson and Palmer 2009). Likewise, climate change has been implicated in the unprecedented severity of the most recent mountain pine beetle (*Dendroctonus ponderosae*) outbreak as the flight season in Colorado now lasts twice as long as had historically been reported (Mitten and Ferrenberg 2012). Some *D. ponderosae* are now producing two broods per year (Mitten and Ferrenberg 2012). Just outside of Region 6, the population of South Hills Red Crossbill (*Loxia curvirostra* complex) in southern Idaho declined by 60% from 2003 to 2008, and this decline has been linked with warmer temperatures (Santisteban et al. 2012). During the 21st century, the amount of suitable montane habitat for boreal species such as wolverine (*Gulo gulo*) is expected to decline (McKelvey et al. 2011), and fire frequency is expected to increase in sub-alpine forests, altering the current fire-climate-vegetation relationships (Westerling et al. 2011), which will presumably affect the avifauna of this habitat. In the Prairie Pothole region, it is predicted that the most productive areas for waterfowl will general shift to the north and east given a 3 °C change in temperature (Johnson et al. 2005).

Given the ongoing changes in habitat, energy development, and climate that are affecting this area, it is imperative that the USFWS be able to assess the population status and relative vulnerabilities of nongame bird species. This is particularly important for bird species of conservation concern that were outlined by USFWS (2008b). Ten species from USFWS Region 6, from a diverse array of habitats and life-histories, were selected and concise species accounts were created. The goal of this report was to create a synopsis on the status and relatively vulnerabilities of each of each of the ten species by summarizing data from the literature, as well analyzing data from the Breeding Bird Surveys and the Christmas Bird Counts. The following précis is a quick and easy-to-follow summary of the status of ten birds of conservation concern in USFWS Region 6

Horned Grebe (*Podiceps auritus*)

Summary

- These small, duck-like birds are colored chestnut and brown during the breeding season, with a streak of buff-colored feathers behind the eye. During the non-breeding season, they are dark gray above with a black cap and white on their neck.
- Horned Grebes breed from northwestern Minnesota (formerly) west to southern British Columbia (with isolated populations in eastern Oregon) and north to central Alaska and extreme southern Nunavut. They winter along the Pacific Coast, from the Aleutians to northern Baja California and along the Atlantic and Gulf coasts from southern Nova Scotia to south Texas. They also winter inland on lakes and reservoirs in areas where the average January temperature is above -1 °C and are generally more common in the eastern US.
- >100,000 pairs are thought to breed in North America.
- The breeding range is gradually contracting to the northwest.
- Since 1966, the number of Horned Grebes detected on Breeding Bird Surveys has declined by 2.6% annually.
- Since 1966, the number of Horned Grebes observed on Christmas Bird Counts (after controlling for the number of observers) has declined by 0.4% annually.

Legal Status

See Tables 1 and 2.

Description

Horned Grebes are 31-38 cm long and weigh from 300 to 570 g. In alternate plumage, this species has bright buff feathers behind the eyes that it can erect. In basic plumage, individuals become black and white. Their crown becomes gray and is bordered by white cheeks extending back to the nape (Stedman 2000).

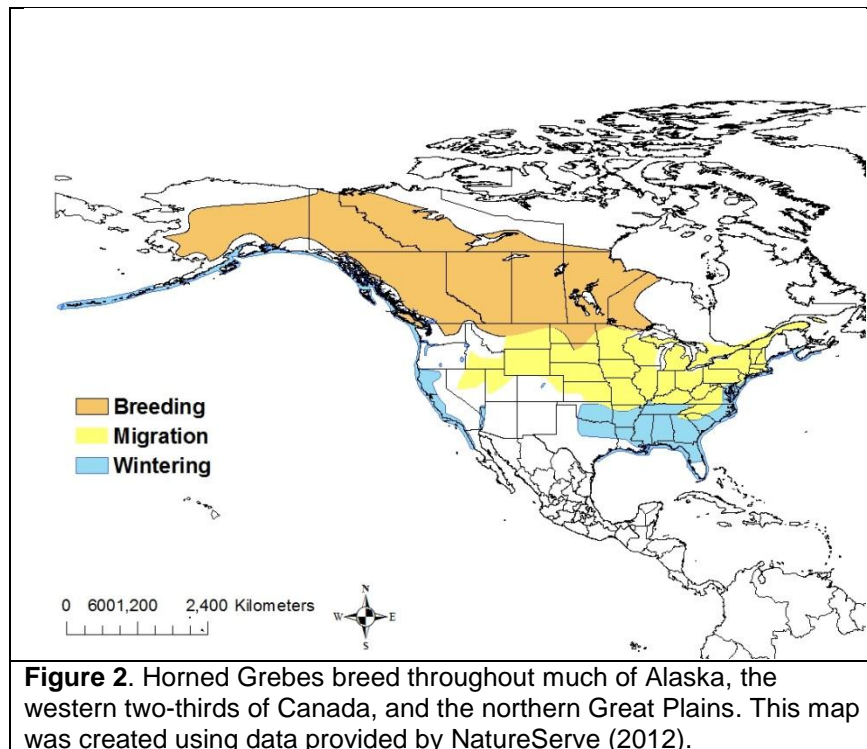
Distribution

Rangewide

Horned Grebes breed throughout the extreme northern continental United States, Canada, and Alaska. They breed from northwestern Minnesota (formerly, no recent records) west to southern British Columbia and north to central Alaska and extreme southern Nunavut. They are rare breeders in eastern Oregon and an isolated population is present at Isles de la Madeleine, Quebec (Stedman 2000, Marshall et al. 2003). This species formerly bred east to New Brunswick and south to Wisconsin (Stedman 2000). The wintering range is along the Atlantic and Pacific coasts of Canada and the US, as well as the interior US (Figure 2), generally where January temperatures average greater than -1 °C (Root 1988) and is most common in the eastern half of the US (Stedman 2000).

Region 6

Colorado: This species is uncommon to fairly common spring and fall migrant in the plains of eastern Colorado. Most sightings are at large reservoirs that are more likely to contain open water in the winter. Reservoir construction is probably responsible for the increased occurrence of Horned Grebe in Colorado (Andrews and Righter 1992).



Kansas: This species is an uncommon spring and fall migrant in Kansas and a rare winter resident (Janzen 2007, Thompson et al. 2011). The median first arrival date is 27-29 March with peak spring migration during mid-April (Thompson et al. 2011). Most migrants have left Kansas by 1 May although stragglers may remain until 19 May (Thompson et al. 2011). Fall migration may begin as early as 22 August with a peak occurring from 10 October to 27 November (Janzen 2007, Thompson et al. 2011). Horned Grebes are common during migration at Cheney Reservoir, Sedgwick

County (Janzen 2007).

Montana: Horned Grebes breed in northern and western Montana. They are transient across the entire state. They may overwinter occasionally in western Montana (Montana Bird Distribution Committee 2012).

Nebraska: Horned Grebes are an occasional to common migrant in Nebraska; they are typically found on lakes and reservoirs. Spring migrants are observed in late March to early April, although some sightings have been recorded as early as 21 February (Sharpe et al. 2001). Fall migrants generally arrive in mid-September and depart by late November. Fall migrants have been recorded as early as 27 August and as late as 2 January. Large flocks of Horned Grebes ($n = 6$ to 266) sporadically occur in western Nebraska (Sharpe et al. 2001). Horned Grebes have been recorded as breeding in Cherry County (Ducey 1988). A report of breeding Horned Grebes in Lincoln County (Ducey 1988) has no supporting documentation (W. Molhoff, *pers. comm.*).

North Dakota: Horned Grebes are an irregular to common breeder throughout the state (Stewart 1975, Faanes and Stewart 1982). The species occasionally nests throughout North Dakota but is much less common in the southeastern third of the state. Wetland draining programs in the early 20th century destroyed breeding habitat (Stewart 1975). Following a very wet spring in 2011, breeding Horned Grebes were widespread and common throughout the eastern half of the state (Martin 2009).

South Dakota: This species is a fairly common migrant in eastern South Dakota (South Dakota Ornithologists' Union 1991). Horned Grebes formerly bred regularly in McPherson County and Edmunds County (South Dakota Ornithologists' Union 1991) but no evidence of breeding was found during the 1988 – 1993 breeding bird atlas (Peterson 1995). However, Horned Grebes were again confirmed breeding in McPherson County in 2010 and in Edmunds County in 2012

during the second breeding bird atlas (N. Drilling, *pers. comm.*). This species was also considered to be a probable breeder in Potter County during 2010 (N. Drilling, *pers. comm.*).

Utah: Horned Grebes are uncommon transients and rare during the winter in Utah (Utah Birds Records Committee 2012).

Wyoming: Horned Grebes are an uncommon migrant in Wyoming. Grebes begin arriving in mid-March and depart by early May with the peak spring migration occurring in mid-April. This species may have bred in Park County in 1978. Fall migrants begin arriving in late September, and large flocks may aggregate on open water. Horned Grebes depart with the freeze-up, and there are no reports of Horned Grebes in Wyoming in January or February (Faulkner 2010).

Biology

General

Horned Grebes are typically found in deep water sites with little vegetation (Barnes and Nudds 1990). These birds are generalists (Kucyznski and Paszkowski 2010), feeding on aquatic arthropods in the summer and fish and crustaceans in the winter (Stedman 2000). The breeding biology of this species has been well-studied (Stedman 2000) and pairs engage in both duetting and coordinated visual displays (Malacarne et al. 1991). After breeding, Horned Grebes move to larger bodies of water and molt remiges (flight feathers), typically during July and August (Stout and Cooke 2003).

Breeding

Pair formation may begin during mid- to late winter (Storer 1969) and is frequently seen during migration (Stedman 2000). The breeding season occurs from late May to mid-September and peaks from early June to early August (Stewart 1975). Floating nests are constructed over beds of submergent vegetation or in stands of emergent vegetation near the water. Average water depth at nesting sites studied by Stewart (1975) measured 40 cm (range 5-123 cm) and nests were located within 30 m of the shore. Nest material consists of the dominant vegetation at the nesting site. Average clutch size is 4.5 eggs (range 3-6; Stewart 1975).

Wintering

Horned Grebes generally travel >1,000 km from breeding to wintering grounds, with the bulk of the North American population wintering along the coasts (Stedman 2000). They are generally solitary or in small groups when foraging but during migration and winter may gather in flocks of up to several hundred individuals (Stedman 2000).

Habitat

Breeding

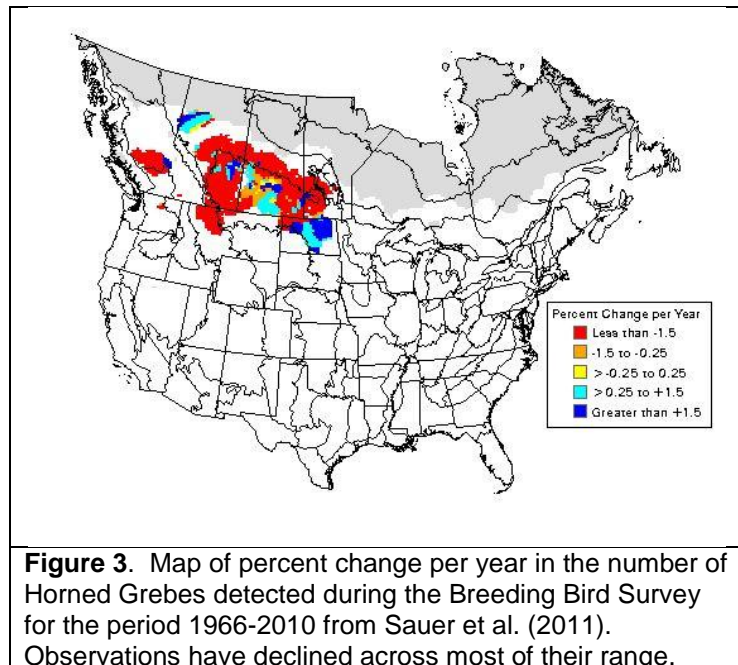
Horned Grebes breed in shallow freshwater wetlands ranging in size from 0.05 ha to 10 ha (Stedman 2000). They prefer hemi-marshes with open water and emergent vegetation consisting of sedges (*Carex* spp.), rushes (*Equisetum* spp.), and cattails (*Typha* spp.; Stedman 2000). Horned Grebes have been observed breeding in artificial impoundments and depressions (Fournier and Hines 1999, Stedman 2000). In North Dakota, breeding pairs were present at both wetlands and lakes. The hydrology of these bodies of water ranged from seasonal to permanent, and the area ranged from 0.1 ha to several hundred ha. Breeding pairs are also found on shallow riverine impoundments that are managed for waterfowl (Stewart 1975).

Migration

Horned Grebes frequent rivers and large bodies of water (>1,000 ha) along the coasts during spring and fall migration, and have also been observed irregularly on small lakes in the interior (Stedman 2000).

Winter

Horned Grebes winter in coastal estuaries and medium-sized or larger bodies of water inland (Stedman 2000). Detailed analyses of winter habitat requirements have apparently not been conducted (Stedman 2000).



Population Trends and Estimates

It is estimated that there are >100,000 pairs in North America (O'Donnell and Fjeldså 1997). For the period 1966-2010, there was a significant rangewide decline of 2.6% annually in the numbers of Horned Grebes observed during the Breeding Bird Surveys (Figure 3; Table 2). During the period 2000-2010, Horned Grebes showed a significant survey-wide decline of 1.9% per year (Sauer et al. 2011). However, although there was a decline of 2.4% annually in the Prairie Pothole region for the period 1966-2010, no significant trend was observed in Region 6 (Sauer et al. 2011), presumably due to the limited number of detections in this area.

The number of Horned Grebes detected on Christmas Bird Counts in the US and Mexico for the period 1966-2010 also showed a significant decline of 0.4% annually (linear regression, number per party-hour = $-0.004 \times \text{year} + 7.42$, $F_{1,44} = 13.89$, $r^2 = 0.22$, $p = 0.0005$; Figure 4).

Threats

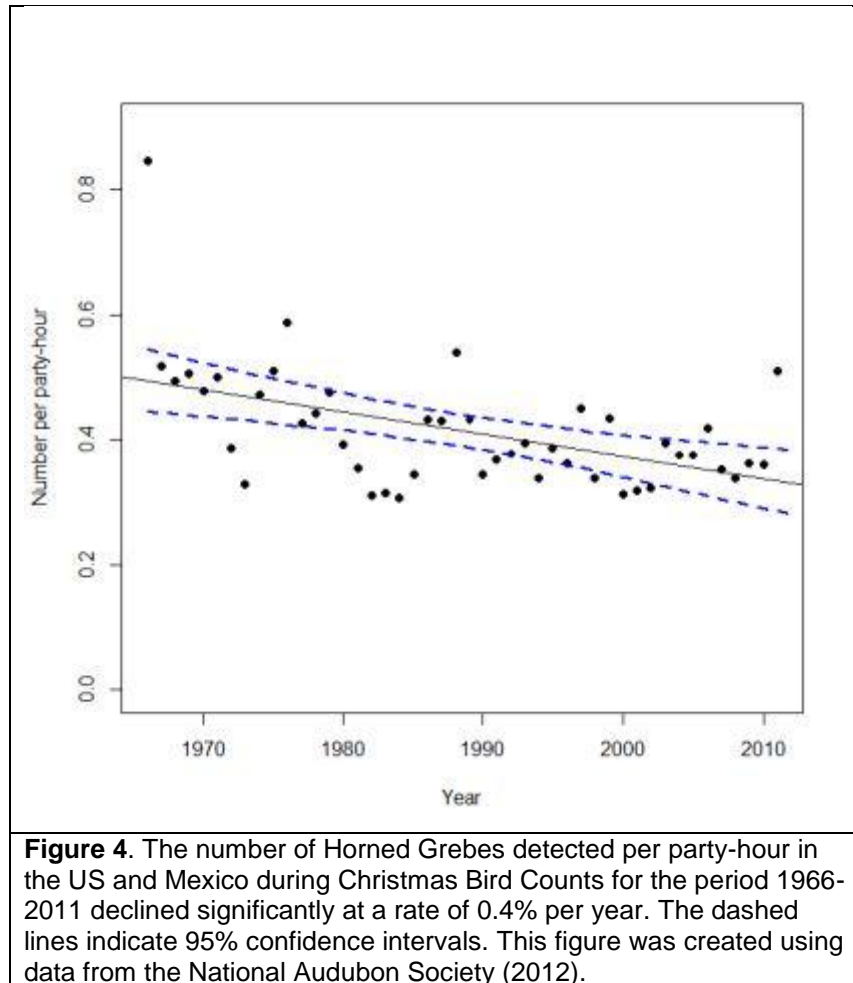
Horned Grebes and their eggs are particularly vulnerable to predation during the breeding season (Stedman 2000). Increasing populations of nest predators pose a significant threat to the species. Competition with Pied-billed Grebe (*Podilymbus podiceps*) for breeding habitat may limit populations (Committee on the Status of Endangered Wildlife in Canada 2012a).

Effects of Climate Change

Increased residency has been observed in European grebe species, suggesting natural selection favors birds that winter closer to breeding grounds or that do not migrate. It is unclear to what extent climate change and increased reservoir availability led to the increase in residency (Cox 2010). The projected increase in the length and frequency of droughts in their breeding range can negatively impact populations (Committee on the Status of Endangered Wildlife in Canada 2012a).

Effects of Energy Development

Oil spills along the coasts of the Pacific and Atlantic Oceans are detrimental to Horned Grebes (Committee on the Status of Endangered Wildlife in Canada 2012a). In Europe, this species is used as a wetland quality indicator species (Stedman 2000) and so wetland loss or degradation by energy development may be a cause for concern.



Management and Conservation

A summary of the threats facing waterbirds can be found in Kushlan et al. (2002). Loss and degradation of breeding habitat by agricultural activities may negatively impact Horned Grebes (Stedman 2000). Oil spills and pesticide bioaccumulation in the winter range may also be detrimental to this species (Stedman 2000). In addition, Breeding Bird Surveys are primarily restricted to the southern portion of the breeding range (Sauer et al. 2011) and so may not accurately track changes in the northern portion.

Completed and Ongoing Conservation Actions

Horned Grebes were included on the Blue List in 1986 (Tate 1986) and are currently listed as a Species of Special Concern in

Canada, and the Isles de la Madeleine population in Quebec is endangered (Nature Canada 2012). In the US, the Horned Grebe is listed as Threatened in Minnesota (Minnesota DNR 2012a) and is a Level I species of special concern in North Dakota.

TABLE 1. Horned Grebe status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for “International Union for Conservation of Nature”, ABC is an abbreviation for “American Bird Conservancy”, and “PIF” is an abbreviation for “Partners in Flight”. A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, “Secure” species have no immediate conservation issues, “Potential Concern” species have smaller populations or ranges or at higher rates of population declines, “Vulnerable” species deserve conservation attention, and “At Risk” species need more urgent conservation attention. The “Birds of Conservation Concern” row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	Potential Concern
Birds of Conservation Concern	BCR 4, BCR 11, BCR 12, BCR 13, BCR 14, BCR 17, BCR 22, BCR 23, BCR 30, USFWS Region 3, USFWS Region 5, USFWS Region 6, USFWS Region 7
PIF	-

TABLE 2. Horned Grebe status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for “Species of Greatest Conservation Need”. A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations. For the BBS trends, data with an important deficiency are labeled as “Insufficient data”. The BBS trends are annual changes. Numbers in parentheses are 95% confidence intervals, with the exception of the Region 6 data which are 97.5% confidence intervals.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G5	-2.6% (-4.5, -1.0%)	-1.9% (-6.3, 2.0%)	-	-
Region 6		1.35% (-4.1, 8.31%)	15.3% (-3.0, 45.4%)	-	-
Montana	S3	-	-	Species of Concern	Tier II
North Dakota	-	Insufficient data	Insufficient data	-	Level I
South Dakota	S2	-	-	-	-
Wyoming	-	-	-	-	-
Colorado	-	-	-	-	-
Utah	-	-	-	-	-
Nebraska	-	-	-	-	-
Kansas	-	-	-	-	-

Yellow Rail (*Coturnicops noveboracensis*)



Figure 5. The bright yellow bill of this male Yellow Rail is only evident during the breeding season. During the non-breeding season the coloration fades to a darker brown (*pers. obs.*). Photo by Chris Butler.

Summary

- Yellow Rails (Figure 5) are small, nocturnal marsh-dwelling birds that are more often heard than seen.
- Yellow Rails breed from New Brunswick and Maine west to Alberta and northeastern British Columbia. They winter near the coast, from North Carolina to Texas and have recently been discovered overwintering in Oklahoma.
- The population is estimated to consist of 17,500 individuals.
- This species is poorly monitored by the Breeding Bird Survey and no trends in population are apparent.
- Since 1966, the number of Yellow Rails detected on Christmas Bird Counts (after controlling for the number of observers) has increased at a rate of 0.04% annually, possibly due to increasing observer experience in locating this species during the non-breeding season.

Legal Status

See Tables 3 and 4.

Description

The Yellow Rail is a small, buff-colored bird with a short bill. Males weigh about 59.2 g and females weigh about 52.2 g. Males are about 15% heavier than females and are larger bodied. Males and females are indistinguishable based on plumage, but the male's bill becomes yellow during the breeding season (Bookhout 1995).

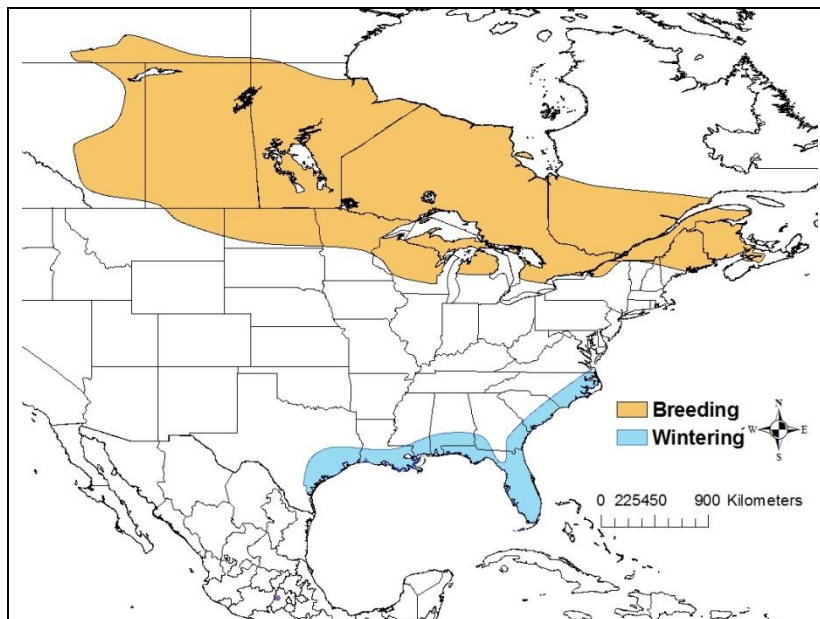


Figure 6. The breeding range of Yellow Rails extends across much of southern Canada and parts of the northern US. However, this species is quite local within that breeding range. Yellow Rails winter from North Carolina to Texas and have recently been discovered overwintering in Oklahoma. This map was created using data provided by NatureServe (2012).

Distribution

Rangewide

The breeding range in Canada extends from eastern Alberta and southeastern Northwest Territories to Nova Scotia. In the United States, Yellow Rails occur in northern New England, Michigan (local), Wisconsin, Minnesota, North Dakota, and northeastern Montana (Bookhout 1995; Figure 6). There is also an isolated breeding population in south-central Oregon and northern California (Taylor 1998, Popper and Stern 2000, Sterling 2008). Recently, Yellow Rails have been found in northeastern British Columbia during the breeding season (British Columbia Breeding Bird Atlas 2008). Yellow Rails winter primarily

along coastal marshes on the Gulf Coast and southern Atlantic coast of the United States but have recently been discovered overwintering in Oklahoma (Butler et al. 2010, Butler et al. 2011).

Region 6

Colorado: Accidental in the state. One Yellow Rail was recorded at Barr Lake area, Adams County in July 1906 (Andrews and Righter 1992).

Kansas: Yellow Rails are rare migrants in the state and are seldom observed (Janzen 2007, Thompson et al. 2011). Since 1985, however, at least 33 individuals have been salvaged near television towers in Kansas (Thompson et al. 2011).

Montana: The Yellow Rail is presumed to be a casual breeding resident in Montana, but due to its secretive nature breeding has not been documented (J. Marks, *pers. comm.*). Most records of Yellow Rails during the breeding season come from extreme northeastern Montana (Montana

Bird Distribution Committee 2012). However, the occurrence of eight males at a marsh near Westby in 1996 strongly suggest that Yellow Rails nest in Montana in some years. Twelve records are from Sheridan County (Medicine Lake and Westby), Phillips County (Bowdoin NWR [National Wildlife Refuge]), and Beaverhead County (Red Rock Lakes NWR) from late May to late July. The only other recorded Yellow Rail in Montana was heard at McGee Meadows in Glacier National Park. Yellow Rail populations in Montana are thought to be under-reported due to the lack of observers, but rails are likely to breed in the state during wet years (J. Marks, *pers. comm.*).

Nebraska: Yellow Rails are a rare to casual migrant in central and eastern Nebraska. Most reports are disturbance or mortality related. Dogs, fires, and mowing during mid-April flush birds and in the fall birds collide with television towers while migrating at night. Yellow Rail have been observed in the month of June in Cherry County, Rock County, and Lancaster County (Sharpe et al. 2001) but there is no documented evidence of breeding (W. Molhoff, *pers. comm.*).

North Dakota: Yellow Rails are considered to be rare breeders in North Dakota (Faanes and Stewart 1982). However, they may be more common in North Dakota than the records indicate, as Yellow Rails are listed on more than half (11 out of 20) of the checklists for refuges in North Dakota (NPWRC 2006). Birds breed in Benson County and may also breed in Bottineau, McHenry, Burleigh, and Stutsman counties (Stewart 1975). Currently, birders wishing to find this species in North Dakota are directed to search McHenry, Sheridan, Kidder, and Grand Forks Counties (Martin 2012).

South Dakota: Yellow Rails are rare spring and fall migrants and may be rare summer residents. This species has been observed during May and June near New Effington Hall in Roberts County, Brule County, and Lacreek NWR in Bennett County (South Dakota Ornithologists' Union 1991).

Wyoming: Yellow Rails are an occasional vagrant in Wyoming, and many Yellow Rail reports are misidentified juvenile Soras (*Porzana carolina*). The majority of Yellow Rails observed in Wyoming occurred in the summer and fall in Park County in Yellowstone National Park and near Cody (Faulkner 2010).

Biology

General

The Yellow Rail feeds upon snails, aquatic insects, and small seeds (Stalheim 1974, Bookhout 1995). Stomach examinations indicate that small snails are the most frequently occurring ingested item followed by insects, sedge seeds, and gravel (Walkinshaw 1939).

Yellow Rails seldom fly but instead tend to freeze or run through the thick vegetation. When flushed, the legs dangle under the body and the white secondaries are conspicuous. Yellow Rails stretch their legs behind the body during longer flights (Walkinshaw 1939, Bookhout 1995). Yellow Rails are strong but infrequent swimmers. They have been observed feeding while swimming, and will also swim to cross open water. Yellow Rails have been found attempting to hide by submerging completely with the exception of their beak (Stalheim 1974).

The call is a distinctive series of clicks, often a 5-note pattern "click-click, click-click-click" (Kellogg 1962, Reynard 1974).

Breeding

Males are territorial and regularly patrol, chasing away intruding males. Males will investigate a call within their territory, and imitating a call will often attract the male to the observer (Bookhout 1995). However, individual territories do overlap (Bookhout and Stenzel

1987). Males lack strong site fidelity, and are rarely recaptured at their territory from the previous year (Bookhout 1995).

In Minnesota and Michigan, Yellow Rails typically arrive during the last week of April or during the first week of May (Walkinshaw 1939, Stalheim 1974, Bookhout 1995). In North Dakota, breeding occurs from late May to late July and peaks from early June to mid-July. Nests occur in dense emergent vegetation and are built on saturated soil or over water up to 10 cm deep (Stewart 1975). Females generally lay 5-10 eggs and incubate the eggs for 17-18 days (Bookhout 1995). The young are semiprecocial and may leave the nest within two days of hatching (Stalheim 1974). Birds will remain on their breeding grounds until late September or early October (Walkinshaw 1939).

Wintering

Little information about Yellow Rail wintering biology has been published. In South Carolina, the sex ratio of Yellow Rails collected between 1903 and 1918 was significantly biased towards females (Post 2008).

Habitat

Breeding

Yellow Rails in Michigan breed in wet sedge meadows dominated by the sedge *Carex lasiocarpa* (Bookhout and Stenzel 1987, Bookhout 1995). Yellow Rails are rarely encountered in cattail (*Typha* sp.) stands, and the presence of woody species diminishes the quality of the breeding habitat. Yellow Rails rarely use habitat with grasses under 0.3 m in height (Bookhout 1995, Sharpe et al. 2001). They prefer areas with saturated soil to standing water up to 46 cm deep (Bookhout 1995). In North Dakota, their breeding habitat consisted of wetlands with thick mats of emergent vegetation (Stewart 1975).

Migration

During migration Yellow Rails have been observed in moist grasslands and fallow fields in Iowa in autumn (S. Dinsmore, *pers. comm.*). Organized excursions to see Yellow Rails in Oklahoma during October are to damp grassy areas where Yellow Rails are known to winter (*pers. obs.*). Participants of the Yellow Rail and Rice Festival in Jennings, Louisiana observe Yellow Rails flushing from rice fields that are being harvested (http://snowyegreterenterprises.com/Snowy_Egret_Enterprises/Yellow_Rails_%26_Rice_Festival.html).

Winter

In South Carolina, Yellow Rails were found primarily in damp fields (Post 2008) and in coastal North Carolina on the edges of high salt marsh (Bob Russell, *pers. comm.*). In southern Mississippi, Yellow Rails can be found in wet pine savanna (*pers. obs.*). Yellow Rails overwintering in Oklahoma used damp fields dominated by *Sporobolus* spp. which averaged 44 cm in height (Butler et al. 2011). Yellow Rails may also use the drier areas of *Spartina* marshes (Anderson 1977).

Population Trends and Estimates

The number of Yellow Rails in North America is estimated to be approximately 17,500 individuals (Butcher et al. 2007). The secretive and nocturnal habits of the Yellow Rail make population assessments difficult and no trend assessment is possible using Breeding Bird Survey data. The number of Yellow Rails observed during Christmas Bird Counts has increased significantly for the period 1966-2010 (linear regression, number per party-hour = $0.0004 \times \text{year} - 0.82$, $F_{1,44} = 10$, $r^2 = 0.17$, $p = 0.003$; Figure 7). However, given the widespread loss of

wetlands across its range, it is most likely that this trend is due to increasing observer experience in locating wintering Yellow Rails rather than a population increase. Large numbers during the breeding season have recently been found in the coastal marshes of James Bay, Ontario (Robert et al. 2004) and in the aspen parkland wetlands of northwestern Minnesota. (S Stucker, *pers. comm.*).

