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Article VI.

The Numbers and Local Distribution in
Summer of Illinois Land Birds
of the Open Country

BY
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and
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ARTICLE VI.—*The Numbers and Local Distribution in Summer of Illinois Land Birds of the Open Country.* BY STEPHEN A. FORBES AND ALFRED O. GROSS.

In 1913 the senior author of this paper published the product of a statistical study of the midsummer birds of Illinois,* based on a part of the data collected by the junior author in the summer of 1907 by methods already repeatedly described, and of that paper the present one is to be taken as a revision and continuation. The data of 1907 were derived from 7693.5 acres (almost all in farms) traversed in 428 miles of travel on foot, of which 41 per cent. was in northern, 26 per cent. in central, and 33 per cent. in southern Illinois. The fact that only tentative general conclusions could be drawn from a single year's study was clearly recognized in the beginning, as is shown by the following statement in a first paper on the general subject† :

"The circumstance that the data of this paper are summarized in numerical tables must not be permitted to obscure the fact that they merely present a fixed picture of a fleeting condition; that they are to be taken only as numerical generalizations of the observations here recorded, and do not, in themselves, warrant much by way of inference beyond their immediate contents * * *. Definite conclusions of permanent value concerning the numbers and significance of the bird life of the state evidently can not be drawn until many such pictures as these have been assembled, compared, and adjusted in their right relations."

It was hence particularly desirable that additional data should be collected during at least a part of a second year in order that it could be seen to what extent those of the first year might have a somewhat general application, and in order also that by a combination of the two sets of data a broader basis might be had for generalizations of more stable value; and this was done by a substantial repetition, during the three summer months of 1909, of the summer program of 1907.

There was a further special reason for repeating our first midsummer observations. The length of the State of Illinois from north to south brings its extremes into materially different climates, and necessitates its division, for comparative purposes, into northern, central, and southern sections; but these differ also in the time of onset of the annual seasons and the length of the period over which each season

* *The Midsummer Bird Life of Illinois.* By Stephen A. Forbes. Bul. Ill. State Lab. Nat. Hist., Vol. IX, p. 373-404.

† *An Ornithological Cross-section of Illinois in Autumn.* By Stephen A. Forbes. Bul. Ill. State Lab. Nat. Hist., Vol. VII, p. 332-333.

prevails.† The observations of the summer of 1907 were made in the early part of the season (June 4 to July 1) for southern Illinois, at the middle of it (July 9 to 24) for central Illinois, and during the latter part of it (July 29 to August 3) for the northern part of the state. By this program observations of the early summer in southern Illinois were brought into comparison with those of late summer in the northern section, and it was hence not possible to distinguish clearly in all cases between regional and seasonal differences in the bird life of these sections. To minimize differences due to season merely, in order that those due to climate and other sectional factors might stand out more clearly, the field program of the second summer (that of 1909) was so arranged that observations were made in early, middle, and late summer in each section of the state, those for southern Illinois June 8 to 17, July 13 to 21, and August 17 to 26; those for central Illinois June 22 to 29, July 23 to 31, and August 28 to September 4; and those for northern Illinois June 30 to July 8, August 4 to 13, and September 6 to 15. Furthermore, in order to give greater variety and validity to the whole body of observations of the two years taken together, those of the second year were given different location and range from those of the first. In 1907 continuous trips had been made between widely separated points, but in 1909 certain places were chosen as centers of characteristic districts, and from these relatively short trips were made in various directions.

In this second summer the total distance traveled by the observers was 654 miles, and the area covered by their observations was 11,624 acres—an increase of 51 per cent. over that of the earlier year. Forty-one per cent. of the total area of 1909 was in northern, 33 per cent. in central, and 26 per cent. in southern Illinois. The area covered in the two summers was 19,317.6 acres.

Notwithstanding the effort made to give a different range to the later observations, the general features of the country traversed in the two years were very similar, as is shown by the following table of the

CROP AREAS, PER CENT., SUMMERS OF 1907 AND 1909

Crops	Northern Illinois		Central Illinois		Southern Illinois	
	1907	1909	1907	1909	1907	1909
Corn	31	31	46	43	23	28
Small grain*	27	24	26	28	21	35
Forage crops	37	38	27	25	44	33
Miscellaneous	5	7	1	4	12	14

* Including stubble and plowed ground.

† The significance of the north and south extension of the state is further illustrated by the fact that three faunal zones are represented in its area, the lower austral in southern Illinois, the upper austral in central, and the transitional in the extreme northern part of the state.

percentage of the whole area of observation for each year which was in each of the principal farm crops.

For the northern and central parts of the state the agreement between the two years is remarkably close, but there are noticeable differences between them in southern Illinois, due to the larger area in small grain in 1909, an increase evidently made at the expense of the forage crops. The comparison just made assures us, however, that any differences of importance noted in the bird life of the two years in the different sections were not attributable to differences in agricultural conditions.

The most striking general difference was in the seeming *greater abundance* of birds in 1909, in all three sections of the state. It is best shown in the following table of the numbers of birds recognized and counted and the number per square mile in each section of the state and in the state as a whole.

NUMBERS OF BIRDS SEEN AND NUMBERS PER SQUARE MILE,
SUMMERS OF 1907 AND 1909

Section	Number of birds			Numbers per square mile		
	1907	1909	Both years	1907	1909	Both years
Southern	2667	3973	6640	682	841	769
Central	2047	6368	8415	650	1071	925
Northern	3026	7647	10673	610	1021	857
State	7740	17988	25728	644	990	852

From this it appears that the number seen per square mile averaged 54 per cent. larger for the whole state in 1909 than in 1907, and that the increase was especially striking in central Illinois, where it amounted to 65 per cent. That this was a general and not a local phenomenon in Illinois is shown by our tables of the number of birds per square mile of different crops in different sections of the state. From these it appears that the numbers per mile recorded in 1909 exceeded those of 1907 in fields of corn, oats, stubble, plowed ground, pasture, orchards, woodlands, and yards and gardens and fell short of the 1907 numbers in wheat, meadow, shrubbery, and waste and fallow, and that the total of the areas of the first of these lists was 14,872 acres and that of the second list 4333 acres, the birds being more abundant in 1909 than in 1907 on tracts aggregating nearly three and a half times as great an area as those in which the 1909 numbers were smaller than those of 1907.

The possible causes of so sudden and so great an apparent increase in the bird population of the state are too numerous and too wide-spread to come within the range of our inquiries; but the fact itself is important, especially as showing the need of prolonged investigation as a basis for

generalization in this field. Among the minor illustrations of this fact is the disagreement of the second year's data with a conclusion reached in an earlier paper* already cited, to the effect that the total number of our summer birds increases from north to south in Illinois. This seemed to be true by our data of 1907, but it was not at all so by those of 1909; and when the averages for both years are brought together, as in the preceding table, we see that the numbers per square mile are larger for southern Illinois than for northern but are largest of all for the central part of the state.

NUMBERS OF GREGARIOUS AND SOLITARY SPECIES, RESPECTIVELY

In a search for possible causes of the marked increase of numbers throughout the state noted in 1909, we have tabulated separately the data for our nine principal gregarious species, namely, the English sparrow, quail, mourning dove, crow, bobolink, cowbird, red-winged blackbird, crow-blackbird, and goldfinch, and have brought these into comparison with the data for the solitary species remaining, with the result that the increase in numbers in 1909 is found almost wholly in the gregarious group. While the numbers of the solitary species per square mile in 1909 average for the whole summer and the whole state 6 per cent. larger than in 1907, those for the gregarious species are 2.39 times as large.

This fact raises the question whether the indicated increase in numbers was real, or only apparent and due to the insufficiency of our data. The unit of observation of the solitary species is the single bird, while that of the gregarious species is often a group of companions varying from a small flock to many hundreds. A record of a thousand solitary birds thus represents a larger number of separate observations than one of the same number of gregarious birds, and the averages in the latter case are less likely to be valid than in the former.

The social birds are not always gregarious, however, most of them scattering during their nesting season and often when in search of food, assembling only at the time of the spring migration and in late summer and fall after their young have become independent. That the actual number of gregarious birds to a single observation is much smaller than might be supposed, is shown by one of our tables which enables us to make a comparison between seven gregarious species and seventeen of the most abundant solitary species with respect to the average numbers recorded for each field or other unit of area covered by the summer survey of 1907. By this table it appears that the gregarious birds ranged in number per record from 2.4 for the mourning dove to 9.1 for the crow-blackbird, with an average of 6 per record for the seven species; while the corresponding numbers for the seventeen solitary species ranged from 1.3 for the brown thrasher and the red-headed woodpecker

* The Midsummer Bird Life of Illinois, *loc. cit.*, p. 375-376.

to 3.5 for the robin, with a general average of 2.1 per record for the group. In other words, the number of gregarious birds to the observation was less than three times the number of the more abundant solitary species; but it follows from even this fact that for equally valid averages and generalizations the number of observations of gregarious birds should be about three times as great as for the solitary species.

A further examination of the details of our tabulated data concerning the most abundant gregarious birds leads us to believe that, with three exceptions, the variations in numbers at different times and in the several sections of the state are not unusual as compared with the range of corresponding variations in the numbers of the solitary species, and

ACREAGE OF SURVEY
AND NUMBERS OF MOST ABUNDANT GREGARIOUS BIRDS,
SUMMERS OF 1907 AND 1909

	1907	1909	Both years
Acreege of Survey:			
Southern Illinois	2504.08	3023.11	5527.19
Central Illinois	2017.09	3806.80	5823.88
Northern Illinois	3172.39	4794.14	7966.53
Totals	7693.56	11624.05	19317.60
Numbers of gregarious birds recorded:			
English sparrow	1414	4239	5653
Quail	91	224	315
Mourning dove	461	670	1131
Crow	89	287	376
Bobolink	119	631	750
Cowbird	102	1845	1947
Red-winged blackbird	347	573	920
Bronzed grackle (crow-blackbird)	900	2455	3355
Goldfinch	158	231	389
Totals	3681	11155	14836
Birds per square mile	306	614	492
Numbers of above birds with three doubtful species omitted	2560	6224	8784
Birds per square mile	213	343	291

that with these exceptional cases eliminated our recorded numbers of gregarious birds per square mile may be accepted as fairly representative of the actual facts for these two years. The doubtful species are the cowbird, the crow-blackbird, and the bobolink, to be dropped from the computation for the following reasons:

The crow-blackbirds recorded, numbered 900 in 1907 and 2455 in 1909, and we omit the species from this comparison because the excess was found mainly in September in two situations in a single section of the state—that is, in yards and in corn fields in northern Illinois. The cowbird is omitted for a like reason, its numbers being 93 in 1907 and 1845 in 1909, of which 1302 were in large flocks seen in September in yards and corn fields, in northern Illinois.

The bobolink is dropped merely because of the restriction of its summer range to the northern part of the state, where the numbers seen were 743 for the two years together as compared with seven (doubtless caught in migration) in the two other sections of the state.

With these three species omitted, we have remaining 235 gregarious birds to the square mile in 1907 and 343 to the mile in 1909, an increase in the latter year of 46 per cent., which we are disposed to take as actual, but of the causes of which we can offer at present no explanation.

MOST ABUNDANT SPECIES, BOTH YEARS

The list of birds recognized and counted in the summer months of 1907 contained 85 species names and the corresponding list for 1909 contained 117 names. Most of the species were seen in both years, the entire list for both numbering only 125; or if we include the species noted in an orchard survey of 1908, the total is 133. Many of the species of these lists were represented by relatively insignificant numbers, 21 of the species seen in 1907 and 19 of those seen in 1909 making up 85 per cent. of the total number of birds seen in those years. The 21 most abundant species of 1907 aggregated 550 to the square mile, and the remaining 68 species only 95 to the mile; and the 19 most abundant species of 1909 aggregated 842 to the mile, and the remaining 88 species only 148.

The 19 most abundant birds of 1909, making up 85 per cent. of all the birds seen in that year, are all on the corresponding list for 1907, the latter differing only by the addition of two names, grasshopper sparrow and upland plover, not on the 1907 list. When we compare the numbers, and especially the ratios, of the different species (the base of the percentages being the total numbers of birds seen), we find a fairly good agreement for the two years, with a few somewhat striking differences, largely of the more gregarious species, as shown by the following table.

