

FLOODPLAIN BIRDS OF WESTON BEND, MISSOURI RIVER

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The Weston Bend of the Missouri River lies 644 km upstream from St. Louis and is adjacent to Fort Leavenworth, Leavenworth Co., Kansas. Bird populations present on the floodplain at Fort Leavenworth were measured during 1973 and 1974 as part of a study of the terrestrial ecology of the Missouri River from Rulo, Nebraska to its mouth for the U.S. Army Corps of Engineers. This report summarizes the species diversities and densities recorded in summer and winter on census plots in pasture, cropland, oldfield, young forest, and mature hardwood forest. The oldfield, young forest and mature hardwood forest represent a typical successional series, while the cropland habitat, and to a lesser extent, the pasture, are common land uses in the floodplain of the river. Since the area is located on Fort Leavenworth, these seral habitats have been only moderately affected by cultural disturbances and provide a good example of the natural changes that occur in bird populations as a result of floodplain plant succession in eastern Kansas. Additionally, the area is of interest because it lies near the western fringe of the ranges of many bird species that are characteristic of the eastern deciduous forest.

METHODS AND DESCRIPTION OF THE VEGETATION

Trips were made to this site in the winter, summer, and fall from mid-February, 1973 to early January, 1974. Breeding bird populations in these 5 habitats were determined by marking the presence of territorial males on scale maps of the census areas on 31 May, 1-4 June, and 8-9 July, 1973. The number of visits to each habitat during this period varied with the difficulty in censusing; for example, 7 censuses were required in the mature hardwood forest, while only 3 were necessary in pasture and cropland. A preliminary reconnaissance was conducted on 17 February 1973, but winter populations were measured on the study plots during the period 7-9 January 1974 by walking transects through the habitats and recording the number of individuals of each species. In winter each habitat was censused twice.

The areas of the census plots are given in Table 1. All were relatively square except that in the mature hardwood forest, which was a long rectangle (152 m \times 1100 m).

The species diversity index (H') used is that of Shannon and Weaver (1949) and is given in units based on natural logarithms computed from the tables of Lloyd et al. (1968).

The mature hardwood forest has a canopy exceeding 20 m in height with hackberry (*Celtis occidentalis*) and elm (*Ulmus americana*) as dominant species. The understory is dominated by pawpaw (*Asimina triloba*), and coralberry (*Symphoricarpos orbiculatus*) is the most abundant shrub. Ground cover is largely tall nettle (*Urtica dioica*). Increment bores indicated that some trees in this stand were over 250 years old. The young forest is approximately 20 years old, and the co-dominants are pawpaw, cottonwood

TABLE 1
BREEDING-BIRD POPULATIONS OF THE LEAVENWORTH FLOODPLAIN

	Pasture	Cropland	Oldfield	Young forest	Mature hardwood forest
Size in hectares	8.0	14.0	20.2	10.4	16.7
Grasshopper Sparrow (<i>Ammodramus savannarum</i>)	(1) ¹ 0.12 ²				
Dickcissel (<i>Spiza americana</i>)	(11.5) 1.44	(11) 0.79	(24.5) 1.22		
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	(7) 0.87	(2) 0.14	(32) 1.59		
Eastern Meadowlark (<i>Sturnella magna</i>)	(4) 0.50	(0.5) 0.04	(6.5) 0.32		
Western Meadowlark (<i>Sturnella neglecta</i>)		(0.5) 0.04			
Horned Lark (<i>Eremophila alpestris</i>)		(2) 0.14			
Common Yellowthroat (<i>Geothlypis trichas</i>)		(3) 0.21	(62) 3.08	(16) 1.54	
Bobwhite (<i>Colinus virginianus</i>)		(1) 0.07	(1) 0.05	(1) 0.10	
Indigo Bunting (<i>Passerina cyanea</i>)		(1) 0.07	(1.5) 0.07	(8) 0.77	(5) 0.30
Brown-headed Cowbird (<i>Molothrus ater</i>)		X ³	X	X	X

