Grazing and passerine breeding birds in a Great Basin low-shrub desert

Dean E. Medin

Intermountain Research Station, Forest Service, U.S. Department of Agriculture, Boise, Idaho

Follow this and additional works at: https://scholarsarchive.byu.edu/gbn

Recommended Citation
Available at: https://scholarsarchive.byu.edu/gbn/vol46/iss3/27

This Article is brought to you for free and open access by the Western North American Naturalist Publications at BYU ScholarsArchive. It has been accepted for inclusion in Great Basin Naturalist by an authorized editor of BYU ScholarsArchive. For more information, please contact scholarsarchive@byu.edu, ellen_amatangelo@byu.edu.
GRAZING AND PASSERINE BREEDING BIRDS
IN A GREAT BASIN LOW-SHRUB DESERT

Dean E. Medin

ABSTRACT.—Densities of passerine breeding birds were compared between four range pastures variously grazed by sheep over a 50-year period. The experimental pastures, located at the Desert Experimental Range in southwestern Utah, included three grazed and one ungrazed. Grazed pastures were each heavily stocked and grazed annually at one of three winter seasons (early, middle, or late). Important structural (physiognomic) and compositional differences existed in the vegetation of the experimental pastures. Horned Larks (Eremophila alpestris [Linnaeus]), numerically dominant in the pastures, apparently responded to those differences. Black-throated Sparrows (Amphispiza bilineata [Cassin]) and Loggerhead Shrikes (Lanius ludovicianus Linnaeus) were less common and found as breeding birds only in dry wash habitats. No significant differences were found between the pastures in estimates of total breeding bird populations, bird standing crop biomass, or bird species richness.

The low-shrub desert is a mosaic of plant communities found throughout the plains, foothills, and valleys of the Great Basin. In some areas, perennial grasses share dominance with the low shrubs. The desert has been variously classified as the shadscale association, the northern desert shrub formation, or the salt-desert shrub association (Holmgren 1973). Many of the native plants are palatable and nutritious, and the deserts are used primarily for winter grazing by domestic sheep (Holmgren and Hutchings 1972).

Physical environments of low-shrub deserts are rigorous. Climatically, they are cold deserts: winters are cold and summers are warm. Annual precipitation is generally low and occurs sporadically. Long-term irregularities in climatic patterns exist. The vegetation is structurally and floristically uncomplicated. Production rates are relatively low (Blaisdell and Holmgren 1984). These features of low-shrub desert environments and vegetation restrict avifaunal development to small species assemblages of broadly distributed forms (Wiens and Dyer 1975).

Vegetation structure is an important factor determining habitat selection in birds (reviewed in Hildén 1965). As a result, habitat structure may affect the organization of the avian community as a whole (Willson 1974, Roth 1976, Rotenberry and Wiens 1980). Because grazing can alter the structure of low-shrub desert vegetation (Hutchings and Stew-

DESSERT EXPERIMENTAL RANGE

The study was conducted at the Desert Experimental Range in southwestern Millard County, Utah. It was established in 1933. Its 225 km² are representative of about 160,000 km² of winter grazing lands in the Great Basin physiographic province as well as adjacent parts of the Columbia and Colorado plateaus (Blaisdell and Holmgren 1984). About 75% of the Experimental Range is alluvial slope or flat valley bottom. The rest is steeper upland overlain by a shallow soil mantle and broken by ledges of hard Paleozoic sedimentary or Tertiary volcanic rock. There are no seeps, springs, or live streams. Numerous dry washes cross the alluvial fans and may flow for short periods following high-intensity summer showers. Elevation ranges from 1,547 to 2,565 m. Soil textures are typically loams, sandy loams, or loamy sands (Holmgren 1973).

1Intermountain Research Station, Forest Service, U.S. Department of Agriculture, Boise, Idaho 83702.
During the 50 years from 1934 to 1984, temperature extremes varied from -40 to 40 C. The ground is frozen most of the time from mid-November into March. Snowfalls are usually light, seldom more than 5 cm deep. The average annual precipitation is 15.7 cm, about half of which falls during the five months from May through September (Holmgren 1973).

The vegetation on the Experimental Range is a mixture of low shrub and shrub-grass types. The dominant shrub species are winterfat (Ceratoideae lanata [Pus.]) J. T. Howell), bud sagebrush (Artemisia spinescens D. C. Eaton in Wats.), and shadscale (Atriplex confertifolia [Torr. & Frem.] Wats.). Three perennial grasses—Indian rice grass (Oryzopsis hymenoides [R. & S.] Ricker in Piper), galleta (Hilaria jamesii [Torr.] Benth.), and sand dropseed (Sporobolus cryptandrus [Torr.] Gray)—are associated with shrubs on most soils.

