

## SAGE SPARROW

### *Amphispiza belli*

#### Description

Five subspecies are recognized.

*Amphispiza belli nevadensis* breeds throughout the intermountain west, including western Colorado (Martin and Carlson 1998).

The sage sparrow is a medium-sized sparrow that breeds in sagebrush shrubsteppe of the intermountain west and California. Males and females are similar in appearance, with a relatively long tail, a pale brownish-gray top of the head and nape, pale brownish mantle, dull white underparts, and brown rump. The breast often has a necklace of thin dark stripes, and a dark brownish central spot. The wing has a distinct whitish bar, and on the underside, a yellow patch at the wrist. Adults have a complete white eye ring, a hazel-brown iris, and two darkish lateral stripes on a white throat. The bill is grayish-brown, and legs and feet are dark grayish-brown (Rising 1996). The *nevadensis* subspecies, the subspecies found in Colorado, is about five percent larger than the other four subspecies (Martin and Carlson 1998).

#### Life history & behavior

Sage sparrows arrive in Colorado to breed from February to late April and depart around mid-October (Andrews and Righter 1992; Righter et al. 2004).

Sage sparrows nest primarily in shrubs, but will occasionally nest on the ground, usually early in the breeding season (Martin and Carlson 1998). They can produce up to 3 clutches in a breeding season (Rotenberry and Wiens 1991), with 3 to 5 eggs in a clutch (Martin and Carlson 1998). They forage on the ground or glean from low shrub branches, eating an omnivorous diet of seeds and arthropods (Rotenberry 1980). Diet varies seasonally and with availability of prey items.

#### Population trends

Trends in the United States and rangewide are uncertain; data are not reliable.

Colorado trends tracked by MCB are as yet uncertain (T. Leukering, pers. comm.).

Standard BBS estimates indicate positive trends in Colorado and survey-wide; however BBS data for sage sparrows generally lack statistical power due to low sample sizes and methodological challenges (Knick et al. 2003). A recent spatial analysis of BBS data by Dobkin and Sauder (2004) suggest that sage sparrow populations are experiencing moderate decline.

Habitat reduction and fragmentation in Colorado and across the sage sparrow's range are cause for alarm (Knick and Rotenberry 2002; Martin and Carlson 1998; PIF 2004). However, no state in the sage sparrow's range reports statistically significant long-term BBS trend data for the species. BBS annual average trend data are mixed (Sauer et al. 2004):

- + 0.1% survey-wide ( $P=0.1$ ,  $n=227$ ,  $RA=5.45$ )
- 0.2% in the Wyoming Basin ( $P=0.95$ ,  $n=29$ ,  $RA=11.85$ )
- +1.3% in Colorado ( $P=0.82$ ,  $n=11$ ,  $RA=1.74$ )

**Range**

In spite of significant habitat loss, the sage sparrow remains extant in all the states where it historically occurred.

In a regional-scale study, sage sparrow and black-throated sparrow abundances and percent changes in abundances were negatively correlated (Rotenberry and Wiens 1980; Wiens and Rotenberry 1981).



No data documenting historic continental-scale shifts in the range and distribution of the sage sparrow exists. However, given that sage sparrows are strongly tied to sagebrush shrubsteppe habitat across their range, and that this habitat has undergone significant decline in the last century (Knick and Rotenberry 2002), it is possible that the range and distribution of this species have changed accordingly (Braun et al. 1976).

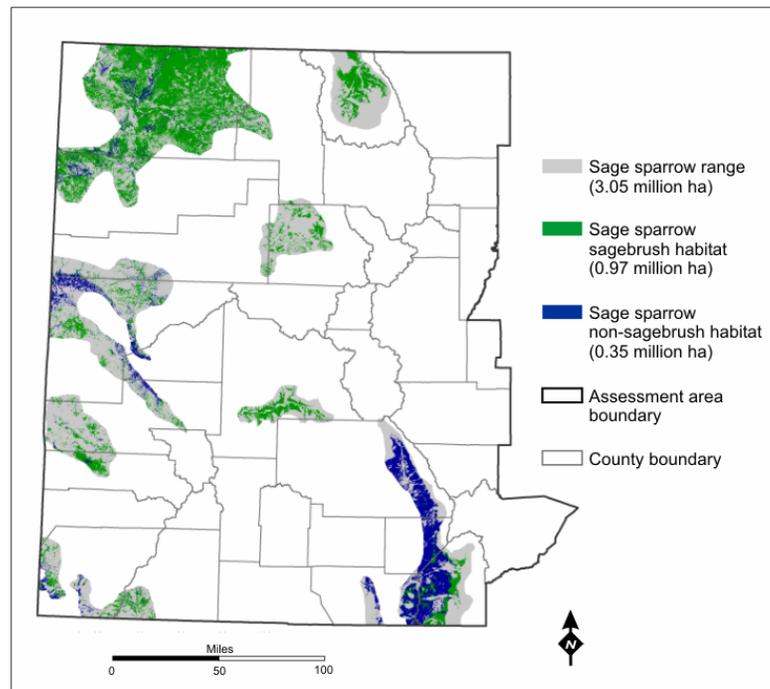
Migrants from Colorado winter in Arizona, New Mexico, southern Nevada and northern Mexico. An occasional straggler may winter in Colorado (Richter et al. 2004).

