

BIRD POPULATION OF AN ILLINOIS FLOODPLAIN FOREST

BEN J. FAWVER

University of Illinois, Urbana

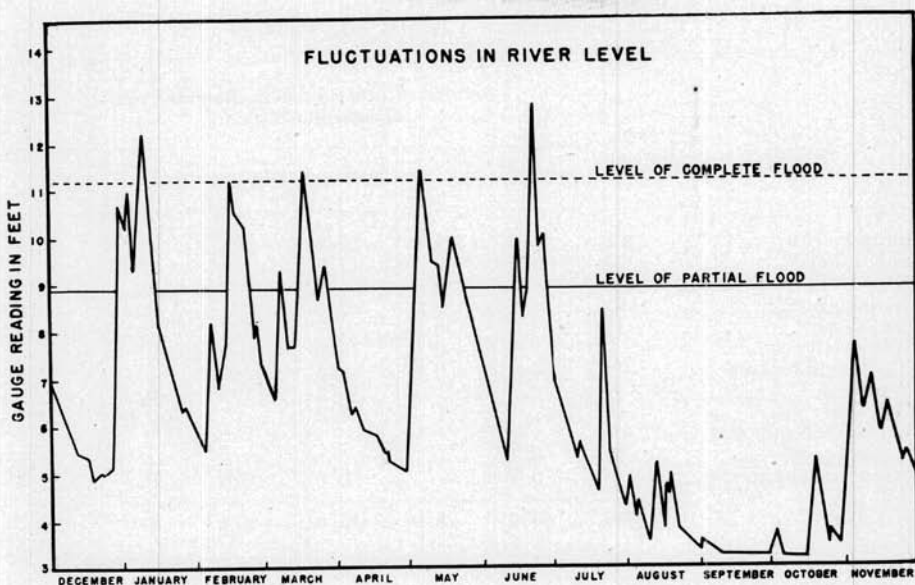
In recent years there has been considerable interest shown in the measurement of animal populations within ecological communities. Such quantitative information is of great service in evaluation of the importance of species within the community and of their habitat requirements. Forbes and Gross (1922) were among the first in this country to determine the bird population of various communities. In 1937, the National Audubon Society began an annual breeding bird census which has stimulated considerable work in this field. Kendeigh (1944) has summarized the history and discussed methods of bird censusing in a recent paper. With the usefulness of some of these newly developed techniques in mind, the floodplain forest was selected as an interesting community for investigation since its distinctive nature had been shown by Shelford (1913).

This paper is based on a study of the birds of a portion of the floodplain of the Sangamon River from March 10, 1946 to March 1, 1947. The area studied is one mile northwest of White Heath, Piatt County, Illinois and about fourteen miles due west of Champaign, Illinois. It lies in Sections 16 and 21 of Township 19 north, Range 6 east. An area of approximately fifty acres was selected for study and some observations were made for comparison over a mile length of the forested floodplain.

The area of study was ungrazed and evidently had not been cut over to any extent. The topography is nearly flat with elevations varying only about six feet. The numerous oxbows and sloughs which are filled with water most of the year account for this variation. According to the Monticello quadrangle of the U. S. Geological Survey, this section of the floodplain lies about 645 feet above sea-level. Since the floodplain is subject to frequent flooding the duff of the forest floor is scanty.

One of the outstanding factors of the physical environment of the floodplain is the periodic floods. The repeated occurrence of flooding is shown in the following graph. Gauge level data were obtained from the Urbana office of the Water Resources Branch, Geological Survey, U. S. Department of Interior. These gauge readings were taken at Monticello, Illinois, five miles downstream from the area of study. Flood levels were determined by observation of the dates of flooding of the study area. Frequently, river levels were high enough to flood only about half of this area and less often, the tract was totally flooded. This is shown in the graph by horizontal lines at these two levels. From December 1, 1945 to December 1, 1946, the area was totally flooded 15 days and partially flooded 28 days.