The most marked discrepancies between the two years are in the percentages of the cowbird, bobolink, and dickcissel, those of the cowbird in one year being about nine times those in the other, and those of

THE MOST ABUNDANT BIRDS, SUMMERS OF 1907 AND 1909

Species	Number seen			Per cent. of all birds seen			Ranking as to numbers		
	1907	1909	1907 and 1909	1907	1909	1907 and 1909	1907	1909	1907 and 1909
English sparrow	1414	4239	5653	18.2	23.6	22.1	1	1	1
Meadowlark	1025	1434	2459	13.2	8.0	9.6	2	4	3
Bronzed grackle*	900	2455	3355	11.6	13.6	13.0	3	2	2
Mourning dove	461	670	1131	6.0	3.8	4.4	4	5	5
Dickcissel	393	353	746	5.1	2.0	2.9	5	11	8
Red-winged blackbird	347	573	920	4.5	3.2	3.6	6	7	6
Prairie horned lark	296	414	710	3.8	2.3	2.8	7	9	9
Flicker	197	419	616	2.5	2.3	2.4	8	8	10
Robin	194	417	611	2.5	2.3	2.4	9	10	11
Field sparrow	186	294	480	2.4	1.7	1.9	10	12	12
Goldfinch	158	231	389	2.0	1.3	1.5	11	15	13
Kingbird	126	184	310	1.6	1.1	1.2	12	18	17
Bobolink	119	631	750	1.5	3.6	2.9	13	6	7
Grasshopper sparrow	110	0	110	1.4	0.0	0.4	14	..	20
Brown thrasher	104	204	308	1.3	1.1	1.2	15	17	18
Red-headed woodpecker	99	259	358	1.3	1.4	1.4	16	14	15
Barn swallow	96	159	255	1.2	0.9	1.0	17	10	19
Cowbird	102	1845	1947	1.3	10.3	7.6	18	3	4
Quail	91	224	315	1.2	1.2	1.2	19	16	16
Upland plover	89	0	89	1.1	0.0	0.3	20	..	21
Crow	89	287	376	1.1	1.6	1.5	21	13	14
Totals	6596	15,292	21,888	85.3	85.0	85.1			
Per square mile	549	842	725						

the other two species two and a half times. By combining the numbers of each species for both years, we get the most authentic record obtainable from our data, and by this means we see that the eleven principal species of the summer birds of the whole state, were the English sparrow, crow-blackbird, meadowlark, cowbird, mourning dove, red-winged blackbird, bobolink, dickcissel, prairie horned lark, flicker, and robin, abundant in the order named. These eleven species taken together aggregated 74 per cent. of all the birds counted in the summer months of the two

* Commonly known in Illinois as the crow-blackbird, or common blackbird.

years and averaged as a group 624 to the square mile, while the numbers of the 114 remaining species amounted to 228 to the mile.

THE MOST ABUNDANT BIRDS BY SECTIONS OF THE STATE

Eighty-five species and one variety of birds were recognized and counted in southern Illinois in the summers of 1907 and 1909 and twenty-two of these were so abundant as to comprise 83 per cent. of the total number of birds, leaving but 17 per cent. for the other sixty-four species. Otherwise stated, twenty-two species averaged 250 birds each while the remaining 64 species averaged only eighteen each. The more common 25 per cent. of the different kinds of birds were about fourteen times as numerous per species as the less common 75 per cent. The commoner group of 22 species averaged 638 birds to the square mile, and the less common group 130 to the mile, the former with one bird to the acre and the latter with about five acres to the bird.

NUMBERS OF PRINCIPAL SUMMER BIRDS OF SOUTHERN ILLINOIS IN 1907 AND 1909 (22 SPECIES)

(83 PER CENT. OF ALL THE BIRDS SEEN)

Meadowlark	1293
English sparrow	795
Mourning dove	518
Field sparrow	322
Dickcissel	314
Red-winged blackbird.....	278
Bronzed grackle	274
Quail	241
Robin	165
Brown thrasher	137
Kingbird	119
Cowbird	116
Mockingbird	112
Blue jay	111
Red-headed woodpecker	105
Orchard oriole	103
Bluebird	96
Grasshopper sparrow	93
Killdeer	87
Flicker	82
Maryland yellow-throat	78
Indigo bunting	75
Total	5514

When we come, however, to compare southern with central Illinois, we find a striking difference in respect to the number of dominant species. The southern part of the state is much more broken and diversified than the central—contains, that is, a greater variety of situations, each with its more or less definite group of characteristic or dominant

birds. The number of these dominant species is thus much larger and the number of birds to the species is correspondingly smaller than in the comparatively level, uniform territory of central Illinois. Although the areas covered by the bird survey were approximately equal in these two sections of the state,* and the number of birds seen was nearly 27 per cent. greater in central Illinois than in southern, the number of species was 20 per cent. smaller and the dominant species were much fewer—85 per cent. of all the birds belonging to thirteen species instead of twenty-two, and these averaging 553 to the species instead of the 250 of southern Illinois.

The average frequency of all birds in the central section was 925 per square mile, and 791 of these (86 per cent.) belonged to the thirteen more abundant species; while the birds of the remaining fifty-nine species, if equally distributed, would each have had about ten acres to itself.

NUMBERS OF PRINCIPAL BIRDS
OF CENTRAL ILLINOIS,
SUMMERS OF 1907 AND 1909
(13 SPECIES)

(85.5 PER CENT. OF ALL THE BIRDS SEEN)

English sparrow	1865
Cowbird	1744
Bronzed grackle	1111
Meadowlark	630
Mourning dove	407
Dickcissel	283
Red-winged blackbird	225
Prairie horned lark	204
Flicker	184
Robin	170
Brown thrasher	133
Red-headed woodpecker	125
Crow	115
Total	7196

Northern Illinois has a somewhat more uneven and diversified surface than the central section of the state, but much less so than the southern, and consistently with these facts we find that 15 of its species made up 84.4 per cent. of its bird population in 1907 and 1909, 79 species contributing but 15.16 per cent., the former group averaging 698 birds of each species and 723 to the square mile, and the latter group but 21 to the species and 131 to the square mile.

Illustration from May-beetles.—The relation shown in the complexity of an environment and the number of dominant species of birds, which it contains is paralleled in a convincing way by data derived from extensive collections of Illinois May-beetles made for the senior

* 5527.19 acres in southern Illinois and 5823.88 in central.

NUMBERS OF PRINCIPAL BIRDS
OF NORTHERN ILLINOIS,
SUMMERS OF 1907 AND 1909
(15 SPECIES)

(84.4 PER CENT. OF ALL THE BIRDS SEEN)

English sparrow	2993
Bronzed grackle	1970
Bobolink	743
Meadowlark	536
Prairie horned lark	451
Red-winged blackbird	417
Flicker	350
Robin	276
American goldfinch	257
Mourning dove	206
Crow	197
Barn swallow	160
Vesper sparrow	151
Grasshopper sparrow	151
Dickcissel	149
Total	9007

author in 1907 to 1912 when he was state entomologist of Illinois. In an article on the subject published in the Twenty-ninth Report of that office* is a tabulation of the distribution by sections of the state of 114,493 specimens of thirty-four species of May-beetles (Phyllophaga), from which it appears that, with these insects also, the number of dominant species is greatest in southern Illinois, where 8 out of 30 species make up 85 per cent. of the total number taken; smallest in central Illinois, where 3 of 28 species made up 81.7 per cent., and 4 species made 91 per cent.; and intermediate to these in the northern part of the state, where 5 of 21 species made up 85 per cent. of the whole number taken. The average number of each dominant species differs, of course, in the same direction. In southern Illinois the eight most abundant May-beetles were represented by an average number of 2959 specimens each and the remaining 22 by only 103 each. In central Illinois the corresponding numbers were 17,952 each for the four commonest species and 291 each for the 24 others, and in northern Illinois they were 2619 each for five of the species and 112 each for the remaining 21.

THE MOST ABUNDANT SPECIES OF THE WHOLE STATE

By uniting into one the three preceding lists and filling in the numbers of each species in all the columns for the sections of the state, we make up the following table, in which it is easy to distinguish the eleven principal species for the whole state. This comprises all whose numbers are larger than 500, and the twenty-nine species of this table

* A General Survey of the May-beetles (Phyllophaga) of Illinois, by S. A. Forbes, State Entomologist, p. 23-70.

aggregate more than 90 per cent. of all the birds recorded during the two summers covered by this discussion.

NUMBERS OF PRINCIPAL BIRDS IDENTIFIED IN EACH SECTION,
AND IN THE WHOLE STATE*
(29 SPECIES)

A. O. U. numbers	Species	S. Ill.	C. Ill.	N. Ill.	Whole state
273	Killdeer	87	23	64	174
289	Quail	241	53	21	315
316	Mourning dove	518	407	206	1131
406	Red-headed woodpecker	105	125	128	358
412	Flicker	82	184	350	616
444	Kingbird	119	52	139	310
474b	Prairie horned lark	55	204	451	710
477	Blue jay	111	37	52	200
488	Crow	64	115	197	376
494	Bobolink	5	2	743	750
495	Cowbird	116	1744	87	1947
498	Red-winged blackbird	278	225	417	920
501	Meadowlark	1293	630	536	2459
506	Orchard oriole	103	3	6	112
511b	Bronzed grackle	274	1111	1970	3355
	English sparrow	795	1865	2993	5653
529	Goldfinch	74	58	257	389
540	Vesper sparrow	1	22	151	174
546	Grasshopper sparrow	54	93	151	298
552	Lark sparrow	93	6	7	106
563	Field sparrow	322	59	49	430
598	Indigo bunting	75	14	27	116
604	Dickcissel	314	283	149	746
613	Barn swallow	4	91	160	255
681	Maryland yellow-throat	78	19	7	104
703	Mockingbird	112	7	1	120
705	Brown thrasher	137	133	38	308
761	Robin	165	170	276	611
766	Bluebird	96	22	79	197
	Numbers of dominant species	22	13	15	11

* Black-face figures show dominant species in each section.

CHANGE OF NUMBERS FROM NORTH TO SOUTH

In an earlier paper on the midsummer bird-life of Illinois, already cited, it was reported that, according to our data of 1907, the English sparrow decreased in numbers in the summer time from north to south in Illinois, but that the numbers of the native summer residents increased in that direction by something like 16 per cent. for central Illinois and

29 per cent. for southern Illinois. When, however, we bring together our data for the two seasons, as in the table on page 197, and compare sectional numbers for the different species, we find that ten species sufficiently abundant to make them available for comparison show a marked progressive increase in numbers from north to south, and that eleven species show a decrease in that direction as follows:

THE MORE ABUNDANT BIRDS WHICH SHOW A
PROGRESSIVE CHANGE IN NUMBERS IN SUMMER
FROM NORTH TO SOUTH IN ILLINOIS
(DATA OF 1907 AND 1909)

<i>Increase</i>	<i>Decrease</i>
Quail	English sparrow
Mourning dove	Red-headed woodpecker
Meadowlark	Flicker
Orchard oriole	Prairie horned lark
Lark sparrow	Crow
Field sparrow	Bobolink
Dickcissel	Bronzed grackle
Maryland yellow-throat	Vesper sparrow
Mockingbird	Grasshopper sparrow
Brown thrasher	Barn swallow
	Robin

The general summer range of two of the above species—the mockingbird and the bobolink—is so definitely limited as to make their preponderance in southern and northern Illinois respectively a matter of course. Indeed, it seems probable that in so level and uniform a state as Illinois, where there are few topographical barriers to the distribution of birds, the contrasts in numbers between the north and the south are mainly due to differences in the general range of the species, those whose centers of general distribution lie to the northward of the state diminishing in number in Illinois toward the southern boundary of their midsummer range, and the Illinois numbers of those whose distribution centers lie southward increasing in that direction.

The degree of overlapping and intermingling of northern and southern species in central Illinois will vary somewhat with the character of the season, as the different species differ in susceptibility to peculiarities of temperature, humidity, and other features of the spring and summer weather. Variations in the abundance or scarcity of the principal elements of the food of the various species may have a similar effect to limit or extend their midsummer distribution in a way to affect them variously. Those, for example, with a fixed and narrow range of food preferences will be severely checked in their migrations by a local deficiency of their favorite food, while others, with less discriminating tastes, may find the deficiency of certain food elements compensated by an unusual abundance of other food.

