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

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# **STATUS OF 10 ADDITIONAL 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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## American Bittern (*Botaurus lentiginosus*)



**Figure 1.** The cryptically colored American Bittern blends in well with marsh vegetation and is easily overlooked. Photo by Katrina Hucks.

### Summary

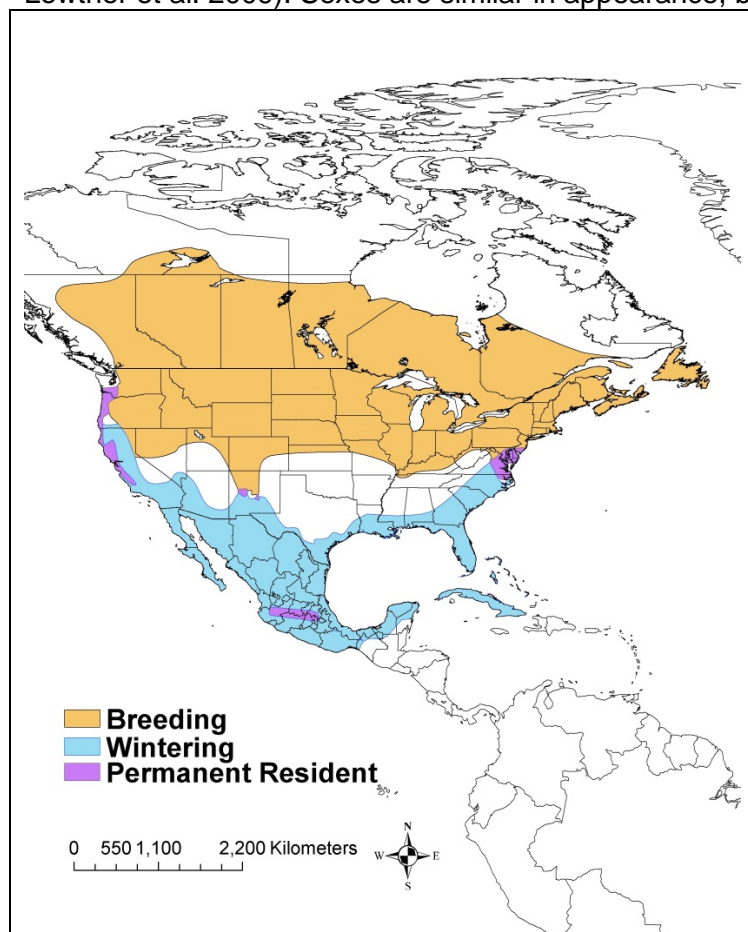
- American Bitterns are medium-sized, brown herons which inhabit large wetlands with dense emergent vegetation. Their cryptic coloration allows them to blend in well with dead emergent vegetation, and American Bitterns have a tendency to “freeze” with the bill pointing up if they feel threatened.
- They breed from Newfoundland west to British Columbia (generally south of 55 °N latitude) and south to California, northern New Mexico, and northeastern North Carolina. American Bitterns generally winter in areas where the average temperature remains above freezing. Their winter distribution stretches from Maryland (rarely New Jersey) south to Florida, west to California, south through Mexico to (rarely) Panama.
- Due to their secretive habitats, no population estimates are available. Within Region 6, American Bitterns are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in North Dakota and Utah. They are listed as a Level II / Tier II species (i.e. a species in need of conservation) in Montana, Wyoming, and Kansas.
- Since 1966, the number of American Bitterns detected on Christmas Bird Counts (CBCs) has declined by a slight but significant rate of 0.04% per year.

## Legal Status

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 1 and 2.

## Description

The American Bittern (Fig. 1) is a brown, medium-sized heron (Lowther et al. 2009). They range from 60 to 85 cm long and 370-500 g in mass (Lowther et al. 2009). Adults are heavily streaked with brown and white on their underparts and are brown with black flecks above (Lowther et al. 2009). They have a rusty-brown crown, a white throat, and a long, black patch extending from below the eye down the side of the neck (Hancock and Kushlan 1984, Lowther et al. 2009). Sexes are similar in appearance, but males are slightly larger (Lowther et al. 2009). Juveniles lack the black neck patches (Lowther et al. 2009).



**Figure 2.** American Bitterns breed across the northern half of the US and the southern half of Canada and winter in the southern US and Mexico. This map was created using data provided by BirdLife International and NatureServe (2012).

## Distribution

### Rangewide

American Bitterns breed from British Columbia east to Newfoundland, usually below the 55<sup>th</sup> parallel, south to California, New Mexico and northeastern North Carolina (Lowther et al. 2009; Fig. 2). Resident populations of American Bittern occur on the Chesapeake Bay, the Pacific Coast of the United States and central Mexico (Lowther et al. 2009, BirdLife International and Nature Serve 2012). They winter from California east to Maryland (rarely New Jersey), and south into Mexico (Lowther et al. 2009, Boyle 2011). American Bitterns formerly wintered as far south as Costa Rica and Panama (Ridgely and Gwynne 1989, Stiles and Skutch 1989).

### Region 6

**Colorado:** Breeding occurs in the North Park basin, lower Arkansas River valley, South Platte River valley, north-central Colorado, and San Luis Valley (Kingery 1998). However, the total number of

breeding birds in the state is relatively low (Kingery 1998). Andrews and Righter (1992) suggest that they are rare to uncommon breeders primarily in the eastern plains as well as in mountain parks. Historically, this bird was described as common in Colorado (Niedrach and Rockwell

1939) and Kingery (1998) suggests that this species may no longer be present in some areas where it bred previously.

Kansas: American Bitterns are considered to be uncommon transients and fairly common summer residents, excluding the westernmost portion of the state (Thompson et al. 2011). The Kansas Breeding Bird Atlas confirmed breeding at Cheyenne Bottoms Wildlife Area (Barton Co.) and probable nesting was noted at Baker Wetlands (Douglas Co), Benedictine Bottoms (Atchison Co.) and Quivira National Wildlife Refuge (Stafford Co.; Thompson et al. 2011). Possible breeding records have also been reported at Seward, Pawnee, Barton, and Sumner Co. (Busby and Zimmerman 2001).

Montana: This species breeds throughout the state, but they are more common in the northern half of the state (Bergeron et al. 1992). American Bitterns arrive from late April to May and breed from May until July (Bergeron et al. 1992). This species is typically found at elevations less than 2000 m (Bergeron et al. 1992).

Nebraska: American Bitterns are uncommon migrants throughout the state (Sharpe et al. 2003). These birds begin arriving in late March, and arrival peaks in late April and early May (Sharpe et al. 2003). Migratory departures cease by November (Sharpe et al. 2003). They breed throughout the eastern two-thirds of the state but are more uncommon in the western half of the state (Molhoff 2001).

North Dakota: American Bitterns occur throughout the state. They are generally fairly common statewide (Faanes and Stewart 1982). Specifically, they are common on the Southern Drift Plain, in the southern portion of the Missouri Coteau, in the Turtle Mountains, and on the J. Clark Salyer National Wildlife Refuge (Stewart 1975). They are fairly common on the remainder of the Drift Plain and Missouri Coteau (Stewart 1975). This species breeds in wetlands containing emergent wetland vegetation, and the inhabited wetlands typically are deep-marsh or shallow-marsh associations (Stewart 1975). Breeding season occurs from late May to mid-August and peaks from mid-June to late July (Stewart 1975).

South Dakota: American Bitterns are locally uncommon throughout South Dakota (Peterson 1995). More observations were recorded in the Prairie Pothole Region, where most of the lakes and marshes occur, than elsewhere in the state (Peterson 1995).

Utah: American Bitterns are uncommon summer residents in Utah (Utah Bird Records Committee 2013). The majority of critical habitat for the American Bittern in Utah occurs in Box Elder Co. and Tooele Co. (Utah Conservation Data Center 2013). Sparse habitat occurs around the Great Salt Lake and Colorado River (Utah Conservation Data Center 2013).

Wyoming: American Bitterns are uncommon summer residents in Wyoming, and they are distributed across Albany, Fremont, Goshen, Lincoln, and Teton Co. (Faulkner 2010). However, recent breeding sites are mostly limited to the Laramie Plains (Albany Co.), Goshen Hole (Goshen Co.), and Cokeville Meadows NWR (Lincoln Co.; Faulkner 2010). Historically, this species may have nested along the wet meadows and freshwater wetlands associated with the state's major rivers, such as the North Platte and Sweetwater Rivers (Knight 1902, Faulkner 2010). Degradation and destruction of these wet meadow and wetland habitats make most of these wetlands currently unsuitable for American Bittern nesting (Faulkner 2010).



## **Biology**

### **General**

American Bitterns feed primarily on insects, amphibians, small fish, small mammals, and crayfish (Lowther et al. 2009). They forage along vegetated fringes and shorelines of wetlands as well as more permanent bodies of water, and they may avoid homogeneous stands of older, dense, or dry vegetation (Lowther et al. 2009).

American Bitterns forage using four techniques: standing in place, neck swaying, walking slowly, and walking quickly (Kushlan 1978). They are solitary feeders that rely on stealth to capture prey (Lowther et al. 2009). The stripes and overall brown coloration provides camouflage in wetland vegetation, and it is believed that this camouflage was evolved to facilitate prey capture rather than to avoid predation (Kushlan 1978). American Bitterns are primarily crepuscular foragers, but they may forage during the day and night (Lowther et al. 2009). Foraging birds move very slowly and deliberately whilst searching for prey, but they jab prey with their beak very quickly (Forbrush 1927a). Prey is swallowed head-first after it has been killed by shaking or biting (Forbrush 1927a).

American Bitterns have a distinctive low-frequency vocalization consisting of clicking and gulping sounds followed by *dunk-a-doo* (Lowther et al. 2009). This call has given the American Bittern a variety of colloquial names, including “stake-driver,” “thunder-pumper,” and “mire-drum” (Lowther et al. 2009). The low-frequency of the vocalization is audible at great distances, even through dense vegetation (Cosens and Falls 1984). Most vocalization occurs early in the breeding season (Lowther et al. 2009).

When alarmed, American Bitterns assume a characteristic stance of pointing their bill up, stretching vertically, compressing their body feathers, and swaying with the breeze to imitate vegetation (Lowther et al. 2009).

### **Breeding**

American Bittern peak arrival time on their breeding grounds occurs from mid-April to early May, and they depart to their wintering grounds from late August to early December (Bent 1963, Knapton 1979, Johnsgard 1980a, and Dechant et al. 2004). Adults show moderate breeding ground fidelity. In Minnesota, a study determined that 41% of marked adults returned to their prior breeding territories (Bringer 1996).

Pair formation occurs when females arrive at the breeding grounds in early March to early May (Lowther et al. 2009). The first brood occurs in late April to early June (Lowther et al. 2009). Timing of female arrival and broods varies by latitude (Lowther et al. 2009). These birds form monogamous pairs, but clumped nest distribution in a male’s territory suggests that polygyny occurs occasionally (Middleton 1949, Lowther et al. 2009). Male displays prior to copulation consist of holding their head low, exhibiting “jerky” movements, and exposing white feathers under the wing (Johnsgard 1980b).

The majority of nests are created in dense emergent wetland vegetation in water 5-20 cm deep (Bent 1926, Mousley 1939, Lowther et al. 2009). The eggs are incubated for approximately four weeks (Lowther et al. 2009), and the female is solely responsible for both brooding and feeding the young (Palmer 1962).

### **Wintering**

The wintering habits of this species are not well understood. Large numbers of American Bittern may forage in upland habitats such as grassland (Lowther et al. 2009), although they are most frequently encountered in cattail (*Typha*) marshes (pers. obs.).

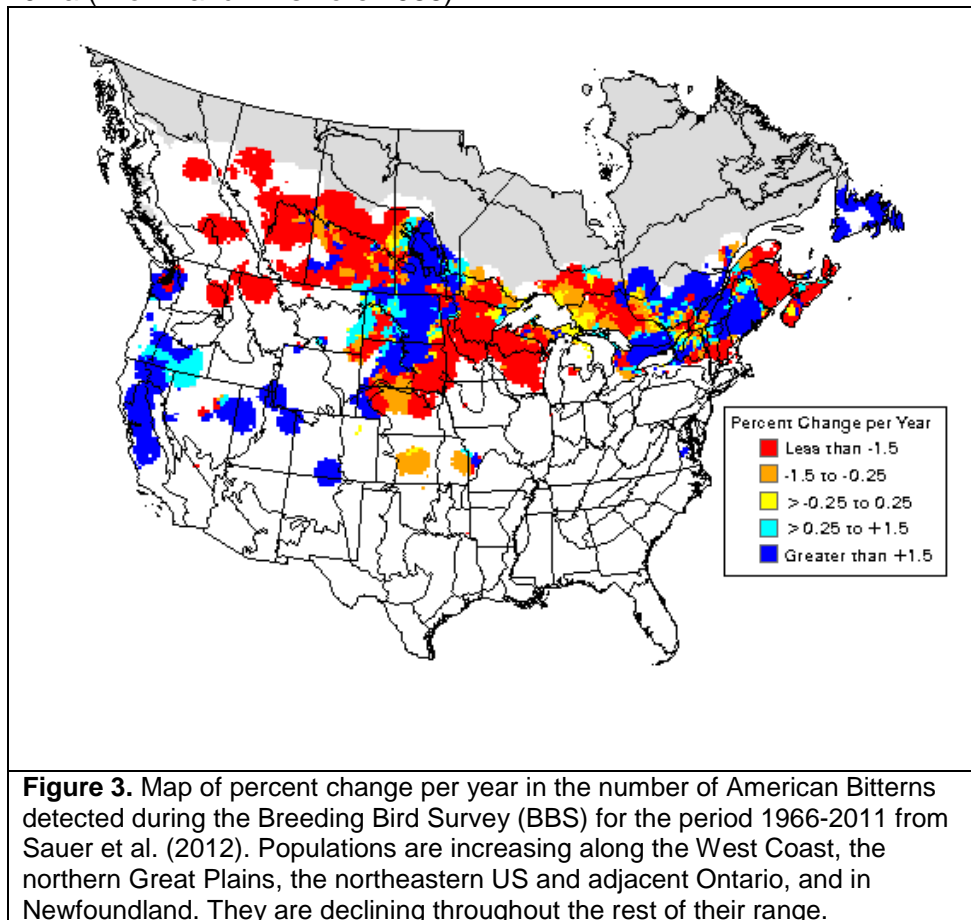
## Habitat

### Breeding

American Bitterns nest primarily in freshwater wetlands (Lowther et al. 2009). Preferred habitat consists of areas with both open water and tall emergent wetland vegetation such as bulrushes (*Scirpus*) and cattails (Duebber and Lokemoen 1977, Lowther et al. 2009, Faulkner 2010). However, these birds will occasionally use sparsely vegetated wetlands as well as upland cover (Lowther et al. 2009).

Historically, American Bitterns nested more commonly in the eastern U.S., but are now considered endangered by some eastern states, such as Illinois (Bowles et al. 1981). This species inhabits wetlands ranging from 0.1 to 1,000 ha, but they are more abundant on larger wetlands (Lowther et al. 2009). Historically, American Bitterns were frequently found in wetlands as small as four ha (Eaton 1910) but more recently American Bitterns in Iowa tended to select wetlands between 11-20 ha (Brown and Dinsmore 1986).

American Bitterns are typically associated with densely vegetated wetlands with water less than 10 cm in depth (Fredrickson and Reid 1986). Studies in Minnesota and Wisconsin observed that American Bitterns occupied habitats with a mean water depth of 10 cm, tall vegetation (1.3 m), and dense sedge and grass vegetation (Hanowski and Niemi 1986, Mancini and Rusch 1988). Interspersion (land-water edge density) was the best predictor of abundance in a study in New York (Rehm and Baldassarre 2007).



**Figure 3.** Map of percent change per year in the number of American Bitterns detected during the Breeding Bird Survey (BBS) for the period 1966-2011 from Sauer et al. (2012). Populations are increasing along the West Coast, the northern Great Plains, the northeastern US and adjacent Ontario, and in Newfoundland. They are declining throughout the rest of their range.

### Migration

Preferred habitats include wetlands dominated by emergent wetland vegetation such as bulrush (*Scirpus*), bur-reed (*Sparganium*), cattail (*Typha*), and smartweed (*Polygonum*; Reid 1989, Lowther et al. 2009).



## Winter

American Bitterns winter in habitat similar to their breeding habitat, but they select areas with above-freezing temperatures and open water (Root 1988, Lowther et al. 2009). Managed wetlands provide important habitat for wintering birds (Root 1988, Lowther et al. 2009).

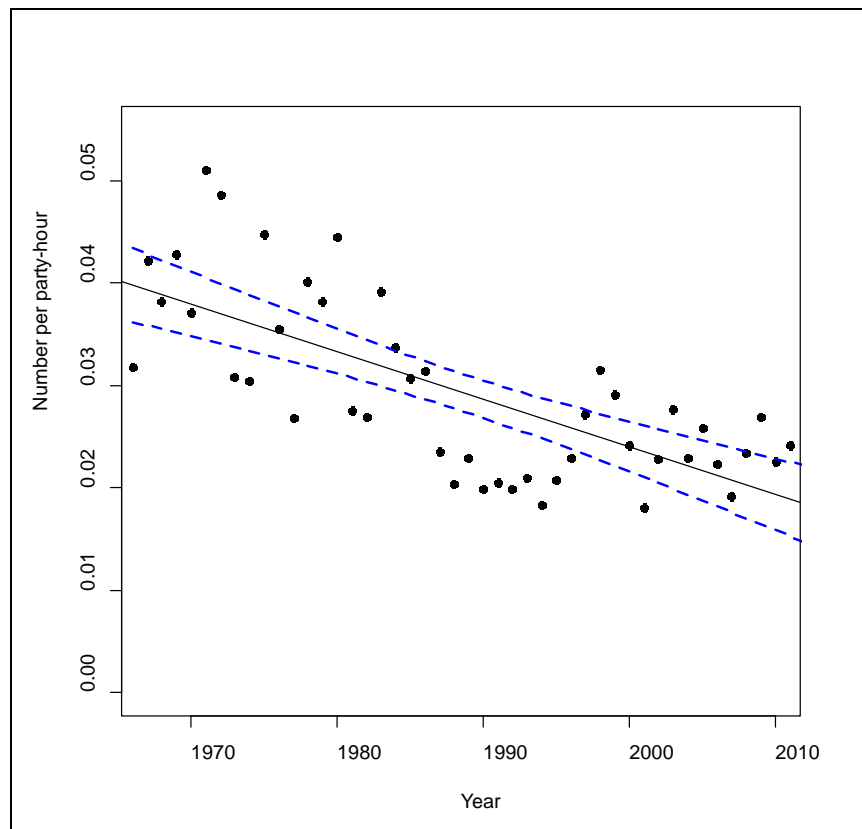
## **Population Trends and Estimates**

No population estimates exist for this species. However, BirdLife International (2014) ranks this species as “Least Concern”, noting that the population size is “extremely large”. The Breeding Bird Survey (BBS) does not show a significant change in American Bittern numbers for the period 1966-2011 (Table 2) although some regional declines are evident (Fig. 3). For example, detections of American Bitterns have declined by 7.6% annually in the Prairie-Hardwood transition (Sauer et al. 2012; Fig. 3). However, BBS protocol may not survey this secretive species very efficiently, and call-response surveys have elicited higher detection than passive observation (Gibbs and Melvin 1997, Rehm and Baldassarre 2007). The number of American Bitterns detected on Christmas Bird Counts (CBCs) in the US and Mexico for the period 1966-2011 also showed a significant decline of 0.01% annually (linear regression, number per party-hour =  $-0.0004 \times \text{year} + 0.95$ ,  $F_{1,44} = 84.48$ ,  $r^2 = 0.50$ ,  $p < 0.0001$ ; Fig. 4).

## **Threats**

In Canada, mortality due to collisions with vehicles is minimal (Bishop and Brogan 2013). For example, only a single casualty was attributed to a vehicular collision during the period 1979-1993 in Big Creek National Wildlife Area in Ontario (Ashley and Robinson 1996). Habitat loss and habitat degradation of freshwater wetlands throughout their breeding, migratory, and wintering ranges are likely the major causes for population decline (Dahl 1990, Dahl and Allord 1996, and Lowther et al. 2009,).

Invasive plant species such as purple loosestrife (*Lythrum salicaria*) may negatively impact habitat, but the effects on American Bittern have not been studied (Lowther et al. 2009).



**Figure 4.** The number of American Bitterns detected per party-hour during CBCs in the US and Mexico for the period 1966-2012 declined at a rate of 0.04% per year. Dashed lines indicate 95% confidence intervals. This figure was created using data from the National Audubon Society (2013).

## Acid Precipitation

Acid precipitation represents a potential threat due to the American Bittern's reliance on freshwater wetlands that may be vulnerable to acidification (Lowther et al. 2009). Amphibians

constitute a high proportion of their diet and are vulnerable to the effects of acid precipitation (Cottam and Uhler 1945, Pierce 1993).

### Pesticides and Contaminants

The direct effects of pesticides and contaminants on American Bitterns have not been well studied. Indirect effects of contaminant runoff may affect their amphibian prey (Lowther et al. 2009).

### Direct Persecution

In the past, direct persecution may have negatively affected this species. Their eerie vocalization caused them to be targeted for local extermination by humans because of the Bible's portrayal of bitterns and wetlands as a consequence of divine wrath (Isaiah 14:23). In 1786, 100 men in Connecticut coordinated to extirpate American Bitterns from nearby wetlands (Merriam 1877). Presently, persecution is not a widespread problem for this species.

### **Effects of Climate Change**

The sensitivity score for the American Bittern on the Climate Change Sensitivity Database is "Medium" (Tomasevic 2010) and Gardali et al. (2012) suggest that birds breeding in wetlands may be sensitive to predicted changes in climate. Climate change in the prairie pothole region is expected to cause an increase in temperatures as well as an increase in droughts (Ojima and Lockett 2002). This is expected to reduce the amount of suitable habitat for American Bitterns in this region by 29% (Steen and Powell 2012). Matthews et al. (2004) suggest that this species may eventually disappear from most of the eastern US.

### **Effects of Energy Development**

American Bitterns primarily inhabit freshwater wetlands throughout their range. These wetlands are not typically selected for wind turbine farms, oil development, or solar farm placement. As such, energy development should not be a major concern for this species.

### **Management**

American Bitterns avoid areas that undergo vegetation-removing disturbances such as annual burning, mowing, grazing, and agriculture (Duebbert and Lokemoen 1977, Messmer 1985, Dechant et al. 2004). Management practices for this species should protect and conserve dense stands of emergent wetland vegetation. In addition, Wiggins (2006) recommends that a 200+ m buffer of upland vegetation be maintained around nesting sites in order to reduce nest depredation, provide additional nesting habitat, and improve water quality through filtering.

### **Conservation**

Protecting existing wetlands should be the primary focus of conservation efforts for this species. Wetland complexes with varying wetland sizes (20-180 ha), vegetation succession, and hemimarsh status represent the highest quality habitat for this species (Brown and Dinsmore 1986, Dechant et al. 2004, Wiggins 2006).

The preservation of large (>10 ha) freshwater wetlands with dense emergent wetland vegetation is essential for the American Bittern (Lowther et al. 2009). Landscape level effects in the watershed must also be considered to prevent habitat degradation from chemical contaminants, siltation, eutrophication, and other pollution (Lowther et al. 2009). Maintaining vegetation buffers around wetlands important for American Bitterns might filter out potential degrading factors. Breeding and wintering American Bitterns heavily utilize wetlands on state and federal refuges, and ongoing management in these refuges is critical for their population (Lowther et al. 2009).

In addition, better tracking of the numbers of this species would facilitate conservation. Playback surveys may be more effective at detecting the presence of American Bittern than passive surveys. For example in a South Dakota study, researchers determined the ratio of detection for playback to passive surveys as 2.4:1 (Allen et al. 2004). Also, American Bittern were shown to respond to a variety of wetland bird vocalizations (Allen et al. 2004).

### **Completed and Ongoing Conservation Actions**

The Waterbird Conservation Plan recommends documenting critical waterbird sites/landscapes and identifying gaps that may hinder efforts to monitor American Bitterns as well as other species (Kushlan et al. 2002). Conservation efforts have improved nesting habitat at Cokeville Meadows National Wildlife Refuge in Wyoming (Wyoming Game and Fish Department 2010).

**TABLE 1.** American Bittern status rangewide summarized by multiple listing agencies. IUCN=International Union for Conservation of Nature, ABC=American Bird Conservancy, and PIF=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.

<b>IUCN</b>	Least Concern
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	Potential Concern
<b>Birds of Conservation Concern</b>	BCR 11, BCR 12, BCR 13, BCR 14, BCR 16, BCR 17, BCR 22, BCR 23, BCR 26, BCR 27, BCR 30, BCR 31, BCR 37, USFWS Region 3, USFWS Region 4, USFWS Region 5, USFWS Region 6,
<b>PIF</b>	-

**TABLE 2.** American Bittern status summarized by Natural Heritage rankings, BBS trends for 1966-2011, BBS trends for 2000-2011, and multiple listing agencies. SGCN=Species of Greatest Conservation Need. A hyphen (-) = 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G4	-0.6% (-2.6, 0.4%)	2.2% (-0.3, 4.6%)	-	-
<b>Region 6</b>	-	0.2 % (-1.4, 1.7%)	0.5% (-3.7, 4.9%)	-	-
<b>Montana</b>	S3B	Insufficient data	Insufficient data	Species of Concern	Tier II
<b>North Dakota</b>	SNRB	0.8% (-1.2, 2.9%)	-0.6% (-6.4, 5.4%)	-	Level I
<b>South Dakota</b>	S4B	-0.4% (-3.2, 2.6%)	-3.3% (-13.2, 7.3%)	-	-
<b>Wyoming</b>	S3B	Insufficient data	Insufficient data	Species of Concern	Tier II
<b>Colorado</b>	S3S4B	-	-	-	-
<b>Utah</b>	S3S4B, S3N	Insufficient data	Insufficient data	-	Species of Greatest Conservation Need
<b>Nebraska</b>	S4	1.3% (-2.6, 5.5%)	1.0% (-7.1, 7.3%)	-	-
<b>Kansas</b>	S1B	Insufficient data	Insufficient data	-	Tier II

## Ferruginous Hawk (*Buteo regalis*)



**Figure 5.** Ferruginous Hawk are among the largest hawks in North America. Photo by Bill Adams.

### Summary

- The Ferruginous Hawk is the largest *Buteo* hawk in North America. There are two color morphs. The light morph is generally pale below and rusty above, with reddish legs and tail. The dark morph is far rarer and is dark rufous to dark brown below with dark undertail coverts.
- Ferruginous Hawks breed from southwestern Manitoba to Saskatchewan southern British Columbia south to Arizona, New Mexico, and the panhandle of Oklahoma. They winter from southwestern Nebraska west to California and south to northern Mexico. They are typically found in grasslands and shrub-steppe habitat.
- The total population of this species is estimated to be 5,842 – 14,000 individuals. Within Region 6, Ferruginous Hawks are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in North Dakota, South Dakota, Wyoming, Nebraska and Kansas. They are listed as a Level II / Tier II species (i.e. a species in need of conservation) in Montana and Utah.
- For the period 1966-2011, detections of Ferruginous Hawks on BBS routes increased at a rate of 1.3% annually. In Montana, detections of Ferruginous Hawks increased by 4% during this same period.
- For the period 1966-2012, detections of Ferruginous Hawks on CBCs increased by 0.05% annually. However, the trends for both the BBS and CBCs are based on small numbers of birds and so should be interpreted with caution.
- The primary threat to this species is human disturbance.

## Legal Status

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 3 and 4.

The U.S. Fish and Wildlife Service rejected a petition to list this species for protection under the Endangered Species Act (Ure et al. 1991, USFWS 1992).

## Description

The Ferruginous Hawk (Fig. 5) is a massive *Buteo* hawk with a large head, broad wings, and robust chest (Bechard and Schmutz 1995). Total length ranges from 56-69 cm, and mass ranges from 977-2074 g (Bechard and Schmutz 1995). Males and females have similar plumage, but females show more pigmentation on legs and belly (Bechard and Schmutz 1995). Females have a larger body mass (Bechard and Schmutz 1995). Light morph adults have a white or gray tail and nearly white underparts with rufous or gray specks on the belly and speckled underwing coverts (Bechard and Schmutz 1995). Adult and fledgling dark morphs have a light-colored tail and primaries, but are otherwise dark brown or reddish (Bechard and

Schmutz 1995). The upper wing and back feathers are fringed with rufous coloration (Bechard and Schmutz 1995). No subspecies are currently recognized (Faulkner 2010).

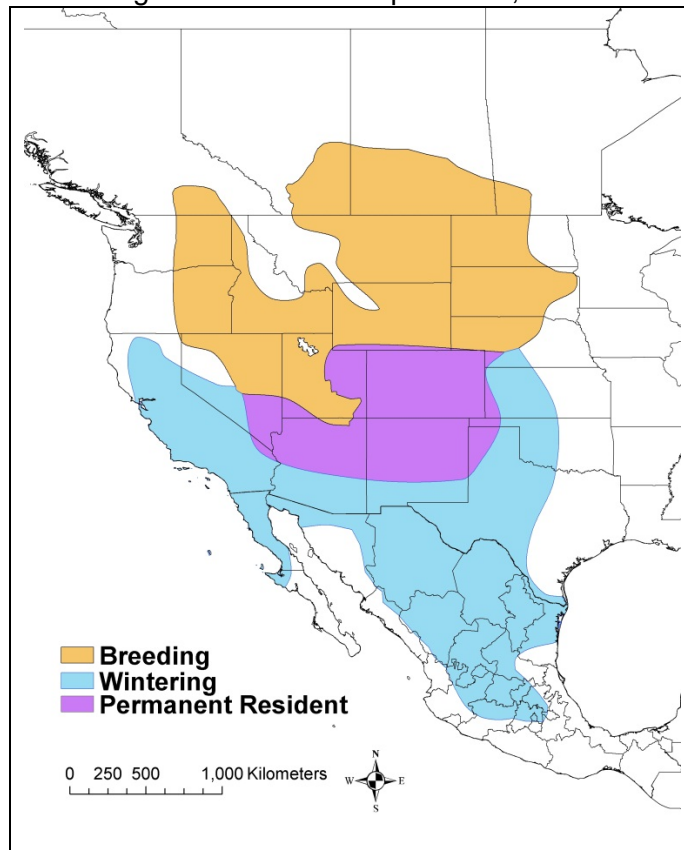
## Distribution

### Rangewide

The breeding range extends from southwestern Manitoba west to British Columbia south to Arizona, New Mexico, and northwestern Texas (Bechard and Schmutz 1995; Fig. 6). Residents occur year-round in Utah, southern Wyoming, southwestern Nebraska, western Kansas, the Texas and Oklahoma panhandles, New Mexico, Arizona, and southeastern Nevada (Bechard and Schmutz 1995). These hawks winter from Nebraska south to northern Mexico and west to California (Bechard and Schmutz 1995).

### Region 6

Colorado: Although range maps show this species occurring statewide (e.g. Fig. 6) the Ferruginous Hawk has only been confirmed breeding in the eastern half of the state and the far northwest corner of the state (Kingery 1998). In the northwest corner of the state, breeding occurs near the Gunnison River, White River, and Yampa River (Kingery 1998). In the



**Figure 6.** The breeding range of the Ferruginous Hawk extends from extreme southwestern Manitoba west to southern British Columbia and south to northern Arizona, New Mexico and the Panhandle of Texas. Ferruginous Hawks may winter as far south as central Mexico. This map was created using data provided by BirdLife International and NatureServe (2012).



eastern half of the state, breeding is more evenly distributed (Kingery 1998). Gillihan et al. (2004) estimate that there are 300 active nests in the state, with the largest numbers breeding in the Pawnee National Grasslands in northeastern Colorado, Comanche National Grasslands in southeastern Colorado, and in Washington and Yuma Counties in extreme northeastern Colorado.