Overall range map reprinted from Martin and Carlson (1998) by permission

**Colorado distribution patterns & abundance**

One might assume that distribution of this sagebrush obligate in Colorado should closely follow distribution of large, unbroken stands of sagebrush in the state. However, sage sparrows are absent from large blocks of apparently suitable habitat in Colorado (Lambeth 1998). One explanation is elevation limitation, but more subtle factors may be at work (see Habitat discussion below). The range of the sage sparrow in the assessment area

Rangewide centers of abundance of breeding birds are west-central Nevada, southern Idaho, and the Wyoming Basin (Sauer et al. 2004). Breeding bird abundances and distributions are highly variable, both spatially and temporally.



Sage sparrows breed in appropriate habitat in basins and on hillsides,

encompasses approximately 3.05 million ha, with an estimated 1.32 million ha of suitable habitat.

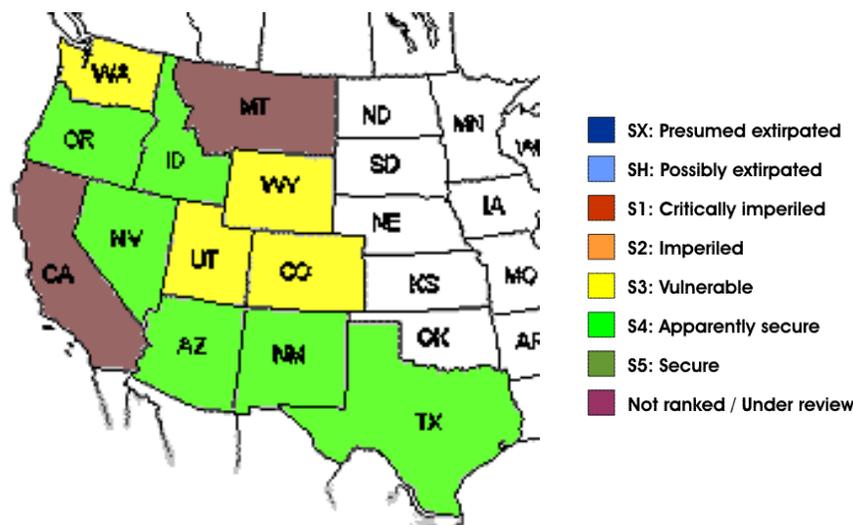
possibly up to 8,500 feet (Righter et al. 2004). Both Colorado BBA and BBS identify summertime sage sparrow centers of abundance in the northwestern counties of Moffat and Routt (Lambeth 1998; Sauer et al. 2004). MCB estimated sage sparrow densities in 2000, 2002, and 2003 as 0.070, 0.017, and 0.068 birds per hectare, respectively (T. Leukering, pers. comm.).

## Conservation status

Ranked G5/S3 - demonstrably secure rangewide, Colorado breeding population vulnerable.

Partial tracking by CNHP (CNHP 2004); Partners in Flight priority tier 1 for breeding birds; watch-listed with "medium priority" (PIF 2004).

Species of concern in Oregon and Washington



Map courtesy of NatureServe (2004).

## Habitat

Local-scale structural habitat preferences have not been quantitatively studied in Colorado.

In the Colorado sagebrush assessment area, about 1.32 million ha of suitable habitat exists for the sage sparrow, 0.97 million ha of which is sagebrush shrublands (see figure in Colorado Distribution Patterns

Experts consider the sage sparrow a sagebrush shrubsteppe obligate (Braun et al. 1976; Knick and Rotenberry 2000; Lambeth 1998; Martin and Carlson 1998; Paige and Ritter 1999). Studies in the Great Basin show that the sage sparrow is more strongly tied to sagebrush shrubsteppe than other sagebrush obligate passerines such as Brewer's sparrow and sage thrasher (Knick and Rotenberry 1999).