It is apparent from these data that the floodplain is a very moist environment. It is interesting to note



that the maximum river level was reached in the third week of June, a time of high nesting activity. Even during the periods of lowest water levels, some of the sloughs contained water and most of the year they all contained some water.

This floodplain forest is characterized by many small openings produced by fallen trees. The number of fallen dead trees, which produce dead stubs and openings in the canopy, is large. The frequent floods also kill much herbaceous growth and large areas are denuded of herbs because of standing water. Such bare portions represented roughly ten to fifteen percent of the area studied.

The composition of the tree canopy was determined by making four transects. Three transects were 3 meters wide and one was 6 meters wide, with the total length equaling 1127 meters. This amounted to 1.3 acres or 2.6 percent of the area. Al-

though this is a rather inadequate sample, it is probably generally indicative. Measurements of the diameter of tree trunks over 2.5 inches were made at breast height with tree calipers. Table 1 shows the data obtained.

Climbing plants constitute a considerable part of the plant structure, both in species and in numbers (tables 3 and 4). These climbers make dense tangles in trees and shrubs as well as in the fallen trees. In openings in the canopy, giant ragweed grow up among the shrubs. Wood nettle is probably the most abundant species of herb in the shaded portions of the area.

Slippery elm and silver maple are the principal dominants of the floodplain (table 1). In drier portions the ironwood, yellowbud hickory, and bur oak form a prominent part of the canopy. Green ash, although not so numerous, forms a conspicuous part of the canopy because of

TABLE 1.—TREES IN VARIOUS SIZE CLASSES

Species	Trees per acre	Percent of individuals in diameter class (Diameter in inches)					Total
		2.5-6	6.1-12	12.1-18	18.1-24	24.0—	
Slippery elm.....	108	19.4	15.6	7.8	1.6	0.9	45.3
Silver maple.....	35	4.5	7.1	1.9	.....	1.0	14.5
Hackberry.....	28	9.7	1.6	.....	0.3	.....	11.6
Green ash.....	21	1.9	2.9	3.5	.....	0.3	8.6
Hawthorn.....	12	4.2	0.6	.....	.....	.....	4.8
Ironwood.....	9	2.9	0.6	0.6	0.3	.....	4.4
Yellowbud hickory...	4	0.6	0.6	0.3	.....	.....	1.5
Sycamore.....	2	.....	.....	0.3	.....	0.6	0.9
Bur oak.....	2	.....	.....	0.3	.....	0.6	0.9
Lianas (Grape and poison ivy).....	12	5.1	.....	.....	.....	.....	5.1
Miscellaneous species.	3	0.7	.....	0.6	0.6	0.6	2.5
Total.....	236	49.0	28.9	15.3	2.8	4.0	

TABLE 2.—BREEDING BIRD POPULATION

Species	Number of pairs in the area	Density—number of pairs per 100 acres
Cardinal.....	9	14
Red-eyed vireo.....	7	12
American redstart.....	6	12
Indigo bunting.....	9	12
Wood pewee.....	7	12
Black-capped chickadee.....	5	10
Crested flycatcher.....	5	10
Downy woodpecker.....	5	10
Wood thrush.....	4	8
Yellow-billed cuckoo.....	4	8
Red-bellied woodpecker.....	4	6
Acadian flycatcher.....	2	4
Tufted titmouse.....	2	4
Barred owl.....	1	2
Ruby-throated hummingbird.....	1	2
Hairy woodpecker.....	1	2
Phoebe.....	1	2
White-breasted nuthatch.....	1	2
Carolina wren.....	1	2
Eastern bluebird.....	1	2
Prothonotary warbler.....	2	2
Cerulean warbler.....	1	2
Scarlet tanager.....	1	2
Cowbird.....	present	present
Crow.....	2	2
Blue jay.....	present	present
Total.....	83	144