Kansas: Considered to be a low-density permanent resident in western Kansas, although it may be common during migration (Thompson et al. 2011). It is an uncommon winter resident in the central part of the state and is rare east of the Flint Hills (Thompson et al. 2011) Gillihan et al. (2004) estimates that there are 40-50 pairs breeding in the state. Breeding records have been reported in the western third of the state, and nests primarily occur in eroded canyons along the Smoky Hill River in Trego, Gove, Logan, and Wallace Co. (Thompson and Ely 1989, Busby and Zimmerman 2001, Gillihan et al. 2004). Confirmed breeding records have been reported in Grant and Morton Co. (Busby and Zimmerman 2001). Probable breeding records have been reported in Kearny and Meade Co. (Busby and Zimmerman 2001). Possible breeding reports are comparatively more scattered throughout western Kansas and occur in Barber, Clark, Meade, Stevens, Grant, Finney, Hamilton, Greeley, Scott, Ness, Rush Co. (Busby and Zimmerman 2001).

Montana: Ferruginous Hawks breed throughout the majority of the state (Bergeron et al. 1992). Birds arrive as early as March and depart by October, and breeding occurs from late April to July (Bergeron et al. 1992). The highest densities occur in Philips, Carter, Cascade, Toole, and Beaverhead Cos. (Bergeron et al. 1992). Ferruginous Hawks are not found at elevations above 2100 m (Bergeron et al. 1992).

Nebraska: Ferruginous Hawks are uncommon migrants and uncommon breeders in Nebraska (Sharpe et al. 2003). They are most often found in summer in the western Sandhills and Panhandle (Sharpe et al. 2003). Peak arrival during migration occurs from March to April, with young Ferruginous Hawks arriving later (Rosche 1994). Migrants depart as early as mid-September, but some individuals will overwinter (Sharpe et al. 2003). Most nests have been found in Kimball, Box Butte, Dawes, and Sioux counties although a few nests have been documented in the southwestern part of the state (Molhoff 2001, Gillihan et al. 2004).

North Dakota: Ferruginous Hawks breed throughout the eastern three-quarters of the state, and they can be locally common in the south-central part of the state (Kidder, Stutsman, Logan, Lamoure, McIntosh, and Dickey Cos.; Stewart 1975, Faanes and Stewart 1982). Populations on the Missouri Slope, Little Missouri Slope, Northeastern Drift Plains, and Northwestern Drift Plains were formerly much greater based on historical records from the early 20<sup>th</sup> century (Stewart 1975). Breeding season occurs from mid-April to late July, and breeding peaks from late April to early July (Stewart 1975).

South Dakota: Ferruginous Hawks are uncommon migrants and breeders in western and north-central South Dakota (Peterson 1995, Tallman and Swanson 2002). They are rare in northeastern South Dakota and are absent in the southeastern portion of the state. Olendorff (1993) estimated that 350-375 pairs breed in the state. However, the recent Breeding Bird Atlas work suggests that numbers have plummeted in the Missouri Coteau region (N. Drilling pers. comm.)

Utah: Ferruginous Hawks breed in all but the southwest corner (San Juan Co.) of the state (Utah Conservation Data Center 2013). Their Utah winter range is mostly constricted to the

mountains in the central portion of the state and the river valleys in Duchesne Co. and Uintah Co. (Utah Conservation Data Center 2013).

Wyoming: This species is listed as an uncommon resident in Wyoming, and the state holds the second-largest breeding population in North America consisting of over 800 pairs (Olendorff 1993, Faulkner 2010). They occur in all counties but are most abundant in open low-elevation grasslands and shrub-steppe of south-central Wyoming (Faulkner 2010). Peak spring arrival occurs in March, and peak spring departure occurs in October (Faulkner 2010).

## **Biology**

### General

In Colorado, Ferruginous Hawks west of the Continental Divide prey primarily on lagomorphs, while Ferruginous Hawks east of the Divide prey primarily on ground squirrels and prairie dogs (Preston and Beane 1996). This raptor has been observed hunting prairie dogs from the ground (Kingery 1998). The hawk crouches near the hole to listen for prairie dogs, and when a prairie dog is detected the hawk reaches into the hole to grasp its prey with its talons (Kingery 1998). Ferruginous Hawks are occasionally subject to kleptoparasitic attacks by Bald Eagles (*Haliaeetus leucocephalus*) who will occasionally steal prey from them (Kingery 1998).

### Breeding

Breeding Ferruginous Hawks typically occur at low densities throughout their breeding range (Kingery 1998). Breeding density in eastern Colorado may be as low as one pair per 108 km<sup>2</sup>, but home range size per breeding pair varies substantially depending upon the quality of the habitat (Olendorff 1972, Fitzner et al. 1977, Schmutz et al. 1980). Pair formation occurs from late February to March; however, some birds may remain throughout the year and move to nesting territories in early March (Olendorff 1972, Smith and Murphy 1973).

Both members of a breeding pair build or repair a previously used nest (Bechard and Schmutz 1995). Males bring most of the material to the nest, and the female uses these materials to build the nest (Bechard and Schmutz 1995). Nests consist of sagebrush stems, sticks, bark, debris, and even bone (Bechard and Houston 1984, Bechard and Schmutz 1995).

### Wintering

Adults depart for migration earlier than young (Schmutz and Fyfe 1987). The Continental Divide typically divides migratory populations, but overall crossover is 8.6% (Gossett 1993, Bechard and Schmutz 1995).

## **Habitat**

### Breeding

Ferruginous Hawks breed in grassland and shrub-steppe regions situated on flat and rolling landscapes (Bechard and Schmutz 1995). These birds avoid high elevation, narrow canyons, and forest interior (Ensign 1983, Bechard et al. 1990, Restani 1991, Bechard and Schmutz 1995). These raptors prefer elevated nest sites located on boulders, creek banks, knolls, low cliffs, buttes, trees, large shrubs, utility structures, and haystacks; however, they will nest on ground if elevated sites are absent (Bechard and Schmutz 1995).

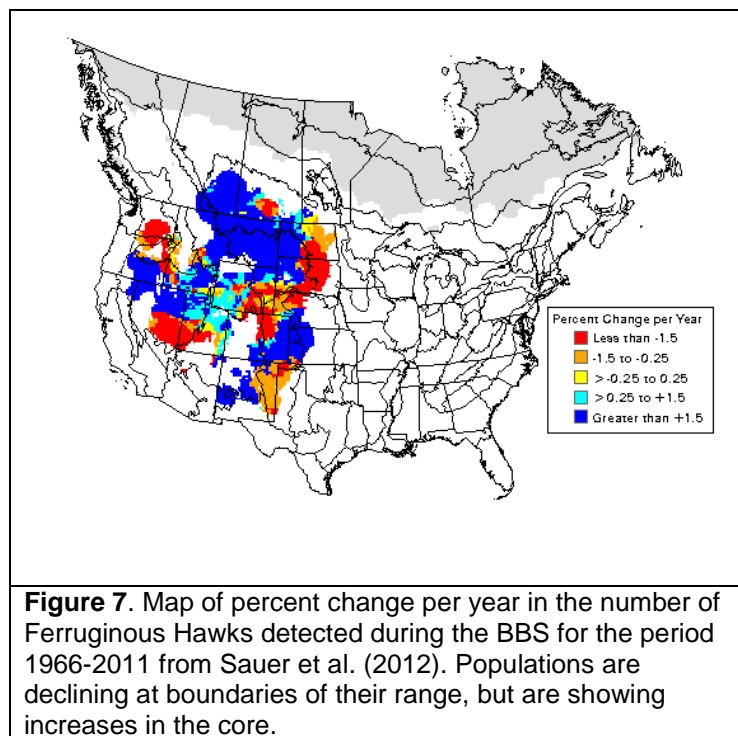
### Migration

No information is available for habitat used during spring and fall migration.

### Winter

Ferruginous Hawks winter in open terrain ranging from grassland to desert (Bechard and Schmutz 1995). East of the Rocky Mountains, they use grasslands with abundant prairie dog

populations (Bechard and Schmutz 1995). West of the Rocky Mountains, they use grassland and arid areas of California, Arizona, and New Mexico with abundant populations of prairie dogs, lagomorphs, or pocket gophers (*Thomomys* spp.; Bechard and Schmutz 1995). Around prairie dog towns, they may roost communally (Olendorff 1993, Bechard and Schmutz 1995).



## Population Trends and Estimates

Partners in Flight (2014) estimate the global population to be 80,000 individuals, with 70,000 occurring in the US. The population in Wyoming is assumed to have declined along with prairie dog (*Cynomys* sp.) populations (Travsky and Beauvais 2005).

BBS data show a significant increase of 1.3% annually in Ferruginous Hawk numbers for the period 1966-2011 (Table 4). Ferruginous Hawk numbers increased by 4.4% in Montana during this period (Table 4; Fig. 7). Detections of Ferruginous Hawks likewise increased at a rate of 0.01% annually on CBCs for the period 1966-2011 (linear regression, number per party-hour =  $0.0005 \times \text{year} - 1.029$ ,  $F_{1,44} = 27.35$ ,  $r^2 = 0.37$ ,  $p < 0.0001$ ; Fig. 8).

## Threats

Disturbance of nest sites during the breeding season is regarded as a significant threat (Collins and Reynolds 2005). Shooting has declined since the mid-20<sup>th</sup> century, but bands are still recovered from shot birds in their wintering range (Gilmer et al. 1985).

## Collisions

Ferruginous Hawks are sometimes struck by automobiles in areas with high jackrabbit populations (Howard 1975). Collisions also occur with power-line wires (Bechard and Schmutz 1995). Mortality caused by collisions does not post a significant threat to this species (Olendorff 1993, Bechard and Schmutz 1995).

## Pesticides and Contaminants

Pesticides and contaminants do not post a significant threat to this species (Bechard and Schmutz 1995). However, strychnine used to poison ground squirrels may be a possible threat (Schmutz et al. 1989).

## Habitat Loss and Degradation

This species has been recorded nesting in trees planted as shelterbelts and so local nesting shortages may result when these trees die (Bechard and Schmutz 1995). Population declines have also been linked to habitat degradation caused by agriculture, grazing, mammal control, mining, and fire in nesting habitats (Olendorff 1993).

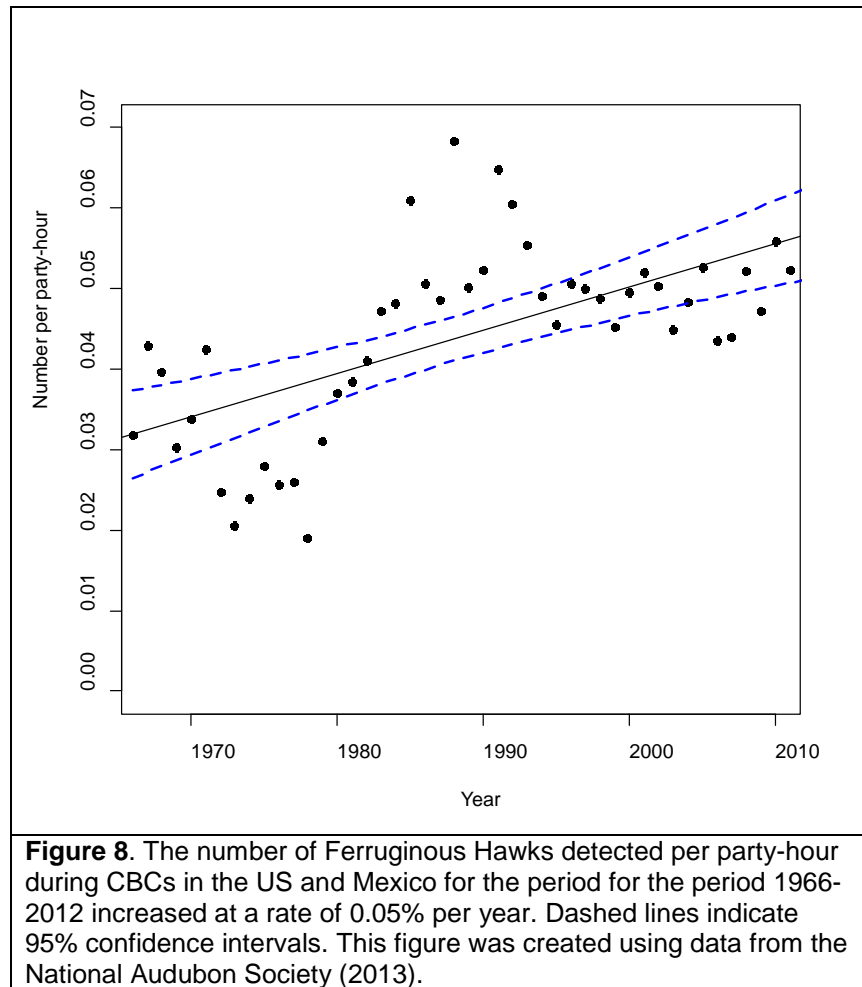
### Effects of Climate Change

The sensitivity score for the Ferruginous Hawk on the Climate Change Sensitivity Database is “Medium” (Tomasevic 2010). No studies have explicitly examined how climate change may affect Ferruginous Hawks. However, climate change in the prairie pothole region is expected to cause an increase in droughts (Ojima and Lockett 2002). Droughts have been linked with prairie dog declines (Avila-Flores et al. 2012) which are an important prey item for Ferruginous Hawks. Consequently, climate change may adversely affect this species by reducing the abundance of their prey base.

### Effects of Energy Development

Switchgrass monocultures cultivated for ethanol development may reduce available grassland habitat (J. Tibbits, pers. obs.). Disturbances from mining operations have led to nest desertion (Evans 1980, Olendorff 1993). A study noted that pairs nesting near petroleum wells are less productive than pairs nesting away from wells (Bechard and Schmutz 1995).

Smith et al. (2010) likewise found that oil and gas development negatively affected raptor breeding success. Collins and Reynolds (2005) provide an excellent overview of the potential effects of the continued development of coal bed methane in Wyoming, Colorado, and Montana. It is estimated that the Powder River Basin development, in the heart of the Ferruginous Hawk's range, will result in the creation of 5311 miles of power poles, 20,000 miles of roads, and wells spaced at an average of one every 80 acres. Collins and Reynolds (2005) suggest that this could negatively affect Ferruginous Hawk populations due to increased habitat fragmentation, increased human disturbance while breeding, increased risk of collision with wires and vehicles, as well as by potentially modifying vegetative and small mammal communities.



## **Conservation and Management**

Little information exists on this species' response to management efforts (Bechard and Schmutz 1995). The nomadic nature and pattern of dispersal of this species is poorly understood (Bechard and Schmutz 1995).

In Alberta, ranching has provided habitat for healthy populations of Ferruginous Hawks (Bechard and Schmutz 1995). Effective management and preservation of the current population should focus on enhancing nest substrates, maintaining prey population numbers, and mitigating the effects of development (Suter and Jones 1980, White and Thurow 1985, Olendorff 1993). Nesting platform construction may increase nesting opportunities (Bechard and Schmutz 1995). For example, up to 63% of available artificial nest structures were used in Wyoming (Tigner et al. 1996).

## **Completed and Ongoing Conservation Actions**

In Canada, this species was downlisted from threatened to vulnerable in 1995 (Travsky and Beauvais 2005). It is listed as a species of conservation concern in Mexico (Travsky and Beauvais 2005). The Ferruginous Hawk has been listed as a Sensitive Species by the Wyoming State Office of the Bureau of Land Management, and this listing affords the species consideration in conservation strategy development (USDI Bureau of Land Management 2001). Ferruginous Hawks are included in the Conservation Plan for Grassland Species in Colorado (Colorado Division of Wildlife 2003).

**TABLE 3.** Ferruginous Hawk status rangewide summarized by multiple listing agencies. IUCN=International Union for Conservation of Nature, ABC=American Bird Conservancy, and PIF=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” is the Bird Conservation Regions (BCR) and US Fish & Wildlife Region where this species is considered to be of conservation concern.

<b>IUCN</b>	Least Concern
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	Potential Concern
<b>Birds of Conservation Concern</b>	BCR 9, BCR 10, BCR 16, BCR 17, BCR 35, USFWS Region 1, USFWS Region 6
<b>PIF</b>	Not a US – Canada Concern Species

**TABLE 4.** Ferruginous Hawk status summarized by Natural Heritage rankings, BBS trends for 1966-2011, BBS trends for 2000-2011, and multiple listing agencies. SGCN=Species of Greatest Conservation Need. A hyphen (-) = 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G4	1.3% (0.3, 2.1%)	2.4% (0.7, 4.3%)	-	-
<b>Region 6</b>	-	1.2% (0.1, 2.2%)	1.5% (-0.7, 3.7%)	-	-
<b>Montana</b>	S3B	4.4% (2.4, 6.6%)	4.2% (-0.1, 8.3%)	Species of Concern	Tier II
<b>North Dakota</b>	SU	0.8% (-1.4, 3.2%)	0.6% (-7.4, 6.7%)	Species of Management Concern	Level I
<b>South Dakota</b>	S4B	1.5% (-1.6, 4.8%)	1.8% (-4.3, 8.5%)	Species of Concern	Species of Greatest Conservation Need
<b>Wyoming</b>	S4B, S5N	0.5% (-1.3, 2.4%)	0.8 (-2.6, 4.2%)	Species of Concern	Tier I
<b>Colorado</b>	S3B, S4N	0.5% (-1.4, 2.3%)	0.7% (-2.8, 4.9%)	State Special Concern	Species of Greatest Conservation Concern
<b>Utah</b>	S3B	-1.8% (-4.1, 0.6%)	-1.0% (-5.6, 4.9%)	State Threatened	Tier II
<b>Nebraska</b>	S2	Insufficient data	Insufficient data	-	Tier I
<b>Kansas</b>	S2B, S4N	Insufficient data	Insufficient data	Species in Need of Conservation	Tier I



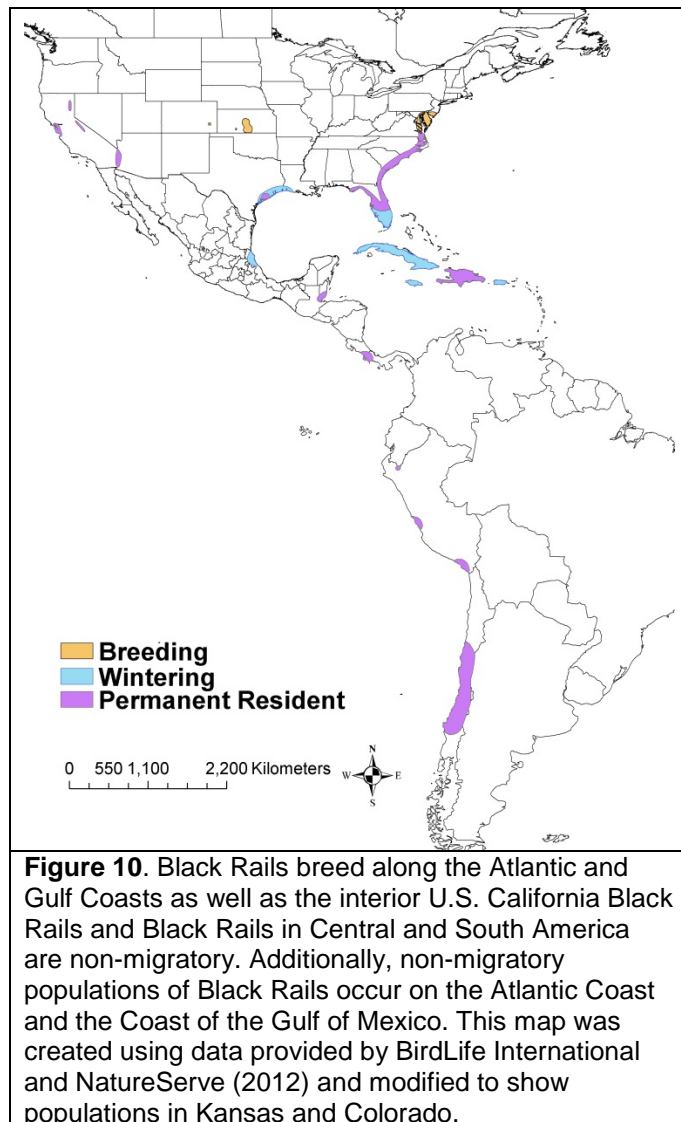
## Black Rail (*Laterallus jamaicensis*)



**Figure 9.** Black Rail are secretive and seldom seen. Photo by Katrina Hucks.

### Summary

- The secretive Black Rail is the smallest rail in North America. They are black with white speckling on the back and flanks and with a chestnut nape
- Coastal birds breed from Connecticut south to Florida and along the Gulf Coast to southern Alabama, with a disjunct population in southeastern Texas. There are also birds breeding in inland North America from Colorado, Kansas and Oklahoma, north to Minnesota and east (possibly) as far as Connecticut. However, the distribution of the inland individuals is not well understood. Along the west coast, this species can be found on the central California coast, concentrated in the northern San Francisco Bay. There are some individuals in the Lower Colorado River Valley and a recently discovered population in the Sierra Nevada foothills.
- No population estimates exist for this species and this species is not well tracked by the BBS. CBCs detected an average of only 21 individuals annually for the period 1966-2012 and so trends derived from the CBCs are not reliable.
- Qualitative declines in this species have been documented along the east coast, in the interior US, and in California. Within Region 6, Black Rails are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in Colorado and Kansas.
- Habitat loss due to wetland degradation and destruction is the primary cause for the decline of this species' population.



**Figure 10.** Black Rails breed along the Atlantic and Gulf Coasts as well as the interior U.S. California Black Rails and Black Rails in Central and South America are non-migratory. Additionally, non-migratory populations of Black Rails occur on the Atlantic Coast and the Coast of the Gulf of Mexico. This map was created using data provided by BirdLife International and NatureServe (2012) and modified to show populations in Kansas and Colorado.

## Legal Status

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 5 and 6.

## Description

The Black Rail (Fig. 9) is the smallest North American rail with adults measuring merely 10 to 15 cm in length and with a mass of only 35 g (Eddleman et al. 1994). The plumage is pale to blackish gray with a chestnut nape and upper back (Eddleman et al. 1994). The remainder of the back is dark gray to slate with scattered white spots extending to wing coverts and secondaries (Eddleman et al. 1994). Juveniles have an appearance similar to adults, but the juvenile plumage is duller with fewer and smaller white spots and white streaks (Eddleman et al. 1994). Sexual dimorphism in plumage exists between males and females, with males more vividly colored (Eddleman et al. 1994).

Two subspecies exist in the United States: the nominate *Laterallus jamaicensis jamaicensis* of the eastern United States, and *Laterallus jamaicensis coturniculus* of California and Arizona (Ripley 1977).

## Distribution

### Rangewide

Black Rails occur in several disjunct populations across North and South America (Fig. 10). In the US, Black Rails can be divided into three groups based on geography: California Black Rail (*L. j. coturniculus*), migratory Eastern Black Rail (*L. j. jamaicensis*), and resident Eastern Black Rail (also *L. j. jamaicensis*). California Black Rails occur in wetlands along the Pacific Coast of California from San Francisco south to Baja California (Eddleman et al. 1994). Additionally, California Black Rails are associated with the Colorado River along the southern border of California and Arizona (Eddleman et al. 1994). Finally, California Black Rails have also recently been found in the northern foothills of the Sierra Nevadas (Richmond et al. 2008).

Resident (non-migratory) Eastern Black Rails occur along the Atlantic and Gulf Coasts from Connecticut to the southern Alabama with a disjunct population in southeastern Texas (Eddleman et al. 1994). Additionally, Black Rails that migrate and breed inland will also winter in

these coastal areas (Eddleman et al. 1994). Inland breeding population sites are not well known, and they are estimated to range from Colorado to New England (Eddleman et al. 1994).

#### Region 6

Colorado: Vocalizations have been recorded at Fort Lyons and Pueblo Co. (Griese et al. 1980). Vocalizations observed in May at the western fringe of John Martin Reservoir in Bent Co. (J. Tibbits, pers. obs.). Most records occur along the Arkansas River valley (Kingery 1998) and the Colorado Field Ornithologists (2006) suggest that the species can easily be found along the Arkansas River from eastern Pueblo County to John Martin Reservoir.

Kansas: Observations occur primarily in the south-central region of the state. Probable breeding records have been reported in Comanche (Coldwater Lake), Barber, and Stafford Counties. (Busby and Zimmerman 2001) with birds being reliably present at Quivira National Wildlife Refuge (Stafford Co.) since at least 1981 (Thompson et al. 2011). Possible breeding records have also been reported in Russell County (Busby and Zimmerman 2001). Black Rails have been observed in apparently suitable habitat at Cheyenne Bottoms in Barton County. (Griese et al. 1980, Thompson et al. 2011), Meade Lake in Meade County (Thompson et al. 2011) and Lake Hargis in Barber County (Thompson et al. 2011).

Montana: Black Rails do not occur in the state (Bergeron et al. 1992).

Nebraska: Black Rails are rare vagrants in the state (Brogie 1987).

North Dakota: Black Rails are hypothetical in North Dakota (Faanes and Stewart 1982).

South Dakota: Black Rails do not occur in the state (Peterson 1995).

Utah: Black Rails do not occur in the state (Utah Bird Records Committee 2013).

Wyoming: Black Rails do not occur in the state (Faulkner 2010).

### **Biology**

#### General

Black Rails are reluctant to fly and will run quickly on the ground (Eddleman et al. 1994). When flushed, their flight is characteristic of rails, where the body is held at an angle and the feet dangle below (Eddleman et al. 1994). Black Rails have a fast and strong flight over long distances, and they can swim for short distances (McMullen 1944, Weske 1969). The majority of Black Rail research has been conducted on the California subspecies or on coastal migrants and residents of the nominate species.

Black Rails feed primarily on small aquatic invertebrates, terrestrial invertebrates, and seeds (Eddleman et al. 1994). The generalized bill shape suggests that this rail gleans or pecks at individual items and thus feeds by sight (Eddleman et al. 1994).

#### Breeding

Arrival time likely differs by region and latitude. Black Rails begin arriving in southeast Colorado and vocalizing in large numbers during the late April (J. Tibbits, pers. obs.). The breeding season of the Black Rail on the Gulf coast begins in March (J. Tibbits, pers. obs., J. Wilson, pers. comm.). As with other rail species, Black Rails are believed to migrate across a broad front (Cooke 1914).

Male vocalization during the breeding season consists of a loud *ki-ki-kerr* (Kellogg 1962). Vocalization times vary broadly across regions and years (Eddleman et al. 1994). The daily

pattern of vocalization is highly variable among subspecies and populations (Eddleman et al. 1994).

Little breeding data exists for Black Rail in the interior United States. A study in Florida determined male home range to be 1.3 ha and female home range to be 0.62 ha (Legare and Eddleman 2001). Nesting success for this study was determined to be 43%, and nest failures were caused by flooding and predation (Legare and Eddleman 2001). Hydrology and water level may be the most important variable determining nest placement and nesting success (Legare and Eddleman 2001).

#### Wintering

Little information exists on the ecology of wintering Black Rails.

#### **Habitat**

##### Breeding

Black Rails use sites with shallower water than any other North American railids (Eddleman et al. 1988, Eddleman et al. 1994). Breeding areas are typically vegetated by fine-stemmed emergent plant species, such as rushes, sedges, and grasses (Todd 1977, Eddleman et al. 1994). In Colorado, Black Rails have been observed vocalizing in dense stands of cattail (*Typha* sp.) in the lacustrine fringe of John Edwards Reservoir (J. Tibbits, pers. obs.). On the Atlantic and Gulf Coasts, Black Rails select wetlands dominated by cordgrass (*Spartina* spp.; Kerlinger and Sutton 1989, J. Tibbits, pers. obs.).

##### Migration

Movement of Black Rails, especially inland populations, is poorly understood. The secretive nature of this species confounds traditional survey efforts such as bird banding, but stable isotope analysis of feathers to determine migratory connectivity has provided data about populations, diet, and migration (Kane 2011, J. Tibbits, pers. obs.). Individuals may be occasionally encountered during migration in wet habitats (Todd 1977).

##### Winter

Migratory Eastern Black Rails winter along the Atlantic and Gulf Coasts (Eddleman et al. 1994). Little information has been published regarding their preferred winter habitat, but it is generally assumed to be salty prairie dominated by cordgrass (J. Wilson, pers. comm.).

#### **Population Trends and Estimates**

Little baseline data exists to estimate populations of Black Rails, but qualitative observations note a drastic population decrease between the 1920s and 1970s (Eddleman et al. 1994). Insufficient observations exist to draw any conclusions from BBS data (Table 6). CBC data in the US and Mexico for the period 1966-2011 shows a very slight increase in the number of birds detected (linear regression, number per party-hour =  $0.0001 \times \text{year} - 0.2562$ ,  $F_{1,44} = 7.43$ ,  $r^2 = 0.13$ ,  $p = 0.009$ ; Fig. 11). However, it should be noted that only small numbers are detected, with an average of only 21 birds detected each year, and so the observed trend is not reliable.

#### **Threats**

Habitat degradation and loss is the primary threat to this species (Eddleman et al. 1994). Hunting of Black Rails ceased in 1967, although harvests were likely small due to their secretive nature (Martin 1979).

##### Collision

As with other species that are nocturnal migrants, TV towers and other objects can produce strikes (Gander 1930, Browne and Post 1972).

### Pesticides and Contaminants

Little information exists on the effects of chemical runoff on Eastern Black Rail populations (Eddleman et al. 1994).

### Habitat Loss and Degradation

Systematic wetland conversion in the conterminous United States from the 1600s to mid-1980s accounted for the loss of 48 million ha of wetland area, resulting in the loss of ~53% of total wetland area (Dahl and Allord 1996). Legal protection has stabilized the overall rate of wetland loss in the 21<sup>st</sup> century, but coastal wetland area still declined by 1.4% between 2004 and 2009 (Dahl 2011). These coastal (estuarine) wetlands are vital wintering habitat for Black Rails. Additionally, inland freshwater wetlands are vital for Black Rails at all times of the year.

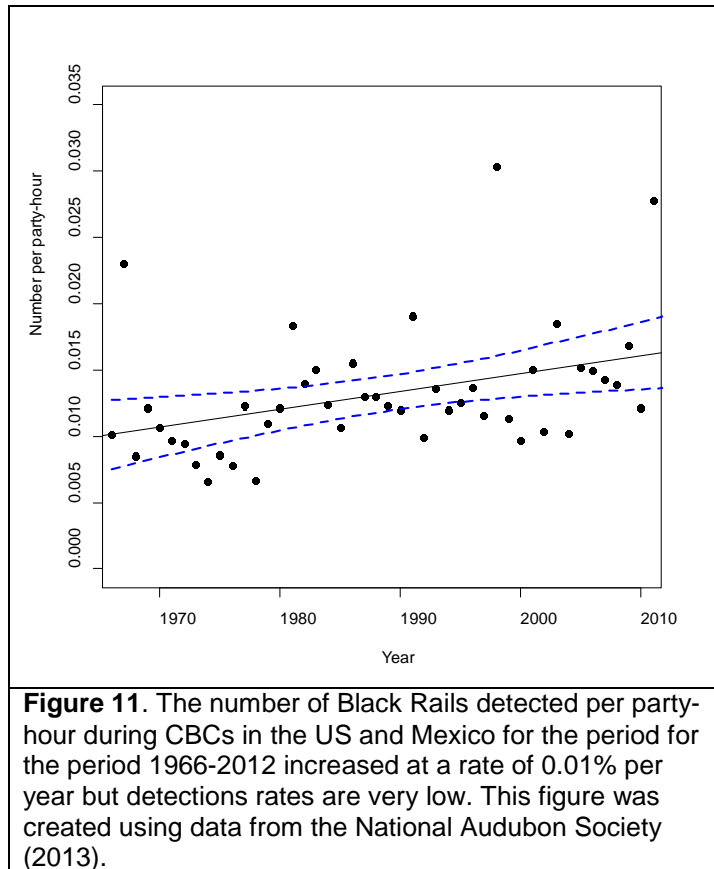
### Invasive/Exotic Species

The closely related Galápagos Rail (*Laterallus spilonotus*) endemic to the Galapagos Islands responded positively to removal of feral pigs (*Sus scrofa*; Donlan et al. 2007). Feral pigs can be common on the coastal wintering grounds of migratory Black Rail, and a group of pigs can degrade large areas of wetland whilst rooting (J. Tibbits, pers. obs.). Direct predation of Black Rails by pigs has not been recorded, and little information exists about interspecies interaction. However, vocalizing Black Rails in Texas are seldom found adjacent to forest and thick vegetation that holds significant populations of feral pigs (*Sus scrofa*; J. Tibbits, pers. obs.).