¹ territorial males observed

² males/ha

³ cowbird densities not recorded

TABLE 1 (continued)

	Pasture	Cropland	Oldfield	Young forest	Mature hardwood forest
Short-billed Marsh Wren (<i>Cistothorus platensis</i>)			(2.5) 0.12		
American Woodcock (<i>Philohela minor</i>)			(1) 0.05		
American Goldfinch (<i>Spinus tristis</i>)			(1) 0.05	(3) 0.29	
Yellow-breasted Chat (<i>Icteria virens</i>)				(4) 0.39	
Gray Catbird (<i>Dumetella carolinensis</i>)				(1) 0.10	
Rose-breasted Grosbeak (<i>Phœucticus ludovicianus</i>)				(10) 0.96	(9) 0.54
Northern Oriole (<i>Icterus galbula</i>)				(9) 0.87	(8) 0.48
Rufous-sided Towhee (<i>Pipilo erythrophthalmus</i>)				(8) 0.77	(5) 0.30
Black-capped Chickadee (<i>Parus atricapillus</i>)				(5) 0.48	(6) 0.36
Common Flicker (<i>Colaptes auratus</i>)				(4) 0.39	(2) 0.12
Blue Jay (<i>Cyanocitta cristata</i>)				(4) 0.39	(4) 0.24
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)				(3) 0.29	(1) 0.06
Cardinal (<i>Cardinalis cardinalis</i>)				(3) 0.29	(10) 0.60

TABLE 1 (continued)

	Pasture	Cropland	Oldfield	Young forest	Mature hard-wood forest
Mourning Dove (<i>Zenaidura macroura</i>)				(1) 0.10	(2) 0.12
Downy Woodpecker (<i>Dendrocopos pubescens</i>)				(1) 0.10	(3) 0.18
Orchard Oriole (<i>Icterus spurius</i>)				(1) 0.10	(1) 0.06
Tufted Titmouse (<i>Parus bicolor</i>)				(0.5) 0.05	(6) 0.36
Red-bellied Woodpecker (<i>Centurus carolinus</i>)					(8) 0.48
Great-crested Flycatcher (<i>Myiarchus crinitus</i>)					(7) 0.42
Wood Thrush (<i>Hylocichla mustelina</i>)					(5.5) 0.33
Red-eyed Vireo (<i>Vireo olivaceus</i>)					(4.5) 0.27
Northern Parula (<i>Parula americana</i>)					(4) 0.24
Red-headed Woodpecker (<i>Melanerpes erythrocephalus</i>)					(3) 0.18
Hairy Woodpecker (<i>Dendrocopos villosus</i>)					(3) 0.18
Eastern Wood Pewee (<i>Contopus virens</i>)					(3) 0.18

TABLE 1 (continued)

	Pasture	Cropland	Oldfield	Young forest	Mature hard-wood forest
Scarlet Tanager (<i>Piranga olivacea</i>)					(3) 0.18
White-breasted Nuthatch (<i>Sitta carolinensis</i>)					(2) 0.12
Carolina Wren (<i>Thyrothorus ludovicianus</i>)					(2) 0.12
Acadian Flycatcher (<i>Empidonax virescens</i>)					(1) 0.06
Starling (<i>Sturnus vulgaris</i>)					(1) 0.06
Yellow-throated Vireo (<i>Vireo flavifrons</i>)					(1) 0.06
Yellow Warbler (<i>Dendroica petechia</i>)					(1) 0.06
Kentucky Warbler (<i>Oporornis formosus</i>)					(1) 0.06
Summer Tanager (<i>Piranga rubra</i>)					(1) 0.06
Total species	4	9	10	19	31
Males/ha	2.93	1.50	6.55	7.98	6.78
Species diversity (H')	1.14	1.53	1.40	2.54	3.16
Equitability (J')	0.83	0.70	0.61	0.86	0.92

