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Breeding Bird Populations of a Floodplain Tallgrass Prairie in Kansas

Calvin Cink
Baker University, Baldwin City, Kansas

Peter Lowther
Field Museum of Natural History, Roosevelt Rd at Lakeshore Drive, Chicago, Illinois

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Calvin L. Cink
Biology Department, Baker University, Baldwin City, Kansas 66006

and

Peter E. Lowther
Field Museum of Natural History, Roosevelt Rd at Lakeshore Drive, Chicago, Illinois 60605

Abstract. Breeding birds were censused yearly from 1974-1988 on a 10.1 ha floodplain tallgrass prairie, a portion of the Baker Wetlands Research Area on the south edge of Lawrence, Kansas. Dickcissels (*Spiza americana*) were the most abundant species, with densities about six times greater than in the Flint Hills tallgrass prairie (149 territorial males/km² *vs.* 25/km²). This may be due to availability of moisture and associated density of grass stems and insect production. The bird community in the floodplain prairie however, is less diverse (5 species *vs.* 10 species). Grasshopper sparrows (*Ammodramus savannarum*) were the second most abundant species in Flint Hills upland prairie, but were absent from floodplain prairie. Red-winged blackbirds (*Agelaius phoeniceus*) which are rarely censused in upland prairie were the second most abundant species in floodplain prairie. Population densities were relatively stable over 15 years with exceptions due to different land use patterns in the vicinity of the study plot and burning or mowing of the prairie prior to the nesting season.

Key Words. population ecology, bird densities, birds, tallgrass prairie, mowing, burning, Kansas

INTRODUCTION

The value of long-term ecological studies is becoming more and more apparent (Callahan 1984), yet a tradition of short-term studies has developed in avian research (Wiens 1984). Research on birds in grassland ecosystems is no exception. Even studies on International Biological Program (IBP) grassland sites tended to emphasize short-term data (Wiens 1974). The population structure of grassland bird communities needs to be monitored over many years to evaluate the impact of environmental changes.

The majority of studies on tallgrass prairie birds deal with upland prairies. This may stem from the fact that few floodplain prairie sites of any size remain. These prairies, with their fertile, deep soils, were among the first to be plowed by early settlers. Although limited in size and extent, the ecology of remaining floodplain prairies should be studied.

The purposes of this paper are to document a long-term (15 year) study of breeding bird populations on a virgin floodplain tallgrass prairie in Kansas, to compare these composition and densities to midwestern prairies in upland or floodplain habitats, and to relate population fluctuations to mowing or burning.

STUDY AREA AND METHODS

The Baker Wetlands Research Area is located on the south edge of Lawrence, Kansas in northeastern Kansas (Figure 1). A portion of the 232.9 ha area was cultivated, and most was grazed until 1958 (Boyd 1980). Virgin prairie containing flora and fauna typical of lowland meadow were found in only two small areas totalling about 20 ha (Figure 1). These prairies were designated as a National Natural Landmark by the Department of the Interior and National Park Service in 1969. The largest of these prairies (14.2 ha) was first censused for breeding birds in the summer of 1974 (Cink 1974).

