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Rocky Mountain Juniper Woodlands: Year-Round Avian Habitat

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Abstract

Birds were sampled monthly for two years in Rocky Mountain juniper (*Juniperus scopulorum*) woodlands and in adjacent grasslands. Total numbers and species richness were consistently higher in every season in juniper stands than on grasslands. Rocky Mountain juniper stands provide food and thermal cover in the winter; migratory corridors in the fall and spring; and feeding, nesting and perching sites in the summer.

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Management Implications

In the expansive northern Great Plains, native woodlands constitute only a small portion of the total land area but provide critical habitat for a number of bird species. Deciduous woodlands are used extensively in the growing season, whereas coniferous stands such as Rocky Mountain juniper (*Juniperus scopulorum*) woodlands are used heavily throughout the entire year. Juniper stands provide thermal cover and food in the winter that other habitats lack, and hence attract large numbers of birds in the fall, winter, and spring months. Traditional bird surveys, conducted in the spring, would significantly underestimate the value of these habitats. Further, the large temporal variation in species presence and abundance made it difficult to assign indicator status to any species. Juniper woodlands are particularly susceptible to erosion and, therefore, require protection from excessive grazing.

Introduction

Native woodlands constitute only a small portion of the land area in the northern Great Plains, but provide specialized habitat for a number of avian species. Woodlands provide a sharp contrast with adjacent grasslands, resulting in an increase in potential nest sites, feeding niches, and perches. Previous research has demonstrated the value of deciduous woodlands in the northern Plains for breeding birds (Faanes 1983, 1984; Hopkins et al. 1986; Hodorff et al. 1988) and migratory birds (Hodorff et al. 1988). However, information on the value of Rocky Mountain juniper woodlands for birds is limited to brief surveys of breeding birds conducted by Hopkins et al. (1986) in southwestern North Dakota.

Native woodlands in the northern Great Plains are limited to areas of increased moisture, such as along streams and rivers, and to areas with increased topographic variation (Girard et al. 1989). Rocky Mountain juniper is restricted to areas of steep topography, such as the Badlands of North and South Dakota, the Black Hills, areas along drainageways of major rivers, and areas on high limestone plateaus in South Dakota and Wyoming. It is more likely to occur on steep, north-facing slopes, and is often associated with soils that are calcareous, poorly developed, and shallow (Fowells 1989). In North Dakota, Rocky Mountain juniper is usually confined to steep slopes (30–60%) (Girard et al. 1989), and the soils are often highly erosive (Noble, press).

The purpose of this study was to characterize bird species composition and seasonal use of Rocky Mountain

juniper woodlands and adjacent mixed-grass rangeland in Badlands National Park, southwestern South Dakota. The objective was to evaluate the potential role Rocky Mountain juniper woodlands play as habitat for breeding, migratory, and wintering birds.

Study Area

The study area is approximately 15 km south of the town of Wall, in Sage Creek Basin, Badlands National Park. Elevation ranges from 950 to 1000 m above sea level. Annual precipitation averages 40 cm at the Badlands National Park Cedar Park Visitor Center, most of which is received in May, June, and July. The terrain in Badlands National Park is rough and irregular, with steep bluffs rising above floodplains onto upland grasslands. Dense stands of Rocky Mountain juniper occur on steep, north-facing slopes and in draws.

Methods

The juniper stands sampled averaged 260 trees per hectare, of which nearly 100% were Rocky Mountain juniper (Sieg 1988). The trees were short, averaging approximately 3 m tall. The robust crowns, averaging 2.3 m wide, extended nearly to the ground. The understory of the juniper stands was sparse in contrast to the grasslands. Total plant canopy cover averaged 24.5% in juniper stands, and 52.8% on the grasslands over the two years (Sieg 1988). Yellow sweetclover (*Melilotus officinalis*) was the most common understory species in the woodlands (9% cover), followed by stonyhills muhly (*Muhlenbergia cuspidata*) (3%), and littleseed ricegrass (*Oryzopsis micrantha*) (2%). The grasslands were dominated by western wheatgrass (*Agropyron smithii*) (10% cover), followed by needle-and-thread grass (*Stipa comata*) (7%), and blue grama (*Bouteloua gracilis*) (5%).