(*Populus deltoides*), and walnut (*Juglans nigra*). Grass cover is present in open areas between the trees and is primarily muhly grass (*Muhlenbergia racemosa*), while the giant ragweed (*Ambrosia trifida*) is the most common forb. Woody species, mainly coralberry and elderberry (*Sambucus canadensis*) cover 22% of the oldfield. Grass is primarily *Bromus japonica* and sedges, and the most frequent forbs are giant ragweed, tall golden-rod (*Solidago altissima*) and the sunflower (*Helianthus* sp.). The pasture stand is almost entirely meadow fescue (*Festuca elatior*) and sweetclover (*Melilotus* sp.). About two-thirds of the cropland was planted in corn while the remaining portion had been planted in a cereal grain which had been overgrown by a mixture of oldfield grasses and forbs. A more detailed analysis of the vegetation is described by Tatschl and Bragg (1974).

RESULTS

Table 1 presents the data for the 5 habitats sampled during the breeding season, and Table 2 presents the winter populations on these same census plots. The Blue-gray Gnatcatcher (*Poliophtila caerulea*), White-eyed Vireo (*Vireo griseus*), Black and White Warbler (*Mniotilta varia*), Prothonotary Warbler (*Protonotaria citrea*), Louisiana Waterthrush (*Seiurus motacilla*), and American Redstart (*Setophaga ruticilla*) were territorial at low densities in other parts of the mature hardwood forest stand.

DISCUSSION

As with grassland communities in general, the species diversity in the floodplain pasture is low in the breeding season and even lower in the winter (Tables 1 and 2). Because of poor drainage, the pasture is actually a wet meadow. Although the species composition in summer is similar to that in upland pastures of tall grass prairie, in the floodplain the Dickcissel and the Red-winged Blackbird are more abundant, while the Eastern Meadowlark and Grasshopper Sparrow have lower densities. Just the opposite is to be expected on upland sites.

During the breeding season in the cropland, only the Horned Lark is restricted to the plowed area planted in corn. Although portions of the corn were included within the territories of Dickcissels, Red-winged Blackbirds, Eastern Meadowlarks and the Indigo Bunting, most of their activities were centered in the third of the field overgrown by annual weeds. Thus the cropland bird population is similar to that of the oldfield; the species diversity index (H') of the cropland (1.53) is close to that of the oldfield (1.40). In winter there is a greater difference in diversity. At this season the species diversity in the cropland is 0.85, while that of the oldfield is 1.98. This reflects the fact that since the vegetation of the cropland was primarily annuals and since the corn had been harvested, the habitat was more open and hence more climatically severe than the oldfield. Yet sufficient grain and weed seeds were available to support a surprisingly dense population of Eastern Meadowlarks.

TABLE 2
WINTER BIRD POPULATIONS OF THE LEAVENWORTH FLOODPLAIN

	Pasture	Cropland	Oldfield	Young forest	Mature hard-wood forest
Size in hectares	8.0	14.0	20.2	10.4	16.7
Eastern Meadowlark (<i>Sturnella magna</i>)	(1) ¹ 0.12 ²	(38)2.71			
Marsh Hawk (<i>Circus cyaneus</i>)	(1) 0.12	(1) 0.07	(3) 0.15		
Tree Sparrow (<i>Spizella arborea</i>)	(15)1.87	(6) 0.43	(24)1.19	(10)0.96	
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)		(1) 0.07	(9) 0.45		
Common Flicker (<i>Colaptes auratus</i>)		(1) 0.07	(1) 0.05	(1) 0.10	(3) 0.18
Song Sparrow (<i>Melospiza melodia</i>)		(1) 0.07	(14)0.70	(4) 0.39	(1) 0.06
Downy Woodpecker (<i>Dendrocopos pubescens</i>)		(1) 0.07			(13)0.78
Swamp Sparrow (<i>Melospiza georgiana</i>)			(13)0.64		
Pine Siskin (<i>Spinus pinus</i>)			(7) 0.35		
Short-eared Owl (<i>Asio flammeus</i>)			(3) 0.15		
Loggerhead Shrike (<i>Lanius ludovicianus</i>)			(1) 0.05		
American Goldfinch (<i>Spinus tristis</i>)			(33)1.64	(3) 0.29	(1) 0.06
Black-capped Chickadee (<i>Parus atricapillus</i>)			(2) 0.10	(12)1.16	(11)0.66
Cardinal (<i>Cardinalis cardinalis</i>)			(1) 0.05		(5) 0.30
Bobwhite (<i>Colinus virginianus</i>)				(1) 0.10	
Tufted Titmouse (<i>Parus bicolor</i>)				(3) 0.29	(5) 0.30
Dark-eyed Junco (<i>Junco hyemalis</i>)				(2) 0.19	(8) 0.48