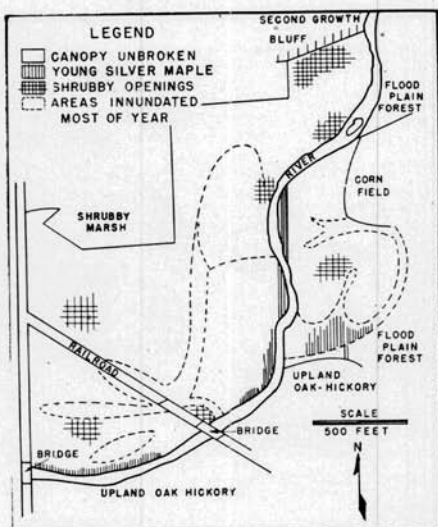


MAP 1.—Aerial photograph.

the large size attained by individuals. Sycamores, however, are the tallest and the largest trees in the forest, growing to a height of about a hundred feet. Hawthorn and hackberry form an important part of the high shrub stratum.

The lateral cutting of the river produces areas of deposition on the inside of curves of the streams and causes numerous changes of course of the stream with accompanying oxbows. These areas of recent deposition are characteristically covered by sapling maples (map 3) in nearly pure stands.

The methods of study were those used by Williams (1936). This consisted of marking the location of each bird seen on a previously mimeographed map of the area. Notes on bird behavior, climatic conditions, vegetation, river levels, and other pertinent information were recorded. Visits were made on the average of once a week. A composite map for each species was then made, as shown in the accompanying

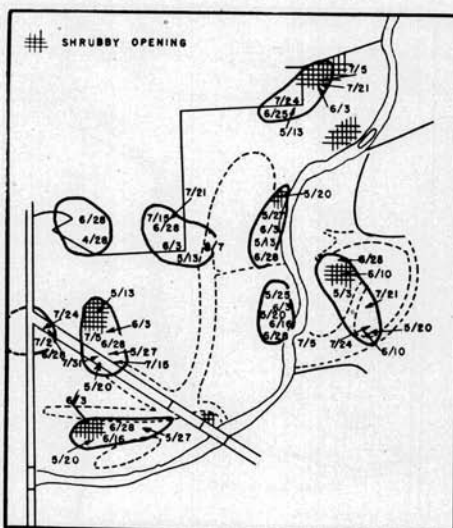


MAP 2.—Outline map of area.

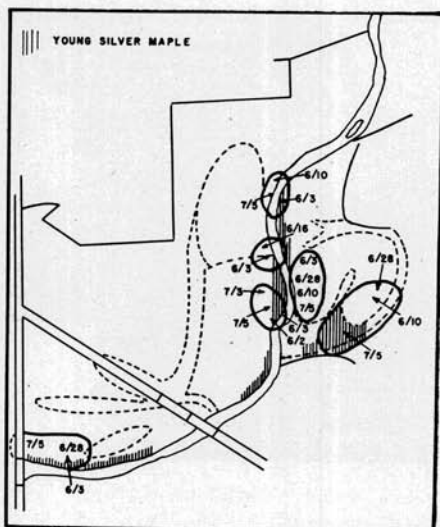
maps. Nesting territories can thus be estimated from them.

The species composition, as well as the total numbers of birds varied from season to season (table 6). The breeding population density is shown in table 2, the density being calculated on the basis of pairs per one hundred acres. When the territory of a given pair extended beyond the limits of the study area, it was assigned a value of a fraction of a pair, depending upon the relative amount of use of the territory that extended into the area. This method explains the apparent discrepancy of calculation in the table. For example, there were nine pairs of indigo buntings in the area, but only five had territories wholly in the area (map 3). Hence, the four portions of territories were assigned a value of one pair and the calculated density per hundred acres was twelve pairs.