BIRDS AND VEGETATION AREAS

The several vegetation areas of our survey, may be arranged for convenient comparison in the order of the numbers of birds to the square mile, as in the following table.

VEGETATION AREAS AND BIRDS PER SQUARE
MILE IN EACH, THE WHOLE STATE,*
SUMMERS OF 1907 AND 1909

Vegetation	Acres	Birds
Orchards	117.69	3943
Yards and gardens	557.39	3418
Swamps	83.66	1974
Woodlands	111.96	1846
Pastures	5196.06	1068
Shrubbery	93.31	1056
Meadows	2763.02	910
Wheat, rye, and barley	822.36	827
Waste and fallow	654.17	787
Plowed ground	300.16	670
Stubble	1069.46	669
Corn	6433.63	593
Oats	2485.57	514
Miscellaneous	29.16	329

* The general state average of all birds, both summers, taken together, was 852 to the square mile.

Half of these 14 classes of area carry a bird population exceeding the average for the state as a whole, and half of them fall below that average. Of the larger areas, each comprising from 1000 to 6000 acres or more and aggregating 85 per cent. of all our census territory, pastures and meadows stand highest, with corn and oats falling much below the average. Generally speaking, the smaller areas attract the largest numbers of birds to the square mile, possibly because, as we have found to be clearly the case with orchards,* the characteristic birds of a single kind of vegetation area are scattered where the area is large, and concentrated where it is small. Of these smaller areas, orchards stand much the highest, with nearly five times the average concentration, and yards and gardens next, the birds of all these situations showing by their local numbers, a high degree of adaptation to the companionship and life of man. Swamps and open woodlands are almost the only approximately wild places on our list, and these contain about twice as many birds as the general average, but less than half

* "The Orchard Birds of an Illinois Summer", by Stephen A. Forbes and Alfred O. Gross. Bul. Ill. State Nat. Hist. Survey, Vol. XIV, p. 1-8.

as many as the areas of human neighborhood. Their total of some 200 acres is, however, rather small for any definite inference.

THE BIRD LIFE OF ILLINOIS PASTURES

On the 3796 acres of pasture whose bird population was accurately ascertained in the two summers, an average of 1068 birds to the square mile was found—1041 in northern, 1274 in central, and 937 in southern Illinois. If we separate the data for the different years, we find an average for the state of 881 to the square mile in 1907 and 1194 to the mile in 1909, the excess for the latter year being 36 per cent. in northern Illinois, 29 per cent. in central Illinois, and 30 per cent. in southern.

The 6335 birds identified in pastures belonged to ninety-six species, but 85 per cent. of these belonged to twenty-three species, leaving but 15 per cent. for the other seventy-three. There was thus no small distinctive group of pasture birds, such as were found in some other habitats, but the pasture was merely one of the preferred resorts of a rather long list of species, every one of which was, in fact, found in one or more other situations more frequently than there.

The English sparrow stood at the head of the list of pasture visitants, but the meadowlark led the native birds in each year and in each section of the state, and was found in southern Illinois pastures more than twice as common as the sparrow. The crow-blackbird, or bronzed grackle, was third in order of numbers in both years and in the whole state, but it was surpassed in the southern part of the state by the field sparrow and the mourning dove, and in central Illinois by the cowbird. Among other more prominent birds were the flicker (which was, however, only about a third as common in southern Illinois pastures as farther north), the robin, also much the least abundant in southern pastures, the prairie horned lark, much the commonest in northern Illinois, and the red-winged blackbird.

Comparing the data of the two years, we find 13 of the 23 most abundant species represented by notably larger numbers per square mile in 1909 than in 1907, two of them by fewer, and 8 by virtually equal numbers. The group of pasture birds thus gives the same indication of increased numbers in 1909 as do the combined data from all situations. Additional particulars concerning these species may be gathered from the following table.

From the known food habits of the more abundant pasture species it appears that the meadowlark and the crow-blackbird are the kinds most serviceable, under ordinary conditions, as a pasture police for the control of injurious insects. When a considerable outbreak of a destructive species occurs, many other birds attracted by unusual chances for "loot" will come to the aid of the regular force; but it is to the less conspicuous services of constant residents and frequent visitants that the farmer must look for a steady pressure upon the multiplication

PRINCIPAL PASTURE BIRDS PER SQUARE MILE,
SUMMERS OF 1907 AND 1909

Species	Southern	Central	Northern	1907	1909	Whole state, both years
Meadowlark	240	168	79	143	157	151
Bronzed grackle	46	101	72	49	88	72
Cowbird	16	162	22	11	85	55
Robin	27	72	53	35	60	50
Prairie horned lark	21	27	72	47	48	48
Flicker	19	53	63	29	59	47
Mourning dove	50	76	14	31	47	41
Red-winged blackbird	34	27	35	23	39	33
Field sparrow	57	27	8	41	19	28
Red-headed wood-pecker	18	36	27	22	29	26
Bobolink	2	1	53	8	35	24
English sparrow	102	244	191	176	178	177
Goldfinch	8	9	37	17	24	21
Barn swallow	2	45	25	17	27	23
Brown thrasher	23	26	15	14	24	20
Kingbird	21	21	17	20	19	19
Crow	8	19	27	14	19	19
Bluebird	17	11	25	14	23	19
Quail	28	11	8	14	15	15
Killdeer	6	8	19	15	10	12
Dickcissel	18	21	4	13	12	12
Blue jay	15	9	10	11	11	11
Grasshopper sparrow	9	12	10	9	10	9
Totals	787	1186	886	773	1038	932
Per cents. of all birds	84	93	86	88	87	87

of cutworms, grasshoppers, May-beetles, and other ordinary insect pests of the pasture.

THE MEADOW BIRDS

In Illinois meadows the meadowlark justified its name by an abundance virtually double that of any of the other "most abundant" birds—194 to the square mile as compared with 100 for the dickcissel and 94 for the English sparrow. In northern Illinois it was surpassed by the bobolink (201 to the square mile and 102 for the meadowlark), but the absence of the bobolink from the more southern sections reduced its meadow average for the state to 96.

Fourteen species made up 82 per cent. of all the birds identified in meadows, and more than half the whole number of birds belonged

to the four species mentioned above. Next in order came the crow-blackbird, red-winged blackbird, and grasshopper sparrow, found in nearly equal numbers per square mile, those for the seven other more abundant species ranging from 31 to the mile down to 9.

PRINCIPAL MEADOW BIRDS PER SQUARE MILE,
WHOLE STATE,
SUMMERS OF 1907 AND 1909

Species	Southern	Central	Northern	1907	1909	Whole state, both years
Upland plover	4	67	22	19	30	25
Mourning dove	36	35	22	31	27	29
Flicker	7	51	40	37	26	31
Kingbird	10	7	21	19	11	15
Prairie horned lark	1	5	41	23	19	21
Bobolink	0	0	201	12	166	96
Red-winged blackbird	80	32	18	50	34	41
Meadowlark	319	204	102	204	185	194
Bronzed grackle	18	85	55	81	21	49
English sparrow	54	85	126	112	79	94
Grasshopper sparrow	19	64	48	56	29	41
Dickcissel	155	179	29	122	81	100
Barn swallow	0	10	16	12	7	0
Robin	7	13	17	17	10	13
Totals	710	837	758	795	725	749
Per cents. of all birds	78.7	83.9	87.1	86.8	81.6	83.4

Compared with pastures, meadows were distinguished by the somewhat greater prominence of the meadowlark (194 to 151), the exclusive habitation of the bobolink (96 to 0), the much greater prevalence of the dickcissel (100 to 12) and the grasshopper sparrow (41 to 10), and the greater abundance of the red-winged blackbird (41 to 33). As against this list of distinctive meadow birds there is a much longer list of those to which the meadow was less attractive than the pasture. The principal of these are the English sparrow (94 to the square mile in meadow and 177 in pasture), the crow-blackbird (49 to 72), the robin (13 to 50), the prairie horned lark (21 to 48), the flicker (13 to 47), and the mourning dove (29 to 41). With the possible exception of the last, these differences are fairly consistent with the known food and habits of the several species. This obvious preference of the species mentioned for pastures over meadows is reflected in the average for the whole state of the meadow and pasture birds respectively (meadows, 910, and pastures, 1085, to the square mile).

BIRDS IN SMALL GRAIN AND IN STUBBLE

Wheat and oats, judging by our data, offer very similar inducements (or lack of special inducements) to birds, but with one notable exception, that of the mourning dove, of which ten times as many to the square mile were found in fields of wheat as in oats (141 to 14, respectively).

Differences seen in the numbers of the gregarious and erratic cowbirds and grackles seem to have little significance, and may probably be attributed mainly to the mere chances of unequal distribution, but with these species eliminated, the numbers of birds in wheat exceed those in oats by about 34 per cent.

NUMBERS PER SQUARE MILE OF PRINCIPAL BIRDS
IN SMALL GRAIN AND STUBBLE, WHOLE STATE,
SUMMERS OF 1907 AND 1909
(Wheat, rye, and barley, 822 acres; oats, 2486;
stubble, 1069.)

Species	Wheat*	Oats	Stubble
Quail	14	4	9
Mourning dove	141	14	40
Prairie horned lark	24	5	11
Crow	21	12	11
Bobolink	4	16	23
Cowbird	121	11	1
Red-winged blackbird	26	21	1
Meadowlark	47	50	89
Bronzed grackle	156	92	4
English sparrow	147	163	159
Goldfinch	8	10	10
Dickcissel	27	28	1
Cliff swallow	2	3	12
Robin	3	4	8
All birds	827	514	669

* Includes rye and barley.

Fields of small grain would seem to undergo so great a change as bird resorts as the grain is cut and shocked, that we might well have anticipated a marked contrast in the species and numbers found in them after harvest, but our table does not confirm this expectation, the differences between stubble fields and those of uncut grain being chiefly in the gregarious cowbirds and blackbirds, and otherwise not noticeably greater than those between fields of oats and wheat.

As a further test of this conclusion, we have tabulated separately the numbers of all species found in fields of small grain, before harvest and after the grain had been cut and shocked, but we find few consistent

or significant differences, variations in numbers in the contrasted situations being generally erratic and in different directions at different times.

A comparison of the columns of our table for the two years gives us, in fact, an impression that the grain fields are resorted to by most birds for occasional and temporary reasons, such as the superabundance of easily accessible and especially desirable food in the shocked wheat, or a scarcity of the ordinary food of the species elsewhere. The marked preference of the mourning dove for harvested wheat over any other of the situations of our table, and the unusual abundance of meadow-larks in 1909 in fields of harvested oats are probably to be thus accounted for; but the apparent preference of the dickcissel for standing grain is not so easily understood. Its uniform averages of 42 to the square mile in this situation, of only 6 or 7 in fields of shocked grain, and virtually none in naked stubble fields mean, on the face of the figures, that it finds in the growing grain important advantages which largely disappear when the grain is cut; but in view of the habits of the species, it seems to us more likely that the difference is due to the mere advancement of the season. The nesting period of the dickcissel is practically over by the time the grain is all harvested, and by the first week in August most of the birds have assembled in secluded roosts for their postjuvinal and postnuptial molts, soon after which they leave for the South. In fact, less than 10 per cent. of our dickcissels were seen after July 31 in fields of grain, either cut or uncut, and their relative scarcity in shocked wheat or oats is very likely due to their gradual withdrawal from the open country.