Black Rails may be more susceptible to the effects of grazing by livestock because they occupy the drier fringes of wetlands (Eddleman et al. 1988). Grazing can lead to the loss of emergent cover, trampling, and disturbance (Whyte and Cain 1979). A study on California Black Rail indicates that overgrazing reduces rail occupancy (Richmond et al. 2012).

### Predation

In California Black Rail, high tides can push rails out of their habitat and expose them to avian predators (Grinnell and Miller 1944, Evens and Page 1986). Avian predators include Northern Harrier (*Cyaneus circus*), Great Egret (*Ardea alba*), Great Blue Heron (*A. herodias*), and Ring-billed Gull (*Larus delawarensis*). Herons and egrets may be significant predators of Black Rails, although the extent of their predation on interior eastern Black Rails is less well understood (Evens and Page 1986). Direct mammalian predation on Black Rails is infrequently documented although feral cats have been observed predating California Black Rails (Evens and Page 1986).



**Figure 11.** The number of Black Rails detected per party-hour during CBCs in the US and Mexico for the period for the period 1966-2012 increased at a rate of 0.01% per year but detections rates are very low. This figure was created using data from the National Audubon Society (2013).

### **Effects of Climate Change**

Gardali et al. (2012) suggests that birds breeding in wetlands may be sensitive to predicted changes in climate. During the 21<sup>st</sup> century, sea level is projected to rise globally by 10 to 90 cm (Intergovernmental Panel on Climate Change 2001). Rising sea levels would result in the inundation of estuarine and low-lying wetlands in the inland Black Rail's wintering habitat along the Gulf Coast and Atlantic Coast (Galbraith et al. 2002, Woodrey et al. 2012). By the mid-21<sup>st</sup> century, annual river runoff and water availability is projected to increase at high latitudes and decrease in mid-latitudes and the tropics (Intergovernmental Panel on Climate Change 2007). In addition to inundated estuarine wetlands, the decrease of snowpack in the Rocky Mountains is projected to cause more winter flooding and reduced summer flows (Intergovernmental Panel on Climate Change 2007). This may affect the fringe habitat along wetlands that interior breeding Black Rails are dependent upon. The altered hydrology of wet meadows, fringe, and other wetland habitats may disrupt the vegetation communities of breeding habitat.

### **Effects of Energy Development**

Little is known on the effects of energy development on Black Rail. Generally, wind turbines, oil drilling, and other energy development projects do not occur in wetlands.

### **Conservation and Management**

Improving survey efforts is a logical step to assess populations, breeding densities, and ecology. Survey protocols may need to be region-specific due to the plastic phenology of this species from region to region. Radio transmitters have caused stress-induced mortality (Flores 1991). Playback calls should be used responsibly so as to not excessively stress individuals.

### **Completed and Ongoing Conservation Actions**

Prescribed burning along the Lower Colorado River resulted in an increase of California Black Rails (Conway et al. 2006). In Kansas, Black Rails were shown to prefer areas burned every two years (Kane 2011).



**TABLE 5.** Black 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.

<b>IUCN</b>	Near Threatened
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	At Risk
<b>Birds of Conservation Concern</b>	BCR 19, BCR 21, BCR 22, BCR 24, BCR 26, BCR 27, BCR 29, BCR 30, BCR 31, BCR 32, BCR 33, BCR 37, BCR U.S. Caribbean Islands, USFWS Region 2, USFWS Region 3, USFWS Region 4, USFWS Region 4a, USFWS Region 5, USFWS Region 6, USFWS Region 8, National
<b>PIF</b>	-

**TABLE 6.** Black Rail status summarized by Natural Heritage rankings, BBS trends for 1966-2011, BBS trends for 2000-2011, 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G3G4	-	-	-	-
<b>Region 6</b>	-	-	-	-	-
<b>Montana</b>	-	-	-	-	-
<b>North Dakota</b>	-	-	-	-	-
<b>South Dakota</b>	-	-	-	-	-
<b>Wyoming</b>	-	-	-	-	-
<b>Colorado</b>	-	-	-	-	Species of Greatest Conservation Concern
<b>Utah</b>	-	-	-	-	-
<b>Nebraska</b>	S1	-	-	-	-
<b>Kansas</b>	S1	-	-	Species in Need of Conservation	Tier I

## Wilson's Phalarope (*Phalaropus tricolor*)



**Figure 12.** Wilson's Phalarope exhibit reverse sexual dimorphism, where the females are more brightly colored than the males. Photo by Katrina Hucks.

### Summary

- Wilson's Phalaropes are small, aquatic shorebirds that feed on aquatic invertebrates, often spinning in the water as they search for prey. During the non-breeding season, they are primarily gray above and white below, with a thin black bill. During the breeding season, a black stripe edged with chestnut develops on their head and neck. At this time of year, females are more brightly colored than males.
- Wilson's Phalaropes have recently expanded their breeding range east and now breed from the Yukon south to California and east to Massachusetts and New Brunswick. They winter in western and southern South America.
- 1,500,000 individuals are thought to breed in North America. Wilson's Phalaropes are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in North Dakota, South Dakota and Wyoming.
- For the period 1966-2011, no trends were observed in the numbers of Wilson's Phalaropes detected on BBS routes across North America. However, during the same time period, populations in Wyoming declined at a rate of 3.4% per year.

## Legal Status

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 7 and 8.

## Description

The Wilson's Phalarope (Fig. 12) is a small aquatic sandpiper (Colwell and Jehl 1994). Females are larger than males and possess a brighter plumage during the breeding season (Colwell and Jehl 1994). Females have a pale blue gray forehead and crown, with a white supercilium which borders a black streak passing through the eye and down the sides of the neck (Colwell and Jehl 1994). White extends from the back of the head down to the upper back (Colwell and Jehl 1994). Additionally, breeding females have a cinnamon throat, chestnut mantle and scapulars, gray brown wings, white rump and underparts, pale grayish tail, black bill, and gray to black legs (Colwell and Jehl 1994). Breeding males are smaller and have less

brightly colored plumage (Colwell and Jehl 1994). In basic (nonbreeding) plumage, both sexes are similarly colored with white rump, white underparts, and pale gray otherwise (Colwell and Jehl 1994). Narrow, pointed wings enable fast flight (80-100 km/h; Jehl 1988).

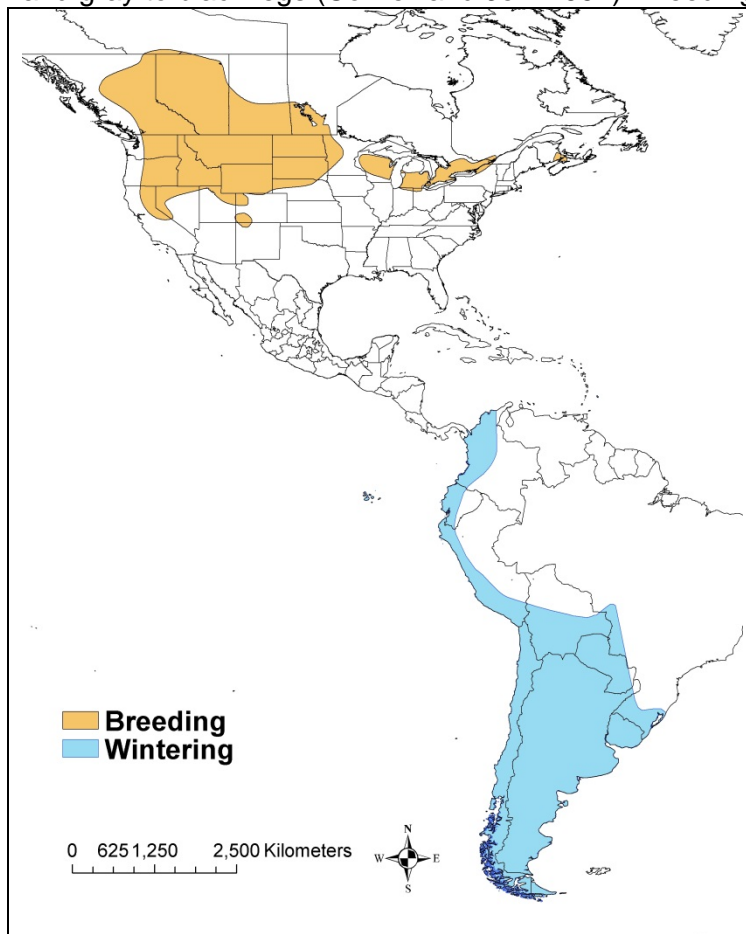
## Distribution

### Rangewide

Breeding range is primarily in western Canada and western United States (Colwell and Jehl 1994; Fig. 13). Wilson's Phalaropes breed from the Yukon south to California and east to Massachusetts and New Brunswick (Colwell and Jehl 1994). This species winters in western and southern South America, but larger concentrations of migrants occur in the highly saline lakes in the highlands of the central Andes (Hurlbert et al. 1984, Colwell and Jehl 1994).

### Region 6

Colorado: Historically, this species bred in prairie wetlands and mountain valleys, but wetland degradation and destruction has reduced their breeding extent on the prairies (Kingery 1998). Current



**Figure 13.** Wilson's Phalaropes breed in western Canada, the western U.S., and south of the Great Lakes. This species winters in the Andes and Pampas of South America. This map was created using data provided by BirdLife International and NatureServe (2012).

nesting sites include the North Park basin, the San Luis Valley, the Gunnison Valley, and the Yampa watershed (Kingery 1998).

Kansas: Confirmed breeding records are limited to Cheyenne Bottoms (Barton Co.) and Quivira National Wildlife Refuge (Stafford Co.; Busby and Zimmerman 2001), and possibly Meade County (Thompson et al. 2011). In addition, Wilson's Phalaropes may occasionally breed at other localities, particularly playas in southwestern Kansas (Thompson et al. 2011). Reports of breeding occurred in late June and late July, and so this species is not reported on BBS routes occurring in early summer (Busby and Zimmerman 2001). Cheyenne Bottoms Wildlife Management Area is an important stopover site for spring arrivals (Skagen et al. 1999).

Montana: Wilson's Phalaropes breed at low densities throughout Wyoming (Bergeron et al. 1992). Particularly high densities of breeding phalaropes occur at the prairie potholes in the far northeastern corner (Sheridan and Roosevelt Co.) of the state (Bergeron et al. 1992). This species arrives in late April and departs by early September (Bergeron et al. 1992). Breeding occurs from late May to July (Bergeron et al. 1992). Occurrence is typically restricted to elevations under 1400 m (Bergeron et al. 1992).

Nebraska: Wilson's Phalaropes are regular but uncommon breeders in Nebraska (Ducey 1988). Most observations were recorded in the Sandhills in the northwest part of that state (Ducey 1988).

North Dakota: Wilson's Phalaropes are common breeders throughout the state (Faanes and Stewart 1982). The highest densities of breeding birds occur on the Missouri Coteau, Drift Plains, and Prairie Pothole Region (Stewart 1975). This species typically breeds in areas of shallow water that are interspersed or adjacent to wet meadows (Stewart 1975). The breeding season occurs from mid-May to late July, and breeding peaks from late May to early July (Stewart 1975).

South Dakota: Wilson's Phalaropes are common and widespread breeding birds in South Dakota (Peterson 1995). Breeding records are relatively evenly distributed, but the southeast corner of the state has fewer records (Peterson 1995).

Utah: This species is a common transient and summer resident in Utah (Utah Bird Records Committee 2013). It breeds mainly in the northern part of the state, and it occurs in enormous aggregations on the Great Salt Lake (Utah Conservation Data Center 2013). Critical staging habitat also occurs at Utah Lake (Utah Co.), Bear Lake (Rich Co.), Lake Powell (Kane Co. and San Juan Co.), and Sevier Lake (Millard Co.). Other smaller staging areas are scattered throughout the state at small bodies of water (Utah Conservation Data Center 2013).

Wyoming: This species is a common summer resident that breeds in wetland habitats at low elevations in the state (Faulkner 2010). Small flocks arrive in mid-April, and peak migration occurs from early to mid-May (Faulkner 2010). By June, most reports are of local breeding birds (Faulkner 2010). Fall migration peaks in early August to mid-August, and by late September there are very few reports (Faulkner 2010). Only one individual has been reported in the winter, and this sighting occurred near Glenrock (Converse Co.; Faulkner 2010).

## **Biology**

### General

Prey consists mainly of small aquatic invertebrates in freshwater or hypersaline wetlands and bodies of water (Colwell and Jehl 1994). Wilson's Phalaropes use a variety of techniques to

capture prey, including spinning, active pursuit, ambushing passing prey, probing soft substrate, and scything in the manner of avocets (Wetmore 1925, Jehl 1988).

Phalaropes capitalize on water's adhesion to its prey using a feeding technique called surface tensions transport of prey, or "mandibular spreading" (Rubega and Obst 1993). This technique draws prey encapsulated in a water drop from the bill tip to the mouth by spreading the mandibles and increasing the surface tension on the water drop (Rubega and Obst 1993). The water drop moves up the mandible towards the mouth where the distance between the mandibles is less and thus decreases surface tension (Rubega and Obst 1993). By continually opening and spreading its mandibles, it can draw the water drop, and consequently prey, up its mandibles into its mouth, and it is believed that this technique assisted phalaropes to assume a more aquatic lifestyle than other birds in the Scolopacidae family (Rubega and Obst 1993, Prakash et al. 2008).

### **Breeding**

While extra-pair fertilizations are common in most birds, Wilson's Phalaropes do not engage in this practice (Delehanty et al. 1998). The absence of this practice is due to intense time investments of females gaining and keeping a mate during the pre-laying and laying periods, and males invest significant parental care into their clutch (Delehanty et al. 1998).

### **Migration**

Arrival and departure times vary by age and sex; females depart breeding areas by mid-June, males depart after, and juveniles are the last to depart. Southbound migrants stage at hypersaline lakes in western North America (Colwell and Jehl 1994). These birds roost in large numbers (>10,000 birds) diurnally and nocturnally (Colwell and Jehl 1994). Diurnal roosting occurs at midday on the shores and boulders, and birds roost nocturnally on the water (Colwell and Jehl 1994). Southbound migration occurs during stable weather patterns, rather than being influenced by cold fronts and tail winds (Jehl 1988, Colwell and Jehl 1994). Narrow, pointed wings enable fast flight (80-100 kph; Jehl 1988). The Wilson's Phalarope's early departure in the summer from staging areas minimizes weather-related downing events (Jehl et al. 1999). In comparison, the Eared Grebe (*Podiceps nigricollis*) departs from these same staging areas in December, and thousands of this species are downed every year due to winter weather events (Jehl et al. 1999).

### **Wintering**

Wintering Wilson's Phalaropes congregate in concentrations exceeding 100,000 birds at hypersaline lakes in South America (Colwell and Jehl 1994). Other records indicated flocks of up to 500,000 birds (Nores and Yzurieta 1980).

### **Habitat**

#### **Breeding**

Wilson's Phalaropes breed in freshwater and saline wetlands of interior North America (Colwell and Jehl 1994). A North Dakota study found that Wilson's Phalaropes occurred more frequently in wetlands away from trees (Naugle et al. 2001, Cunningham and Johnson 2006).

#### **Migration**

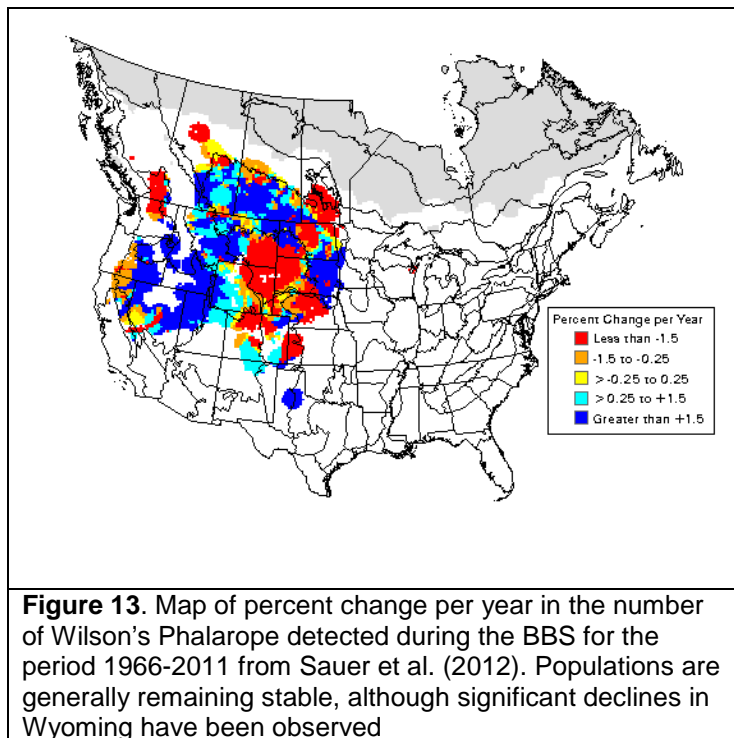
This species relies on freshwater and saline wetlands as staging points prior to migrating to South America (Colwell and Jehl 1994). Hypersaline lakes in western North America provide ample food for rapid molt and premigratory fattening (Colwell and Jehl 1994). More than 90% of the population is believed to stage at Mono Lake (CA) and Great Salt Lake (UT; Jehl et al. 1999).

### Winter

Wilson's Phalaropes winter primarily on mudflats and open-water habitat of Andean salt lakes at high altitudes (Colwell and Jehl 1994). Additional habitat includes freshwater wetlands and alkaline palustrine wetlands (Colwell and Jehl 1994).

### **Population Trends and Estimates**

A 1988 study estimated the North American population to be 1.5 million birds in the fall (Jehl 1988). Morrison et al. (2006) likewise estimated there to be 1.5 million individuals remaining, an estimate that was repeated by Andres et al. (2012). An estimated 172,000 pairs breed in North Dakota (Stewart and Kantrud 1972). In North Dakota, a short-term decline of 6.43% from 1967 to 1993 was noted by Igl and Johnson (1997), although the BBS data do not show a significant trend in detections for the longer period 1966-2011 (Table 8). For the period 1966-2011, no significant changes in detection rates were noted along BBS routes across North America and Canada. However, during the same time period, populations in Wyoming declined at a rate of 3.4% per year (Table 8; Fig. 13).



### **Threats**

Habitat degradation and destruction is the primary threat to this species.

### Predation

Predation is the primary cause of nest failure for the Wilson's Phalarope (Colwell and Oring 1988, Colwell 1992). Avian predators include the American Crow (*Corvus brachyrhynchos*) and the Ring-billed Gull (*Larus delawarensis*; Colwell 1992). Nest concealment may offer protection from avian predators but does not significantly deter mammals. This is likely due to birds employing a visual foraging technique, whereas mammals employ an olfactory search technique (Colwell 1992).

### Pesticides and Contaminants

Effects of pesticides and contaminants are unclear, but contaminant runoff might negatively affect the invertebrate prey that Wilson's Phalaropes predate. Eutrophication caused by excess nutrients from fertilizer or feed lots might similarly affect prey species by creating an anoxic environment. Maintenance of vegetation buffers around breeding wetlands will act as a filter for pesticides and contaminants in overland precipitation runoff.

### Nest Parasitism

Brown-headed Cowbirds (*Moluthrus ater*) have been reported in phalarope nests, albeit rarely (Friedmann 1963, Colwell and Jehr 1994). Male phalaropes are aggressive toward cowbirds near phalarope nests (Colwell and Jehr 1994). A male Wilson's Phalarope was observed hatching a Sora (*Porzana carolina*; Colwell and Jehr 1994).



### Habitat Loss and Degradation

Wilson's Phalaropes breed in freshwater wetlands and loss of prairie wetlands during the 20<sup>th</sup> century were linked with population declines (Colwell and Jehl 1994, Faulkner 2010).

### **Effects of Climate Change**

Gardali et al. (2012) suggest that birds breeding in wetlands may be sensitive to predicted changes in climate but the possible effects of climate change on this species have not been studied. Climate change in the prairie pothole region is expected to cause an increase in temperatures as well as an increase in droughts (Ojima and Lockett 2002) which may reduce the amount of wetlands suitable for breeding.

### **Effects of Energy Development**

Little is known on the effects of energy development on the Wilson's Phalarope. Generally, wind turbines, oil drilling, and other energy development projects do not occur in wetlands. Niemuth et al. (2013) found that Wilson's Phalaropes did not avoid wetlands with nearby (<805 m) wind farms. Ethanol production via switchgrass, corn, and other monocultures might affect runoff if buffers are not maintained around wetlands.

### **Conservation and Management**

Preservation and conservation of wetland complexes are essential for this species (Skagen and Knopf 1994). Wetland complexes are individual wetlands arranged as a mosaic across a landscape, and this connected arrangement diminishes potential negative effects of habitat alteration in the surrounding landscape (Skagen and Knopf 1994).

### **Completed and Ongoing Conservation Actions**

No species-specific management plans currently exist. Along with other wetland birds, Wilson's Phalarope habitat may be afforded some degree of protection from the Conservation Reserve Program (CRP). Cattle grazing may be a beneficial management tool to limit growth and cover of wetland vegetation in stock ponds (May et al. 2002).

**TABLE 7.** Wilson's Phalarope 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.

<b>IUCN</b>	Least Concern
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	Vulnerable
<b>Birds of Conservation Concern</b>	-
<b>PIF</b>	-

**TABLE 8.** Wilson's Phalarope status summarized by Natural Heritage rankings, BBS trends for 1966-2011, BBS trends for 2000-2011, 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G5	-0.7% (-3.9, 0.9%)	1.2% (-1.7, 8.1%)	-	-
<b>Region 6</b>	-	-0.6% (-2.1, 0.8%)	-0.9% (-6.5, 2.9%)	-	-
<b>Montana</b>	S4B	-1.1% (-3.7, 1.5%)	-0.2% (-5.2, 6.7%)	-	Tier III
<b>North Dakota</b>	SNRB	0.3 (-2.0, 2.4%)	1.0% (-4.4%, 7.4%)	-	Level I
<b>South Dakota</b>	S4B	0.9% (-1.9, 4.0%)	0.9% (-9.5, 11.1%)	-	Species of Greatest Conservation Need
<b>Wyoming</b>	S3B, S3N	-3.4% (-6.5, -0.4%)	-4.5% (-13.9, 0.7%)	-	-
<b>Colorado</b>	S4B, S4N	-1.8% (-5.6, 2.2%)	-3.5% (-15.8, 4.6%)	-	Species of Greatest Conservation Need
<b>Utah</b>	S2S3B	Insufficient data	Insufficient data	-	-
<b>Nebraska</b>	S4	Insufficient data	Insufficient data	-	-
<b>Kansas</b>	S1B, S3N	-	-	-	Tier III

## Lewis's Woodpecker (*Melanerpes lewis*)



**Figure 14.** Lewis's Woodpeckers are unique woodpeckers that forage primarily on flying insects during the breeding season. Photo by Katrina Hucks.

### Summary:

- Lewis's Woodpeckers are distinctive woodpeckers of western North America. They have a dark greenish back, a rosy front, a gray collar and breast, and a reddish face. This species is often associated with ponderosa pine (*Pinus ponderosa*) throughout its range.
- Lewis's Woodpeckers breed from southern British Columbia south to California and east to extreme western Oklahoma and South Dakota. The winter range extends from southern Washington south to northern Mexico and east to southwestern South Dakota and western Texas.
- There are an estimated 130,000 individuals. Within Region 6, Lewis's Woodpeckers are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in Colorado, Kansas, and South Dakota. They are listed as a Level II / Tier II species (i.e. a species in need of conservation) in Nebraska, Utah, and Wyoming.
- BBS data from 1966-2011 indicate that a range wide decline of 2.9% annually is occurring.
- CBCs during 1966-2012 also indicate a range wide decline is occurring.
- Habitat loss and fire suppression are likely causes of the decline throughout their range.

### Legal Status:

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 9 and 10.

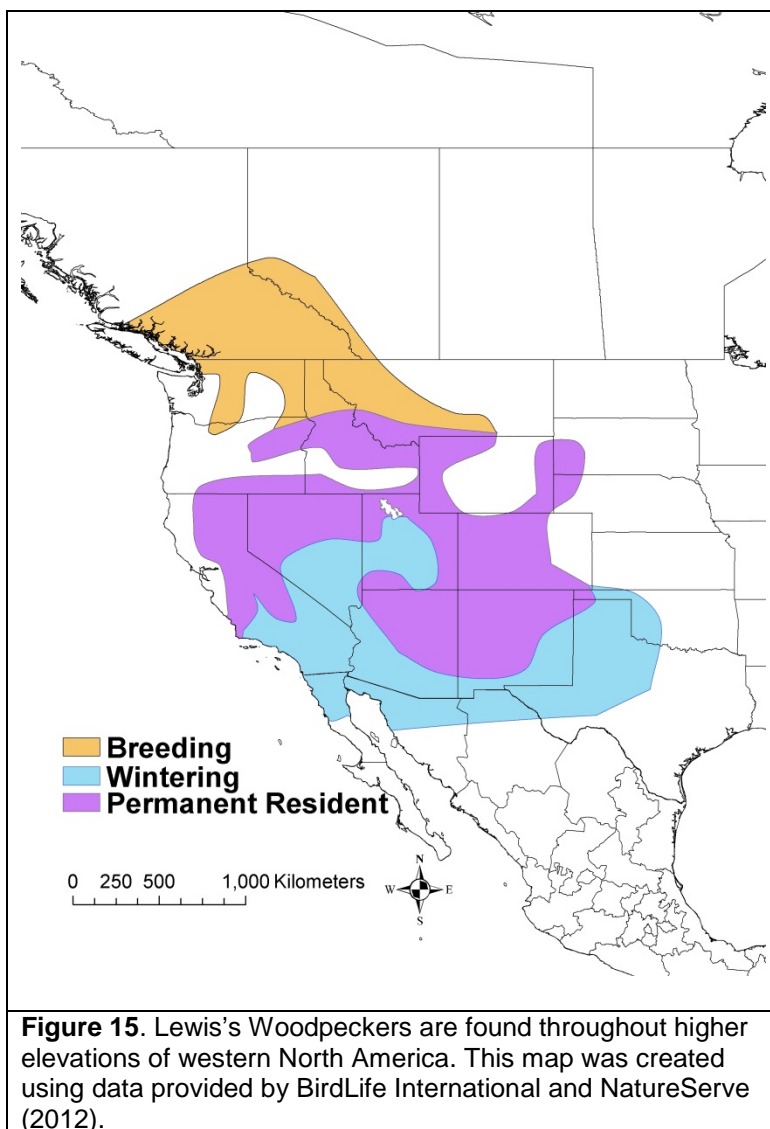
### Description

Lewis's Woodpeckers (Fig. 14) are medium-sized woodpeckers that sport a green-black back and head, a dark red face, and a pinkish belly (Vierling et al. 2013). This species has a gray collar and breast, and a long, dark tail (Vierling et al. 2013). Males and females are similar, though females are smaller (Vierling et al. 2013). Meriwether Lewis, during the Lewis and Clark expedition in 1805, described the species as being similar to a crow or jay, but having distinctive woodpecker behavior (Vierling et al. 2013). These woodpeckers are aerial insectivores, but may also store acorns or other nuts, depending on the season (Brewster 1898, Kaufman 1996, Tobalske 1997, Vierling et al. 2013).

### Distribution

#### Rangewide

Lewis's Woodpeckers are restricted to western North America (Fig. 15; Vierling et al. 2013). They can be locally common but are unevenly distributed across the landscape (Abele et al. 2004). Lewis's Woodpeckers breed from southern British Columbia south to California and east to Oklahoma and southwestern South Dakota. Their distribution throughout their range is local, but they are often associated with ponderosa pine (*Pinus ponderosa*; Vierling et al. 2013). They generally winter from Oregon south to California, and east to western Oklahoma and southwestern South Dakota. Some individuals also winter in the Okanagan Valley in British Columbia, Canada (Vierling et al. 2013). A few individuals may winter as far south as northern Mexico (Vierling et al. 2013). In Oregon, California, Colorado, southwestern Utah, northeastern Arizona, and northwestern New Mexico, Lewis's Woodpeckers are present year-round although numbers are variable (Vierling et al. 2013).



## Region 6

Colorado: In Colorado, Lewis's Woodpeckers concentrate in three areas – pinyon-juniper forests, the watershed of the Arkansas River, and the San Juan Basin in the southern portion of the state (Kingery 1998).

Kansas: Lewis's Woodpeckers are casual visitors to Kansas (Thompson et al. 2011).

Montana: Lewis's Woodpeckers breed in the Rocky Mountains in most of western Montana as well as in Powder River and Carter Counties in southeastern Montana (Bergeron et al. 1992).

Nebraska: Lewis's Woodpeckers are most frequently found at Pine Ridge. They are a rare breeder in the state with only an estimated 10-20 breeding pairs. Evidence of breeding comes from Logan County, Sheridan County, and Dawes County (Molhoff 2000).

North Dakota: Lewis's Woodpeckers are accidental during spring and fall in North Dakota (Faanes and Stewart 1982).

South Dakota: In South Dakota, Lewis's Woodpeckers can be found in areas of ponderosa pine and often several hardwood species. The Black Hills in western South Dakota contain the easternmost Lewis's Woodpecker populations in North America (Gentry and Vierling 2007). However, Lewis's Woodpeckers are local and rare in the Black Hills and surrounding plains (N. Drilling pers. comm.)

Utah: In Utah, Lewis's Woodpeckers breed in the southwestern portions of the state (Utah Conservation Data Center).

Wyoming: In Wyoming, Lewis's Woodpeckers are considered an uncommon summer resident (Faulkner 2010). They are most common east of the Continental Divide (Abele et al. 2004).

## **Biology**

### General

During the breeding season, Lewis's Woodpeckers consume primarily insects (Abele et al. 2004, Vierling et al. 2013). They can be seen fly-catching from open perches (Vierling 1997, Vierling et al. 2013). During the winter, Lewis's Woodpeckers consume primarily acorns, nuts, and grains (Law 1929, Vierling 1997, Abele et al. 2004, Vierling et al. 2013).

Lewis's Woodpeckers can be aggressive when defending food resources (Hadow 1973, Vierling et al. 2013). Lewis's Woodpeckers are known to compete with other woodpecker species for stored acorns, including Acorn (*Melanerpes formicivorus*), Red-headed, and Red-bellied (*M. carolinus*) Woodpeckers (Vierling 1998, Vierling et al. 2013). American Crows (*Corvus brachyrhynchos*) and other Lewis's Woodpeckers have been observed stealing food from neighboring Lewis's Woodpeckers (Constantz 1974).

### Breeding

Red-headed Woodpeckers (*Melanerpes erythrocephalus*) occupy a similar niche, but require more trees and snags for breeding habitat, allowing the two species to co-exist (Vierling et al. 2009). Though Lewis's Woodpeckers are colonial nesters, there is no evidence of cooperative brood care (Tobalske 1997, Vierling 1997). They usually do not excavate cavities like other woodpecker species (Gentry and Vierling 2007, B.C. Conservation Data Centre 2013). Instead, they rely on natural cavities as well as cavities excavated by Hairy Woodpeckers (*Picoides villosus*) and Northern Flickers (*Colaptes auratus*; B.C. Conservation Data Centre 2013, Vierling et al. 2013). Breeding pairs may mate for life (Kaufman 1996, Vierling et al.