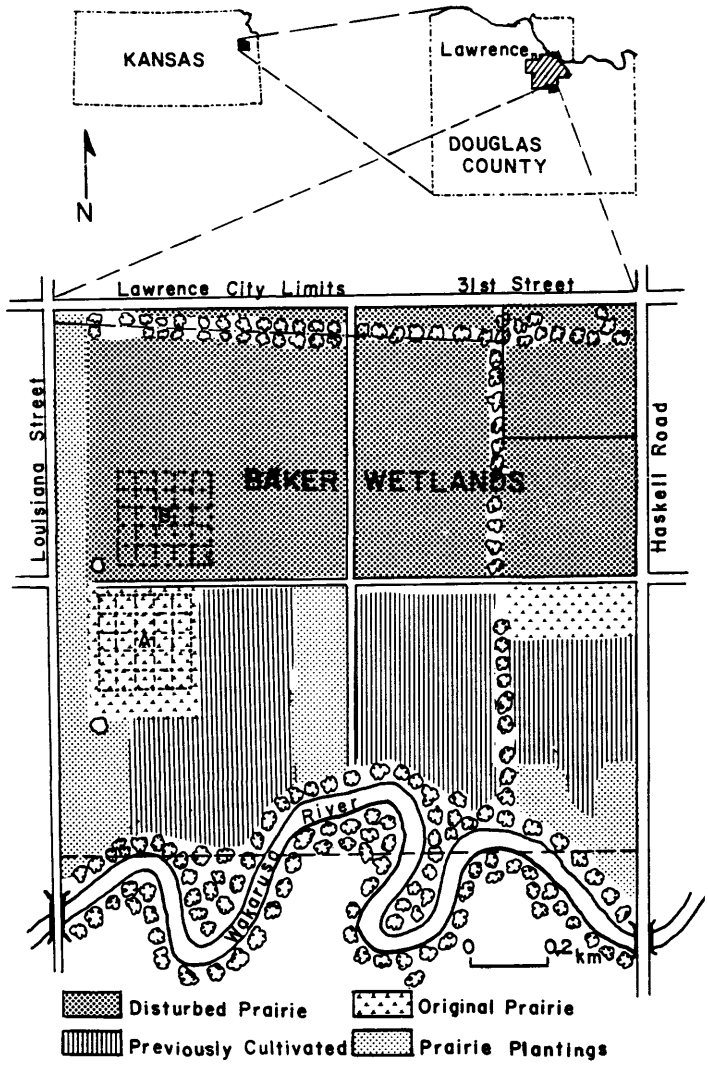

FIG. 1. Location of the Baker University Wetlands Research Area. The grid labelled A is the 10.1 ha census plot in floodplain tallgrass prairie. The grid labelled B is the 10.1 ha census plot in tallgrass prairie-shrub succession.

Küchler (1974) described this prairie as a "Freshwater Marsh (Spartina)" from the dominant grass, prairie cordgrass (*Spartina pectinata* Link.) which often reaches 2 m in height at midsummer and provides well over 70% of the canopy cover. Other dominant

grasses include indiangrass [*Sorgastrum nutans* (L.) Nash], big bluestem (*Andropogon gerardii* Vitman), and switchgrass (*Panicum virgatum* L.). The water table is near the surface (6-12 cm) and allows for tall growth of these grasses. Some low depressions allow expanses of sedge (*Carex frankii* Kunth.) and rushes [*Eleocharis obtusa* (Willd.) J. A. Schult. and *Juncus torreyi* Cov.). Forbs are common and prominent only at midsummer. They include several species of sunflowers (*Helianthus annuus* L., *H. mollis* Larn. and *H. maximiliani* Schrad.), compassplant (*Silphiuml aciniatum* L.), dogbane (*Apocynum cannabinum* L.), showy milkweed (*Asclepias syriaca* L.), thickspike gayfeather (*Liatris pycnostachya* Michx.), and a variety of others. A ditch passing diagonally across the southern one-third of the study area contains a few peachleaf willows (*Salix amygdaloides* Anderss.), and the northern boundary is accentuated by a ditch with buttonbush (*Cephalanthus occidentalis* L.). A 10.1 ha portion of the prairie was marked with posts on the corners of each 0.4 ha in a grid pattern to facilitate mapping bird territories.

Territorial boundaries of each species were mapped with the "territory flush" technique (Wiens 1969). A singing male was flushed and followed to its landing point, and these positions and direction of movement were plotted on a scaled field map. The procedure was repeated usually about 20 times until the outline of the territory was readily apparent. Aggressive encounters with territorial neighbors made boundaries especially well delineated. In all years, at least six censuses of 3-4 hours each were made from June through early July. Since 1981, census periods were extended into late July and early August. In about one-half of the years studied, additional efforts were made to find as many nests as possible to document their success. In some years, nestlings and their parents were banded for identification. Vegetation measures of percent cover and stem density were sampled with 30 randomly located quadrats (1 m^2).

