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AVIAN DENSITY AND DIVERSITY IN FOUR HABITAT TYPES IN MORTON COUNTY, KANSAS

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The density and diversity of breeding birds have been studied in a variety of community types in North America, including prairies (Wiens 1973, Cody 1974), desert scrub (Franzreb 1978), coniferous forest (MacArthur 1958), and deciduous upland forest (Bond 1957). While several avian communities in eastern Kansas have been analyzed (Johnston 1977, Zimmerman 1977) the western area of Kansas, especially the shortgrass prairie and sagebrush grasslands, has received scant attention.

During the summer of 1979 species composition, density, and diversity of breeding birds were determined in four habitat types in Morton County, which is located in the southwest corner of the state and is part of the southern High Plains. These study sites consisted of a cottonwood-tamarix riparian habitat, a shortgrass prairie, and two sagebrush grasslands.

METHODS

A total of five breeding bird counts was conducted on each study site during the period from 23 May to 26 June 1979, using the spot-mapping method (Williams 1936). Breeding bird density is expressed as the number of territorial males per 40 hectares.

From the number of species and individuals counted on each study site a species diversity index was determined using the Shannon Information Formula (Shannon 1948). This index expresses two components, the number of species in a community and the evenness of individuals distributed among the species in a community.

A vegetation analysis was conducted for each study site. A point-center quarter method (Phillips 1959) was used for the cottonwood-tamarix habitat. Thirty-eight random points were selected and the tree species, basal area, and tree height were recorded. For all three grassland habitats and for the ground cover in the riparian habitat, the step-point method was used to sample the vegetation (Evans and Love 1957). Three hundred systematic points were taken in each of these study sites to determine plant composition, canopy cover, and ratio of grasses to forbs. All vegetation analysis was done during the period 26 May to 10 June.

STUDY AREAS

Morton County is divided by the Cimarron flowing from a southwest to a northeast direction. In 1939 430,000 hectares of land north and south of the river in Morton County were purchased by the U.S. Department of Agriculture to stop the massive soil erosion this area had experienced during the drought of the 1930's. All of the study sites were located on this area, which is now called the Cimarron National Grasslands. The four study sites were chosen to represent the three principal community types found on these grasslands.

A 20 ha. area of cottonwood-tamarix habitat was established on the Cimarron River to represent the riparian community. This is an almost monotypic woodland with plains cottonwood (*Populus sargentii*) comprising 94% of the woody

vegetation, and tamarix (*Tamarix gallica*) and sandbar willow (*Salix interior*) comprising the remainder. The plains cottonwood occupied the greatest basal cover and averaged 7.3 meters in height. The ground vegetation consisted of an almost equal percentage of grasses (57%) and forbs (43%), while the canopy cover of the herbaceous plants was 39%.

Growing on calcarous, clay soils north of the river are shortgrass prairies in which buffalo grass (*Buchloe dactyloides*) and blue grama (*Bouteloua gracilis*) were dominant. On this 21 ha. study site, grasses made up 86% of the vegetation composition, while forbs made up 14%. Canopy cover was high on this grassland (63%) due to the mat-forming and bunchgrass characteristics of the dominant grasses. Shallow ditches had been formed by mechanical means to catch rainfall and reduce soil erosion, a process called "pitting".

The second grassland type was situated on river and wind deposited sandy soils south of the river. Two 21 ha. study sites were established on this sagebrush grassland community. One area, hereafter referred to as the burned sagebrush site, was composed of sagebrush (*Artemisia filifolia*), annual forbs, and grasses. In late April 1979, this area was burned as a management practice to control sagebrush and 90% of the sagebrush was destroyed. Shortly after the burn, in mid-May, fifty head of cattle grazed the study area until mid-June, keeping the new vegetation growth at a low height and canopy cover (36%) throughout the nesting season. After the burn, grasses such as little bluestem (*Andropogon scoparius*) and sand dropseed (*Sporobolus crytandrus*) made up 83% of the vegetation while forbs made up only 17%.

A second 21 ha. sagebrush grassland site was dominated by sagebrush and forbs such as annual sunflower (*Helianthus annuus*). Sagebrush and forbs made up 90% of the vegetation on the area, while grasses such as sand dropseed and sand lovegrass (*Eragrostis trichoides*) made up only 10%. This study site has received no sagebrush control in the past and only moderate cattle grazing during the study period. This habitat was characterized by a rapid growth and increase in the density of annual forbs. From mid-May to July, sunflowers increased in height and density from small seedlings to reach an average height of 42 cm and a 53% canopy cover. This luxuriant growth was probably in response to the above average rainfall for the season.

