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AVIAN POPULATIONS OF THE FUNK FOREST NATURAL AREA IN McLEAN COUNTY, ILLINOIS

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Introduction

The purpose of this investigation was to make a detailed study of the bird population of the Funk Forest Natural Area. This paper represents a portion of the Master's Thesis (Calef, 1953a) completed under the supervision of Dr. S. C. Kendeigh. The study area is a remnant of a stream-belt type of maple-elm deciduous forest in east-central Illinois, about fifteen miles southwest of Bloomington, between the towns of Funks Grove and McLean (fig. 1). It is off U. S. Highway 66 in the southeast corner of Section 19, Funk's Grove Township, McLean County. The tract is about 2625 feet long and 1039 feet wide, an area of approximately 63 acres.

Data and detailed discussions on physical environment, local climate, and vegetation are given in Calef (1953b).

Methods

This study began February 25, 1950, and ended November 1, 1951. Field trips were made biweekly in spring and summer seasons, weekly in autumn, and bimonthly in winter. The study area was divided into 50-meter square quadrats using a coordinate system (fig. 2).

Measurement of the bird population was based upon 82 censuses

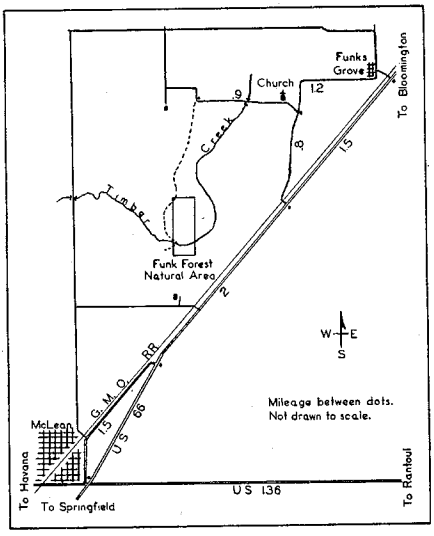

Fig. 1.—Map of the location of the Funk Forest Natural Area.

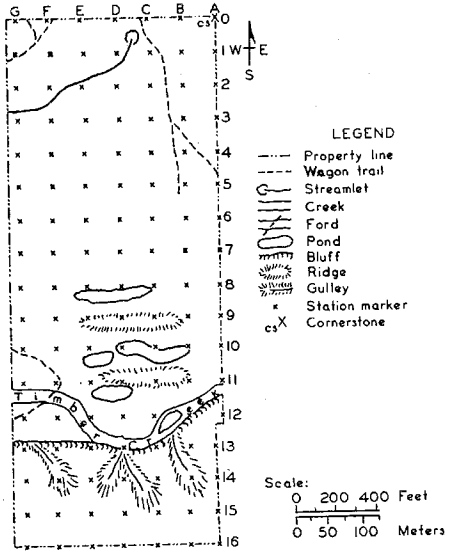

Fig. 2.—Field map of the study area.

made during the period from March 4, 1950, through July 6, 1951. Only 67 census records were satisfactory. The spot-map method (Kendeigh, 1944) was used in conjunction with census-taking routes systematically arranged to provide varied approaches into breeding territories. Territories were determined from the position of the song posts for singing males. Confirmations were based upon location of nest sites, defense zones, mated pairs, and incidence of records about loci of activity.

Avian Population

A total of 94 species of birds in 72 genera and 28 families were recorded during 1950 and 1951 (table 1). The nomenclature is based upon that given in the A. O. U. Checklist (1931). Detailed species accounts are given in Calef (1953a). Breeding population densities were 179.3 pairs per 100 acres in 1950 and 136.5 pairs per 100 acres in 1951 (table 3). In 1950, four species, namely, alder flycatcher, Baltimore oriole, yellow-throated vireo and red-eyed towhee, were present that were not recorded in 1951. In 1951, nine additional species, namely, turkey vulture, bob-white quail, solitary sandpiper, whip-poor-will, veery, Tennessee warbler, red-winged blackbird, rusty blackbird and bronzed grackle, were present that were not recorded in 1950.

Residential Status

The residential status for each species is noted in table 1 and a summary is given in table 2. The breeding population, comprised of permanent residents and summer residents, accounted for about one-third of the total number of recorded species. Migratory transients, birds which passed through the area but did not remain to breed, accounted for another one-third. One-third was composed of occasional visitors and winter visitors.

Population Fluctuation

Data changes in populations of species (table 3) are illustrated in fig. 3. The number of permanent resident species remained fairly constant, although there was a decrease in winter, and an increase in spring and autumn due to local wandering. They dispersed from the study area in search of food and shelter during the winter months and returned with the onset of the breeding season.

Migratory transients and warblers contributed to the peak of species for spring migration waves, which were 61 on May 7, 1950, and 58 on May 13, 1951. These peaks built up rapidly in nine to fifteen days, and then diminished to the summer resident level in about six to nine days.

Summer resident species were superimposed upon the more or less

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Table 1.—Species List and Residential Status for Birds Recorded During 1950 and 1951

ARDEIDAE

Great Blue Heron, *Ardea herodias*. OV.[1]
American Bittern, *Botaurus lentiginosus*. OV.

ANATIDAE

Mallard Duck, *Anas platyrhynchos*. MT.
Wood Duck, *Aix sponsa*. SR.

CATHARTIDAE

Turkey Vulture, *Cathartes aura*. OV.

[1] Permanent resident (PR); summer resident (SR); migratory transient (MT); occasional visitor (OV); and winter visitor (WV).

ACCIPTRIIDAE

Red-tailed Hawk, *Buteo borealis.* PR.

PERDICIDAE

Bob-white Quail, *Colinus virginianus.* OV.

SCOLOPACIDAE

Woodcock, *Philahela minor.* OV.
Spotted Sandpiper, *Actitis macularia.* OV.
Solitary Sandpiper, *Tringa solitaria.* OV.

COLUMBIDAE

Mourning Dove, *Zenaidura macroura.* SR.

CUCULIDAE

Yellow-billed Cuckoo, *Coccyzus americanus.* SR.

STRIGIDAE

Screech Owl, *Otus asio.* OV.
Great Horned Owl, *Bubo virginianus.* PR.
Barred Owl, *Strix varia.* PR.

CAPRIMULGIDAE

Whip-poor-will, *Antrostomus vociferus.* OV.
Nighthawk, *Chordeiles minor.* MT.