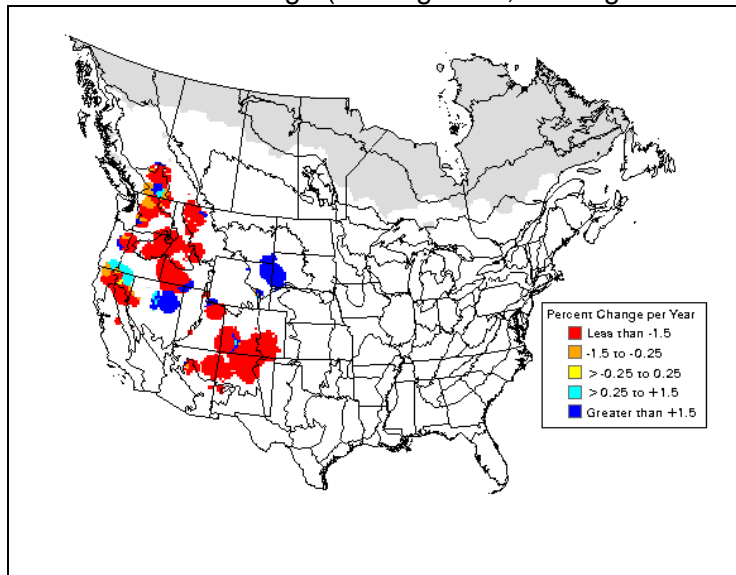
2013). Some pairs may come back to the same site to nest (Kaufman 1996, Vierling et al. 2013). It is unclear which sex initiates the nest site and excavates the hole if necessary (Vierling et al. 2013). Five to nine white oval eggs are laid in a nest lined with wood chips (Vierling et al. 2013). Eggs are incubated 12 to 16 days (Vierling et al. 2013). Both male and female incubate eggs (Vierling et al. 2013). Young leave the nest at 28 to 34 days old, staying near the nest for an additional 10+ days in order to receive additional food from their parents (Vierling et al. 2013). Adults and juveniles form post breeding flocks in autumn (Vierling et al. 2013).

#### Wintering

Lewis's Woodpeckers switch to nuts during the winter months (Vierling et al. 1997, Vierling et al. 2013). They tend to create stockpiles, one for storing, and one for using throughout the winter (Hadow 1973).

#### **Habitat**

Lewis's Woodpeckers prefer open woodlands (Vierling et al. 2013). Generally, they prefer dead or dying tree snags for nesting (Vierling 1997). Gentry and Vierling (2007) consider Lewis's Woodpeckers "burn specialists", meaning they rely on burned areas for nesting (Russell et al. 2007). Lewis's Woodpeckers have a close association with ponderosa pine especially at higher elevations (B.C. Conservation Data Centre 2013). Linder and Anderson (1998) found Lewis's Woodpeckers had a preference for burned ponderosa pine for breeding. Suitable open woodlands can also consist of aspen (*Populus tremuloides*; Newlon and Saab 2011) and cottonwoods (*Populus* spp.) which can be important nest sites, though nest predation is higher in cottonwood, presumably due to predator differences between habitats (Vierling 1997, Saab and Vierling 2001, Vierling et al. 2013). Sporadic distribution may be associated with habitat changes on a local scale (Vierling et al. 2013). Habitat preference in the winter is usually resource driven (Kaufman 1996). Lewis's Woodpeckers will store acorns from oaks (*Quercus* spp.), as well nuts from pecan (*Carya illinoensis*) and walnut (*Juglans* spp.) trees (Kaufman 1996). Cottonwoods are also important for Lewis's Woodpeckers, because the loose bark allows for food storage (Vierling 1997, Vierling et al. 2013).



**Figure 16.** Map of percent change per year in the number of Lewis's Woodpeckers detected during the BBS for the period 1966-2011 from Sauer et al. (2012). The number of observations have declined across the species' range from 1966-2011.

#### **Population Trends and Estimates**

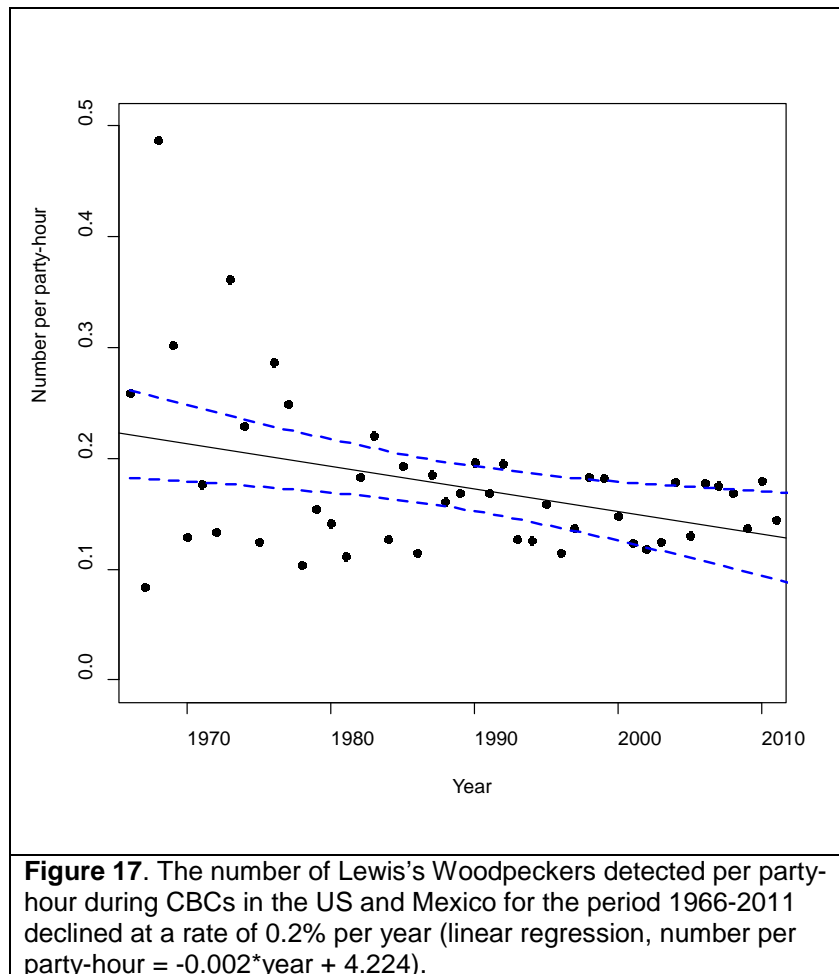
Partners in Flight (2014) estimated that there were 70,000 individuals in North America. Lewis's Woodpeckers are believed to be declining regionally and locally (Towler et al. 2012; Fig. 16). Based on BBS data, Lewis's Woodpeckers exhibited a significant decline of 2.9% annually (Table 10). Within Region 6, however, no significant population changes have been detected (Table 10). CBC data suggest a 0.007% decline since 1966 (linear regression, number per party-hour =  $-0.002 \times \text{year} + 4.224$ ,  $F_{1,44} = 7.357$ ,  $r^2 = 0.1024$ ,  $p = 0.009$ ; Fig. 17).



## Threats

### Habitat degradation and fire suppression

Habitat degradation and fire suppression negatively impact Lewis's Woodpecker breeding and wintering survival (Vierling et al. 2013). Fire is important because it clears up expanse of forest and creates snags for perching and nesting (Vierling et al. 2013). Increased intensity and frequency of fires likewise destroys suitable breeding habitat (Russell et al. 2007).



### Competition

#### Brown-headed

Cowbird nest parasitism is not known to occur, but contact with European Starlings (*Sturnus vulgaris*) can reduce nest success (Abele et al. 2004, Vierling et al. 2013). These encounters are largely territorial and can be energetically costly (Vierling 1998, Abele et al. 2004, Vierling et al. 2013). Lewis's Woodpeckers may abandon a nest if a disturbance comes within 15 m of the nesting site (Vierling et al. 2013).

### Insecticides

#### Being aerial

insectivores, insecticides may also threaten Lewis's Woodpecker survival (Kingery 1998). Ingestion of treated insects will likely result in death (Vierling et al. 2013).

### Human development

Human development can threaten Lewis's Woodpeckers because humans introduce invasive species, destroy habitat, and alter fire regimes (Russell et al. 2007, Vierling et al. 2013).

## Effects of Climate Change

The sensitivity score for the Lewis's Woodpecker on the Climate Change Sensitivity Database is "medium", based on an equation that takes dispersal, disturbance, habitat, physiology, ecology, and non-climatic stressors into account to develop how sensitive the species is to climate change (Tomasevic 2010). The presumed effect on ponderosa pine is that forests would transition to higher elevation areas and exhibit declines (Abele et al. 2004). The effect of this transition on Lewis's Woodpeckers is not known. Drier conditions may restrict breeding habitat and resources while wetter habitats may allow for stable populations for Lewis's Woodpeckers (Abele et al. 2004). Towler et al. (2012) created species response models in burned pine and aspen riparian areas to understand what effects climate might have for



Lewis's Woodpeckers. They found early-burned pine was the most important for Lewis's Woodpeckers until temperature increased by 4°C, when aspen became more important.

### **Effects of Energy Development**

While Lewis's Woodpeckers may not be directly affected by western energy development, habitat loss due to clearing woodland areas can negatively affect Lewis's Woodpeckers in their spotty range (Vierling et al. 2013). Mining practices introduce dust into an area which can affect insect populations (Vierling et al. 2013).

### **Management**

In many areas throughout their range, management efforts focus on prescribed burns. Though burns in eastern Oregon are primarily for the benefit of White-headed Woodpeckers (*Picoides albolarvatus*), Lewis's Woodpeckers benefit from the management practice (pers. obs.). Lewis's Woodpeckers may also benefit from burn management practices for Black-backed Woodpeckers (*P. arcticus*). Sanctuaries and buffer zones should be placed in mining areas to minimize impacts of development (Vierling et al. 2013).

### **Conservation**

Abele et al. (2004) suggest that the losses of breeding and wintering habitats are the most likely causes of future declines. Abele et al. (2004) also suggests that BBS and CBC data are not particularly effective at monitoring Lewis's Woodpecker populations, and suggests that species-specific surveys be undertaken.

### **Completed and Ongoing Conservation Actions**

Citizen science efforts were employed in the East Cascades Bird Conservancy in central Oregon (Shunk 2011). The volunteers monitored nest boxes in snags that the American Bird Conservancy created and collected other information valuable to Lewis's Woodpecker conservation efforts (Shunk 2011).

**TABLE 9.** Lewis's Woodpecker 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.

<b>IUCN</b>	Least Concern
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	Vulnerable
<b>Birds of Conservation Concern</b>	BCR 9, BCR 10, BCR 15, BCR 16, BCR 17, BCR 18, BCR 32, BCR 34, USFWS Region 1, USFWS Region 2, USFWS Region 6, USFWS Region 8, National
<b>PIF</b>	Not a US – Canada Concern Species

**TABLE 10.** Lewis's Woodpecker status summarized by Natural Heritage rankings, BBS trends for 1966-2011, BBS trends for 2000-2011, 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G4	-2.9% (-8.5, -0.9%)	0.3% (-2.8, 4.5%)	-	-
<b>Region 6</b>	-	-0.9% (-6.0, 2.9%)	3.1% (-2.5, 12.0%)	-	-
<b>Montana</b>	S2B	Insufficient data	Insufficient data	Species of Concern	-
<b>North Dakota</b>	-	-	-	-	-
<b>South Dakota</b>	S3B, S3N	Insufficient data	Insufficient data	Species of Concern	Species of Greatest Conservation Need
<b>Wyoming</b>	S2	Insufficient data	Insufficient data	Species of Concern	Tier II
<b>Colorado</b>	S4	-1.8% (-7.0, 2.6%)	-0.7% (-8.1, 3.9%)	-	Species of Greatest Conservation Need
<b>Utah</b>	S3	-	-	Species of Special Concern	Tier II
<b>Nebraska</b>	S2	-	-	-	Tier II
<b>Kansas</b>	SNA	-	-	-	Tier I

## Olive-sided Flycatcher (*Contopus cooperi*)



**Figure 18.** The vocalization of Olive-sided Flycatchers, *Quick! Three beers!* is one of the easiest ways to detect this nondescript flycatcher. Photo by Terri Underhill.

### Summary:

- Olive-sided Flycatchers are large, olive and whitish-gray flycatchers with distinctive white tufts on the rump.
- Olive-sided Flycatchers breed from Alaska east to Newfoundland and south to western North Carolina, western Texas, and California. The winter primarily in Panama and the Andes Mountains of South America.
- There are an estimated 1,200,000 individuals. Within Region 6, Olive-sided Flycatchers are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in Montana and Colorado.
- BBS data from 1966-2011 indicate that a range wide decline of 3.5% annually is occurring. Within Region 6, significant declines of 3.8% per year have been noted in Utah.
- Reasons for such a sharp decline are not well understood, but may be associated with habitat loss, alteration of habitat, fire suppression, and reduction in food availability.

**Legal Status:**

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 11 and 12.

**Description**

Olive-sided Flycatchers (Fig. 18) are large, aggressive flycatchers (Kotliar 2007, Altman and Sallabanks 2012). They are gray to brown above, with a white throat and breast (Altman and Sallabanks 2012). Flanks and sides are olive-gray, and a white patch appears beside the rump (Altman and Sallabanks 2012). Males are similar to females, and juveniles look similar to adults (Altman and Sallabanks 2012). Adults have a bi-colored bill that is dark on the upper mandible and pale on the lower mandible (Altman and Sallabanks 2012).

Although the Olive-sided Flycatcher is usually considered monotypic (Kotliar 2007, Altman and Sallabanks 2012), two subspecies are sometimes described; *Contopus cooperi cooperi*, the eastern subspecies, and *C. c. majorinus*, the western subspecies (Altman and Sallabanks 2012). The *C. c. majorinus* subspecies is larger and is darker, but overall is very similar to *C. c. cooperi* (Kotliar 2007, Altman and Sallabanks 2012).

**Distribution**Rangewide

Olive-sided Flycatchers are summer residents throughout much of Canada and the western United States (Fig. 19). The breeding range extends from Newfoundland and Labrador northwest to Alaska (Altman and Sallabanks 2012). In the eastern United States, the Olive-sided Flycatcher range extends to eastern Tennessee and western North Carolina (Burleigh 1935, Altman and Sallabanks 2012). The western part of their range extends from Alaska to California and Baja California Norte, reaching its eastern limits in Trans-Pecos Texas (Altman and Sallabanks 2012). Wintering Olive-sided Flycatchers migrate through Mexico. Some individuals overwinter in southern Mexico, Panama and other Central American nations, but most flycatchers migrate to the Andes Mountains (Kaufman 1996, Altman and Sallabanks 2012). Here, they concentrate in Ecuador, Peru, Bolivia, northwestern Brazil, and Colombia (Willis et al. 1993, Altman and Sallabanks 2012).

Region 6

Colorado: In Colorado, Olive-sided Flycatchers are found primarily in the western half of the state (Kingery 1998). They utilize mixed forests between 2135-3350 m (Kotliar 2007).

Kansas: Olive-sided Flycatchers are uncommon transients in Kansas (Thompson et al. 2011).

Nebraska: This species is an uncommon transient in Nebraska (Sharpe et al. 2001).

Montana: In Montana, Olive-sided Flycatchers breed primarily in the western half of the state, as well as in south-central Montana. Olive-sided Flycatchers will migrate throughout the state (Bergeron et al. 1992).

North Dakota: Olive-sided Flycatchers are uncommon migrants in North Dakota (Faanes and Stewart 1982).

South Dakota: There are a few observations in the Black Hills of western South Dakota during the breeding season, but no evidence of breeding (Kotliar 2007). No evidence of breeding was detected during the most recent Breeding Bird Atlas (N. Drilling pers. comm.). Otherwise, they are rare to uncommon transients, primarily in the eastern portion of the state (Tallman et al. 2002).

Utah: In Utah, Olive-sided Flycatchers are fairly common summer residents (Utah Bird Records Committee 2013). They breed in the northeast and central parts of the state (Utah Conservation Data Center 2012).

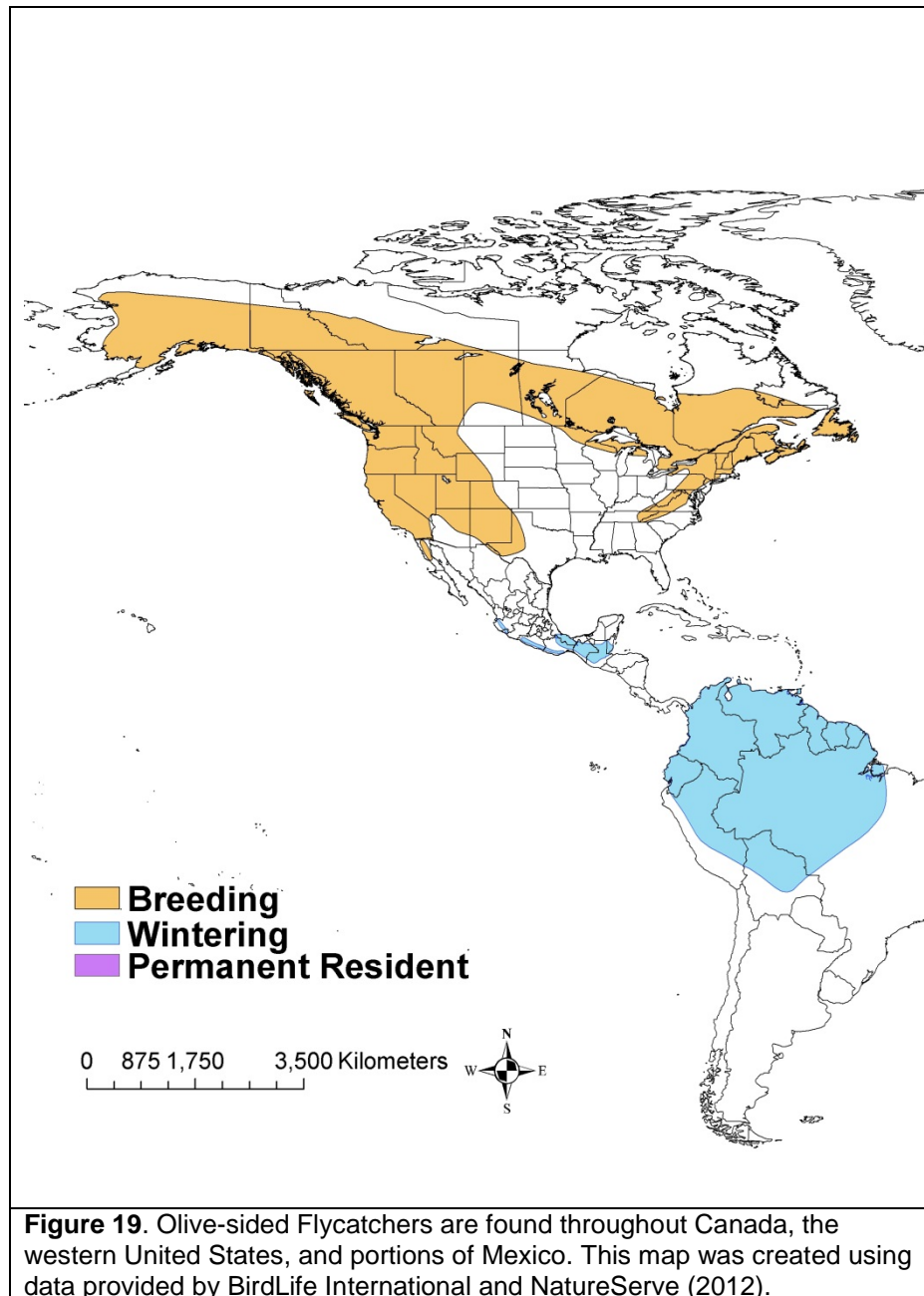
Wyoming: Olive-sided Flycatchers can be found breeding in the Laramie and Big Horn Mountains, primarily associated with coniferous forests in relatively high elevations (Kotliar 2007, Faulkner 2010).

## Biology

### General

#### Olive-sided

Flycatchers feed on insects, especially hymenopterans, from the tops of trees or dead snags (Kaufman 1996, Altman and Sallabanks 2012). They snatch their prey then return to the same or similar post, called yo-yo-flight (Kaufman 1996, Altman and Sallabanks 2012). Their flight pattern is quick and efficient, allowing these flycatchers to pursue prey or predators (Altman and



**Figure 19.** Olive-sided Flycatchers are found throughout Canada, the western United States, and portions of Mexico. This map was created using data provided by BirdLife International and NatureServe (2012).

Sallabanks 2012). Though rarely observed, some Olive-sided Flycatchers may also engage in territorial or courtship pendulum displays, (Tvrđik 1971).

Territories are large, and a pair may defend 40-45 ha (Altman and Sallabanks 2012). Territories average 10-12 ha in most areas (Altman and Sallabanks 2012). Olive-sided

Flycatchers may share territories with other flycatcher species, including Western Wood-Pewee (*Contopus sordidulus*; Altman and Sallabanks 2012). In Oregon, there was evidence of cooperative predator defense between Olive-sided Flycatchers and Western Tanagers (*Piranga ludoviciana*; Altman and Sallabanks 2012).

Olive-sided Flycatchers are monogamous, and the bond remains strong throughout the breeding season (Altman and Sallabanks 2012). There is little evidence for extra-pair copulation, and mated males will drive unmated males away from the territory (Altman and Sallabanks 2012). Males often sing their “Quick! Three beers!” song to defend their territory (Kaufman 1996). Variation of song in males is likely due to development, not evolutionary mechanisms (Robertson et al. 2009).

### Breeding

Males arrive on the breeding grounds first, usually in May. Pair bonds form in about two weeks after females arrive. Nest-building begins in early June. The female chooses the nest site, but may have some help from the male. Both sexes will “belly up” at a site, where they simulate building an open cup nest. Nests are built by the female at varying heights and out on a horizontal branch. The nests are made with twigs and lined with lichens, grasses, and pine needles (Altman and Sallabanks 2012). Olive-sided Flycatchers produce one brood of 3-4 eggs per year, but will re-nest if a nest fails (Kotliar 2007). Incubation is usually 14 to 16 days and nestlings are altricial, fledging after 19 to 21 days (Walkinshaw and Henry 1957, Altman and Sallabanks 2012). A late nesting record on 9 September was recorded in 1957 in Washington (LaFave 1958). Brood parasitism by Brown-headed Cowbirds is rarely observed (Kotliar 2007).

### Wintering

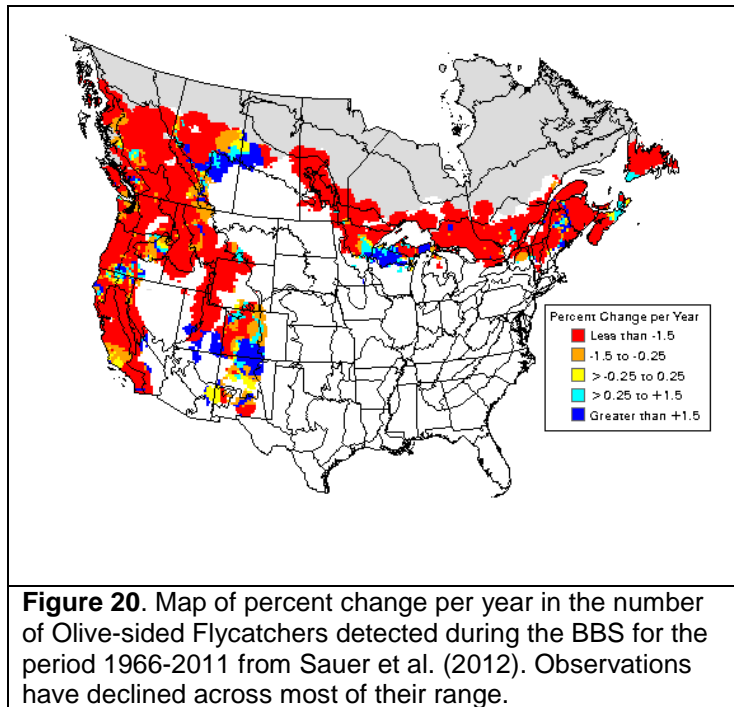
Olive-sided Flycatchers begin migration in August and September and are often territorial on the wintering grounds where they rarely co-mingle in mixed-species flocks (Altman and Sallabanks 2012).

### **Habitat**

Olive-sided Flycatchers are highly variable in elevation and habitat. They can be found from sea-level to 3350 m (Altman and Sallabanks 2012). Most are reported using mid- to high-elevations from 920-2130 m (Altman and Sallabanks 2012). They primarily use coniferous forests and are an edge species using forested areas adjacent to meadows, canyons, streams, rivers, or other openings (Kaufman 1996, Altman and Sallabanks 2012). Olive-sided Flycatchers can utilize a variety of trees species for breeding, including Douglas-fir (*Pseudotsuga menziesii*), red fir (*Abies magnifica*), grand fir (*A. grandis*), aspen (*Populus* spp.), western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), spruce (*Picea* spp.) and tamarack (*Larix laricina*; Altman and Sallabanks 2012). During winter, the flycatchers use broadleaf evergreen or semi-deciduous forests (Kotliar 2007).

### **Population Trends and Estimates**

Partners in Flight (2014) estimated that the population consisted of 1,700,000 individuals. Based on BBS data through 2011, Olive-sided Flycatchers declined by 3.5% annually. From the periods 1968-2006 and 1996-2006, Olive-sided Flycatcher populations declined by 78% and 29%, respectively (NatureServe 2013). The decline is rangewide (see Fig. 20) but the greatest declines have been west of the Rocky Mountains, with significant declines in British Columbia (5.3%), California (4.0%), and Oregon (5.1%; Altman and Sallabanks 2012). In Region 6, a significant decline of 3.8% annually was noted in Utah during the period 1966-2011.



## Threats

### Predation

Predation primarily occurs on eggs and nestlings (Kotliar 2007, Altman and Sallabanks 2012). Squirrels, including Douglas ( *Tamiasciurus douglasii* ), northern flying ( *Glaucomys sabrinus* ) red ( *T. hudsonicus* ) and corvids, including Gray ( *Perisoreus canadensis* ) and Steller's Jays ( *Cyanocitta stelleri* ) and Common Ravens ( *Corvus corax* ), often predated nests (Altman and Sallabanks 2012). Predation on adults may be due to *Accipiter* species or Peregrine Falcons ( *Falco peregrinus* ; Altman and Sallabanks 2012).

### Habitat loss, alteration, and fire suppression

Habitat loss or alteration of habitat is one potential explanation for declines in this species (Altman and Sallabanks 2012). Major deforestation and alteration in the Andes may threaten wintering populations (Willis et al. 1993, Kotliar 2007, Altman and Sallabanks 2012). Fire creates openings in large tracts of forest that are necessary for Olive-sided Flycatcher breeding habitat (Kotliar 2007, Altman and Sallabanks 2012). Increased fire suppression creates dense forests that are unusable for this species (Altman and Sallabanks 2012).

### Pesticides

Effects have not been studied directly, but because the diet is composed primarily of insects, potential negative effects could arise in this species (Altman and Sallabanks 2012).

## Effects of Climate Change

The sensitivity score for the Olive-sided Flycatcher on the Climate Change Sensitivity Database is "medium", based on an equation that takes dispersal, disturbance, habitat, physiology, ecology, and non-climatic stressors into account to develop how sensitive the species is to climate change (Tomasevic 2010). Because Olive-sided Flycatchers primarily consume flying insects, seasonal changes that influence insect activity can impact food availability (Altman and Sallabanks 2012). This can affect nestling development and survival as well as adult survival (Altman and Sallabanks 2012).

## Effects of Energy Development

Effects of energy development have not been studied in this species. Selective logging offers some advantage (Altman and Sallabanks 2012), but clear cut forests are not used by Olive-sided Flycatchers (Kotliar 2007). Energy development may offer temporary habitats for breeding, but may be of poor quality.

## Management

Management efforts should utilize prescribed burning in habitats used by Olive-sided Flycatchers. This species has historically been dependent on postburn habitat (Kotliar 2007,



Robertson and Hutto 2007, Wells 2007, Altman and Sallabanks 2012). Selective logging may be beneficial for this species, because it can provide sufficient cover while allowing for perches and foraging sites (Altman and Sallabanks 2012). However, some suggest that heavy logging may be an “ecological trap” that provides poor-quality habitat that is attractive to Olive-sided Flycatchers and decreases fitness (Kotliar 2007, Robertson and Hutto 2007, Wells 2007).

### **Conservation**

Conservation efforts for this species should focus on preserving tracts of forest in important wintering areas (Altman and Sallabanks 2012). In conjunction with management efforts, preserving forest areas while creating artificially thinned forest edges via burning or logging may be a key component of conserving this species (Altman and Sallabanks 2012).

### **Completed and Ongoing Conservation Actions**

Practices to thin forests and leave both snags and living trees have been implemented in some areas (Altman and Sallabanks 2012).

**TABLE 11.** Olive-sided Flycatcher 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.

<b>IUCN</b>	Near Threatened
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	Vulnerable
<b>Birds of Conservation Concern</b>	BCR 4, BCR 5, BCR 10, BCR 12, BCR 14, BCR 15, BCR 28, USFWS Region 1, USFWS Region 3, USFWS Region 4, USFWS Region 5, USFWS Region 7, USFWS Region 8, National
<b>PIF</b>	US – Canada Concern Species

**TABLE 12.** Olive-sided Flycatcher status summarized by Natural Heritage rankings, BBS trends for 1966-2011, 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G4	-3.5% (-4.6, -2.9%)	-2.4% (-3.6, -1.0%)	-	-
<b>Region 6</b>	-	-1.0% (-2.1, 0.1%)	-1.1% (-3.3, 0.7%)	-	-
<b>Montana</b>	S4B	0.4% (-1.6, 2.3%)	0.7% (-3.3, 4.2%)	-	Tier I
<b>North Dakota</b>	SNA	-	-	-	-
<b>South Dakota</b>	SUB	-	-	Species of Concern	-
<b>Wyoming</b>	S4B	-0.5% (-3.4, 2.4%)	-0.7% (-6.6, 3.6%)	Potential Concern	-
<b>Colorado</b>	S3S4B	-0.7% (-1.9, 0.6%)	-0.9% (-3.6, 1.3%)	-	Species of Greatest Conservation Concern
<b>Utah</b>	S3S4B	-3.8% (-6.2, -1.2%)	-1.0% (-5.6, 7.8%)	-	-
<b>Nebraska</b>	SNRN	-	-	-	-
<b>Kansas</b>	SNA	-	-	-	-

## Sedge Wren (*Cistothorus platensis*)



**Figure 21.** Sedge Wrens exhibit an unusually nomadic breeding system, with nesting during late May through June occurring in the Upper Midwest and adjacent Canada. Some birds then move south and east from July through September and renest in a new location. Photo by Katrina Hucks.