Eight 60- by 400-m study sites were established: four in Rocky Mountain juniper woodlands in draws, and four on upland grasslands (one adjacent to each juniper woodland). Bird populations were sampled for two consecutive years along 400-m transects. The surveyor walked the transect and recorded the number and species of birds seen and/or heard within 30 m of either side of the transect. The surveys were conducted once a month, year-round, for four consecutive days from June 1981 until May 1983. Surveys were started within 30 minutes before sunrise and were conducted only on days with favorable weather conditions.

Data were analyzed with repeated measures analyses of variance (Norusis 1988). Monthly data were combined

into four seasons (June, July, August = Summer; September, October, November = Fall; December, January, February = Winter; March, April, May = Spring). Season and year were within-subject factors; vegetation type was the between-subject factor. Differences among seasons were tested with orthogonal contrasts. Distribution of each variable was examined by plotting residuals. Homogeneity of variances was tested with Bartlett's Box F-test; variables with heterogeneous variances were log-transformed, which adequately corrected variances.

Results

More than twice as many individual birds ($P = 0.01$) were observed in juniper stands, when compared to grasslands (table 1). Total bird observations also differed ($P < 0.05$) between years and among seasons. Numbers declined during the second year in both habitats, from an average of $571.25 (\pm 74.6 \text{ SE})$ to $405.5 (\pm 90.59)$ in juniper stands and from $232.25 (\pm 44.34)$ to $179.5 (\pm 21.46)$ on grasslands. Numbers of six commonly observed species differed ($P < 0.05$) between years (table 1). Numbers of American robins (*Turdus migratorius*), Bohemian waxwings (*Bombycilla garrulus*), American goldfinches (*Carduelis tristis*), northern flickers (*Colaptes auratus*), and Swainson's thrushes (*Catharus*

ustulatus) decreased the second year; only long-eared owls (*Asio otus*) increased during the second year.

Total bird species richness was higher ($P = 0.01$) in juniper woodlands (63 species) than on grasslands (46 species), and was consistently higher ($P < 0.05$) in every season in juniper woodlands (table 2). Seasonal species richness ranged from 12.5 (winter) to 28.5 (summer) in juniper stands, and from 6 (winter) to 15 (fall) on grassland sites. Species richness was higher ($P < 0.05$) in the growing season (April – October) than in the winter months in both habitats. Eight species nested in juniper stands; four species nested on grasslands (table 2).

Total observations were higher ($P < 0.05$) in Rocky Mountain juniper woodlands than on grasslands during every season. Peak observations occurred in the summer in both habitats. Observations on grasslands were higher ($P < 0.05$) in the summer months and lower in the winter than in other seasons; total observations in the spring and fall were similar ($P > 0.05$). Total bird observations in juniper stands were higher ($P < 0.05$) the first summer than other seasons, but did not differ ($P > 0.05$) among remaining seasons.

A total of 28 species were observed only in juniper stands, whereas only 9 species were present on grasslands but not in juniper stands. Numbers of 18 species of birds were higher ($P < 0.05$) in juniper woodlands than on grasslands, compared to 5 species whose num-

Table 1.—Two-year average numbers ($\bar{X} \pm \text{SE}$) of bird species/2.4 ha whose numbers differed ($P < 0.05$) in Rocky Mountain juniper (*Juniperus scopulorum*) and grassland study sites in southwestern South Dakota.