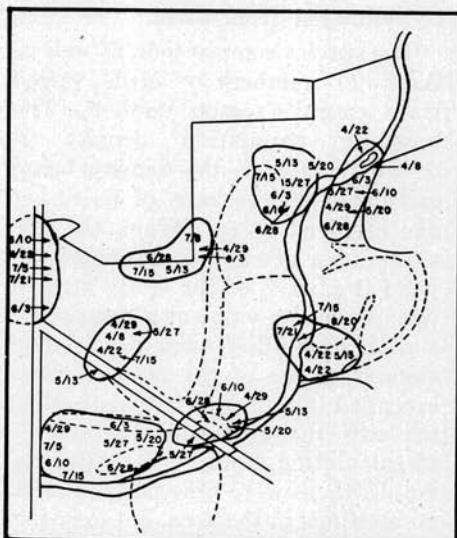
The density of 144 breeding pairs



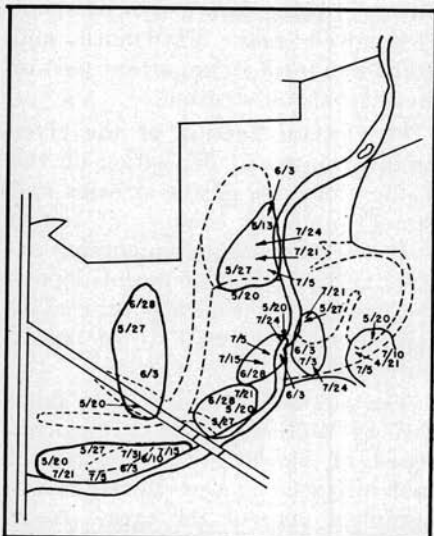
MAP 3.—Territories of Indigo buntings in relation to openings and edge.



MAP 4.—Territories of Redstarts in relation to stands of young silver maple.



MAP 5.—Territories of Cardinals.

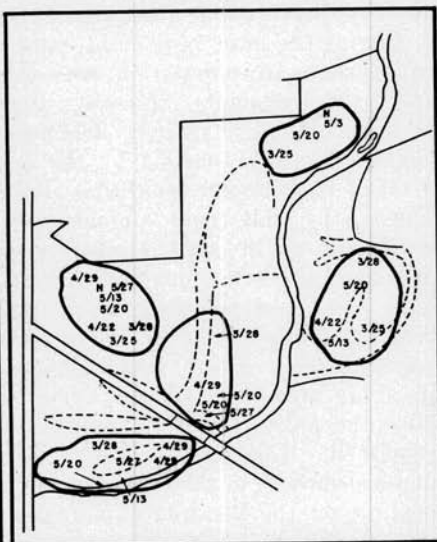
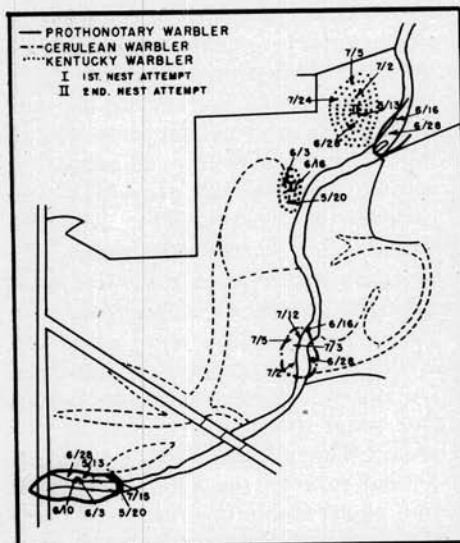
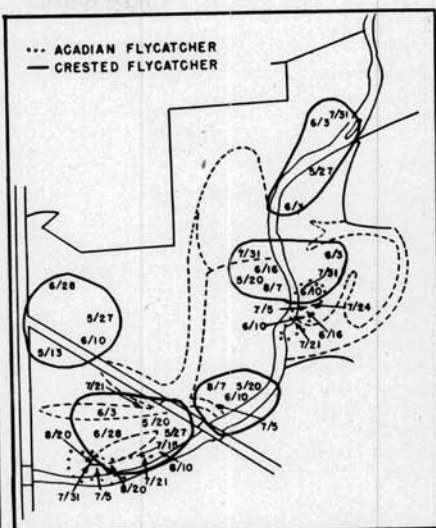
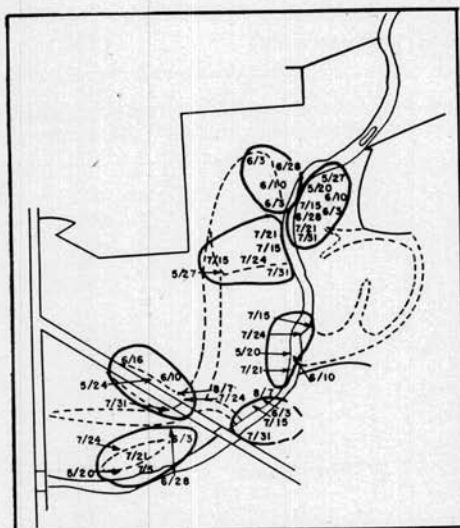