Threats

Habitat loss appears to be the primary threat to Yellow Rails. Commercial development has contributed to losses and degradation of wet meadows and wetlands used by breeding and migrating Yellow Rails. The coastal wetlands in the rail's winter habitat have also been damaged and destroyed by commercial development, and invasive species such as nutria (Bart 2006, Butcher et al. 2007).

Collision

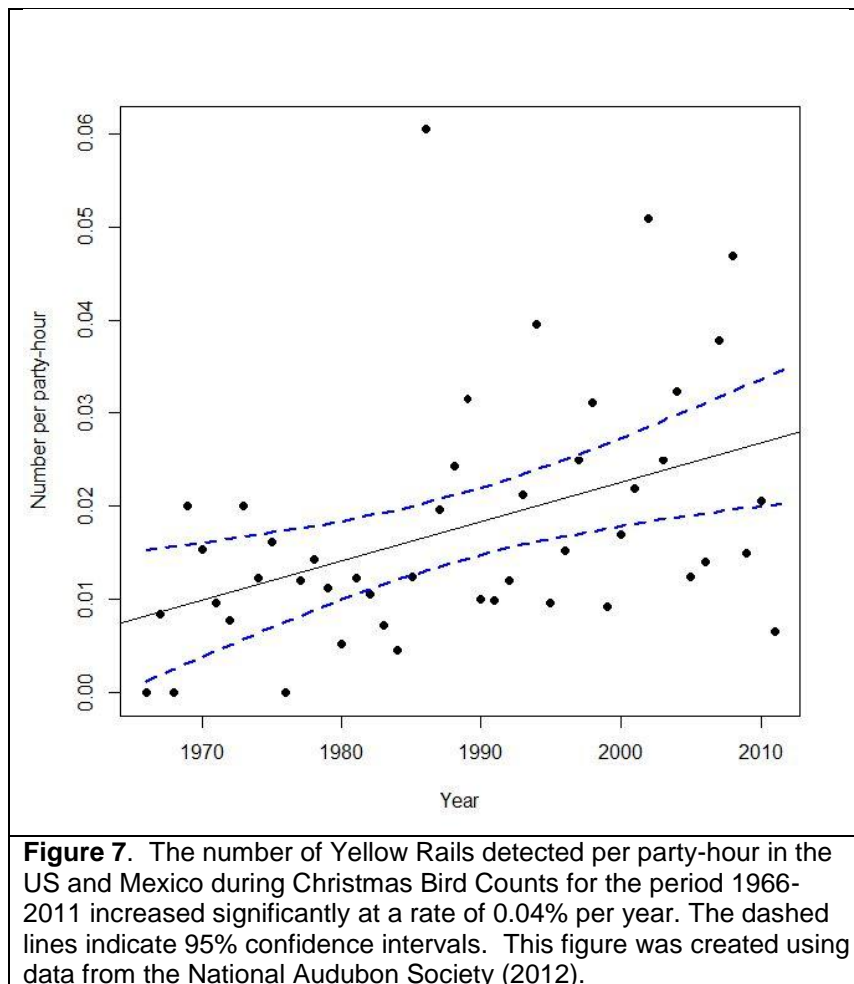
Yellow Rails regularly strike TV towers. Multiple fatal collisions have been reported at the WIBW-TV tower near Topeka, Kansas (Swan and Thompson 1997). Yellow Rail TV-tower collisions have also been reported in Illinois and Texas (Pulich 1961, Seets and Bohlen 1977). In several cases multiple Yellow Rails were killed overnight during nocturnal migration (Pulich 1961, Seets and Bohlen 1977). The height at which the birds are striking the tower has not been reported.

Pesticides and Contaminants

Chemical analyses of tissues have not been reported, and there is no indication that pesticide and/or chemical runoff in marshes has affected Yellow Rails (Bookhout 1995).

Habitat Loss and Degradation

Wetland degradation and loss at breeding and wintering grounds is probably the most significant factor affecting Yellow Rails (Bookhout 1995, Taylor 1998). The rate of wetland loss soared in the 20th century; however, legal protection has stabilized the rate of wetland loss in the 21st century (Dahl 2011).



Effects of Climate Change

The sensitivity score for the Yellow Rail on the Climate Change Sensitivity Database is “Medium” (Tomasevic 2010a) and Gardali et al. (2012) suggest that it is vulnerable to the effects of climate change in California. Wintering Yellow Rails in California are predicted to be at high risk of a loss of suitable habitat, high risk of extreme weather events, and exhibit a high degree of habitat specialization (Gardali et al. 2012). It is possible that the range of Yellow Rails may be shifting north. Although calling Yellow Rails were located at four sites in Maine in 1990 (Gibbs et al. 1991), Yellow Rails have not recently been reported there during the summer (M. Mills, Jr., *pers. comm.*). Yellow Rails have also recently been recorded in British Columbia during the summer (British Columbia Breeding Bird Atlas 2011). The apparent disappearance of this species from the southeastern portion of their range (i.e. Maine) in conjunction with the discovery of breeding birds at the northwestern edge of their range may indicate a range shift to the northwest. In addition, Yellow Rails have recently been documented overwintering in Oklahoma, approximately 300 km from the Gulf Coast (Butler et al. 2010, 2011), considerably further north than they had previously been documented.

Effects of Energy Development

Yellow Rail habitat consists of wet meadows, interior wetlands, and coastal wetlands, and activities that degrade this habitat may have a negative impact on this species. Wind turbines may pose a risk to Yellow Rails during nocturnal migration, but there is insufficient data to assess the impacts of wind farms.

Conservation

The Yellow Rail was designated as a Species of Special Concern by the Committee on the Status of Endangered Wildlife in Canada in April, 1999. The status was reconfirmed on November 2001 and November 2009 (Committee on the Status of Endangered Wildlife in Canada 2012b). They are on the Audubon Society's Red WatchList (Butcher et al. 2007) and are considered “Vulnerable” or a “Species of Special Concern” in most of the states where breeding occurs (Grace et al. 2005).

Conservation and population assessment are confounded by the lack of recaptured banded individuals. Although 1717 Yellow Rails had been banded through the end of 2012, there has been only a single recovery (Bird Banding Laboratory 2013).

Completed and Ongoing Conservation Actions

Burning has been done at Seney NWR, Michigan to set back woody encroachment in sedge meadows.

TABLE 3. Yellow Rail status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for “International Union for Conservation of Nature”, ABC is an abbreviation for “American Bird Conservancy”, and “PIF” is an abbreviation for “Partners in Flight”. A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, “Secure” species have no immediate conservation issues, “Potential Concern” species have smaller populations or ranges or at higher rates of population declines, “Vulnerable” species deserve conservation attention, and “At Risk” species need more urgent conservation attention. The “Birds of Conservation Concern” row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	At Risk
Birds of Conservation Concern	National, BCR 9, BCR 11, BCR 12, BCR 14, BCR 17, BCR 23, BCR 25, BCR 26, BCR 27, BCR 31, BCR 32, BCR 37, USFWS Region 1, USFWS Region 2, USFWS Region 3, USFWS Region 4, USFWS Region 5, USFWS Region 6, USFWS Region 8
PIF	-

TABLE 4. Yellow Rail status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for “Species of Greatest Conservation Need”. A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G4	-	-	-	-
Region 6		-	-	-	-
Montana	S3	-	-	Species of Concern	Species of Concern
North Dakota	S2	-	-	-	Level I
South Dakota	-	-	-	-	-
Wyoming	-	-	-	-	-
Colorado	-	-	-	-	-
Utah	-	-	-	-	-
Nebraska	-	-	-	-	-
Kansas	-	-	-	-	-

Upland Sandpiper (*Bartramia longicauda*)

Summary

- These relatively large, streaky shorebirds are a common sight in grassy areas, far from any shoreline. Upland Sandpipers are dependent upon dry grasslands and may be used as “indicator” species to assess prairie quality.
- Upland Sandpipers breed from Canadian Maritime Provinces south to Virginia and west to Alberta and Oklahoma. There are isolated populations in Alaska, the Yukon, the Northwest Territories, British Columbia, Oregon and Idaho (nearly gone, *ibid*). They winter in South America east of the Andes Mountains, from Suriname south to central Argentina.
- 350,000 individuals are thought to breed in North America.
- Endangered in Connecticut, Delaware, Illinois, Indiana, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Rhode Island, and Washington. Threatened in Maine, New York, Ohio, Vermont and Virginia. In Region 6 Upland Sandpipers are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in North Dakota, South Dakota, Colorado and Utah. Listed as a Level II / Tier II species (i.e. a species in need of conservation) in Region 6 in Montana, Wyoming and Kansas.
- Since 1966, the number of Upland Sandpipers observed on Breeding Bird Surveys has increased by 0.5% annually.

Legal Status

See Tables 5 and 6.

Description

The Upland Sandpiper is a medium-sized sandpiper measuring 280-320 mm in length and weighing from 97 to 226 g. Adults are predominately dull olive-buff with white underparts. The narrow neck and small head create a distinctive body shape and silhouette. The cryptic plumage is very effective in its prairie habitats (Houston et al. 2011).

Distribution

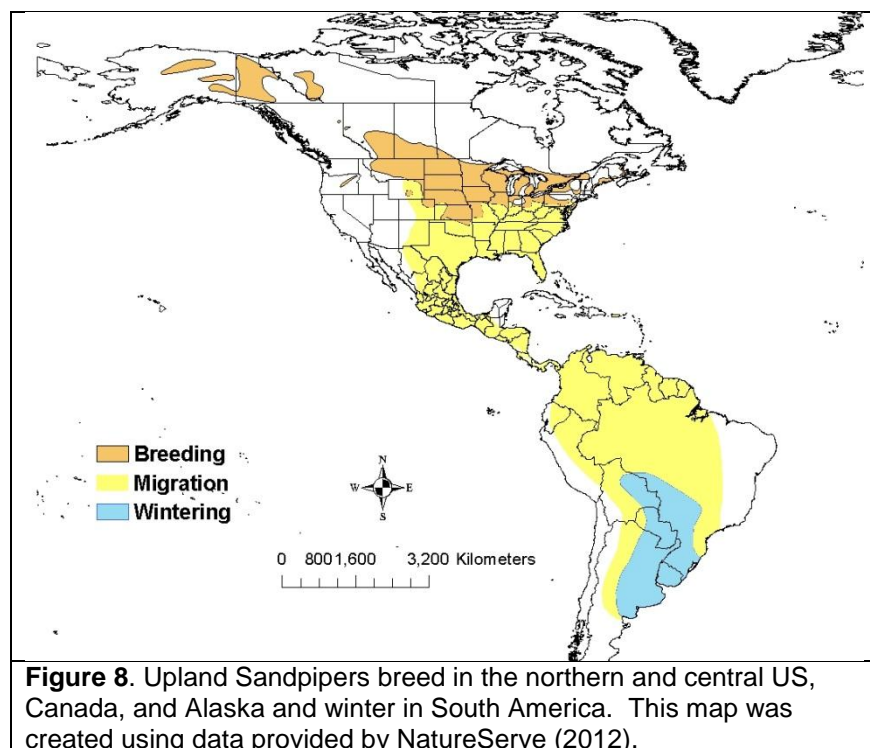
Rangewide

Upland Sandpipers breed from Canadian Maritime Provinces south to Virginia and west to Alberta and Oklahoma. There are isolated populations in Alaska, the Yukon, the Northwest Territories, British Columbia, Oregon and Idaho. They formerly bred in Washington (Wahl et al. 2005). They winter in South America east of the Andes Mountains, from Suriname south to central Argentina (Houston et al. 2011; Figure 8). During the winter, Upland Sandpipers are most frequently encountered in the pampas of South America (Mollhoff 2001).

Region 6

Colorado: Upland Sandpipers are a common summer resident on the plains in northeast Colorado. They also breed in Weld County. Historically, this species bred west to the Barr Lake area of Adams County until 1908 and in western Arapahoe County until 1924. Although Upland Sandpipers are classified as very rare spring and fall migrants, they may be more common than currently assessed as they migrate at night leading to decreased detectability. Upland

Sandpiper habitat in Colorado includes tallgrass sandhill prairie and wet meadows. Migrants have been observed in shortgrass prairie and agricultural fields (Andrews and Righter 1992).



Kansas: The Upland Sandpiper is a locally common migrant and an uncommon to common summer resident in Kansas (Janzen 2007, Thompson et al. 2011). Upland Sandpipers typically begin arriving by 4 April in southeastern Kansas and 17 April in northeastern Kansas. Birds begin migrating south in early July and most have departed by late August, although individuals have lingered as late as 13 October (Thompson et al. 2011). Although less common during the breeding season in the western half of the state (Thompson et al. 2011), Upland Sandpipers

are a common migrant in this area during July and August and are often heard at night (Andrews and Righter 1992).

Montana: Upland Sandpipers are a common breeding resident east of the Continental Divide, but breeding birds are rare west of the Divide (Montana Bird Distribution Committee 2012, J. Marks, *pers. comm.*). Upland Sandpipers historically nested on Kleinschmidt Flat near Ovando, but they have not been recorded at that location since the 1950s and 1960s. (J. Marks, *pers. comm.*).

Nebraska: Upland Sandpipers are a common breeding resident and migrant throughout the state. They are most common on the large patches of pristine prairie at the Sandhills (Mollhoff 2001). They are less common in the more intensively cultivated southeastern portion of the state (south of the Platte River; Sharpe et al. 2001). Conversion of prairie to agricultural production has reduced the amount of suitable breeding sites (Ducey 1988, Sharpe et al. 2001). The second Nebraska breeding bird atlas found that the number of detections was similar to the 1984-1989 breeding bird atlas, but that Upland Sandpipers were now breeding in corn stubble and corn fields and at least some birds were able to successfully fledge young due to current no-till agricultural practices (W. Mollhoff, *pers. comm.*).

North Dakota: Historically, the Upland Sandpiper was a very common breeding species throughout North Dakota in the 1800s. Populations declined in the early 1900s due to the conversion of prairie to agricultural land. Currently, it is listed as a common summer breeding resident (Stewart 1975).

South Dakota: This species is a common and widespread breeding resident in South Dakota. Nests have been observed in every county and breeding birds are only absent at the higher elevations of the Black Hills (South Dakota Ornithologists' Union 1991, Peterson 1995).

Utah: Upland Sandpipers are accidental in Utah (Utah Birds Records Committee 2012).

Wyoming: Most Upland Sandpipers in Wyoming are found in the mixed-grass prairie of Natrona County and Carbon County. Upland Sandpipers are very rare in the western half of the state, and records in Teton County, Park County, and Big Horn County are presumably migrants. Upland Sandpipers probably leave Wyoming in August after the young fledge (Faulkner 2010).

Biology

General

Upland Sandpipers typically leave their wintering grounds in South America from February through April (Houston et al. 2011). The peak of spring migration in Oklahoma is in early April and Upland Sandpipers generally begin arriving on breeding grounds in North Dakota, Minnesota, Wyoming and the Canadian Prairies in early May (Skagan et al. 1999, Faulkner 2010, Houston et al. 2011). Upland Sandpipers typically remain on their breeding grounds for four months (or less) before migrating south (Houston et al. 2011).

Upland Sandpipers inhabit a variety of grassland habitats including shortgrass prairie, mixed-grass prairie, tallgrass prairie, pasture, and agricultural land (Agnew et al. 1986, Sharpe et al. 2001). They feed primarily upon small invertebrates (McAtee and Beal 1912).

Breeding

Upland Sandpipers in late spring and through the summer will often perch on tall structures (such as fence posts) and vocalize. This species is well-known for its "wolf-whistle" call (Sharpe et al. 2001).

In North Dakota, the breeding season occurs from mid-May to late August and peaks from late May to early July. The majority of nests are situated in native prairie species. Clutch size averages 4 eggs (Stewart 1975). In Montana, eggs are usually laid from mid-May to mid-June (J. Marks, *pers. comm.*). Nests are constructed as a shallow, grass-lined cup constructed in or near a clump of grass (Mollhoff 2001). In South Dakota, breeding occurs from 24 May to 16 June (Peterson 1995).

Wintering

Upland Sandpipers may be present for up to seven months of the year on their wintering grounds (Houston et al. 2011). The numbers of Upland Sandpipers observed in Argentina have declined substantially since the late 19th century (Houston et al. 2011).

Habitat

Breeding

Upland Sandpipers prefer upland prairies with native grass species, but they will also use agricultural fields (especially soybeans), grazed pasture, hayfields, fallow cropland, and mowed medians along roads, powerlines, and railroads (Stewart 1975, Houston et al. 2011). Optimal habitat consists of grasses ranging from 30 to 60 cm tall (Mollhoff 2001) and they may be considered an "indicator species" for high-quality native prairie (Shriver et al. 2005). Migrating flocks will often stopover in mowed hay fields in late July and early August (Janzen 2007).

Wintering

Upland Sandpipers are typically found in grasslands on their wintering grounds but will also use agricultural fields (Houston et al. 2011). Little has been published about winter habitat selection (Houston et al. 2011).

Population Trends and Estimates

Morrison et al. (2006) estimated the number of Upland Sandpipers in North America is estimated to be 350,000 (Morrison et al. 2006) and Igl and Johnson (1997) estimate that there were 198,000 individuals in North Dakota. However, Andres et al. (in press) estimated the 2012 population to consist of 750,000 birds. Although Upland Sandpipers are declining in the eastern portion of their range, they are increasing in the Great Plains area (Figure 9). For the period 1966-2010, observations of Upland Sandpipers for the Breeding Bird Survey have showed a significant annual increase of 0.5% (Table 6). Within Region 6, BBS data suggest that Upland Sandpipers significantly increased by a rate of 0.8% annually during this period. Significant statewide increases were observed in Nebraska (2% per year) and Wyoming (7% per year).

Population trends on the wintering grounds were not estimated due to the limited number of Christmas Bird Counts in South America.

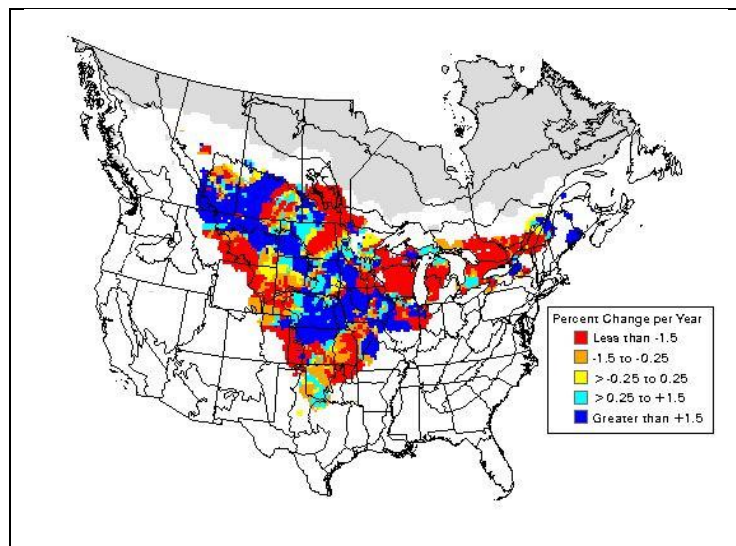


Figure 9. Map of percent change per year in the number of Upland Sandpipers detected during the Breeding Bird Survey for the period 1966-2010 from Sauer et al. (2011). Detections are generally declining at the southern and eastern edge of their range but increasing at the core.

Threats

Upland Sandpipers are listed as Endangered in Connecticut, Delaware, Illinois, Indiana, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Rhode Island, and Washington. They are considered to be Threatened in Maine, New York, Ohio, Vermont and Virginia. In Region 6, they are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in North Dakota, South Dakota, Colorado and Utah. Upland Sandpipers are listed as a Level II / Tier II species (i.e. a species in need of conservation) in Region 6 in Montana, Wyoming and Kansas.

A major cause for the decline of Upland Sandpipers is the conversion of native prairie and wet meadows to cropland (Sharpe et al. 2001). Hay-harvesting operations before July have been noted as a threat to nestlings (Mollhoff 2001). Wahl et al. (2005) also note that infestations of spotted knapweed (*Centaurea stoebe*) likely decreased the amount of suitable habitat.

Effects of Climate Change

The sensitivity score for the Upland Sandpiper on the Climate Change Sensitivity Database is "Medium" (Tomasevic 2010b). The possible effects of climate change on Upland Sandpipers have not been specifically investigated. In general, it is expected that USFWS Region 6 will experience an average increase of 4-9 °C by the end of the century (Christensen et al. 2007). Increasing temperatures and more severe regional droughts will lead to a forest

dieback where forests border prairies (Wyckoff and Bowers 2010), which should cause prairies to shift north. The ability of Upland Sandpipers to shift their breeding distribution in response may be affected by future agricultural practices, changes in land use, and other factors that may reduce the amount of suitable prairie.

Effects of Energy Development

It is estimated that the cumulative footprint of energy development in the western US may exceed 20.6 million hectares by 2030 (McDonald et al. 2009) and it has been predicted energy development could directly or indirectly affect up to 18% of the land area in western North America (Copeland et al. 2011). Chronic noise from energy developments could potentially depress local populations of birds (Bayne and Dale 2011) although this has apparently not been studied in Upland Sandpipers. Likewise, many grassland bird species avoid manmade structure in prairie settings (Bayne and Dale 2011) although this has also not been studied in Upland Sandpipers. Courtship flights of both sexes which may extend skyward several hundred feet bring adults well into the rotor sweep zone of most large wind turbines (S. Jones *pers. comm.*, R. Russell *pers. comm.*).

Management

Mong (2005) has recommended that large grasslands (>1000 ha) be maintained as a mosaic with different disturbance regimes (e.g., burning, grazing, etc.). Controlled burning every three years may help reduce invasion by shrubs (Kirsch and Higgins 1976). The species has disappeared from several protected sites in Minnesota and Illinois when grazing was eliminated (S. Jones, *pers. comm.*).

Conservation

Although the Upland Sandpiper has lost portions of its breeding habitat to agricultural development, it is afforded some protection by the size of its breeding range. Conservation efforts should assess the status of its wintering range in South America to determine which habitat is the limiting factor on populations.

Completed and Ongoing Conservation Actions

The goal for the 2001 U.S. Shorebird Conservation Plan is to increase the number of Upland Sandpipers to 470,000 individuals (Brown et al. 2001). However, given the latest population estimate of 750,000 individuals (Andres et al. in press), the objective ratio for this species should be raised to 1,005,000 individuals (B. Andres *pers. comm.*). At a more local scale, there have been a number of conservation actions aimed at maintaining local populations. For example, the Massachusetts Military Reservation on Cape Cod does not mow from March through July in order to avoid disturbing nesting Upland Sandpipers (Abraham 1999).

TABLE 5. Upland Sandpiper status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for “International Union for Conservation of Nature”, ABC is an abbreviation for “American Bird Conservancy”, and “PIF” is an abbreviation for “Partners in Flight”. A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, “Secure” species have no immediate conservation issues, “Potential Concern” species have smaller populations or ranges or at higher rates of population declines, “Vulnerable” species deserve conservation attention, and “At Risk” species need more urgent conservation attention. The “Birds of Conservation Concern” row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	Potential Concern
Birds of Conservation Concern	National, BCR 4, BCR 10, BCR 11, BCR 12, BCR 13, BCR 14, BCR 17, BCR 18, BCR 19, BCR 20, BCR 21, BCR 22, BCR 23, BCR 27, BCR 28, BCR 30, BCR 37, USFWS Region 2, USFWS Region 3, USFWS Region 5, USFWS Region 6
PIF	-

TABLE 6. Upland Sandpiper status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for “Species of Greatest Conservation Need”. A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G5	0.5% (0.0, 1.1%)	1.2% (-0.1, 2.5%)	-	-
Region 6	-	0.8% (0.3, 1.4%)	1.1% (-0.2, 2.5%)	-	-
Montana	S4	1.9% (-0.2, 4.0%)	3.2% (-1.7, 9.3%)	-	Tier II
North Dakota	-	0.8% (-0.3, 1.9%)	0.9% (-2.1, 3.5%)	-	Level I
South Dakota	S5	0.4% (-0.6, 1.3%)	0.3% (-2.1, 2.8%)	-	Level I
Wyoming	S3	7.0% (4.1, 9.9%)	6.3% (-0.1, 10.9%)	-	Tier II
Colorado	S3	-2.8% (-6.8, 1.5%)	6.5% (-5.1, 21.5%)	-	Tier I
Utah	S1	-	-	-	Species of Greatest Conservation Need
Nebraska	S5	2.0% (0.6, 3.2%)	2.5% (0.1, 5.4%)	-	-
Kansas	S4	-0.9% (-1.9, 0.2%)	-0.9% (-3.8, 2.0%)	-	Tier II

Short-eared Owl (*Asio flammeus*)

Summary:

- Short-eared Owls are brownish with a streaky breast and a white belly. These owls may be active during the day and/or at night. If the density of prey is sufficiently high, Short-eared Owls may occasionally gather into loose flocks.
- Short-eared Owls are one of the most widespread owl species in the world, with a range that includes North America, South America, Europe, Asia, and Africa. In North America, Short-eared Owls breed from Virginia (rarely) west to California and north to northern Alaska and northern Labrador. They winter from southern Canada south to Florida and northern Mexico. Short-eared Owls may be nomadic depending on the local prey population.
- Habitat loss has caused declines in many portions of their range. In Canada, for example, 23% of the Canadian population of Short-eared Owls have disappeared during the last decade.
- The Canadian population of Short-eared Owls is estimated to consist of 350,000 individuals, while the United States population is estimated to consist of 700,000 individuals. Breeding Bird Survey data show a rangewide decreasing trend of -2.5% annually from 1966-2010. The Christmas Bird Count data likewise shows a decline (0.03% annually) in the number of Short-eared Owls detected, after controlling for the number of observers. However, site-specific surveys such as the Breeding Bird Survey and the Christmas Bird Count were not designed to track changes in nomadic species.

Legal Status:

See Tables 7 and 8.

Description

Short-eared Owls are medium sized owls, 34-42 cm in length and weighing 200-450 g (Duncan 2003, Weick 2006, Wiggins et al. 2006). They are brown, streaked owls with pale buffy color below, and are well camouflaged for a grassland environment (Duncan 2003, Wiggins et al. 2006). Females are larger and have darker and heavier chest streaking (Duncan 2003, Wiggins et al. 2006, Committee on the Status of Endangered Wildlife in Canada 2008). Juveniles look similar to adult owls, but have lighter plumages and brown eyes (Wiggins et al. 2006, Committee on the Status of Endangered Wildlife in Canada 2008). Short-eared Owls have yellow eyes, a black bill, and black orbits (Duncan 2003). They have good eyesight and hearing. Their ears are positioned asymmetrically to be able to localize sounds (Johnsgard 2001).

Johnsgard (2001) and Duncan (2003) call the flight pattern of the Short-eared Owl “moth-like”. They usually hover closely to the ground in order to catch prey, but will occasionally perch or fly at greater heights (Backhouse 2008).

Short-eared Owls are crepuscular, active at dawn and dusk (Bent 1961, Wiggins et al. 2006). They are distinguishable from Long-eared Owl by time of activity (though this may vary by location and season), shorter ear tufts, and larger size (Wiggins et al. 2006).

There are 10 recognized subspecies, but only two are present in North America (Wiggins et al. 2006). The main subspecies, *Asio flammeus flammeus*, is similar to the subspecies *A. f. domingensis* that is an uncommon visitor to Florida, but has longer wings, smaller bill, shorter tarsus, more tawny coloring, and highly feathered toes (Wiggins et al. 2006).

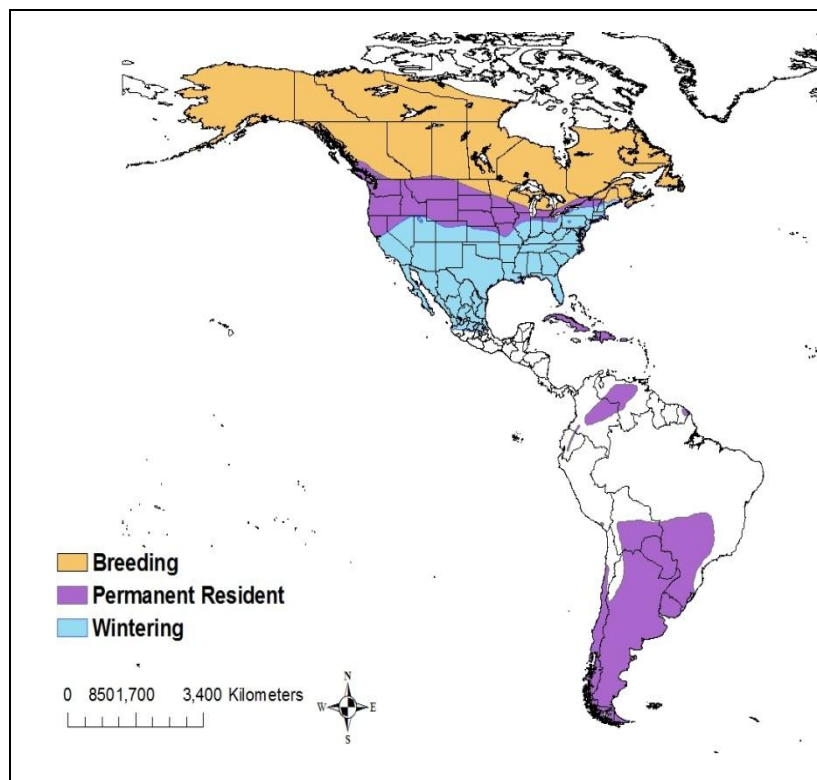


Figure 10. Short-eared Owls are widespread, occurring in Canada during the breeding season, the northern United States year-round, and the southern United States and Mexico during winter. This map was created using data provided by NatureServe (2012).

Distribution

Rangewide

Short-eared Owls have are found in North America, South America, Europe, Asia and Africa (Lynch 2007, Backhouse 2008). South of the United States, Short-eared Owls reside in southern South America, Columbia, Venezuela, Ecuador, French Guiana, Cuba, Haiti, the Dominican Republic, and Puerto Rico. In North America, Short-eared Owls breed from Alaska south to California east to Virginia and northern Labrador (Wiggins et al. 2006, Backhouse 2008; Figure 10). They winter from southern Canada south to northern Mexico. Populations fluctuate depending on prey availability (Duncan 2003, Wiggins et al. 2006). The species is a very local breeder in the southern portion of its breeding range east of the

Dakotas and has disappeared from many former haunts due to intensive agricultural development and loss of grasslands.

