WINTER BIRDS OF UPLAND PLANT COMMUNITIES[1]

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INTRODUCTION

THE purpose of the work described in this paper was to determine the relative abundance of the winter birds occurring in each stage of the upland plant succession at Raleigh, North Carolina. It was based on the assumption that a preliminary study of the winter bird populations associated with the plant communities would be useful to the general problem of the ecological succession of birds. Only the occurrence of the birds, by species and individuals, in the various plant stages was recorded. The factors governing such habitat selection and abundance were not investigated.

The course of revegetation of abandoned fields in the vicinity of Raleigh, N. C., was first worked out by Crafton and Wells (1934). Oosting (1942: 118) describes the complete succession in the Piedmont:

> Almost without exception upland communities have developed on abandoned fields. They are characterized by a few distinct and easily recognized stages of dominance which regularly succeed each other. Fields abandoned for one year are dominated by *Leptilon canadense* and *Digitaria sanguinalis*. The second year *Aster ericoides* with a mixture of *Ambrosia artemisiifolia* is the important species. By the third year Andropogon (usually *A. virginicus*) is dominant and it maintains itself until shaded out by pine (*P. taeda* or *P. echinata*) whose seedlings may be found among the broom-sedge as early as the third year. Pine may overtop the Andropogon by the fifth year and frequently forms closed stands in 10–15 years. Neither of these pines reproduces in its own shade but several hardwoods do. A pine stand is middle-aged by forty years and by then there will have developed a distinct understory of subordinate hardwoods such as red gum, black gum, dogwood and sourwood. In addition several seedling and transgressive oaks and hickories will be present. By 70–80 years the pine is overmature and as it thins out it is replaced by oaks and hickories which have increased steadily in the lesser strata. Eventually (150–200 years) oak-hickory dominance may be attained with scattered pine remaining as relics.

All the study-plots were within a rectangular area of 15 square miles of agricultural land bordering Raleigh on the west. About 70% of the region is cleared farmland, pastures and abandoned fields; 30% is in woody growth, mostly pines. Only two pieces of deciduous woods suitable for study were found. Pine woodlands and bare fields were plentiful. Fields in the herbaceous stages were both fewer and smaller than desired.

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The data presented in this paper were collected between November 1, 1939, and March 1, 1940. Four months proved to be the longest period relatively uninfluenced by migratory movements. Temperature and precipitation for the period were approximately normal as compared with the previous 54 years.

METHODS

Repeated counts were made on selected plots of known acreage and vegetational constitution. Forty fields were used for study-plots, totaling 680 acres: Bare Field, 14; Crab Grass, 6; Crab Grass-Tall Weeds, 2; Tall Weeds-Broomsedge, 5; Broomsedge-Pine, 6; Pine, 5; Deciduous Woods, 2. In addition, 7 Bermuda Grass (*Cynodon dactylon*) pastures in use by cattle, totaling 230 acres, were similarly studied for comparative purposes. Pastures are not a stage in the direct succession but abandoned pastures go into tall weeds or broomsedge. The number of plots in each stage, and the size of the plots, were influenced by availability. Plots varied from 2 to 87 acres and averaged 17 acres.

Seventy-five censuses were made, plus 11 on pastures, each one in the morning between sunrise and noon. On each census the plot was systematically examined by walking back and forth until it was completely covered. All birds seen definitely in the plot were recorded. The time spent on a plot varied with size and according to the difficulty of seeing the birds. The average time was 40 minutes per census. No specimens were collected nor was any attempt made at subspecific identification.

No Bare Field was completely bare. The first eight plots were sown to winter grain, the green blades standing two inches high in thin rows six inches apart; the remainder had only scattered tufts of crab grass. Only two small fields of mixed Crab Grass-Tall Weeds were found. No pure Tall Weeds plots were located. The mixed Tall Weeds-Broomsedge fields showed a graded series from those in which tall weeds were dominant and broomsedge subdominant to those in which broomsedge was dominant and tall weeds subdominant or common. No plots of pure Broomsedge were found. In the Broomsedge-Pine plots, the pines were young, from 3 to 20 feet high, scattered, and either sub- or co-dominant; tall weeds were always common to uncommon, but not rare or subdominant. Pine plots varied somewhat but supported a similar bird life throughout. In the Deciduous Woods, pines were always common but never sub- or co-dominant.