MAP 6.—Territories of Red-eyed Vireos.

per hundred acres compares favorably with that found by Williams (1937) and Deutschlander (1941) in an Ohio floodplain forest. They

found 130 and 128 pairs per hundred acres, respectively.

Although quantitative data are insufficient to present here, it was



apparent that fluctuations in numbers occurred similar to those found by Williams (1936) and Twomey (1945). Permanent residents seemed

to remain fairly constant in numbers during most of the year except immediately after the nesting season, when the young birds swelled the

TABLE 3.—WINTER POPULATION
(On the basis of four visits to area)

Species	Average number individuals in area	Individuals per 100 acres
Black-capped chickadee.....	17	34
Tufted titmouse.....	14	28
Cardinal.....	7	14
Downy woodpecker.....	4	8
White-breasted nuthatch.....	3	6
Carolina wren.....	3	6
Flicker.....	2	4
Hairy woodpecker.....	2	4
Red-bellied woodpecker.....	2	4
Barred owl.....	2	2
Purple finch.....	2	4
Blue jay.....	1	2
Brown creeper.....	1	2
Crow.....	Fluctuating	
Total.....	60	118

population for a period of sixty to seventy days during June and July.

One of the most important causes of increase in population was the influx of transients migrating further northward in spring. The population was also swelled by the arrival of the summer residents. It is noteworthy that these summer residents arrived in large numbers and only part of them remained to nest. This was characteristic of such species as indigo bunting, Kentucky warbler, and redstart, which arrived in a big wave the second week in May and only part of their number remained. Likewise, summer residents elsewhere in the region but not nesting on the floodplain increased this spring peak. Such species as the yellow-throat, catbird, and mourning dove were found in the area during the migration period only.

At the end of the nesting period there was a rapid decrease in the size of the bird population, rather

than an increase that might have been expected. Such species as the prothonotary warbler and indigo bunting disappeared entirely from the area. It is interesting to note that in this same period there was an influx from elsewhere of immature robins, rose-breasted grosbeaks, and catbirds in large numbers. All these species fed voraciously upon the ripening wild grapes in the tree tops. Bronzed grackles, apparently the young of the year, were also seen feeding on the ground in the area. During this time wandering herons and wood ducks were found in the area. The addition of these birds tended to keep the summer population about stable in numbers despite the egress of the nesting residents.

With the coming of autumn, transients and the arrival of winter visitors again swelled the population to a second high peak. By the last of November, the transients and summer residents had left and only the winter visitors and permanent resi-

TABLE 4.—PERCENTAGES OF NESTING PAIRS OCCUPYING DIFFERENT LAYERS IN THREE COMMUNITIES

Type of forest.....	Beech-maple ¹	Elm-maple ²	Floodplain ³
Locality.....	Ohio	Illinois	Illinois
<i>Layer</i>			
Ground.....	10.1	2.3	1.3
Tree cavity.....	15.1	43.6	35.1
Tree canopy.....	29.4	17.3	16.4
Shrub.....	45.9	46.8	47.2

¹ Williams, 1936 (4 year average).² Kendeigh, 1944 (11 year average).³ Present study.