ACREAGE SURVEYED OF WHEAT AND OATS, UN-CUT
AND CUT,
WHOLE STATE, MIDSUMMERS OF 1907 AND 1909

Crops	1907		1909	
	Uncut	Cut	Uncut	Cut
	Acres		Acres	
Wheat	134.52	151.14	201.15	123.90
Oats	531.41	601.07	454.28	669.13

ALL BIRDS, PRINCIPAL SPECIES, AND NATIVE BIRDS
IN WHEAT AND OATS, CUT AND UNCUT,
MIDSUMMERS OF 1907 AND 1909

Birds	1907								
	Wheat				Oats				
	Uncut		Cut		Uncut		Cut		
	Num- bers	To sq. mi.	Num- bers	To sq. mi.	Num- bers	To sq. mi.	Num- bers	To sq. mi.	
English sparrow	77	371	9	38	55	66	231	245	
Mourning dove	20	95	57	241	13	16	6	6	
Meadowlark	12	57	12	51	32	39	57	61	
Prairie horned lark	0	0	8	34	0	0	14	15	
Dickcissel	9	43	3	13	49	59	6	6	
All birds	153	728	291	1228	385	469	422	445	
Native birds	76	362	282	1194	330	397	191	203	
Birds	1909								
	English sparrow	25	80	15	77	611	861	417	379
	Mourning dove	8	25	29	150	9	13	16	15
	Meadowlark	12	38	0	0	23	32	75	72
Prairie horned lark	23*	74	0	0	8	4	1	1	
Dickcissel	10	32	1	5	29	41	6	6	
All birds	133	423	128	635	813	1145	842	805	
Native birds	108	344	113	584	202	285	425	426	

* Twenty in one flock.

THE BIRDS OF THE CORN FIELD

With the exception of occasional raids made on fields of corn by flocks of crow-blackbirds and cowbirds in fall to feed on grain torn from the tips of the ears, there is little in our data to indicate that our Illinois birds find any special lure or attraction in corn fields. It is true that the English sparrow was found there in numbers averaging 130 to the square mile, but this was less by 57 than the average of the sparrow for the whole state. The blackbird, on the other hand, was more abundant in corn fields than its general average (138 and 111 to the

square mile respectively), as was also the cowbird (88 in corn fields and 64 in the state at large). None of the eleven remaining "more abundant" species necessary to bring the total up to 82.5 per cent. of all the corn field birds, was present in greater number than 29 to the square mile, the ratio of the mourning dove. The heterogeneous composition of this list of fourteen species and the moderate average numbers of each in corn fields suggests, indeed, that their presence there was "accidental" rather than purposive, and we find no evidence in our records, with the two exceptions mentioned, that there is any group of corn field birds, properly so-called. In other words, we can not say that the corn plant either profits or suffers from the visits of birds to the fields in which it is growing (again excepting, of course, the cowbird and the crow-blackbird) to any extent which we have been able to discover.

PRINCIPAL BIRDS PER SQUARE MILE OF CORN,
SUMMERS OF 1907 AND 1909

Species	Southern	Central	Northern	1907	1909	Both years
Quail	24	4	5	2	9	6
Mourning dove	50	32	14	26	32	29
Red-headed woodpecker	10	6	3	4	7	6
Flicker	5	9	14	7	12	10
Prairie horned lark	6	29	16	20	19	19
Crow	3	9	14	4	13	10
Cowbird	15	213	2	6	141	88
Red-winged blackbird	14	7	30	9	23	18
Meadowlark	25	7	2	10	9	9
Bronzed grackle	32	133	206	60	188	138
English sparrow	49	120	189	50	181	130
Goldfinch	4	5	19	12	9	10
Vesper sparrow	1	3	18	5	10	8
Brown thrasher	9	9	2	7	6	6

BIRDS ON PLOWED GROUND

Ground plowed for planting but not yet planted can scarcely be said to resemble any natural habitat, or be expected to serve as a place of assemblage for any definite group of birds, and our data, derived from three hundred acres of plowed fields, chiefly in southern Illinois, are in accord with this supposition. A record of 314 birds occurring on this area, equivalent to the very respectable average of 670 to the square mile, is attributable mainly to the prairie horned lark, which has an unexplained but well-known preference for bare earth as a resting place. On plowed ground it was usually feeding busily on tiny weed seeds lodged in the soil, as shown by its actions and by the contents of crops examined. It was more than twice as abundant in plowed fields (162 to the square

mile) as any other species, the next in order being the mourning dove (77) and cowbird (49). These and four other species—the killdeer (58), robin and upland plover (34 each), and English sparrow (30)—together made up 86 per cent. of all the birds recognized on plowed ground. The occurrence here of two species of shore birds in some numbers (22 examples of the killdeer and 14 of the upland plover) was probably due to their search for earthworms and insect larvae in the soft earth.

THE BIRDS OF THE SWAMPS

Open swampy lands are so scarce in Illinois that in 1070 miles of travel made in the summers of 1907 and 1909, only 4.6 miles were over swamps. In the area of 83.66 acres thus covered, 258 birds, belonging to thirty species, were identified, an average of 1974 birds to the square mile—about two and a quarter times the general average for the whole state. Two thirds of the swamp area was in northern Illinois, and there more than three fourths of the swamp birds were found. All of our thirty species were represented in this northern list, while on the nineteen acres of southern Illinois swamp there were but five species (the red-winged blackbird, crow-blackbird, meadowlark, dickcissel, and Maryland yellow-throat); and in $2\frac{3}{4}$ acres in central Illinois there was but one—the red-winged blackbird. The six species of the following table made up 82.6 per cent. of all the birds identified in swamps.

PRINCIPAL BIRDS OF ILLINOIS SWAMPS, SUMMERS OF 1907 AND 1909 NUMBERS PER SQUARE MILE	
Red-winged blackbird	1125
Bronzed grackle	207
Bobolink	130
Quail	76
Green heron	46
Long-billed marsh wren	46

BIRDS OF THE OPEN WOODS

Our data concerning the woodland birds are rather meager, mainly because it was impossible to use our method of identification and enumeration in any except open woodlands of comparatively small trees, and the one hundred and twelve acres accurately covered consequently made too small and too special an area to be fully representative. Furthermore, the southern Illinois forest area surveyed was more than twice as large as that of all the rest of the state, and hence the forest birds of the southern section predominate strongly in our lists for the state as a whole.

About half of the fifty species recorded from woods were distinctively forest birds, rarely if ever seen in the open fields, and especially adapted by habit, preference, and sometimes by structural endowment

also, to life among trees. Nothing of the sort can be said of the birds of the pasture or the stubble field or of other distinguishable vegetation areas of the open country.

The forest is a more complex environment than the meadow or the grain field, and its bird society is less dominated by a few conspicuous species. Thirty-one of the fifty species of our list were, in fact, necessary to bring our total of the more abundant kinds up to 85 per cent. of the whole number of birds; and the most abundant of these, the blue jay and the field sparrow, averaged only 194 and 131 to the square mile respectively. These were followed by the flicker, with 97 to the square mile, the robin, with 86, the brown thrasher and crested flycatcher, 69 each, and these, in order of numbers, by the wood pewee, crow, and mourning dove, with other species in ratios gradually decreasing to 17 to the square mile. The aggressive and presuming English sparrow, usually at the top of our lists, was in

PRINCIPAL WOODLAND BIRDS (85 PER
CENT. LIST)
IN ORDER OF NUMBERS PER SQUARE MILE,
WHOLE STATE, SUMMERS OF 1907
AND 1909

Blue jay	194
Field sparrow	131
Flicker	97
Robin	80
Crested flycatcher	68
Brown thrasher	69
Wood pewee	63
Crow	63
Mourning dove	51
Red-headed woodpecker	51
Towhee	51
Indigo bunting	51
Tufted titmouse	51
Bronzed grackle	46
English sparrow	46
Cardinal	46
Bluebird	46
Redstart	46
Goldfinch	40
Quail	34
Downy woodpecker	34
Cowbird	34
Red-winged blackbird	34
Maryland yellow-throat	34
Bewick's wren	34
Dickcissel	23
Black and white warbler	23
Wood thrush	23
Turkey vulture	17
Sparrow hawk	17
Yellow-bellied flycatcher	17

the fourteenth place of this series, with an average of only 46 to the mile, and no more abundant than the bluebird or the cardinal.

The yearly ratios of these woodland birds (2187 to the mile in 1909 and 1441 in 1907) confirm our general conclusion that birds were much the more numerous in Illinois in 1909.

BIRDS IN ORCHARDS

We have already reported on the orchard birds of a southern Illinois summer, with some reference to other parts of the state, in a paper* in which we made special use of data obtained in August and September of 1908 by a trip through a commercial orchard district of that section; and we have here to report more fully on the product of a survey of 117.69 acres of farm orchards only, of which 71 per cent. was in southern, 18 per cent. in central, and 11 per cent. in northern Illinois.

In these orchard belts, 825 birds were identified, equivalent to 4026 to the square mile. The English sparrow, however, made up more than half this number, leaving 1987 native birds to the square mile. Next to the sparrow, the more abundant species were the mourning dove (256 to the mile), quail (212), field sparrow (190), crow-blackbird (158), robin (152), brown thrasher (125), orchard oriole (120), blue jay (114), catbird (103), mockingbird (77), and flicker (76). The birds of these twelve species made up 80.4 per cent. of the aggregate number belonging to the 52 species found in these farm orchards. It will be seen from the table following that, as in other vegetation areas, the English sparrow decreased rapidly in numbers from north to south, and that both it and the native birds were much more numerous in 1909 than in 1907 (1255 native birds to the square mile in 1907 and 1746 in 1909); and this notwithstanding the fact that there were evidently no flocks of gregarious birds to confuse the record in the orchards visited.

Although the orchard is, like the open woodland, essentially a field of closely set trees with a ground cover more or less deep and dense according to its treatment, and might hence be supposed to attract the same species of birds in something like the same average number, it is really so different from a forest in the relatively small variety of foods and situations which it offers, and especially in its human environment, that the two make a widely different appeal to birds. In the comparatively simple orchard, a smaller number of species dominate, 13 out of 52 native species comprising 70 per cent. of the whole number; while in the complex forest 20 out of 49 must be taken to make up this 70 per cent. Moreover, a comparison of the corresponding species lists illustrates the wide difference of the two environments, as is shown in the table on page 211. In the first column are the numbers per square mile of birds found in farm orchards, and in the second are the numbers

* The Orchard Birds of an Illinois Summer, by Stephen A. Forbes and Alfred O. Gross. *Bul. Nat. Hist. Survey*, Vol. XIV, Art. 1, June, 1921.

PRINCIPAL BIRDS PER SQUARE MILE OF ORCHARDS,
SUMMERS OF 1907 AND 1909

	Southern	Central	Northern	1907	1909	Both years
Quail	289	31	0	15	327	212
Mourning dove	297	218	49	310	224	256
Flicker	53	187	49	74	77	76
Blue jay	114	124	98	14	172	114
Orchard oriole	165	0	0	177	86	120
Bronzed grackle	137	342	0	192	138	158
English sparrow	426	4607	8373	592	2882	2039
Field sparrow	251	62	0	163	206	190
Mockingbird	84	93	0	30	103	77
Catbird	84	124	49	14	129	103
Brown thrasher	84	249	196	118	129	125
Robin	145	187	147	148	155	152
Totals	2129	6224	8961	1847	4628	3622

in woodlands multiplied by 2.14 to compensate for difference in density of the total bird population in orchard and woodland, and thus to make the averages comparable directly.

BIRDS IN SHRUBBERY

On ninety-three acres of shrubbery, 85 per cent. of it in southern Illinois and nearly all the remainder in the northern part of the state, 154 birds belonging to 35 species were found, a number equivalent to 1056 birds to the square mile. The only especially notable item of the record is the fact that nearly a quarter of these birds were field sparrows (*Spizella pusilla*), present in numbers equivalent to 254 to the square mile. Indigo buntings and yellow-breasted chats were each about a third as numerous as the sparrows; and then came goldfinches (55 to the square mile), quail, towhees, cardinals, and Maryland yellow-throats (each 41 to the mile), blue jays, brown thrashers, and red-headed woodpeckers (each 34), bluebirds and cowbirds (27 each), and mourning doves (21), crested flycatchers, crows, meadowlarks, and robins (21 each), making in all as beautiful and interesting a group of birds as we shall find mustered in any one situation.