Region 6

Colorado: Breeding Short-eared Owls are found primarily on the northern plains in Colorado but are very sparse (Kingery 1998). In south-central Colorado, the Monte Vista and Alamosa National Wildlife Refuges have nesting Short-eared Owls (Chipley et al. 2003), and breeding Short-eared Owls have also been reported from San Luis Valley and North Park (Kingery 1998). Breeding may occasionally occur elsewhere in Colorado in areas of suitable habitat (Kingery 1998). Short-eared Owls are more common and widespread in Colorado during the winter (Kingery 1998).

Kansas: Short-eared Owls disappeared from the eastern 1/3 of Kansas during the 20th century (Busby and Zimmerman 2001) and are now considered a rare resident in central and western Kansas (Thompson et al. 2011). During winter, Short-eared Owls become uncommon to common in grasslands and marshy areas (Chipley et al. 2003, Thompson et al. 2011).

Montana: Short-eared Owls are uncommon to fairly common permanent residents in suitable habitat throughout Montana (Lambeth 1993, Chipley et al. 2003, Montana Bird Distribution Committee 2012, J. Marks, *pers. comm.*)

Nebraska: Short-eared Owls are sparse, rare breeders in suitable habitat in Nebraska (Ducey 1988, Sharpe et al. 2001) and their status has not changed since the 1984-1989 breeding bird

atlas (W. Molhoff, *pers. comm.*). Short-eared Owls are more uncommon during the winter but can be found across the state (Sharpe et al. 2001, Chipley et al. 2003, Wiggins et al. 2006).

North Dakota: In North Dakota, Short-eared Owls are common in the Northwestern Drift Plain and Missouri Coteau regions, but uncommon in other regions (Stewart 1975, Chipley et al. 2003). Stewart (1975) states that Short-eared Owls were formerly more common in the state prior to extensive habitat losses. Short-eared Owls winter primarily in the southern half of the state (Wiggins et al. 2006).

South Dakota: In South Dakota, Short-eared Owls are present year-round across much of the state but are absent from the Black Hills region and the southeastern portion of the state (South Dakota Ornithologists' Union 1991, N. Drilling *pers. comm.*). They are rare breeders in the northeast and are more common breeders in the western half (South Dakota Ornithologists' Union 1991, Chipley et al. 2003, Wiggins et al. 2006).

Utah: Short-eared Owls are uncommon permanent residents in Utah (Utah Birds Record Committee 2012) but suitable habitat for breeding Short-eared Owls is restricted to western Utah where it is patchily distributed (USDI National Biological Service and Utah State University 1999).

Wyoming: In Wyoming, it is a resident, scattered throughout all portions of the state, but breeding is local and irregular (Faulkner 2010, Wyoming Game and Fish Department 2010).

Biology

General

The number of Short-eared Owls in a given area depends upon prey density, primarily voles and other small mammals (Dechant et al. 2001, Wiggins et al. 2006). Because of changes in rodent abundance, numbers at any given location will vary year-to-year (Dechant et al. 2001, Duncan 2003, Wiggins et al. 2006). In addition to small mammals, Short-eared Owls will occasionally consume small birds (Bent 1961, Johnsgard 2001).

Breeding

Short-eared Owls typically nest on the ground, using the surrounding grass and weeds for nesting materials (Bent 1961, Busby and Zimmerman 2001, Lynch 2007). However, they will occasionally nest in trees (Backhouse 2008). The nest is created by making a depression a few inches deep rather than burrowing into the ground (Lynch 2007). Site fidelity is low (Johnsgard 2001, Wiggins et al. 2006). Clutch size is 5 – 11 eggs with a mean of 5.6. Studies of hatching success in the northern United States and Canada ranged from 3.4 – 7.5 young per nest. Montana nests had 74% hatching success while North Dakota and South Dakota had 100% hatching success (Wiggins et al. 2006).

There is a high mortality rate for first year birds, but mortality decreases as the owls age (Johnsgard 2001). Longevity is usually around four years in the wild in North America. However, there is a European longevity record of 12.9 years (Wiggins et al. 2006).

Wintering

In winter, Short-eared Owls tend to roost communally (Duncan 2003). Whether they return to the same wintering sites for multiple years needs further investigation (Wiggins et al. 2006).

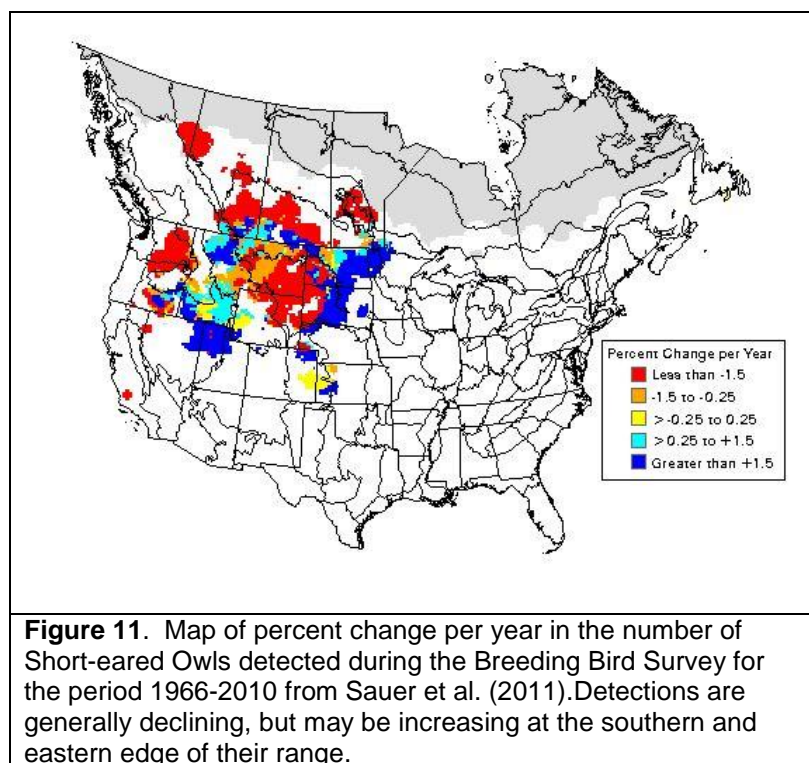
Habitat

Breeding

Short-eared Owls breed in grasslands, often on the ground (Dechant et al. 2001, Weick 2006, Thompson et al. 2011). They may utilize prairies, meadows, marshes, savanna, heathlands, shrublands, crop-fields, tundra and even open woodlands (Busby and Zimmerman 2001, Wiggins et al. 2006). Because numbers of Short-eared Owls depend upon prey density, they typically choose suitable habitat with high concentrations of small mammals, primarily *Microtus* voles (Dechant et al. 2001, Wiggins et al. 2006).

Wintering

Short-eared Owls will forage in open fields, marshes, grassland and shrubland (Wiggins et al. 2006). Short-eared Owls will also hunt for prey at gravel and mining pits (Wiggins et al. 2006, Backhouse 2008).



Population Trends and Estimates

BirdLife International (2012a) estimates a global population of 2,000,000, but suggests that this species is declining. However, population sizes fluctuate with prey availability (BirdLife International 2012a). The Committee on the Status of Endangered Wildlife in Canada (2008) estimates the Canadian population of Short-eared Owls to be 350,000 individuals, while the United States population is 700,000 individuals. Rich et al. (2004) estimates that the total North American population is 700,000 individuals. It has experienced a loss of 23% of the Canadian population in the last decade

(Committee on the Status of Endangered Wildlife in Canada 2008).

Breeding Bird Survey data show a significant rangewide decline of -2.5% annually from 1966-2010 (Sauer et al. 2011; Figure 11). Within the Prairie Pothole region, observations of Short-eared Owls for the Breeding Bird Survey showed a significant decline of 4.7% annually for the period 1966-2010 and a decline of 11.0% during the period 2000-2010 (Table 8). Christmas Bird Count data for the US and Mexico likewise show a significant decline for the period 1966-2010, albeit at a slower rate of 0.03% per year after controlling for the number of observers (linear regression, $F_{1,44} = 11.62$, $r^2 = 0.19$, $p = 0.001$, Figure 12). No change in the number of Short-eared Owls wintering in Region 6 has been observed during this period (linear regression, $F_{1,44} = 2.50$, $r^2 = 0.03$, $p = 0.12$). However, due to the nomadic nature of this species, fixed-area census such as Breeding Bird Surveys and Christmas Bird Counts may not accurately track population changes (Wiggins et al. 2006).

Threats

Short-eared Owls have historically experienced declines due to conversion of grassland habitat to agricultural lands (Thompson et al. 2011). Habitat loss on the wintering grounds may contribute the most to population decline, but habitat loss and use of pesticides also have contributed to declines in Canadian provinces (Committee on the Status of Endangered Wildlife in Canada 2008). Short-eared Owl adults and nestlings are also susceptible to fire in grassland habitats (Duncan 2003).

Effects of Climate Change

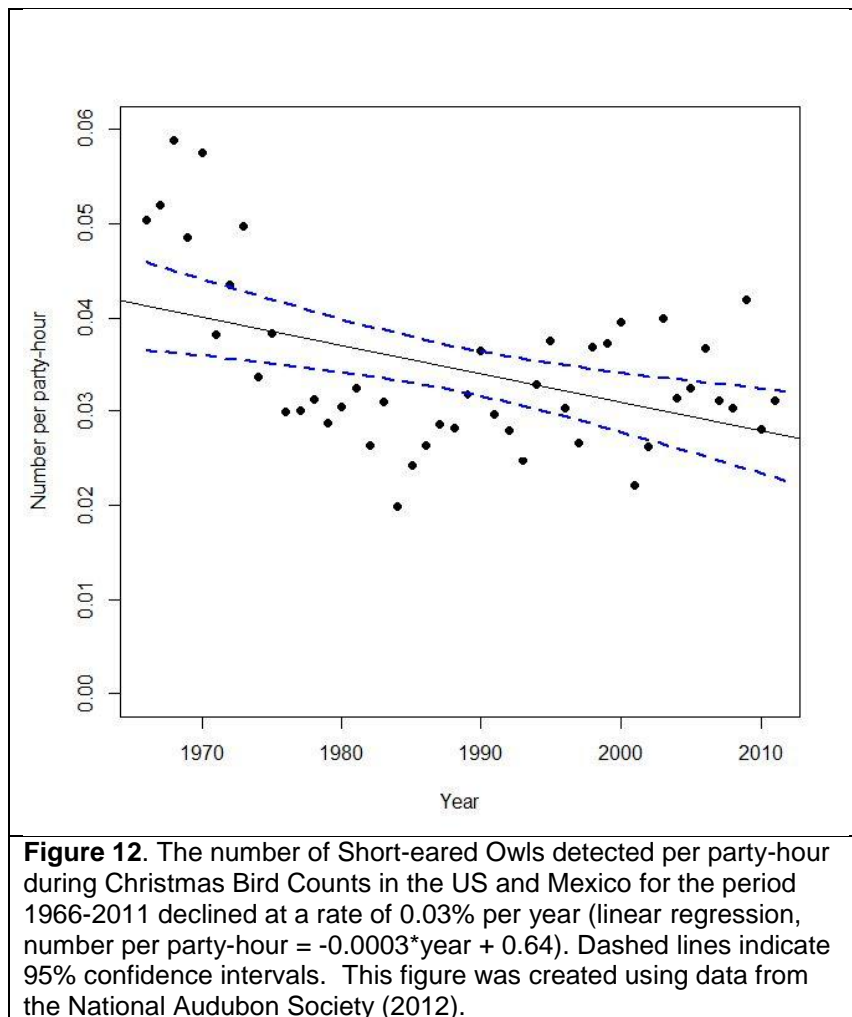
The sensitivity score for the Short-eared Owl on the Climate Change Sensitivity Database is “Medium” (Evans-Mack 2010b). Because numbers of Short-eared Owls are dependent on prey abundance and density, they are sensitive to climate change as small mammal populations may change in response to climate change (Ims and Fuglei 2005, Wildlife Conservation Society Canada 2011).

Effects of Energy Development

Short-eared Owls in Washington and Oregon accounted for 8% of all raptor fatalities due to wind energy development (Johnson and Erickson 2011). Their courtship flights take them into the rotor sweep zone of most large wind turbines (S. Jones, *pers. comm.*). Loss or degradation of high-quality habitat is another concern due to energy development (Illinois Department of Natural Resources 2007). Anthropogenic activities can cause noise disturbance that interfere with the ability of owls to detect prey using auditory cues (Barber et al. 2010).

Management

One of the problems of management and conservation strategies is fixed-location census techniques fail to adequately monitor populations of nomadic Short-eared Owls (Wiggins 2004, Wyoming Game and Fish Department 2010). Northeastern states such as Massachusetts suggest adapting survey protocol for Short-eared Owl, maintaining habitat, and monitoring predation. Montana, in conjunction with Alberta and Alaska, is conducting migratory studies using satellite tags to further understand migration and dispersal patterns (Montana Bird Conservation Partnership 2012).



Some central states suggest adapting mowing and fire regime to maintain short grasslands for Short-eared Owls (Wiggins et al. 2006). Paige and Ritter (1999) also suggest that haying should be delayed when possible to allow young birds to fledge. Paige and Ritter (1999) recommend adopting minimum till and no-till systems on agricultural land. Wiggins et al. (2006) also suggest that practices that benefit waterfowl (such as nest cover protection) will also benefit Short-eared Owls. The wet meadow habitat conservation strategy in the Nevada Bird Conservation Plan should likewise have a positive effect on Short-eared Owl numbers (Great Basin Bird Observatory 2010).

Conservation

Though Short-eared Owls are declining in portions of their range, they are considered G5, or Globally Secure (Wiggins 2004, Wiggins et al. 2006). Many declines are occurring in the northeastern United States (Backhouse 2008).

Completed and Ongoing Conservation Actions

The Conservation and Wetland Reserve Program has helped restore habitat for Short-eared Owls on private lands, as well as small mammal habitat (Wiggins et al. 2006). According to Wiggins (2004), there are no current conservation actions specifically for Short-eared Owls.

TABLE 7. Short-eared Owl status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for “International Union for Conservation of Nature”, ABC is an abbreviation for “American Bird Conservancy”, and “PIF” is an abbreviation for “Partners in Flight”. A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, “Secure” species have no immediate conservation issues, “Potential Concern” species have smaller populations or ranges or at higher rates of population declines, “Vulnerable” species deserve conservation attention, and “At Risk” species need more urgent conservation attention. The “Birds of Conservation Concern” row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	Potential Concern
Birds of Conservation Concern	National, BCR 11, BCR 13, BCR 17, BCR 22, BCR 23, BCR 24, BCR 26, BCR 29, BCR 30, BCR 37, BCR 67, USFWS Region 1, USFWS Region 3, USFWS Region 4, USFWS Region 5, USFWS Region 6
PIF	Not a US-Canada Concern Species

TABLE 8. Short-eared Owl status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for "Species of Greatest Conservation Need". A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G5	-2.5%	-4.1%	-	-
		(-6.8, -0.1%)	(-11.1, 4.1%)		
Region 6	-	-0.8%	-4.0%	-	-
		(-5.2, 2.7%)	(-12.3, 5.9%)		
Montana	S4	-1.9%	-0.9%	Potential Species of Concern	Tier III
		(-6.2, 2.1%)	(-13.0, 12.6%)		
North Dakota	-	Insufficient data	Insufficient data	-	Level II
South Dakota	S3	Insufficient data	Insufficient data	-	-
Wyoming	S2	Insufficient data	Insufficient data	-	Tier II
Colorado	S2	Insufficient data	Insufficient data	-	Species of Greatest Conservation Concern
Utah	S1	Insufficient data	Insufficient data	Special Concern	Tier II
Nebraska	S1	Insufficient data	Insufficient data	-	Tier I
Kansas	S2	Insufficient data	Insufficient data	-	Tier I

Gray Vireo (*Vireo vicinior*)

Summary

- The Gray Vireo is a drab denizen of mid-elevation mountains and is typically found in juniper/pinyon, pinyon/oak, and chaparral associations in the southwestern United States and northwestern Mexico. This species is aptly named as it is predominantly gray with pale underparts, dark wings and a white eye ring.
- It breeds in Colorado, Utah, Nevada, California, Arizona, New Mexico, Texas and Baja California Norte. Gray Vireos winter in Baja California Sur, Sonora, Coahuila, Arizona and Texas. On its wintering grounds, Gray Vireos are typically found in desert scrub.
- Breeding Bird Survey data does not indicate a significant rangewide change in the population for the period 1966-2010. However, there was a significant increase in the number of Gray Vireos detected in Arizona during this period. During the same period, the numbers of Gray Vireos detected on Christmas Bird Counts, after controlling for the number of observers, declined at a rate of 0.09% per year. Limited numbers of individuals are detected using both Breeding Bird Surveys and Christmas Bird Counts and so these results should be interpreted cautiously.
- Gray Vireos may be at risk from clearing of pinyon pines, juniper, and chaparral.

Legal Status

See Tables 9 and 10.

Description

Gray Vireos are medium-sized vireos which exhibit sexually monomorphic plumage color and pattern. Individuals average 141 mm in length and weigh 12.1 g; males are slightly larger than females. Gray Vireos have a complete white eye-ring, distinguishing it from the Hutton's Vireo (*Vireo huttoni*) which possesses an incomplete white eye-ring (Barlow et al. 1999). Gray Vireos are one of the few vireos to lack carotenoids (Cicero and Johnson 1998).

Distribution

Rangewide

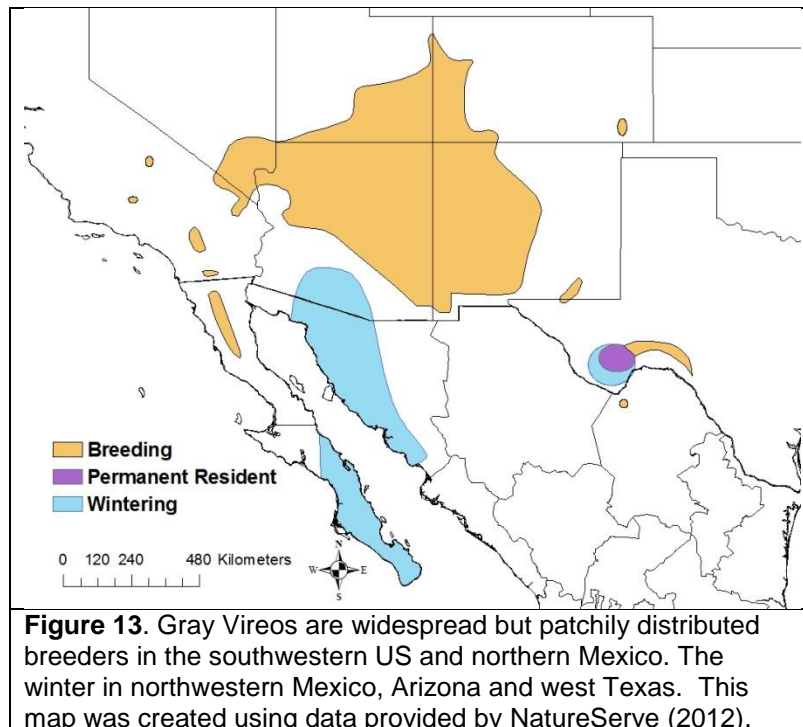
Gray Vireos breed in the montane regions and scrublands of the southwest US and northern Mexico (Figure 13). This species breeds in Colorado, Utah, Nevada, California, Arizona, New Mexico, Texas, Baja California Norte and possibly Durango (Barlow et al. 1999). Gray Vireos winter in Baja California Sur, Arizona, Sonora, and southwestern Texas (Barlow et al. 1999).

Region 6

Colorado: This species is a local summer resident in southern and western Colorado (Andrews and Righter 1992). Gray Vireos breed primarily in the western portion of the state in Rio Blanco County south to Montezuma County. A disjunct population breeds along the border of Las Animas County and Otero County (Kingery 1998, Barlow et al. 1999). This species may be more widespread than the current records indicate (Andrews and Righter 1992).

Utah: Gray Vireos breed north to the mountains of Washington County, Garfield County, Sevier County, and Grand County (Barlow et al. 1999). They are uncommon summer residents of Utah (Utah Bird Records Committee 2012).

Wyoming: Gray Vireo are a very rare summer resident of Wyoming. All Wyoming reports of Gray Vireo are from the juniper woodlands of southern Sweetwater County and the majority of those sighting occurred on the east side of Flaming Gorge Reservoir (Faulkner 2010).



Biology

General

Gray Vireos feed primarily on insects during the breeding season (Chapin 1925). Foraging occurs from the ground up to 9 m, but the majority of feeding is at 1-4 m in the inner two-thirds of bushes and small trees (Barlow et al. 1970, Barlow et al. 1999). Wintering birds have been observed eating the capsule-free fruit of the elephant tree (*Bursera microphylla*; Bates 1992a).

Gray Vireos occur in pairs during the breeding season, but are typically solitary during migration and the winter. They occasionally form small flocks prior to migration, and will briefly associate with mixed

flocks during the winter (Barlow et al. 1999).

Breeding

Migrants may begin arriving on their more southerly breeding grounds such as Big Bend, Texas and San Diego, California by late March but may not arrive on more northerly breeding grounds until early May (Kingery 1998, Barlow et al. 1999). Males sing, patrol, and fight other males to maintain their breeding territory (Barlow et al. 1999). Territories adjacent to another male's territory are generally 2-4 ha, and isolated territories may be 4-10 ha (Barlow et al. 1999). However, in Colorado, Gray Vireos require 16 ha (Kingery 1998). Males show very strong site fidelity (Barlow et al. 1999).

Gray Vireos form monogamous pairs during the breeding season, but either sex may change mates if the breeding attempt is unsuccessful or a disturbance separates the pair. Fledglings leave the nest 13-14 days after hatching (Barlow et al. 1999). Gray Vireos typically engage in a pre-basic molt before migration (Voelker 2000).

Wintering

Migrants generally depart breeding grounds by the second week of August (Garrett and Dunn 1981). They generally arrive on their wintering grounds by late September or early October (Barlow et al. 1999). Gray Vireos will defend winter territories, which average 0.9 ha in size (Bates 1992b). Their winter diet in Arizona is primarily fruit, particularly fruits of the elephant tree (Bates 1992a). However, in Texas, Gray Vireos are thought to be primarily insectivorous during the winter (Barlow et al. 1999).

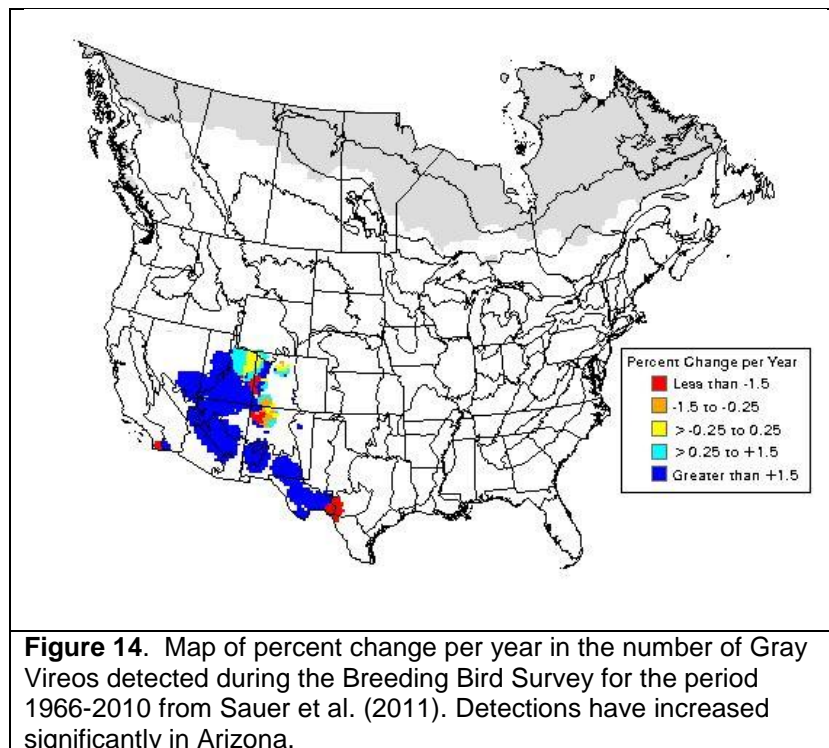
Habitat

Breeding

Gray Vireos prefer associations of juniper, pinyon, oak, and chaparral in hot, arid mountains and high plains scrubland (Barlow et al. 1999). In juniper/pinyon habitats, Gray Vireos preferred areas where junipers dominated pinyon pines (Schlossberg 2006). Gray Vireos migrate a short distance and stop at sites similar to their breeding and wintering range (Barlow et al. 1999). Gray Vireos avoid dense pinyon-juniper woodlands at higher altitudes that are occupied by other vireo species. Gray Vireos are very local and patchily distributed (Andrews and Righter 1992).

Wintering

Gray Vireos generally overwinter in desert scrub (Barlow et al. 1999).



Population Trends and Estimates

The global Gray Vireo population is estimated to contain 360,000 individuals (Rich et al. 2004). However, the accuracy of this estimate is thought to be poor (Rich et al. 2004). Populations are difficult to assess because Gray Vireos are cryptic, occur in difficult-to-access areas, and are patchily distributed. The greatest population density occurs in northern Arizona and southern Utah (Barlow et al. 1999), although it is now thought that Nevada contains over 20% of this species population (Great Basin Bird Observatory 2010). In California, the Gray Vireo is listed as a Species of Special

Concern (Coachella Valley Multi-Species HCP 2005) as the range as contracted (Barlow et al. 1999). It is listed as a Threatened species by New Mexico (New Mexico Dept. of Game and Fish 2012) where there are an estimated 418 territories (DeLong and Williams 2006).

Rangewide, there has not been a significant change in the numbers of Gray Vireos observed from 1966-2010 on the Breeding Bird Survey routes (Table 10). However, the sample size for detections is low ($n = 92$). There has been a significant increase during this time in the number of Gray Vireos detected in Arizona, where the trend is an annual increase of 4.2% (95% confidence intervals of 0.6 – 8.3%; Figure 14). However, this result is based on a low sample size ($n = 19$) and this result should be interpreted cautiously.

The number of Gray Vireos detected per party-hour during Christmas Bird Counts for the period 1966-2011 declined at a rate of 0.09% per year (linear regression, number per party-hour = $-0.0009 \times \text{year} + 1.80$; Figure 15). Again, however, this is based on a very small sample size, as only 78 birds were detected during this time period, an average of only 1.7 birds per year.

Threats

Habitat loss is the main threat to Gray Vireo, primarily due to clearing and degradation of pinyon-juniper woodlands for pasture and firewood (Butcher et al. 2007). Conversion of woodland to pasture can increase the population of Brown-headed Cowbirds (*Molothrus ater*), which parasitize Gray Vireo nests. Development, agriculture, and golf courses attract Brown-headed Cowbirds and may increase the threat to Gray Vireos. The impact of nest parasitism by Brown-headed Cowbirds on Gray Vireo populations is not well understood. Nest parasitism is low outside California, and rarely observed in Utah and Colorado, but most parasitized nests are abandoned (Barlow et al. 1999). Fire suppression may drive habitat changes that adversely affect Gray Vireos

(Coachella Valley Multi-Species HCP 2005, Butcher et al. 2007). Loss of desert wintering habitat to large-scale solar farms might be a future threat to this species in the Southwest. Use of wintering bushes and shrubs (ironwood [*Olneya tesota*], elephant tree, etc.) by the horticultural and craft industries may be an issue in Arizona and Sonora, Mexico.

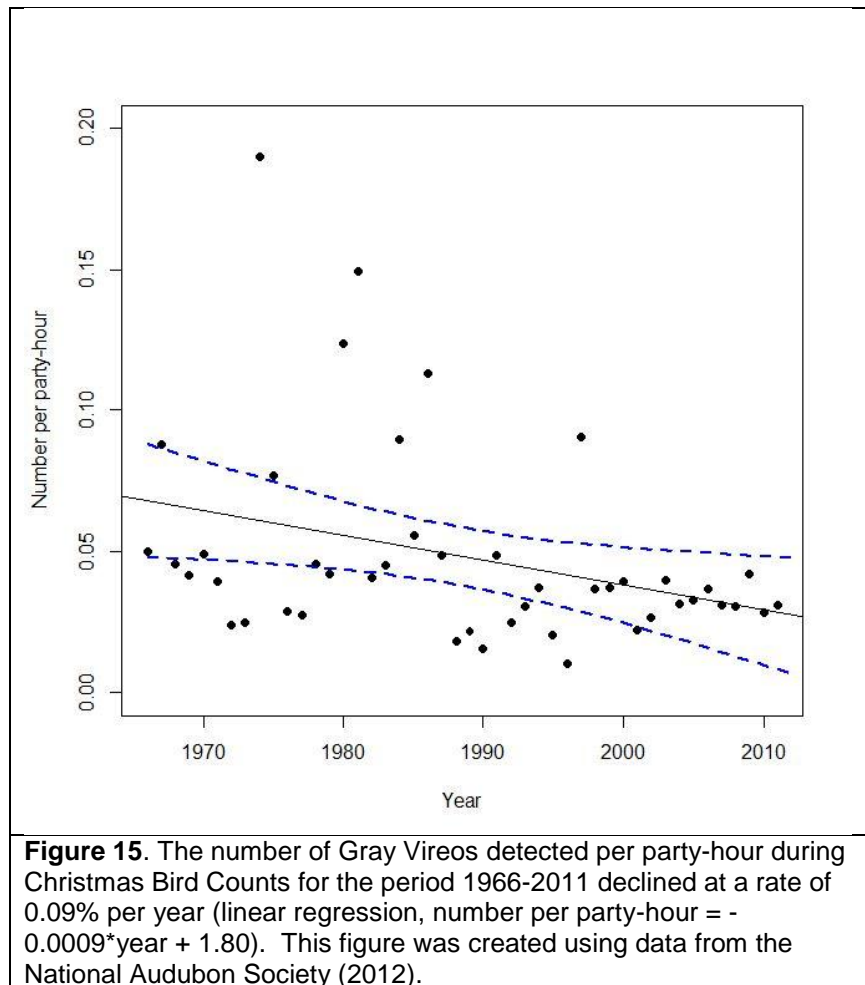
Gray Vireos may abandon nests if disturbed by humans, predators, or cowbirds. Banding will sometimes cause a breeding pair to separate, and a female has been observed forcing a banded nestling out of the nest. However, adults become less sensitive to intrusion and disturbance after laying multiple eggs. Overall, banding of adults and nestlings is not usually disruptive (Barlow et al. 1999).