TABLE 5.—SIZE OF NESTING TERRITORIES

Species	Number of territories measured	Average observed (Size in acres)	Maximum acreage available per pair
Cardinal.....	7	2.7	7.1
Red-eyed vireo.....	6	3.1	8.0
American redstart.....	6	1.4	7.7
Indigo bunting.....	6	2.2	7.5
Wood pewee.....	6	2.9	8.0
Black-capped chickadee....	5	2.1	10.0
Crested flycatcher.....	5	3.1	10.0
Downy woodpecker.....	5	4.7	10.0
Yellow-billed cuckoo.....	3	2.5	12.5
Wood thrush.....	2	4.7	....
Red-bellied woodpecker....	3	6.1	17.0
Tufted titmouse.....	2	4.0	....
Acadian flycatcher.....	2	1.7	....
Kentucky warbler.....	2	1.1	....
Prothonotary warbler.....	1	1.6	....
Cerulean warbler.....	1	1.3	....
Bluebird.....	1	3.5	....
Carolina wren.....	1	7.5	....
White-breasted nuthatch..	1	5.7	....
Phoebe.....	1	0.7	....
Barred owl.....	1	40.0	....

dents remained. The winter visitors to the floodplain are small in numbers and species, as shown in table 3.

An outstanding and obvious influence of the river is affected through its repeated inundation of the floodplain. The first nesting attempt of one pair of Kentucky warblers was flooded out (map 9). It is noteworthy that the season of highest flood, both for the year of study and

also for the previous year, occurred in June when most species of birds were nesting. Only 1.2 percent of the population are ground-nesting birds (table 4). This is low compared with upland communities and is probably a result of flooding. The oven-bird, one of the most abundant nesting species of the deciduous forest (Kendeigh, 1944), is conspicuously absent from the breeding pop-

ulation of the floodplain forest. Since this species nests on the ground, flooding doubtless prevents its nesting in this community; why nesting attempts are not made is open to speculation. The small layer of duff on the forest floor and the wet soil may be factors.

The indigo bunting was the only other low nesting species that could have been affected by floods. Dam-bach and Good (1940) found that indigo buntings were the only herb-shrub nesting species in a grazed woodland; grazing would have the same effect as flooding on ground-nesting species.

The flycatchers exhibited a decided preference for the forest edge along the river (maps 7 and 8). Gates (1911) also found this in a study of birds in a floodplain forest near Havana, Illinois. Since the river offers an open expanse of air for feeding, bordered by perches of various heights, such a situation is an ideal habitat for this group. Apparently it is the sharp transition from forest to open without gradual decrease in tree and shrub height that is important since the railroad offered a similar habitat niche and was utilized in a similar manner. The road also provided a suitable situation for at least one pair of wood pewees just outside the area of study. This theory is further substantiated by the fact that the flycatchers did not utilize the field and marsh edges which were characterized by a gradual transition in height from tree, shrub, to open area.

The importance of the river as a barrier was entirely negative. The width of the river is only about

thirty feet, and, consequently, is not wide enough to be an obstacle to birds. Such species as the cardinal, cerulean warbler, and wood pewee defended territories that extended on both sides of the river. Birds were seen crossing the river at all seasons and often. The boundaries of some territories coincided with the river, but this was probably a response to the forest edge along the stream as a habitat niche rather than a barrier as the same species frequently used both sides of the river in one territory. Such species as the cardinal and wood pewee exhibited this behavior (maps 5 and 7).

The river and oxbows offered a supply of food to the kingfishers and herons. A kingfisher evidently nested in a river bank about 100 yards upstream from the area and fed regularly in the area along the river. Great blue herons, green herons, and black-crowned night herons fed in the tract all during the months of July and August. One immature black-crowned night heron spent several days in the vicinity of a drying slough, feeding on trapped minnows there.

During July and August the river was used as a watering and bathing site by the large influx of robins and rose-breasted grosbeaks, and it was doubtlessly important to other species as a source of water.

The forest edge along the river is the characteristic habitat of the prothonotary warbler. In central Illinois this species is confined to the larger stream valleys (Loucks, 1895).