BIRDS OF THE FARMYARD AND GARDEN

Five hundred and fifty-seven acres of the area covered by our bird survey were made up of patches of yards and gardens of the farm premises, and on these 2977 birds were identified, a number equivalent to 3418 to the square mile. Here the English sparrow was, of

COMPARISON OF NUMBERS PER SQUARE MILE OF THE
MORE ABUNDANT BIRDS IN ORCHARDS AND IN OPEN WOODS,
SUMMERS OF 1907 AND 1909
(IN ORDER OF NUMBERS IN ORCHARDS)

Birds	Orchard	Woods (weighted)*
English sparrow	2039	98
Mourning dove	256	109
Quail	212	73
Field sparrow	190	280
Bronzed grackle	158	98
Robin	152	184
Brown thrasher	125	148
Orchard oriole	120	24
Blue jay	116	415
Catbird	103	13
Mockingbird	77	0
Flicker	76	208
Red-headed woodpecker	44	109
Chickadee	33	109
Crested fly-catcher	16	148
Indigo bunting	0	109
Wood pewee	0	135
Crow	0	135
Towhee	0	109
Cardinal	0	98
Tufted titmouse	0	109
Redstart	0	98

* To get the actual numbers per square mile found in woods, divide the numbers of this column by 2.14.

course, enormously predominant, making nearly half the total number of birds seen. The bronzed grackle was about half, and the cowbird about a third, as abundant as the sparrow. These three species together averaged 2820 to the square mile, leaving but 598 to the mile for all the other fifty-nine species seen in this situation. If to these three super-abundant birds we add seven others, of which the robin, meadowlark, flicker, mourning dove, mockingbird, and chimney swift were the most numerous, we shall include 90 per cent. of the whole number of yard and garden birds on our survey list.

The record is much distorted, however, by the occurrence in fall of large flocks of blackbirds and cowbirds during the period of their assemblage for migration; but even if we ignore these flocks, the crow-blackbird still stands next to the sparrow in numbers, although the cowbird drops quite out of the list of the more abundant species. If we omit the sparrows, we have remaining native birds equivalent to 1883 to the square mile, and if we exclude also the flocks of cowbirds and crow-blackbirds as merely aimless visitors which chanced to settle on the trees of the farmyard as a temporary convenience, we have a residue

of 1757 birds to the square mile which may be supposed to seek, or at least not obviously to avoid, the companionship of man.

WASTE AND FALLOW LANDS

Under the heading of waste and fallow lands we have brought together a heterogeneous variety of situations which have in common only the negative character of a lack of growing crops, at least for the year, and the fact that they can not be classified under any of the other vegetation areas of our grouping. These wastes and fallows seem, however, to make an appeal of their own to a more or less definite group of birds, or to many birds, perhaps, under certain conditions, for we find in them a marked inverse relation, such as we have called attention to in discussing other situations, between the acreage of this habitat in each section of the state and the birds found in it per square mile. The smaller the percentage of waste and fallow land to the general area the greater the density of its bird population, as is seen in the table following:

<i>Section</i>	<i>Acres surveyed</i>	<i>Birds per square mile</i>
Southern Illinois	479	708
Northern Illinois	147	955
Central Illinois	28	1236

It is perhaps in the central part of the state, where this special kind of surface is smallest, that we shall find among the commonest species those which may be distinguished as birds of the waste lands, and these our MS table shows to be the crow-blackbird (247 to the square mile in that section), red-winged blackbird (202), quail (202), English sparrow (157), field sparrow (112) dickcissel (112), and Maryland yellow-throat (90). In northern Illinois, it is true, the English sparrow leads the list, and the bobolink stands next, the sparrow being, in fact, most abundant northward in nearly all situations, and the bobolink confined in Illinois to that part of the state by the limitations of its general range.

If, on the other hand, we take the larger area and more numerous observations of southern Illinois as furnishing a better index to the true relations of birds and their environment, we shall find the heterogeneous character of wastes and fallows (particularly evident in that section) reflected in the absence of any strongly dominant species or group of species, and the consequent large number of species which we must take into account to include any large majority of the whole number of birds. Of the 61 species identified on 479 acres of our southern waste and fallow lands, 19 are needed to make only 72 per cent. of our total number of 804 birds from that situation.

First among these more abundant species of southern Illinois stands the meadowlark, with 182 to the square mile for the southern section and 142 for the state at large, averages to be compared with 319 for meadows in southern Illinois and 194 for those of the whole state.

Next after the meadowlark comes the red-winged blackbird, (93 to the mile), prominent by reason of its numbers in northern and central Illinois. This is followed by the English sparrow (57), much the least abundant in the southern section, the field sparrow (47), mourning dove (37), dickcissel (29), goldfinch and quail (27 each), and ten others in numbers gradually diminishing from 26 to 10 to the square mile. The species are, as a whole, derived from the prairies as represented in pastures and meadows, with only a minor invasion from forest or marsh.

MOST ABUNDANT BIRDS IN WASTE AND FALLOW LANDS,
WHOLE STATE, SUMMERS OF 1907 AND 1909
NUMBERS PER SQUARE MILE

Meadowlark	142
Red-winged blackbird	93
English sparrow	57
Field sparrow	47
Mourning dove	37
Dickcissel	29
Goldfinch	27
Quail	27
Bobolink	26
Bronzed grackle	20
Kingbird	19
Brown thrasher	17
Bluebird	16
Maryland yellow-throat	15
Red-headed woodpecker	13
Blue jay	11
Crow	10
Short-billed marsh wren	10
Total	616

SUMMARY AND DISCUSSION

A compact summary of our most general averages of the numbers of our most abundant birds, as found on distinguishable vegetation areas, is given in the following table, an examination of which will enable us to point out certain conclusions not otherwise readily arrived at. The totals at the bottom of the table show the relative densities of the bird population (both with and without the English sparrow) in the thirteen recognized situations and in the total area of the survey which stands for the state as a whole.

THE MORE ABUNDANT SPECIES IN HABITATS
NUMBERS PER SQUARE MILE, WHOLE STATE, SUMMERS OF 1907 AND 1909

Species	Total number seen	State average	Meadows	Pastures	Swamps	Waste and fallow	Wheat, rye, barley	Oats	Corn	Stubble	Plowed ground	Woods	Orchards	Shrubby	Yards and gardens
Acreeage.....			2763	5196	84	654	822	2486	6434	1069	300	112	118	93	557
English sparrow.....	5653	187	94	177	23	57	147	163	130	159	30	46	2039	0	1535
Crow-blackbird.....	3355	111	49	72	207	20	56	92	138	4	28	46	158	0	761
Meadowlark.....	2459	82	194	151	31	142	47	50	9	89	21	0	44	21	55
Cowbird.....	1947	64	3	55	0	10	121	11	88	1	49	34	22	27	524
Mourning dove.....	1131	37	29	41	0	37	141	14	29	40	77	51	256	21	31
Dickcissel.....	746	25	100	12	2	29	27	28	5	1	0	23	11	20	6
Prairie horned lark.....	710	24	21	48	0	1	24	5	19	11	162	0	0	0	22
Bobolink.....	750	24	96	24	130	26	4	16	4	23	6	0	0	0	1
Flicker.....	616	20	31	47	0	7	4	6	10	2	0	97	76	0	36
Red-winged blackbird.....	920	20	41	33	1125	93	26	21	18	1	2	34	11	0	1
Robin.....	611	20	13	50	8	59	3	4	10	8	34	80	152	21	59
Field sparrow.....	430	14	10	28	0	47	9	4	5	4	13	131	190	254	4
Goldfinch.....	389	13	7	21	15	27	8	10	10	10	11	40	38	55	14
Red-headed woodpecker.....	358	12	9	26	0	13	10	5	6	5	6	51	44	34	26
Crow.....	376	12	13	19	0	10	21	12	10	11	0	63	5	21	2
Quail.....	315	11	8	15	76	27	14	4	6	9	3	34	212	41	13
Grasshopper sparrow.....	298	10	41	9	23	8	12	5	1	5	0	0	0	0	0
Brown thrasher.....	308	10	6	20	0	17	9	5	6	1	9	69	125	34	20
Kingbird.....	310	9	15	19	0	19	2	5	6	1	11	0	27	0	21
Barn swallow.....	255	8	9	23	0	8	5	8	3	5	0	0	0	0	10
Upland plover.....	218	7	25	8	0	2	2	2	2	5	34	0	0	0	6
Blue jay.....	200	7	2	11	0	11	0	1	2	1	0	194	114	34	23
Bluebird.....	197	7	4	19	0	16	1	1	2	1	15	46	11	27	7
Killdeer.....	174	6	0	12	8	1	0	0	7	0	58	0	0	0	4
Chimney swift.....	181	6	12	9	0	11	2	3	2	0	4	0	5	0	28
Vesper sparrow.....	174	6	7	5	0	4	1	3	8	1	13	0	0	0	5
Cliff swallow.....	151	6	2	9	0	0	2	3	3	12	0	0	0	0	15
Orchard oriole.....	112	4	1	1	0	4	2	0	1	0	0	11	120	14	23
Indigo bunting.....	116	4	1	3	8	9	4	2	4	1	0	51	38	82	0
Mockingbird.....	120	4	1	6	0	5	1	0	3	0	13	0	77	0	29
Lark sparrow.....	106	3	1	9	0	8	5	1	3	0	6	0	22	0	5
Song sparrow.....	93	3	3	4	38	6	1	1	3	1	0	0	5	1	5
Maryland yellow-throat.....	104	3	4	5	15	15	4	2	2	0	0	34	3	41	2
Wood pewee.....	46	2	1	3	8	1	0	0	0	2	0	63	5	0	5
Cardinal.....	54	2	1	1	0	7	0	0	1	0	0	46	38	41	0
Catbird.....	67	2	0	2	0	1	0	1	1	0	2	6	103	0	11
Green heron.....	32	1	2	2	46	1	0	0	2	0	0	6	5	0	0
Downy woodpecker.....	27	1	0	1	0	1	0	0	1	0	2	34	5	0	2
Crested flycatcher.....	25	1	0	1	0	0	0	0	0	1	0	68	16	21	1
Towhee.....	30	1	0	1	0	0	0	0	0	0	0	51	16	41	1
Yellow-breasted chat.....	20	1	0	1	0	1	0	0	0	68	0	11	0	68	1
Short-billed marsh wren.....	12	1	0	0	15	10	0	0	0	0	0	0	0	0	0
Long-billed marsh wren.....	10	1	0	0	46	4	0	0	0	0	0	0	0	0	0
Tufted titmouse.....	18	1	0	1	0	0	0	0	0	0	0	51	33	14	0
Totals.....		793	856	1004	1824	773	715	488	560	483	609	1471	4026	933	3314
Total native species.....		606	762	827	1801	716	568	325	430	324	579	1425	1987	933	1779
Averages of above.....		18	19	22	41	18	16	11	13	11	14	33	92	21	75
		14	17	19	42	16	13	7	10	7	13	33	45	21	40

Arranging these totals in series, we find that orchards stand at the top of both lists and stubble fields at the bottom, the former con-

taining nearly nine times as many birds per square mile as the latter if the English sparrows are counted, and about six times as many if they are not. Fields in crops of wheat, rye, barley, oats, or corn, and those from which the small grains have been harvested, are the least attractive to birds of all the situations listed, their numbers of native species per square mile ranging from 324 to 579, while the other areas rise from 716 for waste and fallow to 1987 for orchards.

We further notice that our two series do not differ materially in respect to the order of abundance, the dropping out of English sparrows having the effect only to shift six of the habitat names one place up or down, and leaving the positions of seven of the thirteen unchanged.

BIRDS PER SQUARE MILE OF 44 OF THE ABUNDANT
SPECIES,
THE WHOLE STATE, SUMMERS OF 1907 AND 1909,
IN ORDER OF NUMBERS

All species		Native species	
Orchards	4026	Orchards	1987
Yards and gardens	3314	Swamps	1801
Swamps	1824	Yards and gardens	1779
Woods	1471	Woods	1425
Pastures	1004	Shrubs	933
Shrubs	933	Pastures	827
Meadows	856	Meadows	762
Waste and fallow	773	Waste and fallow	716
Wheat, rye, barley	715	Plowed ground	579
Plowed ground	609	Wheat, rye, barley	568
Corn	560	Corn	430
Oats	488	Oats	325
Stubble	483	Stubble	324

An inspection of our preceding general table (page 214) shows that some birds have but a single favorite haunt or set of closely related haunts, that others have two very different places of principal resort, and that still others have a wide and rather indiscriminate range of local preference. Thus the English sparrow is seen to be mainly a bird of the orchard and the yard and garden; the meadowlark of the meadow, pasture, and waste lands; the dickcissel of the meadow only; the prairie horned lark of pasture fields and plowed ground; the bobolink of swamp and meadow; the field sparrow of shrubbery, orchard, and woods; and other local concentrations within one situation may be readily made out for the blue jay, orchard oriole, indigo bunting, song sparrow, cardinal, catbird, green heron, downy woodpecker, crested fly-catcher, towhee, the two marsh wrens, the red-headed woodpecker, and the mockingbird; while a distinctly double or multiple local allegiance is

apparent in our records of the crow-blackbird, found especially abundant in swamps, corn fields, orchards, and yards and gardens, of the cowbird in wheat and yards and gardens, the mourning dove in wheat and orchards, the flicker in meadow, pasture, and woods, and the upland plover in meadow and plowed land. This seems, in most cases at least, mainly a matter of the relations of feeding and breeding places, identical for some birds and for others more or less separate and unlike.