### Summary

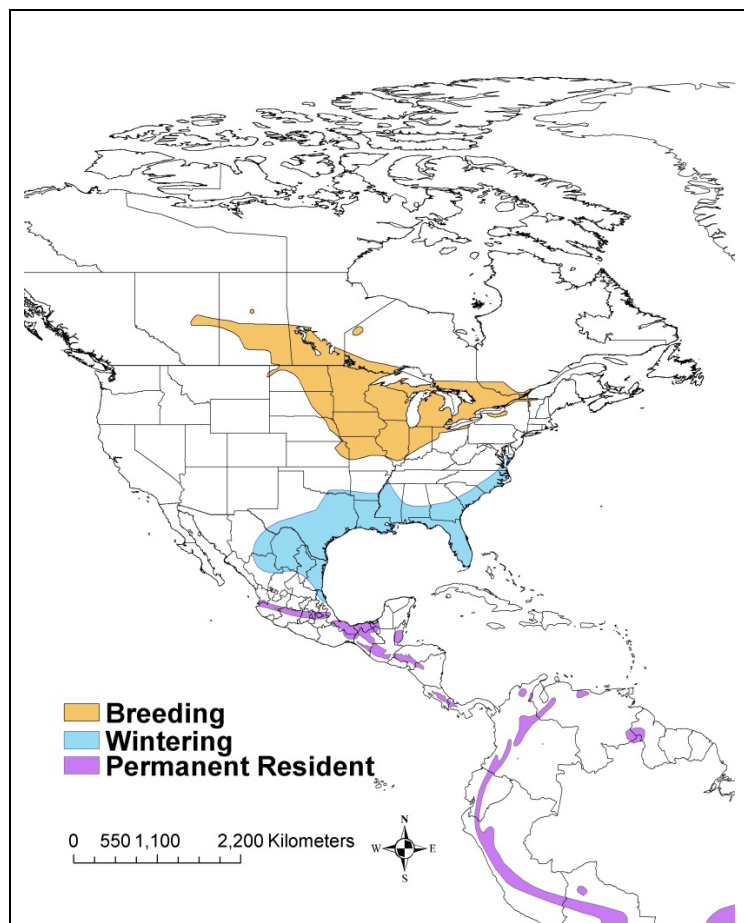
- Sedge Wrens are small wrens that inhabit wetland and wet meadows. They are brown overall, with the crown and the back streaked with white and buffy underparts.
- In North America, Sedge Wrens breed from east-central Alberta east to New Brunswick and south to Kansas, southern Illinois and Maryland. However, breeding birds are concentrated during late May and June in Wisconsin, Minnesota, North Dakota and Saskatchewan. During July through September birds can be found throughout their breeding range. Sedge Wrens winter from southern New Jersey west to southeastern Oklahoma and south to Florida and Veracruz, Mexico.
- There are an estimated 6,200,000 Sedge Wrens in North America. Within Region 6, Sedge Wrens are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in Montana. They are listed as a Level II / Tier II species (i.e. a species in need of conservation) in Nebraska and North Dakota.
- BBS data for the period 1966-2011 does not show a change in the population size. However, there has been a significant decline of 1.6% annually in the Prairie-Hardwood Transition. Within Region 6, there has been a 5.0% decline annually since 2000.
- In contrast, CBC data for the U.S. and Mexico for the period 1966-2011 suggests a slight 0.2% annual increase.
- Wet meadow and wetland degradation and destruction are thought to be the primary cause for observed population declines.

## Legal Status

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 13 and 14.

## Description

This species is a small wren measuring from 10 to 12 cm in length and weighing 7 to 10 g (Herkert et al. 2001). The back and crown are black and tawny brown with white stripes (Herkert et al. 2001; Fig. 22). Eighteen subspecies of Sedge Wren occur, and these subspecies are divided into three groups (Herkert et al. 2001). Only one subspecies of the North American Sedge Wren group, *C. p. stellaris*, occurs in the U.S. (Herkert et al. 2001).



**Figure 22.** Sedge Wrens regularly breed in the Midwestern US north to southern Quebec, Ontario, Manitoba and Alberta. They will occasionally breed as far east as Maryland and New Brunswick. Sedge Wrens winter in the southeastern US south to Mexico. Sedge Wrens in Central and South America are non-migratory. This map was created using data provided by BirdLife International and NatureServe (2012).

## Distribution

### Rangewide

The core breeding range is primarily in the Great Plains of the United States and Canada, and it ranges from Saskatchewan east to New England and south to Kansas Missouri, and southern Illinois (Herkert et al. 2001; Fig. 22). Sedge Wrens typically breed during late May and June in Saskatchewan, North Dakota, Minnesota, and Wisconsin. During July through September breeding birds may turn up as far east as New Brunswick, south to Maryland and eastern Kansas.

The winter ranges occurs from the Chesapeake Bay west to southeastern Oklahoma and south to Florida and Veracruz, Mexico (Herkert et al. 2001). Residents occur year-round from central Mexico into South America (Herkert et al. 2001).

### Region 6

**Colorado:** Sedge Wrens are a review species in Colorado and do not breed in this state although occasional vocalizing males have been found from late May to late June (Andrews and Righter 1992, Kingery 1998).

**Kansas:** The Sedge Wren is a local summer resident in eastern Kansas (Thompson et al. 2011). The complex

breeding strategy of the Sedge Wren confounds early summer BBS efforts in Kansas because this species does not nest in the state until late July and August (Busby and Zimmerman 2001). Thus, this species' occurrence and distribution are certainly underrepresented by current survey efforts (Busby and Zimmerman 2001). Breeding records are reported primarily in the tallgrass prairie and wetlands of the eastern third of the state (Busby and Zimmerman 2001).

Montana: Sedge Wrens breed in the northeast corner of the state, with the majority of observations limited to Sheridan and Roosevelt Co. (Bergeron et al. 1992). Birds begin arrive in May and depart by October, and breeding occurs from May to August (Bergeron et al. 1992). Occurrences are primarily at elevations lower than 600 m (Bergeron et al. 1992).

Nebraska: Sedge Wrens breed in the extreme northeast of the state (Johnsgard 1979, Lingle et al. 1989, Dechant et al. 1998). In CRP (Conservation Reserve Program) land, Sedge Wrens were observed in habitat with dense, tall vegetation (1.2-1.5 m; Bedell 1987, Delisle and Savidge 1997). The wet meadows and wetlands inhabited by Sedge Wrens included cattails (*Typha* spp.) big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), tall mannagrass (*Glyceria*), and/or Indiangrass (*Sorghastrum nutans*; Clausen 1989).

North Dakota: Sedge Wrens are listed as uncommon to fairly common breeders with a limited range, and they breed in the eastern two-thirds of the state (Faanes and Stewart 1982, Dechant et al. 1998). The highest densities of breeding birds occur in the Prairie Pothole Region (Stewart 1975). Sedge Wrens have been recorded in CRP, restored prairies, wet meadows, and wetlands (Messmer 1990, Johnson and Igl 1995). Density of breeding birds is higher in areas with high grass, high litter cover, and little bare ground (Renken 1983). Breeding season occurs from early June to late August, and breeding peaks from mid-June to early August (Stewart 1975).

South Dakota: Sedge Wrens breed in wetlands and wet meadows primarily in the eastern portion of the state (Blankespoor 1980, Peterson 1995, Dechant et al. 1998). All breeding records occur east of the Missouri River (Peterson 1995, Tallman and Swanson 2002), although there are also a handful of records from the sandhills region of the extreme south edge and around Lacreek National Wildlife Refuge (Bennet County). Sedge Wrens have been observed in dug-brood complexes (constructed wetlands for waterfowl) and fields restored by seeding prairie grasses (Blankespoor 1980, Dechant et al. 1998). The most recent Breeding Bird Survey found Sedge Wrens in wet meadows, Conservation Reserve Program lands, and uncut hayfields near wetlands (N. Drilling pers. comm.).

Utah: Sedge Wrens have not been recorded in Utah (Utah Bird Records Committee 2013).

Wyoming: Sedge Wrens are listed as a vagrant in Wyoming, and a handful of records exist for the bird in this state (Faulkner 2010).

## **Biology**

### General

Sedge Wrens typically run to evade intruders, and they usually fly only a short distance before dropping down into the grass (Howell 1932, Roberts 1932, Herkert et al. 2001). Territorial conflicts have not been described, but this species elicits a strong response to playback calls (J. Tibbits, pers. obs.).

Males develop a unique repertoire of vocalizations that can be composed of 20-70 song types (Herkert et al. 2001). Male songs typically begin with three or four introductory notes and

are followed by a great variety of trills (Herkert et al. 2001). Songs last 1.5-2.0 seconds, and a Sedge Wren can sing as many as 17 different songs in one minute (Herkert et al. 2001).

### Breeding

Sedge Wrens are very nomadic, and breeding is concentrated in different portions of its range at different times of the season (Herkert et al. 2001). Males arrive at the breeding grounds up to two weeks before females (Schramm et al. 1986). Males establish a territory upon arrival to the breeding grounds, and this territory is used for courtship, nesting, and foraging (Burns 1982). Territory boundaries are plastic and may shift throughout the breeding season (Burns 1982). A study in Minnesota observed that territory size for males averaged 1,780 m<sup>2</sup> (Burns 1982). Male polygyny and female polyandry exists at varying rates in different regions, and reproductive success differs between polygynous males and monogamous males in these different breeding areas (Crawford 1977, Burns 1982, Herkert et al. 2001).

Males build multiple nests to possibly act as decoys for predators (Verner 1965, Burns 1977, Burns 1982). The majority of courtship activity occurs near nests, and a positive relationship between the number of nests built by males and the number of mated females was observed (Verner and Engelson 1970). Sedge Wrens will destroy the nests of other Sedge Wrens and other species that nest near their territory (Picman and Picman 1980). Nests are destroyed by piercing eggs with their beaks, and this behavior is thought to reduce competition with Sedge Wrens and other species (Picman and Picman 1980).

Early nesting in the northern breeding range (WI, MN, ND, Saskatchewan) occurs from May to June (Herkert et al. 2001). Nesting in the southern portion of its breeding range (AR, KS, IL, NE, MO) may not occur until July or August (Herkert et al. 2001). Nesting attempts late in the breeding season may represent renesting attempts from Sedge Wrens arriving from other areas within their breeding range (Bedell 1996).

### Wintering

Sedge Wrens probably migrate in flocks with other wren species (Taylor et al. 1983). Sedge Wrens have been observed vocalizing on their wintering grounds (J. Tibbits, pers. obs.). However, they are typically elusive and difficult to detect in their wintering areas (Herkert et al. 2001, Baldwin et al. 2007).

### **Habitat**

#### Breeding

A North Dakota study found that Sedge Wren occur less frequently in areas with tree cover or near trees (Cunningham and Johnson 2006). A South Dakota study found that Sedge Wren occupancy was 12-23% higher in small patches with more than 60% grassland in the surrounding landscape than in large, isolated patches with less than 60% grassland habitat (Bakker et al. 2002). Nests are usually built in dense growth of emergent vegetation consisting of sedges and grass (Walkinshaw 1935, Peck and James 1987).

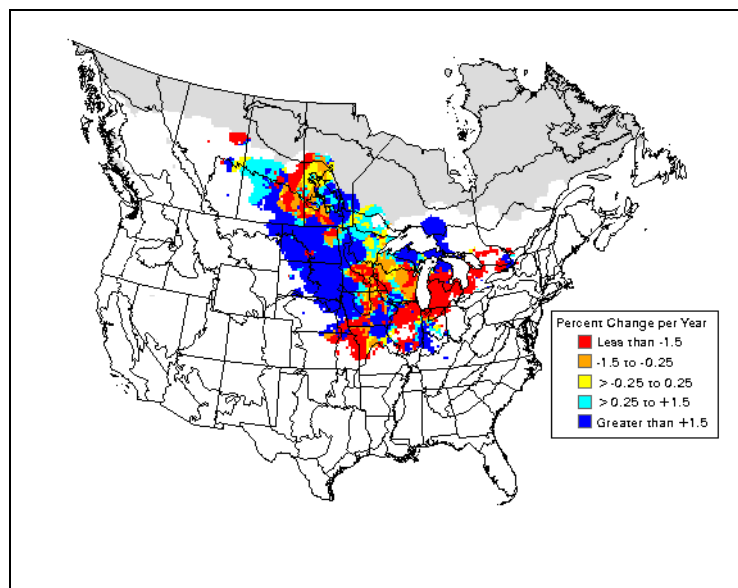
#### Migration

Sedge Wrens are most frequently encountered in habitats similar to their preferred breeding habitats, but are also found in mesic grasslands, salt marshes, and agricultural fields (Forbush 1927b, Palmer 1949, Mumford and Keller 1984, Herkert et al. 2001).

#### Winter

Little information is available for Sedge Wren winter habitat (Herkert et al. 2001). In Florida, they have been found in sedge meadows, pine savannas, wet palmetto prairies, and fields of dense grasses and forbs (Sprunt 1954, McNair 1998, Herkert et al. 2001). In Alabama, they have been observed at the edges of wetlands, boggy areas in flat pines, and grasslands

(Imhof 1976). In Louisiana, Sedge Wrens are found in grassy wetlands in coastal areas and dry grassland in upland areas (Lowery 1974). Sedge Wrens are more common in areas that are burned at intervals greater than 2 years, and they also occur more in areas with dense vegetation (Baldwin et al. 2007).



**Figure 23.** Map of percent change per year in the number of Sedge Wrens detected during the BBS for the period 1966-2011 from Sauer et al. (2012). Observations have declined in the Prairie Hardwood Transition of southeastern Minnesota, Wisconsin, Michigan, and northern Indiana.

per party-hour =  $0.002 \cdot \text{year} - 3.734$ ,  $F_{1,44} = 7.834$ ,  $r^2 = 0.249$ ,  $p = 0.0002$ ; Fig. 24).

## Population Trends and Estimates

Partners in Flight (2013)

estimate the global population to be 20,000,000, with 4,600,000 occurring in the US. Based on BBS data, Sedge Wrens have not exhibited a significant change (Table 14). At a regional scale, Sedge Wrens have declined by 1.6% annually within the Prairie Hardwood Transition (Fig. 23). Within Region 6, the population increased at an annual rate of 5.4% (Table 14). However, since 2000, the population of Sedge Wrens in Region 6 has decreased by 5.0% annually (Table 14). Herkert et al. (2001) caution that population trends may not efficiently survey Sedge Wrens because BBS routes are sampled occur early in their breeding season (Herkert et al. 2001). CBC data suggest a 0.2% increase since 1966 (linear regression, number

## Threats

### Predation

Nest predation may be a major source of nest failure, and a Minnesota study attributed five of seven nest failures to predation (Burns 1982). Red foxes (*Vulpes vulpes*) have been known to prey on Sedge Wrens, and maintaining vegetation buffers in Sedge Wren habitat may provide shelter from predators (Errington 1935). Blancher (2013) also suggests that Sedge Wrens may be vulnerable to predation by cats.

### Collision

Fatal collisions with television towers and buildings have been recorded, but the impact of collisions on overall population is unknown (Taylor et al. 1983).

### Pesticides and Contaminants

The effects of pesticides and contaminants are unknown. Vegetation buffers around wetlands provide a defense against runoff contaminants from agriculture, feed lots, etc., and these buffers should be excluded from development.

### Habitat Loss and Degradation

Degradation and destruction of wet meadow and wetland habitat occurred with the conversion of these wet areas to agricultural land (Tiner 1984). The wet meadows and



palustrine wetlands preferred by Sedge Wrens are the easiest to drain and fill, and many of these wetlands have been destroyed (Tiner 1984).

### Effects of Climate Change

Gardali et al. (2012) suggest that birds breeding in wetlands may be sensitive to predicted changes in climate but the effects of climate change on this species have not been well-studied. Butler (2003) found that Sedge Wrens were arriving earlier in upstate New York by the end of the 20<sup>th</sup> century. Matthews et al. (2004) forecast that climate change will cause the breeding range to contract and Woodrey et al. (2012) suggests that climate change along the Gulf Coast may negatively affect wetland birds.

### Effects of Energy Development

Monotypic switch grass plots grown for ethanol development are likely to have a negative effect on Sedge Wrens. Sedge Wren densities in native grasses were 71-73% higher than densities in monotypic vegetation (Bakker and Higgins 2009).

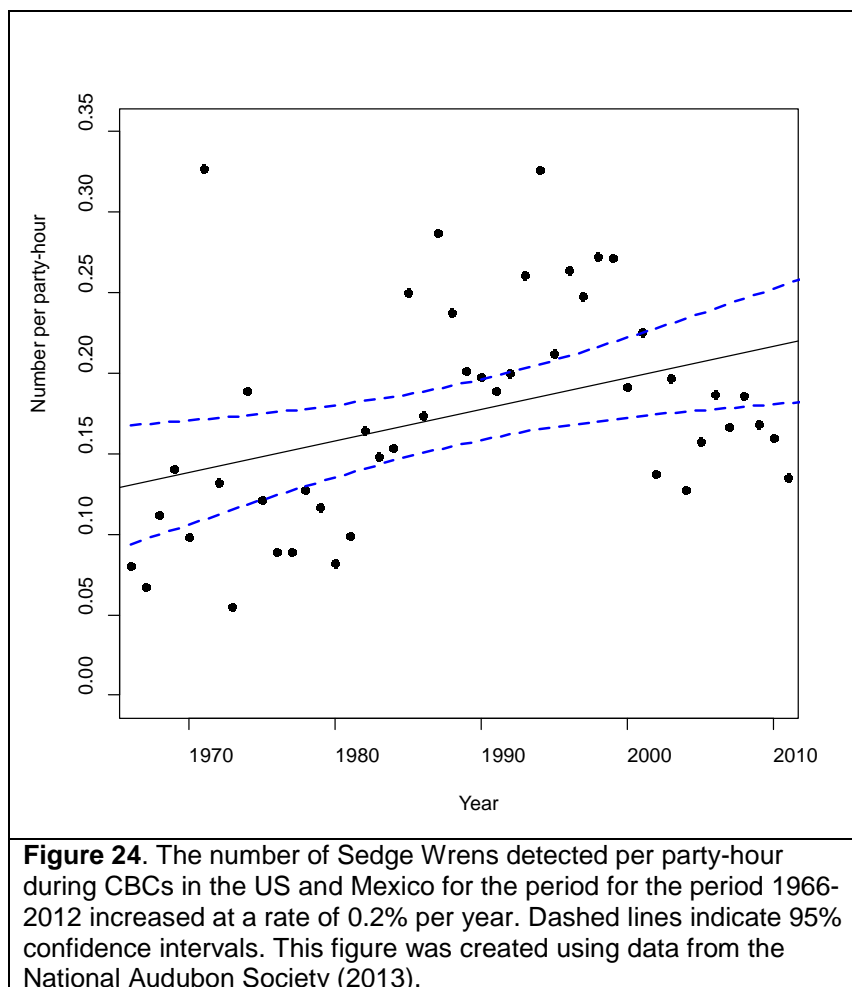
### Conservation and Management

Sedge Wrens respond positively to spring burning, but require a mosaic of different habitats for successful breeding (Eddleman 1974, Schramm et al. 1986, Dechant et al. 1998). In an Illinois study,

Sedge Wrens preferred nesting and foraging in spring-burned areas, but required litter for nest building from unburned areas (Schramm et al. 1986). Response varied by region to postburn treatments, but populations were lower in areas 1-year postburn (Dechant et al. 1998). Sedge Wrens typically avoid vegetation less than 10 cm in height or with reduced vegetation density due to moderate to heavy grazing (Messmer 1985, Dechant et al. 1998).

Land management practices should take Sedge Wren breeding biology into account. Ill-timed grazing, mowing, and burning will significantly reduce breeding densities in both breeding and winter habitat (Herkert et al. 2001).

Wetland legislative protection is the most important tool to preserve Sedge Wren habitat (Herkert et al. 2001). Responsible authorization of 404 permits for wetland dredging and filling is essential to protect the wetland habitat of this species, and mitigation should be undertaken to replace lost habitat for granted permits. Habitat conservation programs such as the



Conservation Reserve Program (CRP) and North American Waterfowl Management Plan may have contributed to regional population increases, but it should be noted that these programs are not designed with Sedge Wren conservation in mind (Johnson and Schwartz 1993, Best et al. 1997, Prescott and Murphy 1999, Herkert et al. 2001).

#### **Completed and Ongoing Conservation Actions**

No information exists on species-specific conservation plans for this species. However, Sedge Wrens benefit from the umbrella protection by land-conservation programs such as the CRP in the United States and North American Waterfowl Management Plan in Canada (Herkert et al. 2001).

**TABLE 13.** Sedge Wren 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.

<b>IUCN</b>	Least Concern
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	Secure
<b>Birds of Conservation Concern</b>	BCR 24, BCR 26, BCR 27, BCR 28, BCR 29, BCR 30, BCR 37, USFWS Region 2, USFWS Region 4, USFWS Region 5
<b>PIF</b>	Not a US – Canada Concern Species

**TABLE 14.** Sedge Wren status summarized by Natural Heritage rankings, BBS trends for 1966-2011, BBS trends for 2000-2011, 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G5	1.2% (-0.8, 2.2%)	1.9% (0.0, 3.8%)	-	-
<b>Region 6</b>	-	5.4% (2.9, 8.0%)	-5.0% (-8.5, -1.0%)	-	-
<b>Montana</b>	S3B	-	-	Species of Concern	Tier I
<b>North Dakota</b>	SNRB	4.3% (1.6, 7.3%)	0.1% (-5.1, 5.4%)	-	Level II
<b>South Dakota</b>	S4B	8.9% (5.3, 12.8%)	11.2% (2.3, 21.3%)	-	-
<b>Wyoming</b>	-	-	-	-	-
<b>Colorado</b>	SNA	-	-	-	-
<b>Utah</b>	-	-	-	-	-
<b>Nebraska</b>	S3	-	-	-	Tier II
<b>Kansas</b>	S3B	Insufficient data	Insufficient data	-	-

## Chestnut-collared Longspur (*Calcarius ornatus*)



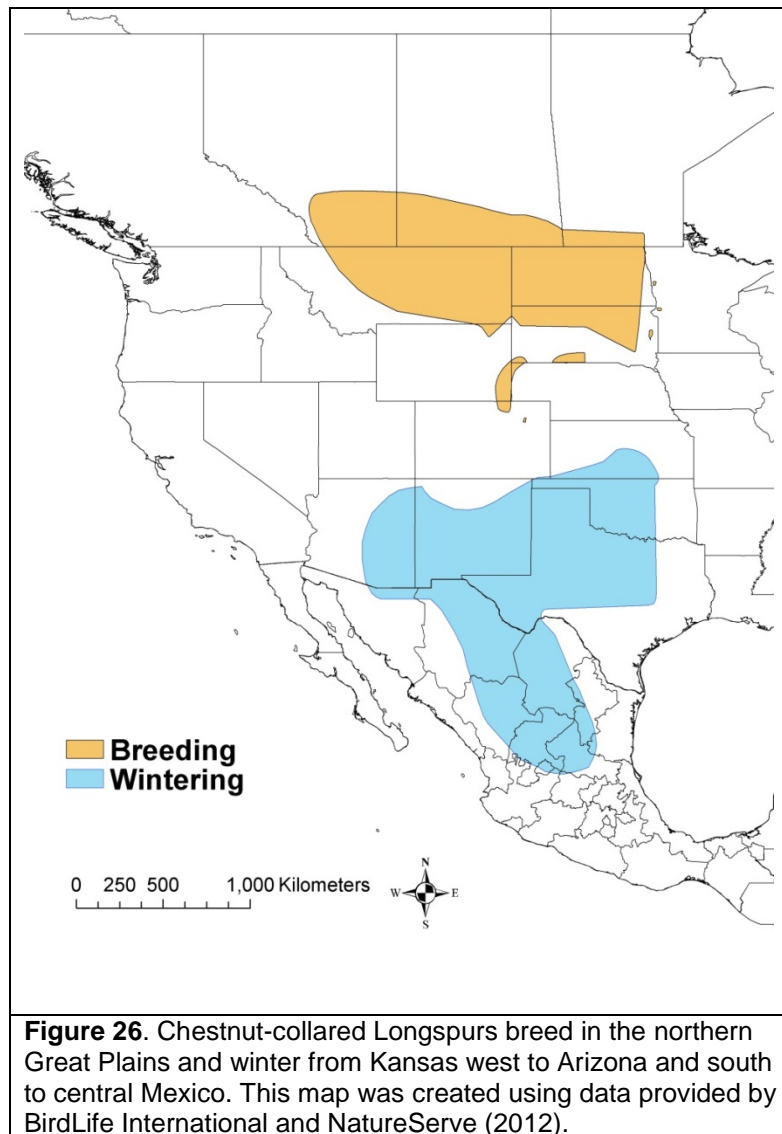
**Figure 25.** Male Chestnut-collared Longspurs (left) are far more striking than the cryptically colored females (right). Photos by Chris Butler (left) and Bill Adams (right).

### Summary:

- Male Chestnut-collared Longspurs in breeding plumage have a strikingly jet black breast, a black-and-white head, a rufous nape, and a yellowish throat. Females and non-breeding males are brown and streaky.
- Chestnut-collared Longspurs breed from northwestern Minnesota west to southern Alberta and south to northeastern Colorado. They winter from southern Kansas west to southeastern Arizona and south to Texas and northern Mexico.
- There are an estimated 5,600,000 Chestnut-collared Longspurs in North America. Within Region 6, Chestnut-collared Longspurs are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in North Dakota, South Dakota, Colorado, Nebraska and Kansas. They are listed as a Level II / Tier II species (i.e. a species in need of conservation) in Wyoming.
- BBS data for the period 1966-2011 shows a significant rangewide decline of 4.3% annually. Within Region 6, there has been a 3.8% annual decline.
- No significant changes in detection rates on CBCs, however, were observed in the U.S. and Mexico for the period 1966-2012.
- Declines in this species are due primarily to habitat loss, fire suppression, and habitat alteration.

### Legal Status:

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 15 and 16.



### Description

Breeding male Chestnut-collared Longspurs are distinctively colorful (DuBois 1937, Hill and Gould 1997; Fig. 25). They have a black belly, black cap, chestnut nape, white face with a black eyestripe, and buffy yellow cheeks and throat (DuBois 1937, Hill and Gould 1997). In non-breeding males the black on head and belly and chestnut nape are masked by buffy feather tips (Hill and Gould 1997). Females are buffy and dull, streaked grayish (Hill and Gould 1997). Both sexes have white outer tail feathers and dark inner tail feathers, giving a striped appearance (DuBois 1937, Hill and Gould 1997). Winter plumage is drab (Hill and Gould 1997). Longspurs have a long claw on the hind toe (Hill and Gould 1997). Bills are conical and often have a dark tip (Hill and Gould 1997).

### Distribution

#### Rangewide

Chestnut-collared Longspurs breed in the northern Great Plains of North America (Fig. 26). In Canada, they breed from southwestern Manitoba to

southern Saskatchewan and Alberta (Hill and Gould 1997, Davis et al. 1999). In the United States, Chestnut-collared Longspurs are found in short-grass and mixed-grass prairies from Montana east to extreme western Minnesota and south to northeastern Colorado (Hill and Gould 1997, Sedgwick 2004). They winter from eastern Arizona east to south-central Kansas and central Oklahoma, and south to Zacatecas and San Luis Potosi in central Mexico (Hill and Gould 1997).

## Region 6

Colorado: Chestnut-collared Longspurs are found in grasslands of the northeast (Kingery 1998). The first breeding records of Chestnut-collared Longspurs were in 1936 and 1937 by Bailey and Neidrach (1938).

Kansas: Chestnut-collared Longspurs formerly bred in large numbers in western Kansas (Thompson and Ely 1992). They no longer breed in Kansas, but are uncommon in winter in the central and western portion of the state (Hill and Gould 1997, Thompson et al. 2011).

Montana: Chestnut-collared Longspurs are found primarily east of the Continental Divide (Hill and Gould 1997).

Nebraska: Chestnut-collared Longspurs nest in northwestern Nebraska. Most observations are in Kimball and Cherry counties (Ducey 1988).

North Dakota: Chestnut-collared Longspurs can be found throughout the state in suitable areas, especially the southwestern corner of the state (Hill and Gould 1997). They are common to locally abundant breeders (Faanes and Stewart 1982).

South Dakota: Chestnut-collared Longspurs breed across much of northern South Dakota, with the highest concentrations in the northwestern portion of the state (Hill and Gould 1997). During the second Breeding Bird Atlas, it was recorded in 41 of 66 counties and 40% of all atlas blocks. The density of this species generally declines along a northwest/southeast gradient, with highest numbers during the second Breeding Bird Atlas reported from northwestern South Dakota and very few birds reported from southeastern South Dakota (N. Drilling pers. comm.).

Utah: Chestnut-collared Longspurs are accidental in Utah (Utah Bird Records Committee 2013).

Wyoming: Chestnut-collared Longspurs are usually found in the eastern part of the state, especially in the southeast (Faulkner 2010). They are common breeders in Thunder Basin National Grassland in northeastern Wyoming (Sedgwick 2004). Observations elsewhere in the state are typically non-breeding vagrants (Faulkner 2010).

## **Biology**

### General

Chestnut-collared Longspurs breed selectively, using fields prone to a disturbance (Hill and Gould 1997) or with shorter grass (Dieni and Jones 2003, Jones and Dieni 2009). Historically, they bred in bison-grazed (*Bison bison*) fields or fire-disturbed areas (Hill and Gould 1997). Chestnut-collared Longspurs will utilize locally disturbed areas, including mowed and grazed fields (Hill and Gould 1997) although habitat type and structure is more important than the disturbance (Dieni and Jones 2003). Chestnut-collared Longspurs in Montana breed in short, relatively dense vegetation with forbs and clubmoss (Dieni and Jones 2003). Chestnut-collared Longspurs show negative response to edges (Sliwinski and Koper 2012). Declines in this species are presumably due to disappearing breeding habitat (Sedgwick 2004).

Chestnut-collared Longspurs perform two displays: aerial song display and distraction display (Hill and Gould 1997). The aerial song display consists of upward flight, circling, and singing while descending (Hill and Gould 1997). On descent, Chestnut-collared Longspurs flap their wings and spread their tail (Hill and Gould 1997). Individuals will display repeatedly before landing (Hill and Gould 1997). The distraction display consists of flying through the grass with wings spread, presumably to lead an intruder away from a nest (Hill and Gould 1997).

Diet consists of seeds, insects, and arachnids (Wiens and Rotenberry 1979, Hill and Gould 1997, Sedgwick 2004). Grasshoppers are a primary component of nestling diet (Wiens and Rotenberry 1979, Hill and Gould 1997, Sedgwick 2004). Chestnut-collared Longspurs capture prey by gleaning, foraging from the ground, and aerial predation (Sedgwick 2004).

### Breeding

Males usually arrive in small groups in the breeding range before females in mid-April (Hill and Gould 1997). Males perform aerial song displays and claim territories shortly before females arrive (Hill and Gould 1997). Pair formation begins after territory establishment (Hill and Gould 1997). Nests are built in late-April or early-May, and pairs copulate throughout the nest-building and egg laying process (Hill and Gould 1997). Some female may even lay eggs before the nest is built (Hill and Gould 1997). Chestnut-collared Longspurs may produce two broods in a breeding season (Hill and Gould 1997). Some individuals have initiated three broods (Hill and Gould 1997). If successive nest failures occur, pairs will attempt to reneest up to three times (Hill and Gould 1997). Eggs are variable in color and blotching, usually white or gray with brown markings (DuBois 1937, Hill and Gould 1997). Clutches consist of 3-5 eggs and eggs are laid successively (DuBois 1937, Hill and Gould 1997). Incubation usually begins after all eggs are laid and lasts 10-13 days (Hill and Gould 1997). Some paternal care via feeding and defense is required for nest success (Wyckoff 1983, Lynn and Wingfield 2003). Nestlings are altricial and remain in the nest for 9-14 days after hatching (Hill and Gould 1997). Immature birds form flocks before migration (Hill and Gould 1997). Nest parasitism incidence by Brown-headed Cowbirds (*Molothrus ater*) is low and depredation is the major cause of nest failure (Hill and Gould 1997, Davis et al 2002, Jones and Dieni 2009, Jones et al. 2010). Chestnut-collared Longspurs are not known to regularly eject cowbird eggs (Davis et al. 2002). Distraction displays may be more important than nest concealment for Chestnut-collared Longspurs to avoid nest depredation (Jones and Dieni 2009).