TROCHILIDAE

Ruby-throated Hummingbird, *Archilochus colubris.* OV.

ALCEDINIDAE

Belted Kingfisher, *Megaceryle alcyon.* SR.

PICIDAE

Yellow-shafted Flicker, *Colaptes auratus.* PR.
Red-bellied Woodpecker, *Centurus carolinus.* PR.
Red-headed Woodpecker, *Melanerpes erythrocephalus.* OV.
Yellow-bellied Sapsucker, *Sphyrapicus varius.* MT.
Hairy Woodpecker, *Dryobates villosus.* PR.
Downy Woodpecker, *Dryobates pubescens.* PR.

TYRANNIDAE

Crested Flycatcher, *Myiarchus crinitus.* SR.
Eastern Phoebe, *Sayornis phoebe.* OV.
Alder Flycatcher, *Empidonax traillii.* OV.
Least Flycatcher, *Empidonax minimus.* OV.
Wood Pewee, *Myiochanes virens.* SR.

CORVIDAE

Blue Jay, *Cyanocitta cristata.* SR.
Crow, *Corvus brachyrynchos.* OV.

PARIDAE

Black-capped Chickadee, *Penthestes atricapillus.* PR.
Tufted Titmouse, *Baelophus bicolor.* PR.

SITTIDAE

White-breasted Nuthatch, *Sitta carolinensis.* PR.

CERTHIIDAE

Brown Creeper, *Certhia familiaris.* WV.

TROGLODYTIDAE

House Wren, *Troglodytes aedon.* SR.
Carolina Wren, *Thryothorus ludivicianus.* SR.
Winter Wren, *Nannus hiemalis.* WV.

MIMIDAE

Catbird, *Dumatella carolinensis.* OV.
Brown Thrasher, *Toxostoma rufum.* OV.

TURDIDAE

Robin, *Turdus migratorius.* SR.
Wood Thrush, *Hylocichla mustelina.* SR.
Hermit Thrush, *Hylocichla guttata.* MT.
Olive-backed Thrush, *Hylocichla ustulata.* MT.
Gray-cheeked Thrush, *Hylocichla minima.* MT.
Veery, *Hylocichla fuscescens.* OV.
Eastern Bluebird, *Sialis sialis.* OV.

SYLVIIDAE

Golden-crowned Kinglet, *Regulus satrapa.* MT.
Ruby-crowned Kinglet, *Corthylio calendula.* MT.

STURNIDAE

Starling, *Sturnus vulgaris.* OV.

VIREONIDAE

White-eyed Vireo, *Vireo grisseus.* OV.
Yellow-throated Vireo, *Vireo flavifrons* OV.
Red-eyed Vireo, *Vireo olivaceus.* SR.
Warbling Vireo, *Vireo gilvus.* OV.

PARULIDAE

Black and White Warbler, *Mniotilta varia.* MT.
Prothonotary Warbler, *Protonotaria citrea.* MT.
Tennessee Warbler, *Vermivora peregrina.* MT.
Yellow Warbler, *Dendroica aestiva.* MT
Magnolia Warbler, *Dendroica magnolia* MT.

Black-throated Blue Warbler, *Dendroica caerulescens*. MT.
Myrtle Warbler, *Dendroica coronata*. MT.
Black-throated Green Warbler, *Dendroica virens*. MT.
Cerulean Warbler, *Dendroica cerulea*. MT.
Blackburnian Warbler, *Dendroica fusca*. MT.
Yellow-throated Warbler, *Dendroica dominica*. MT.
Chestnut-sided Warbler, *Dendroica pennsylvanica*, MT.
Pine Warbler, *Dendroica pinus*. MT.
Oven-bird, *Seiurus aurocapillus*. SR.
Louisiana Water-thrush, *Seiurus motacilla*. OV.
Kentucky Warbler, *Oporornis formosus*. SR.
Yellow-throat, *Geothlypis trichas*. SR.
Hooded Warbler, *Wilsonia citrina*. MT.
Canada Warbler, *Wilsonia canadensis*. MT.
American Redstart, *Setophaga ruticilla*. SR.

ICTERIDAE

Red-wing, *Agelaius phoeniceus*. MT.
Baltimore Oriole, *Icterus galbula*. MT.
Rusty Blackbird, *Euphagus carolinus*. MT.
Bronzed Grackle, *Quiscalus quiscula*. MT.
Cowbird, *Molothrus ater*. SR.

THRAUPIDAE

Scarlet Tanager, *Piranga erythromelas*. SR.
Summer Tanager, *Piranga rubra*. MT.

FRINGILLIDAE

Cardinal, *Richmondena cardinalis*. SR.
Rose-breasted Grosbeak, *Hedymeles ludovicianus*. SR.
Indigo Bunting, *Pascerina cyanea*. SR.
Purple Finch, *Carpodacus purpureus*. MT.
Eastern Goldfinch, *Spinus tristis*. OV.
Red-eyed Towhee, *Pipilo erythropthalmus*. OV.
Slate-colored Junco, *Junco hyemalis*. WV.
Field Sparrow, *Spizella pusilla*. OV.
White-crowned Sparrow, *Zonotrichia leucophrys*. MT.
White-throated Sparrow, *Zonotrichia albicollis*. MT.
Fox Sparrow, *Passerella iliaca*. MT.
Song Sparrow, *Melospiza melodia*. OV.

TABLE 2.—SUMMARY OF THE RESIDENTIAL CLASSIFICATION OF AVIAN SPECIES

Symbol	Classification	Species No.	Species Percent
MT	Migratory Transients	32	34.1
OV	Occasional Visitors...	28	29.8
SR	Summer Residents ..	21	22.3
PR	Permanent Residents	10	10.6
WV	Winter Visitors	3	3.2
	Totals	94	100.0

stable permanent resident base level. They began arriving as early as February and increased to a peak in early and mid-May. The number of summer resident species declined gradually over a six and one-half month period due to nesting failure, post-breeding dispersion, and quiescence in aestival activity.

Winter visitors were present from late October through mid-April and early May. Occasional visitors wandered into and out of the study area more often in April and May than at any other time. They were not recorded in November and December.

Fluctuations in the number of individuals (table 4) corresponded with those for species (fig. 4).

Waves of migrant individuals were reflected by peaks in the spring and autumn with maximum numbers approximating 1356 per 100 acres on May 7, 1950; and 1383 per 100 acres on May 13, 1951. With them came summer residents which swelled the basic population to the breeding season peak.