RESULTS AND DISCUSSION

A total of 13 species were censused on the study area from 1974-1988 (Table 1), but the average was five species any given year. Only dickcissel, red-winged blackbird, common yellowthroat (*Geothylpis trichas*), and eastern meadowlark (*Sturnella magna*) were censused every year. Some species, such as the brown thrasher (*Toxostoma rufum*), were censused infrequently, because they were associated with woody vegetation that only persisted when fires or mowing did not occur in a given year. The species of birds that breed on the floodplain tallgrass prairie in this study were similar to those found in a floodplain tallgrass prairie of similar vegetational composition studied by Wilson (1983) in southwestern Iowa (Table 1). Note that the total density for both areas was similar although the Kansas data were for a 15-year period while the Iowa study was for one year. Differences in avifaunas occurred between floodplain tallgrass prairies and more xeric upland tallgrass prairies of the Flinthills only 110 km west (Table 2). Clearly some of these differences were a reflection of habitat, and others may be related to size of the study areas. Konza Prairie study sites were 12-38 ha. While Baker Wetlands prairie had less diversity (7 species *vs.* 10 species), the densities of its component populations were greater. Dickcissels, for example, were the most abundant species in both prairies, but densities were about 6 times greater in floodplain tallgrass prairie. This difference may be attributed to moisture differences and associated density of vegetation and arthropod abundance. Zimmerman (1971) observed that dickcissels were present in higher densities in oldfield communities than on Konza prairie. Upland tallgrass prairie may not be preferred habitat, at least in males (Zimmerman and Finck 1983). A similar pattern was seen for red-winged blackbirds. They were 50 times more abundant in floodplain prairie than in upland prairie. The structure of the vegetation or abundance of preferred arthropod foods may have been the critical difference in habitat selection for this species.

Table 1. Bird species composition and densities (number/km^2) of two midwestern tallgrass prairies.

Species	Bird density	
	Kansas	*Iowa*[1]
	-----number/km^2-----	
Dickcissel (*Spiza americana*)	138	87
Red-winged blackbird (*Agelaius phoeniceus*)	59	76
Common yellowthroat (*Geothlypis trichas*)	69	49
Sedge wren (*Cistothorus platensis*)	30	71
Grasshopper sparrow (*Ammodramus savannarum*)	0	22
Eastern meadowlark (*Sturnella magna*)	tr	tr
Ringnecked pheasant (*Phasianus colchicus*)	tr	tr
Northern bobwhite (*Colinus virginianus*)	tr	tr
American goldfinch (*Carduelis tristis*)	tr	tr
Mourning dove (*Zenaida macroura*)	tr	0
Northern cardinal (*Cardinalis cardinalis*)	tr	0
Brown-headed cowbird (*Molothrus ater*)	tr	0
Bell's vireo (*Vireo bellii*)	tr	0
Brown thrasher (*Toxostoma rufum*)	tr	0
Eastern kingbird (*Tyrannus tyrannus*)	0	tr
American kestrel (*Falco sparverius*)	0	tr
Total number of species	13	11
Density of all species combined	316	331

[1]Data from a 1-year study (Wilson, 1983); Kansas data represent 15-year summary, tr = fewer than 0.5 birds/km^2.

Table 2. A comparison of bird species and densities (number/km^2) from two Kansas tallgrass prairies.

Species	Bird density	
	Baker Wetlands	*Konza*[1]
	-----number/km^2-----	
Dickcissel (*Spiza americana*)	149	25
Redwinged blackbird (*Agelaius phoeniceus*)	59	1
Common yellowthroat (*Geothlypis trichas*)	50	0
Eastern meadowlark (*Sturnella magna*)	10	14
Grasshopper sparrow (*Ammodramus savannarum*)	0	20
Upland sandpiper (*Bartramia longicauda*)	0	6
Mourning dove (*Zenaida macroura*)	0	6
Brown-headed cowbird (*Molothrus ater*)	tr	6
Eastern kingbird (*Tyrannus tyrannus*)	0	6
Common nighthawk (*Chordeiles minor*)	0	5
Brown thrasher (*Toxostoma rufum*)	5	0
Bell's vireo (*Vireo bellii*)	5	0
Henslow's sparrow (*Ammodramus henslowii*)	0	3

[1]Konza Prairie Research Natural Area, data from Knodel (1980) represent an average of 4 census plots; Baker Wetlands data are for the same census year, tr = fewer than 0.5 birds/km^2.