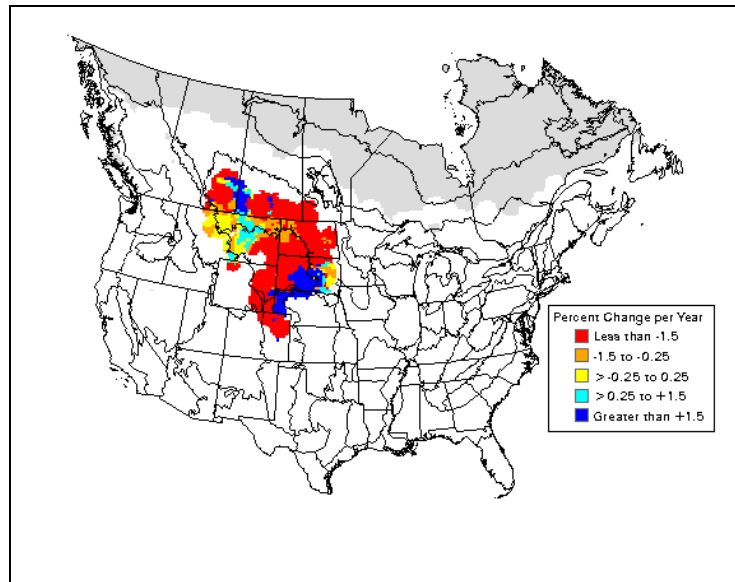
### Wintering

Wintering Chestnut-collared Longspurs utilize dry grasslands and deserts (Hill and Gould 1997). They winter and graze in large flocks of up to 166 individuals per ha (Hill and Gould 1997). Flocks may concentrate around water sources (Hill and Gould 1997).

### **Habitat**

Chestnut-collared Longspurs prefer native short- to mixed-grass prairie (Hill and Gould 1997, Davis et al. 1999, Davis et al. 2002, Jones et al. 2010). This species requires very little leaf litter (Hill and Gould 1997, Davis et al. 1999). Preferred grass species include rough fescue (*Festuca scabrella*), blue gamma grass (*Bouteloua gracilis*), needlegrass (*Stipa* spp.), wheat grass (*Agropyron* spp.) and other species (Hill and Gould 1997). Territories may also include cactus or shrub cover (Hill and Gould 1997). Lloyd and Martin (2005) found that nest success was lower in fields with exotic vegetation, as was nestling growth. In the winter, Chestnut-collared Longspurs prefer short grasses and forbs (Dieni and Jones 2003), including gamma





**Figure 27.** Map of percent change per year in the number of Chestnut-collared Longspurs detected during the BBS for the period 1966-2011 from Sauer et al. (2012). Observations have declined across most of their range.

grasses (*Bouteloua* spp.), big bluestem (*Andropogon saccharoides*), little bluestem (*Schizachyrium scoparium*), and needlegrass (*Stipa* spp.; Hill and Gould 1997). Shrubs and yucca (*Yucca* spp.) may also be present (Hill and Gould 1997).

### Population Trends and Estimates

Partners in Flight (2014) estimated that Chestnut-collared Longspur population consisted of 3,000,000 individuals. For the period 1966-2011, BBS data show a significant 4.3% annual decline (Table 16). Within Region 6, significant declines were observed in Montana (3.0% per year), North Dakota (4.4% per year), and South Dakota (4.2% per year; Fig. 27). Overall, this species is declining at a rate of 3.6% in Region

6. Igl and Johnson (1997) found that populations of Chestnut-collared Longspurs on randomly selected plots declined by 33% from 1967 to 1993. In addition to population declines, Jones et al. (2010) found a linear decline ( $r = -0.53$ ) in nests for Chestnut-collared Longspurs during 1997-2007.

However, CBC data do not show a trend since 1966 (linear regression, number per party-hour =  $-0.008 \times \text{year} + 15.135$ ,  $F_{1, 44} = 0.627$ ,  $r^2 = -0.008$ ,  $p = 0.432$ ). Likewise, no trend is apparent for Chestnut-collared Longspurs wintering in Region 6, although only two counts on average encounter this species.

### Threats

#### Insecticides and fungicides

Insecticides may affect the number of hatchlings in a nest, but does not affect other aspects of growth and reproduction (Hill and Gould 1997). Insecticides also have a negative effect on adults who consume treated grasshoppers and other insects (Sedgwick 2004). Similarly, fungicides applied to plants may affect longspurs that eat the treated seeds (Hill and Gould 1997).

#### Habitat loss and fire suppression

While Chestnut-collared Longspurs can tolerate naturally disturbed areas, they prefer native prairie (Hill and Gould 1997). Decline of native prairie has led to declines in Chestnut-collared Longspurs (Hill and Gould 1997, Sedgwick 2004). Chestnut-collared Longspurs will not breed in cultivated fields (Hill and Gould 1997). Fire suppression in suitable areas has also led to an altered vegetative structure that Chestnut-collared Longspurs will not use (Hill and Gould 1997, Sedgwick 2004).

#### Other threats

Blancher (2013) also suggests that Chestnut-collared Longspurs may be vulnerable to predation by cats. Human interaction is probably not a major disturbance. Nests are usually not abandoned or predated because of human interaction (O'Grady et al. 1996, Hill and Gould 1997).

### **Effects of Climate Change**

Because insects are largely climate sensitive, availability of food may affect Chestnut-collared Longspurs (Sedgwick 2004). This area needs more study. Climate change may also have a negative effect on native prairies (Tarnoczi 2010).

### **Effects of Energy Development**

Hamilton et al. (2011) found no relationship between natural gas well density and abundance of Chestnut-collared Longspurs in southern Alberta. Energy development, however, is likely detrimental to Chestnut-collared Longspur habitat (Sedgwick 2004). Increased development can lead to habitat loss and fragmentation, which is already an issue in this species (Sedgwick 2004). Specific effects in addition to habitat alteration have not been studied in Chestnut-collared Longspurs (Sedgwick 2004).

### **Management**

Maintaining prairie tracts for this species is necessary for protection (Hill and Gould 1997). Introduction of native grazing species like bison and prairie dogs (*Cynomys* spp.) could benefit Chestnut-collared Longspurs in grassy areas that are currently too tall for them to use (Sedgwick 2004). Controlling for invasive species and introducing prescribed burning are also beneficial management practices (Sedgwick 2004). Management of areas that increased claypan permeability also benefited Chestnut-collared Longspurs in North Dakota (Rich et al. 2005).

### **Conservation**

Preserving native prairie is critical for this species as Chestnut-collared Longspurs will not use cultivated areas (Hill and Gould 1997).

### **Completed and Ongoing Conservation Actions**

No conservation actions are currently in place for this species. However, management for other grassland bird species may benefit Chestnut-collared Longspurs (Sedgwick 2004).

**TABLE 15.** Chestnut-collared Longspur 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.

<b>IUCN</b>	Near Threatened
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	Vulnerable
<b>Birds of Conservation Concern</b>	BCR 11, BCR 16, BCR 17, BCR 18, BCR 19, BCR 20, BCR 34, BCR 35, BCR 36, USFWS Region 2, USFWS Region 3, USFWS Region 6
<b>PIF</b>	US – Canada Concern Species

**TABLE 16.** Chestnut-collared Longspur status summarized by Natural Heritage rankings, BBS trends for 1966-2011, BBS trends for 2000-2011, 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G5	-4.3% (-5.2, -3.4%)	-2.7% (-4.7, -0.7%)	-	-
<b>Region 6</b>	-	-3.8% (-4.8, -2.8%)	-3.6% (-5.8, -1.3%)	-	-
<b>Montana</b>	S2B	-3.0% (-4.6, -1.5%)	-2.4% (-5.2, 0.9%)	Species of Concern	Tier III
<b>North Dakota</b>	SNRB	-4.4% (-6.0, -2.9%)	-5.0% (-9.0, -0.8%)	-	Tier I
<b>South Dakota</b>	S4B	-4.2% (-6.1, -2.3%)	2.4% (-3.7, 10.0%)	-	Species of Greatest Conservation Need
<b>Wyoming</b>	S1	Insufficient data	Insufficient data	Species of Concern	Tier II
<b>Colorado</b>	S1B	Insufficient data	Insufficient data	-	Species of Greatest Conservation Need
<b>Utah</b>	-	-	-	-	-
<b>Nebraska</b>	S3	-	-	-	Tier I
<b>Kansas</b>	S3N	-	-	-	Tier I

## Brewer's Sparrow (*Spizella breweri*)



**Figure 28.** Brewer's Sparrows are fairly common across much of the western US. Photo by Katrina Hucks.

### Summary:

- Brewer's Sparrows are small, drab birds that inhabit arid sagebrush-steppe environments in western North America. They are brownish above and grayish below. The facial pattern is not very distinct, although a white eye-ring is present.
- This sparrow breeds from the Yukon and extreme eastern Alaska south to California and east to New Mexico, Nebraska and southwestern Saskatchewan. Brewer's Sparrows winter from California and southern Nevada east to western Texas and south to Central Mexico.
- There are an estimated 16,000,000 Brewer's Sparrows in North America. Within Region 6, Brewer's Sparrows are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in Colorado and Nebraska. They are listed as a Level II / Tier II species (i.e. a species in need of conservation) in Montana and Wyoming.
- BBS data for the period 1966-2011 does not show a significant range wide change. Region 6, however, has experienced a significant decline of 0.9% annually.
- Likewise, CBC data for the U.S. and Mexico for the period 1966-2012 do not show a trend.
- Local declines in this species are due primarily to habitat loss, fire suppression, and habitat alteration.

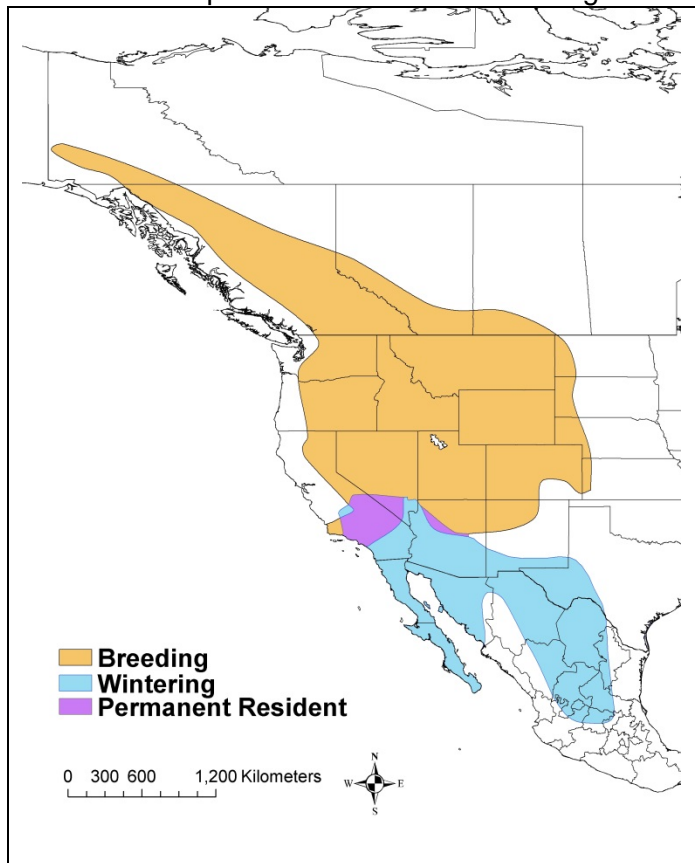
## Legal Status:

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 17 and 18.

## Description

Brewer's Sparrow (Fig. 28) is a nondescript sagebrush shrub-steppe species (Kaufman 1996, Rotenberry et al. 1999, Faulkner 2010, Thompson et al. 2011; Fig. 29). Its drab appearance allows it to blend with its sagebrush surroundings (Rotenberry et al. 1999). Brewer's Sparrow is brown above and gray below. Their brown crown is finely streaked with black and there is a pale eye-ring. The facial pattern is similar to a Clay-colored Sparrow but less distinct (Rotenberry et al. 1999). Songs include complex musical trills (Phillips et al. 1964, Kaufman 1996, Rotenberry et al. 1999, Rich 2002).

There are two subspecies, *Spizella breweri breweri*, and *S. breweri taverneri* (Rotenberry et al. 1999). Commonly called Timberline Sparrow or Taverner's Sparrow, the *S. b. taverneri* subspecies is found at northern high altitudes in the far northwest portion of the range, and may eventually be split as a different species (Kaufman 1996, Rotenberry et al. 1999, Faulkner 2010). This subspecies exhibits differences in morphology, song, and breeding habitat (Rotenberry et al. 1999). Timberline Sparrow is darker, more gray than brown, and has a contrasting gray breast to white belly (Rotenberry et al. 1999). Timberline Sparrow is also streakier and has a darker bill (Rotenberry et al. 1999).



**Figure 29.** Brewer's Sparrows breed from the Northwest Territories south to California, and east through Arizona to extreme western Kansas. They winter in the southwestern US and northern Mexico. This map was created using data provided by BirdLife International and NatureServe (2012).

## Distribution

### Rangewide

Brewer's Sparrows are found in western North America (Fig. 30). In Canada, they range from southwestern Alberta to eastern British Columbia, north to the Yukon Territory (Rotenberry et al. 1999). In the United States, breeding Brewer's Sparrows range from eastern North Dakota, South Dakota, Nebraska, and Kansas westward to eastern Washington, Oregon, and California. Breeding populations also occur in east-central Alaska (Rotenberry et al. 1999). Wintering Brewer's Sparrows occur in southeastern California, through southwestern Texas (Rotenberry et al. 1999). In Mexico, wintering Brewer's Sparrows are found in Baja California, Sonora, eastern Chihuahua, Coahuila,

Nuevo Leon, Jalisco, and Guanajuato (Rotenberry et al. 1999). The densest areas of breeding Brewer's Sparrows include southeastern Idaho, southwestern Wyoming, and northwestern Colorado (Johnsgard 2011). In sagebrush habitats of the West, Brewer's Sparrows can be the most abundant species in the spring and summer (Kaufman 1996, Rotenberry et al. 1999, Wells 2007).

#### Region 6

Colorado: Brewer's Sparrows are widespread in western and central Colorado in suitable habitat. They are also found in the Pawnee National Grassland in eastern Colorado (Rotenberry et al. 1999). Brewer's Sparrows breed in sagebrush-steppe, especially saltbush-greasewood communities, but also sub-timberline spruce (*Picea* spp.) in the Rocky Mountains (Johnsgard 2011).

Kansas: Brewer's Sparrows are very local summer residents in extreme southwestern Kansas. They are most frequently found in Morton and Finney Counties, although there are also multiple records from Ellis County (Thompson et al. 2011).

Montana: Brewer's Sparrows are widespread in suitable habitat (Bergeron et al. 1992).

Nebraska: Breeding Brewer's Sparrows are found in extreme northwestern Nebraska (Sharpe et al. 2001).

North Dakota: In North Dakota, Brewer's Sparrows may be found in the southwestern portion of the state, primarily Bowman and Slope Counties (Rotenberry et al. 1999). They can be locally common (Faanes and Stewart 1982).

South Dakota: In South Dakota, Brewer's Sparrows may be found in the extreme northwest and southwest corners of the state (Rotenberry et al. 1999). They can be relatively common in sage prairies within their limited distribution which is primarily restricted to Harding, Butte, and Fall River Counties (N. Drilling pers. comm.).

Utah: Brewer's Sparrows are common summer residents (Utah Bird Records Committee 2013). Subspecies *S. b. breweri* breeds in Utah. It can be found across Utah where habitat is suitable, including each corner of the state. The central portion of the state is less suitable. (Utah Conservation Data Center).

Wyoming: The highest density of Brewer's Sparrow is found in Wyoming. This state has large, continuous tracts of sagebrush that allow Brewer's Sparrows to thrive. Brewer's Sparrows are more common in western Wyoming than in eastern Wyoming where grasslands predominate. Low elevations are represented by subspecies *S. b. breweri*, but some higher elevations may include subspecies *S. b. taverneri* (Faulkner 2010).

## **Biology**

### General

Brewer's Sparrows feed on seeds and small insects (Kaufman 1996, Rotenberry et al. 1999). This species typically gleans insects from plant material but will also consume seeds from the ground (Rotenberry et al. 1999). Though most active in the morning and evening, Brewer's Sparrows will forage throughout the day during the breeding season (Rotenberry et al. 1999). Brewer's Sparrows are able to survive in arid conditions on limited water intake, but will drink and bathe if water is available (Dawson et al. 1979, Kaufman 1996, Rotenberry et al.



1999). In a study by Ohmart and Smith (1970), Brewer's Sparrows were able to maintain most of their body weight when different concentrations of sodium chloride in water were introduced.

Competition between Sage Thrashers (*Oreoscoptes montanus*), Sagebrush Sparrows (*Artemisiospiza nevadensis*), and Brewer's Sparrows may occur (Holmes and Johnson 2005a). These species use similar habitats and may interfere with access to nesting sites or perches for singing (Holmes and Johnson 2005a).

### Breeding

Male Brewer's Sparrows arrive on breeding sites in the spring, usually mid- to late-April (Kingery 1998, Rotenberry et al. 1999). Individuals sing both on the breeding grounds and during migration (Kingery 1998). Males show weak site fidelity (25%; Rotenberry et al. 1999). Brewer's Sparrows begin breeding at one year of age (Rotenberry et al. 1999). They produce one or two broods in a breeding season (Kaufman 1996, Rotenberry et al. 1999, Mahony et al. 2001). Concealed nests in sagebrush (Petersen and Best 1985) are lined with hair, grass, and sagebrush bark. Nest building begins after pairs have mated and are usually completed by May or early June (Kaufman 1996, Kingery 1998, Rotenberry et al. 1999). Fecundity and clutch size are affected by the amount of precipitation and other ecological factors (Kingery 1998, Mahony et al. 2006). Clutches usually consist of 3-4 brown speckled blue-green eggs (Kaufman 1996, Rotenberry et al. 1999). There is evidence of both males and females incubating the eggs (Rotenberry et al. 1999, Mahony et al. 2001). Incubation is 10-11 days and hatchlings are altricial (Rotenberry et al. 1999, Wells 2007). Growth of young Brewer's Sparrows is not complete upon fledging, and fledglings cannot fly (Petersen et al. 1986, Rotenberry et al. 1999).

Nest parasitism by Brown-headed Cowbirds does not occur very often (6 instances; Rich 1978, Kingery 1998, Rotenberry et al. 1999). However, nest predation is the most likely cause of failure, especially in fragmented habitats (Holmes and Johnson 2005a). In most cases, Brewer's Sparrows abandon a parasitized nest, so success of Brown-headed Cowbirds is low (Rich 1978, Biermann et al. 1987). Adults of a failed nest will often use a different habitat structure for re-nesting (Chalfoun and Martin 2010).

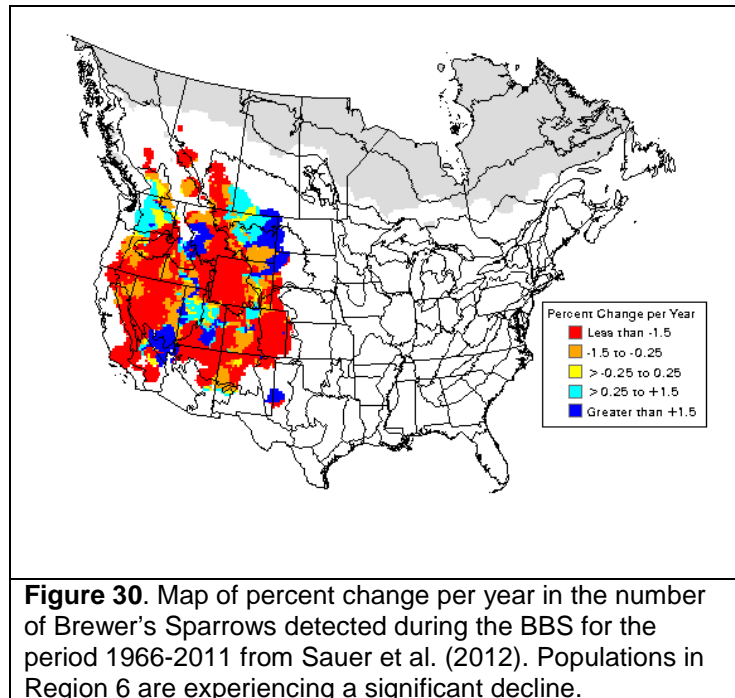
### Wintering

The winter range of Brewer's Sparrow overlaps with Black-chinned Sparrow (*Spizella atrogularis*) and Clay-colored Sparrow (*S. pallida*). Flocks may perch and sing together, as well as forage together (Kaufman 1996, Rotenberry et al. 1999). Brewer's Sparrows consume mostly seeds on the wintering grounds (Rotenberry et al. 1999).

### **Habitat**

Brewer's Sparrows will utilize different habitats but the most preferred is big sagebrush (*Artemisia tridentata*; Dawson et al. 1979, Kingery 1998). This observation was borne out by a patch-level habitat analysis of territories by Harrison and Green (2010) in British Columbia. Other sagebrush species used by Brewer's Sparrows include rabbitbrush (*Crysothamnus* spp.), saltbush (*Atriplex* spp.), greasewood (*Sarcobatus* spp.), and hopsage (*Grayia* spp.; Kingery 1998, Johnsgard 2011). *Spizella breweri taverneri* breeds near the alpine timberline in low canopy cover (Rotenberry et al. 1999). This subspecies uses spruce (*Picea* spp.) for breeding (Johnsgard 2011). Brewer's Sparrows may also use willow (*Salix* spp.), birch (*Betula* spp.), and fir (*Abies* spp.) for breeding in high elevation areas (Kingery 1998). During the winter, Brewer's Sparrows can be found in desert shrublands, utilizing saltbrush (*Atriplex* spp.) and creosote (*Larrea tridentata*; Dawson et al. 1979, Rotenberry et al. 1999).





## Population Trends and Estimates

Partners in Flight (2014) estimated that there were 13,000,000 Brewer's Sparrows in North America. Although this species may be declining in many areas (Fig. 30), the BBS data shows that the species as a whole is not exhibiting a significant decline. Within Region 6, however, a significant region-wide annual decline of -0.9% has been observed since 1966 (Table 18). The population in Colorado is declining faster than other states in Region 6, and shows an annual decline of 2.0% from 1966-2011.

CBC data, however, do not show a significant trend (linear regression,  $F_{1,44} = 0.05967$ ,  $r^2 = -0.02$ ,  $p = 0.808$ ).

## Threats

### Habitat loss and fragmentation

Clearing of sagebrush-steppe habitat has negatively impacted Brewer's Sparrows (Rotenberry et al. 1999, Holmes and Johnson 2005a, Wells 2007, Johnsgard 2011). Roughly 10% of sagebrush habitat was cleared through the 1970s to make use of agricultural practices (Rotenberry et al. 1999). Other disturbances to the area such as grazing and invasive species including cheatgrass (*Bromus tectorum*) continue to degrade sagebrush habitat (Rotenberry et al. 1999, Wells 2007). Agricultural practices may also introduce Brown-headed Cowbirds into nesting sites, reducing nest success of Brewer's Sparrows (Rich 1978). Energy development, including oil, natural gas, and mining also fragment usable habitat (Holmes and Johnson 2005a, Gilbert and Chalfoun 2011).

### Fire

Fire removes cover for Brewer's Sparrows, fragments the area, and can create tracts of habitat too small to be used (Holmes and Johnson 2005a, Wells 2007). Repeated fire can facilitate the invasion of cheatgrass, which Brewer's Sparrow does not use.

### Predation

Loggerhead Shrikes (*Lanius ludovicianus*), American Kestrels (*Falco sparverius*), Sharp-shinned Hawks (*Accipiter striatus*), Cooper's Hawks (*A. cooperi*) and some corvids are known to predate adult Brewer's Sparrows (Rotenberry et al. 1999, Holmes and Johnson 2005a). Blancher (2013) also suggests that Brewer's Sparrows may be vulnerable to predation by cats.

## Effects of Climate Change

The sensitivity score for the Brewer's Sparrow on the Climate Change Sensitivity Database is "medium", based on an equation that takes dispersal, disturbance, habitat, physiology, ecology, and non-climatic stressors into account to develop how sensitive the species is to climate change (Tomasevic 2010). However, the possible effects of climate change have not been directly studied in this species. In response to climatic conditions, arid habitat is

expected to shift north and east (Archer and Predick 2008), which could potentially have negative effects on Brewer's Sparrows.

### **Effects of Energy Development**

Energy development directly impacts sagebrush habitat and therefore affects Brewer's Sparrows (Holmes and Johnson 2005a, Wells 2007). This development can introduce invasive species and can greatly reduce the amount and quality of habitat available (Holmes and Johnson 2005a). Gilbert and Chalfoun (2011) found that increased well density had a negative impact on Brewer's Sparrow abundance in Wyoming. Predation risk from aerial predators also increases with power line activity (Holmes and Johnson 2005a).

### **Management**

Management efforts should avoid burning large expanses of sagebrush and protecting areas from invasion of introduced species and habitat fragmentation (Holmes and Johnson 2005a). Rich et al. (2005) suggest that Greater Sage-Grouse may act as an umbrella species for a suite of sagebrush birds. The breeding ranges of Greater Sage-Grouse and Brewer's Sparrow overlap by 43%, and so management activities that benefit Greater Sage-Grouse should also benefit Brewer's Sparrow (Rich et al. 2005).

### **Conservation**

Holmes and Johnson (2005a) suggest that conservation actions for this species should include protecting and restoring sagebrush habitat. More life history research should also be performed to better understand the management and conservation needs of this species.

### **Completed and Ongoing Conservation Actions**

Partners in Flight programs have been implemented to protect Brewer's Sparrows and sagebrush-steppe habitat (Wells 2007). In addition, Bureau of Land Management (BLM) has created management programs for Greater Sage-Grouse (*Centrocercus urophasianus*) that Brewer's Sparrow may also benefit from (Wells 2007).

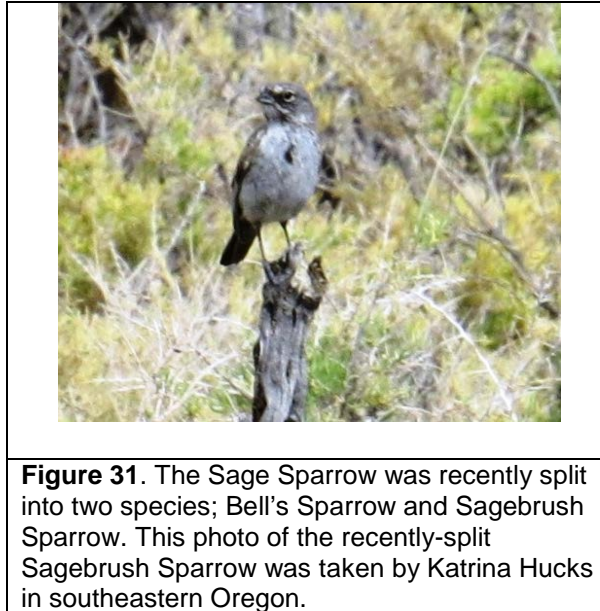
**TABLE 17.** Brewer's Sparrow status rangewide summarized by multiple listing agencies. IUCN is an abbreviation for "International Union for Conservation of Nature", ABC is an abbreviation for "American Bird Conservancy", and "PIF" is an abbreviation for "Partners in Flight". A hyphen (-) indicates 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.

<b>IUCN</b>	Least Concern
<b>Federal listing</b>	No
<b>ABC Conservation Assessment</b>	Potential Concern
<b>Birds of Conservation Concern</b>	BCR 9, BCR 10, BCR 16, BCR 17, USFWS Region 1, USFWS Region 8, National
<b>PIF</b>	Not a US – Canada Concern Species

**TABLE 18.** Brewer's Sparrow status summarized by Natural Heritage rankings, BBS trends for 1966-2011, BBS trends for 2000-2011, 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 (1966-2011)	BBS Trend (2000-2011)	State Listing	SGCN
<b>Rangewide</b>	G5	-0.4% (-1.2, 0.8%)	1.1 (-1.3, 4.2%)	-	-
<b>Region 6</b>	-	-0.9% (-1.8, -0.1%)	0.0% (-1.8, 1.6%)	-	-
<b>Montana</b>	S3B	-1.2% (-3.0, 0.6%)	-1.6% (-5.8, 2.2%)	Species of Concern	Tier II
<b>North Dakota</b>	S3	-	-	-	Level III
<b>South Dakota</b>	S2B	-	-	Species of Concern	-
<b>Wyoming</b>	S5	-0.5% (-1.8, 0.6%)	-1.1% (-4.5, 1.4%)	Species of Concern	Tier II
<b>Colorado</b>	S4B	-2.0% (-3.7, -0.1%)	-1.8% (-4.4, 1.3%)	-	Species of Greatest Conservation Need
<b>Utah</b>	S4B	0.0% (-1.6, 1.6%)	3.2% (-0.1, 7.2%)	-	Tier III
<b>Nebraska</b>	S4	Insufficient data	Insufficient data	-	Tier I
<b>Kansas</b>	S1B	-	-	-	-

## Sagebrush Sparrow (*Artemisiospiza nevadensis*)



### Summary:

- Sagebrush Sparrows are medium-sized sagebrush-dwelling birds that are found in the western United States and northern Mexico,
- In 2013, Sage Sparrow was split into two species; Sagebrush Sparrow (*Artemisiospiza nevadensis*) and Bell's Sparrow (*Artemisiospiza belli*). Bell's Sparrow is restricted to California and Baja California, while Sagebrush Sparrow is widespread in the Great Basin. There is only a small zone of overlap in breeding ranges in eastern California.
- Sagebrush Sparrow has a grayish head, a buffy back and a dark spot on the breast. The facial pattern includes a distinct white eyering, dark malar stripe, and white submustachial stripe. Bell's Sparrows tends to be darker above than Sagebrush Sparrows.
- Sagebrush Sparrows breed from eastern Washington south to eastern California and east to eastern Wyoming and northern New Mexico. Sagebrush Sparrows winter from southeastern California east to west Texas and south into northern Mexico.
- There are an estimated 3,900,000 "Sage" Sparrows. Within Region 6, Sagebrush Sparrows are listed as a Level I / Tier I species (i.e., a species in greatest conservation need) in Colorado. They are listed as a Level II / Tier II species (i.e. a species in need of conservation) in Wyoming.
- For the period 1966-2011, no trend is apparent in BBS data. Within Region 6, detections of presumed Sagebrush Sparrows are increasing at a rate of 2.2% per year.
- During the same period, no trend is apparent based on CBC data.

### Legal Status:

The Migratory Bird Treaty Act (MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA protects any migratory bird under 50 CFR 10.12. The Service maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Status rangewide is summarized by Tables 19 and 20.