WINTER SOCIAL FLOCKS

Winter residents comprised such winter visitors as brown creepers, winter wrens, slate-colored juncos

TABLE 3.—SUMMARY OF DATA FOR 31 BREEDING SPECIES
Note: (p) present in the area

Species	Number of Breeding Pairs				1950 Territories				1951 Territories			
	per 63 Acres		per 100 Acres		Number Measured	Area in Acres			Number Measured	Area in Acres		
	1950	1951	1950	1951		Min.	Max.	Ave.		Min.	Max.	Ave.
Wood Duck	1.0	1.0	1.6	1.6	0	....	....	....	0	....	....	....
Red-tailed Hawk	1.0	1.0	1.6	1.6	0	....	....	....	0	....	....	....
Mourning Dove	2.0	1.0	3.2	1.6	0	....	....	....	0	....	....	....
Yellow-billed Cuckoo	2.0	1.0	3.2	1.6	2	2.02	2.35	2.18	1	....	....	2.43
Great Horned Owl	1.0	0	1.6	p	0	....	....	....	0	....	....	....
Barred Owl	p	1.0	p	1.6	0	....	....	....	0	....	....	....
Belted Kingfisher	1.0	1.0	1.6	1.6	0	....	....	....	0	....	....	....
Yellow-shafted Flicker	2.0	1.0	3.2	1.6	1	....	....	1.55	0	....	....	....
Red-bellied Woodpecker	7.0	7.0	11.0	11.0	6	2.06	5.19	3.58	5	2.23	4.61	3.41
Hairy Woodpecker	5.5	7.5	8.7	11.9	6	1.63	3.71	2.54	7	1.58	3.30	2.70
Downy Woodpecker	9.5	5.0	15.1	7.9	9	1.26	3.08	2.05	4	1.28	2.09	1.54
Crested Flycatcher	7.0	6.0	11.0	9.5	7	0.61	2.75	1.46	6	2.06	4.64	3.05
Wood Pewee	9.0	6.5	14.3	10.3	8	1.36	2.94	1.93	4	2.38	3.13	2.70
Blue Jay	2.5	2.5	4.0	4.0	5	0.49	0.95	0.62	0	....	....	....
Black-capped Chickadee	6.5	7.5	10.3	11.9	5	1.19	4.42	2.76	7	2.47	5.02	3.28
Tufted Titmouse	4.5	3.0	7.1	4.8	5	1.60	2.94	2.24	3	3.40	4.56	3.85
White-breasted Nuthatch	6.0	5.0	9.5	7.9	3	1.39	3.01	2.31	7	1.79	3.33	2.44
House Wren	5.0	2.0	7.9	3.2	3	2.43	2.84	2.69	1	....	....	1.00
Carolina Wren	5.5	2.5	8.7	4.0	5	0.71	1.21	1.02	2	1.43	1.62	1.53
Robin	1.5	0.5	2.4	0.8	0	....	....	....	0	....	....	....
Wood Thrush	8.5	5.0	13.5	7.9	7	1.67	4.27	3.17	4	2.43	3.23	2.81
Red-eyed Vireo	5.0	4.0	7.9	6.3	4	0.58	2.53	1.43	4	1.92	2.60	2.36
Oven-bird	8.5	5.5	13.5	8.7	8	1.33	4.61	2.51	5	2.82	5.47	4.11
Kentucky Warbler	1.0	0.5	1.6	0.8	1	....	....	2.52	0	....	....	....
Yellow-throat	2.0	1.0	3.2	1.6	2	0.48	1.46	0.97	1	....	....	0.71
American Redstart	1.0	p	1.6	p	1	....	....	3.20	0	....	....	....
Cowbird	p	p	p	p	0	....	....	....	0	....	....	....
Scarlet Tanager	1.0	1.5	1.6	2.4	1	....	....	1.58	1	....	....	2.74
Cardinal	2.5	1.5	4.0	2.4	0	....	....	....	0	....	....	....
Rose-breasted Grosbeak	3.0	3.5	4.8	5.6	2	1.79	1.89	1.84	2	1.97	2.47	2.22
Indigo Bunting	1.0	1.5	1.6	2.4	1	....	....	2.72	0	....	....	....
	113.0	86.0	179.3	136.5	92				64			

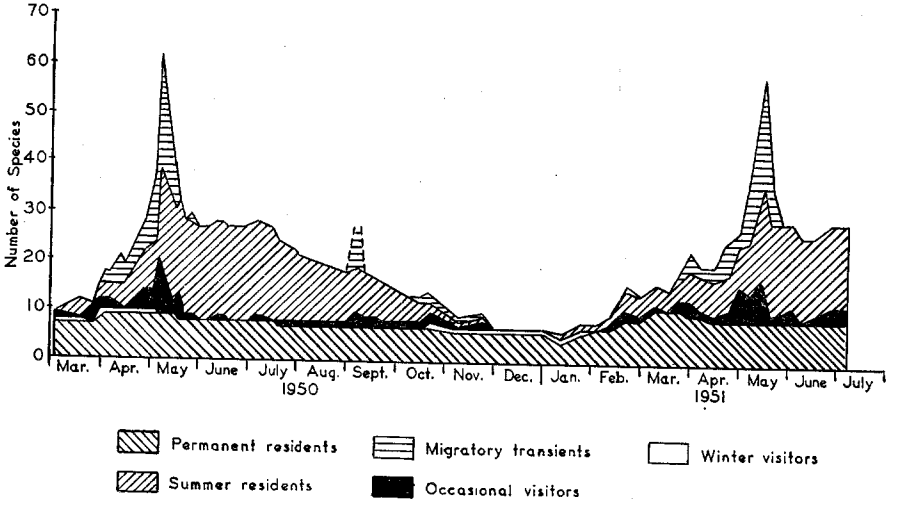

FIG. 3.—Fluctuations in number of species during 1950 and 1951. The open, broken-line peak in September indicates that data were incomplete.

and the group of permanent resident species. Red-bellied woodpeckers, downy woodpeckers, hairy woodpeckers, black-capped chickadees, tufted titmice, white breasted nuthatches and brown creepers began congregating into winter social groups by mid-November (fig. 5). Woodpeckers appeared to be the leaders, the red-bellied woodpecker being the despotic one when present. Feeding was the chief activity and call notes were uttered frequently. Chickadees, titmice, nuthatches, and brown creepers followed the woodpeckers from tree to tree, apparently having learned that they would benefit where woodpeckers found food. Brown creepers were usually at the periphery of group activity or by themselves a short distance away. Since these birds were not banded, it was not known whether or not the same individuals composed each flock throughout the winter season.