If we may assume that the present meadows and woodlands most nearly resemble the primitive prairie and forest as homes and haunts of birds, we see that in bringing the last two under cultivation we have greatly diminished the areas most desirable to birds, and must have reduced the total number of birds accordingly except as these unfavorable effects may have been compensated by more favorable conditions established at other points.

Such compensation appears in the substitution of pastures for prairie, as may be seen by a comparison of a total of 1004 birds per square mile of pasture with that of 856 for meadow; and in the substitution of orchard for forest, the numbers of which per square mile (English sparrow excluded) are 1987 and 1425 respectively—gains of 17 per cent. in the first case and nearly 39 per cent. in the second.

By a more detailed comparison of our tabulated data, one habitat column with another, we may get more precise ideas of the apparent affiliation of habitats as related to birds. These affiliations may be inferred from an examination of the following table, made by dropping from each column of the preceding general table the numbers per square mile which are smaller than the general average for the habitat, those remaining showing the species which are equal to or greater than the habitat average for all the species.

It will be readily seen that this table is divisible vertically into three more or less definite areas or bands, made up respectively of (1) meadows, pastures, swamps, and waste and fallow lands, the nearest approach remaining to us of the primitive prairies of the state; (2) fields of cereal crops together with plowed and stubble fields which have lately borne them; and (3) areas of forest, orchard, and shrubbery to which the exceptionally and radically new habitat of yards and gardens may be appended as more nearly related here than anywhere else.* For convenience' sake these may be distinguished as pasture-meadow, cereal-crop, and tree-shrub associations; and the numbers of birds per square mile of each were as follows: cereal-crop, 602, pasture-meadow, 923, and tree-shrub, 3111, related to each other respectively as 1, 1.65, and 5.17.

By a more detailed comparison of our tabulated data, one habitat column with another, we may get more precise ideas of the apparent affiliation of habitats as related to birds. The cereal-crop area is evidently

* For more significant features of this relationship, see the detailed general table on the opposite page. 314

CONDENSED GENERAL TABLE WITH SUBSTITUTION OF AN ASTERISK FOR ALL NUMBERS
LESS THAN THE AVERAGE OF ALL BIRDS FOR THE HABITAT

Species	Meadows	Pastures	Swamps	Waste and fallow	Wheat, rye, barley	Oats	Corn	Stubble	Plowed ground	Woods	Orchards	Shrubby	Yards and gardens
English sparrow.....	94	177	*	57	147	163	130	159	30	46	2039	0	1535
Bronzed grackle.....	49	72	207	20	56	92	138	*	28	46	158	0	761
Meadowlark.....	194	151	*	142	47	50	*	89	21	0	*	21	*
Cowbird.....	*	55	0	*	121	11	88	*	49	34	*	27	524
Mourning dove.....	29	41	0	37	141	14	29	40	77	51	256	21	*
Dickcissel.....	100	*	*	29	27	28	*	*	0	*	*	*	*
Prairie horned lark.....	21	48	0	*	24	*	19	11	162	0	0	0	*
Bobolink.....	96	24	130	26	*	16	*	23	*	0	0	0	*
Flicker.....	31	47	0	*	26	*	*	*	0	97	*	0	*
Red-winged blackbird.....	41	33	1125	93	26	21	18	*	*	34	*	0	*
Robin.....	*	50	*	59	*	*	*	*	34	80	152	21	*
Field sparrow.....	*	28	0	47	*	*	*	*	*	131	190	254	*
Goldfinch.....	*	*	*	27	*	*	*	*	*	40	*	55	*
Red-headed woodpecker.....	*	26	0	*	*	*	*	*	*	51	*	34	*
Crow.....	*	0	*	21	12	*	11	0	63	*	21	*	*
Quail.....	*	*	78	27	*	*	*	*	*	34	212	41	*
Grasshopper sparrow.....	41	*	*	*	*	*	*	*	0	0	0	0	0
Brown thrasher.....	*	*	0	*	*	*	*	*	*	69	125	34	*
Kingbird.....	*	*	0	19	*	*	*	*	*	0	*	0	*
Barn swallow.....	*	23	0	*	*	*	*	*	0	0	0	0	*
Upland plover.....	25	*	0	0	*	*	*	*	34	0	0	0	*
Blue jay.....	*	*	0	*	0	*	*	*	*	194	114	34	*
Bluebird.....	*	*	0	*	*	*	*	*	15	46	*	27	*
Killdeer.....	0	*	*	0	0	0	*	0	58	0	0	0	*
Chimney swift.....	*	*	0	*	*	*	*	*	0	0	0	0	*
Vesper sparrow.....	*	*	0	*	*	*	*	*	0	0	0	0	*
Cliff swallow.....	*	*	0	0	*	*	*	12	0	0	0	0	*
Orchard oriole.....	*	*	0	*	*	0	*	0	0	*	120	*	*
Indigo bunting.....	*	*	*	*	*	*	*	*	0	51	*	82	0
Mockingbird.....	*	*	0	*	0	*	0	*	0	*	*	0	*
Lark sparrow.....	*	*	0	*	*	*	*	0	*	0	*	0	*
Song sparrow.....	*	*	*	*	*	*	*	0	0	0	*	*	*
Maryland yellow-throat.....	*	*	*	*	*	*	*	0	0	34	*	41	*
Wood pewee.....	*	*	*	0	0	0	0	0	0	63	*	0	*
Cardinal.....	*	*	0	*	0	0	*	0	0	46	*	41	0
Catbird.....	0	*	0	*	0	*	*	0	*	*	103	0	*
Green heron.....	*	*	46	*	0	0	*	0	0	*	*	0	0
Downy woodpecker.....	0	*	0	*	0	0	*	0	*	34	*	0	*
Crested flycatcher.....	0	*	0	0	0	0	0	0	0	68	*	21	*
Towhee.....	0	*	0	0	0	0	0	0	0	51	*	41	*
Yellow-breasted chat.....	0	*	0	*	0	0	0	68	0	*	0	68	*
Short-billed marsh wren.....	0	0	*	*	0	0	0	0	0	0	0	0	0
Long-billed marsh wren.....	0	0	46	*	0	0	0	0	0	0	0	0	0
Tufted titmouse.....	0	*	0	0	0	0	0	0	0	51	*	*	0
Averages.....	19	22	41	18	16	11	13	11	14	33	92	21	75

a derivative of the pasture-meadow association, differentiated to the advantage of the former, but to the detriment of the birds; and the ornithological preponderance of the tree-shrub association may be more clearly shown by a comparison with the first two associations thrown together as one, giving us an average of 762 birds per square mile for the combination against 3111 for the tree-shrub association. Otherwise stated, we have found the summer-time birds of Illinois more than

four times as abundant to the unit of area in the tree-shrub association as in the remainder of the state. In this connection, however, we must recall the fact that the woodland area of our survey is not the dense and full grown forest of the wilderness, but is rather to be taken as equivalent to the forest edge; and the further fact that the limited acreage of our tree-shrub formation, 880 acres in all as against 18,408 of the other habitats, has probably led to a certain concentration of the normal forest birds, and especially of those which nest in trees and shrubs and seek their food largely in the open fields.

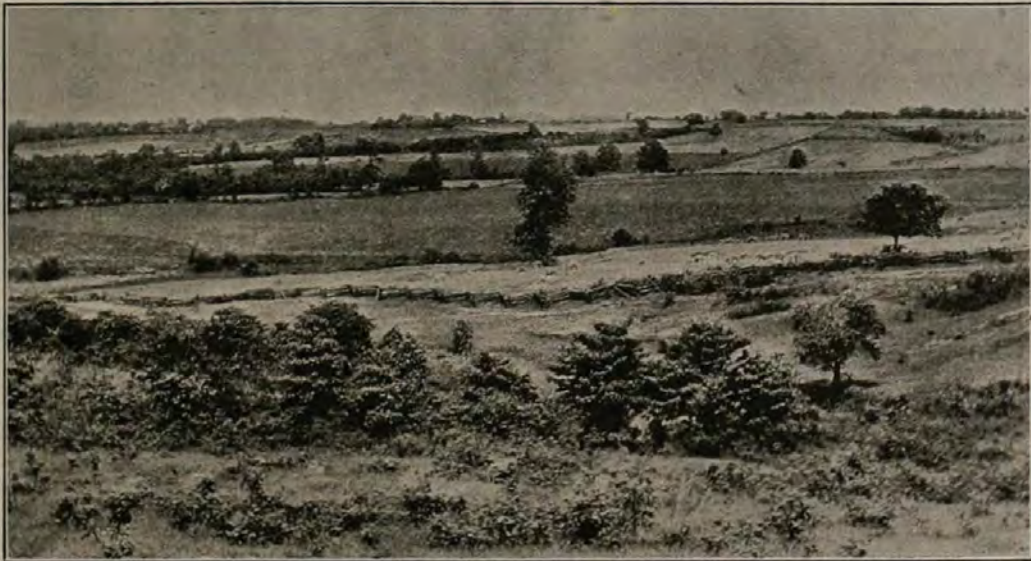
As a most general outcome of this final discussion, we may conclude that the remaining birds of the Illinois wilderness have adapted themselves to civilization, and especially to agriculture and horticulture, not so much by a change of choice or of habits, as by searching out under the new conditions the places which most nearly resemble their original nesting sites and which offer them food the nearest to that which, by hereditary inclination, they were impelled to choose; that in pastures, orchards, and yards and gardens they have found situations more favorable, and in the vast areas devoted to the cereal crops less favorable, to their maintenance and multiplication than their original habitats; and that while certain species have suffered heavily, in some cases nearly or quite to extermination (mainly, however, by the deliberate acts of man), others have greatly increased in numbers, the numerical make-up of the bird population of the state having thus shifted its balance in response to an increase of some resources and a diminution of others. Their remarkable success in self-maintenance under changes of environment which, from their viewpoint, may be called revolutionary, is not due to any flexibility of organization and consequent power of physical adaptation to new conditions—for which, indeed, they are much too highly and rigidly specialized—but to their remarkable sensory endowment and unequalled powers of locomotion, by the use of which each species is enabled to search out and occupy the most satisfactory ecological situations still to be found in the area of its geographical distribution.

PLATE XXXV



Southern Illinois landscape near Cave in Rock, Hardin county. On the Ohio River—indistinctly seen at the extreme left.

PLATE XXXVI



Typical view in farming area of southern Illinois, Hardin county.

PLATE XXXVII



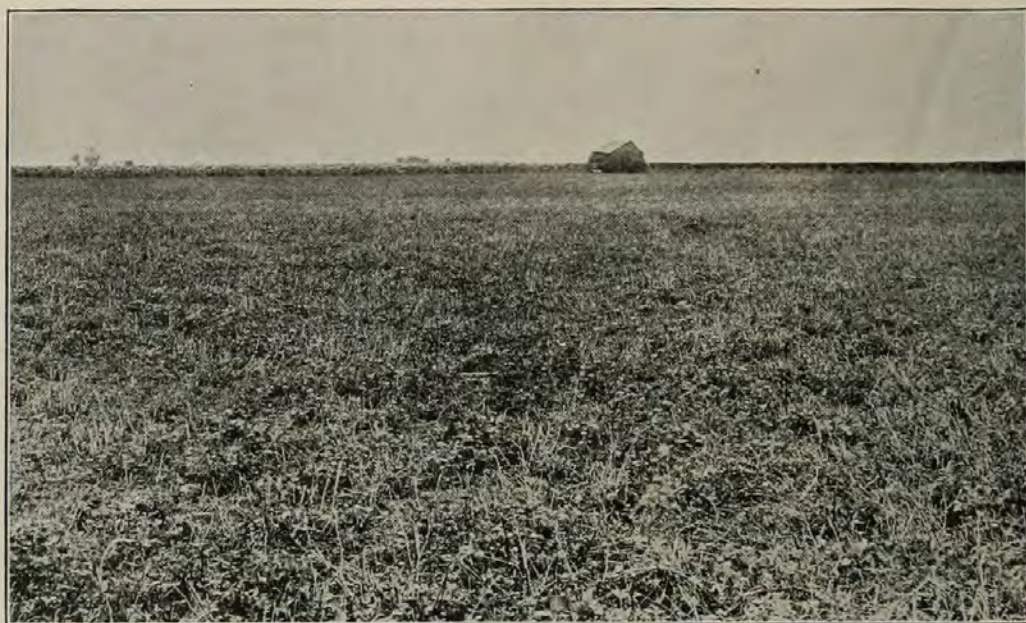
Typical central Illinois pasture near Ogden, Champaign county. Upland plovers in this field.