Species	No. of birds	
	Juniper	Grasslands
American robin (<i>Turdus migratorius</i>)	74.5 $\pm$ 41.1* @	6.5 $\pm$ 2.7
Mourning dove (<i>Zenaidura macroura</i>)	38.0 $\pm$ 5.3*	15.0 $\pm$ 2.5
Black-capped chickadee (<i>Parus atricapillus</i>)	36.0 $\pm$ 3.9*	0
Dark-eyed junco (<i>Junco hyemalis</i>)	33.1 $\pm$ 9.2*	0
Lark sparrow (<i>Chondestes grammacus</i>)	32.1 $\pm$ 10.4*	2.5 $\pm$ 0.7
Townsend's solitaire (<i>Myadestes townsendi</i>)	27.7 $\pm$ 5.0*	0.1 $\pm$ 0.1
Chipping sparrow (<i>Spizella passerina</i>)	25.8 $\pm$ 6.7*	3.0 $\pm$ 2.9
Field sparrow (<i>Spizella pusilla</i>)	22.9 $\pm$ 5.9*	0.3 $\pm$ 0.3
Western meadowlark (<i>Sturnella neglecta</i>)	20.4 $\pm$ 3.4	75.4 $\pm$ 5.2+
Rufous-sided towhee (<i>Pipilo erythrophthalmus</i>)	20.1 $\pm$ 0.1*	0
Bohemian waxwing (<i>Bombycilla garrulus</i>)	15.5 $\pm$ 15.2* @	0
Black-billed magpie (<i>Pica pica</i>)	14.8 $\pm$ 1.3*	1.8 $\pm$ 0.8
American crow (<i>Corvus brachyrhynchos</i>)	11.1 $\pm$ 2.1	4.5 $\pm$ 0.5
American tree sparrow (<i>Spizella arborea</i>)	10.5 $\pm$ 2.0	2.1 $\pm$ 2.1
Long-eared owl (<i>Asio otus</i>)	9.3 $\pm$ 8.8* @	0.1 $\pm$ 0.5
Brown-headed cowbird (<i>Molothrus ater</i>)	8.0 $\pm$ 5.3*	0.4 $\pm$ 0.3
Brown thrasher (<i>Toxostoma rufum</i>)	4.8 $\pm$ 0*	0
American goldfinch (<i>Carduelis tristis</i>)	3.8 $\pm$ 2.9* @	0.6 $\pm$ 0.6
Swainson's thrush (<i>Catharus ustulatus</i>)	2.6 $\pm$ 1.9* @	0
Northern flicker (<i>Colaptes auratus</i>)	2.1 $\pm$ 1.4* @	0.4 $\pm$ 0.1
Loggerhead shrike (<i>Lanius ludovicianus</i>)	2.0 $\pm$ 0*	0.1 $\pm$ 0.1
Horned lark (<i>Eremophila alpestris</i>)	1.8 $\pm$ 0.9	25.5 $\pm$ 4.0+
Cliff swallow (<i>Hirundo pyrrhonota</i>)	1.6 $\pm$ 1.4	15.4 $\pm$ 4.1+
Sharp-tailed grouse (<i>Tympanuchus phasianellus</i>)	1.0 $\pm$ 0.5	10.9 $\pm$ 2.6+
Grasshopper sparrow (<i>Ammodramus savannarum</i>)	0.3 $\pm$ 0.3	13.1 $\pm$ 3.6+
Western kingbird (<i>Tyrannus verticalis</i>)	0	1.5 $\pm$ 0.4+
TOTAL	488.4 $\pm$ 83.1* @	205.9 $\pm$ 26.5

*Numbers higher ($P < 0.05$) in juniper woodlands, compared to grasslands.

+Numbers higher ($P < 0.05$) on grasslands, compared to juniper woodlands.

@Numbers differed ($P < 0.05$) between years.

Table 2.—Seasonal bird species richness ($\bar{X} \pm SE$), number of nesting species, and total species richness in Rocky Mountain juniper (*Juniperus scopulorum*) and grassland study sites in southwestern South Dakota.

	Species richness	
	Juniper	Grassland
Species richness ¹		
Spring	27.0 $\pm$ 3.0 b	18.5 $\pm$ 1.5 a
Summer	28.5 $\pm$ 1.5 b	22.5 $\pm$ 1.5 a
Fall	25.0 $\pm$ 5.0 b	16.0 $\pm$ 3.0 a
Winter	12.5 $\pm$ 3.5 b	6.0 $\pm$ 0.5 a
No. of nesting species	28	34
Total species richness ¹	63 b	46 a

¹Different letters indicate that numbers were significantly different ($P < 0.05$) in the two habitats.

²Nesting species in juniper stands were mourning doves, long-eared owls, black-billed magpies, American crows, rufous-sided towhees, chipping sparrows, black-capped chickadees, and field sparrows (Sieg, in press).