The flocks began to disband in mid-February when woodpeckers began territorial and mating activities. Brown creepers were next to leave for northward migration. Other members of the winter flocks seemed to break away in no definite order. Nuthatches and tufted titmice remained together the longest time.

EFFECT OF WINDS UPON BIRD DISTRIBUTION

Determinations of the effect of wind velocity and direction upon bird distribution within the study area were made throughout seasonal stages of forest tree foliation (table 5). Percentages of foliation were based upon a method of subjective measurement and observation. Foliage conditions in the winter were considered as barren, which was less than 1 percent but not 0 percent because oaks and hornbeams held withered leaves until early spring. The appearance of bursting leaf buds and

TABLE 4.—BIRD CENSUS DATES AND NUMBERS RECORDED

Date	Number of Species Per 63 Acres	Number of Individuals Per 63 Acres	Number of Individuals Per 100 Acres
1950:			
Mar.: 4	9	48	76
19	12	244	387
27	11	35	56
29	16	228	362
Apr.: 2	18	135	214
5	17	98	156
12	22	339	538
16	19	79	125
19	21	102	162
26	28	266	422
May: 3	37	456	724
7	61	854	1356
14	39	712	1130
17	34	556	883
21	28	260	413
24	29	269	427
28	27	265	420
31	28	266	422
June: 4	27	256	406
7	27	247	392
11	28	258	410
14	28	235	373
18	27	241	383
21	27	234	371
25	27	213	338
July: 7	28	209	331
16	27	218	346
20	24	181	287
29	22	148	235
Aug.: 4	21	111	176
11	20	94	149
Sept.: 1	18	83	132
6	20	107	170
11	18	52	83
Sept.: 17	17	60	95
24	16	55	87
Oct.: 15	13	34	54
20	14	66	105
Nov.: 10	9	45	71
24	10	31	49
Dec.: 1	7	21	33
19	7	19	30
29	7	27	43
1951:			
Jan.: 11	6	20	32
25	8	23	37
Feb.: 6	8	30	48
11	10	30	48
22	16	100	159
Mar.: 1	14	75	119
8	16	74	117
18	15	56	89
23	18	90	143
29	23	107	170
Apr.: 1	19	335	532
7	20	121	192
15	20	112	178
23	24	136	216
29	27	193	306
May: 6	38	461	732
13	58	871	1383
19	36	339	538
26	29	233	370
June: 3	29	206	327
10	26	183	290
16	26	183	290
27	29	189	300
July: 6	29	187	297

TABLE 5.—WIND AND FOLIATION DATA AFFECTING BIRD DISTRIBUTION

Date	Percentage of tree Foliation	Velocity MPH		Prevailing Direction	Bird Distribution
		Sta. A in Open Country	Sta. B Within Forest		
1950:					
Mar. 19	barren	20	15-20	NE	SW corner
Mar. 27	barren	20	20	NW	SW corner
Mar. 29	barren	2	0- 1	W	forest-wide
Apr. 2	barren	25	20	S	forest-wide
Apr. 5	barren	2	2	NE	forest-wide
Apr. 12	barren	15	12	NW	forest-wide
Apr. 16	barren	12	11	W	forest-wide
Apr. 19	barren	8	2	W	forest-wide
Apr. 26	barren	5	3	W	forest-wide
May 3	25% foliated	6	0- 1	W	forest-wide
May 7	75% foliated	6	2	E	forest-wide
May 10	95% foliated	2	0- 1	E	forest-wide
May 14	100% foliated	15-18	5- 8	S	forest-wide
May 21	100% foliated	5	0- 1	W	forest-wide
June 4	100% foliated	10-15	4	NW	forest-wide
July 12	100% foliated	5-10	1- 3	S	forest-wide
Sept. 17	100% foliated	12	4- 6	E	forest-wide
Oct. 15	95% foliated	0-15	0- 4	E	forest-wide
Oct. 20	25% foliated	.....	0- 4	W	forest-wide
Nov. 10	barren	.....	4	W	E & S margins
Nov. 24	barren	.....	8	NE	SW corner
Dec. 1	barren	.....	5	E	SW & W margins
Dec. 19	barren	.....	7	NE	E margin
Dec. 29	barren	.....	5	E	W & SW margins
1951:					
Jan. 11	barren	.....	5	E	W margin
Jan. 25	barren	0	0	0	SW corner
Feb. 6	barren	.....	0- 1	NW	E margin
Feb. 11	barren	.....	20	NW	S & SE margins
Feb. 22	barren	0	0	0	forest-wide
Mar. 1	barren	.....	2	W	forest-wide
Mar. 8	barren	.....	2	W	forest-wide
Mar. 18	barren	30-40	30	W	Refer to text.
Mar. 23	barren	10	8	SW	W & NW margins
Mar. 29	barren	10	3	SW	forest-wide
Apr. 1	barren	15	14	W	forest-wide
Apr. 7	barren	3	0- 1	W	forest-wide
Apr. 15	barren	16	14	W	forest-wide
Apr. 23	barren	10	3	NW	forest-wide
Apr. 29	barren	2	0- 1	W	forest-wide
May 6	25% foliated	10	5-10	W	forest-wide
May 13	75% foliated	3	0- 1	SE	forest-wide
May 19	95% foliated	2	0- 1	E	forest-wide
May 26	100% foliated	25	4	W	forest-wide
June 3	100% foliated	3	0- 1	SW	forest-wide
June 27	100% foliated	10-15	6	SW	forest-wide
July 6	100% foliated	3	0- 1	SE	forest-wide

