THE RESIDENT MAMMAL AND BIRD POPULATIONS OF A SAND PRAIRIE AND FOREST NEAR BATH, ILLINOIS

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ABSTRACT. — A unique sand prairie and scrub forest on the Wilkinson Farm, near Bath, Illinois, was studied in 1968 for an analyis and measurement of the vegetation and of the mammal and bird populations. The prairie was dominated by *Andropogon scoparius, A. furcatus, Stipa spartea, Koeleria cristata,* and *Panicum pseudopubescens.* The dominant trees were *Quercus marilandica, Q. velutina,* and *Carya ovalis.* The small mammals, *Peromyscus leucopus, P. maniculatus,* and *Microtus ochrogaster,* were about equally abundant in the prairie as in the forest, although only *P. leucopus* occurred in the forest. Only 17 bird species nested in the sand prairie and forest. The Field Sparrow, *Spizella pusilla,* and Lark Sparrow, *Chondestes grammacus,* were the most numerous species in the sand prairie and the Bobwhite, *Colinus virginianus,* and Tufted Titmouse, *Parus bicolor,* in the forest. Although the small mammal populations were considerably higher than the bird populations, population densities of both mammals and birds were very low compared with other non-sandy areas in Illinois.

During the spring and summer of 1968, an inventory was made of the vegetation and of the mammal and bird populations in the north half section of the Wilkinson Farm, recently acquired by the Illinois Department of Conservation for a possible future Nature Preserve. The Wilkinson Farm is located nine miles south of Havana, Illinois, between the towns of Bath and Kilbourne. This study is part of a research program at the University of Illinois designed to compare the productivity of a poor habitat with the characteristically highly fertile habitats occurring elsewhere in Illinois. The entire sandplain is about 14 miles, 22.5 kilometers, wide; 75 miles, 120.8 kilometers, long; and has a total area of about 179,200 acres, 72520 hectares, most of which is found in Mason County (Vestal, 1913). Previous studies on sand prairie in this vicinity have been done by Hart and Gleason (1907), Gleason (1910), and Vestal (1913).

The sand prairie is made up of bunch-grasses, numerous forbs, and blowsand openings.

Common grasses are:

Andropogon scoparius Michx., little bluestem
A. furcatus Muhl, big bluestem
Stipa spartea Trin., porcupine grass
Koeleria cristata (Linn.) June grass
Panicum pseudopubescens Nash, switch grass

Common forbs are:

Baptisia leucophaea Nutt.
Lithospermum croceum Fern.
Viola pedata L.
Coreopsis laceolata L.
Krigia virginica (L.) Willd.
Erigeron strigosus Muhl.
Rudbeckia hirta L.
Opuntia rafinesquii Engelm.
Commelina erecta L.
Oenothera rhombipetala Nutt.
Euphorbia corrollata L.
Asclepias tuberosa L.
A. verticillata L.

A. amplexicaulis Sm.
Fragaria virginiana Duch.
Specularia perfoliata (L.) A. DC.
Tephrosia virginiana (L.) Pers.
Potentilla simplex Michx.
Rosa carolina L.
Antennaria plantaginifolia (L.) Richards
Polygonatum biflorum (Walt.) Ell.
Smilacina stellata (L.) Desf.
Verbena stricta Vent.
Helianthemum canadense (L.) Michx.
Phlox bifida Beck
Penstemon pallidus Small
Myosotis verna Nutt.
Tradescantia canaliculata Raf.
Chrysopsis villosa (Pursh) Nutt.

The scrubby forest consists chiefly of blackjack oak, *Quercus marilandica* Muench (61% of stems 3 inches, 7.6 cm, or more in diameter, 50% of total basal area), black oak, *Q. velutina* Lam. (28%, 46%) and sweet pignut hickory, *Carya ovalis* (Wang.) (11%, 4%). The total number of trees per acre average 430, 1063 per hectare, and their total basal area, 9220 square inches, 59,484 square centimeters. These measurements are based on an analysis of eight equally spaced square plots, each 50 meters, 164 feet, on a side.

This study was submitted as a thesis for a Master of Science degree at the University of Illinois. I wish to thank Dr. S. Charles Kendeigh, my advisor, for aid in analyzing and presenting the data; James R. Karr, Roland Roth, and Charles Blem, graduate students, for helpful discussions; Dr. Donald F. Hoffmeister for assistance with mammal identifications; and Dr. Robert A. Evers for assistance with plant identifications.