RESULTS

Table 1 summarizes by stages the number of plots, plot size in acres, census distribution, number of species and average number of birds-per-acre; the data on pastures is added at the bottom.

TABLE 1

SUMMARY OF CENSUSES BY STAGES

Stage	*Plots*	*Acres*	*Censuses*	*Species*	*Average number birds-per-acre*
Bare Field	14	281.2	31	15	2.35
Crab Grass	6	47.3	9	8	10.50
Crab Grass-Tall Weeds	2	7.1	2	7	——
Tall Weeds-Broomsedge	5	50.5	9	9	10.10
Broomsedge-Pine	6	60.1	9	7	6.50
Pine	5	91.4	10	25	7.00
Deciduous Woods	2	142.0	5	23	1.00
Totals	40	680.0	75	42	4.35
Pastures	7	230.0	11	12	2.8

The birds were listed according to their frequency and abundance within each stage. Frequency is a percentage measure of the number of censuses on which the species was recorded. Abundance is a more subjective value, the numbers one to five being used to designate the following relative values: 5—the Most Abundant and widespread species; 4—Abundant but not the most abundant; 3—Common or frequently present; 2—Uncommon but not rare; 1—Rare or accidental. Abundance is not based on frequency alone, but also on the number of individuals per census and duration of occurrence throughout the four-month study period. The abundance and frequency ratings for all the bird species in all stages appear in Table 2. The frequencies are not comparable between stages, because of the differences in number of censuses per stage and in size and number of plots. The abundance values are felt to be fairly comparable from stage to stage.

Bare Fields.—The Meadowlark was the Most Abundant bird on Bare Fields, with Killdeer and Mourning Doves Common. Twelve species were Uncommon to Rare. The Savannah Sparrow's presence was conditioned by the existence of a little crab grass or lespedeza. One or two Sparrow Hawks were always found around each group of fields. Horned Larks were present only between December 26 and January 24, when there was snow and ice. Pipits were last seen on December 21. Species found only in this stage were: Horned Lark, Pipit, Killdeer, Starling and Cowbird. The bird population of the Pastures was quite similar to that of the Bare Fields. The Meadowlark was again the Most Abundant bird, and the Starling was the only Common species.

TABLE 2

ABUNDANCE AND FREQUENCY RATINGS FOR ALL BIRDS IN ALL STAGES

Frequencies under Crab Grass-Tall Weeds in parentheses because based on only two censuses. R = Residence Status. P = Permanent Resident. W = Winter Resident. Har = Highest Abundance Rating attained by each species. a = abundance. f = frequency.