RESULTS AND DISCUSSION

A total of 22 species was recorded for the cottonwood-tamarix habitat, and 14 of these species were actually breeding in the study area. This habitat had the highest total density of the four study sites and also the highest species diversity (Table 1). The vegetation of this habitat has a greater structural complexity in terms of vertical stratification and plant composition when compared with the grassland vegetation. These vegetation factors offer the breeding birds of this habitat a greater range of nest sites, singing posts, foraging surfaces, insect habitats, and protection from weather and predators.

A total of 10 species was recorded for the shortgrass prairie site, and only five of these species were known to actually nest there. Compared to the other grassland habitats, this prairie had a very high density and of all the habitats examined it had the lowest species diversity at 1.63 (Table 1). The Grasshopper Sparrow was very common here, and made up 44% of the total density. The shortgrass prairie site probably had the simplest vegetation structure of the habitats examined. The number of species and the breeding diversity were similar to shortgrass prairies in Colorado and Texas and Palouse prairie in Wyoming, (Wiens 1973). Annual variation in the total density of breeding birds on shortgrass prairie varies from 4 to 44%, probably in response to the instability of rainfall and the subsequent responses by the vegetation (Wiens 1974). The high density of Grasshopper Sparrows on this site may have been indirectly due to the above average rainfall for the season. Wiens (1974) similarly attributed a high density of Grasshopper

TABLE 1. Breeding Season Birds in Morton County Habitats¹

Species	Cottonwood-Tamarix Riparian	Shortgrass Prairie	Burned Sagebrush Grassland	Unburned Sagebrush Grassland
Mississippi Kite				V
Swainson's Hawk			V	
Lesser Prairie Chicken				breeder
Scaled Quail			V	
Bobwhite	V			
Killdeer			V	
Long-billed Curlew		V		
Mourning Dove	74	6	V	10
Yellow-billed Cuckoo	8			
Burrowing Owl		V		
Common Nighthawk	V	V	V	
Yellow-shafted Flicker	2			
Red-headed Woodpecker	V			
Downy Woodpecker	2			
Western Kingbird	36	V		
Eastern Kingbird	4			
Horned Lark		36	12	
Blue Jay	V			
Black-billed Magpie	V			
Common Crow	V			
White-necked Raven				V
House Wren	2			
Northern Mockingbird	22			
Brown Thrasher	2			
Warbling Vireo	4			
Yellow Warbler	24			
Orchard Oriole	36			
Northern Oriole	42			
Western Meadowlark		16	6	6
Red-winged Blackbird	V	V		
Brown-headed Cowbird	V		V	V
Lark Bunting		26	V	2
Lark Sparrow	16		6	V
Grasshopper Sparrow		66		
Brewer's Sparrow				6
Cassin's Sparrow			4	14
Total Density (singing males 40/ha.)	274	150	28	38
Number of Breeding Species	14	5	4	5
Total Number of Species	22	10	11	13
Species Diversity Indices	2.39	1.63	2.15	2.19

¹numbers are males 40/ha, V = visitor

Sparrows on shortgrass prairie to abundant resources (food, cover, nest sites) brought on by increased rainfall. It is possible, however, that the practice of "pitting" may have increased nest site availability by making depressions below the foliage of bunch grasses.

Eleven species were recorded for the burned sagebrush grassland, and only 4 of these species were thought to be actually breeding on the study site. This area had

the lowest total density of the four study sites with 28 territorial males (Table 1). The Cassin's Sparrow was restricted to a small section of the study site where scattered sagebrush had survived the burn. On this site, burning and subsequent grazing reduced the vegetation height and cover, thus reducing nest site locations, singing post availability, and foraging surfaces. The result was a low avian density and diversity. It is probable that burning and subsequent heavy grazing of the sagebrush grassland is harmful to the original breeding birds using this area, such as the Western Meadowlark, which requires a fairly dense forb and grass cover (Wiens 1969). On the other hand, this burn probably attracted and benefited such species as the Horned Lark and Lark Sparrow which generally prefer sparse, short vegetation as breeding habitat (Sutton 1967).

A total of 13 species was recorded for the unburned grassland, and 5 of these species were known to nest in the area. This area had a total density of 38 territorial males, and a species diversity value of 2.19 (Table 1). The Lesser Prairie Chicken was present in the area, and two nests were located within the study site. The untreated sagebrush grassland is important habitat for shrub nesting birds such as the Cassin's Sparrow and Brewer's Sparrow. It is also used as a booming ground and nesting habitat by the Lesser Prairie Chicken.