Effects of Climate Change

Gardali et al. (2012) assigned the Gray Vireo a low (but not unprioritized) climate priority score, indicating that this species may be susceptible to the effects of climate change, particularly extreme weather events. Drought influences population fluctuations for many bird species in the southwestern US. Thus, inferences about the effects of climate change are difficult to make because of natural population dynamics (Cox 2010).

Effects of Energy Development

Gray Vireos avoid nesting near natural gas wells due to the noise generated from the well pad (Francis et al. 2009). The avoidance of noise suggests that oil exploration and wind turbines will fragment breeding habitat.



Conservation and Management

Partners in Flight drafted a Bird Conservation Plan in 1998 that outlines conservation objectives, recommendations, and research priorities (Butcher et al. 2007, Partners in Flight 2012). Control of Brown-headed Cowbird populations may benefit Gray Vireos. Further studies and surveys are needed to determine the exact causes of decline and the influences of Brown-headed Cowbirds and lack of prescribed burning (Coachella Valley Multi-Species HCP 2005). Management strategies should seek to preserve and maintain vegetative structure, particularly well-developed shrub understory communities (Great Basin Bird Observatory 2010). The pinyon-juniper habitat conservation strategy in the Nevada Bird Conservation Plan should benefit this species (Great Basin Bird Observatory 2010). The Nevada Bird Conservation Plan also recommends thinning pinyon-juniper habitat when closure exceeds 35% as well as when there is both the potential for developing a desirable shrub understory and a low risk of invasion by exotic weeds (Great Basin Bird Observatory 2010). Researchers should be aware of the effects of disturbance when banding during the breeding season.

Completed and Ongoing Conservation Actions

New Mexico established a state recovery plan in 2007, and has been monitoring the Gray Vireo's response to habitat restoration to ascertain the preferred vegetation and landscape structures (New Mexico Dept. of Game and Fish 2012). Gray Vireos are also an Evaluation Species for the Clark County MSHCP in Nevada (Great Basin Bird Observatory 2010).

TABLE 9. Gray Vireo status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for “International Union for Conservation of Nature”, ABC is an abbreviation for “American Bird Conservancy”, and “PIF” is an abbreviation for “Partners in Flight”. A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, “Secure” species have no immediate conservation issues, “Potential Concern” species have smaller populations or ranges or at higher rates of population declines, “Vulnerable” species deserve conservation attention, and “At Risk” species need more urgent conservation attention. The “Birds of Conservation Concern” row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	Vulnerable
Birds of Conservation Concern	National, BCR 16, BCR 20, BCR 33, BCR 34, BCR 35, USFWS Region 2, USFWS Region 6, USFWS Region 8
PIF	US-Canada Concern Species

TABLE 10. Gray Vireo status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for “Species of Greatest Conservation Need”. A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G4	1.7% (-1.2, 4.4%)	2.1% (-2.3, 6.1%)	-	-
Region 6	-	0.15% (-3.4, 3.9%)	-2.1% (-8.1, 3.3%)	-	-
Montana	-	-	-	-	-
North Dakota	-	-	-	-	-
South Dakota	-	-	-	-	-
Wyoming	-	-	-	-	-
Colorado	S2	Insufficient data	Insufficient data	-	Species of Greatest Conservation Concern
Utah	S3	0.2%	-3.0%	-	Tier III
Nebraska	-	-	-	-	-
Kansas	-	-	-	-	-

Pinyon Jay (*Gymnorhinus cyanocephalus*)

Summary:

- Pinyon Jays are endemic to western North America and have a mutualistic relationship with several pine species collectively known as pinyon pines (*Pinus* subgenus *Ducampopinus*). These birds are primarily dull blue with whitish streaks on the belly and throat. Pinyon Jays are highly social.
- Pinyon Jays are residents from southwestern South Dakota and southern Montana west to central Oregon and south to New Mexico and Baja California Norte. When pine crops fail, this species ranges widely and may turn up hundreds of miles beyond its normal range.
- It is difficult to obtain an accurate estimate of the population using conventional censusing methods, as Pinyon Jays typically occur in flocks across a large home range. Pinyon Jays have declined by approximately 75% during the last forty years and populations are continuing to decline. Breeding Bird Survey data indicate that Pinyon Jays experienced a significant rangewide decline from 1966-2010 of 4% per year. A significant decline was also noted in Region 6 during this period where observations of Pinyon Jays on Breeding Bird Surveys has also declined by 4% annually. Christmas Bird Count data likewise show a significant decline.
- Populations have declined due to the clearing of pinyon pine and the loss of suitable habitat to agriculture. Over the long-term, pinyon pine may continue to decline due to an expected increase in the intensity and severity of droughts. Clearing of pinyon pines to enhance sage grouse habitat could potentially also have a detrimental effect on this species.
- The decline of several corvid species has also been linked to the spread of West Nile virus and this may also have negatively impacted Pinyon Jay populations.

Legal Status:

See Tables 11 and 12.

Description

The Pinyon Jay is a medium-sized corvid with a mass of approximately 125 grams (Balda and Kamil 1998, Balda 2002). Pinyon Jays are uniformly blue, but females and juveniles are duller than males (Balda 2002). They are distinguishable from other jays by their shorter tails, coloring, and lack of crest (Balda 2002). Pinyon Jays tend to walk rather than hop (Balda and Kamil 1998, Marzluff and Angell 2005).

Distribution

Rangewide

Pinyon Jays are associated primarily with pine species collectively known as pinyon pines (*Pinus* subgenus *Ducampopinus*), particularly Twoneedle Pinyon (*Pinus edulis*), Singleleaf Pinyon (*P. monophylla*), and Mexican Pinyon (*P. cembroides*) in the western portion of North America from Oregon to western South Dakota, south to New Mexico, Arizona, and Baja California Norte (AOU 1998, Balda 2002). It may also breed in the extreme northwest

corner of Oklahoma (Baumgartner and Baumgartner 1992). In Region 6, Pinyon Jay occurs in Montana, Wyoming, Utah, Colorado, Nebraska, and South Dakota (Figure 16). It is a resident in

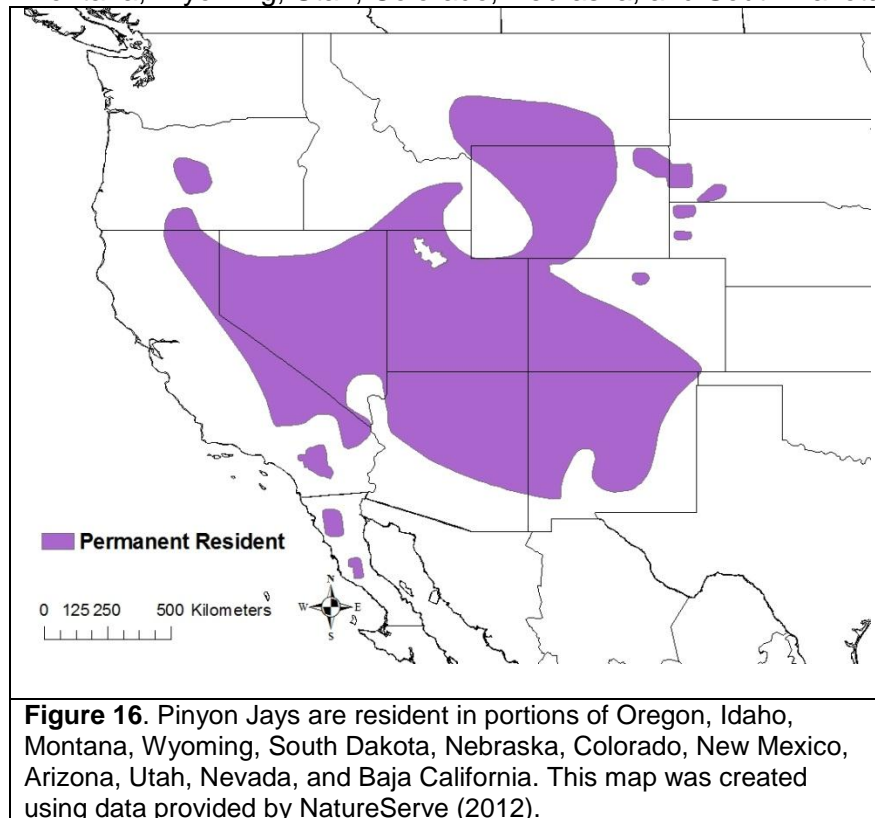


Figure 16. Pinyon Jays are resident in portions of Oregon, Idaho, Montana, Wyoming, South Dakota, Nebraska, Colorado, New Mexico, Arizona, Utah, Nevada, and Baja California. This map was created using data provided by NatureServe (2012).

these areas. On some occasions, northern populations will migrate (Balda 2002). Jays may periodically irrupt west to the Pacific coast, south into Mexico, and east into Oklahoma and Iowa, apparently in response to periodic cone crop failures (Balda and Kamil 1998, Balda 2002).

Region 6

Colorado: In Colorado, Pinyon Jay occurs commonly in central, southern and western Colorado (Andrews and Righter 1992, Wiggins 2005). It is an occasional visitor to eastern Colorado after the breeding season (Andrews and Righter 1992). In southeastern and

northwestern Colorado, Pinyon Jay thrives on juniper berries rather than pinyon pine seeds (Kingery 1998).

Kansas: In Kansas, Pinyon Jays are irregular visitors to the western portion of the state, mainly in autumn and the beginning of winter, probably due to pine cone scarcity (Thompson et al. 2011). There are no breeding records (Wiggins 2005).

Montana: In Montana, Pinyon Jays are found primarily in the south-central portion of the state (Montana Bird Distribution Committee 2012).

Nebraska: Pinyon Jays are regular in the northwestern portion of Nebraska, especially Pine Ridge (Ducey 1988). They are most commonly observed during spring and fall, and are uncommon during summer (Sharpe et al. 2001). Wintering birds have traveled as far as central Nebraska (Sharpe et al. 2001). Breeding was first confirmed in northwestern Nebraska in 1999 (W. Molhoff, *pers. comm.*). The population has remained essentially stable since this discovery, although there is some concern that recent wildfires may have reduced the amount of suitable habitat in the state (W. Molhoff, *pers. comm.*).

South Dakota: Pinyon Jays were formerly common in South Dakota's Black Hills and ranged north to the Cave Hills, Short Pines, and the Long Pines of Harding County (Peterson 1995, South Dakota Ornithologists Union, 1991, Tallman and Swanson 2002) as well as south to the Nebraska border (Sharpe et al. 2001). However, they are now considered to be very rare, local, and rapidly declining with populations in the northwestern portion of the state (Cave Hills, Short Pines, and Long Pines of Harding County) disappearing in the early 21st century (N. Drilling

pers. comm.). During the 2008-2012 breeding bird atlas, Pinyon Jays were confirmed breeding only in Meade County, although birds were also detected at Fall River County (around the town of Edgemont), Butte County, Lawrence County, and Custer County (Wind Cave National Park and Custer State Park; N. Drilling *pers. comm.*).

Utah: In Utah, Pinyon Jays are common, widespread, permanent residents throughout most of the state (Balda 2002, Utah Bird Records Committee 2012).

Wyoming: In Wyoming, Pinyon Jays in the east occupy Ponderosa Pine (*Pinus ponderosa*) stands where juniper woodlands are scarce (Faulkner 2010). Most Pinyon Jays are found in the west, where juniper habitat is also found (Faulkner 2010). They occur throughout most of the state (Wiggins 2005).

Biology

General

Corvids have an enlarged nidopallium and hippocampus in the forebrain that aids in spatial memory, learning processes, adaptation, and social structure (Marzluff and Angell 2005). Pinyon Jays cache seeds and have impressive spatial memory that allows them to find hidden food caches even after months have passed (Bednekoff et al. 1996, Balda and Kamil 1998, Balda 2002). They can recover stored seeds at a >90% accuracy rate, and will learn from mistakes they make in caching or nesting (Marzluff and Angell 2005). Pinyon Jays use a strong, sharp bill (which lacks rictal bristles) to extract pine seeds, sometimes using forked tree branches to hold the cones in place (Balda and Kamil 1998, Marzluff and Angell 2005). Pinyon Jays have an expandable esophagus which is able to hold roughly 39 pine seeds (Balda and Kamil 1998, De Kort and Clayton 2006). While Pinyon Jays prefers pine seeds, they will also consume berries, grains, insects, small reptiles and small mammals (Balda 2002).

Seed caching in these corvids is a group effort, and large flocks will store seeds in a communal area, which can amount to 4.5 million seeds per autumn (Balda and Kamil 1998). Each underground store can hold 20,000 seeds and these seeds are 70-90% of a jay's winter diet (Gould-Beierle 2000). Though pine seeds are the main component of a Pinyon Jay's diet, they are omnivorous, taking berries, fruits, nuts, and insects (Kaufman 1996).

Pinyon Jays are highly social and gregarious (Kaufman 1996, Templeton and Kamil 1999, Balda 2002, Wiggins 2005). A flock of hundreds of individuals will inhabit the home range together (Balda and Kamil 1998, Balda 2002, Dunlap et al. 2006). Pinyon Jays form pair bonds that last throughout their lifespan, which can be up to 16 years for males and 14 years for females (Marzluff and Balda 1988, Dahlin et al. 2004, Wiggins 2005, Dunlap et al. 2006). Young raised by a pair will generally stay in their natal flock (Marzluff and Balda 1988, Kingery 1998, Wiggins 2005).

Breeding

Pinyon Jays rely on food sources to breed rather than photoperiod (Brown et al. 1999). As a result, they are one of the earliest breeding birds in North America (Dunlap et al. 2006). Breeding may occur from February to May, depending on location and food source (Wiggins 2005). They breed in colonies, where many pairs will flock together (Kingery 1998). Pinyon Jays create large nests of sticks, grass, pine needles, and fur. Two to three pairs may nest in the same tree (Kaufman 1996, Kingery 1998, Balda 2002). Clutch size typically ranges from three to five eggs, and incubation is approximately 16 days (Kingery 1998). Females stay with the nest while males provide food for the females (Wiggins 2005). Nestlings are mostly provided insects

by both parents (Kaufman 1996, Wiggins 2005). Before fledging, young Pinyon Jays can be fed by any adult in the breeding colony (Kingery 1998).

Wintering

Most Pinyon Jays stay in their home range during winter, but some may utilize other areas of suitable habitat (Wiggins 2005). Rarely, jays may wander out onto the far western Great Plains in fall and winter. Presumably, this happens more frequently during low pine seed crop years (Wiggins 2005). Courtship behavior begins in the winter, sometimes as early as November, and birds may nest as early as February (Kingery 1998, Wiggins 2005).

Habitat

Because Pinyon Jays have a co-evolutionary relationship with pinyon pines, they rely heavily on the trees for food, nesting, and shelter (Kingery 1998, Balda 2002). The jays also act as a dispersal agent for pines (Balda and Kamil 1998). When Pinyon Jays cache the seeds but do not return to eat them, the pinyon pine seeds germinate (Kingery 1998). If Pinyon Pine is scarce, Pinyon Jays will sometimes forage on Ponderosa Pine (*Pinus ponderosa*; Balda and Kamil 1998).

Population Trends and Estimates

Rich et al. (2004) estimates the population consists of 4,100,000 individuals. However, it is difficult to get an accurate estimate of the population using conventional census methods, as Pinyon Jays typically occur in flocks across a large home range (Balda 2002). From the 1940s through the 1960s, pinyon pine was considered to be essentially worthless, so clearing programs were organized (Balda 2002). In response, Pinyon Jays likewise declined. This species experienced a 74.8% decline over 40 years (BirdLife International 2012b). Pinyon Jays are declining in western Colorado due to extensive pinyon pine loss (Wiggins 2005).

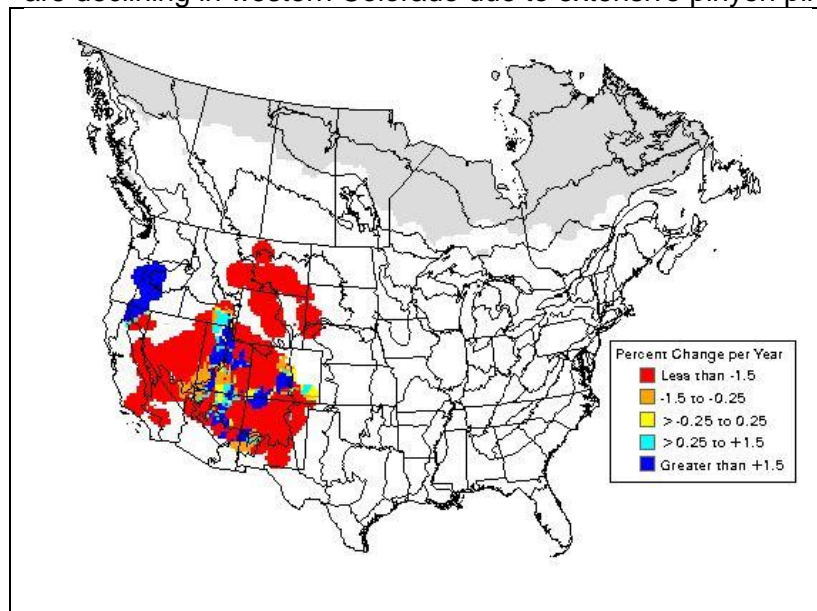


Figure 17. Map of percent change per year in the number of Pinyon Jays detected during the Breeding Bird Survey for the period 1966-2010 from Sauer et al. (2011). Detections have declined across most of their range.

According to Breeding Bird Survey data, Pinyon Jays declined significantly during 1966-2010, with populations falling at an annual rate of 4.0% (Sauer et al. 2011; Figure 17). Pinyon Jays also declined significantly in Region 6 overall and in the state of Utah during the same period (Table 12). After controlling for the number of observers, observations of Pinyon Jays during the 1966-2011 Christmas Bird Counts declined at an average rate of 2% per year (linear regression, $F_{1,44} = 18.55$, $r^2 = 0.28$, $p < 0.001$, Figure 18).

Threats

Clearing of western pinyon-juniper forests in the 1940s-1960s posed a threat to Pinyon Jays (Balda 2002). Habitat degradation for agricultural use is also a cause for population decline (Balda 2002). Altered fire regimes have negatively affected pinyon pine, which has also led to population declines in Pinyon Jays (Balda 2002, Wiggins 2005). In addition to fire, drought is a cause for concern for pinyon-juniper forests. Drought causes water stress in trees which makes them more susceptible to damage by pinyon engraver beetles (*Ips confusus*) (Wiggins 2005, Jensen 2006). In 2004, pinyon engraver beetles contributed to 15% of observed pinyon pine declines (U. S. Forest Service 2004).

Declines in several western corvids have been linked to the spread of West Nile virus (Koenig et al. 2007). The Yellow-billed Magpie (*Pica nuttalli*) has declined precipitously (Ernest et al. 2010), and declines in the Black-billed Magpie (*Pica hudsonia*), American Crow (*Corvus brachyrhynchos*), Steller's Jay (*Cyanocitta stelleri*) and Western Scrub-Jay (*Aphelocoma californica*) have also been linked to the prevalence of spread of West Nile Virus. It is possible that this disease may also reduce populations of Pinyon Jays.

Effects of Climate Change

The sensitivity score for the Pinyon Jay on the Climate Change Sensitivity Database is "Medium" (Tomasevic 2010c) while Gradali et al. (2012) assigned this an unprioritized species score, indicating that it should not be negatively affected by climate change in California. However, this may be understating the risk to this species. Warmer drought years caused pinyon pine to die off (Jensen 2006). The droughts in the mid-20th century were not as damaging as droughts in the last 12 years (Jensen 2006). Stands of pinyon pine became paler, and presumably less healthy, as droughts in the early 21st century persisted (Jensen 2006).

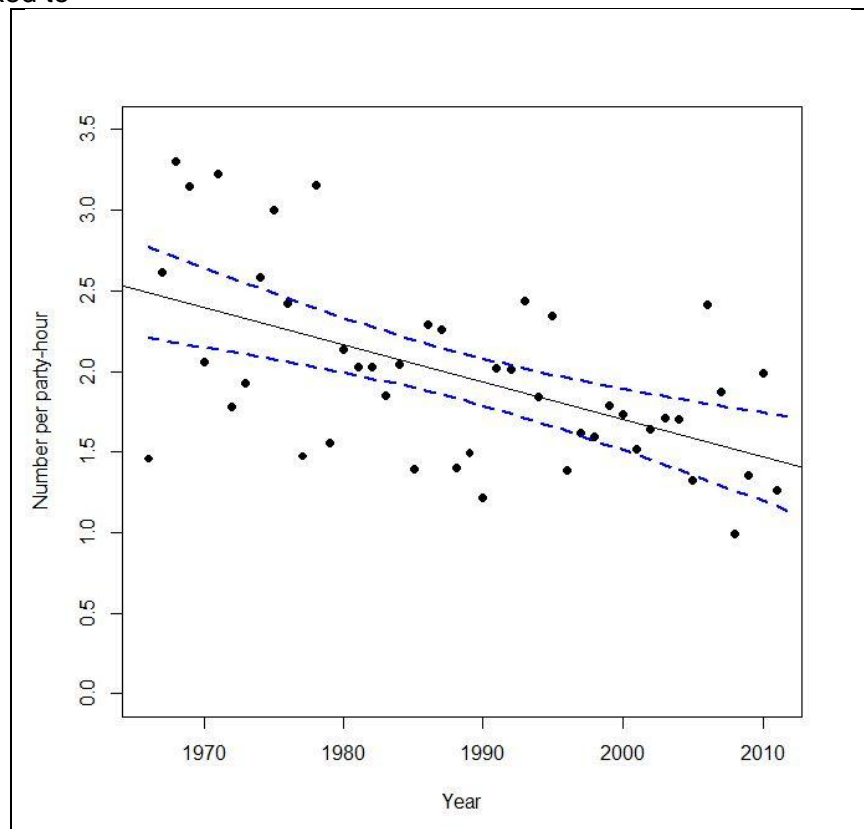


Figure 18. The number of Pinyon Jays detected per party-hour during Christmas Bird Counts for the period 1966-2011 declined at a rate of 2% per year (linear regression, number per party-hour = $-0.02 \times \text{year} + 47.96$). This figure was created using data from the National Audubon Society (2012).

Effects of Energy Development

Nothing has been published on this topic. However, energy development that results in the loss of additional pinyon pine/juniper habitat would likely exacerbate the decline in this species.

Management

An increased small-scale fire regime would benefit Pinyon Jays in pinyon pine habitats (Wiggins 2005). Small-scale controlled burns prevent large, destructive fires from damaging large portions of pinyon-juniper forests (Wiggins 2005). It would also benefit growth, regeneration and diversity of the habitat (Wiggins 2005). The Pinyon-Juniper habitat conservation strategy outlined in the Nevada Bird Conservation Plan should benefit this species (Great Basin Bird Observatory 2010). The Nevada Bird Conservation Plan also advocates mixed-age structured pinyon-juniper woodlands interspersed with a healthy shrub understory interspersed with sagebrush habitat (Great Basin Bird Observatory 2010). Removing pinyon/juniper in order to improve habitat for sage-grouse, while apparently effective in increasing sage-grouse populations (Commons et al. 1999, Connelly et al. 2000), could also potentially have a negative impact on Pinyon Jay populations.

Historically, Pinyon Jay was a Management Indicator Species (Wiggins 2005). Currently, there are no management strategies in place for Pinyon Jay (Wiggins 2005). Wiggins (2005) suggests that future management strategies include conservation of pinyon pine stands in the mountain-prairie region.

Conservation

Populations in New Mexico and Arizona have been studied extensively, especially the colony at Town Flock (Wiggins 2005). However relatively little research has been conducted in the northern portions of their range such as Region 6. There is a need to study northern flocks to see how they differ in colonization, habitat selection and use, and behavior.

In Nebraska, young birds with parents have been seen, but there has been no recent documentation of breeding (Sharpe et al. 2001, Wiggins 2005). Researchers should investigate whether Pinyon Jays breeding in Nebraska for future conservation concerns.

Pinyon Jays in urban and suburban areas are known to use bird feeders (Wiggins 2005). It is unknown whether this strategy would allow a population to thrive under habitat constraints by humans (Wiggins 2005).

Completed and Ongoing Conservation Actions

No conservation actions are currently in place (Balda 2002).

TABLE 11. Pinyon Jay status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for “International Union for Conservation of Nature”, ABC is an abbreviation for “American Bird Conservancy”, and “PIF” is an abbreviation for “Partners in Flight”. A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, “Secure” species have no immediate conservation issues, “Potential Concern” species have smaller populations or ranges or at higher rates of population declines, “Vulnerable” species deserve conservation attention, and “At Risk” species need more urgent conservation attention. The “Birds of Conservation Concern” row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Vulnerable
Federal listing	No
ABC Conservation Assessment	Vulnerable
Birds of Conservation Concern	National, BCR 9, BCR 16, BCR 17, BCR 34, USFWS Region 1, USFWS Region 2, USFWS Region 6, USFWS Region 8
PIF	US-Canada Concern Species

TABLE 12. Pinyon Jay status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for “Species of Greatest Conservation Need”. A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G5	-4.0% (-5.6, -2.4%)	-3.2% (-5.7, -0.4%)	-	-
Region 6	-	-4.0% (-5.8, -2.2%)	-3.4% (-6.3, -0.4%)	-	-
Montana	S3	Insufficient data	Insufficient data	Species of Concern	Tier II
North Dakota	-	-	-	-	-
South Dakota	S4	Insufficient data	Insufficient data	-	-
Wyoming	S5	Insufficient data	Insufficient data	-	-
Colorado	S5	-3.0% (-5.7, 0.5%)	-3.4% (-10.1, 2.1%)	-	Species of Greatest Conservation Concern
Utah	S4	-3.8% (-6.0, -1.8%)	-4.0% (-7.8, -0.2%)	-	-
Nebraska	S3	-	-	-	Tier I
Kansas	-	-	-	-	-

Sage Thrasher (*Oreoscoptes montanus*)

Summary:

- Sage Thrashers are plainly colored birds with a melodious song which can extend for up to several minutes. They are gray-brown above with two wing bars and are streaked brown on the front. Sage Thrashers are sagebrush (*Artemisia* spp.) obligates during the breeding season.
- Sage Thrashers breed in western North America and winter in the southwestern United States and northwestern Mexico. They breed from southwestern South Dakota and extreme southwestern Saskatchewan west to southern British Columbia and south to eastern California and New Mexico. They winter in the western two-thirds of Texas west to southern California south to Durango and Baja California.
- For the period 1966-2010, there has not been a significant rangewide change in the number of Sage Thrashers observed during Breeding Bird Surveys. Likewise, for the period 1966-2011, there has not been a significant change in the numbers of Sage Thrashers detected on Christmas Bird Counts in the US and Mexico after controlling for the number of observers. Within USFWS Region 6, there has been a significant decline in the numbers of Sage Thrashers detected on Breeding Bird Surveys in Utah.
- Populations in USFWS Region 2 are declining and Sage Thrashers in British Columbia and Saskatchewan, Canada are considered critically imperiled. In these areas, it is thought that these declines are due to habitat fragmentation and loss.

Legal Status:

See Tables 13 and 14.

Description

Once known as the Mountain Mockingbird (Bent 1964), the Sage Thrasher is the smallest thrasher, weighing 40-50 g and having a total body length of 20-23 cm (Reynolds et al. 1999). Sage Thrasher tails have white tips on the corners and white wing bars (Reynolds et al. 1999, Buseck et al. 2004). Tail length differs between populations at different geographical locations, indicating some morphological differences (Reynolds et al. 1999, Buseck et al. 2004). They have gray-brown backs and light colored fronts with heavy streaking (Reynolds et al. 1999). Their bills are short and straight, and dark on the tips (Pyle 1997, Reynolds et al. 1999). Juveniles look similar to adults, but plumage is paler with less streaking (Pyle 1997, Buseck et al. 2004). When interrupted, Sage Thrashers will run along the ground rather than take flight (Reynolds et al. 1999).

The Sage Thrasher is the only member of the genus *Oreoscoptes* (Reynolds et al. 1999, Lovette et al. 2012). Genetic studies and hybridization analyses suggest Sage Thrashers may actually be more closely related to mockingbirds than thrashers, but both are in the family Mimidae (Reynolds et al. 1999, Buseck et al. 2004, Lovette et al. 2012).

Distribution

Rangewide

In western North America, Sage Thrashers breed from British Columbia, east to southwestern Saskatchewan and southwestern South Dakota, and south to eastern California, Arizona, and western New Mexico (Figure 18). Breeding birds are rare and local in southern Saskatchewan and Alberta (Buseck et al. 2004, BirdLife International 2012c). Sage Thrashers

winter in the southern United States from California to Texas and south into Baja California and north-central Mexico, including Sonora, Chihuahua, Durango, Tamaulipas, and Guanajuato (Figure 19).

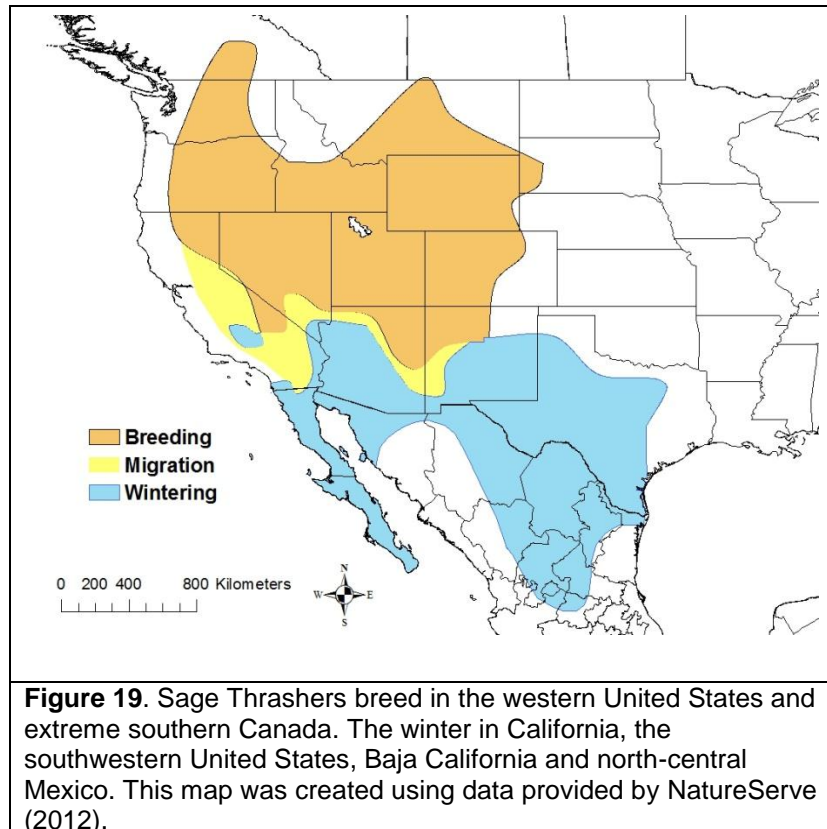


Figure 19. Sage Thrashers breed in the western United States and extreme southern Canada. The winter in California, the southwestern United States, Baja California and north-central Mexico. This map was created using data provided by NatureServe (2012).