¹ individuals observed² individuals/ha

TABLE 2 (continued)

	Pasture	Cropland	Oldfield	Young forest	Mature hard-wood forest
Red-bellied Woodpecker (<i>Centurus carolinus</i>)				(2) 0.19	(10)0.60
White-breasted Nuthatch (<i>Sitta carolinensis</i>)					(4) 0.24
Golden-crowned Kinglet (<i>Regulus satrapa</i>)					(3) 0.18
Red-headed Woodpecker (<i>Melanerpes erythrocephalus</i>)					(3) 0.18
Hairy Woodpecker (<i>Dendrocopos villosus</i>)					(2) 0.12
Blue Jay (<i>Cyanocitta cristata</i>)					(2) 0.12
Brown Creeper (<i>Certhia familiaris</i>)					(2) 0.12
White-throated Sparrow (<i>Zonotrichia albicollis</i>)					(1) 0.06
Total species	3	7	12	9	16
Individuals/ha	2.11	3.49	5.52	3.67	4.44
Species diversity (H')	0.44	0.85	1.98	1.85	2.48
Equitability (J')	0.40	0.44	0.80	0.84	0.89

As Margalef (1963) suggested and as Karr (1968) and Kricher (1972) have demonstrated, there is an increase in bird species diversity as communities are compared through the successional series to the climax community. Thus in the breeding season, the diversity index (H') is 1.40 for the oldfield, 2.54 for the young forest, and 3.16 for the mature hardwood forest. This increase is less pronounced in winter when the structural complexity of the vegetation is reduced through leaf fall and by the decrease in herbaceous cover and when the weather is more severe (1.98, 1.85, and 2.48 respectively). That the diversity of the oldfield is actually greater in winter than in the summer appears to be a function of the abundance of a winter seed supply on the oldfield that supports a large population of wintering fringillids in mixed-species flocks as well as raptors like the Marsh Hawk and Short-eared Owl that feed upon seed-eating rodents. Furthermore, several forest species, for example the Black-capped Chickadee and Cardinal, moved into the oldfield to exploit this food supply.

The Shannon-Weaver diversity index is a function of 2 factors: species richness and the distribution of individuals among the species, the equitability. We used the measure of equitability (J') calculated by dividing the species diversity for the community by the maximum species diversity possible (the natural logarithm of the number of species in the sample) (Pielou 1966). Two patterns in equitability are apparent in Tables 1 and 2. One is the decrease in equitability from summer to winter in the pasture and cropland communities, the more structurally simple ones and the ones that are more affected by seasonal change. Although absolute values for equitability during the winter are lower in the young forest and mature hardwood forest, the differences are slight. This is perhaps correlated with the fact that the overall seasonal change in general structural complexity from summer to winter of woody vegetation is much less than with the herbaceous vegetation dominating the pasture and cropland sites. Kricher (1972) and Tramer (1969) suggest that the higher summer values reflect the spacing of individuals through territoriality, while the lower winter values are related to the greater variability and more stressful conditions of the winter climate. The higher equitability value for the oldfield in winter is due to the similar densities of Tree Sparrows, Song Sparrows, Swamp Sparrows, and American Goldfinches that make up the mixed-species flocks using the habitat and the relative stability of flock composition, as Kricher (1972) suggested was the case in his winter, oak forest community. The other pattern is the increase in equitability with successional stage from oldfield to young forest to mature hardwood forest in both summer and winter. A similar trend was noted by Kricher (1972), and again, the lower equitability values may be related to the greater instability of the earlier seral stages. The observation by Emlen (1972) that low equitability was associated with disturbance of the habitat supports this suggestion.