³Nesting species on grasslands included short-eared owls, mourning doves, western meadowlarks, and grasshopper sparrows (Sieg, in press).

bers were higher on grasslands than in juniper stands (table 1). American robins were the most frequently observed bird in juniper stands, followed by mourning doves (*Zenaidura macroura*), black-capped chickadees (*Parus atricapillus*), dark-eyed juncos (*Junco hyemalis*), lark sparrows (*Chondestes grammacus*), Townsend's solitaires (*Myadestes townsendi*), and chipping sparrows (*Spizella passerina*). Other species observed in greater numbers in juniper woodlands than on grasslands included field sparrows (*S. pusilla*), rufous-sided towhees (*Pipilo erythrophthalmus*), black-billed magpies (*Pica pica*), long-eared owls, brown-headed cowbirds (*Molothrus ater*), Bohemian waxwings, brown thrashers (*Toxostoma rufum*), American goldfinches, Swainson's thrushes, northern flickers, and loggerhead shrikes (*Lanius ludovicianus*).

In juniper stands, American robins were present throughout the year, dominating observations in all seasons except summer (fig. 1). Black-capped chickadees, black-billed magpies, and long-eared owls (second year) were other species observed throughout the year in juniper stands. Lark sparrows and mourning doves were the most common species in the summer (fig. 2). Other summer species included field sparrows, rufous-sided towhees, chipping sparrows, and western meadowlarks (*Sturnella neglecta*). Winter species, in addition to American robins, included Townsend's solitaires, dark-eyed juncos, Bohemian waxwings, and American tree sparrows (*Spizella arborea*) (fig. 3). These were also the dominant species during migratory periods. The remainder of the species observed in higher numbers in juniper stands when compared to grasslands were present in the summer. Swainson's thrush was the only migratory species whose numbers were higher in juniper stands.

On the grasslands, western meadowlarks dominated bird composition, followed by horned larks (*Upophila alpestris*), cliff swallows (*Hirundo pyrrhonota*), mourning doves, and grasshopper sparrows (*Ammodramus savannarum*) (table 1). Western meadowlarks were the most common species on grasslands

throughout the growing season (fig. 4). Cliff swallows, grasshopper sparrows, and mourning doves constituted other important species during the growing season. Horned larks and sharp-tailed grouse (*Tympanuchus phasianellus*) were present throughout the year, and dominated the observations during the winter months.

Discussion

Higher bird densities and greater species richness observed in juniper stands when compared to grasslands were attributed to the increased cover, perches, nesting sites, and diverse food items provided by these coniferous woodlands. However, both total numbers and species richness were lower than Hodorff et al. (1988) and Hopkins et al. (1986) observed during the growing season in green ash (*Fraxinus pennsylvanica*)/chokecherry (*Prunus virginiana*) woodlands in northwestern South Dakota and southwestern North Dakota, respectively. The number of breeding species (8) is greater than Hopkins et al. (1986) observed in Rocky Mountain juniper woodlands in North Dakota (5 species), but lower than Hodorff and Sieg (1986) found in green ash woodlands (23 species). The strong dominance of juniper in the overstory and near absence of deciduous trees and shrubs, as well as the sparse, grass-dominated understory in juniper stands, provides fewer substrates for various bird activities compared to multispecies deciduous woodlands with shrub understories.

The wide yearly fluctuations in bird observations in juniper woodlands is common on the northern Great Plains. Hodorff et al. (1988) and Hopkins et al. (1986) both noted large year-to-year variations in numbers of birds in deciduous woodlands. These fluctuations may be due to variable weather and food resources. Variations in both precipitation and temperature influence bird densities indirectly through effects on food resources and directly through effects on the timing of migrations and need for winter cover. Variable fall and winter bird densities may also be influenced by juniper