Region 6

Colorado: Breeding Sage Thrashers are most frequent in the northwestern corner of the state, as well as in the San Luis Valley of south-central Colorado (Johnsgard 1979, Andrews and Righter 1992, Kingery 1998). Outside of these areas, they are generally sparse and local breeders with the exception of northeastern Colorado where they are not currently known to breed (Kingery 1998). They begin arriving in mid-March (Kingery 1998). Nests have been found between 13 May and 13 July (Kingery 1998). During migration, they can be found throughout most the state, especially in the west (Andrews and Righter 1992). There are 14 wintering records, mostly near foothills in

the east (Andrews and Righter 1992).

Kansas: There is one breeding record for Morton County in southwestern Kansas (Johnsgard 1979, Thompson et al. 2011). It is a rare visitor during the fall and winter, but may also visit in the spring (Thompson et al. 2011). Sage Thrashers are generally found in the southwestern corner of the state, but some may stray eastward into south-central Kansas (Thompson et al. 2011).

Montana: In Montana, Sage Thrashers are fairly common breeders east of the Continental Divide and are considered to be uncommon west of the divide (J. Marks, *pers. comm.*). However, there are few breeding records for northeastern Montana (Montana Bird Distribution Committee 2012). Sage Thrashers usually arrive in April and depart by September (J. Marks, *pers. comm.*).

Nebraska: Sage Thrashers are casual to rare in western Nebraska (Sharp et al. 2001). What little suitable habitat is present in Nebraska is primarily restricted to the extreme northwest corner of the state and to Kimball County in the southwest Panhandle (Ducey 1988, Molhoff, *pers. comm.*). In northwest Nebraska, they are most frequently found in Hat Creek Basin, a grassland area north of Pine Ridge (W. Molhoff, *pers. comm.*). Breeding was confirmed in 2006

(Mollhoff 2006). Sharpe et al. (2001) lists Sage Thrasher as a hypothetical winter visitor with one report from the 1960s.

North Dakota: In North Dakota, Sage Thrashers are considered occasional vagrants during spring and summer with observations of birds expected every 3-5 years (Faanes and Stewart 1982). There are no confirmed breeding records in North Dakota, but Stewart (1975) and Johnsgard (1979) list the species as a hypothetical breeder as there are a few records for western North Dakota during the breeding season (Stewart 1975).

South Dakota: In South Dakota, Sage Thrashers uncommonly breed in the southwestern portion of the state and occasionally north of the Black Hills in Harding and Butte Counties (Johnsgard 1979; South Dakota Ornithologists' Union 1995, Tallman and Swanson, 2002). Peterson (1995) reported the first active nest in big sagebrush (*Artemisia tridentata*) in 1994. During the 2008-2012 breeding bird atlas, breeding Sage Thrashers were confirmed in Fall River and Butte Counties (N. Drilling, *pers. comm.*). This species appears to be increasing in the state and there were persistent May and July reports in the plains east of Rapid City (N. Drilling, *pers. comm.*).

Utah: In Utah, Sage Thrashers are common during the summer (Utah Bird Records Committee 2012). Sage Thrashers nest in sagebrush and greasewood throughout most of the state, especially the south (Utah Conservation Data Center 2012).

Wyoming: In Wyoming, Sage Thrashers are present throughout the state in sagebrush habitats (Faulkner 2010). Breeders return between March and April (Faulkner 2010). Birds depart in September, though may leave earlier (Faulkner 2010). There are three wintering records for Wyoming, all mid-December through early January (Faulkner 2010).

Biology

Sage Thrashers are omnivorous, feeding on insects such as grasshoppers and caterpillars, arachnids, berries, and other fruits (Ryser 1985, Kaufman 1996).

Breeding

During the breeding season, Sage Thrashers sing from shrubs as well as during display flights (Kingery 1998, Buseck et al. 2004). However, they are much quieter at the nest, which accounts for low detection during nesting (Kingery 1998).

Sage Thrashers breed as second-year birds (Buseck et al. 2004). Pairs form roughly one week after females arrive on the breeding grounds (Reynolds et al. 1999). They usually only breed once during a season, but are sometimes able to breed twice (Kingery 1998, Reynolds et al. 1999). The first brood starts in early-mid April and is usually completed by late May. Second broods begin in early June and are completed in mid-July (Reynolds et al. 1999).

Nests are bulky and placed either in sagebrush or other shrub, or on the ground (Johnsgard 1979, Ryser 1985, Kingery 1998). This aids in nest concealment from the sun (Ryser 1985, Kingery 1998). Some may create a shade out of twigs above the nest (Kingery 1998). Records from sagebrush at higher altitudes in Colorado may mean Sage Thrashers can nest up to 10,000 feet (Kingery 1998).

Clutch size ranges from 3-7 eggs, averaging 4-5 (Johnsgard 1979, Kaufman 1996, Buseck et al. 2004). However, the clutch size can be influenced by annual precipitation. Clutch sizes of a second brood are generally smaller (Buseck et al. 2004). Average incubation period is 14-17 days (Johnsgard 1979). Although Sage Thrashers are parasitized by Brown-headed Cowbirds, Sage Thrashers will eject Brown-headed Cowbird eggs from the nest (Kingery 1998,

Buseck et al. 2004). There are few data on the lifespan or survivorship of Sage Thrashers, but predation may be a factor in low nest success (Buseck et al. 2004).

Wintering

Wintering birds in extreme west Texas occur may occur at higher densities (1.45 individuals per ha) than birds during the breeding season (0.2-0.7 individuals per hectare, Reynolds et al. 1999).

Habitat

Breeding

The former common name of Sage Thrasher, Mountain Mockingbird, and its current scientific name, *Oreoscoptes montanus*, both imply that the bird is a montane species (Bent 1964). However, this thrasher is not a mountainous species (Bent 1964). As the current common name suggests, Sage Thrashers are highly associated with sagebrush (*Artemisia* sp.; Kaufman 1996, Reynolds et al. 1999). In some states, they will utilize rabbitbrush (*Chrysothamnus* sp.) and other shrub cover (Kingery 1998, Faulkner 2010). In Nebraska, they are most often found in big sagebrush (*Artemisia tridentata*), silver sagebrush (*Artemisia cana*), or occasionally sand sagebrush (*Artemisia filifolia*; W. Molhoff, pers. comm.).

Wintering:

During the non-breeding season, Sage Thrashers will also occupy scrub, thickets, brush or cholla in arid environments and deserts (Andrews and Righter 1992, Kaufman 1996, Kingery 1998, Reynolds et al. 1999). They may be common at the ecotone where sagebrush meets pinyon-juniper forests (Andrews and Righter 1992, Kaufman 1996).

Population Trends and Estimates

Rich et al. (2004) estimates the population consists of 7,900,000 individuals. Approximately 20% of the population breeds in Nevada (Great Basin Bird Observatory 2010). Breeding Bird Survey (BBS) data for the period 1966-2010 does not show a significant rangewide change in the numbers of Sage Thrashers detected. Likewise, Christmas Bird Count data for 1966-2011 does not show a significant change in the numbers of Sage Thrashers detected (after controlling for the number of observers) for the period 1966-2011.

Breeding Bird Survey data do not show a significant trend for the period 1966-2010 across USFWS Region 6. However, the numbers of Sage Thrashers detected on Breeding Bird Surveys in Utah during this time did show a significant decline of 2.6% annually (Table 14).

Threats

Populations in USFWS Region 2 are declining, while Sage Thrashers in British Columbia and Saskatchewan, Canada are considered critically imperiled (Reynolds et al. 1999). Habitat loss and alteration due to conversion to agriculture and industry may be a threat (Buseck et al. 2004). Other impacts on habitat include altered fire regimes and invasive species such as cheatgrass (*Bromus tectorum*; Great Basin Bird Observatory 2011).

Large nests may contribute to predation, leading to lower nest success (Buseck et al. 2004). In addition to predation, blow fly larvae (*Protocalliphora braueri*) will parasitize nestlings (Buseck et al. 2004). Though they do not alter size or growth, combination with other factors may negatively affect nestlings (Buseck et al. 2004).

Effects of Climate Change

The sensitivity score for the Sage Thrasher on the Climate Change Sensitivity Database is "Medium" (Tomasevic 2010d). Blouin (2004) suggested that climate change may have a positive impact on Sage Thrashers in Alberta. However, more information is needed to better

assess how climate change will affect both sagebrush habitat and Sage Thrashers (Blouin 2004).

Effects of Energy Development

The density of sagebrush obligates was reduced around dirt roads associated with natural gas extraction (Ingelfinger and Anderson 2004). Sage Thrashers are subject to habitat displacement by oil and natural gas activity (Braun et al. 2002, Blouin 2004). In addition to increasing development, Sage Thrashers had higher mortality when there was increased vehicular activity (Mabey and Paul 2007). Species such as Sage Thrasher that are dependent on one habitat have increased sensitivity to anthropomorphic activities (Gilbert and Chalfoun 2011).

Management

In British Columbia, Sage Thrashers are on the Red List (British Columbia Conservation Data Centre 2013) due to a very small amount of suitable habitat (Reynolds et al. 1999). Most management strategies aim to address habitat preservation and protection (Reynolds et al. 1999, Blouin 2004). Sites controlling for cheatgrass invasion are of high-priority management for Sage Thrashers. Another important strategy is fire suppression and managing fire-resistant plant species in sites susceptible to cheatgrass invasion, so to promote natural succession (Reynolds et al. 1999, Great Basin Bird Observatory 2010). The Nevada Bird Conservation Plan also recommends removing recent pinyon-juniper encroachment when possible.

Conservation

There is little known about Sage Thrasher metapopulation dynamics. Destruction and fragmentation of sagebrush habitat may severely limit access to breeding sites and affect distribution of this bird species (Buseck et al. 2004). Maintaining or increasing the number of patches and corridors connecting suitable habitat may be a useful conservation action (Reynolds et al. 1999).

Completed and Ongoing Conservation Actions

The Bureau of Land Management in the United States is investigating the potential for land exchanges so that sagebrush and shrub-steppe habitat can be used for sage-dependent bird species. This should help preserve suitable habitat on private lands (Reynolds et al. 1999).

TABLE 13. Sage Thrasher status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for “International Union for Conservation of Nature”, ABC is an abbreviation for “American Bird Conservancy”, and “PIF” is an abbreviation for “Partners in Flight”. A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, “Secure” species have no immediate conservation issues, “Potential Concern” species have smaller populations or ranges or at higher rates of population declines, “Vulnerable” species deserve conservation attention, and “At Risk” species need more urgent conservation attention. The “Birds of Conservation Concern” row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	Potential Concern
Birds of Conservation Concern	BCR 9, BCR 10, BCR 17, USFWS Region 1, USFWS Region 6, USFWS Region 8
PIF	Not a US-Canada Concern Species

TABLE 14. Sage Thrasher status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for “Species of Greatest Conservation Need”. A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G5	-0.6% (-1.4, 0.3%)	0.8% (-0.8, 2.9%)	-	-
Region 6	-	-0.1%	1.3%	-	-
Montana	S3	-1.9% (-4.0, 0.3%)	-1.1% (-7.0, 5.5%)	Species of Concern	Tier III
North Dakota	-	-	-	-	-
South Dakota	S2	-	-	-	-
Wyoming	S5	1.0% (-0.1, 2.0%)	2.1% (0.0, 4.7%)	-	Tier II
Colorado	S5	-0.6% (-2.3, 1.1%)	-0.9% (-4.4, 1.8%)	-	-
Utah	S4	-2.6% (-4.3, -0.9%)	1.3% (-2.1, 4.8%)	-	Tier III
Nebraska	-	-	-	-	-
Kansas	-	-	-	-	-

Baird's Sparrow (*Ammodramus bairdii*)

Summary

- Baird's Sparrows are small, brown streaky sparrows. They have a pale bill, a buffy eyestripe and neck collar, an ochre tinge to the head, and some rufous-brown by the shoulder of the wing. During the breeding season, males will sing from a relatively prominent perch and are fairly straightforward to find. During the non-breeding season, detecting these sparrows is far more difficult.
- Baird's Sparrows breed from western Minnesota west to the Continental Divide in Montana and north into southern Alberta, Saskatchewan, and Manitoba. This species winters from southeastern Arizona to west Texas and south to Sonora and northern Zacatecas.
- The population is estimated to consist of 1,200,000 individuals. There are an estimated 171,000 – 279,000 pairs in North Dakota.
- For the period 1966-2010, the numbers of Baird's Sparrows detected during the Breeding Bird Survey has declined significantly at a rate of 2.7% per year. Significant declines occurred in North Dakota (5.1% per year), Saskatchewan (3.1% per year), and the prairie potholes region (2.8%) per year. In USFWS Region 6, Baird's Sparrow exhibited a significant decline of 3.2% annually.
- For the period 1966-2011, there has not been a significant trend in the numbers of Baird's Sparrows observed on Christmas Bird Counts in the US and Mexico. However, the number of counts reporting this species are low (median of three counts per year) and the number of Baird's Sparrows detected are also low (median of eight birds per year), so Christmas Bird Counts may not effectively monitor population changes in this species.
- Populations of Baird's Sparrows are thought to have declined dramatically from pre-settlement numbers. Loss and degradation of their mixed-grass prairie habitat is believed to have driven this decline. This species is listed as Threatened or Endangered in Arizona, Minnesota, New Mexico, and Manitoba.

Legal Status

Global

See Tables 15 and 16. Globally, Baird's Sparrows are considered Apparently Secure (G4; Wiggins 2006). They are protected in North America under the Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703–712). Baird's Sparrows are listed as a species of Least Concern by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species and BirdLife International (BirdLife International 2012d, IUCN 2012).

Canada

Baird's Sparrows are currently listed as a Species of Special Concern (Committee on the Status of Endangered Wildlife in Canada 2012c). NatureServe (2012) considers breeding Baird's Sparrows in Canada Apparently Secure (N4B). They are considered Apparently Secure (S4B) in Saskatchewan, Vulnerable (S3) in Alberta, and Critically Imperiled (S1B) in Manitoba (NatureServe 2012).

United States

Baird's Sparrows are not listed as an Endangered Species by the US Fish and Wildlife Service (USFWS 2012b). The species was proposed for listing in 1997 but by 1999 it was decided that listing was unwarranted (Green et al. 2002, Wiggins 2006).

Mexico

Baird's Sparrows winter in Sonora, Chihuahua, Durango, and Zacatecas but there is little enforcement of the MBTA in this country (Green et al. 2002).

Description

Baird's Sparrows are small (length 12 cm, mass 19g), streaked sparrows similar to those in the *Ammodramus* genus (Green et al. 2002). Baird's Sparrows have relatively long, notched tails (Green et al. 2002). They have a characteristic flat head with a yellow-brown stripe through the crown, lateral throat stripes, a tan-buffy neck line, overall ochre color and dark facial border lines (Green et al. 2002). They have a light-colored belly with brown streaking on the upper parts of the chest and flanks (Green et al. 2002). Males and females are similar, but females have heavier streaking and a lighter colored head (Green et al. 2002). Juveniles are streakier below with light-colored edges to feathered upperparts (Green et al. 2002). Similar species include Savannah Sparrow, (*Passerculus sandwichensis*), Grasshopper Sparrow (*Ammodramus savannarum*), Le Conte's Sparrow (*Ammodramus leconteii*), and Henslow's Sparrow (*Ammodramus henslowii*) (Green et al. 2002).

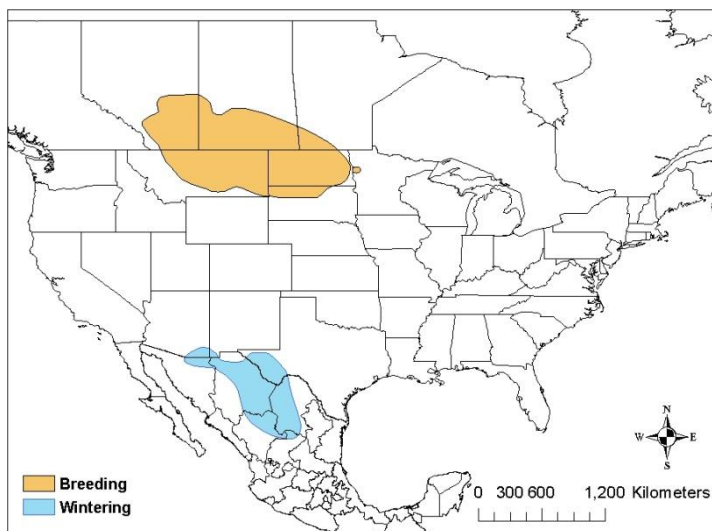


Figure 20. Breeding (orange) and wintering (blue) range of the Baird's Sparrow. This map was created using data provided by NatureServe (2012).

Prebasic molt can happen in the northern edge of the wintering range, or the monsoon zone of the southwestern United States and northern Mexico (Voelker 2004). Males take longer to molt than females, averaging 46 days while females average 27 days (Voelker 2004). In the western US, this is the fastest molting rate of breeding passerines (Voelker 2004).

Distribution Rangewide

Baird's Sparrows are short to medium-distance migrants, travelling from southern Canada and the

northern Great Plains States of the US to northern Mexico and the southwestern US (Figure 20).

Canada

Baird's Sparrows breed in southern Alberta, southern Saskatchewan, and Southern Manitoba (AOU 1998).

United States

In the US, Baird's Sparrows breed in Montana, North Dakota, northern South Dakota, and northwestern Minnesota.

Individuals winter from southeastern Arizona and southwestern New Mexico to the high plains of Trans-Pecos Texas (AOU 1998). In Mexico, they winter from northeastern Sonora through Chihuahua, northeastern Durango, western Coahuila, and south to northern Zacatecas (Green et al. 2002).

Baird's Sparrows are accidental or casual in California (Farallon Islands, San Diego), southern Texas, Oklahoma, Wisconsin, New York (Montauk), Maryland (Ocean City), and Ohio (AOU 1998).

Arizona: Baird's Sparrows are most frequently found in the San Rafael Valley and Sonoita Plains (Pettingill 1981). They can also be found in the Altar Valley as well as the bases of Chiricahua, Huachuca, Patagonia, and Santa Rita Mountains (Monson and Phillips 1981). Baird's Sparrows begin arriving at the end of August or the beginning of September (R. Hoyer, *pers. comm.*)

Colorado: Andrews and Righter (1992) speculated that this species might be a regular migrant through Colorado but list only four fall records and two spring records. Fall migrants were recorded in El Paso County, Weld County, Kiowa County, and Sedgwick County. Spring migrants recorded in Logan County and Huerfano County (Andrews and Righter 1992).

Kansas: Baird's Sparrows are rare transients statewide (Janzen 2007, Thompson et al. 2011). This species occasionally strikes TV towers (Ball et al. 1995).

Minnesota: Historically, Baird's Sparrows were common in the northwest part of the state. By the 1960s most records came from a small patch of native prairie in Wilkin County Minnesota (Janssen 1987, Green et al. 2002). In 1969, a Baird's Sparrow was observed near Felton in Clay County (Bolduc 1969) and a small population was present through the 1980s (Minnesota DNR 2012). However, since 1990, this species has only been observed three times during the summer at this location (Felton Prairie; Minnesota DNR 2012b). Baird's Sparrow is currently listed as Endangered in the state of Minnesota (Minnesota DNR 2012b). It is considered to be occasional in Clay, Polk, Pennington and Kittson Counties and rare in Norman County (Minnesota Ornithologists Union 2011).

Montana: Baird's Sparrows are fairly common on prairies east of the Continental Divide (Montana Bird Distribution Committee 2012). The largest populations occur in Phillips County, Valley County, and Sheridan County (J. Marks, *pers. comm.*).

Nebraska: This species is rare to casual during spring and fall migration through western and central Nebraska; they are accidental in eastern Nebraska (Sharpe et al. 2001). Sharpe et al. (2001) speculate that the dense shortgrass prairie from Sheridan County and Garden County westward may be regularly used by the Baird's Sparrow during migration. There is a

hypothetical breeding record from the Pine Ridge area in Sioux County from 1901 (Ducey 1988) but there is no supporting documentation for this record (W. Molhoff, *pers. comm.*).

New Mexico: Baird's Sparrows have been observed on Otero Mesa and the Animas Valley (New Mexico Partners in Flight 2007).

North Dakota: Baird's Sparrows are considered to be fairly common in North Dakota (Faanes and Stewart 1982). Stewart (1975) considered them to be most common on the Missouri Coteau, while they were fairly common in the Northwestern Drift Plain, Coteau Slope, Missouri Slope and in Bowman and Slope Counties in the southern Little Missouri Slope. They were uncommon on the rest of the Little Missouri Slope, the Northeastern Drift Plain, and the Southern Drift Plain and were generally rare on the Agassiz Lake Plain (Stewart 1975).

South Dakota: The Baird's Sparrow is listed as uncommon to fairly common but local in South Dakota (South Dakota Ornithologists' Union 1991, Peterson 1995). In general, breeding birds are found in north-central and northwestern South Dakota (Peterson 1995). During the 2008-2012 breeding bird atlas, singing males were detected in 11 counties, all of either them bordering North Dakota or in the next tier south, although Baird's Sparrows were not detected in either the extreme northwestern or northeastern part of the state (N. Drilling, *pers. comm.*).

Utah: Baird's Sparrows are accidental in Utah (Utah Birds Records Committee 2012).

Wyoming: This species is a rare migrant and are rare but regular during summer in Wyoming. Baird's Sparrows generally occur east of a line from Sheridan to Albany Counties but breeding has not yet been confirmed in the state (Faulkner 2010).

Mexico

Winters in northern Sonora, Durango, Chihuahua, Coahuila, and northern Zacatecas (AOU 1998, Green et al. 2002).

Historical Changes

Coues (1874) wrote that Baird's Sparrows in North Dakota were extremely abundant and in some places outnumbered all other bird species together. Likewise, in Manitoba in the late 19th century, Baird's Sparrows were considered to be abundant (Manitoba Avian Research Committee 2003). However, Baird's Sparrow is now considered to be generally rare throughout its range although it can still be locally abundant in high-quality mixed-grass prairie (Green et al. 2002). The distribution of this species in Minnesota has declined and it is now considered to be endangered (Minnesota DNR 2012b). The range has retracted in Manitoba and it is now restricted to the southwestern corner of that province (Manitoba Avian Research Committee 2003). In Arizona, Baird's Sparrows formerly wintered north to Graham County but are now restricted to Cochise County (Monson and Phillips 1998).

Biology

Breeding

Arrival

Males arrive 3-7 days before females. At Medicine Lake NWR in northeast Montana, arrival is in late April or early to mid-May (Green et al. 2002). The earliest arrival was at Medicine Lake NWR on 18 Apr 2005, and the latest departure recorded was near Terry on 10 September, 1902 (Green et al. 2002, J. Marks *pers. comm.*). In southwest Manitoba, birds arrive during the first two weeks of May and begin initiating clutches as soon as May 25 (Davis and Sealy 1998).

Breeding Display

Male Baird's Sparrows perch on the highest point in their territory and sing (Wiggins 2006). Males perform courtship flights that are marked by quick wing-beats (Wiggins 2006). Conspecific attraction may play a role in the establishment of territories (Ahlering et al. 2006).

Territoriality

In areas of similar vegetation composition and structure, males will often select territories adjacent to a singing male which suggests that conspecific attraction plays a part in territory selection (Ahlering et al. 2006). Pairs form after territories are established (Lane 1968). Territory size ranges from 0.68-1.2 ha (Luce and Keinath 2003).

Nest Characteristics

Baird's Sparrows select nest sites in shallow depressions that are often surrounded by grass (Wiggins 2006). The depression may be excavated by a sparrow or already be present. Nests are sometimes concealed under an overhang of grass (Green et al. 2002). Nests are made of fine interwoven grasses and stems and average 6.2 cm in diameter and 4.6 cm deep (Green et al. 2002, Luce and Keinath 2003).

Nest Behavior

Incubation lasts 11-12 days, and females incubate eggs (Luce and Keinath 2003, Wiggins 2006).

Broods and Clutch Size

Females lay 4 or 5 oval to subelliptical eggs (range 2-6) measuring about 19 mm. Eggs are light gray with brown splotches. Eggs are laid on successive days during the morning (Lane 1968, Green et al. 2002, Wiggins 2006). In Montana, the median clutch initiation date was 9 June (Jones et al. 2010).

Some Baird's Sparrows will initiate a second brood within 5 days of completion of the first nest (Green et al. 2002, Luce and Keinath 2003, Wiggins 2006). Females may switch mates between clutches, though Baird's Sparrows are considered monogamous (Luce and Keinath 2003). First broods are typically completed from late May through mid-July; second broods are completed from mid to late-July through early August (Green et al. 2002, Luce and Keinath 2003).

Nestling Stage

Parents either remove egg shells or eat them. Upon hatching, Baird's Sparrows are essentially naked with gray down along six feather tracts. Parts of the mouth and tongue are a translucent red-purple and remaining skin pink or pale red. Skin color changes to orange or flesh-colored within a day. Feather papillae emerge on most tracts by days two and three. Eyes begin to open on day four and nestlings can hold their heads up. Nestlings are active by day six and will chip in response to disturbance. Most distinguishing features are present by day seven or eight (Green et al. 2002).

Fledgling

Nestlings fledge within 8-11 days of hatching (Green et al. 2002, Luce and Keinath 2003). Both parents will feed young before fledging, but the male takes care of fledglings after they leave the nest. Fledglings are unable to fly for 2-3 additional days and are independent at 19 days old (Green et al. 2002).

Nest Success

Successful nests on average fledged 2.8 ± 0.2 young (Luce and Keinath 2003). Nests in Manitoba fledged 37% of young while nests in Montana fledged 57% of young (Green et al. 2002, Luce and Keinath 2003).

Foraging Behavior

Baird's Sparrows forage inconspicuously between bunchgrasses and over grass litter while avoiding open areas. They pluck insects from the ground and glean from grass and forbs (Green et al. 2002).

Diet

Baird's Sparrows feed primarily on insects and seeds. However, their diet changes throughout the year; they feed more heavily on seeds during migration and overwintering, and they focus more on invertebrates and insects during the breeding season (Lane 1968, Green et al. 2003, Luce and Keinath 2003, Wiggins 2006).

Predation

Though inclement weather can cause nest failure, predation was the main cause (Luce and Keinath 2003). Predation rates varied by location and caused a 37-63% loss (Green et al. 2002, Luce and Keinath 2003).

Nest Parasitism

A study in southwestern Manitoba showed that Brown-headed Cowbirds (*Molothus ater*) parasitized 36% of Baird's Sparrow nests. Baird's Sparrows successfully fledged 21% of the Brown-headed Cowbird eggs laid in their nests. Most parasitized nests contain more than one Brown-headed Cowbird egg, and the female cowbird usually removed on average one Baird's Sparrow egg. Non-parasitized nests averaged 4.1 young per nest, and parasitized nests averaged 3.3 young per nest (Davis and Sealy 1998).

Mortality Other Than Predation

Cold, damp weather may cause females to abandon nests. For example, eight of 52 monitored nests in Montana were abandoned due to weather (Green et al. 2002).

Return Rates

Baird's Sparrows are generally considered to have limited site fidelity between years. Only five of 95 color-banded individuals in North Dakota returned to the same sites in the next year and only four of 69 color-banded individuals returned to the same sites in Montana during the following year (Green et al. 2002).

Wintering

Gordon (2000a) found that wintering Baird's Sparrows tended to remain the same area. Green et al. (2002) suggests that this may mean that Baird's Sparrows have a wintering home range although Rising (1996) mentions that no territoriality has been observed during the non-breeding season.

Habitat

Breeding Baird's Sparrows prefer native mixed grasslands with tall grasses and with moderate to relatively dense litter cover (Green et al. 2002, Martin and Forsyth 2003, Wiggins 2006, J. Marks, *pers. comm.*). Grassland species composition varies geographically (Table 17). Arnold and Higgins (1986) found Baird's Sparrows only on transects lacking shrubs, while

Madden et al. (2000) likewise found that Baird's Sparrows were most often associated with relatively sparse bunchgrass and little shrub cover.

Wilson and Belcher (1989) found that Baird's Sparrow in Manitoba is positively associated with native vegetation and negatively associated with introduced vegetation. However, preference between habitats differed with geographic location, and grassland structure is deemed to be more important than composition (Sutter et al. 1995, Green et al. 2002). Baird's Sparrows in Saskatchewan were most common in native habitat and least common in unharvested hayfields (Dale et al. 1997). Baird's Sparrows have been recorded singing in croplands, but it is uncertain if they are nesting in agricultural habitat. Singing males are generally used to assess foraging habitat (Wiggins 2006). Females and non-singing males forage along the ground and are not often seen (J. Marks, *pers. comm.*)

Few studies have been conducted on winter habitat preferences. Gordon (2000a) found wintering Baird's Sparrows in Arizona in open semidesert or plains grasslands which were dominated by bunchgrasses. There was little woody vegetation greater than one meter in height (Gordon 2000a). Gordon (2000b) also suggested that Baird's Sparrows will use moderately grazed grasslands.

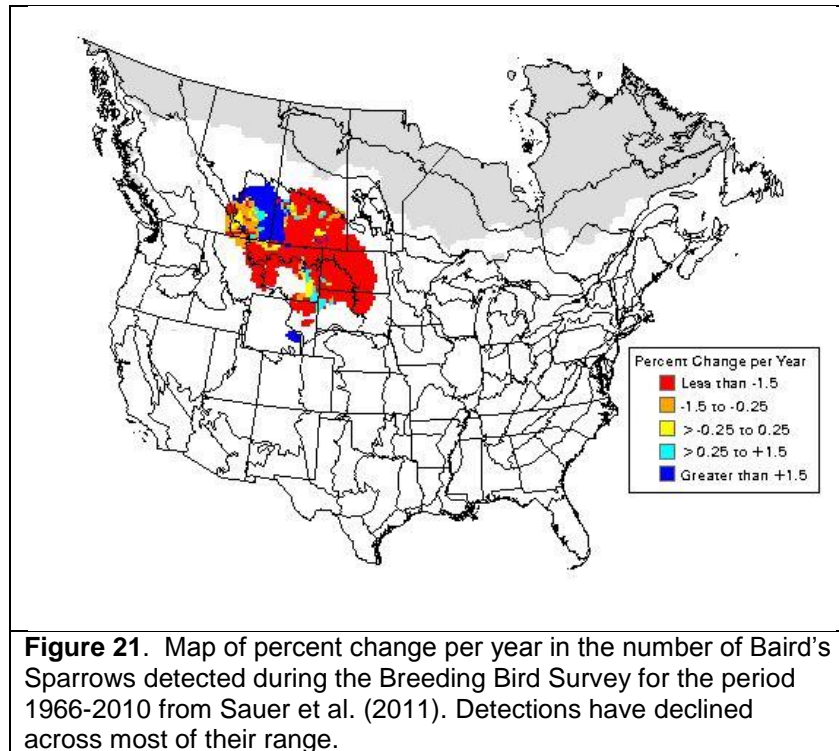
Table 17: Components of mixed-grass prairie habitat in Alberta, Saskatchewan, Manitoba, and North Dakota from Wiggins (2006).