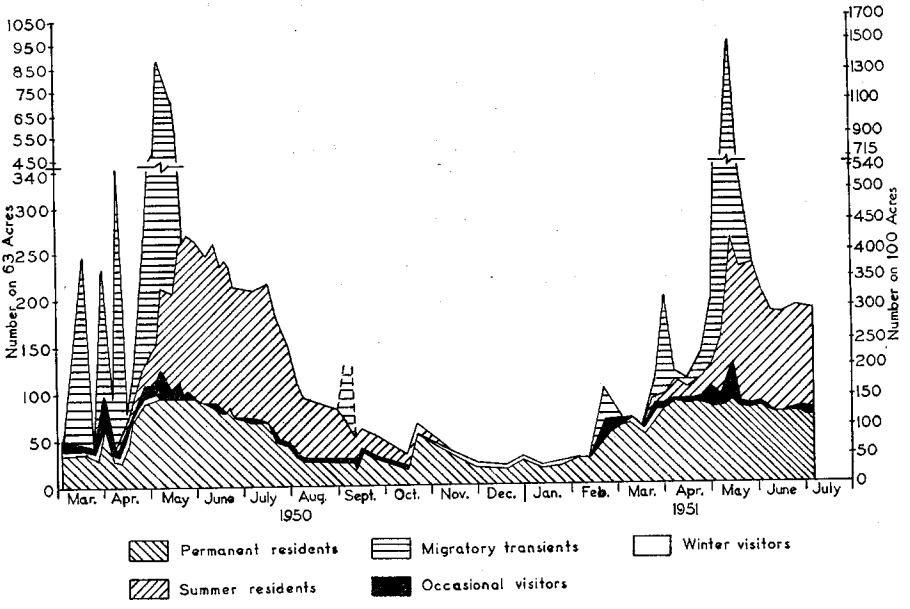

FIG. 4.—Fluctuations in number of individuals during 1950 and 1951. The open, broken-line peak in September indicates data were incomplete.

leaflets was considered as 25 percent foliated. As leaf growth progressed and the crown mass became more dense, the forest was considered as 75 percent foliated. Since oaks and hickories did not reach full foliage until later than other species, the late vernal forest was considered only 95 percent foliated. The condition of 100 percent foliation was reached only after all trees were in full mature leaf, which then persisted throughout the summer and into the autumn.

In 1950, trees began leafing about May 1, reaching complete foliation by May 14. Defoliation began about October 15 and reached the winter barren condition by November 10. In 1951, foliation began May 3 and reached its completion about May 21. No observations were made for the autumn of 1951.

Wind directions and velocities were measured with a hand anemometer held six feet high. Readings were taken at several stations. For velocities of unobstructed winds, readings were taken in open country on the windward side of the study area. These locations are grouped together under the designation, Station A. For velocities of winds obstructed by trees, measurements were taken within the forest either on the lee side or in the center at D-6 (fig. 2) where the weather instruments were situated. These were grouped together under the heading, Station B.

Distribution of birds was based upon sight and song records indicating locations of individual birds. Of particular importance were observa-

tions of flocks or such signs of bird groupings that might indicate massing together.

Only critical data are given in table 5 since the majority of the summer records showed no evidence for winds affecting bird distribution. Comparison of wind velocities between open country and within the forest shows that velocities are reduced less when trees are barren than when they are foliated. Reductions during the barren period range from 0 to 70 percent, with an average of 27 percent. During the foliated period, reductions range from 67 to 84 percent, with an average of 71 percent.

A significant factor at the time of recording was wind force variability, i.e., whether gusty or steady. This variability produced considerable differences between records taken in the open and those inside the forest. In general, it appeared to be a cumulative effect of continuous winds which caused the birds to congregate in the lee of the forest rather than gusts of moderate velocities.

An interesting exception to this general response of birds to winds was observed March 18, 1951, at 1:30 P.M. Several flocks of birds, composed of downy woodpeckers, hairy woodpeckers, red-bellied woodpeckers, black-capped chickadees, tufted titmice, brown creepers and slate-colored juncos, were feeding high in the tree tops and snags found in the slash timber at the western side of the study area. A 30 m.p.h. west wind blew with gusts up to 40 m.p.h. The sun was obscured by clouds. The temperature had dropped from 39°F to 27°F in the course of three hours. Yet these birds continued to feed in the full force of the strong cold winds.

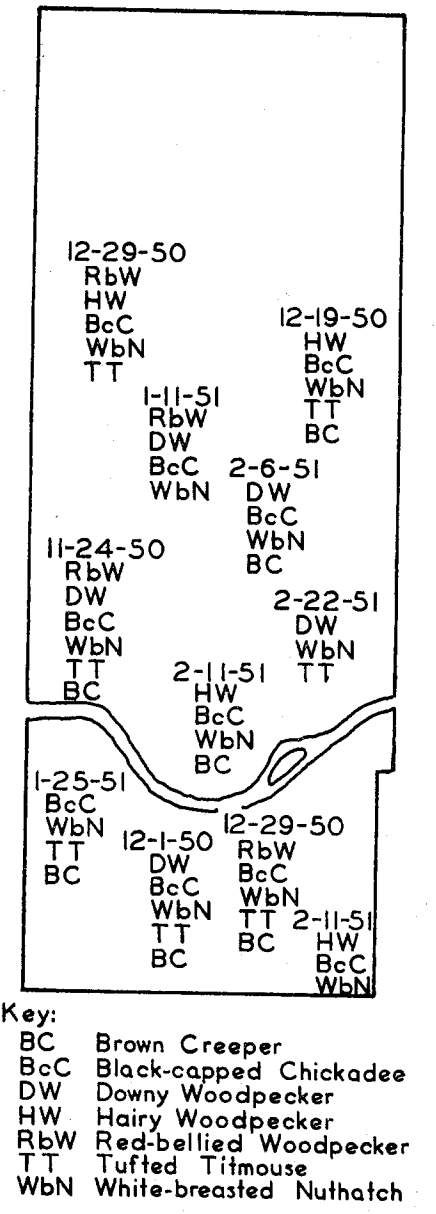

FIG. 5.—Position and composition of eleven winter social flocks.