Census data from climax floodplain forests in Illinois (Karr 1968) and Maryland (Criswell, et al. 1973 and previous years) provide for geographic comparisons with the Leavenworth site. The Rose-breasted Grosbeak, which was the second most abundant species at Leavenworth, did not occur in either the Illinois or Maryland censuses. Although the Kansas densities were low, the Orchard Oriole, Yellow Warbler, and Summer Tanager similarly were not present in the floodplain forest censuses further east. Other species show a higher density in Kansas than in the east. For example, the density of the Great Crested Flycatcher in Maryland for the last 10 years the census has been published is 0.33 males/ha and in Illinois it is 0.32 males/ha, while at Leavenworth the density is 0.42 males/ha. The Northern Oriole is missing from the Maryland avifauna, has a density of 0.15 males/ha in Illinois, but a density of 0.48 males/ha at Leavenworth. The major generalization that

can be seen in these data, however, is the decrease in species densities towards the west. The combined densities of the parids (*P. carolinensis* and *P. bicolor*) in Maryland is 1.2 males/ha (10-year average) and in Illinois it is 1.4 males/ha. At Leavenworth it is only 0.72 males/ha (*P. atricapillus* and *P. bicolor*). As should be expected, the decreasing trend is even more evident in typical eastern deciduous forest species. In Maryland the Red-eyed Vireo has a density of 1.7 males/ha (10-year average), in Illinois, 0.32 males/ha, and at Leavenworth only 0.27 males/ha. The Acadian Flycatcher drops from 1.4 males/ha in Maryland (10-year average) to 0.57 males/ha in Illinois to 0.06 males/ha at Leavenworth. The Northern Parula, Eastern Wood Pewee, Downy Woodpecker, and Starling generally show a similar pattern.

The number of species present in the mature floodplain forest is a little lower in Maryland (25 species, 10-year average) and similar in Illinois and Leavenworth (32 and 31 species respectively), but the decrease in density is quite definite from east to west. The 10-year average in the Maryland forest is 15.04 males/ha, while in Illinois the total density is 12.08 males/ha. At Leavenworth the density is only 6.76 males/ha.

SUMMARY

Bird populations were censused in both summer and winter in pasture, cropland, old-field, young forest, and mature hardwood forest habitats at Fort Leavenworth, Kansas on the floodplain of the Missouri River.

In both summer and winter, species diversity was lowest in the pasture, low in the cropland, and increased through the successional habitats to the mature hardwood forest. Equitability was higher in summer than in winter in the cropland and pasture habitats and increased with the successional stage.

A comparison with breeding-bird census data from mature floodplain forests in Maryland and Illinois revealed that species richness did not vary greatly with longitude, but that the density of territorial males decreased markedly from east to west. Although some species reached their highest densities in the Leavenworth forest, this trend in overall density reflects the general westward decrease of species characteristic of the eastern deciduous forest.

ACKNOWLEDGMENTS

This study was supported by contract No. DACW4173CO112 from the U.S. Army Corps of Engineers. Permission to conduct the research on Fort Leavenworth was granted through the courtesy of the Commander, Headquarters, Fort Leavenworth.

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NEW LIFE MEMBER



Professor Robert A. Whiting has recently become a life member of the Wilson Ornithological Society. Professor Whiting teaches Ornithology and Conservation of Natural Resources at Jackson Community College, Jackson, Michigan. He is the author of publications on wildlife photography and Michigan birds, including "Enjoying Birds in Michigan," which is now in its second edition. Professor Whiting has been very active in the Michigan Audubon Society for over 30 years. He has served as that society's president, as a member of its board, and he originated the Michigan Audubon Society endowment fund. Professor Whiting and his wife, Marie, enjoy bird-watching, canoeing, bird-photography, and traveling.