**METHODS**

Grazing studies began on the Desert Experimental Range during the winter of 1934-1935 (Hutchings and Stewart 1953). Sheep grazed 20 large (129 ha) range pastures at one of three intensities (light, moderate, or heavy) and one of three winter seasons (early, middle, or late). Grazing assignments for each experimental pasture remained unchanged. The winter of 1933-1934 marked 50 consecutive years of grazing in the pastures. The rest of the area was divided into 14 units. Over the years, 11 have been grazed by sheep and 2 by cattle. One unit had not been grazed.

Three heavily grazed pastures, one each grazed in early, middle, or late winter, and part of the ungrazed unit (hereafter referred to as the ungrazed pasture) were selected for study. The experimental pastures were chosen for maximal contrasts in seasonal grazing assignments and minimal differences in soil-site characteristics. Grazed pastures were contiguous, and all of the pastures selected for study were covered with similar plant types when the experiments started in 1934 (Hutchings and Stewart 1953). To avoid dissimilarities in soil and site characteristics, only the northern half of the late-winter grazed pasture and the eastern half of the ungrazed pasture were studied.

Four 9-ha plots were randomly located in each of the four selected experimental pastures and censused for breeding birds using the Williams spot-map method (International Bird Census Committee 1970). The square plots were surveyed and gridded in a Cartesian coordinate system with points flagged and numbered with stakes at 50-m intervals. Seven census visits were made to each plot from 5 April to 1 June 1984. Most of the work was done from sunrise to late morning. To ensure complete coverage, a plot was censused by walking within 25 m of all points on the grid. Census routes through each plot were varied. Observations extended well beyond plot boundaries.

At the end of the sampling period, concentrated groups of observations and coded activity patterns were circled as indicating areas of activity or approximate home ranges. Fractional parts of boundary territories were recognized. Results were converted to the number of pairs of breeding birds per 40 ha. Species richness (N) was expressed as the total number of breeding bird species observed or a plot.

Vegetation and other features of experimental pastures were measured from 11 June to 2 August 1984. A m² quadrat was located at each of 49 equally spaced stakes that defined the coordinates of the 9-ha bird census grids. Canopy coverage (Daubenmire 1959) was usually estimated for each plant species and recorded as the midpoint of one of eight percent coverage classes (0-1, 1-5, 5-10, 10-25, 25-50, 50-75, 75-95, and 95-100). Percentages of litter, rock, and bare ground were similarly estimated. Distances to the nearest grass plant, forb, and shrub in each quadrant were measured from the center of each quadrat. The patchiness of the vegetation was estimated using Roth's (1976) index of heterogeneity (D) calculated as

\[
D = 100 \frac{SD}{\bar{x}}
\]

where SD is the standard deviation and \(\bar{x}\) is the mean of the point-to-plant distances. The height of each grass plant, forb, and shrub nearest the center of each quadrat was measured with a pocket tape.