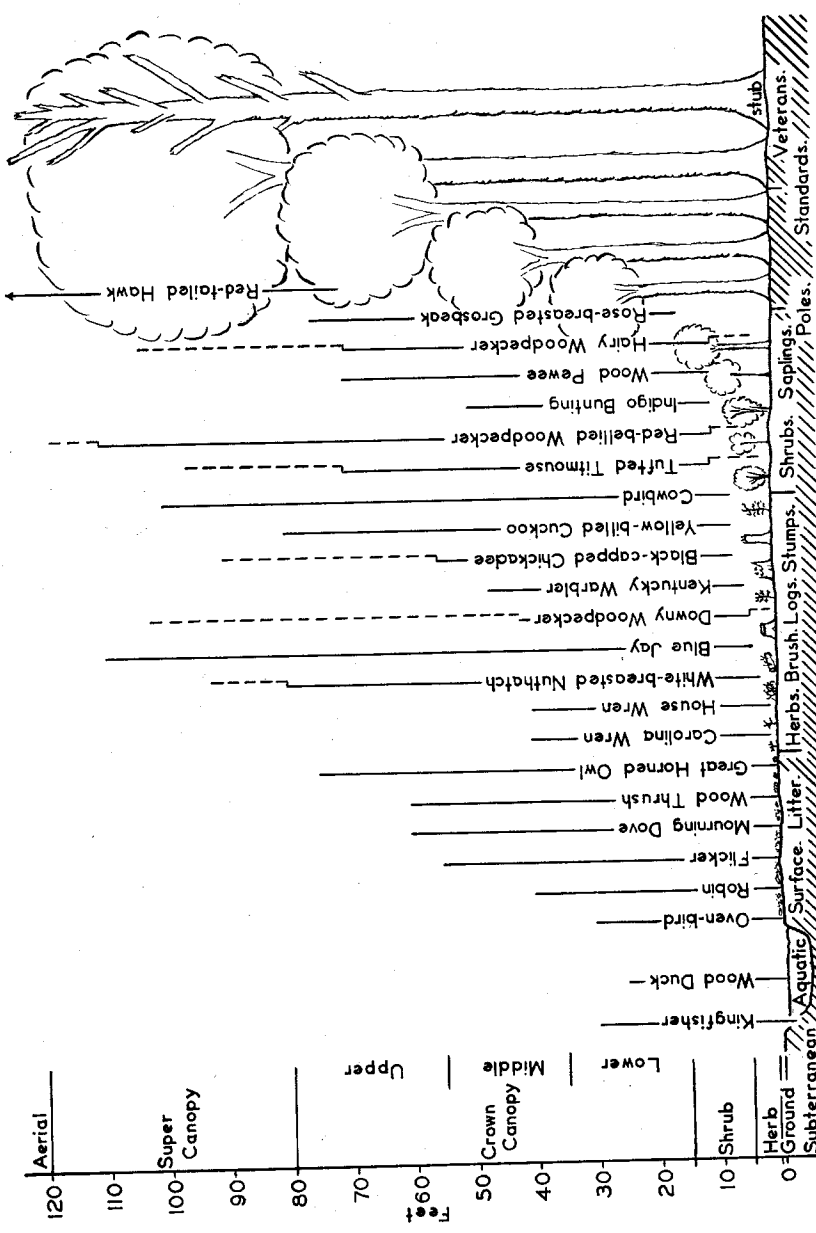

FIG. 6.—Profile of the forest community strata of the Funk Forest Natural Area and the components of each chiefly utilized in the vertical ranges of 24 species of birds. Breeding season ranges (——) and winter ranges (– – –).

There were no birds in the forest where they usually sought shelter under less severe conditions. By using lineman's pole climbers, the writer scaled trees and examined the bark. Unsheltered trees revealed sluggishly active insects that had been warmed to life by mild temperatures and the bright sun during the previous three or four days. But insects in sheltered trees in the forested area were not active. It was concluded that the birds sought food where the supply was abundant in preference to seeking shelter during adverse weather conditions.

Other exceptions to winds affecting the distribution of forest species were observed in early spring before the trees produced leaves. With the onset of migration, territorial establishment, and mating, the rate of wind velocities had no apparent effect upon bird distribution. Their responses were much like those observed when complete foliation acted as a barrier. It was concluded that the innate desire to mass together for migration, to defend individual territories, and to mate may be more intense than the desire to seek shelter from strong winds.

Vertical Ranges and Spatial Units

By means of classification systems and systematic observations, a method was devised for use in life history studies and the analysis of data pertinent to niche requirements of birds.

The niche is here considered to be the prime part or "core" of the habitat which is essential for continued survival of members of a species (Linsdale, 1946). It is the smallest local distributional unit of space that is occupied and utilized by the species. The niche involves the life habits of the animal. It includes the manner in which the animal responds to the biological and physical elements of its external environment. This behavioral response is governed by inherent characteristics that are determined by such internal forces as morphological, physiological, psychological and hereditary factors.

The first approach for the isolation of niches, or spatial units, was the classification of the plant strata so that vertical ranges utilized by birds could be identified. The second step was the classification of microhabitats in order to facilitate recognition of the sites most often frequented by birds. Third, life habit activities were classified for the determination and correlation of behavior at microhabitat sites within the plant community structure.

Strata for this deciduous forest community are diagrammed in fig. 6. A brief description of each follows. (1) The subterranean stratum was that part of the earth below the surface of the soil. (2) The aquatic stratum was the free body of water. (3) The ground stratum was the surface of the soil, including the litter and humus. (4) The herb stratum was varied from 3 to 5 feet high, depending upon the height of the component herbaceous plants. (5) The shrub stratum included the crown mass of small trees and shrubs from 5 to 15 feet high. (6) The crown canopy stratum was characterized by the general level of the tree canopy from 20 to about 80 feet. (7) The super canopy stratum was composed of veteran trees, of which the living crowns or dead upper structures ex-

tended to distinctive heights above the crown canopy. (8) The aerial stratum was the free air above the crown canopy and into which components of the super canopy extended.

All air space below the aerial stratum was considered sub-aerial with designation identified by the stratum concerned. Erect stems that projected through successive strata were not subdivided but were considered as portions of microhabitats.

Such life habit responses as nesting, defense, feeding and shelter-seeking showed greatest intensity about the following sites: (1) nest sites, (2) advertizing sites, (3) feeding sites, and (4) shelter sites. Life habit responses, which varied for different species in regard to both duration and intensity, were confined within vertical range limits. The vertical ranges for 24 species were determined during both the breeding and non-breeding seasons. These data, in addition to those for horizontal territorial limits, may serve to identify the spatial unit of volume utilized by a given species in its niche.

Spatial units were found to be flexible, fluctuating in shape and volume for different species and with variation in seasonal activities. General population pressures influenced the limits of size and range on a long term, breeding season basis. Intra-specific territorial conflict caused short term changes during the breeding season.

During the non-breeding season, life habit activities were not restricted to former breeding season spatial units. During the post-breeding period, vertical ranges contracted and horizontal ranges expanded as a result of parental care of fledglings. During the remainder of the non-breeding season, both vertical and horizontal ranges were greatly expanded as birds wandered in search of food and shelter.

Computation of total spatial volumes, the characteristics of the spatial units, and the description of micro-environmental factors encompassed by them have been omitted until better techniques and mathematical calculations are developed for more accurate measurement.