Species	R	Har	Bare Field		Crab Grass		Crab Grass-Tall Weeds		Tall Weeds-Broom Sedge		Broom Sedge-Pine		Pine		Decid. Woods		Pastures	
			a	f	a	f	a	f	a	f	a	f	a	f	a	f	a	f
Meadowlark	P	5	5	39	3	33	—	—	1	11	—	—	—	—	—	—	5	81
Killdeer	P	3	3	26	—	—	—	—	—	—	—	—	—	—	—	—	1	9
Mourning Dove	P	3	3	21	—	—	—	—	—	—	—	—	1	10	—	—	—	—
Savannah Sparrow	W	5	2	13	5	100	3	(100)	3	67	3	56	—	—	—	—	2	27
Field Sparrow	P	5	—	—	1	22	5	(100)	5	78	5	78	—	—	—	—	—	—
Junco	W	4	1	3	1	11	4	(100)	4	56	4	67	2	30	2	40	—	—
Song Sparrow	W	3	—	—	1	11	3	(100)	3	67	3	56	—	—	—	—	—	—
Golden-crowned Kinglet	W	5	—	—	—	—	—	—	—	—	—	—	5	100	5	80	—	—
Ruby-crowned Kinglet	W	4	—	—	—	—	—	—	—	—	—	—	4	100	2	60	—	—
Pine Warbler	P	4	—	—	—	—	—	—	—	—	—	—	4	100	2	40	—	—
Chickadee	P	4	—	—	—	—	1	(50)	1	11	—	—	4	90	3	80	—	—
Myrtle Warbler	W	3	—	—	—	—	—	—	—	—	—	—	3	80	2	40	1	18
Brown Creeper	W	3	—	—	—	—	—	—	—	—	—	—	3	70	3	80	—	—
Titmouse	P	3	—	—	—	—	—	—	—	—	—	—	3	60	2	60	—	—
Winter Wren	W	3	—	—	—	—	—	—	—	—	—	—	1	10	3	80	—	—
Carolina Wren	P	3	—	—	—	—	—	—	—	—	—	—	2	30	3	80	—	—
Sparrow Hawk	P	2	2	13	—	—	—	—	1	11	—	—	—	—	—	—	2	36
Horned Lark	W	2	2	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Starling	P	2	2	10	—	—	—	—	—	—	—	—	—	—	—	—	3	45
Pipit	W	2	2	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Flicker	P	1	1	6	—	—	—	—	—	—	—	—	1	10	1	20	1	18
Bob-white	P	1	1	3	—	—	—	—	—	—	1	11	—	—	—	—	—	—
Crow	P	2	1	3	1	11	—	—	—	—	—	—	2	30	—	—	1	9
Bluebird	P	1	1	3	—	—	1	(50)	—	—	1	11	—	—	1	20	—	—
Cowbird	W	1	1	3	—	—	—	—	—	—	—	—	—	—	—	—	2	27
Goldfinch	P	2	1	3	—	—	1	(50)	—	—	1	11	2	30	1	20	1	9
Vesper Sparrow	W	1	—	—	1	11	—	—	1	11	—	—	—	—	—	—	—	—
Marsh Hawk	W	1	—	—	1	11	—	—	1	11	—	—	—	—	—	—	1	9
Downy Woodpecker	P	2	—	—	—	—	—	—	—	—	—	—	2	50	2	60	—	—
Brown-headed Nuthatch	P	2	—	—	—	—	—	—	—	—	—	—	2	40	—	—	—	—
Hermit Thrush	W	2	—	—	—	—	—	—	—	—	—	—	2	40	1	20	—	—
Sharp-shinned Hawk	P	1	—	—	—	—	—	—	—	—	—	—	1	20	—	—	—	—
Barred Owl	P	1	—	—	—	—	—	—	—	—	—	—	1	20	—	—	—	—
Hairy Woodpecker	P	2	—	—	—	—	—	—	—	—	—	—	1	20	2	60	—	—
White-breasted Nuthatch	P	2	—	—	—	—	—	—	—	—	—	—	1	20	2	40	—	—
Blue-headed Vireo	P	1	—	—	—	—	—	—	—	—	—	—	1	20	—	—	—	—
Sapsucker	W	2	—	—	—	—	—	—	—	—	—	—	1	10	2	60	—	—
Robin	P	1	—	—	—	—	—	—	—	—	—	—	1	10	1	20	1	18
Cardinal	P	2	—	—	—	—	—	—	—	—	—	—	1	10	2	40	—	—
Phoebe	P	2	—	—	—	—	—	—	—	—	—	—	—	—	2	40	—	—
White-throated Sparrow	W	2	—	—	—	—	—	—	—	—	—	—	—	—	2	40	—	—
Red-bellied Woodpecker	P	1	—	—	—	—	—	—	—	—	—	—	—	—	1	20	—	—
							7		9		7		25		23			
Number of Species....42			15		8				12				29				12	

Crab Grass.—The Savannah Sparrow was the Most Abundant bird of the Crab Grass, with a frequency of 100 and an average of 67 individuals per census on plots that averaged 8 acres in size. The Meadowlark was Common. The remaining 6 species were Rare.

Crabgrass-Tall Weeds, Tall Weeds-Broomsedge, Broomsedge-Pine.—In all three of these old-field stages the Field Sparrow was the Most Abundant species, the Junco was Abundant, and the Savannah and Song Sparrows Common. The other 8 species were Rare. There were no exclusive species in any of these three stages or the Crab Grass.

Pines.—Twenty-five species appeared in the Pines, 19 of which were in no previous stage. A four-species group constituted the principal birds: Most Abundant—Golden-crowned Kinglet; Abundant—Ruby-crowned Kinglet, Pine Warbler and Chickadee. Four species were found exclusively in Pines: Brown-headed Nuthatch, Sharp-shinned Hawk, Barred Owl, Blue-headed Vireo. There were almost no differences in the species from plot to plot.