Vegetation data and attributes of avian community organization between experimental pastures were compared using analysis of vari-
Table 1. Vegetation and other features of grazed and ungrazed pastures, Desert Experimental Range, Utah, 1984.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Heavy, early winter</th>
<th>Heavy, middle winter</th>
<th>Heavy, late winter</th>
<th>Ungrazed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground cover (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bare ground</td>
<td>72.82 a</td>
<td>74.30 a</td>
<td>74.26 a</td>
<td>68.11 a</td>
</tr>
<tr>
<td>Litter</td>
<td>2.36 ab</td>
<td>2.21 a</td>
<td>3.23 ab</td>
<td>4.49 b</td>
</tr>
<tr>
<td>Rock(^2)</td>
<td>4.26 a</td>
<td>3.62 a</td>
<td>2.08 a</td>
<td>5.01 a</td>
</tr>
<tr>
<td>Grass</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aristida purpurea</td>
<td>0.28 ab</td>
<td>0.02 a</td>
<td>0.02 a</td>
<td>0.93 b</td>
</tr>
<tr>
<td>Bromus tectorum</td>
<td>0.47 a</td>
<td>1.01 a</td>
<td>0.73 a</td>
<td>0.52 a</td>
</tr>
<tr>
<td>Hilaria jamesii</td>
<td>2.15 ab</td>
<td>0.42 b</td>
<td>0.95 b</td>
<td>3.66 a</td>
</tr>
<tr>
<td>Oryzopsis hymenoides</td>
<td>2.09 a</td>
<td>4.43 ab</td>
<td>10.19 c</td>
<td>4.82 b</td>
</tr>
<tr>
<td>Sitanion hystrix</td>
<td>0.17 a</td>
<td>0.13 a</td>
<td>0.02 b</td>
<td>0.64 c</td>
</tr>
<tr>
<td>Sporobolus contractus</td>
<td>0.04 a</td>
<td>0.58 ab</td>
<td>1.65 b</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Sporobolus cryptandrus</td>
<td>6.51 a</td>
<td>5.25 ab</td>
<td>2.41 b</td>
<td>0.22 c</td>
</tr>
<tr>
<td>Others</td>
<td>0.02 a</td>
<td>0.00 a</td>
<td>0.00 a</td>
<td>0.21 a</td>
</tr>
<tr>
<td>Totals</td>
<td>11.73 a</td>
<td>11.84 a</td>
<td>15.97 a</td>
<td>11.00 a</td>
</tr>
<tr>
<td>Forb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chaenactis macrantha</td>
<td>0.02 a</td>
<td>0.05 a</td>
<td>0.00 a</td>
<td>0.05 a</td>
</tr>
<tr>
<td>Descurainia pinnata</td>
<td>0.01 a</td>
<td>0.00 a</td>
<td>0.00 a</td>
<td>0.10 a</td>
</tr>
<tr>
<td>Halogoton glomeratus</td>
<td>0.03 a</td>
<td>0.07 ab</td>
<td>0.25 b</td>
<td>0.29 ab</td>
</tr>
<tr>
<td>Lappula occidentalis</td>
<td>0.39 a</td>
<td>0.40 a</td>
<td>0.15 a</td>
<td>0.55 a</td>
</tr>
<tr>
<td>Lepidium montanum</td>
<td>0.20 a</td>
<td>0.45 b</td>
<td>0.02 c</td>
<td>0.06 c</td>
</tr>
<tr>
<td>Machaeranthra canescens</td>
<td>0.06 a</td>
<td>0.06 a</td>
<td>0.04 a</td>
<td>0.63 b</td>
</tr>
<tr>
<td>Phaela corrugata</td>
<td>0.01 a</td>
<td>0.07 ab</td>
<td>0.00 a</td>
<td>0.18 b</td>
</tr>
<tr>
<td>Salsola iberica</td>
<td>0.02 a</td>
<td>0.03 a</td>
<td>1.54 b</td>
<td>0.10 a</td>
</tr>
<tr>
<td>Sphaeralcea grossularifolia</td>
<td>0.59 a</td>
<td>0.19 b</td>
<td>0.23 b</td>
<td>1.10 c</td>
</tr>
<tr>
<td>Towensendia florifer</td>
<td>0.04 a</td>
<td>0.06 a</td>
<td>0.01 a</td>
<td>0.01 a</td>
</tr>
<tr>
<td>Others</td>
<td>0.10 a</td>
<td>0.33 a</td>
<td>0.04 a</td>
<td>0.19 a</td>
</tr>
<tr>
<td>Totals</td>
<td>1.47 a</td>
<td>1.71 a</td>
<td>2.28 ab</td>
<td>3.26 b</td>
</tr>
<tr>
<td>Shrub</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artemisia spinescens</td>
<td>2.32 ab</td>
<td>1.22 a</td>
<td>0.02 c</td>
<td>2.53 b</td>
</tr>
<tr>
<td>Atriplex canescens</td>
<td>0.09 a</td>
<td>0.00 a</td>
<td>0.00 a</td>
<td>0.21 a</td>
</tr>
<tr>
<td>Atriplex confertifolia</td>
<td>3.94 ab</td>
<td>6.05 b</td>
<td>1.68 c</td>
<td>2.98 ac</td>
</tr>
<tr>
<td>Ceratoides lanata</td>
<td>2.49 a</td>
<td>0.84 b</td>
<td>1.10 ab</td>
<td>2.95 a</td>
</tr>
<tr>
<td>Chrysothamnus viscidiflorus</td>
<td>0.06 a</td>
<td>0.09 a</td>
<td>0.02 a</td>
<td>3.92 b</td>
</tr>
<tr>
<td>Xanthocyclus sarothrace</td>
<td>0.97 a</td>
<td>1.38 a</td>
<td>0.28 b</td>
<td>0.03 b</td>
</tr>
<tr>
<td>Others</td>
<td>0.50 a</td>
<td>0.51 a</td>
<td>0.23 a</td>
<td>0.07 a</td>
</tr>
<tr>
<td>Totals</td>
<td>10.37 a</td>
<td>10.09 a</td>
<td>3.33 b</td>
<td>12.59 a</td>
</tr>
<tr>
<td>Vegetation height (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td>0.16 a</td>
<td>0.18 ab</td>
<td>0.23 c</td>
<td>0.21 bc</td>
</tr>
<tr>
<td>Forb</td>
<td>0.05 a</td>
<td>0.04 a</td>
<td>0.04 a</td>
<td>0.12 b</td>
</tr>
<tr>
<td>Shrub</td>
<td>0.11 a</td>
<td>0.12 a</td>
<td>0.12 a</td>
<td>0.15 a</td>
</tr>
<tr>
<td>Patchiness index (%)(^3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td>107 a</td>
<td>107 a</td>
<td>116 a</td>
<td>120 a</td>
</tr>
<tr>
<td>Forb</td>
<td>109 ab</td>
<td>108 ab</td>
<td>122 b</td>
<td>89 a</td>
</tr>
<tr>
<td>Shrub</td>
<td>94 a</td>
<td>102 a</td>
<td>114 a</td>
<td>120 a</td>
</tr>
</tbody>
</table>