Territorial Areas

Territories which had nest sites within the study area numbered 136 in 1950 and 117 in 1951. Since about 15 percent in 1950, and 18 percent in 1951, had ranges that extended outside the boundaries of the tract, only 156 territorial areas for 22 breeding species could be measured with a polar planimeter (table 3). Also, since these measurements were based upon records of approximated positions of territorially singing males, the results are general and only indicate relative territorial sizes.

The following analysis is made for 22 breeding species which had 92 measurable territories in 1950. The smallest territories were made by the yellow-throat. The largest were made by the red-bellied woodpeckers. The least range between the smallest and the largest sizes was found for rose-breasted grosbeaks, while the greatest was for the oven-birds.

In 1951, 17 species had 64 measurable territories. The smallest was again made by the yellow-throat. The largest territories were made by the oven-birds rather than by the red-

bellied woodpeckers. However, the latter species had nearly the same average size for both years. The least range between extreme sizes was found for the Carolina wren, while the greatest was for the oven-birds.

Evidence from field observations and measurements of territories indicated that, when one year is compared with the next, species of birds may be grouped into the following categories. (1) When a decrease occurred in the population size for a given species, there was a corresponding increase in the average territorial size, and a decrease in the range between extreme limits of their sizes. This was noted for wood pewees, white-breasted nuthatches, tufted titmice, Carolina wrens, red-eyed vireos and oven-birds. These changes indicated that intra-specific competition was reduced. (2) Negligible changes in population size, average territorial size, and range between extreme size limits for a given species may indicate optimum territorial sizes as controlled by normal population pressures. This was noted for yellow-billed cuckoos, red-bellied woodpeckers and rose-breasted grosbeaks. (3) Changes occurred that could not be logically explained, indicating discrepancies owing either to census and recording techniques, or other factors such as redistribution of some territories on account of renesting attempts, territorial overlap, and excessive competitive pressure.

Illustrations of conflict due to population pressure, and territorial proximity and overlap were more obvious in 1950 than in 1951. Competition was keen among red-bellied woodpeckers, especially between two males which had overlapping territories (fig. 7). As a result, one pair shifted their post-breeding range southward in order to avoid continued rivalry.

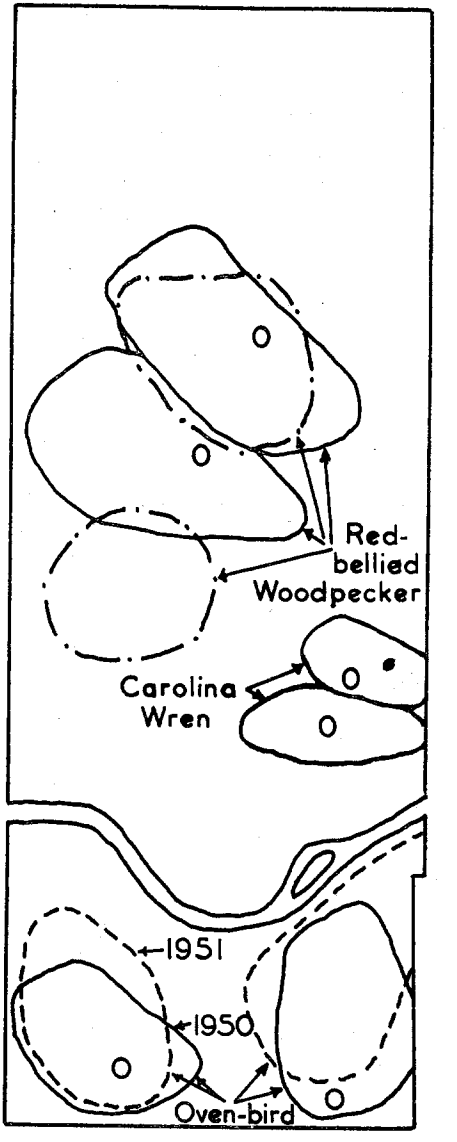

FIG. 7.—Breeding territories for red-bellied woodpeckers, oven-birds and Carolina wrens.

Proximity of wood pewee territories created more frequent conflicts during 1950 than 1951 (fig. 8). On two occasions fighting was so bitter that the writer picked up the downed contestants and found them exhausted. When they recovered, they returned to their respective territories. These two were later observed fighting many times.

Overlap of two Carolina wren territories caused considerable conflict between males (fig. 7). Singing, posturing and combat were frequent and intense. Nest sites were about 80 feet apart. The birds appeared to be cautious about entering their nests while their neighbors were either nearby or singing. When one male came close and sang, the other flew at him scolding and posturing. This behavior was not exhibited if singing was at a distance.

Singing displays were most frequent between the oven-bird males occupying the two territories south of Timber Creek (fig. 7). They sang alternately for long periods of time. This pattern was heard again in 1951 from these same areas which suggested that the same males may have returned to their original territorial sites.

When the territories are plotted for two years, some are found to be superimposed upon areas used the previous year. This may indicate that certain individuals return and occupy the same general location from one year to the next. There was some certainty that in 1951 a crested flycatcher, two wood pewees, several white-breasted nuthatches, three house wrens, a yellow-throat and two oven-birds may have returned to their 1950 territorial sites. In addition, there was likelihood that some hairy woodpeckers, downy woodpeckers, red-bellied woodpeckers, black-capped chickadees and wood

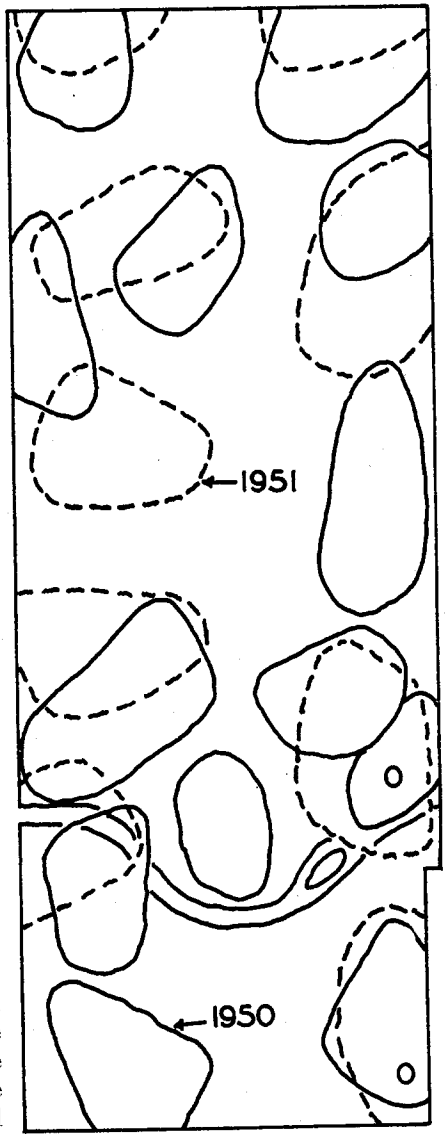

FIG. 8.—Breeding territories for wood pewees.

thrushes returned to former locations (Calef, 1953a). However, since the birds were not banded, it is impossible to be certain that it was the same male present each year.