Some species found at Konza were not found on the floodplain prairie. This included the grasshopper sparrow, upland sandpiper (*Bartramia longicauda*), and Henslow's sparrow (*Ammodramus henslowii*). The latter two species possess critical area requirements (Samson 1980). It is possible that the area of virgin prairie in the Baker Wetlands was too small to fulfill the requirements for viable populations of these two species. The small size of the area, coupled with the fact that there were no islands of similar grassland habitat nearby, may also contribute to the absence of these birds. It was more likely that habitat differences such as vegetation structure were more important for grasshopper sparrows. Minimum area seems less important for this species. Common yellowthroats that occurred in high densities in floodplain prairie were not observed by Knodel (1980) but were observed in low frequency on other sites at Konza (Zimmerman and Finck 1983). Moist environments appeared to be an important component of habitat selection for this species. Differences in total densities between the two study areas, though not indicated in the table, were similar in magnitude to those found for the dickcissel alone (277 territorial males/km^2 for floodplain prairie and 97 males/km^2 for upland prairie).

Densities have remained nearly constant between 275-300 territorial males/km^2 on the Baker Wetlands prairie over the 15 year study (Figure 2). This represented a difference of only 2-4 birds/10 ha. Three peaks represent a departure from this pattern (1978, 1982, and 1986-88). A difference in the timing of censuses was partly responsible for these peaks. Beginning in 1981, censuses were made into late July, and sedge wrens (*Cistothorus platensis*) were recorded. This species may have been missed in cursory observations in late July previously because the prairie was mowed in July and no habitat was available. The density of wrens was particularly high in 1988 (69/km^2) and increased the total density for the area to its highest point in 15 years.

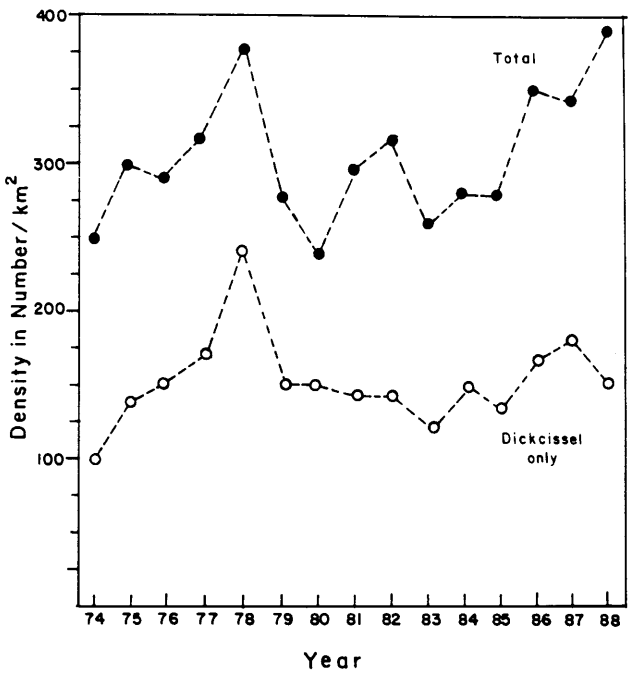

FIG. 2. Breeding densities of birds on floodplain tallgrass prairie. Solid circles represent total densities. Open circles represent densities of dickcissels.

To further evaluate densities among all 15 years, dickcissels alone were examined. The peak for 1988 disappeared, but the peak for 1978 remained. The small peak for 1982 was due to increases in common yellowthroats and red-winged blackbirds, and without their influence the peak disappears. Management practices may have influenced dickcissel numbers. Prior to 1983, mowing of the prairie in July or August was a normal practice. Mowing may have had pronounced influence on the birds breeding the following season by removing the standing vegetation. This removal might mean a later time of territorial settlement for returning males and less dense cover for early nest building. Both have been documented for dickcissels on the study area (Cink, unpublished data). It may also be that standing vegetation from previous years provided more singing posts for territorial males, and more males could be supported on the same area of grassland. When mowed and unmowed years are superimposed on a graph of nesting densities of dickcissels (Figure 3), it does appear that peak populations occurred after a buildup of standing vegetation. Yearly decreases after mowing were not always present, however. Mowing that occurred on adjacent grassland to the north may have influenced the largest peak in density (1978). This partially grazed grassland was not mowed or burned for at least seven years prior to 1977. During this period of succession, it became dominated by rough-leaved dogwood (*Cornus drummondii* C. A. Mey.). A 10.1 ha plot of this habitat (Figure 1) was censused at the same time as the prairie plot (Cink and Paul 1975). The difference in species diversity and density between the plots is shown in Table 3. When the shrub succession plot and surrounding area were cut in 1977, returning birds were forced into other areas. Evidence from banding suggests that some shrub succession plot birds established territories in the tallgrass prairie plot in 1978. Territories in 1978 were on the average 40 m^2 smaller in 1978 than years before or since. This suggests that the resident population condensed their territories to make room for new birds. Levels of aggression were notably higher in 1978 than other years.