The close relation of nesting indigo buntings to edge has been shown by Kendeigh (1944). A

TABLE 6.—BIRDS OF THE AREA—SEASONAL GROUPS

Permanent Residents

Barred owl, *Strix varia*
Red-bellied woodpecker, *Centurus carolinus*
Hairy woodpecker, *Dryobates villosus*
Downy woodpecker, *Dryobates pubescens*
Blue jay, *Cyanocitta cristata*
Crow, *Corvus brachyrhynchos*
Black-capped chickadee, *Parus atricapillus*
Tufted titmouse, *Parus bicolor*
White-breasted nuthatch, *Sitta carolinensis*
Carolina wren, *Thryothorus ludovicianus*
Cardinal, *Richmondia cardinalis*

Summer Residents

Red-shouldered hawk, *Buteo lineatus*
Yellow-billed cuckoo, *Coccyzus americanus*
Ruby-throated hummingbird, *Archilochus colubris*
Belted kingfisher, *Megasceryle alcyon*
Crested flycatcher, *Myiarchus crinitus*
Eastern phoebe, *Sayornis phoebe*
Acadian flycatcher, *Empidonax virescens*
Eastern wood pewee, *Myiochanes virens*
Wood thrush, *Hylocichla mustelina*
Red-eyed vireo, *Vireo olivaceus*
Prothonotary warbler, *Protonotaria citrea*
Cerulean warbler, *Dendroica cerulea*
Kentucky warbler, *Oporornis formosus*
American redstart, *Setophaga ruticilla*
Cowbird, *Molothrus ater*
Scarlet tanager, *Piranga olivacea*
Indigo bunting, *Passerina cyanea*

Autumn and Winter Visitors

Flicker, *Colaptes auratus*
Brown creeper, *Certhia familiaris*
Slate-colored junco, *Junco hyemalis*
Tree sparrow, *Spizella arborea*
Purple finch, *Carpodacus purpureus*

Transients (Autumn and Spring)

Whip-poor-will, *Caprimulgus vociferus*
Yellow-bellied sapsucker, *Sphyrapicus varius*
Olive-sided flycatcher, *Nuttallornis borealis*
Red-breasted nuthatch, *Sitta canadensis*

Permanent Residents

Winter wren, *Troglodytes troglodytes*
Hermit thrush, *Hylocichla guttata*
Olive-backed thrush, *Hylocichla ustulata*
Gray-cheeked thrush, *Hylocichla minima*
Golden-crowned kinglet, *Regulus satrapa*
Ruby-crowned kinglet, *Regulus calendula*
Warbling vireo, *Vireo gilvus*
Black and white warbler, *Mniotilta varia*
Golden-winged warbler, *Vermivora chrysoptera*
Magnolia warbler, *Dendroica magnolia*
Myrtle warbler, *Dendroica coronata*
Black-throated green warbler, *Dendroica virens*
Chestnut-sided warbler, *Dendroica pennsylvanica*
Palm warbler, *Dendroica palmarum*
Oven-bird, *Seiurus aurocapillus*
Canada warbler, *Wilsonia canadensis*
Rusty blackbird, *Euphagus carolinus*
White-throated sparrow, *Zonotrichia albicollis*
Fox sparrow, *Passerella iliaca*

Occasional Visitors

Great blue heron, *Ardea herodias*
Green heron, *Butorides virescens*
Black-crowned night heron, *Nycticorax nycticorax*
Wood duck, *Aix sponsa*
Turkey vulture, *Cathartes aura*
Cooper's hawk, *Accipiter cooperi*
Red-tailed hawk, *Buteo jamaicensis*
Bob-white, *Colinus virginianus*
Coot, *Fulica americana*
Mourning dove, *Zenaidura macroura*
Red-headed woodpecker, *Melanerpes erythrocephalus*
House wren, *Troglodytes aedon*
Catbird, *Dumetella carolinensis*
Brown thrasher, *Toxostoma rufum*
Robin, *Turdus migratorius*
Cedar waxwing, *Bombicilla cedrorum*
Starling, *Sturnus vulgaris*
Yellow-throated vireo, *Vireo flavifrons*
Water thrush, *Seiurus noveboracensis*
Yellow-throat, *Geothlypis trichas*
Bronzed grackle, *Quiscalus versicolor*
Rose-breasted grosbeak, *Pheucticus ludovicianus*
Goldfinch, *Spinus tristis*
Towhee, *Pipilo erythrophthalmus*

similar relation was noted on the floodplain both along the river and also in openings of the forest canopy (map 3). This species prefers shrubby openings for nesting and high posts for singing.