Deciduous Woods.—These woods had 23 species but were much less rich in individuals than the Pines. Nineteen of these species occurred in the Pines also. The Golden-crowned Kinglet was the Most Abundant bird and it less so than in Pines. Exclusive species were Phoebe, White-throated Sparrow and Red-bellied Woodpecker. The presence of the Red-bellied Woodpecker is indicative of the mesic nature of these woodlands.

DISCUSSION

The 42 species of birds that appear in this study represent but 50% of the total regularly found around Raleigh in winter (Brimley, 1930: 74). The reason for the difference is that the hydroseral communities, and such modified habitats as hedgerow, thicket, barnyard and garden, were not included.

Only a few species fall in the higher abundance ratings, the majority being Uncommon to Rare. This is true both as a whole and within each stage, as shown in Table 2. The number of species, and the percentages, in each of the five abundance ratings, together with division into permanent (P), or winter (W) residence status, are:

	Number of Species			
Abundance Rating	P	W	*Total*	*Percentage*
5—Most Abundant	2	2	4	9.52
4—Abundant	2	2	4	9.52
3—Common	4	4	8	19.04
2—Uncommon	10	5	15	35.70
1—Rare	8	3	11	26.18
	26	16	42	100.00

While there are 26 permanent resident to 16 winter resident species, the two types are equally divided in the first three abundance ratings, which include at least three-fourths of all individuals.

The similarities of the bird populations between the two woody stages, and among the three old-field stages, indicate the existence for the birds of only four basic habitats in the upland plant succession. These are, with their predominant birds: Bare Field (and Pasture)—Meadowlark; Crab Grass—Savannah Sparrow; Old Field—Field Sparrow, Junco; Woods—Golden-crowned Kinglet, Ruby-crowned Kinglet, Pine Warbler, Chickadee.

Most species exhibit a narrow habitat range, as illustrated in Table 3. On the basis of the 7 plant stages used for the census work, 12 species of birds or 28% were limited to one stage, and an additional 20 species or 47% limited to 2 stages. On the basis of the 4 plant stages postulated in the preceding paragraph, 27 species or 64% occurred in but one stage.

TABLE 3

HABITAT RANGE, ALL SPECIES

On basis of seven plant stages			*On basis of four plant stages*		
Number of stages	*Number of species*	*Percentage*	*Number of stages*	*Number of species*	*Percentage*
1	12	28.56	1	27	64.26
2	20	47.60	2	9	21.42
3	3	7.14	3	5	11.90
4	4	9.52	4	1	2.38
5	2	4.76		42	100.00
6	0	0.00			
7	1	2.38			
	42	100.00			

Twenty-two species, or 52% of the total, occurred only in the woodlands. Thirteen species, or 31% occurred only in the pre-pine stages. The remaining 7 species, constituting 17% (Dove, Junco, Chickadee, Flicker, Crow, Bluebird, Goldfinch), were wide-ranging, occurring in both seral and woody stages, and disturbing somewhat the otherwise clear species shift from stage to stage.

The birds-per-acre figures listed in Table 1 are not offered as accurate quantitative estimates. They represent the average number of individuals counted per acre on each census, and are used to give comparative information only. The similarities between Bare Fields and

Pastures are shown by figures of 2.35 and 2.8 birds-per-acre respectively. The Crab Grass and the three Old Field stages had higher populations, with figures between 6.5 and 11.5 birds-per-acre. The Pines supported a much larger population than did the barren Deciduous Woods, as shown by the ratio of 7 to 1 birds-per-acre. The overall average of 4.35 individuals per acre may not be too far off from the true winter population.

SUMMARY AND CONCLUSIONS

1. A study was made of the relative abundance of the winter birds occurring in each stage of the upland plant succession in the vicinity of Raleigh, North Carolina.

2. Forty plots totaling 680 acres were used, divided among 7 stages. Seventy-five censuses were taken, between November 1, 1939, and March 1, 1940. Some relative figures are given on birds-per-acre.

3. Forty-two species were recorded. The birds of each stage were listed according to abundance and frequency. Only a few species (19%) were of high abundance. From 75% to 85% of the species exhibited a range of only one or two habitats.

4. Four basic plant habitats are indicated on the basis of their associated bird populations. These are, with their predominant birds: Bare Field—Meadowlark; Crab Grass—Savannah Sparrow; Old Field—Field Sparrow, Junco; Woods—Golden-crowned Kinglet, Ruby-crowned Kinglet, Pine Warbler, Chickadee.

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