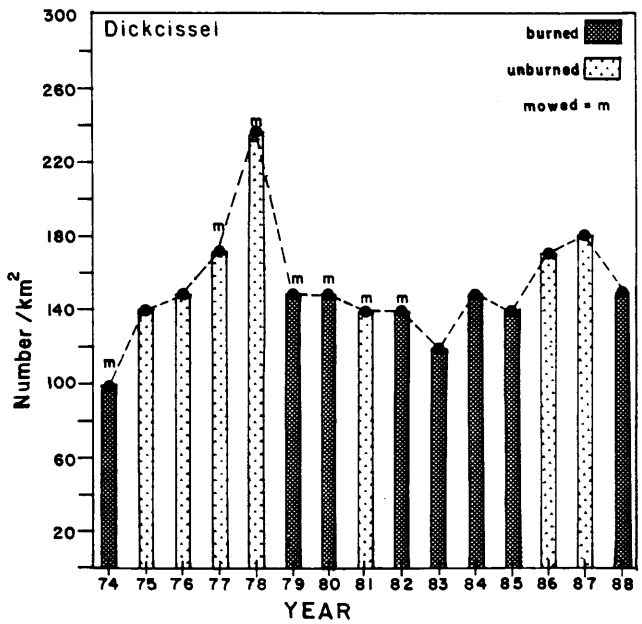

FIG. 3. Yearly pattern of mowed and unmowed prairie, and of burned and unburned prairie superimposed on the breeding densities of dickcissels at Baker Wetlands. Summer mowing occurred in July and spring burns occurred in April.

Table 3. Bird species and densities (number/km²) in adjoining floodplain tallgrass prairie and prairie-shrub succession. Data from adjoining 10.1 ha plots censused the same year.

Species	*Bird density*	
	Succession plot	*Mowed & Burned*
	number/km²	
Red-winged blackbird (*Agelaius phoeniceus*)	230	70
Dickcissel (*Spiza americana*)	210	140
Common yellowthroat (*Geothlypis trichas*)	180	50
Eastern meadowlark (*Sturnella magna*)	70	40
Bell's vireo (*Vireo bellii*)	85	0
Mourning dove (*Zenaida macroura*)	70	0
Yellow-billed Cuckoo (*Coccyzus americanus*)	60	0
Brown-headed Cowbird (*Molothrus ater*)	60	0
American goldfinch (*Carduelis tristis*)	50	0
Willow flycatcher (*Empidonax traillii*)	40	0
Yellow warbler (*Dendroica petechia*)	40	0
Orchard oriole (*Icterus spurius*)	40	0
Common grackle (*Quisculus quiscula*)	35	0
Black-billed cuckoo (*C. erythropthalmus*)	30	0
Brown thrasher (*Toxostoma rufum*)	30	0
Gray catbird (*Dumetella carolinensis*)	20	0
Northern bobwhite (*Colinus virginianus*)	15	0
Indigo bunting (*Passerina cyanea*)	10	0
American robin (*Turdus migratorius*)	5	0
Total number of species	19	4
Density of all species combined	1280	300

When years of spring burning were superimposed on the densities of dickcissels (Figure 3), a decrease in breeding bird densities occurred for that year, or densities were maintained at the same level as a previous year in which burning occurred. Spring burning produced an impact similar to mowing the previous year, namely removing standing vegetation. When stem density was lowered and potential song posts lost, the habitat suitability may have been lowered. Settlement on territories averaged two weeks later in years of burns. Less potential nesting cover was available and predation seemed to be higher. All these could have combined to lower the densities of nesting birds on this prairie. The pattern of burning and mowing was such that it was often difficult to separate the effects of the two on subsequent numbers of territorial males.

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