Species	Location
Rough fescue (<i>Festuca campestris</i>)	Southern Alberta
Obtuse sedge (<i>Carex obtusata</i>)	Southern Alberta, southern Saskatchewan
Porcupine grass (<i>Hesperostipa spartea</i>)	Southern Alberta, southwestern Manitoba
Lesser spikemoss (<i>Selaginella densa</i>)	Southern Alberta, North Dakota, southern Saskatchewan
Spike oat (<i>Avenula hookeri</i>)	North Dakota
Prairie sagewort (<i>Artemisia frigida</i>)	North Dakota, southern Saskatchewan, southwestern Manitoba
Prairie Junegrass (<i>Koeleria pyramidata</i>)	North Dakota, southern Saskatchewan, southwestern Manitoba
Needle and thread (<i>Hesperostipa comata</i>)	North Dakota, southern Saskatchewan
Sandberg bluegrass (<i>Poa secunda</i>)	Southern Saskatchewan
Clustered field sedge (<i>Carex praegracilis</i>)	Southern Saskatchewan
Foxtail barley (<i>Hordeum jubatum</i>)	Southern Saskatchewan
Thickspike wheatgrass (<i>Elymus lanceolatus</i>)	Southern Saskatchewan
Western wheatgrass (<i>Agropyron smithii</i>)	Southern Saskatchewan
Blue grama (<i>Bouteloua gracilis</i>)	Southern Saskatchewan
Western snowberry (<i>Symphoricarpos occidentalis</i>)	Southern Saskatchewan, southwestern Manitoba
Smooth brome (<i>Bromus inermis</i>)	Southwestern Manitoba
Bluegrass (<i>Poa</i> spp.)	Southwestern Manitoba
Silverberry (<i>Elaeagnus commutata</i>)	Southwestern Manitoba
Mat muhly (<i>Muhlenbergia richardsonis</i>)	Southwestern Manitoba

Population Trends and Estimates

Breeding Bird Survey

Observations of Baird's Sparrows on the Breeding Bird Survey for the period 1966-2010 showed a significant rangewide decline of 2.7% per year (Figure 21). Significant declines were noted in USFWS Region 6 (3.2% per year) and in North Dakota (5.1% per year; Table 16). Significant declines were also observed in Saskatchewan (3.1% per year) and across the Prairie Potholes (2.8% per year).



Christmas Bird Count

There has been no significant trend in the numbers of Baird's Sparrows observed on Christmas Bird Counts for the period 1966-2011 after controlling for the numbers of observers (linear regression, $F_{1,44} = 2.98$, $r^2 = 0.04$, $p = 0.09$). However, the Christmas Bird Counts are not well suited for monitoring changes in the numbers of this species. The number of counts reporting this species are low (median of three counts per year, range 1-8 counts) and the number of Baird's Sparrows detected are also low (median of eight birds per year, range 1-47 birds).

Population Estimates

Rich et al. (2004) estimated the Baird's Sparrow population to be approximately 1,200,000 individuals. Igl and Johnson (1997) estimated that North Dakota had 171,000 – 279,000 breeding pairs during 1992-93.

Monitoring Activities

Sutter et al. (2000) found detection rates in Baird's Sparrows were 42% lower along roadsides, suggesting that roadside counts may not be the most accurate way to sample. Grassland trails may be a more effective method (Sutter et al. 2000).

Threats

Historical threats include loss of habitat to agricultural land (Sutter et al. 1995, Wiggins 2006). Recent threats to breeding habitat are fire suppression in grasslands, grazing, and introduced species (Wiggins 2006). Introduced plant species had a negative effect on Baird's Sparrows (Wilson and Belcher 1989, Wiggins 2006). However, Sutter et al. (1995) found that the extent of grazing had a larger impact than introduced species.

The main threat to wintering habitat is overgrazing and agricultural conversion. More information is needed on habitat requirements for wintering Baird's Sparrows (Wiggins 2006).

Nest Parasitism

Baird's Sparrows are susceptible to nest parasitism by Brown-headed Cowbirds. Habitat and landscape changes favorable to the spread of Brown-headed Cowbirds could potentially have adverse effects on Baird's Sparrow populations (Green et al. 2002).

Effects of Climate Change

BBS data indicates that many small, short-distance migrant species have shifted their breeding range north at a rate of 23.5 km/decade (Cox 2010). Baird's Sparrows thus should be relatively quick to respond to climate change. However, the breeding range is projected to

contract dramatically by 2055 and areas suitable for breeding will shift northwest (Peterson 2003).

Effects of Energy Development

Baird's Sparrows tend to avoid infrastructure associated energy development, including wells and trails (Bayne and Dale 2011). This species is both area- and edge-sensitive (Green et al. 2002); consequently, energy development may fragment suitable habitat. Several studies have demonstrated that energy development facilitates the spread of non-native invasive plants (summarized in Bayne and Dale 2011) which may reduce populations of Baird's Sparrows as the presence and numbers of this species is negatively correlated with non-native vegetation (Wilson and Belcher 1998). However, reclaimed strip-mines may potentially provide suitable habitat for this species, as this habitat supports populations of grasslands sparrows in other locations (Mattice et al. 2005).

Collision

Over half of the collected specimens in Kansas were collision fatalities from towers and other tall structures (Thompson and Ely 1992).

Data Gaps and Limitations

The difficulty in detecting Baird's Sparrow limits the effectiveness of population and ecological studies (George et al. 1992). The Baird's Sparrow is similar to the Savannah Sparrow and therefore may go undetected in some circumstances due to misidentification (AOU 1998).

Historically, little is known about the Baird's Sparrow (Youngworth 1934). Winter habitat selection and preservation should be studied with respect to Baird's Sparrow. It is unknown if disturbance and habitat loss and degradation in their wintering range affect Baird's Sparrow populations (Wiggins 2006).

Conservation and Management

Jones and Green (1998) provides an summary of threats and recommendations for conservation and management. Baird's Sparrow is listed by NatureServe as Apparently Secure (G4), but some states have listed it as a species of conservation concern (NatureServe 2012). Currently, Baird's Sparrow is not a Management Indicator Species. In Canada, recovery actions have shown that populations are stable, and the Canadian Wildlife Service has removed Baird's Sparrow from the list of Threatened Species (Wiggins 2006).

Casey (2000) includes Baird's Sparrow in the Montana Partners in Flight Conservation Plan as a high priority species in mixed grassland habitats. Because Baird's Sparrows exhibit little site fidelity, populations may change breeding locations in subsequent years. One of the priorities for management of this species is to preserve expanses of habitat to allow for movement across the landscape and still maintain large enough patches for breeding territories. In addition to preserving habitat, the fire regime should be closely managed to keep woody vegetation to a minimum and litter to a moderate level preferred by Baird's Sparrows. Grasslands should be restored using native vegetation, and mowing should be done in July or August after the breeding season to decrease nestling and fledgling mortality. Light grazing or rotational grazing is recommended because it maintains the preferred vegetative structure (Casey 2000, Wiggins 2006).

Completed and Ongoing Conservation Actions

The Grassland Conservation Program has protected some habitat that is useful for Baird's Sparrows. Other grassland programs such as the Conservation Reserve Program seed using exotic plant species and therefore do not contribute to habitat preservation for this species

(Green et al. 2002). Baird's Sparrows are listed as Threatened or Endangered in Arizona, Minnesota, New Mexico, and Manitoba (Jones and Green 1998).

TABLE 15. Baird's Sparrow status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for "International Union for Conservation of Nature", ABC is an abbreviation for "American Bird Conservancy", and "PIF" is an abbreviation for "Partners in Flight". A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, "Secure" species have no immediate conservation issues, "Potential Concern" species have smaller populations or ranges or at higher rates of population declines, "Vulnerable" species deserve conservation attention, and "At Risk" species need more urgent conservation attention. The "Birds of Conservation Concern" row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	Vulnerable
Birds of Conservation Concern	National, BCR 11, BCR 17, BCR 34, BCR 35. USFWS Region 2, USFWS Region 6
PIF	US-Canada Concern Species

TABLE 16. Baird's Sparrow status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for "Species of Greatest Conservation Need". A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G4	-2.7% (-4.3, -1.1%)	0.2% (-4.0, 5.3%)	-	-
Region 6	-	-3.2% (-5.2, -0.7%)	1.3% (-4.5, 10.4%)	-	-
Montana	S3	0.4% (-3.2, 5.2%)	6.5 (-4.1, 23.7%)	Species of Concern	Tier II
North Dakota	-	-5.1% (-7.1, -2.7%)	-4.2 (-10.9, 3.4%)	-	Level I
South Dakota	S2	Insufficient data	Insufficient data	-	Species of Greatest Conservation Need
Wyoming	S1	Insufficient data	Insufficient data	-	-
Colorado	-	-	-	-	-
Utah	-	-	-	-	-
Nebraska	-	-	-	-	Tier I
Kansas	-	-	-	-	Tier I

Le Conte's Sparrow (*Ammodramus leconteii*)



Figure 22. Le Conte's Sparrows are relatively inconspicuous birds of damp grasslands, meadows, and prairies. Photo by Chris Butler

Summary

- Le Conte's Sparrows are small, brown, streaky, furtive sparrows that are often difficult to see well. They have a gray bill, an ochre eyestripe, a light-colored median stripe, an ochre tinge to the head, purplish brown streaks on the nape, and buffy coloration extending along the sides. They are very similar to Nelson's Sparrows (*Ammodramus nelsoni*) which are generally a darker orange color on the head and have an unstreaked grayish nape.
- Le Conte's Sparrows breed from the upper peninsula of Michigan west to Montana, south to west-central Minnesota, and north to southwestern Mackenzie and northwestern Manitoba. There are also isolated breeding populations in Quebec and Ontario but the breeding range of this species in eastern Canada is not well understood. This species winters from southeastern Virginia west to southern Illinois and Oklahoma and south to Texas and Florida. Some individuals also overwinter in southeastern New Mexico.
- For the period 1966-2010, the numbers of Le Conte's Sparrows detected during the Breeding Bird Survey did not show a significant trend. Likewise there has not been a significant change in the population in Region 6, although there has been a significant increase (3.2% per year) in the numbers detected across the United States.
- For the period 1966-2011, there has been a slight but significant increase of 0.1% per year in the numbers of Le Conte's Sparrows detected on Christmas Bird Counts after controlling for the number of observers.

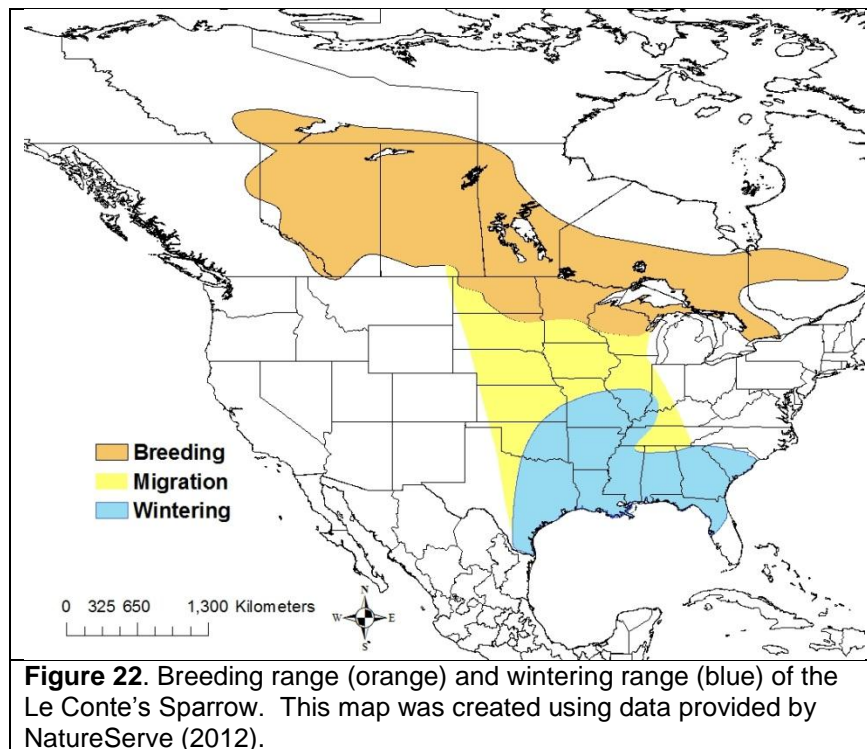
- The primary threat to this species is loss of suitable grassland habitat.

Legal Status

See Tables 18 and 19.

Description

The Le Conte's Sparrow is a small, brown and buff colored sparrow (Figure 22). The light-colored median crown-stripe flanked by blackish lateral stripes is an important field mark to help distinguish it from other *Ammodramus* spp. The eyebrow stripe is bright buff, and the malar stripe is a more even buff. The chestnut nape is streaked with light gray. The white-edged wings are short and very rounded (Lowther 1996).



Distribution

Rangewide

Le Conte's Sparrows breed in central and southern Canada and the northern US and winter in the southeastern US (Figure 23). The breeding range is more or less contiguous from the Upper Peninsula of Michigan west to northeastern Montana and north to southwestern Mackenzie and northwestern Manitoba (Lowther 2005). There are also scattered records during the breeding season elsewhere in Michigan (Johnson 2011). The distribution of this species in eastern Canada is not well understood. The greatest

numbers are found in western Ontario and near James Bay (Lowther 2005, Cadman et al. 2009). It wasn't until 1987 that they were documented nesting in eastern Ontario (Villard and Bracken 1989). There are isolated populations elsewhere in Ontario and southern Quebec (Lowther 2005, Cadman et al. 2009, Québec Breeding Bird Atlas 2012). The wintering range extends from extreme southeastern Virginia (not shown on map) west through southern Illinois to Oklahoma and south to Florida and Texas. There is also an isolated wintering population in southeastern New Mexico (Lowther 2005). The greatest numbers of individuals winter in eastern Texas (Lowther 2005).

Region 6

Colorado: Le Conte's Sparrows are casual in the spring, fall, and winter in Colorado. This species has been recorded near Gunnison, Gunnison County, near Wellington, Larimer County, and at the west end of John Martin Reservoir, Bent County (Andrews and Righter 1992).

Kansas: Le Conte's Sparrows are uncommon migrants across Kansas and rare to uncommon in eastern Kansas during the winter (Janzen 2007, Thompson et al. 2011). Spring migration generally runs from mid-March through mid-May with a peak during April (Thompson et al. 2011). Autumn migration generally occurs from early October to late November with a peak in mid- to late October (Thompson et al. 2011).

Montana: Le Conte's Sparrows are uncommon breeding residents in the northeast counties of Montana and have also been found along the North Fork Milk River in Glacier County, west of Brockway, and at the Swan River Oxbow Preserve, Lake County (Montana Birds Records Committee 2012, J. Marks, *pers. comm.*). The majority of breeding bird records are from Sheridan County, Roosevelt County, and Flathead County. The earliest spring arrival occurred on 10 May, 2001 in Sheridan County, and the latest fall sighting was at Lake Helena on 6 October 2000 (J. Marks, *pers. comm.*).

Nebraska: Le Conte's Sparrows are fairly common spring and fall migrants in eastern Nebraska, rare in the central part of the state, and accidental in the west (Sharpe et al. 2001).

North Dakota: This species is fairly common during the breeding season in North Dakota (Faanes and Stewart 1982), particularly in the northeastern half of the state (Stewart 1975). Le Conte's Sparrows are rare and local in the southwestern portion of the state during the breeding season (Stewart 1975). Local breeding populations fluctuate depending on precipitation; they peak in wet years and may be scarce or absent during dry years (Stewart 1975).

South Dakota: Le Conte's Sparrows are an uncommon migrant and uncommon and local summer resident in the northeastern part of the state and are accidental in the west (South Dakota Ornithologists' Union 1991, Peterson 1995, N. Drilling, *pers. comm.*). Spring migrants generally pass through from the last week in April and the first two weeks of May while fall migrants generally pass through from the last week of September through mid-October (South Dakota Ornithologists' Union 1991). During the 2008-2012 breeding bird atlas, singing males were found in 15 eastern counties, with the bulk of the records coming from Brown, McPherson, Edmunds, Roberts and Campbell Counties which border North Dakota. (N. Drilling, *pers. comm.*). This species is generally found only during wet years (N. Drilling, *pers. comm.*).

Utah: Le Conte's Sparrows are accidental in Utah (Utah Birds Records Committee 2012).

Wyoming: Le Conte's Sparrows are vagrants during spring and fall in eastern Wyoming, with multiple sightings from Sheridan County (Faulkner 2010).

Biology

General

Le Conte's Sparrows are secretive birds of damp grasslands and marsh edges (Lowther 2005). Wintering birds seldom flush unless an observer is within 3 m (Lowther 2005). These birds feed primarily on seeds and insects (Esterla 1962).

Breeding

Le Conte's Sparrows arrive on their breeding grounds in late April and early May (Murray 1969). In North Dakota, the probable breeding season occurs from mid-May to early September and peaks from late May to mid-August (Stewart 1975). In South Dakota, where breeding records are few, nesting occurs from early June to late July (Peterson 1995). Nests are built on the ground amongst dense vegetation (Stewart 1975).

Le Conte's Sparrows occur with the Nelson's Sparrow (*Ammodramus nelsonii*) and Sedge Wren (*Cistothorus platensis*). Le Conte's Sparrows typically occur in wet meadows or upland prairie adjacent to wetlands, Nelson's Sparrows occur in wet meadows and emergent vegetation near wetlands, and Sedge Wrens occupy areas with woody vegetation (Stewart 1975).

Wintering

Le Conte's Sparrows are generally found in old fields and prairies dominated by grasses and shrubs (Lowther 2005). In coastal areas they winter in high salt marsh and the shrubby borders of such marshes. They also occur in damp, weedy fields and clearings, especially those with broom sedge (*Carex scoparia*), even within pine plantations and pine forests (Toups and Jackson, 1987). They do not flock and apparently maintain winter territories (Grzybowski 1983).

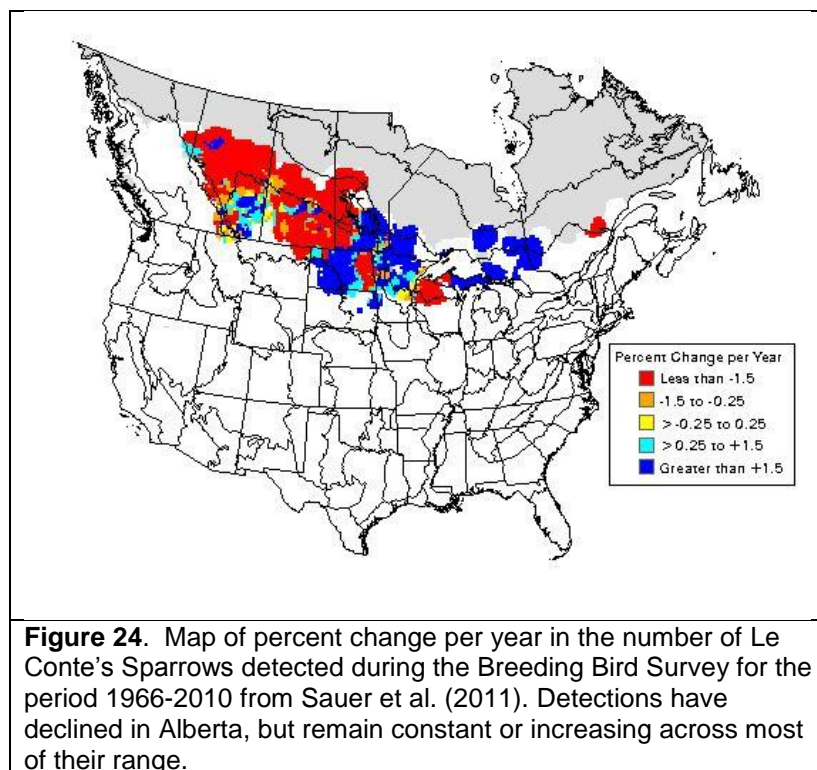


Figure 24. Map of percent change per year in the number of Le Conte's Sparrows detected during the Breeding Bird Survey for the period 1966-2010 from Sauer et al. (2011). Detections have declined in Alberta, but remain constant or increasing across most of their range.

Habitat

In North Dakota, the optimal breeding habitat occurs on pristine fens with a vegetated buffer zone (Stewart 1975). Other nesting habitats include depressions in tallgrass prairie and wet meadows along wetlands (Lowther 2005). Active and fallow pasture and cropland are occasionally used by breeding birds (Stewart 1975, Lowther 2005).

Population Trends and Estimates

Rich et al. (2004) estimates the population to be approximately 3,000,000 individuals. For the period 1966-2010, the numbers of Le Conte's Sparrows detected during the Breeding Bird Survey

did not show a significant trend. Likewise there has not been a significant change in the population in Region 6, although there has been a significant increase (3.2% per year) in the numbers detected across the United States (Table 19). There has been a significant decrease of 4.0% annually in Alberta (Figure 24) and this decline was also noted in the most recent breeding bird atlas (Federation of Alberta Naturalists 2007).

In contrast, Christmas Bird Count data for the period 1966-2011 shows a slight but significant increase of 0.1% in the numbers of Le Conte's Sparrows detected after controlling for the numbers of observers (linear regression, number per party-hour = $0.01 \cdot \text{year} - 2.22$, $F_{1,44} = 14.04$, $R^2 = 0.22$, $p = 0.0005$; Figure 25). However, given the secretive nature of this species, it is possible that the increase in numbers may be due to increased observer efficiency rather than an increase in the wintering population.

Threats

Habitat loss and degradation is the primary threat to breeding populations. Audubon noted this sparrow as being common in the wet meadows of North Dakota (Lowther 2005). Dense stands of damp grassy vegetation appear to be crucial habitat for this species, and practices such as burning, grazing, and mowing have decreased the amount of available habitat (Lowther 1996).

Effects of Climate Change

BBS data indicates that many small, short-distance migrant species have shifted their breeding range north at a rate of 23.5 km/decade (Cox 2010). However, studies on Le Conte's Sparrows have not yet been carried out. Igl and Johnson (1995)

demonstrated that changes in precipitation affect local population densities of Le Conte's Sparrows and so future changes in precipitation could potentially affect the distribution of this species.

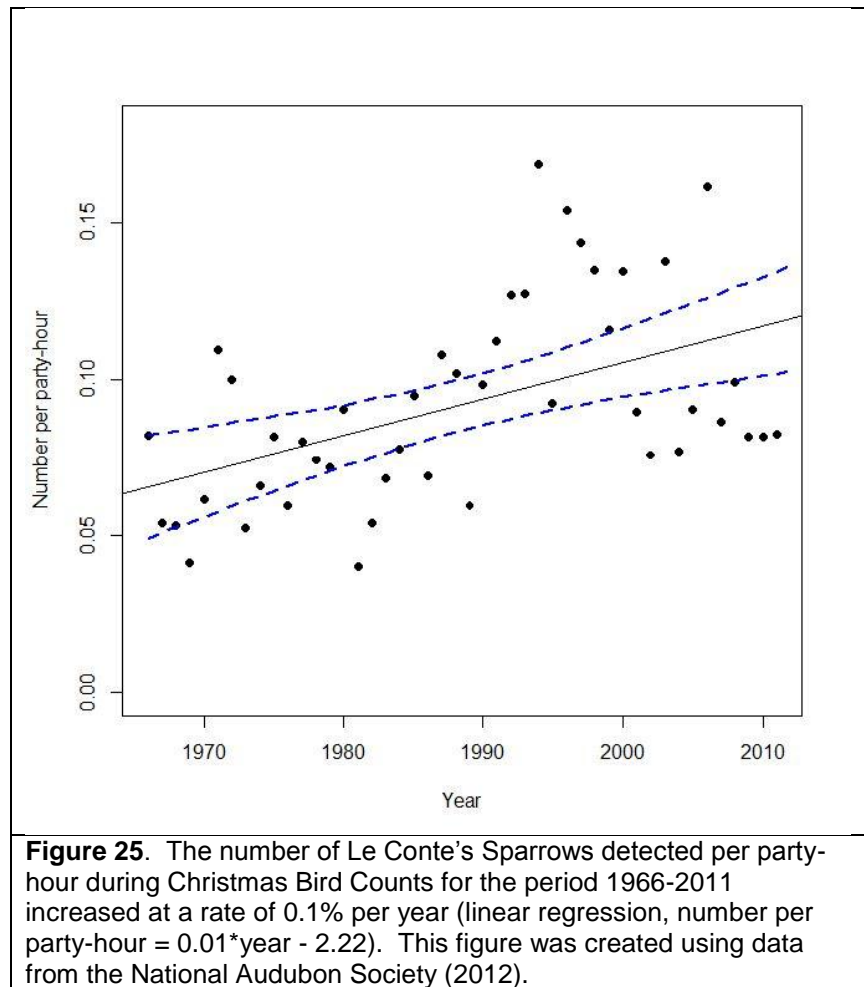
Effects of Energy Development

Le Conte's Sparrows are apparently not sensitive to patch size (Winter et al. 2005). Fleming and Schmiegelow (2003) found that Le Conte's Sparrows were more likely to be on or near wide (>15 m) pipeline right-of-ways in Alberta.

Twenty-eight individuals were salvaged from towers in Kansas in mid- to late October (Thompson et al. 2011) which suggests that this nocturnal migrant may be at risk from collisions with tall vertical structures.

Conservation and Management

The key to maintaining Le Conte's Sparrow populations is to control succession and manage grassy areas so that tall, herbaceous vegetation is present and thick litter accumulates (Dechant et al. 2002a). Fire regimes of 2-4 years are thought to be optimal, although Le Conte's Sparrows will avoid burned areas immediately after burning (Dechant et al. 2002a). This species utilizes habitat preserved by the Conservation Reserve Program (CRP). Le Conte's Sparrows will rapidly colonize CRP fields during a wet year (Igl and Johnson 1995). Annual haying and/or mowing negatively impacts the population of this species (Dechant et al. 2002a).



Completed and Ongoing Conservation Actions
None.

TABLE 18. Le Conte's Sparrow status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for "International Union for Conservation of Nature", ABC is an abbreviation for "American Bird Conservancy", and "PIF" is an abbreviation for "Partners in Flight". A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, "Secure" species have no immediate conservation issues, "Potential Concern" species have smaller populations or ranges or at higher rates of population declines, "Vulnerable" species deserve conservation attention, and "At Risk" species need more urgent conservation attention. The "Birds of Conservation Concern" row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	Potential Concern
Birds of Conservation Concern	BCR 24, BCR 26, BCR 27, BCR 37, USFWS Region 2, USFWS Region 4
PIF	Not a US-Canada Concern Species

TABLE 19. Le Conte's Sparrow status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for "Species of Greatest Conservation Need". A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	State Listing	SGCN
Rangewide	G4	-1.5% (-3.1, 0.2%)	-2.5% (-6.4, 2.6%)	-	-
Region 6	-	3.3% (-0.6, 7.4%)	-5.8% (-12.4, 0.9%)	-	-
Montana	S3	-	-	Species of Concern	Tier II
North Dakota	-	3.3 (-0.6, 7.4%)	-6.4% (-13.6, 1.0%)	-	Level II
South Dakota	S1/S2	-	-	-	Species of Greatest Conservation Need
Wyoming	-	-	-	-	-
Colorado	-	-	-	-	-
Utah	-	-	-	-	-
Nebraska	-	-	-	-	-
Kansas	-	-	-	-	-

Nelson's Sparrow (*Ammodramus nelsoni*)



Figure 26. Nelson's Sparrows are also relatively inconspicuous birds of wetlands and wet meadows that are easiest to find by listening for their song. This species vocalizes both during the day and at night. Photo by Chris Butler.

Summary

- Nelson's Sparrows were split from Sharp-tailed Sparrows in 1995. Nelson's Sparrows are small, brown, streaky, furtive sparrows that are often difficult to see well. They have a grayish-black bill, a dark-orange eyestripe a dark orange tinge to the head, and an unstreaked grayish nape. They are very similar to Le Conte's Sparrows (*Ammodramus leconteii*) which are generally a lighter orange color on the head and have a streaked purplish-brown nape.
- Nelson's Sparrows breed in three disjunct areas. One population breeds from northwest Wisconsin northwest to northeastern British Columbia and south Mackenzie and south to northeastern Montana. Another population breeds around the James and Hudson Bays. The third population breeds in coastal areas from the St. Lawrence estuary to Massachusetts. All populations winter along the coastline from North Carolina to Texas.
- For the period 1966-2010, the numbers of Nelson's Sparrows observed on the Breeding Bird Survey did not show a significant change. However, significant increases were observed in North Dakota (5.5% annually) the Prairie Pothole region (3.5% annually) and the United States (4.9% annually). A significant increase of 5.5% was also noted in USFWS Region 6.
- For the period 1966-2011, there has not been a significant change in the numbers of Nelson's Sparrows detected on Christmas Bird Counts after controlling for the number of observers.
- The primary threat to this species is loss of suitable wetland habitat.

Legal Status

See Tables 20 and 21.

Description

Nelson's Sparrows are a small passerine songbird with striking orange and olive tones (Figure 26). The face and breast are a bright orange-buff. The conspicuous orange-buff eyebrow and malar stripe run back along the head around the gray ear coverts and are separated by a dark brown postocular stripe. A gray stripe runs along the crown and is bordered by dark brown and black lateral stripes. The nape and back are olive-brown and the posterior neck is gray. The wings are primarily brown and the abdomen is white (Greenlaw and Rising 1994).