PLATE XXXVIII



Boggy pasture, characteristic of lowland fields near marshes
in northern Illinois. Libertyville, Lake county.

PLATE XXXIX



Clover field, cut and pastured, near Midland City, Dewitt county, central Illinois, July 16, 1907. Containing red-winged blackbirds, robin, upland plovers, meadowlarks, prairie horned larks, and brown thrasher.

PLATE XL



Meadowlark, from life, April 1, 1907, near Bismarck, Vermilion county, central Illinois.

PLATE XLI



Meadowlark's nest with two eggs of the meadowlark and three of the cowbird, Urbana, Champaign county, central Illinois, May 20, 1908.

PLATE XLII



Meadowlark's nest and young, near Benton, Franklin county, southern Illinois, June 11, 1907.

PLATE XLIII



Meadowlark's nest and eggs, near Easton, Mason county, central Illinois,
May 1, 1907.

PLATE XLIV



Meadowlark's nest and eggs, near Urbana, Champaign county, central Illinois, May 30, 1907.

PLATE XLV



Meadowlark's nest and eggs, near Elkhville, Jackson county, southern Illinois, June 21, 1907.

PLATE XLVI



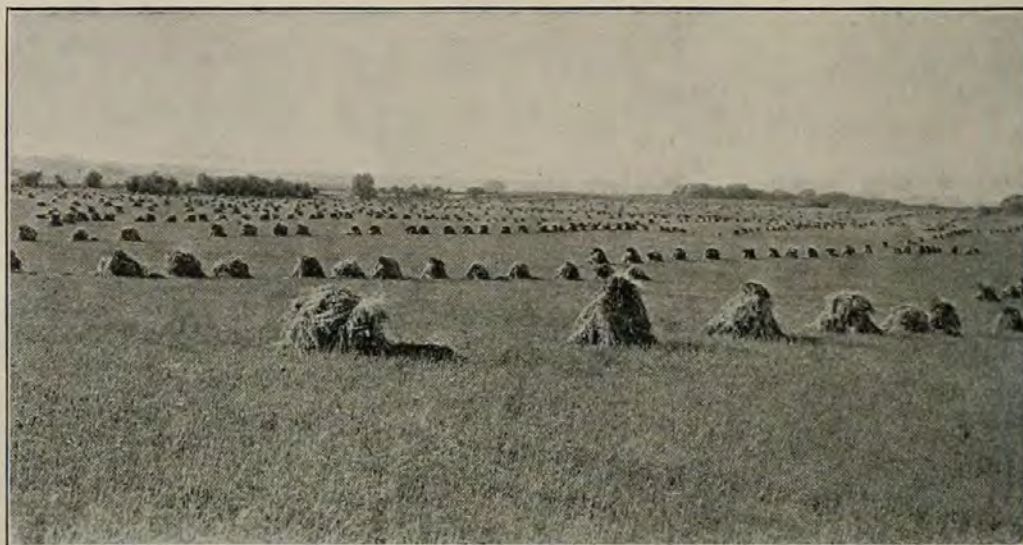
Meadowlark's nest and eggs, near Clinton, Dewitt county, central Illinois,
May 16, 1907.

PLATE XLVII



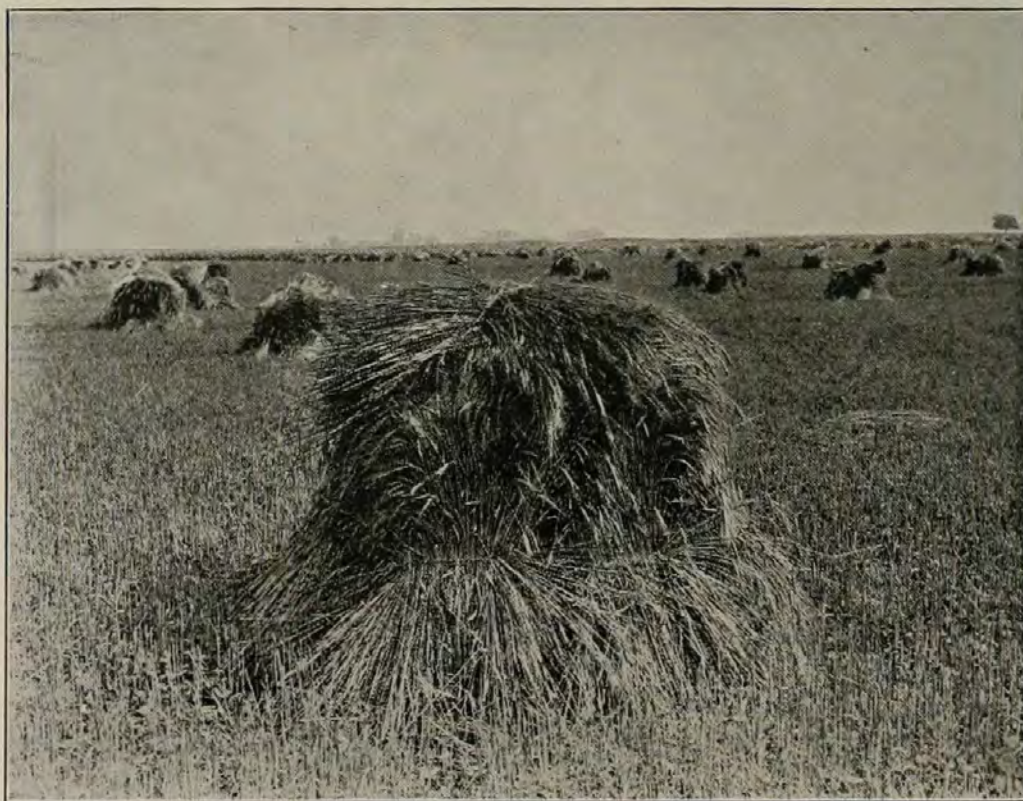
Nest and eggs of prairie-hen, near Clinton, Dewitt county, central Illinois.
A few yards from nest of meadowlark shown in preceding picture.

PLATE XLVIII



Typical oats field, Lee county, northern Illinois, August 7, 1907.

PLATE XLIX



Wheat field near Emery, Macon county, central Illinois, July 18, 1907.

PLATE L



Nest and eggs of red-winged blackbird, July, 1909.

PLATE LI



Nest and eggs of red-winged blackbird, in timothy meadow near Benton,
Franklin county, southern Illinois, June 4, 1907.

PLATE LII



Nest and four eggs of grasshopper sparrow in alfalfa field, Urbana,
Champaign county, central Illinois, May 27, 1907.

PLATE LIII



Typical Illinois corn field near Buffalo Hart, Sangamon county, central Illinois, July 24, 1907.

PLATE LIV



Nest and eggs of prairie horned lark in oats field near Ogden, Champaign county, central Illinois, May 28, 1907.

PLATE LV



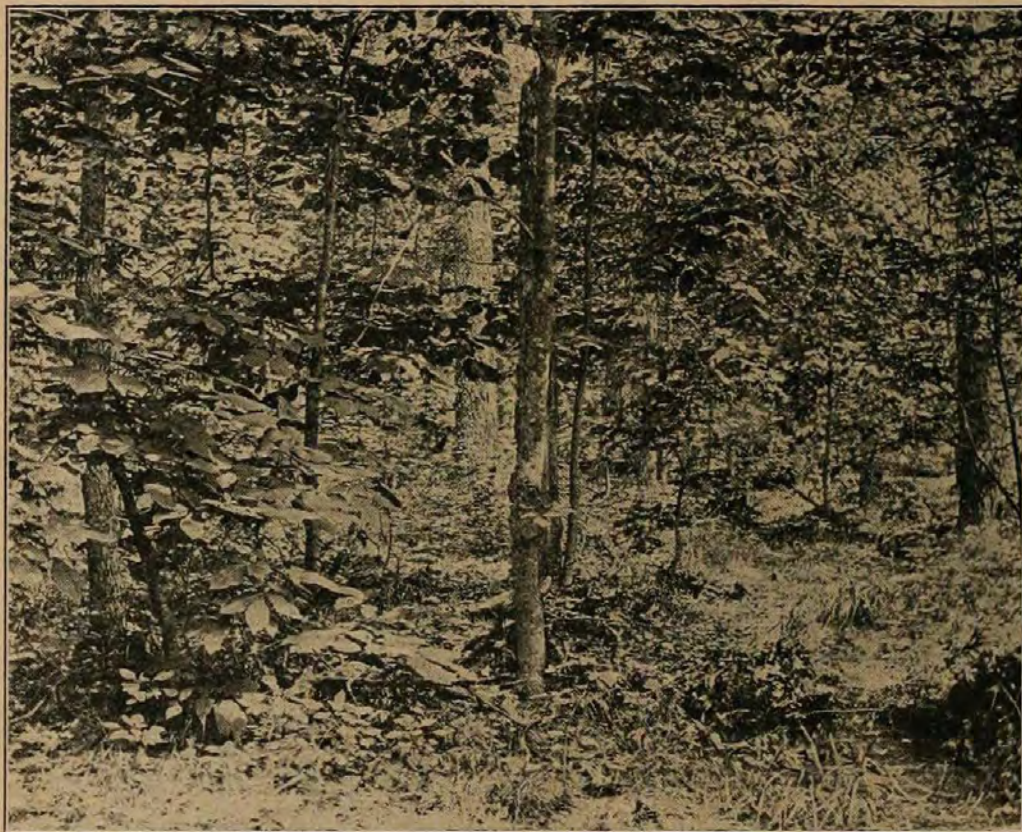
Marsh near Davis Junction, Ogle county, northern Illinois, July 30, 1907.
Home of the short-billed marsh wren—of which young birds were seen
at this date. Bobolinks and red-winged blackbirds common here.