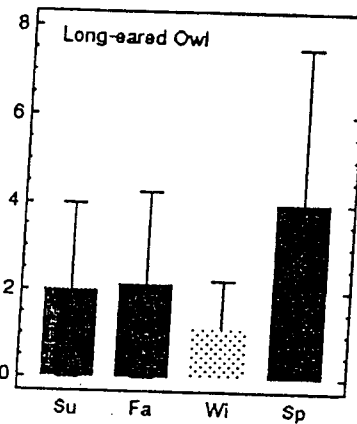
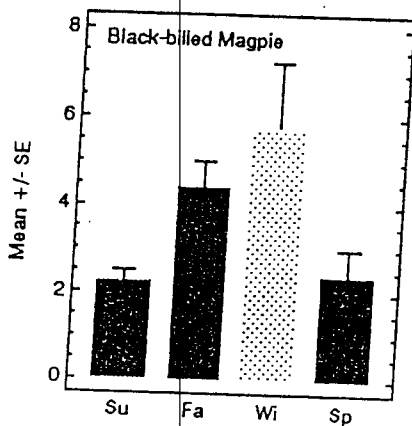
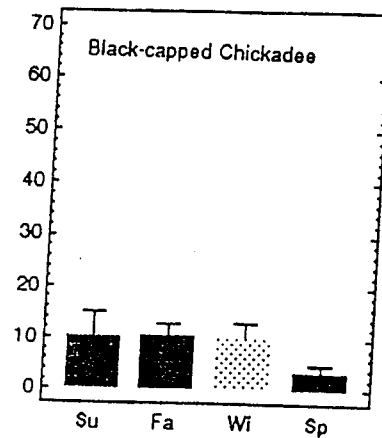
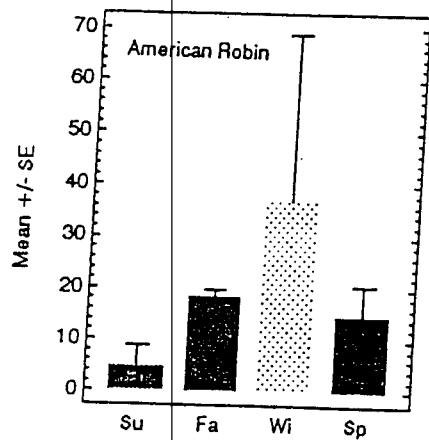


Figure 1.—Average ($\pm$ SE) seasonal numbers of year-round resident bird species/2.4 ha, in Rocky Mountain juniper woodlands, Badlands National Park.

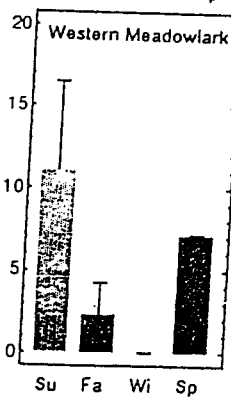
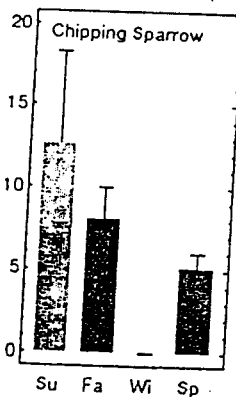
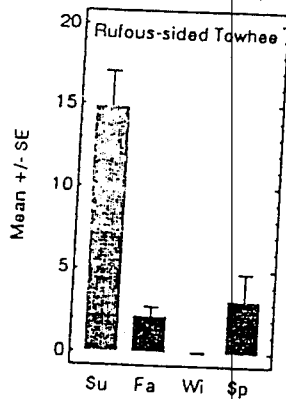
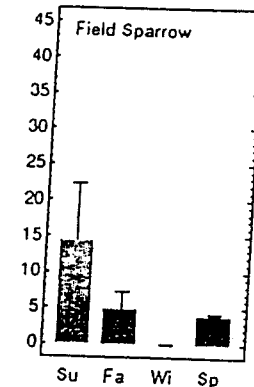
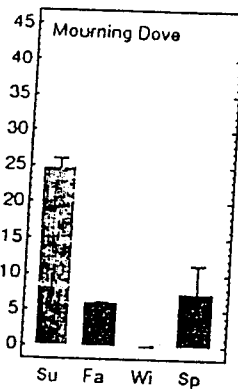
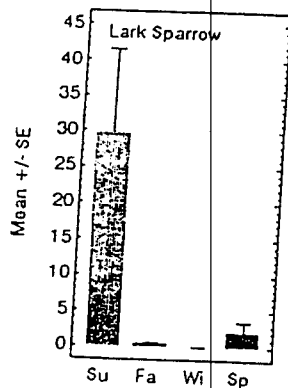


Figure 2.—Average ($\pm$ SE) numbers of common bird species/2.4 ha observed most frequently in the summer in Rocky Mountain juniper woodlands, Badlands National Park.