Mammals

Mammal censuses were taken concurrently in the forest interior and on the sand prairie from 12 July to 19 July, 1968. Fitch (1950) live-traps were used and individuals captured were identified by toe-clipping and then released. The traps were placed in a circular grid pattern to maximize the area to circumference ratio and minimize the influx of animals from the outside. Each circular area contained 129 live-traps and covered 6.53 acres, 2.6 hectares. The traps were set at appropriate locations approximately 45 feet, 13.7 meters, apart. There was a total of 2064 trap nights.

Three species were taken in the sand prairie. Fourteen white-footed mice, *P. leucopus,* were taken a total of 30 times in the sand prairie; five deer mice, *P. maniculatus,* for a total of 20 times; and three prairie voles, *M. ochrogaster,* for a total of seven times. Male *P. leucopus* outnumbered the females ten to four.

Only one species, *P. leucopus,* was taken in the forest. Seventeen individuals were taken a total of 34 times, and again, there was a preponderance of males, ten to seven.

The locations of the captures were recorded and mapped. *P. maniculatus* individuals were more centrally located in the grassland, while *P. leucopus* captures were peripherally adjacent to the forest-edge. It appears likely that as trees continue to invade and replace the grasses, *P. maniculatus* will disappear.

Maximum distances between recaptures, which may provide some indication of the size of home ranges, average 68 feet, 20.7 meters, for *P. leucopus* in the sand prairie and 128 feet, 39.5 meters, in the forest-interior and for *P. maniculatus* in the sand prairie, 146 feet, 45 meters.

Four different methods were used for calculating population densities (Table 1). The calculation after Will (1962) divides the total number of individuals taken by the actual area trapped. The Blair (1941) calculation adds a buffer strip to the circumference of the trapping area equal to one-half the width of the average home range of the individuals captured more than once. This acreage is then divided into the number of individuals captured. The density determination after Stickel (1946, 1954) subtracts a buffer strip one-half the average maximum distance between traps in which individuals were captured four or more times during a 7-day (8 days in this study) trapping period. Animals taken in both the central area and buffer strip are counted, divided by two, and added to the number taken only in the central area, and the density is then calculated using the acreage of the central area. Blem (1968) considers the two outer rows of traps to make up a boundary strip. Those animals caught only in the boundary strip and obviously with the greater portion of their home range outside the grid are eliminated from the density calculation, while individuals caught in both the boundary strip and central portion of the grid are included although their home ranges may also extend outside the grid. The entire trapping area, including the boundary strip, is used in the density calculation. The population density was estimated by the Lincoln Index, grouping the first four days as marking days and the last four as recapture days.

Population densities calculated by these four methods show considerable discrepancy and there is no sure way of telling which is most reliable. Densities based on Will's methods are the highest as no correction is made for portions of home ranges extending outside the trapped area. However, there is very little agreement or consistent difference between densities calculated by the other three methods where corrections are attempted for peripheral animals. The averages of the four methods of calculating the densities give at least some idea of the relative abundance of the different species in the two areas. The total number of small mammals in the sand prairie, 244/-100 acres (40 hectares), is about the same as in the forest-interior, 256/-

TABLE 1. Small mammal population densities per 100 acres, 40 hectares.

Area	Species	Method of Calculation				Average
		Will	Blair	Stickel	Blem	
Sand	*P. leucopus*	214	104	65	214	149
Prairie	*P. maniculatus*	77	43	66	61	62
	M. ochrogaster	46	37	.....	15	33
Forest	*P. leucopus*	260	95	454	214	256

100 acres. The number of small mammals in the sand prairie is 1.6 times the number of birds; in the forest-interior, 8.5 times greater. Will (1962) found only 80/100 acres (40 hectares) *P. leucopus* in a deciduous forest of south-central Illinois. Blem (1968) obtained 260/100 acres (40 hectares) during July in upland deciduous forest in east-central Illinois. However, Kendeigh (personal communication) finds very much larger populations both in prairie and forest on the black soils of east-central Illinois. All three investigators also found the short-tailed shrew, *Blarina brevicauda* present, although it was absent on the sandy areas.