### Description

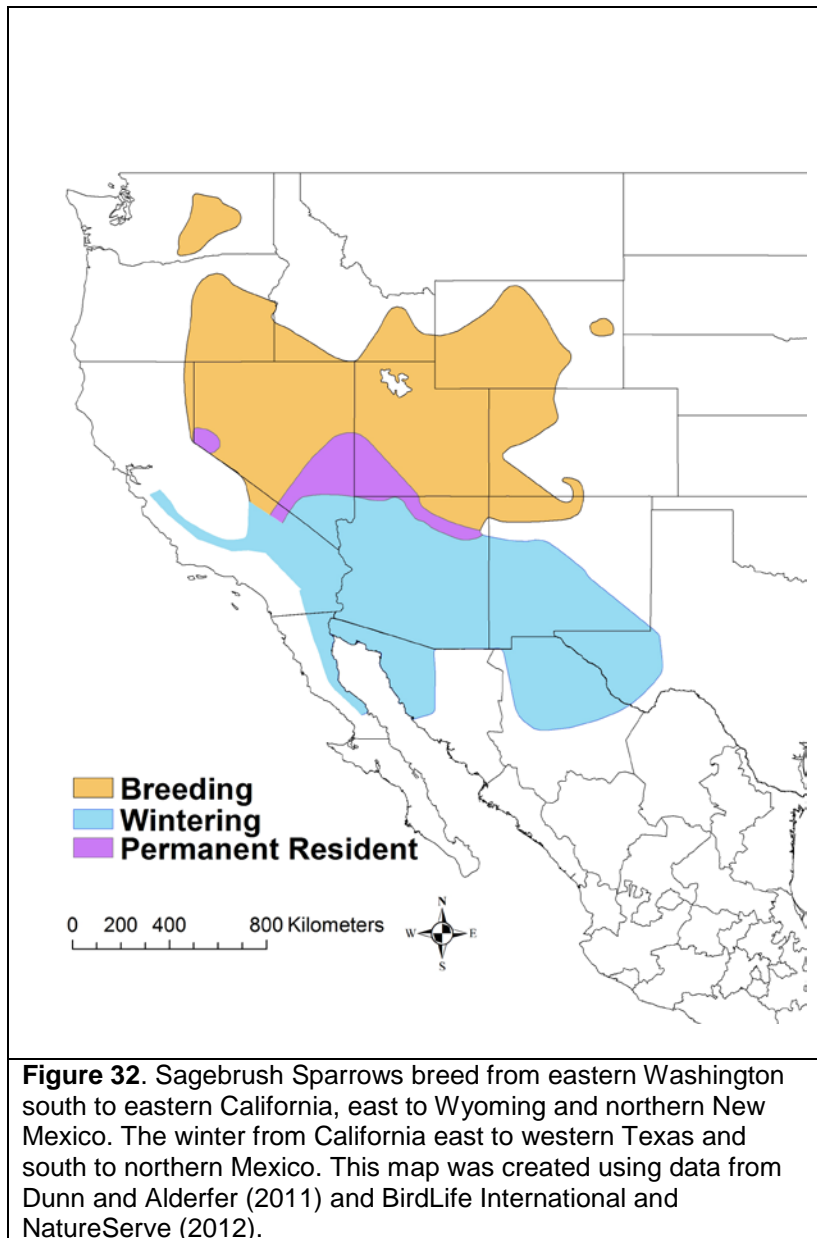
In July 2013, the American Ornithologist's Union split Sage Sparrow into two distinct species; Sagebrush Sparrow (*Artemisiospiza nevadensis*) and Bell's Sparrow (*A. belli*; Chesser et al. 2013, Retter 2013). *Artemisiospiza belli belli*, *A. b. clementae*, *A. b. cinerea*, and *A. b. canescens* are now considered to be Bell's Sparrow while *Artemisiospiza belli nevadensis*, has been split into its own species, Sagebrush Sparrow.

Sagebrush Sparrows are medium-sized sparrows with grayish-brown upper plumage, a gray head with a white spot over the lores and a white eye-ring (Martin and Carlson 1998; Fig. 31). A white line runs from the base of the bill across the cheeks (Martin and Carlson 1998). A dark spot is present in the central breast region and streaking occurs along the upper sides (Martin and Carlson 1998). The tail is dark in contrast with the white or gray belly (Martin and Carlson 1998). Sagebrush Sparrows are sexually monomorphic (Martin and Carlson 1998).

### Distribution

#### Rangewide

Sagebrush Sparrows are found in the western United States and northern Mexico (Fig. 32). Sagebrush Sparrow breeds from Wyoming west to eastern Oregon with a disjunct population in eastern Washington (Martin and Carlson 1998). This range extends south to eastern California through northern New Mexico (Martin and Carlson 1998). Resident



populations can be found in western and southern California (Kaufman 1996, Martin and Carlson 1998). The winter range of the Sagebrush Sparrow extends through southeastern California and Arizona (Phillips et al. 1964) through to west Texas and northern Mexico (Martin and Carlson 1998, Chessser et al. 2013). Some individuals winter locally throughout southern Nevada, southeastern Utah, and northwestern Arizona. The winter range of the Sagebrush Sparrow in Mexico is restricted to Sonora and Chihuahua (Martin and Carlson 1998).

#### Region 6

Colorado: Sagebrush Sparrows are found in western Colorado as well as the Luis Valley in south-central Colorado. Populations are largest in the northwest corner. (Kingery 1998, Holmes and Johnson 2005b).

Kansas: Sagebrush Sparrows are vagrants to southwestern Kansas (Thompson et al. 2011).

Montana: Sagebrush Sparrows are rare in south-central and southwestern Montana (Bergeron et al. 1992).

Nebraska: Sagebrush Sparrows are accidental in Nebraska (Sharpe et al. 2001).

North Dakota: Sagebrush Sparrows do not occur in North Dakota.

South Dakota: Sagebrush Sparrows are accidental in South Dakota (Rotenberry et al. 1999).

Utah: In Utah, Sagebrush Sparrows are uncommon throughout the state (Utah Conservation Data Center 2012, Utah Bird Records Committee 2013). Some individuals may winter in the southwestern corner of the state (Martin and Carlson 1998).

Wyoming: In Wyoming, Sagebrush Sparrows occur throughout southwestern and central portions of the state. The greatest density of Sagebrush Sparrows occurs in the southwest corner (Faulkner 2010).

### **Biology**

#### General

Sagebrush Sparrows consume arthropods including Orthoptera, Hemiptera, Diptera, Lepidoptera, and Coleoptera, seeds and small fruits during the breeding season (Knowlton and Nye 1946, Petersen and Best 1986, Kaufman 1996, Martin and Carlson 1998). Petersen and Best (1986) found that Lepidopterans were important components of nestling diets. Individuals forage primarily at ground level (Martin and Carlson 1998). During winter, Sagebrush Sparrows feed mostly on seeds but will also feed on insects if available (Martin and Carlson 1998). Most water is obtained from their diet (Martin and Carlson 1998), but they do need occasional supplemental water in order to avoid dehydration (Moldenhauer and Wiens 1970).

Sagebrush Sparrows may form pairs before arrival on the breeding grounds (Martin and Carlson 1998). Because Sagebrush Sparrows are sexually monomorphic, direct observation of sexual roles is lacking (Martin and Carlson 1998). Males exhibit site fidelity and defend the territory by singing (Rich 1980a, Kaufman 1996, Martin and Carlson 1998) or by walking in a parallel line (Rich 1983). Migrating individuals arrive on the breeding grounds in March (Martin and Carlson 1998). Songs vary between populations (Rich 1981).

Competition between Sage Thrashers (*Oreoscoptes montanus*), Brewer's Sparrows (*Spizella breweri*) and Sagebrush Sparrows may occur (Rich 1980b, Wiens et al. 1990, Holmes and Johnson 2005b). These species use similar habitats and may interfere with access to nesting sites or perches for singing (Rich 1980b, Holmes and Johnson 2005b). Usually, each

species nest in different vegetative cover, height, or profile (Rich 1980b, Reynolds 1981, Wiens et al. 1990).

### Breeding

Sagebrush Sparrows initiate clutches in early April. Clutch initiation can last until July, with possible second and third broods attempted (Martin and Carlson 1998). Nests are built by the female and consist of an open cup made of twigs and grass lined with feathers, fur, and grasses. The female lays eggs 1 to 5 eggs successively and incubates when the last egg is laid. Incubation ranges from 10-16 days, and nestlings are altricial, fledging in 9 to 10 days (Kaufman 1996, Martin and Carlson 1998). Growth, development, and number of fledglings depend on environmental conditions (Petersen et al. 1986); drier periods produce larger nestlings, while hotter temperatures produce fewer fledglings (Martin and Carlson 1998). Brood parasitism by Brown-headed Cowbirds (*Molothrus ater*) has been recorded in this species, mostly in human-settled areas (Martin and Carlson 1998). The presence of Brown-headed Cowbird eggs usually results in nest failure (Rich 1978).

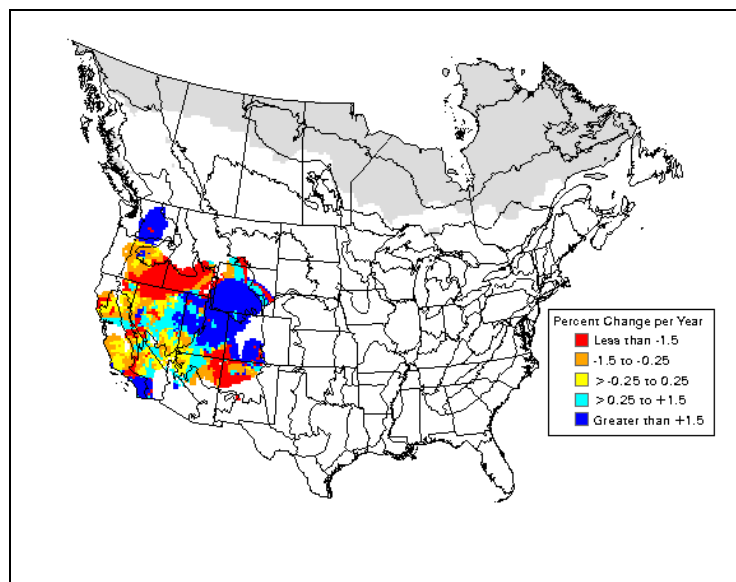
### Wintering

Migratory populations move to desert habitats (Kaufman 1996). The passages of cold fronts are assumed to be migratory triggers (Fesenmyer and Knick 2011). Sagebrush Sparrows do not exhibit territoriality on the winter grounds (Martin and Carlson 1998). Resident populations travel in pairs or small flocks (Kaufman 1996, Martin and Carlson 1998).

### **Habitat**

Sagebrush Sparrows are often associated with big sagebrush (*Artemisia tridentata*; Petersen and Best 1985, Wiens and Rotenberry 1985, Martin and Carlson 1998, Holmes and Johnson 2005b). They prefer areas with little to no litter cover (Petersen and Best 1985, Wiens and Rotenberry 1985, Martin and Carlson 1998, Faulkner 2010). Sagebrush Sparrows utilize a suite of different vegetative structures including dry chaparral components such as chamise (*Adenostoma fasciculatum*), saltbush (*Atriplex* spp.; Chesser et al. 2013), bitterbrush (*Purshia tridentata*), shadscale (*Acamptopappus schockleyi*), rabbitbrush (*Chrysothamnus* spp.), and greasewood (*Sarcobatus vermiculatus*; Martin and Carlson 1998). Sagebrush Sparrows, however, are not known to use three-tip sagebrush (*A. tripartita*; Rich pers. comm.). During the winter, Sagebrush Sparrows will use desert scrub communities, including big sagebrush, cactus, yucca (*Yucca* spp.), as well as honey mesquite (*Prosopis glandulosa*) communities with inkweed (*Suaeda torreyana*; Meents et al. 1982, Martin and Carlson 1998).





**Figure 33.** Map of percent change per year in the number of “Sage” Sparrows detected during the BBS for the period 1966-2011 from Sauer et al. (2012). BBS data does not yet differentiate among the two species and so this map shows changes in Bell’s Sparrows as well as Sagebrush Sparrows. Populations are generally stable across their range, although populations in Idaho and Oregon are declining, while populations in Wyoming are increasing.

## Population Trends and Estimates

Partners in Flight (2014) estimated that there were 4,000,000 “Sage” Sparrows in North America. Detecting this species is difficult, because mated males do not sing consistently throughout the breeding season and seasonal changes may also affect the detectability (Best and Petersen 1982, Best and Petersen 1985).

BBS data from 1966-2011 do not show a significant annual trend. Within Region 6, detections of Sage Sparrows along BBS routes are increasing at a rate of 2.2% per year (Table 20; Fig. 33). CBC data likewise do not show a change in detection rates (linear regression,  $F_{1,44} = 3.268$ ,  $r^2 = 0.048$ ,  $p = 0.077$ ).

## Threats

### Predation

Nest failure is often caused by predation from Townsend’s ground squirrels (*Spermophilus townsendi*; Martin and Carlson 1998). There is evidence of predaceous birds including Common Raven (*Corvus corax*), Loggerhead Shrike (*Lanius ludovicianus*), Merlin (*Falco columbarius*), and Great Horned Owl (*Bubo virginianus*) consuming nestlings and adults (Martin and Carlson 1998). Greater Roadrunner (*Geococcyx californianus*) may also predate nestlings (Martin and Carlson 1998).

### Habitat loss and fire

Introduction of exotic grazers including cattle, pigs, and goats has led to reduction in usable habitat (Martin and Carlson 1998, Holmes and Johnson 2005b, Fesenmyer and Knick 2011). Agricultural practices may also introduce Brown-headed Cowbirds into nesting sites, reducing nest success of Sagebrush Sparrows (Rich 1978). Habitat loss due to clearing of big sagebrush destroys usable habitat for Sagebrush Sparrows and may be a main reason for observed declines (Martin and Carlson 1998, Holmes and Johnson 2005b, Fesenmyer and Knick 2011). Fire suppression can allow vegetation to grow too tall to be used by Sagebrush Sparrows (Martin and Carlson 1998, Fesenmyer and Knick 2011). Increasing fire frequency in the Great Basin, however, leads to invasion of cheatgrass (*Bromus tectorum*) which Sagebrush Sparrows will not use (Martin and Carlson 1998) and removes shrub cover (Winter and Best 1985, Holmes and Johnson 2005b).

## Effects of Climate Change

The sensitivity score for the “Sage” Sparrow on the Climate Change Sensitivity Database is “high”, based on an equation that takes dispersal, disturbance, habitat, physiology, ecology, and non-climatic stressors into account to develop how sensitive the species is to climate change (Tomasevic 2010). However, the effects of climate change have not been directly studied in this species. A changing climate may mean southwestern North American climate may become more arid (Archer and Predick 2008). In response to climatic conditions,

arid habitat is expected to shift north and east (Archer and Predick 2008), which could potentially have positive and negative effects on Sagebrush Sparrows.

### **Effects of Energy Development**

Energy development disrupts sagebrush habitats (Holmes and Johnson 2005b). Roads, pipelines, and human interaction can fragment suitable habitat and allow invasive species to spread (Holmes and Johnson 2005b). Predation risk may also be higher in these areas (Holmes and Johnson 2005b).

### **Management**

Preserving tracts of sagebrush shrubland habitat is critical for the survival of Sagebrush Sparrows. Practices should include protection from invasive species and exotic grazers. The breeding range of Greater Sage-Grouse overlaps with “Sage” Sparrow by 68% (Rich et al. 2005). This suggests that Greater Sage-Grouse may be an umbrella species for sagebrush species such as Sagebrush Sparrow (Rich et al. 2005).

### **Conservation**

Restoration and protection of sagebrush habitats practices should be implemented. Conservation strategies may differ between subspecies. More research should be done on individual subspecies requirements.

### **Completed and Ongoing Conservation Actions**

Sagebrush Sparrow is listed as a priority species under the Colorado Land Bird Conservation Plan and the Wyoming Bird Conservation Plan (Holmes and Johnson 2005b).

**TABLE 19.** Sage 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.

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

**TABLE 20.** Sage 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. 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
<b>Rangewide</b>	G5	-0.1% (-1.4, 1.5%)	0.3% (-2.3, 3.0%)	-	-
<b>Region 6</b>	-	0.6% (-2.3, 2.5%)	1.2% (-2.1, 3.7%)	-	-
<b>Montana</b>	S3B	-	-	Species of Concern	Tier III
<b>North Dakota</b>	-	-	-	-	-
<b>South Dakota</b>	-	-	-	-	-
<b>Wyoming</b>	S3	2.2% (0.3, 4.1%)	1.9% (-1.9, 4.9%)	Species of Concern	Tier II
<b>Colorado</b>	S3B	Insufficient data	Insufficient data	-	Species of Greatest Conservation Concern
<b>Utah</b>	S4B	-0.5% (-2.8, 1.6%)	-0.8% (-4.5, 3.2%)	-	Tier III
<b>Nebraska</b>	-	-	-	-	-
<b>Kansas</b>	SNA	-	-	-	-

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## Literature Cited

- Abele, S.C., V.A. Saab, and E.O. Garton. 2004. Lewis's Woodpecker (*Melanerpes lewis*): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region: Fort Collins, CO.
- Allen, T., S. L. Finkbeiner, D. H. Johnson. 2004. Comparison of detection rates of breeding marsh birds in passive and playback surveys at Lacreek National Wildlife Refuge, South Dakota. *Waterbirds* 27:277-281.
- Altman, B. and R. Sallabanks. 2012. Olive-sided Flycatcher (*Contopus cooperi*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved 10 October 2013 from: <http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/502>.
- Andres, B.A., Smith, P.A., Morrison, R.I.G., Gratto-Trevor, C.L., Brown, S.C. & Friis, C.A. 2012. Population estimates of North American shorebirds, 2012. *Wader Study Group Bulletin* 119: 178–194.
- Andrews, R. and R. Righter. 1992. Colorado Birds. Denver Museum of Natural History, Denver, CO.
- Archer, S.R. and K.I. Predick. 2008. Climate change and ecosystems of the southwestern United States. *Rangelands* 30:23-28.
- Ashley E. P., and J. T. Robinson. 1996. Road mortality of amphibians, reptiles and other wildlife on the Long Point Causeway, Lake Erie, Ontario. *Canadian Field Naturalist* 110:403–412.
- Avila-Flores, R., G. Ceballos, A. de Villa-Meza, R., List, E. Marcé, J. Pacheco, G.A. Sánchez-Azofeifa, and S. Boutin. 2012. Factors associated with long-term changes in distribution of black-tailed prairie dogs in northwestern Mexico. *Biological Conservation* 145: 54-61.
- Bailey, A.M. and R.J. Niedrach. 1938. The Chestnut-collared Longspur in Colorado. *Wilson Bulletin* 50:243-246.
- Bakker, K. K., D. E. Naugle, and K. F. Higgins. 2002. Incorporating landscape attributes into models for migratory grassland bird conservation. *Conservation Biology* 16:1638-1646.
- Bakker, K. K. and K. F. Higgins. 2009. Planted grasslands and native sod prairie: equivalent habitat for grassland birds? *Western North American Naturalist* 69: 235-242.
- Baldwin, H. Q., J. B. Grace, W. C. Barrow Jr., and F. C. Rohwer. 2007. Habitat relationships of birds overwintering in a managed coastal prairie. *Wilson Journal of Ornithology* 119:189-197.
- Bechard, M. J. Houston and C. S. Houston. 1984. North Dakota oologists. *Blue Jay* 42:176-183.
- Bechard, M. J., R. L. Knight, D. G. Smith, and R. E. Fitzner. 1990. Nest sites and habitats of sympatric hawks (*Buteo* spp.) in Washington. *Journal of Field Ornithology* 61:159-170.
- Bechard, M. J. and J. K. Schmutz. 1995. Ferruginous Hawk (*Buteo regalis*), 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/172> doi:10.2173/bna.172

- Bechard, M. J., R. L. Knight, D. G. Smith, and R. E. Fitzner. 1990. Nest sites and habitats of sympatric hawks (*Buteo* spp.) in Washington. *Journal of Field Ornithology* 61:159-170.
- Bedell, P. A. 1987. Early fall migration of Sedge Wrens. *Nebraska Bird Review* 55:86-88.
- Bedell, P. A. 1996. Evidence of dual breeding ranges for the Sedge Wren in the central Great Plains. *Wilson Bulletin* 108:115-122.
- Bent, A. C. 1926. Life histories of North American marsh birds. U.S. National Museum Bulletin 135.
- Bent, A. C. 1963. Life histories of North American marsh birds. Dover Publications, New York, NY.
- Bergeron, D., C. Jones, D.L. Genter, and D. Sullivan. 1992. P. D. Skaar's Montana bird distribution. Fourth edition. Special Publication number 2. Montana Natural Heritage Program, Helena, MT.
- Best, L.B. and K.L. Petersen. 1982. Effects of stage of breeding cycle on sage sparrow detectability. *Auk* 99:788-791.
- Best, L.B. and K.L. Petersen. 1985. Seasonal changes in detectability of Sage and Brewer's Sparrows. *Condor* 87:556-558.
- Best, L. B., H. Campa III, K. E. Kemp, R. J. Robel, and M. R. Ryan. 1997. Bird abundance and nesting in CRP fields and cropland in the Midwest: a regional approach. *Wildlife Society Bulletin* 25:864-877.
- Biermann, G.C., W.B. McGillivray, and K.E. Nordin. 1987. The effect of cowbird parasitism on Brewer's Sparrow productivity in Alberta. *Journal of Field Ornithology* 58:350-354.
- BirdLife International. 2014. Species factsheet: *Botaurus lentiginosus*. Retrieved 19 January 2014 from <http://www.birdlife.org>.
- BirdLife International and NatureServe. 2012. Bird species distribution maps of the world. BirdLife International, Cambridge, UK and NatureServe, Arlington, USA.
- Bishop, C. A., and J. M. Brogan. 2013. Estimates of avian mortality attributed to vehicle collisions in Canada. *Avian Conservation and Ecology* 8(2): 2. <http://dx.doi.org/10.5751/ACE-00604-080202>.
- Blancher, P. 2013. Estimated number of birds killed by house cats (*Felis catus*) in Canada. *Avian Conservation and Ecology* 8(2): 3. <http://dx.doi.org/10.5751/ACE-00557-080203>.
- Blankespoor, G. W. 1980. Prairie restoration: effects on nongame birds. *Journal of Wildlife Management* 44:667-672.
- Bowles, M. L., K. Kerr, R. H. Thom, and D. E. Birkenholz. 1981. Threatened, endangered, and extirpated birds of Illinois prairies. *Ohio Biological Survey Notes* No. 15.
- Boyle, W. J. 2011. The birds of New Jersey: status and distribution. Princeton University Press, Princeton, N.J.
- Brewster, W. 1898. Lewis's Woodpecker storing acorns. *Auk* 2: 188.

- Brininger, W. L., Jr. 1996. The ecology of the American Bittern in northwest Minnesota. M.S. thesis. St. Cloud State University, St. Cloud, MN.
- British Columbia Conservation Data Centre. 2013. Species summary: *Melanerpes lewis*. B.C. Ministry of Environment. Retrieved 28 September 2013 from: <http://a100.gov.bc.ca/pub/eswp/speciesSummary.do?id=20006>.
- Brogie, M. A. 1987. Black Rail in Knox County, Nebraska. Nebraska Bird Review 55: 40-41.
- Brown, M. and J. T. Dinsmore. 1986. Implications of marsh size and isolation for marsh bird management. Journal of Wildlife Management 50:392-397.
- Browne, M.M., and W. Post. 1972. Black Rails Hit a Television Tower at Raleigh, North Carolina. Wilson Bulletin 84:491-492.
- Burleigh, T.D. 1935. The present status of the olive-sided flycatcher as a breeding bird in western North Carolina and eastern Tennessee. Wilson Bulletin 47:165.
- Burns, J. T. 1977. Social organization of Short-billed Marsh Wrens. M.S. thesis, University of Minnesota, Minneapolis, Minnesota.
- Burns, J. T. 1982. Nests, territories, and reproduction of Sedge Wrens (*Cistothorus platensis*). Wilson Bulletin 94:338-349.
- Busby, W.H. and J.L. Zimmerman. 2001. Kansas breeding bird atlas. University of Kansas, Lawrence, KS.
- Butler, C. 2003. The disproportionate effect of global warming on the arrival dates of short-distance migratory birds in North America. Ibis 145: 484-495.
- Chalfoun, A.D. and T.E. Martin. 2010. Facultative nest patch shifts in response to nest predation risk in the Brewer's sparrow: a "win-stay, lose-switch" strategy? Oecologia 163:885-892.
- Chesser, R.T., R.C. Banks, F.K. Barker, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovette, P.C. Rasmussen, J.V. Remsen, Jr., J.D. Rising, D.F. Stotz, and K. Winker. 2013. Fifty-Fourth Supplement to the American Ornithologists' Union Check-list of North American Birds. Auk 130: 558-572.
- Clausen, M. K. 1989. Recent Sedge Wren observations in Nebraska. Nebraska Bird Review 57:92-93.
- Collins, C. P. and T. D. Reynolds. 2005. Ferruginous Hawk (*Buteo regalis*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region, accessed on 13 Oct 2013: <http://www.fs.fed.us/r2/projects/scp/assessments>
- Colorado Division of Wildlife. 2003. Conservation Plan for grassland species in Colorado. Colorado Grassland Species Working Group, Commerce City, CO
- Colorado Field Ornithologists. 2006. Colorado county birding. <http://coloradocountybirding.com/>. Accessed 2 November 2013.



- Colwell, M. A. and L. W. Oring. 1988. Breeding biology of Wilson's Phalarope in southcentral Saskatchewan. *Wilson Bulletin* 100:567-582.
- Colwell, M. A. 1992. Wilson's Phalarope nest success is not influenced by vegetation concealment. *Condor* 94:767-772.
- Colwell, M. A. and J. R. Jehl, Jr. 1994. Wilson's Phalarope (*Phalaropus tricolor*). 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/083> doi:10.2173/bna.83
- Constantz, G.D. 1974. Robbing of breeding Lewis's Woodpecker food stores. *Auk* 91: 171.
- Conway, C. J., C. P. Nadeau, and L. Piest. 2006. Fire effects on Yuma Clapper Rails and California Black Rails on the Lower Colorado River. Arizona Cooperative Fish and Wildlife Research Unit, Wildlife Research Report Number 2006-2007: Tucson, AZ.
- Cooke, W. W. 1914. Distribution and migration of North American rails and their allies. *Bulletin of the U.S. Department of Agriculture* No. 128.
- Cosens, S.E. and J. B. Falls. 1984. A comparison of sound propagation and song frequency in temperate marsh and grassland habitats. *Behavioral Ecology and Sociobiology*. 15:161-170.
- Cottam, C. and F. M. Uhler. 1945. Birds in relation to fishes. U.S. Fish Wildlife Service Leaflet 272.
- Crawford, R. D. 1977. Polygynous breeding of Short-billed Marsh Wrens. *Auk* 94:359-362.
- Cunningham, M. A. and D. H. Johnson. 2006. Proximate and landscape factors influence grassland bird distributions. USGS Northern Prairie Wildlife Research Center.
- Dahl, T. E. 1990. Wetlands losses in the United States 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.
- Dahl, T. E. and G. J. Allord. 1996. History of wetlands in the conterminous United States. National water summary on wetland resources. United States Geological Survey Water Supply Paper 2425:19-26.
- 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.
- Davis, S.K., D.C. Duncan, and M. Skeel. 1999. Distribution and habitat associations of three endemic grassland songbirds in southern Saskatchewan. *Wilson Bulletin* 111:389-396.
- Davis, S.K., D. R. Klippenstine, and R.M. Brigham. 2002. Does egg rejection account for the low incidence of cowbird parasitism in Chestnut-collared Longspurs (*Calcarius ornatus*)? *Auk* 119:556-560.
- Dawson, W.R., C. Carey, C.S. Adkisson, and R.D. Ohmart. 1979. Responses of Brewer's and Chipping Sparrows to water restriction. *Physiological Zoology* 52:529-541.

- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, B. D. Parkin, and B. R. Euliss. 1998. Effects of management practices on grassland birds: Sedge Wren. USGS Northern Prairie Wildlife Research Center: Jamestown, ND.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2004. Effects of management practices on grassland birds: American Bittern. USGS Northern Prairie Wildlife Research Center
- Delehanty, D. J., R. C. Fleischer, M. A. Colwell, and L. W. Oring. 1998. Sex-role reversal and the absence of extra-pair fertilization in Wilson's Phalaropes. *Animal Behavior* 55:995-1002.
- Delisle, J. M. and J. A. Savidge. 1997. Avian use and vegetation characteristics of Conservation Reserve Program fields. *Journal of Wildlife Management* 61:318-325.
- Dieni, J. S., and S. L. Jones. 2003. Grassland songbird nest site selection patterns in north central Montana. *Wilson Bulletin* 115:32-40.
- Donlan, C. J., K. Campbell, W. Cabrera, C. Lavoie, V. Carrion, and F. Cruz. 2007. Recovery of the Galápagos rail (*Laterallus spilonotus*) following the removal of invasive mammals. *Biological Conservation* 138:520-524.
- DuBois, A.D. 1937. Notes on coloration and habits of the Chestnut-collared Longspur. *Condor* 39:104-107.
- Ducey, J. E. 1988. Nebraska birds: breeding status and distribution. Cornell University: Ithaca, NY.
- Duebbert, H. F. and J. T. Lokemoen. 1977. Upland nesting of American Bitterns, Marsh Hawks, and Short-eared Owls. US Fish & Wildlife Publications. Paper 248.
- Dunn, J. L. and J. Alderfer. 2011. National Geographic field guide to birds of North America: Sixth edition. National Geographic Society: Washington, D.C.
- Eaton, E. H. 1910. Birds of New York. SUNY: Albany, NY.
- Eddleman, W. R. 1974. The effects of burning and grazing on bird populations in native prairie in the Kansas Flint Hills. Unpublished report, National Science Foundation-Undergraduate Research Program. Kansas State University, Manhattan, Kansas.
- Eddleman, W. R., F. L. Knopf, B. Meanley, F. A. Reid, and R. Zembal. 1988. Conservation of North American Rallids. *Wilson Bulletin of Ornithology* 100:458-475.
- Eddleman, W. R., R. E. Flores, and M. L. Legare. 1994. Black Rail (*Laterallus jamaicensis*). In *The Birds of North America*, No. 123. Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, D.C.
- Ensign, J. T. 1983. Nest site selection, habitat utilization, and breeding biology of the Ferruginous Hawk in central North Dakota. Master's thesis, North Dakota State University, Fargo, ND.
- Errington, P. L. 1935. Food habits of mid-west foxes. *Journal of Mammalogy* 16:192-200.

- Evans, D.L. 1980. Impacts of surface mining on ferruginous hawks: recommendations for monitoring and mitigation. U.S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center, Jamestown, ND.
- Evens, J. and G. W. Page. 1986. Predation on Black Rails during high tides in salt marshes. *Condor* 88:107-109.
- Faanes, C. A., and R. E. Stewart. 1982. Revised checklist of North Dakota birds. *Prairie Naturalist* 14: 81-92.
- Faulkner, D. W. 2010. *Birds of Wyoming*. Roberts & Company, Greenwood Village, CO, US. 404 pages.
- Fesenmyer, K.A. and S.T. Knick. 2011. Seasonal movements and environmental triggers to fall migration of Sage Sparrows. *Wilson Journal of Ornithology* 123:803-807.
- Fitzner, R. E., D. Berry, L. L. Boyd, and C. A. Reick. 1977. Nesting of Ferruginous Hawks (*Buteo regalis*) in Washington. *Condor* 79:245-249.
- Flores, R. E. 1991. Ecology of the California Black Rail in southwestern Arizona. M.Sc. thesis. Univ. Rhode Island, Kingston.
- Forbush, E. H. 1927a. *Birds of Massachusetts and other New England states*. Vol. 1. Massachusetts Department of Agriculture. Boston, MA.
- Forbush, E. H. 1927b. *Birds of Massachusetts and other New England states*. Vol. 3. Massachusetts Department of Agriculture. Norwood: Norwood, MA.
- Fredrickson, L. H. and F. A. Reid. 1986. Wetland and riparian habitats: a nongame management overview. Pages 59-96 in *Management of nongame wildlife in the Midwest: a developing art* (Hale, J. B., L. B. Best, and R. L. Clawson, Eds.) Symposium Proceedings of the 47<sup>th</sup> Midwest Fish Wildlife Conference, Grand Rapids, MI.
- Friedmann, H. 1963. Host relations of the parasitic cowbirds. *United States National Museum Bulletin*. No. 233.
- Gailbraith, H., R. Jones, R. Park, J. Clough, S. Herrod-Julius, B. Harrington, and G. Page. 2002. Global climate change and sea level rise: potential losses of intertidal habitat for shorebirds. *Waterbirds* 25:173-183.
- Gander, F. F. 1930. A Black Rail leaves the salt marsh. *Condor* 32:211.
- Gardali T., Seavy N. E., DiGaudio R. T., 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.
- Gentry, D.J., and K.T. Vierling. 2007. Old burns as source habitats for Lewis's Woodpeckers breeding in the Black Hills of South Dakota. *Condor* 109: 122-131.
- Gibbs, J. P. and S. M. Melvin. 1997. Power to detect trends in waterbird abundance with call-response surveys. *Journal of Wildlife Management* 61:1262-1267.