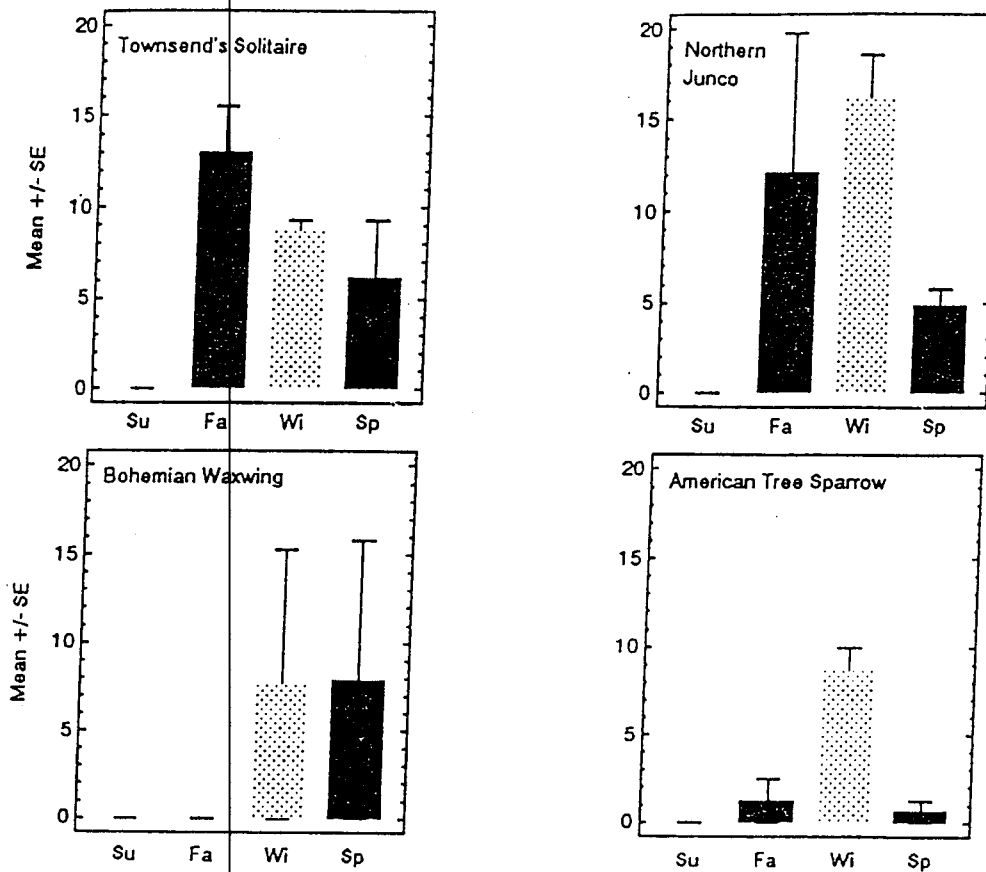


Figure 3.—Average ($\pm$ SE) numbers of common bird species/2.4 ha observed most frequently in the winter in Rocky Mountain juniper woodlands, Badlands National Park.