Colorado BBA (Lambeth 1998) reported about 82 percent of sage sparrow occurrences in big sagebrush habitats and 18 percent in other shrubland types or pinyon-juniper woodlands. Breakdowns of occurrences are as follows:

- 64% - lowland sagebrush shrubland
- 18% - mountain sagebrush shrubland
- 11% - tall desert shrubland
- 4% - pinyon-juniper woodlands
- 3% - mountain shrublands

MCB data for sage sparrows are available for the years 2000, 2002, and 2003. In 2000 and 2003, MCB found sage sparrows exclusively in sagebrush shrublands. In 2002, similar densities were reported for

and Abundance).

Elsewhere in its range, the species generally prefers a relatively high percentage of shrub cover, a high percentage of bare ground, and horizontal patchiness in the shrub community (Rotenberry and Wiens 1980). It prefers as nest sites taller shrubs with larger canopies (Petersen and Best 1985).

Studies in the Great Basin indicate that the relationship between patch size and sagebrush cover is a strong predictor of breeding sage sparrow presence, and that breeding birds respond to landscape characteristics on scales much larger than individual territories (Knick and Rotenberry 1995).

sagebrush shrublands and semi-desert shrublands (T. Leukering, pers. comm.).

In a southwestern Idaho big sagebrush community (*Artemisia tridentata*—no subspecies identified), Petersen and Best (1985) found that mean canopy coverage of sagebrush shrubs around nest sites was significantly lower, height of nest shrubs was significantly taller, and shrubs around sage sparrow nest sites were significantly more clumped than representative samples from the study area. Mean sagebrush canopy cover was  $23 \pm 9$  percent, mean nest shrub height was  $66 \pm 12$  cm, mean herbaceous plant cover was  $9 \pm 12$  percent, mean litter cover was  $6 \pm 8$  percent, and mean bare ground percentage was  $51 \pm 30$ . Ninety-six percent of nests were placed in shrubs that with 75 percent or more living branches, and nests were never placed in dead portions of shrubs. In southern Idaho, Rich (Rich 1980a) found sage sparrow nests in shrubs with a mean height of  $67.1 \pm 8.4$  cm, and the sagebrush cover in the study area ranged from 11 to 44 percent. Rich (1980b) found that territory sizes of breeding males varied in size and shape daily and seasonally. In Idaho, mean territory sizes ranged from  $0.81 \text{ ha} \pm 0.21$  (Reynolds 1981) to  $4.43 \text{ ha} \pm 1.86$  (Rich 1980b). In Nevada, Washington, and Oregon, territory sizes ranged from 0.65 to 5.81 ha (Wiens et al. 1985).

Early work on sage sparrow population dynamics at the regional (coarse) scale, showed that distribution and abundance of breeding sage sparrows correlated with basic structural characteristics of shrub communities versus grassland communities (Rotenberry and Wiens 1980). At the local (fine) scale, however, direct relationships between structural habitat characteristics and breeding bird abundances were weak, and non-spatial factors such as floristic composition became more significant (sage sparrows showed strong preference for big sagebrush) (Wiens and Rotenberry 1981).

A combination of factors may be responsible for the apparent decoupling of the relationship between breeding bird abundance and local-scale habitat characteristics:

- Mortalities during migration and/or on wintering grounds may affect abundances on breeding grounds (Rotenberry and Wiens 1980; Wiens and Rotenberry 1981).
- Because of site fidelity, sage sparrows may return to territories that have been substantially altered, and may persist in returning for a number of years, even to seemingly unsuitable sites (Knick and Rotenberry 2000; Wiens and Rotenberry 1985).
- Sage sparrows respond to habitat characteristics at multiple spatial scales; projections of population dynamics based on simple organism-habitat correlations may overlook important details of the patch responses of sage sparrows (Wiens 1985).

Later work by Knick and Rotenberry (1995) showed that the probability of habitat occupancy by sage sparrows was strongly related to the interaction between local and landscape-scale habitat characteristics. When probability of site occupancy was plotted as a function of shrub patch size (a landscape-scale variable) and big sagebrush percent cover (a local-scale

variable), a nonlinear interaction of these components was apparent; The relationship between percent sagebrush cover and the probability of occupancy, although always positive, changed as a function of shrub patch size. In general, this model predicted that sage sparrows were more likely to return to sites that had “high shrub cover (particularly sagebrush) and low disturbance, combined with large patch sizes and high within-site spatial similarity” (Knick and Rotenberry 1995).