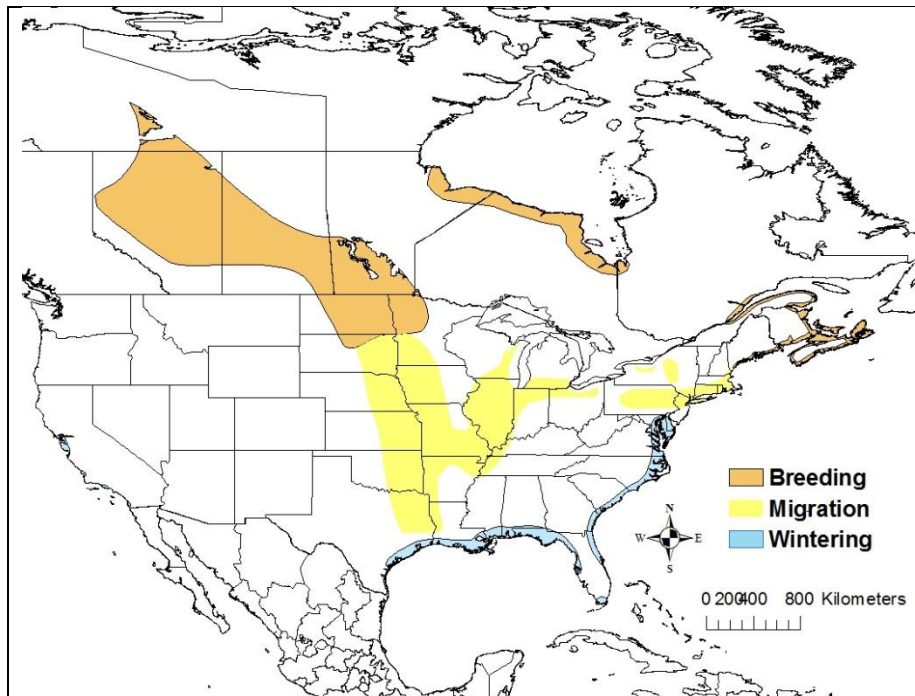


Figure 27. Nelson's Sparrow breeds in three disjunct areas but all populations winter in coastal areas in the southeastern US. This map was created using data provided by NatureServe (2012).

Distribution

Rangewide

Nelson's Sparrows have three disjunct breeding ranges. One population breeds from the mouth of the St. Lawrence River along the coast to Massachusetts (Shriver et al. 2010). Another population breeds along the Hudson and James Bays (Shriver et al. 2011). The third population breeds northwest Wisconsin northwest to northeastern British Columbia and south Mackenzie and south to northeastern Montana (Shriver et al. 2011).

They generally winter

along the Atlantic and Gulf Coast of the US, from North Carolina to Texas (Shriver et al. 2011; Figure 27) but some individuals may winter as far north as New England (Greenlaw and Woolfenden 2007).

Region 6

Colorado: Nelson's Sparrows are accidental during fall migration in Colorado (Andrews and Righter 1992).

Kansas: Nelson's Sparrows are rare spring and fall migrants through eastern and central Kansas (Janzen 2007, Thompson et al. 2011). They are found more frequently during fall migration (Thompson et al. 2011).

Montana: Nelson's Sparrows breed in northeastern Montana (Montana Birds Records Committee 2012). They are an uncommon to common breeding resident in Sheridan County,

Roosevelt County, and Daniels County in northwestern Montana (J. Marks, *pers. comm.*). They possibly breed in Phillips County and Valley County, and are a rare migrant across the rest of the state (J. Marks, *pers. comm.*).

Nebraska: This species is a rare spring migrant in eastern Nebraska and accidental in central Nebraska. During fall migration, they are uncommon in the east, rare to casual in the central part of the state, and accidental in the western part of the state (Sharpe et al. 2001).

North Dakota: Nelson's Sparrows are common breeding residents throughout the northeastern half of the state and are generally absent from the south-eastern half of the state (Stewart 1975, Faanes and Stewart 1982). Breeding populations fluctuate in relation to precipitation. Breeding populations peak during wet years and may be locally scarce or absent in dry years (Stewart 1975).

South Dakota: The Nelson's Sparrow is rare and local in the northeastern half of the state (South Dakota Ornithologists' Union 1991). Spring migrants pass through the state in mid- to late May, and fall migrants occur during the last half of September to the first half of October (South Dakota Ornithologists' Union 1991). Nesting wasn't confirmed until 1992 (William and Zimmer 1992) and has been observed during the summer primarily in the north-central part of the state in Walworth, Edmunds, and McPherson counties (Peterson 1995). During the 2008-2012 breeding bird atlas, singing males were found in 13 counties although it is thought that they were not as common as Le Conte's Sparrows (N. Drilling, *pers. comm.*). In general, Nelson's Sparrows tend to be more common during wet years and unrecorded during dry years (N. Drilling, *pers. comm.*).

Utah: Nelson's Sparrows are unrecorded in the state (Utah Birds Records Committee 2012).

Wyoming: Nelson's Sparrows are vagrants in Wyoming, and have been recorded only twice in the state (Faulkner 2010).

Biology

General

Nelson's Sparrows feed primarily on a variety of protein-rich insects and arthropods. Small mollusks are a secondary food source for breeding birds. The diet shifts to primarily seeds during the fall and winter (Shriver et al. 2011).

Predators of the Nelson's Sparrow include Northern Harrier, Short-eared Owl (*Asio flammeus*), Fish Crow (*Corvus ossifragus*), Norway rat (*Rattus norvegicus*), and garter snake (*Thamnophis sirtalis*). Nests occurring along the ecotone between wetlands and uplands were particularly susceptible to predation from garter snakes and rats (Shriver et al. 2011).

Breeding

Nelson's Sparrows generally arrives on the breeding grounds in mid-May to early June (Murray 1969, Dechant et al. 2002). Breeding in North Dakota occurs from early June to late August and peaks from mid-June to early August (Stewart 1975). Nests are built on the ground on saturated soils in coarse emergent vegetation. Clutch size averages five eggs (Stewart 1975). In the Gulf of Maine, home range size averaged 120 ha (Shriver et al. 2010).

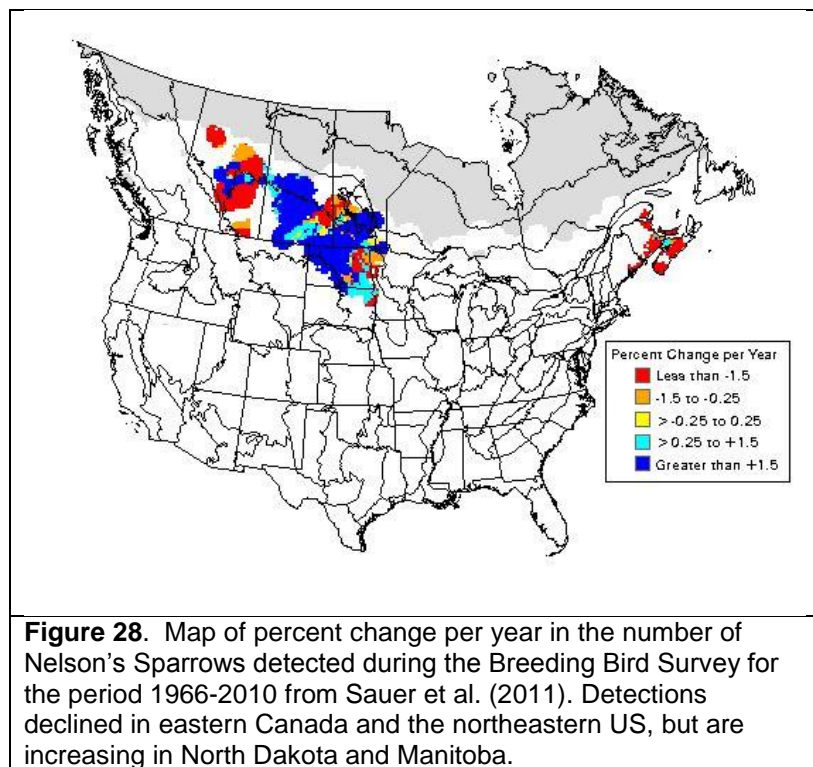
Nelson's Sparrows often occur with the Le Conte's Sparrow (*Ammodramus leconteii*) and Sedge Wren (*Cistothorus platensis*). Le Conte's Sparrows typically occur in wet meadows or upland prairie adjacent to wetlands, Nelson's Sparrows occur in wet meadows and emergent vegetation near wetlands, and Sedge Wrens occupy areas with woody vegetation (Stewart 1975).

Wintering

Nelson's Sparrows began arriving at coastal sites in North Carolina by October and typically remained through March or April (Winder et al. 2012). The subspecies that breeds along the northeastern shoreline (*A. n. subvirgatus*) is thought to migrate solely along the coast, while the other two subspecies will migrate through the interior of North America (Greenlaw and Woolfenden 2007). Wintering Nelson's Sparrows exhibit high site fidelity. Over a five-year study in North Carolina, survivorship of Nelson's Sparrows was estimated to be 67.3% (Winder et al. 2012). The percentage of recaptured individuals was negatively correlated with temperature (Winder et al. 2012).

Habitat

Breeding habitat consists of wetlands and wet meadows with cordgrass (*Spartina pectinata*), whitetop (*Scolochloa festuacea*), squirreltail (*Hordeum jubatum*), and native phragmites (*Phragmites australis*) (Murray 1969, Greenlaw and Rising 1994). Optimal breeding habitat in North Dakota consists of fens and wetland complexes with coarse emergent vegetation (Stewart 1975). Migrating birds occur in a variety of habitats including wet meadows, wetlands, grassy swales near water, and agricultural fields (Greenlaw and Rising 1994, Sharpe et al. 2001). Nelson's Sparrows winter along the Atlantic and Gulf Coast in cordgrass and, less frequently, cattail (*Typha* spp.) dominated wetlands (Greenlaw and Rising 1994).



Population Trends and Estimates

The Nelson's Sparrow population is estimated to be approximately 500,000 individuals (Rich et al. 2004). For the period 1966-2010, there was no significant change in the numbers of birds detected using the Breeding Bird Surveys (Figure 28). However, there was a significant increase in the number of birds detected during this period in North Dakota (5.5% annual increase) and Manitoba (5.9% annual increase) due perhaps to several decades of higher than normal precipitation (Table 21). There was also a significant increase in the Prairie Pothole region (3.5% annual increase) and in USFWS Region 6 (5.5%

annual increase).

During 1966-2011, there was not a significant change in the numbers of Nelson's Sparrows observed on Christmas Bird Counts after controlling for the number of observers (linear regression, $F_{1,15} = 0.19$, $r^2 = -0.05$, $p = 0.66$).

Threats

Habitat loss and degradation are the main threat to the Nelson's Sparrow (Shriver et al. 2011). A large proportion of coastal wetlands has already been lost and so the northeastern population in particular remains vulnerable (Shriver et al. 2011).

Mercury concentrations in Nelson's Sparrows from Grand Forks, ND were 2.0 – 4.9 times as high as mercury levels in individuals from Ontario and New Brunswick (Winder and Emslie 2010). Cristol et al. (2011) showed that mercury levels are higher in Saltmarsh Sparrows than in Nelson's Sparrows and suggest that this may be a cause for concern as the highest exposures occur on breeding grounds. Winder and Emslie (2012) measured mercury levels in Nelson's Sparrows wintering in North Carolina and suggest that mercury levels on their breeding grounds may be increasing.

Effects of Climate Change

Although no studies have examined potential range shift for this species, BBS data indicates that many small, short-distance migrant species have shifted their breeding range north at a rate of 23.5 km/decade (Cox 2010). Cristol et al. (2011) suggest that their marsh habitat may be susceptible to the effects of climate change.

Effects of Energy Development

Nelson's Sparrows breed and winter in wetlands (Shriver et al. 2011) and activities that eliminated or degraded wetlands could potentially negatively affect this species. Nelson's Sparrows could also potentially be adversely affected by an oil spill in their wintering range.

Conservation and Management

Nelson's Sparrows are dependent on persistent grasses at their breeding sites. Preserving wetlands, the vegetative buffers, and adjacent upland habitat are key to successful management (Shriver et al. 2011). Nelson's Sparrows can become extirpated from a site if the vegetative buffer and upland habitat are harvested or burned (Shaffer et al. 1990).

Managing populations of Nelson's Sparrows requires knowledge of the numbers that are present (Shriver et al. 2011). Nelson's Sparrows are most active as the sun sets and during the early hours of darkness (Shriver et al. 2011). They may be difficult to detect using standard diurnal censuses but reasonable numbers are detected in the late evening and shortly after the sun sets (Dechant et al. 2002b, Federation of Alberta Naturalists 2007).

Completed and Ongoing Conservation Actions

None.

TABLE 20. Nelson's Sparrow status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for "International Union for Conservation of Nature", ABC is an abbreviation for "American Bird Conservancy", and "PIF" is an abbreviation for "Partners in Flight". A hyphen (-) indicates a lack of data. For the ABC Conservation Assessment, "Secure" species have no immediate conservation issues, "Potential Concern" species have smaller populations or ranges or at higher rates of population declines, "Vulnerable" species deserve conservation attention, and "At Risk" species need more urgent conservation attention. The "Birds of Conservation Concern" row shows the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

IUCN	Least Concern
Federal listing	No
ABC Conservation Assessment	Vulnerable
Birds of Conservation Concern	National, BCR 11, BCR 14, BCR 27, BCR 30, BCR 31, BCR 37, USFWS Region 2, USFWS Region 3, USFWS Region 4, USFWS Region 5, USFWS Region 6
PIF	Not a US-Canada Concern Species

TABLE 21. Nelson's Sparrow status summarized by Natural Heritage rankings, BBS trends for 1966-2010, BBS trends for 2000-2010, and multiple listing agencies. SGCN is an abbreviation for "Species of Greatest Conservation Need". A hyphen (-) indicates a lack of data. For the natural heritage rankings, G = global and S = state, where S5 = secure (common, widespread, abundant, and lacking major threats or long-term concerns), S4 = apparently secure (uncommon but not rare, but with some cause for long-term concern, usually having more than 100 occurrences and 10,000 individuals), S3 = Vulnerable (rare; typically having 21 to 100 occurrences, or 3,000 to 10,000 individuals), S2 = Imperiled (typically having six to twenty occurrences, or 1,000 to 3,000 individuals), and S1 = Critically imperiled (typically having five or fewer occurrences, or 1,000 or fewer individuals). Natural Heritage rankings are only for breeding populations.

	Natural Heritage Ranking	BBS Trend (1966-2010)	BBS Trend (2000-2010)	Federal Listing	State Listing	SGCN	IUCN
Rangewide	G5	1.4% (-2.9, 3.5%)	1.1% (-4.1, 4.6%)	No	-	-	Least Concern
Region 6	-	5.5% (3.2, 7.7%)	4.7% (0.2, 7.8%)	-	-	-	-
Montana	S3	-	-	-	Species of Concern	Tier I	-
North Dakota	-	5.5% (3.3, 7.7%)	5.2% (0.2, 8.7%)	-	-	Level I	-
South Dakota	S2	-	-	-	-	-	-
Wyoming	-	-	-	-	-	-	-
Colorado	-	-	-	-	-	-	-
Utah	-	-	-	-	-	-	-
Nebraska	-	-	-	-	-	-	-
Kansas	-	-	-	-	-	-	-

Acknowledgements

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Literature Cited

- Abraham, Y. 1999. Endangered birds find a home at polluted base. Boston Globe, Metro Region, 9 Aug 1999.
- Agnew, W., D. W. Uresk, and R. M. Hansen. 1986. Flora and fauna associated with prairie dog colonies and adjacent ungrazed mixed-grass prairie in western South Dakota. *Journal of Range Management* 36: 135-139.
- Ahlering, M. A., D. H. Johnson, and J. Faaborg. 2006. Conspecific attraction in a grassland bird, the Baird's Sparrow. *Journal of Field Ornithology* 77: 365-371.
- American Ornithologists' Union (AOU). 1998. Check-List of North American Birds, 7th edition. American Ornithologists' Union: Washington, D.C.
- Anderson, J. M. 1977. Yellow Rail (*Coturnicops noveboracensis*). Pp 66-70 in Sanderson, G. C. (Ed.). Management of migratory shore and upland game birds in North America. International Association of Fish and Wildlife Agencies, Washington, D.C.
- Andres, B. A., P. A. Smith, R. I. G. Morrison, C. L. Gratto-Trevor, S. C. Brown. and C. A. Friis. *In press*. Population estimates of North American shorebirds, 2012. Wader Study Group Bulletin.
- Andrews, R. and R. Righter. 1992. Colorado birds. Denver Museum of Natural History: Denver, CO.
- Arnold, T. W., and K. F. Higgins. 1986. Effects of shrub coverages on birds of North Dakota mixed-grass prairies. *Canadian Field-Naturalist* 100: 10-14.
- Backhouse, F. 2008. Owls of North America. Buffalo: Firefly Books: Buffalo, NY.
- Baisner, A. J., J. L. Andersen, A. Findsen, S. W. Y. Granath, K. O. Madsen, and M. Desholm. 2010. Minimizing collision risk between migrating raptors and marine wind farms: development of a spatial planning tool. *Environmental Management* 46: 801-808.
- Balda, R. P. and A. Kamil. 1998. The ecology and evolution of spatial memory in corvids of the southwestern USA: The perplexing Pinyon Jay: Animal cognition in nature. Academic Press: San Diego.
- Balda, R. P. 2002. Pinyon Jay (*Gymnorhinus cyanocephalus*). In *The Birds of North America*, No. 605 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.
- Ball, L. G., K. Zyskowski, and G. Escalona-Segura. 1995. Recent bird mortality at a Topeka television tower. *Kansas Ornithological Society Bulletin* 46: 33-39.
- Barber, J., R., K. R. Crooks, and K. M. Fristrup 2010. The costs of chronic noise exposure for wildlife. *Trends in Ecology & Evolution* 25: 180-189.
- Barnes, G. C. and T. D. Nudds. 1990. Temporal variation in microhabitat relationships among grebes and coots. *Wilson Bulletin* 102: 99-108.

- Barlow, J.C., R.D. James, and N. Williams. 1970. Habitat co-occupancy among some vireos of the subgenus *Vireo* (Aves: Vireonidae). *Canadian Journal of Zoology* 48: 395-398.
- Barlow, J.C., S.N. Leckie, and C.T. Baril. 1999. Gray Vireo (*Vireo vicinior*). *The Birds of North America*, no. 447. The Birds of North America, Inc., Philadelphia, PA.
- Bart, J. 2006. Management issues to be addressed by the North American bird monitoring program. U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Boise, Idaho. Accessed 28 September 2012. <http://www.waterbirdconservation.org/pdfs/marshbirdmonitoring/managementissues.pdf>.
- Bates, J.M. 1992a. Frugivory on *Bursera microphylla* (Burseraceae) by wintering Gray Vireos (*Vireo vicinior*, Vireonidae) in the coastal deserts of Sonora, Mexico. *Southwestern Naturalist* 37: 252-258.
- Bates, J. M. 1992b. Winter territorial behavior of Gray Vireos. *Wilson Bulletin* 104: 425-433.
- Baumgartner, F. M. and A. M. Baumgartner. 1992. Oklahoma bird life. University of Oklahoma: Norman, OK.
- Bayne, E. M. and B. C. Dale. 2011. Effects of energy development on songbirds. Pp. 95-114 in Naugle, D. E. (ed). *Energy development and wildlife conservation in western North America*. Island Press: Washington D.C.
- Bednekoff, P. A., R. P. Balda, A. C. Kamil, and A. G. Hile. 1996. Long-term spatial memory in four seed-caching corvid species. *Animal Behavior* 53: 335-341.
- Bent, A. C. 1961. *Life histories of North American birds of prey*. Dover: New York, NY.
- Bent, A. C. 1964. *Life histories of North American nuthatches, wrens, thrashers, and their allies*. Dover: New York.
- Bird Banding Laboratory. 2013. Summaries of banding and encounter data. Accessed 14 January 2013. <http://www.pwrc.usgs.gov/bbl/homepage/start.cfm>.
- BirdLife International 2012a. *Asio flammeus*. IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. Accessed 26 September 2012. <http://www.iucnredlist.org>.
- BirdLife International 2012b. Pinyon Jay (*Gymnorhinus cyanocephalus*). Accessed 25 September 2012. <http://www.birdlife.org>.
- BirdLife International 2012c. Sage Thrasher (*Oreoscoptes montanus*). Accessed 11 October 2012. <http://www.birdlife.org>.
- BirdLife International. 2012d. Baird's Sparrow (*Ammodramus bairdii*). Accessed 3 October 2012. <http://www.birdlife.org>.
- Blouin, F. 2004. Status of the sage thrasher (*Oreoscoptes montanus*) in Alberta. Alberta Wildlife Status Report No. 53. Alberta Sustainable Resource Development and Alberta Conservation Association.

- Bolduc, D. 1969. Baird's Sparrow. *Loon* 41:28.
- Bookhout, T. A. 1995. Yellow Rail (*Coturnicops noveboracensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online:
<http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/139>
 doi:10.2173/bna.139
- Bookhout, T. A. and J. R. Stenzel. 1987. Habitat and movements of breeding Yellow Rails. *Wilson Bulletin* 99:441-447.
- Braun, C. E., O. O. Oedekoven, and C. L. Aldridge. 2002. Oil and gas development in western North America: Effects on sagebrush steppe avifauna with particular emphasis on sage grouse. *Transactions of the North American Wildlife and Natural Resources Conference* 67: 337-349.
- British Columbia Breeding Bird Atlas. 2011. British Columbia breeding bird Atlas. Accessed 21 September 2012. <http://www.birdatlas.bc.ca/bcdata/newsarchives.jsp>.
- British Columbia Conservation Data Centre. 2013. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Accessed 10 Jan 2013.
<http://a100.gov.bc.ca/pub/eswp/>.
- Brown, J. L., S. Li, and N. Bhagabati. 1999. Long-term trend toward earlier breeding in an American bird: A response to global warming? *Proceedings of the National Academy of Science* 96: 5565-5569.
- Brown, S., C. Hickey, B. Harrington, and R. Gill (eds). 2001. The U.S. Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences, Manomet, MA.
- Busby, W.H. and J.L. Zimmerman. 2001. Kansas breeding bird atlas. University of Kansas: Lawrence, KS.
- Buseck, R. S., D. A. Keinath, and M. H. McGee. 2004. Species assessment for sage thrasher (*Oreoscoptes montanus*) in Wyoming. United States Department of the Interior Bureau of Land Management.
- Butcher, G. S., D. K. Niven, A. O. Panjabi, D. N. Pashley, and K. V. Rosenberg. 2007. WatchList: The 2007 WatchList for United States birds. *American Birds* 61: 18–25.
- Butler, C. 2003. The disproportionate effect of climate change on the arrival dates of short-distance migrant birds. *Ibis* 145: 484-495.
- Butler, C. J., L. H. Pham, J. N. Stinedurf, C. L. Roy, E. L. Judd, N. J. Burgess, and G. M. Caddell. 2010. Yellow Rails wintering in Oklahoma. *Wilson Journal of Ornithology* 122: 385-387.
- Butler, C. J., R. Beagles, T. Stuart, and J. N. Stinedurf. 2011. Two noteworthy records of Yellow Rail in Oklahoma. *Bulletin of the Oklahoma Ornithological Society* 44: 5-8.

- Cadman, M. D., D. A. Sutherland, G. C. Beck, D. Lepage, and A. R. Coutrier (eds.). 2009. Atlas of breeding birds of Ontario: 2001-2005. Bird Studies Canada: Toronto, ON.
- Carrete, M., J. A. Sánchez-Zapata, J. R. Benítez, M. Lobón, and J. A. Donazar. 2009. Large scale risk-assessment of wind-farms on population viability of a globally endangered long-lived raptor. *Biological Conservation* 142: 2954-2961.
- Casey, D. 2000. Montana Partners in Flight Bird Conservation Plan. Version 1.0. American Bird Conservancy, Kalispell, MT.
- CEC. 1997. Ecological regions of North America – Toward a common perspective. Montreal, Quebec. Commission for Environmental Cooperation.
- Chapin, E.A. 1925. Food habits of vireos: a family of insectivorous birds. US Department of Agriculture. Bulletin 1355.
- Chipley, R. M., G. H. Fenwick, M. J. Parr, and D. N. Pashley. 2003. The American Bird Conservancy Guide to the 500 Most Important Bird Areas in the United States. Random House: New York, NY.
- Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R.K. Kolli, W.-T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C.G. Menéndez, J. Räisänen, A. Rinke, A. Sarr and P. Whetton. 2007. Regional Climate Projections. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University: Cambridge, UK.
- Cicero, C. and N.K. Johnson. 1998. Molecular phylogeny and ecological diversification in a clade of New World songbirds (genus *Vireo*). *Molecular Ecology* 7: 1359-1370.
- Coachella Valley Multiple Species Habitat Conservation Plan & Natural Communities Conservation Plan. 2005. Coachella Valley. Association of Governments. Palm Desert, CA.
- Colorado Field Ornithologists. 2012. Checklist of the birds of Colorado. Accessed 13 June 2012. <http://www.coloradocountybirding.com/checklists/checklist.php?flag=pdf&name=Colorado>.
- Committee on the Status of Endangered Wildlife in Canada. 2008. COSEWIC assessment and update status report on the Short-eared Owl *Asio flammeus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Accessed 26 September 2012 http://www.sararegistry.gc.ca/status/status_e.cfm.
- Committee on the Status of Endangered Wildlife in Canada. 2012a. Horned Grebe (*Podiceps auritus*). Accessed 3 October 2012. <http://www.cosewic.gc.ca>.
- Committee on the Status of Endangered Wildlife in Canada. 2012b. Yellow Rail (*Coturnicops noveboracensis*) Committee on the Status of Endangered Wildlife in Canada. Accessed 21 September 2012. <http://www.cosewic.gc.ca>.

- Committee on the Status of Endangered Wildlife in Canada. 2012c. Baird's Sparrow (*Ammodramus bairdii*). Accessed 3 October 2012. <http://www.cosewic.gc.ca>.
- Commons, M. L., R. K. Baydack, C. E. Braun. 1999. Sage Grouse response to pinyon-juniper management. USDA Forest Service Proceedings RMRS-P-9: 238-239.
- Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin 28: 967-985.
- Connelly, J.W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation assessment of greater sage-grouse and sagebrush. Cheyenne, WY: Western Association of Fish and Wildlife Agencies. i to A6-8. Accessed 13 June 2012. http://sagemap.wr.usgs.gov/docs/Greater_Sage-grouse_Conservation_Assessment_060404.pdf.
- Copeland, H. E., A. Pocewicz, and J. M. Kiesecker. 2011. Geography of energy development in western North America: Potential impacts on terrestrial ecosystems. Pp. 7-22 *in* Naugle, D. E. (ed). Energy development and wildlife conservation in western North America. Island Press: Washington, D.C.
- Coues, E. 1874. Birds of the Northwest: a hand-book of the ornithology of the region drained by the Missouri River and its tributaries. U.S. Geological. Survey of the Territories, Miscellaneous Publication 3.
- Cox, G. W. 2010. Bird migration and global change. Island Press: Washington, DC.
- Cristol, D. A., F. M. Smith, C. W. Varian-Ramos, and B. D. Watts. 2011. Mercury levels in Nelson's and saltmarsh sparrows at wintering grounds in Virginia, USA. *Ecotoxicology* 20: 1773-1779.
- Dahl, T.E. 2011. Status and trends of wetlands in the conterminous United States 2004 to 2009. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C.
- Dahlin, C. R., R. P. Balda, and C. Slobodchikoff. 2004. Food, audience and sex effects on pinyon jay (*Gymnorhinus cyanocephalus*) communication. *Behavioral Processes* 68: 25-39.
- Dale, B. C., P. A. Martin, and P. S. Taylor. 1997. Effects of hay management on grassland birds in Saskatchewan. *Wildlife Society Bulletin* 25: 616-626.
- Davis, S. K. and S. G. Sealy. 1998. Nesting biology of the Baird's Sparrow in southwestern Manitoba. *Wilson Bulletin of Ornithology* 110: 262-270.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, and C. M. Goldade. 2001. Effects of management practices on grassland birds: Short-eared Owl. USGS Northern Prairie Wildlife Research Center. Paper 136.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2002a. Effects of management practices on grassland birds: Le Conte's Sparrow. Northern Prairie Wildlife Research Center, Jamestown, ND.

- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, P. A. Rabie, and B. R. Euliss. 2002b. Effects of management practices on grassland birds: Nelson's Sharp-tailed Sparrow. Northern Prairie Wildlife Research Center, Jamestown, North Dakota.
- DeLong, J. P. and S. O. Williams, III. 2006. Status report and biological review of the Gray Vireo in New Mexico. Unpublished report to New Mexico Department of Game and Fish, Santa Fe, New Mexico.
- De Kort, S. R. and N. S. Clayton. 2006. An evolutionary perspective on caching by corvids. *Proceedings of the Royal Society B* 273: 417-423.
- Ducey, J. E. 1988. Nebraska birds: breeding status and distribution. University of Nebraska at Omaha: Omaha, NE.
- Duncan, J. R. 2003. Owls of the world: Their lives, behavior and survival. Firefly Books: Buffalo, NY.
- Dunlap, A. S., B. B. Chen, P. A. Bednekoff, T. M. Greene, and R. P. Balda. 2006. A state-dependent sex difference in spatial memory in pinyon jays, *Gymnorhinus cyanocephalus*: Mated females forget as predicted by natural history. *Animal Behavior* 72: 401-411.
- Easterla, D. A. 1962. Foods of Le Conte's Sparrow. *Auk* 79:272-273.
- Environmental Protection Agency. 2012. Ecoregions of North America. Accessed 11 June 2012. http://www.epa.gov/wed/pages/ecoregions/na_eco.htm.
- Ernest, H. B., L. W. Woods, and B. R. Hoar. 2010. Pathology associated with West Nile Virus infections in the Yellow-billed Magpie (*Pica nuttalli*): a California endemic bird. *Journal of Wildlife Diseases* 46: 401-408.
- Euliss, N. H., Jr., D. M. Mushet, and D. A. Wrubleski. 1999. Wetlands of the Prairie Pothole Region: Invertebrate species composition, ecology, and management. Pp. 471-514 in D. P. Batzer, R. B. Rader and S. A. Wissinger (eds). *Invertebrates in Freshwater Wetlands of North America: Ecology and Management*. John Wiley & Sons: New York, NY.
- Evans-Mack, D. 2012. Asio flammeus – continental North America. Accessed 13 January 2013. <http://climatechangesensitivity.org/species/asio-flammeus>.
- Faanes, C. A., and R. E. Stewart. 1982. Revised checklist of North Dakota birds. *Prairie Naturalist* 14: 81-92.
- Faulkner, D. 2010. Birds of Wyoming. Roberts and Company: Greenwood Village, CO.
- Federation of Alberta Naturalists. 2007. The atlas of breeding birds of Alberta: a second look. Friesens: Altona, MB.
- Ferrer, M., M. de Lucas, G. F. E. Janss, E. Casado, A. R. Munoz, M. J. Bechard, and C. P. Calabuig. 2012. Weak relationship between risk assessment studies and recorded mortality in wind farms. *Journal of Applied Ecology* 49: 38-46.