\(^1\) Dissimilar letters in rows denote differences (P < 0.10) in means between pastures.
\(^2\) Exposed bedrock and rock particles on the surface of the ground greater than 2.5 cm in diameter.
\(^3\) Roth's (1976) index of heterogeneity.

Results

Vegetation

Structural and compositional differences existed in the vegetation of the experimental pastures (Table 1). The pasture grazed in late winter each year differed from the others mainly in its reduced shrub ground cover,
which was less than a third that of the other pastures. The reduced shrub cover and the slightly larger percentage of grass cover gave the late-winter grazed pasture a grassy aspect. Also, the average grass height was higher than those pastures grazed earlier in the winter. Bud sagebrush, common in the other pastures, was a minor part of the plant cover in the late-winter grazed pasture. Indian ricegrass dominated the grass component, and Russian thistle (Salsola iberica Sennek & Pau) was most abundant among the forbs.

Few features of the ungrazed pasture differed from those pastures that were grazed. The ungrazed area had slightly less bare ground and slightly more rock cover than grazed pastures, but neither component was significantly different from grazed pastures. There was significantly more litter cover in the ungrazed pasture when compared to the pasture grazed in the middle of the winter. Forbs made up a larger percentage of the ground cover and were taller in the ungrazed pasture. Of the more common perennials, squirelltail (Sitamion hystrich [Nutt.] J. G. Sm.), galleta, and globemallow (Sphaeralcea grossulariifolia [H. & A.] Rydb.) made up a larger percentage of the plant cover on ungrazed sites. Sand dropseed, common in grazed pastures, was a minor component in the ungrazed pasture. Among the shrubs, only low rabbitbrush (Chrysothamnus viscidiflorus [Hook.] Nutt.) was more abundant in the ungrazed pasture.

The pastures grazed in the early- and middle-winter periods were comparable in nearly all the features measured. Only winterfat and globemallow had larger cover values in the early-grazed pasture; pepperweed (Lepidium montanum Nutt. in T. & G.) was more important in the pasture grazed in midwinter.

**Birds**

Only three passerine breeding bird species occurred in the experimental pastures (Table 2). The most common of these was the Horned Lark (Eremophilia alpestris [Linnaeus]). A permanent resident, this broadly distributed bird was found throughout the variously grazed pastures. Less common, and found in more restricted habitats, were two summer residents, the Black-throated Sparrow (Amphisita bilineata [Cassin]) and the Loggerhead Shrike (Lanias ludovicianus Linnaeus). Wide-ranging raptorial birds of prey, although commonly seen, were not included in the analysis. Large numbers of transient species were also excluded.

Mean breeding bird density ranged from 19.6 to 27.8 pairs/40 ha in the experimental pastures (Table 2). From 65% to 76% of the average total bird density in each pasture was accounted for by the Horned Lark. Black-throated Sparrow and Loggerhead Shrike numbers were highly variable. Among the individual species, only the Horned Lark differed significantly in density; the highest average density was in the early-winter grazed
pasture and the lowest in the late-winter grazed pasture. Although not significant, there was a tendency toward intermediate bird density and bird biomass values in the ungrazed pasture. Species richness means were slightly higher in the early- and middle-winter grazed pastures. No significant differences were found in estimates of total bird numbers, bird standing crop biomass, or bird species richness between the various pastures.