Colorado BBA (Lambeth 1998) reported about 18 percent of breeding bird occurrences in vegetation types other than sagebrush shrublands, including mountain shrublands, semi-desert shrublands, and pinyon-juniper woodlands. In other states, sage sparrow nests have been observed in or under rabbitbrush, spiny hopsage, bitterbrush, greasewood, saltbush, Russian thistle, or bunchgrasses.

In northern portions of winter range, big sagebrush provides the favored habitat. Farther south, sage sparrows have also been observed in desert washes, creosote bush, sparse cactus scrub, arid grasslands, and honey mesquite (Martin and Carlson 1998). During migration, sage sparrows often travel through greasewood stands in desert country (Richter et al. 2004).

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## Threats & sensitivities

Threats are primarily habitat loss and fragmentation.

In western Colorado, where sagebrush makes up about 74 percent of sage sparrow suitable habitat, threats to sagebrush are a major concern.

Because of the sage sparrow’s close association with sagebrush habitats, it is assumed that activities that directly reduce or fragment habitat—such as urbanization, sub-urbanization, agricultural conversion, mineral resource development, and

For sage sparrows in the shrublands of the Intermountain West, loss, fragmentation, and degradation of sagebrush habitat are primary concerns (Knick et al. 2003; Knick and Rotenberry 2002).

In the Colorado sagebrush assessment area, where sagebrush makes up about 74 percent of sage sparrow suitable habitat, threats to sagebrush are major concerns also. Sage sparrow sagebrush habitat in the assessment area is at risk of four widespread threats modeled in the Colorado sagebrush conservation assessment and strategy: pinyon-juniper encroachment, encroachment by invasive herbaceous plants, residential development, and energy development.

Residential development probably poses the lowest threat of the four, with an estimated 3 percent of sage sparrow sagebrush habitat at high or moderate risk and 10 percent at low risk. About 87 percent of sage sparrow sagebrush habitat is at no risk of residential development based on our predictive model. Residential development threats to sagebrush are fairly scattered overall, with hot spots in sage sparrow range around Craig and Steamboat Springs.

Pinyon-juniper encroachment risk is also relatively low. Our predictive model estimated 22 percent of sage sparrow sagebrush habitat is at high risk of pinyon-juniper encroachment, while 22 percent is at moderate or low risk, and 56 percent is at no risk.

Risk of energy development is broadly moderate. About 78 percent of sage sparrow sagebrush habitat is at moderate risk of energy development in the Colorado sagebrush assessment area, 13 percent is at low or no risk, and 9 percent is at high risk. Energy development can result in destruction, degradation, and fragmentation of habitat. Sage sparrow sagebrush habitat at highest risk of energy development is scattered throughout the western-

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road and power rights-of-way—can significantly influence their populations.

See [Chapter 6](#) for more detail about habitat estimates and predictive threats modeling for sage sparrow sagebrush habitat in the Colorado assessment area. [Chapter 4](#) presents rule sets for threats modeling in sagebrush habitat.

most counties in the assessment area, with larger hot spots clustered in Rio Blanco, and Garfield counties. Sage sparrows are sensitive to habitat fragmentation, given that their probability of habitat occupancy increases with patch size (see [Habitat](#) and other paragraphs below).

Over 99 percent of sage sparrow sagebrush habitat is at some degree of risk of encroachment by invasive herbaceous plants. Our model predicts 47 percent at high risk, 50 percent at moderate risk, and 3 percent at low risk. The effects of invasive herbaceous plant encroachment on sage sparrow sagebrush habitat are significant. For instance, Knick and Rotenberry (1995) showed that sage sparrow habitat occupancy decreased with increasing percent cover of Russian thistle. Sagebrush habitat at moderate or high risk of invasive herbaceous plant encroachment in sage sparrow range is mostly broadly scattered across the western-most counties at lower elevations. Moffat and Rio Blanco counties contain the largest contiguous patches of sagebrush habitat at high risk.

At the landscape scale, sage sparrows appear to be sensitive to habitat fragmentation; studies show positive correlations between breeding bird distribution and abundance with patch size and homogeneity of habitat (Knick and Rotenberry 1995). Sage sparrows were almost entirely absent from sagebrush shrubsteppe areas in southern Idaho with moderate or high levels of fragmentation (Knick and Rotenberry 1999). The mechanisms by which fragmentation of sagebrush ecosystems influences the density of breeding birds or their productivity are not understood (Knick et al. 2003).