- Fleming, W. D. and F. K. A. Schmiegelow. 2003. Response of bird communities to pipeline rights-of-way in the boreal forest of Alberta. Proceedings of the Seventh International Symposium on Environmental Concerns in Rights-of-Way Management.
- Fournier, M. A. and J. E. Hines. 1999. Breeding ecology of the Horned Grebe (*Podiceps auritus*) in subarctic wetlands. Occasional Papers no. 99. Canadian Wildlife Service.
- Francis, C. D., C. P. Ortega, and A. Cruz. 2009. Noise pollution changes avian communities and species interactions. *Current Biology* 19: 1415-1419.
- Gardali T., N.E. Seavy, R. T. DiGaudio, and L. A. Comrack. 2012. A climate change vulnerability assessment of California's at-risk birds. *PLoS ONE* 7(3): e29507. doi:10.1371/journal.pone.0029507.
- Garrett, K. and J. Dunn. 1981. Birds of southern California: status and distribution. Los Angeles Audubon Society. Los Angeles, CA.
- George, T. L., A. C. Fowler, R. L. Knight, and L. C. McEwen. 1992. Impacts of a severe drought on grassland birds in western North Dakota. *Ecological Applications* 2: 275-284.
- Gibbs, J.P., W.G. Shriver and S.M. Melvin. 1991. Spring and summer records of the Yellow Rail in Maine. *Journal of Field Ornithology* 62: 509-516.
- Gilbert, M. M. and A. D. Chalfoun. 2011. Energy development affects populations of sagebrush songbirds in Wyoming. *Journal of Wildlife Management* 75: 816-824.
- Gordon, C. E. 2000a. Movement patterns of wintering grassland sparrows in Arizona. *Auk* 117: 748-759.
- Gordon, C. E. 2000b. Fire and cattle grazing on wintering sparrows in Arizona grasslands. *Journal of Range Management* 53: 384-389.
- Gould-Beierle, K. 2000. A comparison of four corvid species in a working and reference memory task using a radial maze. *Journal of Comparative Psychology* 114: 347-356.
- Grace, J.B., L.K. Allain, H.Q. Baldwin, A.G. Billock, W.R. Eddleman, A.M. Given, C.W. Jeske, and R. Moss. 2005. Effects of prescribed fire in the coastal prairies of Texas: USGS Open File Report 2005-1287.
- Great Basin Bird Observatory. 2010. Nevada Comprehensive Bird Conservation Plan, ver. 1.0. Great Basin Bird Observatory, Reno, NV. Accessed 10 January 2013. www.gbbo.org/bird_conservation_plan.html.
- Great Basin Bird Observatory. 2011. Bird population responses to projected effects of climate change in Nevada: An analysis for revision of the Nevada wildlife action plan. Nevada Department of Wildlife.
- Green, M.T., P.E. Lowther, S.L. Jones, S.K. Davis, and B.C. Dale. 2002. Baird's Sparrow (*Ammodramus bairdii*). *The Birds of North America*, no. 638. The Birds of North

- America, Inc., Philadelphia, PA.
- Greenlaw, J. S. and J. D. Rising. 1994. Sharp-tailed Sparrow. Pages 1-25 in *Birds of North America*, No. 112. (Poole, A. and F. Gill, Eds.) Academy of Natural Sciences and American Ornithologists' Union, Philadelphia, PA.
- Greenlaw, J. S. and G. E. Woolfenden. 2007. Wintering distributions and migration of Saltmarsh and Nelson's Sharp-tailed Sparrows. *Wilson Journal of Ornithology* 119: 361-377.
- Grzybowski, J. A. 1983. Patterns of space use in grassland bird communities during winter. *Wilson Bulletin* 95: 591-602.
- Houston, C. S., C. R. Jackson, and D. E. Bowen, Jr. 2011. Upland Sandpiper (*Bartramia longicauda*). *The Birds of North America Online*. Ithaca: Cornell Lab of Ornithology.
- Hughes, L. 2000. Biological consequences of global warming: is the signal already apparent? *Trends in Ecology and Evolution* 15: 56-61.
- Igl, L. D. and D. H. Johnson. 1995. Dramatic increase of Le Conte's Sparrow in Conservation Reserve Program fields in the northern Great Plains. *Prairie Naturalist* 27: 89-94.
- Igl, L.D., and D.H. Johnson. 1997. Changes in breeding bird populations in North Dakota: 1967 to 1992-93. *Auk* 114: 74-92.
- Illinois Department of Natural Resources. 2007. The possible effects of wind energy on Illinois birds and bats. Report of the Illinois Department of Natural Resources.
- Inglefinger, F. and S. Anderson. 2004. Passerine response to roads associated with natural gas extraction in a sagebrush steppe environment. *Western North American Naturalist* 64: 385-395.
- Ims, R. A. and E. Fuglei. 2005. Trophic interaction cycles in tundra ecosystems and the impact of climate change. *American Institute of Biological Sciences* 55: 311-322.
- IUCN 2012. IUCN Red List of Threatened Species. Version 2012.1. Accessed 19 September 2012. <http://www.iucnredlist.org>.
- Janssen, R.B. 1987. *Birds in Minnesota*. University of Minnesota Press: Minneapolis, MN.
- Janzen, P. 2007. *The birds of Sedgwick County and Cheney Reservoir*. Kansas Ornithological Society: Wichita, KS.
- Jensen, M. N. 2006. Underlying cause of massive pinyon pine die off revealed. *University of Arizona Alumnus*. Accessed 4 October 2012. <http://www.uagrad.org/Alumnus/gw/pine.html>.
- Johnsgard, P. A. 1979. *Birds of the Great Plains: Breeding species and their distribution*. University of Nebraska: Lincoln, NE.

- Johnsgard, P. A. 2001. *Prairie birds: fragile splendor in the Great Plains*. University Press of Kansas: Lawrence, KS.
- Johnson, B. 2011. Le Conte's Sparrow (*Ammodramus leconteii*). In A.T. Chartier, J.J. Baldy, and J.M. Brenneman (eds.). *The Second Michigan Breeding Bird Atlas*. Kalamazoo Nature Center. Kalamazoo, Michigan, USA. Accessed 15 October 2012. www.mibirdatlas.org/Portals/12/MBA2010/LCSPaccount.pdf.
- Johnson, G. D. and W. P. Erickson. 2011. Avian, bat and habitat cumulative impacts associated with wind energy development in the Columbia Plateau Ecoregion of eastern Washington and Oregon. Klickitat County Planning Department.
- Johnson, W. C., B. V. Millett, T. Gilmanov, R. A. Voldseth, G. R. Guntenspergen, and D. E. Naugle. 2005. Vulnerability of northern prairie wetlands to climate change. *BioScience* 55: 863-872.
- Jones, S. L., and M. T. Green. 1998. Baird's Sparrow status assessment and conservation plan. May 1998. Administrative Report. U.S. Department of Interior, Fish and Wildlife Service, Denver, CO.
- Jones, S. L., J. S. Dieni, and P. J. Gouse. 2010. Reproductive biology of a grassland songbird community in northcentral Montana. *Wilson Journal of Ornithology* 122: 455-464.
- Kansas Ornithological Society. 2012. Kansas Ornithological Society. Accessed 4 June 2012. <http://ksbirds.org/kos/KOSindex.html>.
- Kaufman, K. 1996. *Lives of North American birds*. Houghton Mifflin Company: New York, NY.
- Kellogg, P. P. 1962. Vocalizations of the Black Rail (*Laterallus jamaicensis*) and the Yellow Rail (*Coturnicops noveboracensis*). *Auk* 79: 698-701.
- Kingery, H. E., (Ed.). 1998. *Colorado breeding bird atlas*. Colorado Bird Atlas Partnership: Denver, CO.
- Kirsch, L. M. and K. F. Higgins. 1976. Upland Sandpiper nesting and management in North Dakota. *Wildlife Society Bulletin* 4: 16-20.
- Koenig, W. D., L. Marcus, T. W. Scott, and J. L. Dickinson. 2007. West Nile Virus and California breeding bird declines. *EcoHealth* 4: 18-27.
- Kuczynski, E. C. and C. A. Paszkowski. 2010. Food-web relations of the Horned Grebe (*Podiceps auritus*) on constructed ponds in the Peace Parkland, Canada. *Wetlands* 30: 853-863.
- Kushlan, J. A., M. J. Steinkamp, K. C. Parsons, J. Capp, M. A. Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. 2002. *Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1*. Waterbird Conservation for the Americas. Washington, DC, U.S.A.

- Lafferty, K. D. 2009. The ecology of climate change and infectious diseases. *Ecology* 90: 888-900.
- Lambeth, D. O. 1993. Northern Great Plains Region. *American Birds* 47: 110-112.
- Lane, J. 1968. *Ammodramus bairdii* (Audubon). Baird's Sparrow. pp. 745-765. Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows, and their allies. United States National Museum Bulletin 237: 745-765.
- Leitch, J.A. 1989. Politicoeconomic overview of prairie potholes. Pp. 2–14 in van der Walk, A. (ed). Northern prairie wetlands. Iowa State University Press, Ames, IA.
- Lovette, I. J., B. S. Arbogast, R. L. Curry, R. M. Zink, C. A. Botero, J. P. Sullivan, A. L. Talaba, R. B. Harris, D. R. Rubenstein, R. E. Ricklefs, and E. Bermingham. 2012. Phylogenetic relationships of the mockingbirds and thrashers (Aves: Mimidae). *Molecular Phylogenetics and Evolution*. 63: 219-229.
- Lowther, P. 1996. Le Conte's Sparrow (*Ammodramus leconteii*). in *The Birds of North America*, No. 224. (Poole, A. and Eds F. Gill, Eds.) The Academy of Natural Sciences, Philadelphia; The American Ornithologists' Union, Washington, DC.
- Lowther, P. E. 2005. Le Conte's Sparrow (*Ammodramus leconteii*), *The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online:
<http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/224>
doi:10.2173/bna.224
- Luce, R. and D. Keinath. 2003. Species assessment for Baird's Sparrow (*Ammodramus bairdii*) in Wyoming. United States Department of the Interior. Bureau of Land Management, Wyoming State Office. Cheyenne, Wyoming.
- Lynch, W. 2007. Owls of the United States and Canada. The Johns Hopkins University Press: Baltimore, MD.
- Mabey, S. and E. Paul. 2007. Impact of wind energy and related human activities on grassland and shrub-steppe birds. The National Wind Coordinating Collaborative by the Ornithological Council.
- Madden, E. M., R. K. Murphy, A. J. Hansen, and L. Murray. 2000. Models for guiding management of prairie bird habitat in northwestern North Dakota. *American Midland Naturalist* 144: 377-392.
- Malacarne, G., M. Cucco, and S. Camanni. Coordinated visual displays and vocal duetting in different ecological situations among Western Palearctic non-passerine birds. *Ethology, Ecology and Evolution* 3: 207-219.
- Manitoba Avian Research Committee. 2003. The birds of Manitoba. Manitoba Naturalists Society: Winnipeg, MB.
- Marshall, D. B., M. G. Hunter, and A. L. Contreras (eds). 2003. *Birds of Oregon: A general reference*. Oregon State University: Corvallis, OR.

- Martin, R. 2009. Northern Great Plains. *North American Birds* 63: 618-619.
- Martin, P. A. and D. J. Forsyth. 2003. Occurrence and productivity of songbirds in prairie farmland under conventional versus minimum tillage regimes. *Agriculture, Ecosystems, and Environment* 96: 107-117.
- Martin, R. 2012. Tips for finding ND specialties. Accessed 24 October 2012. <http://www.ndbirdingsociety.com/ndSpecialties.php>.
- Marzluff, J. M., and T. Angell. 2005. *In the company of crows and ravens*. Yale University Press: New Haven, CT.
- Marzluff, J. M., and R. P. Balda. 1988. The advantages of, and constraints forcing, mate fidelity in pinyon jays. *Auk* 105: 286-295.
- Mattice, J. A., D. W. Brauning, and D. R. Diefenbach. 2005. Abundance of grassland sparrows on reclaimed surface mines in western Pennsylvania. USDA Forest Service General Technical Report PSW-GTR-191.
- McAtee, W. L. and F. E. L. Beal. 1912. Some common game, aquatic and rapacious birds in relation to man. U.S. Department of Agriculture Farmer's Bulletin 497: 1-30.
- McDonald R.I., J. Fargione, J. Kiesecker, W. M. Miller, and J. Powell. 2009. Energy sprawl or energy efficiency: climate policy impacts on natural habitat for the United States of America. *PLoS ONE* 4(8): e6802. doi:10.1371/journal.pone.0006802
- McKelvey, K. S., J. P. Copeland, M. K. Schwartz, J. S. Littell, K. B. Aubry, J. R. Squires, S. A. Parks, M. M. Elsner, and G. S. Mauger. 2011. Climate change predicted to shift wolverine distributions, connectivity, and dispersal corridors. *Ecological Applications* 21: 2882-2897.
- Millett, B., W. C. Johnson, and G. Guntenspergen. 2009. Climate trends of the North American prairie pothole region 1906-2000. *Climatic Change* 93: 243-267.
- Minnesota Department of Natural Resources. 2012a. Horned Grebe (*Podiceps auritus*). Accessed 3 October 2012. <http://www.dnr.state.mn.us>.
- Minnesota Department of Natural Resources. 2012b. Baird's Sparrow (*Ammodramus bairdii*). Accessed 28 October 2012. <http://www.dnr.state.mn.us>.
- Minnesota Ornithologists Union. 2011. County checklists. Accessed 28 October 2012. <http://moumn.org/>.
- Mitsch, W. J. and J. G. Gosselink. 2007. *Wetlands*. John Wiley & Sons: New York, NY.
- Mitten, J. B. and S. M. Ferrenberg. 2012. Mountain pine beetle develops an unprecedented summer generation in response to climate warming. *American Naturalist* 179: E163-E171.

- Mollhoff, W. J. 2001. The Nebraska Breeding Bird Atlas 1984-1989. Nebraska Technical Series No. 20. Nebraska Game and Parks Commission, Lincoln, NE.
- Mollhoff, W. J. 2006. The 2006 Nebraska nest report. Nebraska Bird Review 74: 142-147.
- Mong, T. W. 2005. Using radiotelemetry to determine range and resource requirements of Upland Sandpipers at an experimentally managed prairie landscape. Thesis. Kansas State University, Manhattan.
- Monson, G. and A. R. Phillips. 1981. Annotated checklist of the birds of Arizona. 2nd ed. University of Arizona Press: Tucson, AZ.
- Montana Audubon. 2012. Official state bird list. Accessed 13 June 2012. <http://mtaudubon.org/birds/list.html>.
- Montana Bird Conservation Partnership. 2012. Short-eared Owl migration study. Accessed 27 September 2012. <http://www.montanabirds.org/short-eared-owl-migration-study/>.
- Montana Bird Distribution Committee. 2012. P. D. Skaar's Montana bird distribution. 7th ed. Montana Natural Heritage Program Special Publication no. 3: Helena, MT.
- Morrison, R. I. G., B. J. McCaffery, R. E. Gill, S. K. Skagen, S. L. Jones, G. W. Page, C. L. Gratto-Trevor, and B. A. Andrews. 2006. Population estimates of North American shorebirds, 2006. Wader Study Group Bulletin 111: 67-85.
- Murray, B. G. 1969. A comparative study of Le Conte's and Sharp-tailed sparrows. Auk 86: 199-231.
- National Audubon Society. 2012. The 2007 Audubon WatchList. Accessed 3 October 2012. <http://birds.audubon.org/2007-audubon-watchlist>.
- Nature Canada. 2012. Endangered Species: Species spotlight: Horned Grebe. Accessed 4 October 2012. http://www.naturecanada.ca/endangered_know_our_species_hornedgrebe.asp.
- NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life. Accessed 15 September 2012. <http://www.natureserve.org>.
- Nebraska Ornithologists' Union. 2012. Birds of Nebraska. Accessed 13 June 2012. <http://noubirds.org/Birds/Birds.aspx>.
- New Mexico Department of Game and Fish. 2012. Threatened and endangered species of New Mexico. Draft 2012 Biennial Review.
- New Mexico Partners in Flight. 2007. New Mexico Bird Conservation Plan Version 2.1. C. Rustay and S. Norris, compilers. Albuquerque, New Mexico.
- North Dakota Game and Fish Department. 2012. Species of conservation priority. Accessed 23 October 2012. <http://gf.nd.gov/conservation-nongame-wildlife/species-conservation-priority>.

- O'Donnell, C. and J. Fjeldså. 1997. Grebes: Status survey and conservation action plan. IUCN/SSC Grebe specialist group. IUCN, Gland, Switzerland and Cambridge, UK.
- Paige, C. and S. A. Ritter. 1999. Birds in a sagebrush sea: Managing sagebrush habitats for bird communities. Partners in Flight, Western Working Group, Boise, Idaho.
- Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. *Annual Review of Ecology, Evolution and Systematics* 37: 637-669.
- Partners in Flight. 2012. Gray Vireo. Partners in Flight – U.S. Accessed 10 October 2012. <http://www.partnersinflight.org/watchlistneeds/GRVI.htm>.
- Pederson, G. T., L. J. Graumlich, D. B. Fagre, T. Kipfer, and C. C. Muhlfeld. 2010. A century of climate and ecosystem change in western Montana: what do temperature trends portend? *Climatic Change* 98: 133-154.
- Peterson, A. T. 2003. Projected climate change effects on Rocky Mountain and Great Plains birds: generalities of biodiversity consequences. *Global Change Biology* 9: 647-655.
- Peterson, R. A. 1995. The South Dakota breeding bird atlas. South Dakota Ornithologists' Union: Aberdeen, SD.
- Pettingill Jr., O. S. 1981. A guide to bird finding west of the Mississippi. Second Edition. Oxford University Press: New York, NY.
- Popper, K.J. and M.A. Stern. 2000. Nesting ecology of Yellow Rails in southcentral Oregon. *Journal of Field Ornithology* 71: 460-466.
- Post, W. 2008. Winter ecology of Yellow Rails based on South Carolina specimens. *Wilson Journal of Ornithology* 120: 606-610.
- Pruett, C. L., M. A. Patten, and D. H. Wolfe. 2009. Avoidance behavior by prairie grouse: Implications for wind energy. *Conservation Biology* 23: 1253-1259.
- Pulich, W.M. 1961. A record of the Yellow Rail from Dallas County, Texas. *Auk* 78:639-640.
- Pyle, P. 1997. Identification guide to North American Birds: Part I: Columbidae to Ploceidae. Slate Creek Press: Bolinas, CA.
- Québec Breeding Bird Atlas. 2012. Québec breeding bird atlas. Accessed 29 October 2012. http://www.atlas-oiseaux.qc.ca/index_en.jsp.
- Reynard, G. B. 1974. Some vocalizations of the Black, Yellow, and Virginia Rails. *Auk* 91: 747-756.
- Reynolds, T. D., T. D. Rich, and D. A. Stephens. 1999. Sage Thrasher (*Oreoscoptes montanus*). In *The Birds of North America*, No. 463 (A. Poole and F. Gill, eds.). The Birds of North America Inc., Philadelphia, PA.

- Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D. W.Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY.
- Rising, J. D. 1996. A guide to the identification and natural history of the sparrows of the United States and Canada. Academic Press: New York, NY.
- Robert, M., J. B. Jobin, F. Shaffer, L. Robillard and B. Gagnon. 2004. Yellow Rail distribution and numbers in southern James Bay, Québec, Canada. *Waterbirds* 27: 282-288.
- Root, T. 1988. Atlas of wintering North American birds: an analysis of Christmas bird count data. University of Chicago Press: Chicago, IL.
- Ryser, F. A., Jr. 1985. Birds of the Great Basin. University of Nevada: Reno, NV.
- Santisteban, L., C. W. Benkman, T. Fetz, and J. W. Smith. 2012. Survival and population size of a resident bird species are declining as temperature increases. *Journal of Animal Ecology* 81: 352-363.
- Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2010*. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, MD.
- Schlossberg, S. 2006. Abundance and habitat preferences of Gray Vireos (*Vireo vicinior*) on the Colorado Plateau. *Auk* 123: 33-44.
- Seets, J. W. and H. D. Bohlen. 1977. Comparative mortality of birds at television towers in central Illinois. *Wilson Bulletin* 89: 422-433.
- Shaffer, F., J.P. LeBel, and R. Ouellet. 1990. State of the Sharp-tailed Sparrow (*Ammodramus caudacutus subvirgatus*) in Quebec and Canada. Department of Recreation, Hunting, and Fishing, Quebec Association of Ornithological Unions, Quebec.
- Sharpe, R. S., W. R. Silcock, and J. G. Jorgensen. 2001. Birds of Nebraska: their distribution and temporal occurrence. University of Nebraska Press: Lincoln, NE.
- Shriver, W. G., A. L. Jones, P. D. Vickery, A. Weik, and J. Wells. 2005. The distribution and abundance of obligate grassland birds breeding in New England and New York. U.S.D.A. Forest Service General Tech. Rep. PSW 191: 511-518.
- Shriver, W. G., T. P. Hodgman, J. P. Gibbs, and P. D. Vickery. 2010. Home range sizes and habitat use of Nelson's and Saltmarsh Sparrows. *Wilson Journal of Ornithology* 122: 340-345.
- Skagen, S.K., P.B. Sharpe, R.G. Waltermire, and M.B. Dillon. 1999. Biogeographical profiles of shorebird migration in midcontinental North America: U.S. Geological Survey Biological Science Report 2000-0003.

- South Dakota Ornithologists' Union. 1991. The birds of South Dakota. Northern State University: Aberdeen, SD.
- South Dakota Ornithologists' Union. 2011. South Dakota State Checklist. Accessed 13 June 2012. <http://www.homepages.dsu.edu/palmerj/sdou/checklist.htm>.
- Stalheim, P.S. 1974. Behavior and ecology of the Yellow Rail (*Coturnicops noveboracensis*). Master's thesis, University of Minnesota, Minneapolis.
- Stedman, S. J. 2000. Horned Grebe (*Podiceps auritus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/505> doi:10.2173/bna.505.
- Steinauer, E.M. and S.L. Collins. 1996. Prairie ecology—the tallgrass prairie. In Samson, F.B. and F.L. Knopf (eds). Prairie conservation: Preserving North America's most endangered ecosystem. Island Press: Washington, D.C.
- Sterling, J. 2008. Yellow Rail (*Coturnicops noveboracensis*). Pp. 163-166, In Shufford, W.D. and T. Gardali (eds.). Studies of Western Birds 1. Western Field Ornithologists: Camarillo, CA.
- Stewart, R. E. 1975. Breeding birds of North Dakota. Lund: Minneapolis, MN.
- Storer, R. W. 1969. The behavior of the Horned Grebe in spring. Condor 71: 180-205.
- Stout, B. E. and F. Cooke. 2003. Timing and location of wing molt in Horned, Red-necked, and Western Grebes in North America. Waterbirds 26: 88-93.
- Sutter, G. C., T. Troupe, and M. Forbes. 1995. Abundance of Baird's sparrows, *Ammodramus bairdii*, in native prairie and introduced vegetation. Ecoscience 2: 344-348.
- Sutter, G. C., S. K. Davis, and D. C. Duncan. 2000. Grassland songbird abundance along roads and trails in southern Saskatchewan. Journal of Field Ornithology 71: 110-116.
- Swan, T. and M. C. Thompson. 1997. Records of the Yellow Rail in Kansas. Kansas Ornithological Society Bulletin 48: 25-27.
- Swanson, D. L. and J. S. Palmer. 2009. Spring migration phenology of birds in the Northern Prairie region is correlated with local climate change. Journal of Field Ornithology 80: 351-363.
- Tallman, D. and D. Swanson. 2002. The birds of South Dakota. South Dakota Ornithologists' Union. Northern State University Press: Aberdeen, SD.
- Tate, J. 1986. The Blue List for 1986. American Birds 40: 227-236.
- Taylor, B. 1998. Rails: a guide to the rails, crakes, gallinules, and coots of the world. Yale University Press: New Haven, CT.

- Templeton, J. J. and A. C. Kamil. 1999. Sociality and social learning in two species of corvids: The pinyon jay (*Gymnorhinus cyanocephalus*) and the clark's nutcracker (*Nucifraga columbiana*). *Journal of Comparative Psychology* 113: 450-455.
- Thompson, M. C. and C. Ely. 1992. Birds in Kansas, Vol. II. University of Kansas Museum of Natural History Public Education Service no. 12.
- Thompson, M. C., C. A. Ely, B. Gress, C. Otte, S. T. Patti, D. Seibel, and E. A. Young. 2011. Birds of Kansas. University Press of Kansas: Lawrence, KS.
- Tomasevic, J. 2010a. *Coturnicops noveboracensis*. Accessed 13 January 2013. <http://climatechangesensitivity.org/node/561>.
- Tomasevic, J. 2010b. *Bartramia longicauda*. Accessed 13 January 2013. <http://climatechangesensitivity.org/node/554>.
- Tomasevic, J. 2010c. *Gymnorhinus cyanocephalus*. Accessed 13 January 2013. <http://climatechangesensitivity.org/species/gymnorhinus-cyanocephalus>.
- Tomasevic, J. 2010d. *Oreoscoptes montanus*. Accessed 13 January 2013. <http://climatechangesensitivity.org/node/578>.
- Toups, J. A. and J. A. Jackson. 1987. Birds and birding on the Mississippi coast. University Press of Mississippi: Jackson, MS.
- USDI National Biological Service and Utah State University. 1999. Utah Gap Analysis: An Environmental Information System: DWR Neotrops Revision.
- U.S. Fish and Wildlife Service. 2008a. Regional boundaries. Accessed 13 June 2012. <http://www.fws.gov/where/>.
- U.S. Fish and Wildlife Service. 2008b. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. [Online version available at <http://www.fws.gov/migratorybirds>].
- U.S. Fish and Wildlife Service. 2012a. Migratory Bird Treaty Act of 1918. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. Accessed 18 September 2012. <http://www.fws.gov/laws/lawsdigest/migtrea.html>.
- U.S. Fish and Wildlife Service. 2012b. Endangered Species Act. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. Accessed 3 October, 2012. <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B09B>.
- US Forest Service. 2004. Insect and Disease Aerial Detection Surveys – Acres with mortality. Accessed 4 October 2012. http://fhm.fs.fed.us/dm/maps/04/surveys_acres_mortality.pdf.
- USWFS. Migratory Bird Treaty Act of 1918. Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service. Accessed 23 September 2012. <http://www.fws.gov/laws/lawsdigest/migtrea.html>.

- Utah Birds Records Committee. 2012. Checklist of the birds of Utah. Accessed 27 October 2012. <http://www.utahbirds.org/checklistUtah.htm>.
- Utah Conservation Data Center. 2012. Sage Thrasher. State of Utah Natural Resources Division of Wildlife Resources.
- Villard, M.-A. and R. A. Bracken. 1989. First confirmed breeding record of Le Conte's Sparrow, *Ammodramus leconteii*, in eastern Ontario. *Canadian Field-Naturalist* 103: 89-90.
- Voelker, G. 2000. Molt of the Gray Vireo. *Condor* 102: 610-618.
- Voelker, G. 2004. Can migrants do it faster? Accelerated molt of Baird's sparrows and further insights into southwestern molting grounds. *Condor* 106: 910-914.
- Wahl, T. R., B. Tweit, and S. G. Mlodinow. 2005. Birds of Washington: status and distribution. Oregon State: Corvallis, Oregon.
- Walkinshaw, L. H. 1939. The Yellow Rail in Michigan. *Auk* 56: 227-237.
- Weick, F. 2006. Owls (Strigiformes) annotated and illustrated checklist. Springer: New York, NY.
- Westerling, A. L., M. G. Turner, E. A. H. Smithwick, W. H. Romme, and M. G. Ryan. 2011. Continued warming could transform Greater Yellowstone fire regimes by mid-21st century. *PNAS* 108: 13165-13170.
- Wiggins, D. 2004. Short-eared Owl (*Asio flammeus*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region.
- Wiggins, D. A. 2005. Pinyon Jay (*Gymnorhinus cyanocephalus*): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region.
- Wiggins, D. A. 2006. Baird's sparrow (*Ammodramus bairdii*): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region.
- Wiggins, D. A., D. W. Holt and S. M. Leasure. 2006. Short-eared Owl (*Asio flammeus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved 27 September 2012 from the Birds of North America Online: <http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/062>.
- Wildlife Conservation Society Canada. 2011. Climate change. Accessed 5 October 2012. <http://www.wcsCanada.org/WhatWeDo/Arctic/ClimateChange.aspx>.
- Williams, J. D. and M. Zimmer. 1992. First Sharp-tailed Sparrow South Dakota nesting record. *South Dakota Bird Notes* 44: 84-85.
- Wilson, S. D. and J. W. Belcher. 1989. Plant and bird communities of native prairie and introduced Eurasian vegetation in Manitoba, Canada. *Conservation Biology* 3: 38-44.
- Winder, V. L. and S. D. Emslie. 2010. Mercury in Nelson's Sparrow subspecies at breeding sites. *PLoS ONE* 7(2): e32257. doi:10.1371/journal.pone.0032257.

- Winder, V. L. and S. D. Emslie. 2012. Mercury in non-breeding sparrows of North Carolina salt marshes. *Ecotoxicology* 21: 325-335.
- Winder, V. L., A. K. Michaels, and S. D. Emslie. 2012. Winter survivorship and site fidelity of Nelson's Saltmarsh, and Seaside Sparrows in North Carolina. *Condor* 114: 421-429.
- Winter, M., J. A. Shaffer, D. H. Johnson, T. M. Donovan, W. D. Svedarsky, P. W. Jones, and B. R. Euliss. 2005. Habitat and nesting of Le Conte's Sparrows in the northern tallgrass prairie. *Journal of Field Ornithology* 76: 61-71.
- Wyckoff, P. H. and R. Bowers. 2010. Response of the prairie-forest border to climate change: impacts of increasing drought may be mitigated by increasing CO₂. *Journal of Ecology* 98:197-208.
- Wyoming Game and Fish Department. 1998. Wyoming bird checklist. Accessed 13 June 2012. <http://www.npwrc.usgs.gov/resource/birds/chekbird/r6/wyoming.htm>.
- Wyoming Game and Fish Department. 2010. Short-eared owl – *Asio flammeus*. Wyoming State Wildlife Action Plan. Accessed 27 September 2012. http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SWAP_SHORTEAREDOWL0000458.pdf.
- Youngworth, W. M. 1934. Baird's sparrow at home. *Wilson Bulletin* 46: 257.