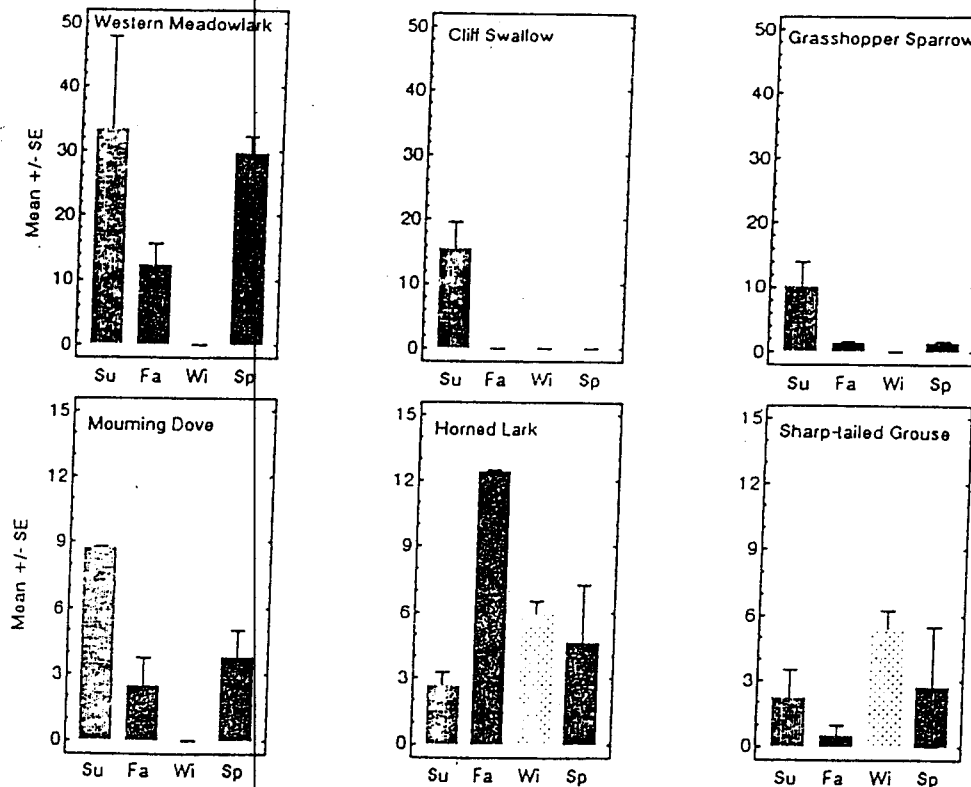


Figure 4.—Average ($\pm$ SE) numbers of common bird species/2.4 ha observed on mixed-grass rangelands, Badlands National Park.

berry production. Year-to-year variations of as much as 74% have been reported for wintering bird populations in pinyon-juniper stands in the Southwest, and have been linked with berry production (Balda and Masters 1980). Rocky Mountain juniper produces some seed every year, but produces bumper crops only every 2 to 5 years (Noble, in press), which may explain the variation in numbers of American robins, Townsend's solitaires, and Bohemian waxwings in this study.

This large temporal variation in species presence and abundance made it difficult to assign indicator status to any species. The yearly variation in presence and abundance was so high that short-term measures of presence or abundance were not adequate for judging the quality of the habitat for these species, much less the vegetation type in general. Further, the absence of a species in one year does not mean that juniper stands are unimportant habitats for this species. Therefore, traditional breeding bird surveys, conducted for a day or two in the spring, would be a poor assessment of the number and variety of birds present.

Rocky Mountain juniper woodlands provided year-round habitat in the Badlands (where other woodland types are generally lacking) for several avian species that would otherwise be absent. American robins, black-capped chickadees, black-billed magpies, and long-eared owls were observed throughout the year in juniper stands. Black-capped chickadees and magpies are generally associated with deciduous woodlands or ponderosa pine (*Pinus ponderosa*) forests (Whitney 1978), but black-billed magpie nesting densities were higher in Rocky Mountain juniper woodlands than in three other woodland types in North Dakota (Hopkins et al. 1986). Black-capped chickadees were present in high numbers during both the nesting and winter seasons. The long-eared owl is considered a rare species in South Dakota, and their high nesting densities in some years (Paulson and Sieg 1984) and presence in juniper stands in other seasons indicates the value of these communities as nesting and, perhaps, wintering habitat. This species uses woodlands for roosting and nesting sites and nearby grasslands for hunting (Erhlich et al. 1988).

Summer residents constituted a large portion of species that were more abundant in juniper stands than on grasslands. Juniper stands attracted woodland specialists, habitat generalists, and edge species. Species generally restricted to wooded habitats included chipping sparrows, rufous-sided towhees, brown thrashers, common flickers, and American goldfinches (Whitney 1978). Chipping sparrows and rufous-sided towhees had the highest nesting densities of any species in Rocky Mountain juniper stands in North Dakota (Hopkins et al. 1986). Mourning doves are considered habitat generalists, occupying nearly every upland habitat in the region, and nesting in Rocky Mountain juniper stands in North Dakota (Hopkins et al. 1986). Edge species included lark sparrows, field sparrows, brown-headed cowbirds, and loggerhead shrikes. These species are found in fields or grasslands with an interspersed shrubs or trees, and may nest in deciduous woodlands (Hodorff and Sieg 1986).

The Swainson's thrush was the only migrant observed in higher numbers in juniper stands than on grasslands, although twelve other species were observed in Rocky Mountain juniper woodlands only during migratory periods (Sieg, in press) and several other species, including robins and juncos, were likely migrants. Swainson's thrushes are generally associated with dense coniferous forests (Johnsgard 1979). Juniper stands, as well as deciduous woodlands (Hodorff et al. 1988), serve as migratory corridors for this species, as well as others.