- Gilbert, M.M., and A.D. Chalfoun. 2011. Energy development affects populations of sagebrush songbirds in Wyoming. *Journal of Wildlife Management* 75:816-824.
- Gillihan, S.W., D. Rubenstein, and D. Hanni. 2004. Ferruginous hawk (*Buteo regalis*) conservation assessment for Great Plains national grasslands. Unpublished report. USDA Forest Service, Chadron, NE.
- Gilmer, D. S., D. L. Evans, P. M. Konrad, and R. E. Stewart. 1985. Recoveries of Ferruginous Hawks banded in south-central North Dakota. *Journal Field Ornithology* 56:184-187.
- Gosset, D. N. 1993. Studies of Ferruginous Hawk biology: I. Recoveries of banded Ferruginous Hawks from presumed eastern and western subpopulations. II. Morphological and genetic differences of presumed subpopulations of Ferruginous Hawks. III. Sex determination of nestling Ferruginous Hawks. Master's Thesis. Boise State Univ., Boise, ID.
- Griese, H. J., R. A. Ryder, and C. E. Braun. 1980. Spatial and temporal distribution of rails in Colorado. *Wilson Bulletin* 92:96-102.
- Grinnell, J., and H. Miller. 1944. The distribution of the birds of California. *Pacific Coast Avifauna* 27.
- Hadow, H.H. 1973. Winter ecology of migrant and resident Lewis' woodpeckers in southeastern Colorado. *Condor* 75:210-224.
- Hamilton, L. E., B. C. Dale, and C. A. Paszkowski. 2011. Effects of disturbance associated with natural gas extraction on the occurrence of three grassland songbirds. *Avian Conservation and Ecology* 6(1): 7.<http://dx.doi.org/10.5751/ACE-00458-060107>.
- Hancock, J. and J. Kushlan. 1984. *The herons handbook*. Croom Helm: Kent, UK.
- Hanowski, J. M. and G. J. Niemi. 1986. Habitat characteristics for bird species of special concern. Unpublished Report to the Minnesota Department of Natural Resources, St. Paul, MN.
- Harrison, M.L. and D.J. Green. 2010. Vegetation influences patch occupancy but not settlement and dispersal decisions in a declining migratory songbird. *Canadian Journal of Zoology* 88:148-160.
- Herkert, James R., Donald E. Kroodsma and James P. Gibbs. 2001. Sedge Wren (*Cistothorus platensis*), *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/582> doi:10.2173/bna.582
- Hill, D.P. and L.K. Gould. 1997. Chestnut-collared Longspur (*Calcarius ornatus*). *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/288>.
- Holmes, J.A. and M.J. Johnson. 2005a. Brewer's Sparrow (*Spizella breweri*): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region: Fort Collins, CO.
- Holmes, J.A. and M.J. Johnson. 2005b. Sage Sparrow (*Artemisiospiza belli*): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region: Fort Collins, CO.

- Howard, R. P. 1975. Breeding ecology of the Ferruginous Hawk in northern Utah and southern Idaho. Master's thesis, Utah State University, Logan.
- Howell, A. H. 1932. Florida bird life. Florida Department of Game and Freshwater Fish: Tallahassee, FL..
- Hurlbert, S. H., M. Lopez, and J. O. Keith. 1984. Wilson's Phalarope in the central Andes and its interaction with the Chilean Flamingo. *Revista Chilena de Historia Natural* 57:47-57.
- Igl, L. and D. Johnson. 1997. Changes in breeding bird populations in North Dakota: 1967 to 1992-1993. USGS Northern Prairie Wildlife Research Center. Paper 31.
- Imhof, T. A. 1976. Alabama birds. 2nd ed. University of Alabama: Tuscaloosa, AL.
- Intergovernmental Panel on Climate Change. 2001. Summary for Policymakers: Climate Change 2001. Impacts, Adaptation, and Vulnerability. Intergovernmental Panel on Climate Change, Geneva.
- Intergovernmental Panel on Climate Change. 2007. Contribution of Working Group II to the fourth assessment report of the Intergovernmental Panel on Climate Change. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY.
- Jehl, J. R., Jr. 1988. Biology of the Eared Grebe and Wilson's Phalarope in the nonbreeding season: a study of adaptations to saline lakes. *Studies in Avian Biology* 12:1-74.
- Jehl, J. R., Jr., A. E. Henry, and S. I. Bond. 1999. Flying the gantlet: population characteristics, sampling bias, and migration routes of Eared Grebes downed in the Utah desert. *Auk* 116:178-183.
- Johnsgard, P.A. 1979. Birds of the Great Plains: Breeding species and their distribution. University of Nebraska: Lincoln, NE.
- Johnsgard, P. A. 1980a. A preliminary list of the birds of Nebraska and adjacent Plains states. University of Nebraska, Lincoln, Nebraska. 156 pages.
- Johnsgard, P. A. 1980b. Copulatory behavior of the American Bittern *Botaurus lentiginosus*. *Auk* 97:868-869.
- Johnsgard, P.A. 2011. Rocky Mountain birds: Birds and birding in the Central and Northern Rockies. Lincoln: Zea E-Books.
- Johnson, D. H. and M. D. Schwartz. 1993. The Conservation Reserve Program and grassland birds. *Conservation Biology* 7:934-937.
- Johnson, D. H. and L. D. Igl. 1995. Contributions of the Conservation Reserve Program to populations of breeding birds in North Dakota. *Wilson Bulletin* 107:709-718.
- Jones, S. L., and J. S. Dieni. 2007. The relationship between predation and nest concealment in mixed-grass prairie passerines: an analysis using program MARK. *Studies in Avian Biology* 34:117-123.

- Jones, S.L., S. Dieni, and P.J. Gouse. 2010. Reproductive biology of a grassland songbird community in northcentral Montana. *Wilson Journal of Ornithology* 122:455-464.
- Kane, S. A. 2011. Breeding habitat structure and use by Kansas-occurring Black Rail. M.Sc. Thesis, Fort Hays State University.
- 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.
- Kerlinger, P. and C. Sutton. 1989. Black Rail in New Jersey. *Records of New Jersey Birds* 15:22-26.
- Kingery, H. E, (Ed.). 1998. *Colorado breeding bird atlas*. Colorado Bird Atlas Partnership: Denver, CO.
- Knapton, R. W. 1979. *Birds of the Gainsborough-Lyleton region*. Saskatchewan Natural History Society Publication 10.
- Knight, W. C. 1902. *The birds of Wyoming*. University of Wyoming Agricultural Experiment Station Bulletin No. 55.
- Knowlton, G.F. and W.P. Nye. 1946. Some insect food of the sage sparrow. *Journal of the Kansas Entomological Society* 19:139.
- Kotliar, N.B. 2007. *Olive-sided Flycatcher (Contopus cooperi): A technical conservation assessment*. USDA Forest Service, Rocky Mountain Region: Fort Collins, CO.
- Kushlan, J. A. 1978. Feeding ecology of wading birds. *National Audubon Society Research Report* 7:249-298.
- 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.
- LaFave, L.D. 1958. An apparent late breeding record of the Olive-sided Flycatcher. *Murrelet* 39:13.
- Law, J.E. 1929. Another Lewis Woodpecker stores acorns. *Condor* 31:233-238.
- Legare, M. L. and W. R. Eddleman. 2001. Home range size, nest-site selection and nesting success of Black Rails in Florida. *Journal of Field Ornithology* 72:170-177.
- Linder, K.A. and S.H. Anderson. 1998. Nesting habitat of Lewis' woodpeckers in southeastern Wyoming. *Journal of Field Ornithology* 69:109-116.
- Lingle G. R., P. A. Bedell, and J. Paseka. 1989. Nesting ecology of Sedge Wrens in Hall County, Nebraska. *Nebraska Bird Review* 57: 47-49.

- Lloyd, J.D. and T.E. Martin. 2005. Reproductive success of Chestnut-collared Longspurs in native and exotic grassland. *Condor* 107:363-374.
- Lowery, Jr., G. H. 1974. Louisiana birds. 3rd ed. Louisiana State University: Baton Rouge, LA.
- Lowther, P., A. F. Poole, J. P. Gibbs, S. Melvin and F. A. Reid. 2009. American Bittern (*Botaurus lentiginosus*), 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/018>
- Lynn, S.E. and J.C. Wingfield. 2003. Male chestnut-collared longspurs are essential for nestling survival: A removal study. *Condor* 105:154-158.
- Mahony, N.A., W.M. Vander Haegen, B.L. Walker, and P.G. Krannitz. 2001. Male incubation and multiple brooding in sagebrush Brewer's sparrows. *Wilson Bulletin* 113:441-444.
- Mahony, N.A., P.G. Krannitz, and K. Martin. 2006. Seasonal fecundity of Sagebrush Brewer's Sparrow (*Spizella breweri breweri*) at the northern edge of its breeding range. *Auk* 123:512-523.
- Manci, K. M. and D. H. Rusch. 1988. Indices to distribution and abundance of some inconspicuous waterbirds at Horicon Marsh. *Journal of Field Ornithology* 59:67-75.
- Martin, E. M. 1979. Hunting and harvest trends for migratory game birds other than waterfowl: 1964-76. U.S. Fish and Wildlife Service Special Science Report-Wildlife No. 218.
- Martin, J.W. and B.A. Carlson. 1998. Sage Sparrow (*Artemisiospiza belli*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved 10 October 2013 from: <http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/326>.
- Matthews, S. N., R. J. O'Connor, L. R. Iverson, and A. M. Prasad. 2004. Atlas of climate change effects in 150 bird species in the Eastern United States. USDA Forest Service General Technical Report NE-318.
- May, S. M., D. E. Naugle, and K. F. Higgins. 2002. Effects of land use on nongame wetland birds in western South Dakota stock ponds, U.S.A. *Waterbirds* 25 (Special Publication 2): 51-55.
- McMullen, T. E. 1944. The Black Rail. *Cassinia* 34:20-21.
- McNair, D. B. 1998. Henslow's Sparrow and Sedge Wren response to a dormant-season prescribed burn in a pine savanna. *Florida Field Naturalist* 26:46-47.
- Meents, J.K., B.W. Anderson, and R.D. Ohmart. 1982. Vegetation relationships and food of sage sparrows wintering in honey mesquite habitat. *Wilson Bulletin* 94:129-138.
- Merriam, C. H. 1877. A review of the birds of Connecticut with remarks on their habits. Transactions of the Connecticut Academy of Arts and Sciences Volume 4.
- Messmer, T. A. 1985. Effects of specialized grazing systems on upland nesting birds in southcentral North Dakota. M.S. thesis. North Dakota State University, Fargo, North Dakota.



- Messmer, T. A. 1990. Influence of grazing treatments on nongame birds and vegetation structure in south central North Dakota. Ph.D. dissertation. North Dakota State University, Fargo, ND..
- Middleton, D. S. 1949. Close proximity of two nests of American Bitterns. *Wilson Bulletin* 51:83-85.
- Moldenhauer, R.R. and J.A. Wiens. 1970. The water economy of the Sage Sparrow, *Amphispiza belli nevadensis*. *Condor* 72:265-275.
- Molhoff, W. J. 2000. Report of the breeding status of Lewis's Woodpecker in Nebraska. *Nebraska Bird Review* 68: 50-55.
- Molhoff, W. J. 2001. The Nebraska Breeding Bird Atlas 1984-1989. Nebraska Technical Series No. 20. Nebraska Game and Parks Commission, Lincoln, NE.
- 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.
- Mousley, H. 1939. Home life of the American Bittern. *Wilson Bulletin* 51:83-85.
- Mumford, R. E. and C. E. Keller. 1984. The birds of Indiana. Indiana University: Bloomington, IN.
- NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life. Accessed 28 October 2013. <http://www.natureserve.org>.
- Naugle, D. E., R. R. Johnson, M. E. Estey, and K. F. Higgins. 2001. A landscape approach to conserving wetland bird habitat in the Prairie Pothole Region of eastern South Dakota. *Wetlands* 21:1-17.
- Newlon, K.R. and V.A. Saab. 2011. Nest-site selection and nest survival of Lewis's Woodpecker in aspen riparian woodlands. *Condor* 113: 183-193.
- Niedrach, R. J. and R. B. Rockwell. 1939. Birds of Denver and mountain parks. Colorado Museum of Natural History Popular Series No. 5. Denver, CO.
- Niemuth, N. D., J. A. Walker, J. S. Gleason, C. R. Loesch, R. E. Reynolds, S. E. Stephens, and M. E. Erickson. 2013. Influence of wind turbines on presence of Willet, Marbled Godwit, Wilson's Phalarope and Black Tern on wetlands in the Prairie Pothole Region of North Dakota and South Dakota. *Waterbirds* 36: 263-276.
- Nores, M. and D. Yzurieta. 1980. Aves de ambientes acuaticos de Cordoba y centro de Argentina. Academia Nacional de Ciencias de Cordoba, Cordoba, Argentina.
- O'Grady, D.R., D.P. Hill, and R.M.R. Barclay. 1996. Nest visitation by humans does not increase predation on chestnut-collared longspur eggs and young. *Journal of Field Ornithology* 67:275-280.
- Ohmart, R.D. and E.L. Smith. 1970. Use of sodium chloride solutions by the Brewer's Sparrow and tree sparrow. *Auk* 87:329-341.

- Ojima, D. S. and J. M. Lockett. 2002. Preparing for a changing climate: The potential consequences of climate variability and change – Great Plains. Report for the US Global Change Research Program, Colorado State University, Fort Collins, CO.
- Olendorff, R. R. 1972. Large birds of prey of the Pawnee National Grassland: nesting habitats and productivity 1969-1971. U.S. Internal Biological. Program Technical Report 151. Colorado State University: Fort Collins, CO.
- Olendorff, R. R. 1993. Status, biology, and management of Ferruginous Hawks: a review. Raptor Research and Technical Assistance Center Special Report, Bureau of Land Management. Boise, ID.
- Palmer, R. S. 1949. Maine birds. Bulletin of the Museum of Comparative Zoology. Harvard University: Cambridge, MA.
- Palmer, R. S. (Ed). 1962. Handbook of North American birds. Vol. 1. Yale University Press, New Haven, CT.
- Partners in Flight. 2014. PIF population estimates database, version 2.0. Accessed 18 January 2014 from <http://rmbo.org/pifpopestimates/Default.aspx>.
- Peck, G. and R. James. 1987. Breeding birds of Ontario: nidiology and distribution, Vol. 2: passerines. Royal Ontario Museum Publications In Life Sciences Miscellaneous Publications: Toronto, ON.
- Petersen, K.L. and L.B. Best. 1985. Nest-site selection by Sage Sparrows. *Condor* 87:217-221.
- Petersen, K.L. and L.B. Best. 1985. Brewer's Sparrow nest-site characteristics in a sagebrush community. *Journal of Field Ornithology* 56:23-27.
- Petersen, K.L. and L.B. Best. 1986. Diets of nestling Sage Sparrows and Brewer's Sparrows in an Idaho sagebrush community. *Journal of Field Ornithology* 57:283-294.
- Petersen, K.L., L.B. Best, and B.M. Winter. 1986. Growth of nestling Sage Sparrows and Brewer's Sparrows. *Wilson Bulletin* 98:535-546.
- Peterson, R. A. 1995. The South Dakota breeding bird atlas. South Dakota Ornithologists' Union: Aberdeen, SD.
- Phillips, A., J. Marshall, and G. Monson. 1964. The birds of Arizona. University of Arizona Press. Tucson, AZ.
- Picman, J. and A. K. Picman. 1980. Destruction of nests by the Short-billed Marsh Wren. *Condor* 82:176-179.
- Pierce, B. A. 1993. The effects of acid precipitation on amphibians. *Ecotoxicology* 2:66-77.
- Prakash, M., D. Quéré, J. W. M. Bush. 2008. Surface tension transport of prey by feeding shorebirds: the capillary ratchet. *Science* 320:931-934.
- Prescott, D. R. C. and A. J. Murphy. 1999. Bird populations of seeded grasslands in the Aspen Parkland of Alberta. *Studies in Avian Biology* 19:203-210.

- Preston, C. R. and R. D. Beane. 1996. Occurrence and distribution of diurnal raptors in relation to human activity and other factors at Rocky Mountain Arsenal, Colorado, pp. 365-374. In D. M. Bird, D. E. Varland, and J. J. Negro (eds.), *Raptors in human landscapes: adaptations to built and cultivated environments*. Academic Press, San Diego, CA.
- Rehm, E. M. and G. A. Baldassarre. 2007. Temporal variation in detection of marsh birds during broadcast of conspecific calls. *Journal of Field Ornithology* 78:56-63.
- Reid, F. A. 1989. Differential habitat use by waterbirds in a managed wetland complex. Ph.D. dissertation, University of Missouri, Columbia, MO.
- Renken, R. B. 1983. Breeding bird communities and bird-habitat associations on North Dakota waterfowl production areas of three habitat types. M.S. thesis. Iowa State University, Ames, IA.
- Restani, M. 1991. Resource partitioning among three *Buteo* species in the Centennial Valley, Montana. *Condor* 93:1007-1010.
- Retter, M. 2013. 2013 AOU Check-List Changes. Retrieved 11 October 2013 from: <http://blog.aba.org/2013/08/2013-aou-check-list-changes.html>.
- Reynolds, T.D. 1981. Nesting sage thrasher, sage sparrow, and Brewer's sparrow in southeastern Idaho. *Condor* 83:61-64.
- Rich, T. D. 1978. Cowbird parasitism of Sage and Brewer's Sparrow. *Condor* 80:348.
- Rich, T. 1980a. Territorial behavior of the Sage Sparrow: Spatial and random aspects. *Wilson Bulletin* 92:425-438.
- Rich, T. 1980b. Nest placement in Sage Thrashers, Sage Sparrows, and Brewer's Sparrows. *Wilson Bulletin* 92:362-368.
- Rich, T. 1981. Microgeographic variation of the Sage Sparrow. *Condor* 83:113-119.
- Rich, T. 1983. "Walking-in-line" behavior in Sage Sparrow territorial encounters. *Condor* 85:496-497.
- Rich, T. D. 2002. The short song of Brewer's Sparrow: individual and geographic variation in southern Idaho. *Western North American Naturalist* 62: 288-299.
- Rich, T. D., M. J. Wisdom, and V.A. Saab. 2005. Conservation of priority birds in sagebrush ecosystems. USDA Forest Service General Technical Report PSW-GTR-191:589-606.
- Richmond, O. M., J. Tecklin, and S. R. Beissinger. 2008. Distribution of California Black Rails in the Sierra Nevada foothills. *Journal of Field Ornithology* 79: 381-390.
- Richmond, O. M. W., J. Tecklin, and S. R. Beissinger. 2012. Impact of cattle grazing on the occupancy of a cryptic, threatened rail. *Ecological Applications* 22:1655-1664.
- Ridgely, R. S. and J. A. Gwynne. 1989. *A guide to the birds of Panama*. Princeton University: Princeton, NJ.

- Ripley, S. D. 1977. Rails of the world. David R. Godine: Boston, MA.
- Roberts, T. S. 1932. The birds of Minnesota. University of Minnesota: Minneapolis, MN.
- Robertson, B.A., J.J. Fontaine, and E. Loomis. 2009. Seasonal patterns of song structure variation in a suboscine passerine. *Wilson Journal of Ornithology* 121: 815-818.
- Robertson, B.A. and R.L. Hutto. 2007. Is selectively harvested forest an ecological trap for Olive-sided Flycatchers? *Condor* 109:109-121.
- Root, T. 1988. Atlas of wintering North American birds, an analysis of Christmas Bird Count data. University of Chicago Press, Chicago, IL.
- Rosche, R. C. 1994. Birds of Lake McConaughy area and the North Platte River Valley, Nebraska. Published by author.
- Rotenberry, J.T., M.A. Patten, and K. L. Preston. 1999. Brewer's Sparrow (*Spizella breweri*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved 10 October 2013 from: <http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/390>.
- Rubega, M. A. and B. S. Obst. 1993. Surface-tension feeding in phalaropes: discovery of a novel feeding mechanism. *Auk* 110:169-178.
- Russell, R.E., V.A. Saab, and J.G. Dudley. 2007. Habitat-suitability models for cavity-nesting birds in a postfire landscape. *Journal of Wildlife Management* 71:2600-2611.
- Saab, V.A. and K.T. Vierling. 2001. Reproductive success of Lewis's Woodpeckers in burned pine and cottonwood riparian forests. *Condor* 103:491-501.
- Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2012. The North American Breeding Bird Survey, Results and Analysis 1966 - 2011. Version 07.03.2013 USGS Patuxent Wildlife Research Center, Laurel, MD
- Schmutz, J.K., S. M. Schmutz, and D. A. Boag. 1980. Coexistence of three species of hawks (*Buteo* spp.) in the prairie-parkland ecotone. *Canadian Journal of Zoology* 58:1075-1089.
- Schmutz, J. K. and R. W. Fyfe. 1987. Migration and mortality of Alberta Ferruginous Hawks. *Condor* 89:169-174.
- Schmutz, J. K., A. Rose, and R. G. Johnson. 1989. Hazards to raptors from strychnine poisoned ground squirrels. *Journal of Raptor Research* 23:147-151.
- Schramm, P., D. S. Schramm, and S. G. Johnson. 1986. Seasonal phenology and habitat selection of the Sedge Wren *Cistothorus platensis* in a restored tallgrass prairie. Pages 95-99 (G. K. Clambey and R. H. Pemble, eds.). Proceeding of the Ninth North American Prairie Conference, Tri-College University Center for Environmental Studies, Fargo, North Dakota.
- Sedgwick, J.A. 2004. Chestnut-collared Longspur (*Calcarius ornatus*): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region: Fort Collins, CO.

- Sharpe, R. S., W. R. Silcock, and J. G. Jorgensen. 2003. Birds of Nebraska: their distribution and temporal occurrence. University of Nebraska: Lincoln, NE.
- Shunk, S.A. 2011. The ABCs of Lewis's Woodpecker Conservation. The Cornell Lab of Ornithology. Retrieved 28 September 2013 from: <http://www.allaboutbirds.org/Page.aspx?pid=2151>.
- Skagen, S. K. and F. L. Knopf. 1994. Migrating shorebirds and habitat dynamics at a prairie wetland complex. *Wilson Bulletin* 106:91-105.
- Skagen, S. K., P. B. Sharpe, R. G. Waltermire, and M. B. Dillon. 1999. Biogeographical profiles of shorebird migration in midcontinental North America. Biological Science Report USGS/BRD/BSR—2000—0003. U. S. Government Printing Office: Denver, CO.
- Sliwinski, M. S., and N. Koper. 2012. Grassland bird responses to three edge types in a fragmented mixedgrass prairie. *Avian Conservation and Ecology* 7(2): 6. <http://dx.doi.org/10.5751/ACE-00534-070206>.
- Smith, D. G. and J. R. Murphy. 1973. Breeding ecology of raptors in the eastern Great Basin of Utah. *Brigham Young University Science Bulletin, Biological Series* 13:1-76.
- Smith, J. P., S. J. Slater, and M. C. Neal. 2010. An assessment of the effects of oil and gas field activities on nesting raptors in the Rawlins, Wyoming, and Price, Utah, Field Offices of the Bureau of Land Management. Technical Note No. 433. USDI Bureau of Land Management, Utah State Office, Salt Lake City, UT, Wyoming State Office, Cheyenne, WY, and Colorado State Office, Lakewood, CO U.S.A.
- Sprunt, Jr., A. 1954. Florida bird life. Coward-McCann: New York, NY.
- Steen, V. and A. N. Powell. 2012. Potential effects of climate change on the distribution of waterbirds in the Prairie Pothole Region, U.S. A. *Waterbirds* 35: 217-229.
- Stewart, R. E. and H. A. Kantrud. 1972. Population estimates of breeding birds in North Dakota. *Auk* 89:766-788.
- Stewart, R. E. 1975. Breeding Birds of North Dakota. Tri-College Center for Environmental Studies, Fargo, ND.
- Stiles, G. F. and A. F. Skutch. 1989. A guide to the birds of Costa Rica. Cornell University: Ithaca, NY.
- Suter II, G. W. and J. L. Jones. 1980. Criteria for Golden Eagle, Ferruginous Hawk, and Prairie Falcon nest site protection. *Raptor Research* 15:12-18.
- Tallman, D. and D. Swanson. 2002. The birds of South Dakota. South Dakota Ornithologists' Union. Northern State University Press: Aberdeen, SD.
- Tarnoczi, T. 2010. Transformative learning and adaptation to climate change in the Canadian prairie agro-ecosystem. *Mitigation and Adaptation Strategies for Global Change* 16:387-406.
- Taylor, W. K., R. L. Crawford, M. Kershner, and S. Gravel. 1983. House wren migration compared with other wrens: an emphasis on Florida. *Journal of Field Ornithology* 54:17-24.

- Thompson, M. C. and C. Ely. 1989. Birds in Kansas: Volume I. . University of Kansas Museum of Natural History Public Education Service no. 11. University Press of Kansas, Lawrence, Kansas, USA.
- Thompson, M. C. and C. Ely. 1992. Birds in Kansas, Vol. II. University of Kansas Museum of Natural History Public Education Service no. 12. University Press of Kansas, Lawrence, Kansas, USA.
- 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.
- Tigner, J.R., M.W. Call, and M.N. Kochert. 1996. Effectiveness of artificial nesting structures for ferruginous hawks in Wyoming. Pages 137-146 in D.W. Bird, D.E. Varland, and J.J. Negro, editors. Raptors in human landscapes, Academic Press: New York, NY.
- Tiner, Jr., R. W. 1984. Wetlands of the United States: current status and recent trends. U.S. Fish and Wildlife Service, National Wetlands Inventory, Washington, D.C.
- Todd, R. L. Black Rail, Little Black Rail, Black Crake, Farallon Rail (*Laterallus jamaicensis*). Pgs. 71-83 in Sanderson, G. C. (ed.). Management of migratory shore and upland game birds in North America (Sanderson, G. C., ed.) International Association of Fish and Wildlife Agencies Washington D.C.
- Tomasevic, J. 2010. Climate change sensitivity database. <http://climatechangesensitivity.org/>. Accessed 2 November 2013
- Towler, E., V.A. Saab, R.S. Sojda, K. Dickinson, C.L. Bruyère, and K.R. Newlon. 2012. A risk-based approach to evaluating wildlife demographics for management in a changing climate: A case study for the Lewis's woodpecker. *Environmental Management* 50:1152-1163.\*
- Travsky, A. and G. P. Beauvais. 2005. Species assessment for the Ferruginous Hawk. Report for the Bureau of Land Management, Cheyenne, Wyoming.
- Tvrđik, G.M. 1971. Pendulum display by Olive-sided Flycatcher. *Auk* 88:174.
- United States Department of the Interior Bureau of Land Management, 2001. Instruction memorandum no. WY-2001-040, sensitive species policy and list. USDI Bureau of Land Management, Cheyenne, WY.
- United States Fish and Wildlife Service. 1992. Endangered and threatened wildlife and plants-notice of finding on petition to list the Ferruginous Hawk. *Federal Register* 57:37507-37513.
- Ure, J., P. Briggs, and S. W. Hoffman. 1991. Petition to list as endangered the Ferruginous Hawk (*Buteo regalis*), as provided by the Endangered Species Act of 1973, as amended in 1982. Ferruginous Hawk Project, Salt Lake City, UT.
- Utah Birds Records Committee. 2013. Checklist of the birds of Utah. Accessed 1 November 2013. <http://www.utahbirds.org/PrintCenter/UtahChecklist.pdf>.
- Utah Conservation Data Center. 2013. Utah Conservation Data Center. State of Utah Natural Resources Division of Wildlife Resources. Accessed 1 November 2013. <http://dwrcdc.nr.utah.gov/ucdc/>

- Verner, J. 1965. Breeding biology of the Long-billed Marsh Wren. *Condor* 67:6-30.
- Verner, J. and G. H. Engelson. 1970. Territories, multiple nest building and polygamy in the Long-billed Marsh Wren. *Auk* 87:557-567.
- Vierling, K.T. 1997. Habitat selection of Lewis's Woodpeckers in southeastern Colorado. *Wilson Bulletin* 109:121-130.
- Vierling, K.T. 1998. Interactions between European Starlings and Lewis's Woodpeckers at nest. *Journal of Field Ornithology* 69:376-379.
- Vierling, K. T., D. J. Gerry, and A. M. Haines. 2009. Nest niche partitioning of Lewis's and Red-headed Woodpeckers in burned pine forests. *Wilson Journal of Ornithology* 121: 89-96.
- Vierling, K.T., V.A. Saab, and B.W. Tobalske. 2013. Lewis's Woodpecker (*Melanerpes lewis*), *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/284>.
- Walkinshaw, L. R. 1935. Studies of the Short-billed Marsh Wren (*Cistothorus stellaris*) in Michigan. *Wilson Bulletin* 52:361-368.
- Walkinshaw, L.H. and C.J. Henry. 1957. Incubation and nestling periods of the Olive-sided Flycatcher. *Auk* 74:389-390.
- Wells, J. 2007. *Birder's Conservation Handbook: 100 North American birds at risk*. Princeton University: Princeton, NJ.
- Weske, J. S. 1969. An ecological study of the Black Rail in Dorchester County, Maryland. M.Sc. Thesis. Cornell Univ. Ithaca, NY.
- Wetmore, A. 1925. Food of American phalaropes, avocets, and stilts. United States Department of Agriculture Bulletin No. 1359.
- White, C. M. and T. L. Thurow. 1985. Reproduction of Ferruginous Hawks exposed to controlled disturbance. *Condor* 87:14-22.
- Whyte, R. J. and B. W. Cain. 1979. The effect of grazing on nesting marshbird habitat at the Welder Wildlife Refuge, San Patricio County, Texas. *Bulletin of the Texas Ornithological Society* 12:42-46.
- Wiens, J.A. and J.T. Rotenberry. 1979. Diet niche relationships among North American grassland and shrubsteppe birds. *Oecologia* 42:253-292.
- Wiens, J.A. and J.T. Rotenberry. 1985. Response of breeding passerine birds to rangeland alteration in a North American shrubsteppe locality. *Journal of Applied Ecology* 22:655-668.
- Wiens, J.A., B. Van Horne, and J.T. Rotenberry. 1990. Comparisons of the behavior of Sage and Brewer's Sparrows in shrubsteppe habitats. *Condor* 92:264-266.



- Wiggins, D. A. 2006. American Bittern (*Botaurus lentiginosus*): A technical conservation assessment. USDA Forest Service, Rocky Mountain Region, Fort Collins: CO.
- Willis, E.O., D.W. Snow, D.F. Stotz, and T.A. Parker III. 1993. Olive-sided flycatchers in southeastern Brazil. *Wilson Bulletin* 105:193-194.
- Winter, B.M. and L.B. Best. 1985. Effect of prescribed burning on placement of Sage Sparrow nests. *Condor* 87:294-295.
- Woodrey, M. S., S. A. Rush, J. A. Cherry, B. L. Nuse, R. J. Cooper, A. Joy, and J. Lehmicke. 2012. Understanding the potential impacts of global climate change on marsh birds in the Gulf of Mexico region. *Wetlands* 32: 35-49.
- Wyckoff, A.M. 1983. Male "incubation" in a Chestnut-collared Longspur. *Wilson Bulletin* 95:472.
- Wyoming Game and Fish Department. 2010. Wyoming Species of Greatest Conservation Need. Wyoming State Wildlife Action Plan -2010. Accessed on 15 Oct. 2013: [http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SWAP\\_SPECIESCONSERVATIONINTRO0002949.pdf](http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SWAP_SPECIESCONSERVATIONINTRO0002949.pdf)