Besides the two species of *Peromyscus* and the prairie vole, other species observed in the general area include the eastern fox squirrel, *Sciurus niger;* red fox, *Vulpes fulva;* eastern cottontail, *Sylvilagus floridanus;* white-tailed deer, *Odocoileus virginianus;* and raccoon, *Procyon lotor.*

Birds

Bird censuses were taken in the grassland (50 acres, 20 hectares), on the forest-edge (57.5 acres, 23 hectares), and in the forest-interior (40 acres, 16 hectares). The grassland and forest-edge areas overlapped so broadly that their bird populations are listed together in Table 2. Mimeographed maps were prepared from aerial photograps. Bird activity was recorded on these maps after the method of Williams (1936), Ken-

Table 2. Breeding bird populations; number of pairs per 100 acres, 40 hectares. (+ indicates bird found in area, but accurate breeding population not determined)

Species	Grassland and Forest-Edge	Forest Interior
Field sparrow *(Spizella pusilla)*	31	2
Lark sparrow *(Chondestes grammacus)*	24	
Rufous-sided towhee *(Pipilo erythrophthalmus)*	5	
Mourning dove *(Zenaidura macroura)*	4	
Brown thrasher *(Toxostoma rufum)*	3	
Cardinal *(Richmondena cardinalis)*	3	
Summer tanager *(Piranga rubra)*	2	
Grasshopper sparrow *(Ammondramus savannarum)*	2	
Mockingbird *(Mimus polyglottos)*	1	
Bluejay *(Cyanocitta cristata)*	+	+
Bobwhite *(Colinus virginianus)*		8
Tufted titmouse *(Parus bicolor)*		8
Black-capped chickadee *(Parus atricapillus)*		4
Nighthawk *(Chordeiles minor)*		2
Whip-poor-will *(Caprimulgus vociferus)*		2
Downy woodpecker *(Dendrocopus pubescens)*		2
Crested flycatcher *(Myiarchus crinitus)*		2
Number of species	10	9
Number of pairs	75	30

deigh (1944), and Enemar (1959). Sixteen complete surveys were made between 17 March and 7 July, 1968. A total of 72 census hours were spent in the field. Composite maps were prepared for each species and the number of pairs per 100 acres, 40 hectares, calculated.

Bird life was quite scanty in all census areas (Table 2). The largest number of species and pairs occurred in the grassland and on the forest-edge. The field and lark sparrows were the most conspicuous and predominant species. The lark and grasshopper sparrows are the only typically grassland species in this group. In contrast, Blem (1968) totaled 528 pairs of breeding birds per 100 acres, 40 hectares, in a deciduous forest along the Sangamon River near Mahomet, Illinois and Karr (1968) obtained populations of 329 to 489 pairs per 100 acres, 40 hectares, in shrub and forest vegetation in east-central Illinois. While the sand prairie and scrub forest areas have an abundance of such insect food as grasshoppers, the lack of water, thickets, and diversified vegetation appear to exclude many species.

The most distinctive bird species of this sandy habitat, the lark sparrow, has not generally been considered a common nesting species in Illinois (Johnson 1968). However, its restriction and prevalence in sandy areas over the state has been known for some time (Eifrig 1913, Vestal 1913). This is the first quantitative study of the species or of the bird population in general on this type of terrain in Illinois. Large numbers of blue jays occurred in the area and doubtlessly some nested. Sixteen birds were counted on 6 May but evidence is accumulating that many birds at this time of the year are daytime transients moving northward. Other species were seen occasionally during the summer but they nested off the area.

Summary

1. Sand prairie and scrub forest on the Wilkinson Farm, near Bath, Illinois, were studied in the spring and summer of 1968 with respect to composition and density of the vegetation and mammal and bird populations.

2. The dominant grasses are *Andropogon scoparius, A. furcatus, Stipa spartea, Koeleria cristata,* and *Panicum pseudopubescens.* The dominant trees are *Quercus marilandica* (61% total stems, 50% total basal area), *Q. velutina* (28%, 46%), and *Carya ovalis* (11%, 4%).

3. *P. leucopus* is the most numerous mammal species and is more abundant in the forest than on the prairie. *P. maniculatus* is more numerous than *Microtus ochrogaster,* and both species are largely restricted to the prairie. Mammals are more numerous than birds.

4. Maximum distances between recaptures of marked individual mammals, which may provide some indication of the size of home ranges, average 68 feet, 20.7 meters, for *Peromyscus leucopus* in the sand prairie and 128 feet, 39.5 meters, in the forest-interior and for *P. maniculatus* in the sand prairie, 146 feet, 45 meters.

5. Only 17 bird species were found nesting with populations of about 75 pairs per 100 acres, 40 hec-

tares, in the sand prairie and forest-edge and 30 pairs per 100 acres, 40 hectares, in the forest. The lark and field sparrows were the predominant species. These population densities are very low compared with other areas in central Illinois.

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Manuscript received September 16, 1969