Although bird species richness declined in the winter in juniper stands, twice as many species were observed in juniper sites than on grasslands, and total numbers did not decline relative to other seasons. The dense juniper trees provided cover and berries that attracted large flocks of American robins, dark-eyed juncos, Townsend's solitaires, and Bohemian waxwings. In northwest Arizona, 97% of the Townsend's solitaire's diet consisted of berries of one-seed juniper (*Juniperus monosperma*) (Salomonson and Balda 1977). Robins (Balda and Masters 1980) and waxwings (Martin et al. 1951) are also attracted to various types of juniper woodlands during years of high berry production. The berries of Rocky Mountain juniper ripen sometime between mid-September and December, and remain on the tree until March or April of the following year (Noble, in press). Thus, the timing of ripening may have a profound effect on which species are observed and the length of their stay. Another feature of Rocky Mountain juniper stands that attracts wintering birds is the dense foliage that provided roosting cover for species such as juncos. Dark-eyed juncos were common wintering species in pinyon-juniper woodlands (Balda and Masters 1980).

The edge that the Rocky Mountain juniper woodlands provided enhanced the bird richness and numbers on grasslands. With the exception of western meadowlarks, grasshopper sparrows, and horned larks, the presence of juniper stands enhanced the quality of grassland habitats. Juniper woodlands in this area occur in long, narrow draws, and hence provide a high edge-to-area ratio. Many grassland avian species take advantage of this large amount of edge. For example, western kingbirds (*Tyrannus verticalis*) prefer small open areas with a perch from which to "hawk" insects and a tree to support their nests (Whitney 1978). Sharp-tailed grouse prefer grasslands interspersed with woody cover; hence, juniper woodlands play a role in providing cover and, perhaps, food at certain times of the year.

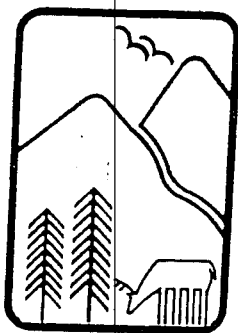
Conclusion

These results suggest that Rocky Mountain juniper woodlands contribute nesting habitat, migratory corridors, and winter food and cover for birds generally restricted to forested sites and enhance grasslands by providing increased edge habitat for birds requiring some woody cover. In light of the limited woody cover on the northern Great Plains, the perpetuation of this type is warranted. Rocky Mountain juniper is generally not grown for commercial timber, but is susceptible to

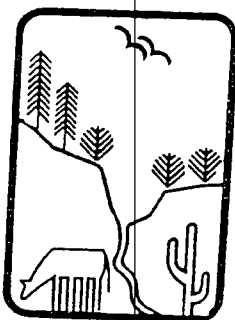
loss from erosion because it often grows on sites with highly erodible soils. Overuse by livestock and American bison (*Bison bison*) can accelerate the erosion process (Noble, in press). The dense foliage and steep slopes in many areas preclude cattle and bison. On these study sites, bison were rarely seen in the dense juniper stands. However, in the relatively flat bottoms, particularly near springs, lone bulls were often encountered. Use by deer (*Odocoileus* spp.) was generally restricted to narrow trails that showed little erosion. Occasionally, mass wasting was observed on isolated steep slopes adjacent to trails. Therefore, in wet years, and near springs, use by bison and cattle should be monitored to avoid overuse. Damage by ungulates may be decreased by reducing animal numbers, and protecting damaged areas by fencing or by placing natural barriers such as logs and brush across pathways. Placing livestock salt blocks and feed on uplands is another potential method of lessening overuse, and may help ensure the perpetuation of this valuable wildlife habitat.

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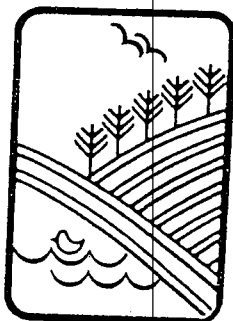
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Rocky
Mountains



Southwest



Great
Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

RESEARCH LOCATIONS

Research Work Units of the Rocky Mountain Station are operated in cooperation with universities in the following cities:

Albuquerque, New Mexico
Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Rapid City, South Dakota
Tempe, Arizona

*Station Headquarters: 240 W. Prospect Rd., Fort Collins, CO 80526