PLATE LVI



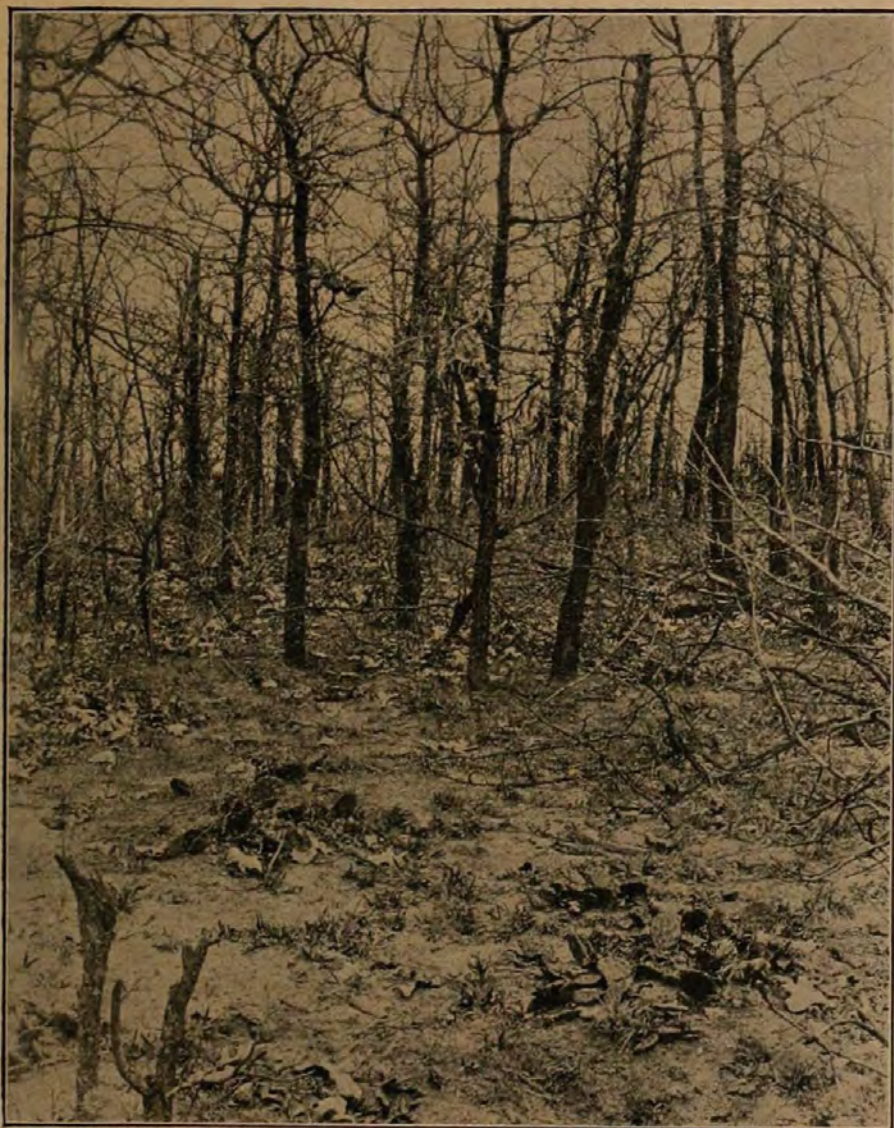
Tamarack swamp near Wauconda, Lake county, northern
Illinois, March 4, 1907.

PLATE LVII



Woodland forest near Mulkeytown, Franklin county, southern Illinois,
June 20, 1907. Wood thrush and towhee common. Great crested
fly-catcher, yellow-bellied cuckoo, cardinal, red-bellied
woodpecker, and tufted titmouse seen here.

PLATE LVIII



Bur oak woodland near Poplar City, Mason county, central Illinois, May 2, 1907. Prickly pears on the sandy soil. Field sparrow and towhee here.

PLATE LIX



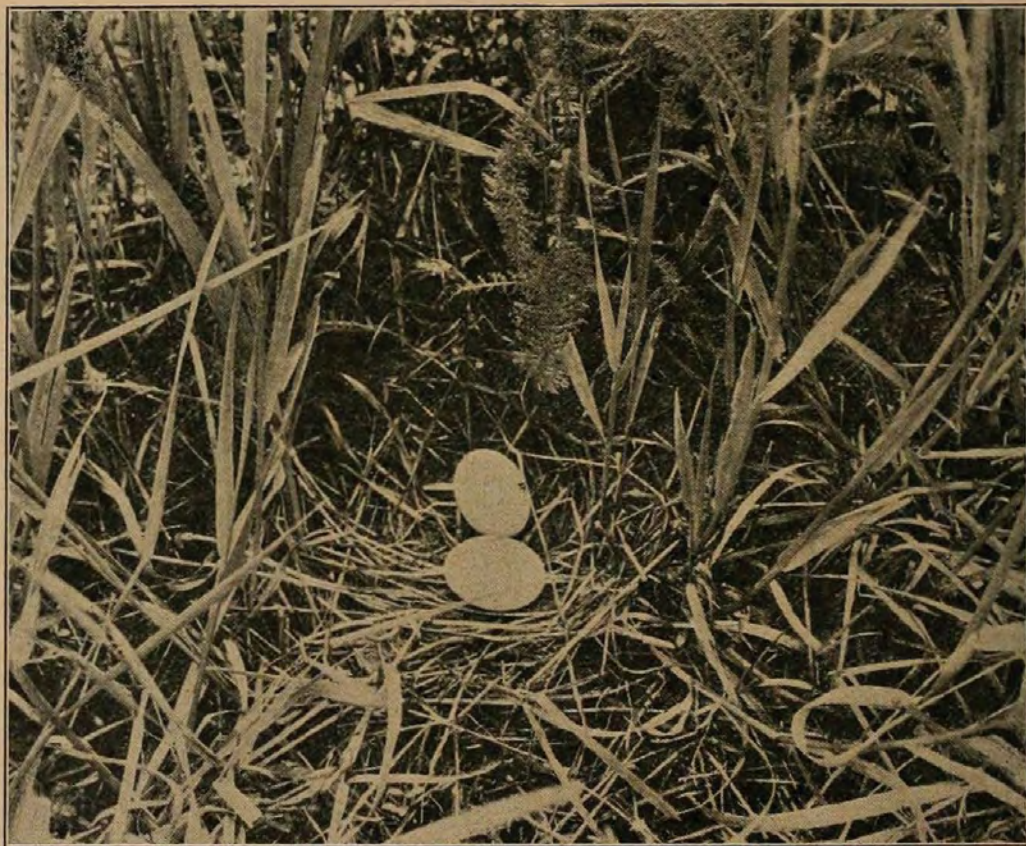
Lowland forest near Cave in Rock, Hardin county, southern Illinois, July 1, 1907. Wood thrush and red-eyed vireo very common here.

PLATE LX



Mourning dove's nest and eggs, near Thompsonville, Franklin county,
southern Illinois, June 5, 1907.

PLATE LXI



Mourning dove's nest and eggs, near Mount Vernon, Jefferson county,
southern Illinois, June 14, 1907.

PLATE LXII



Mourning dove's eggs in old robin's nest, Olney, Richland county, southern Illinois, September 7, 1908.

PLATE LXIII



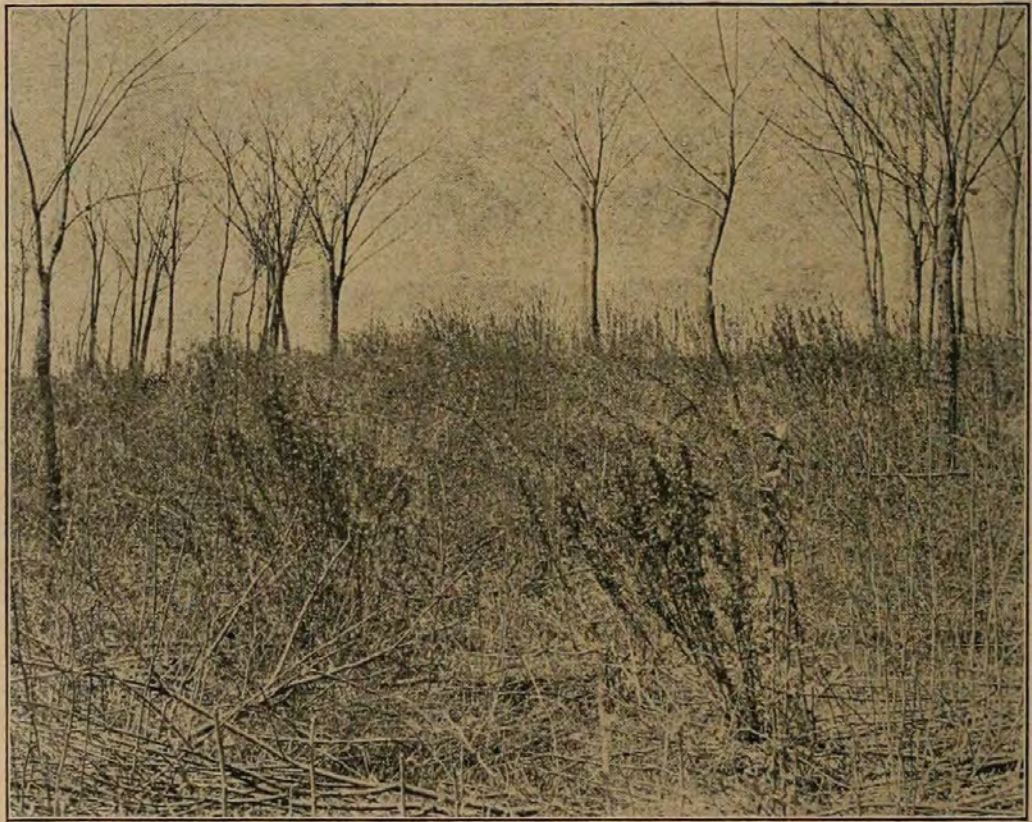
Mourning dove's nest and eggs near center of large corn field, July 16, 1907.

PLATE LXIV



Mourning dove's nest and two young, near Mount Vernon, Jefferson county, southern Illinois, June 14, 1907.

PLATE LXV



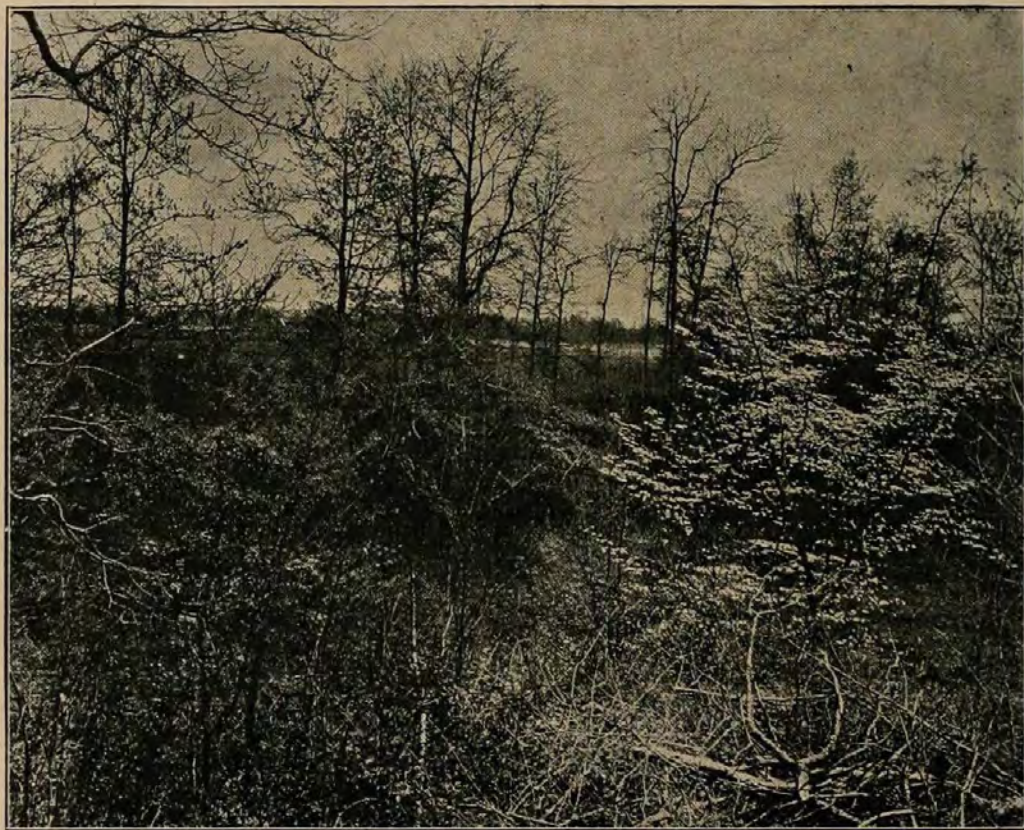
Shrubbery near Clinton, Dewitt county, central Illinois, April 26, 1907.

PLATE LXVI



Sassafras thicket near Golconda, Pope county, southern Illinois, June 28, 1907. Prevalent condition throughout this county. Maryland yellow-throat, indigo bunting, and field sparrow very common. Two adults and three young of Kentucky warbler seen in woods near by.

PLATE LXVII



Open woods and shrubbery near Mt. Carmel, Wabash county, southern Illinois, April 9, 1907. Near the limit of density permitting the counting of birds.

PLATE LXVIII



Old corn field near Farmer City, Dewitt county, central Illinois,
March 29, 1907. Prairie-hens flushed in this field,
and two mallard ducks arose near by.

PLATE LXIX



Southern Illinois fallow, June, 1909.

PLATE LXX



Fallow field near Tamaroa, Perry county, southern Illinois, June 19, 1907.
Meadowlarks abundant, two of their nests with eggs and one
with young found within fifty yards of each other.