This analysis of the avifauna of Morton County not only describes the present breeding birds for this region, but also suggests certain associations between groups of breeding birds and the plant communities which they prefer. In many of the western counties in Kansas the riparian habitats usually support the greatest diversity and density of breeding birds (Rising 1974). The results from the cottonwood riparian habitat in this study agree with this generalization. The extreme fluctuations in climatic factors and the effects of range management practices in Morton County no doubt alter the density and diversity of breeding birds in the grassland communities. Annual rainfall, temperature extremes, fire, pitting, and grazing all affect the vegetation of grasslands, and in turn, affect the birds' breeding habitats.

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First Winter Record of the Lesser Goldfinch in Kansas.—On the evening of 7 January 1978 I received a telephone call from Malia Weide of Topeka informing me that a Lesser Goldfinch (*Carduelis psaltria*) had appeared at her feeder earlier in the day. Her description of the bird left little doubt as to its identity, and her conclusion was confirmed the next day by Eulalia Lewis, Robert Glazier, and myself. The bird was feeding alongside American Goldfinches (*C. tristis*) and Pine Siskins (*C. pinus*). It was a beautifully colored male with bright yellow underparts, black on the top of the head, a dark green back and dark wings with white streaks in them. The bird was noticeably smaller than the other goldfinches and easier to approach. Pictures taken by Malia Weide show the color and size difference compared to the American Goldfinches. The bird was seen again on 9 January at the same feeder and later the same day by another observer at a feeder a block away. The normal range of the Lesser Goldfinch is from as far north as Colorado and Oregon south to northwest Peru, central Colombia, and northern Venezuela (A.O.U. 1957. Checklist of North American Birds, Fifth Edition, xiii + 691 pp.). Bent (1968. Life Histories of North American Cardinals, Grosbeaks, Buntings, Towhees, Finches, Sparrows and Allies. Bull. U. S. Natl. Mus., 237:474-486) states that the green-backed race, *C. p. hesperophilus*, is found in the western part of the species' range, which makes the Topeka bird of special interest. This is also the first winter record, and the first to have photographic confirmation. The only two previous sightings in Kansas were made in summer at the Chaplin Wildlife Refuge (now the Chaplin Nature Center). Thompson and Chaplin (1971. Lesser Goldfinch in Kansas. Kans. Ornithol. Soc. Bull. 22:7-8) reported a male present in 1970 between 28 July and 21 August with a female also seen on 21 August. Evidence of nesting, however, was not found. This same report stated that a male had been previously seen for ten days in August 1960. Thompson (pers. comm.) corrected that date to August 1961. The subspecies was not named, so I assume that it was the black-backed race, *C. p. psaltria*. Sutton (1967. Oklahoma Birds. Univ. Oklahoma Press, Norman, OK) list the Lesser Goldfinch as breeding in Cimarron County in extreme western Oklahoma with a few sightings in both summer and winter in the western part of the state. The four specimens on hand, including the one from winter, are given as *S. p. psaltria*. Rapp et al. (1958. Revised Checklist of Nebraska Birds, suppl. through 1970, Nebraska Ornithol. Union) does not list the Lesser Goldfinch for Nebraska.

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Headlong Downward Climbing by the Brown Creeper, *Certhia familiaris*.—The different climbing positions of Brown Creepers (*Certhia familiaris*) and nuthatches (*Sitta* spp.) are commonly known. Why nuthatches ascend and descend headlong with equal agility, while creepers normally climb only upward, is a

matter of speculation. Possible reasons could include purely behavioral factors or actual structural limitations. For example, weaker legs and feet might allow creepers to climb only with the added support of their stiff rectrices, which would be lacking in headlong descent. This is improbable, however, because creepers frequently cling to the undersides or horizontal branches, and Bent (1948. Life Histories of North American Nuthatches, Wrens, Thrashers, and Their Allies, U.S. Natl. Mus. Bull. 195:62) cites observations of young birds, with tails too short to afford any support, climbing like adults. Moreover, woodpeckers have powerful legs and feet and yet share creepers' climbing restrictions. In both, the limitation is likely a matter of balance rather than strength. My recent observation in El Dorado, Butler County, Kansas, supports this last hypothesis.

At 11:35 on 16 November 1979 I noticed a Brown Creeper climbing up a near-vertical limb of an American elm (*Ulmus americana*) in residential El Dorado. Shortly, however, it abruptly stopped, turned 180°, and went straight back down the limb headfirst. Midway in its descent it turned and sidled a few centimeters down the limb, its body slanted approximately 45° off vertical, as if to slow its too-rapid acceleration. Altogether, it moved vertically downward approximately 2 ft. (61 cm) to a knothole, which it investigated nuthatch-like before resuming a normal climb.

This most unusual behavior demonstrates that Brown Creepers are physically capable of headlong downward climbing. The side-turn after descent of only a foot (30 cm), however, suggests that the position of the bird's center of gravity is nonconducive to such activity.

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