At a local scale, sage sparrows are sensitive to habitat degradation, such as invasion of weedy annuals or reduction in shrub coverage. Sage sparrows forage on the ground and dense ground cover characteristic of areas invaded by non-native grasses and forbs appears to disturb their feeding patterns (Paige and Ritter 1999). At least one expert has never known sage sparrows to breed in sagebrush with extensive cheatgrass in the understory (R. Lambeth, pers. comm.). Disturbances to sagebrush patches that encourage invasions of weedy annuals (fire, certain recreational uses, or heavy grazing, for example) are likely to lead to habitat degradation and lower occupancy by sage sparrows. Sagebrush treatments reducing sagebrush cover and increasing grass cover led to significant declines in sage sparrow abundance after an initial time lag attributed to site fidelity or tenacity of breeding birds (Wiens and Rotenberry 1985). Sage sparrows probably respond positively to light or moderate grazing (Bock et al. 1993), and negatively to heavy grazing (Saab et al. 1995).

Sage sparrows are known to abandon nests parasitized by brown-headed cowbirds (Reynolds 1981; Rich 1978), but may occasionally accept cowbird eggs. Colorado BBA observers found a pair of sage sparrows attending a cowbird fledgling in Moffat County (Lambeth 1998). Rates of sage sparrow nest parasitism ranged from 0 to 52 percent in various studies reviewed by Knick and Rotenberry (2002). Parasitism rates in these studies increased with increasing fragmentation, possibly because cowbirds found ready access to sagebrush shrubsteppe habitats from newly introduced agricultural areas. Quantitative effects of parasitism on sage sparrow nesting success are uncertain.

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**Research needs**

Although the sage sparrow is the most well-studied of the avian species of concern, many of the data are anecdotal or derived from community-based studies. Even in studies in which the sage sparrow was the focal species, more questions were raised than resolved.

Little is known about how sage sparrow populations are regulated during migration or on wintering grounds. Experts suggest that low returns to breeding grounds during some years by this highly philopatric species indicate that overwintering habitat or conditions may not be adequate, but more investigation is needed (Martin and Carlson 1998; Rotenberry and Wiens 1980; Wiens and Rotenberry 1981). Degree of fidelity to winter ranges is unknown (Knick and Rotenberry 2002).

The acceptable range of habitat requirements (physiognomic and floristic) is not well defined at either the regional or spatial scale in the assessment area. Because bird abundances do not necessarily imply favorability of habitat conditions or correlation with bird productivity, studies should couple population trend and demographics monitoring with investigation of nest success (including brood parasitism and predation) under alternate rangeland management regimes, over a spectrum of habitat conditions and geographic areas in Colorado.

Research is needed to determine why sage sparrows are absent from large blocks of apparently suitable habitat in Colorado. The mechanisms by which fragmentation of sagebrush ecosystems influence the density of sage sparrows or their productivity are not understood. “We unavoidably approach the study of patch dynamics from an anthropocentric perspective, seeing the boundaries and discontinuities in nature that seem important to us. Unless we adopt an organism-centered view of the environment, we are unlikely to discern or measure the elements of patch structure or dynamics that are really important, and instead may well document apparent 'patterns' that are little more than artifacts, products of our misperception” (Wiens 1985).

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**Management issues**

Sage sparrows respond to breeding habitat variables at multiple spatial scales. This carries important implications for how this species and its habitat are monitored in a management context (Knick and Rotenberry 2002; Wiens 1985).

Patch size is one measure of habitat integrity that could aid managers in conserving the sage sparrow. However, equal probabilities of breeding bird occupancy are possible with different combinations of sagebrush cover and patch size (Knick and Rotenberry 1995). Experts also caution that landscape context (e.g., degree of isolation of a patch, the degree of contrast between the patch and the surrounding matrix) greatly influences minimum patch size requirements (S. Knick, pers. comm.).

Nevertheless, there is a general, albeit cautious, consensus among experts that presence of breeding sage sparrows is unlikely in patches of sagebrush smaller than 100 to 200 acres (Paige and Ritter 1999; R. Lambeth, pers. comm.; J. Rotenberry, pers. comm.). In the face of the lack of quantitative data on patch size, “bigger is better” remains a conservation axiom for fragmentation and area-sensitive species such as the sage sparrow (S. Knick, pers. comm.), and patches of sagebrush 200 acres or larger are the best conservation targets. See [Chapter 3](#) for a discussion of patch size distribution of sagebrush in the Colorado sagebrush assessment area.

About 39 percent of sage sparrow sagebrush habitat in the Colorado

sagebrush assessment area is controlled by private landowners, posing a challenge for effective, integrated habitat management for the species. Nevertheless, about 85 percent of the sagebrush habitat managed by non-private entities is managed by the BLM, making it the public entity best-positioned to have a positive impact on the species.

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