**DISCUSSION**

Horned Larks were distributed throughout the experimental pastures. Few locations within the 9-ha bird census plots were not included within the territorial boundaries of a nesting pair of Horned Larks. Breeding territories were contiguous and frequently overlapped. Densities, however, differed between pastures. Horned Lark density was highest in the early-winter grazed pasture and lowest in the late-winter grazed pasture (Table 2). Important differences occurred in the floristics and the physiognomy of those two pastures (Table 1). The late-grazed pasture had the lowest shrub cover, the highest grass cover, and the tallest average grass height. Grasses, mostly Indian ricegrass, dominated the aspect. The early-grazed pasture had the lowest forb cover, the lowest average grass and shrub heights, and generally lower grass and shrub patchiness indexes. The visual impression was that of an open, low-growing, mixed grass-shrub habitat.

Black-throated Sparrows and Loggerhead Shrikes were locally distributed within the experimental pastures. As breeding birds, they were largely restricted to the dry washes that cross the alluvial fans and bajadas of the Desert Experimental Range. Dry washes were generally only a few meters wide, and they contained taller shrubs, mostly desert peachbrush (*Prunus fasciculata* [Torr.] Gray), interspersed among shorter vegetation. Densities of Black-throated Sparrows and Loggerhead Shrikes within the larger boundaries of an experimental pasture (Table 2) were apparently a function of the size and linear extent of the dry washes and the taller vegetation they contained.

The distribution of breeding birds within the experimental pastures is perhaps best explained by their different nesting requirements. Other investigators, working in a variety of habitats and locations, have noted the apparent preference of Horned Larks for open and low-growing vegetation as nesting sites (Fautin 1946, Wiens 1973, Owens and Myres 1973, Krementz and Sauer 1982, Castrale 1982). In this study, Horned Lark nests were found only in open habitats and always on the ground. Nests were placed in a shallow excavation partly beneath or beside a low shrub or grass tussock.

Fautin (1946) first noted that the Black-throated Sparrow seems to prefer an open type of vegetation within which there are occasional larger shrubs. Raitt and Maze (1968) found Black-throated Sparrows and Loggerhead Shrikes nesting exclusively in dry wash (arroyo) habitats. Similarly, I found Black-throated Sparrows and Loggerhead Shrikes nesting above the ground in the shrubs of the dry washes. Black-throated Sparrow nests were placed near the ground (<1 m) in small to medium-sized shrubs. Loggerhead Shrike nests were placed higher (>1 m) and in larger, more thickly foliaged shrubs.

Taller shrubs in the dry washes were frequently used as perches by each of the breeding bird species. Horned Larks sang from the ground, while perched, or from the air during nuptial flight displays. Black-throated Sparrows sang from elevated perches and sometimes foraged in the foliage of shrubs; they occasionally hawked insects from exposed perches. Loggerhead Shrikes used tall shrubs as observation posts. Both the Loggerhead Shrike and the Black-throated Sparrow were often seen coursing up and down the dry washes. Agonistic encounters between the two were occasionally seen in dry wash habitats. The Loggerhead Shrike was the aggressor in those encounters.

Several workers (e.g., Cody 1968, Wiens 1969, Rotenberry and Wiens 1980) have shown that the physical structure of the habitat can affect relationships between grassland and shrubsteppe birds. In this study, significant structural differences were found in the vegetation of range pastures variously grazed by sheep for 50 years. One passerine breeding bird species, the Horned Lark, apparently responded to those structural differences. Other passerines, the Black-throated Sparrow
and the Loggerhead Shrike, nested only in the taller vegetation that occurred in dry wash habitats. On the other hand, no significant differences were found in bird community attributes between the experimental pastures. The results of this study suggest that winter grazing by sheep, to the degree that it can alter the structure of low-shrub desert vegetation, has the potential to alter breeding bird populations and their distribution.

ACKNOWLEDGMENTS

I gratefully acknowledge the field assistance of G. Medlyn and J. Martin. J. Kinney, R. C. Holmgren, and W. P. Clary of the Shrub Sciences Laboratory at Provo, Utah, provided support and contributed in many other ways. J. Verner made constructive comments on an earlier draft of this manuscript.

LITERATURE CITED


HUTCHINGS, S. S. AND G. STEWART. 1953. Increasing forage yields and sheep production on intermountain winter ranges. USDA Cir. 925.