The fact that some individuals may also hold to their breeding territories or ranges after one would usually expect them to be abandoned seems to be clearly illustrated by the red-bellied woodpeckers (fig. 9). Post-breeding ranges were remarkably coincident with the breeding territories for six birds.

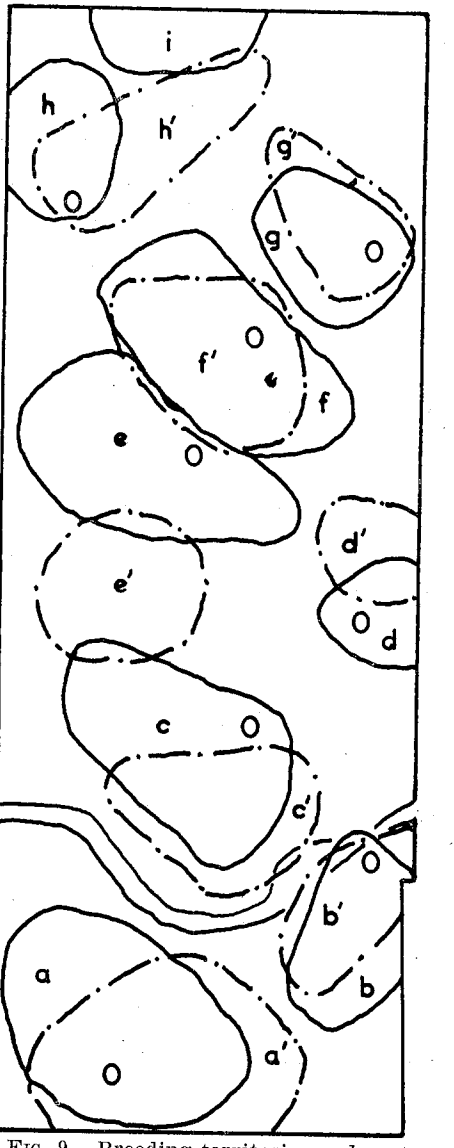

FIG. 9.—Breeding territories and post-breeding ranges for red-bellied woodpeckers during 1950.

SEASONAL SONG RHYTHM

Observations and records of singing male birds on territories indicated daily variations in intensity and frequency which showed a cumulative seasonal rhythm. The comparison of singing with other activity records that confirmed the presence of the male on its territory is illustrated in fig. 10. March and early April data were unclassified prior to the beginning of this particular investigation.

The singing activity increased to a peak by mid-May as territorial activity reached its height. Its decline reflects the period of caring for the brood which merges with the post-breeding period of song quiescence. The two upswings in late June and mid-July is the result of renewed singing by previously quiet birds. Singing frequency for males did not keep pace with their total territorial activities, that is, although they were present on their territories, they did not sing continuously. The decline in the breeding activity curve reflects dispersion, song quiescence, and the aestival reduction of general activity as territories were abandoned. Song activity during the autumn and winter months was difficult to classify. Activities were not territorial and, therefore, songs and call notes for-

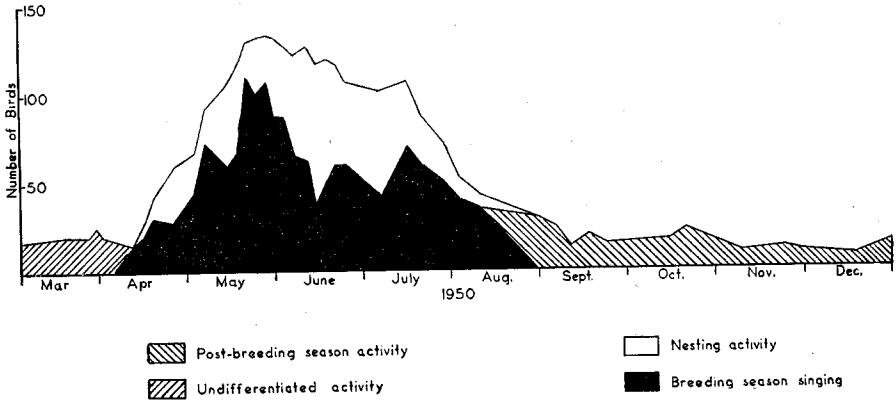

FIG. 10.—Comparison of fluctuations in singing activity with nesting activity.

merly associated with breeding season displays served different functions.

SUMMARY AND CONCLUSIONS

Birds include 94 species in 72 genera and 28 families. Breeding population density for 1950 was 179.3 pairs per 100 acres, and for 1951, it was 136.5 pairs per 100 acres. One-third of the total number of species comprised the breeding population, one-third were migratory transients, and one-third were occasional visitors and winter visitors.

The annual species population included permanent resident species plus groups of summer residents, migratory transients, occasional visitors, and winter visitors. The fluctuation in number of individuals corresponded with that for species. Winter social flocks were usually composed of seven species, which apparently formed in response to some social bond or mutual beneficial relationship such as food-getting.

Moderately high wind velocities usually affected bird distribution in winter when the foliage was gone, but they had no apparent effect when demands for feeding, mating, defending territories, and preparing for migration were dominant. Winds had no effect when tree foliage reduced the force of the wind.

Eight major plant strata were identified in this community and their utilization by 24 species of birds was recorded. It is suggested that the spatial unit of volume determined by measurement of the vertical ranges and horizontal areas may be useful in describing the microhabitats characteristic for a given species.

Measurements of 156 territories indicate that annual variations in areal size and ranges between extreme size limits may be a function of population pressure and aggregation to hold territories. Some individuals may have returned to their former territorial areas the next breeding season. Red-bellied woodpeckers retained their former breeding territories during the immediate post-breeding period. Seasonal rhythm for singing males occurs with variations in breeding and territorial activities.

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