The redstart seemed to exhibit strong tendencies to establish territories in young silver maple stands along the river (map 4). Probably any second growth deciduous trees would have been used either in stands or in edge such as described. Six of the nine pairs of cardinals in the study area used the forest edge made by the river (map 5).

There was a high percentage of shrub nesting species on the floodplain (table 4.). The number of pairs nesting in tree cavities was high and may be the result of large numbers of decaying and hollow trees. The percentage of species frequenting the tree canopy is correlated with the broken and relatively small extent of this layer. The edge effect of the river has been mentioned previously, and this effect is reflected in the fact that 20.2 percent of the breeding population was edge nesting species. Part of these species also nested in openings in the forest and on the edges produced by the field and marsh.

Another factor of importance to population density is that of competition. It seems probable that the strong competition for territory among cardinals was a limiting factor and indicated that this area was becoming saturated with this species. The minimum size to which the territory could be compressed would be of great importance here. The small size of cardinal territories is shown in table 5. Conflict for nesting ter-

ritory was noted frequently between individuals of such species as cardinals and wood pewees.

An interesting question is raised concerning the competition between species. In several cases, territories of species closely related ecologically and taxonomically overlapped without visible conflict. Such is the case of the wood pewee, crested flycatcher, and Acadian flycatcher (maps 9 and 10). This lack of conflict might be partially explained by the fact that the crested flycatcher occupied the high tree top canopy, while the wood pewee and the Acadian flycatcher stayed in the lower branches of the trees. This segregation to different layers cannot be offered in explanation of the territorial overlaps between downy, hairy and red-bellied woodpeckers which also occurred in the floodplain forest.

Conflict between species did occur, however. This conflict was observed between the red-eyed vireo and the Kentucky warbler and between the wood pewee and the black-capped chickadee. A study of one breeding season, such as this one, only makes such a problem apparent. Further study of such factors would answer many problems in ecology.

The writer wishes to express his appreciation to S. Charles Kendeigh for aid and advice in preparation of this paper.

LITERATURE CITED

- DAMBACH, C. A. AND E. E. GOOD, 1940. The effect of certain land use practices on populations of breeding birds in Southwestern Ohio. *Journal of Wildlife Management*, 4: 63-76.
- DEUTSCHLANDER, G., 1941. Audubon breeding bird census, 28. Northern Ohio floodplain forest. *Audubon Magazine*, 43: 494-495.

- FORBES, S. A. AND A. GROSS, 1922. The numbers and local distribution in summer of Illinois land birds of the open country. *Bulletin of the Illinois Natural History Survey*, 14:187-218.
- GATES, F. C., 1911. Summer bird life in the vicinity of Havana, Illinois in its relation to prominent plant associations. *Wilson Bulletin*, 23:1-27.
- KENDEIGH, S. C., 1944. Measurement of bird populations. *Ecological Monographs*, 14:67-106.
- LOUCKS, W. E., 1895. The life history and distribution of the prothonotary warbler in Illinois. *Bulletin of the Illinois State Laboratory of Natural History*, 4:10-35.
- SHELFORD, V. E., 1913. Animal Communities of Temperate America. Chicago. pp. 197-203.
- TWOMEY, A. C., 1945. The bird population of an elm-maple forest with special reference to aspection, territorialism, and coaction. *Ecological Monographs*, 15:173-205.
- WILLIAMS, A. B., 1936. The Composition and dynamics of a beech-maple climax community. *Ecological Monographs*, 6:317-408.
- , 1936. Audubon breeding bird census. Floodplain forest. *Bird Lore*, 39:382-383.