AN ECOLOGICAL STUDY OF BREEDING BIRDS IN A SANDY UPLAND ASPEN ASSOCIATION

by

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A report of an original field study conducted as a requirement for Advanced Ornithology (Zoology 119), University of Michigan Biological Station

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TABLE OF CONTENTS

INTRODUCTION

This study was made in an attempt to discover the species and relative numbers of birds breeding in sandy upland aspen association near the University of Michigan Biological Station, Cheboygan County, Michigan. The field work on which this study is based was done almost entirely between the dates July 5 and July 13, inclusive, and comprised 50 hours' work. Study after July 13 was found to bring forth no utilizable data.

There is much to be said in defense of the use of an aspen association for a study such as this. In the initiation of study in any branch of ecology, it is best to study an association which is relatively simple, and one which covers a fairly large area, so that the effects of edge between the association studied and its bordering associations will be minimized; the sandy upland aspen association qualifies on both of these points.

All field work was done with Oscar M. Root, for whose valuable aid and advice the author is very grateful. The author is also indebted to Dr. Frank C. Gates for information as to precipitation, temperatures, ecological history of the area studied, and other information of a like nature. Thanks are also due Dr. Olin Sewall Pettingill, Jr., for his criticisms and advice both as to the work itself and to the preparation of the report.

HISTORY OF THE AREA STUDIED

The area was originally forested by large pines, but lumbering interests and public indifference to the fate of these regions has led to the disappearance of the pines, and the aspens have invaded the territory. Fires, many of them set purposely to clear the land, have ~~the~~ destroyed the trees from time to time. The property belonging to the University has been protected as completely as possible since it came into the ownership of the University, but some fires have been unavoidable. The last fire to have burned off the area generally was a quite severe one, in the summer of 1919. A smaller, less severe fire occurred in the summer of 1925 in the south-east quarter of section 32. (See Map 1)

The plant association following severe and repeated burning in this region is the aspen association. There are, however, aafew large relic pines (Pinus resinosa and Pinus strobus) which escaped the double hazard of fire and lumbering, and which are functioning as seed trees for the future restoration of pines to this area. (See Map 1 for the locations of these trees.) Also, 350 of the 936 acres under study have been planted with seedlings of Pinus resinosa, P. strobus, and P. Banksiana.

Dr. Frank C. Gates estimates that the aspens will have vanished almost completely from this region in 40 years, andthe pines will again be established, if natural succession is not interfered with. Then, in approximately 700 more years, the soil will have been built up to the point where it will support the beech-maple climax forest, and the pines, in their turn, will disappear. There are some regions near the

Biologiaal Station which were logged in the 1870's but which have not been burned since 1892; these show the trend toward reinstatement of the pine and disappearance of the aspens.

HABITAT

The soil in the area studied is very loose and sandy. It is light and mixed with clay or gravel in some of the glacial moraines (Gates, 1926: 171). Water drains away readily. Because of the frequent fires which the area has undergone, the soil is apt to be deficient in humus.

The temperature of the region is moderate, as befits an area in the temperate zone near large bodies of water. The rainfall, though only about 30 inches, is well distributed throughout the year. The growing season extends from about May 20 or June 15 to September 10 or September 25. For further details as to climate, reference is made to Table 1.

The area under study comprises 936 acres; it is bounded on the east, south and west by roads, and on the north partly by roads and the Biological Station campus and partly by the margin between aspen and beech-maple woods which occurs along the southern shore of Douglas Lake. (These boundaries are shown in orange on Map 1.) The area is cut up by section lines and fire lanes, which are kept open by the clearing of brush and the plowing of an area about 20 feet wide; in addition, there are a few other trails which are passable to automobiles if damage to springs is not considered too important; there is also a railroad grade which was constructed, but never used, during the time of the lumbering of the pines of this area in the 1870's. The general character of the aspen

METEOROLOGICAL SUMMARY, CHEBOYGAN, MICHIGAN

(U.S.Weather Bureau Figures)

Temperature °F.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Absolute maximum	59	51	72	86	89	95	101	95	95	89	73	59
Mean	19	16	25	39	50	61	66	65	60	48	35	23
Absolute minimum	-20	-38	-82	-2	17	28	33	35	25	15	-6	-18
Growing Season	May 20....June 15 - - - - - September 10....September 2											
Wind	NW	NW	NW	NW	NW	NW	NW	NW	SW	SW	NW	SW
Precipitation (inches)	1.70	1.38	1.90	1.79	3.10	1.85	3.10	2.97	2.92	2.50	2.49	1.93
Number of days with precipitation	9	7	6	7	8	7	8	9	8	8	9	9
Snowfall (inches) (6/27/34)	15.6	13.6	9.0	2.3	0.7	--	--	--	T	0.7	6.6	12.5

TABLE 1.

forest, however, is so open that often fire lands and section lines might not be noticed, were it not for the plowed ground or section markers, and trails sometimes duck around a clump of poplars to disappear completely on the other side; for this reason, the effect of these trails is not so great as might at first be imagined.

Even at the outer boundaries of the area, along the main roads, the vegetation does not differ so markedly from that in the interior. Young trees, not exceeding 20 feet, and averaging about eight feet, are found in this edge: they are of the following species: Populus grandidentata (Large-tooth Aspen), Acer rubrum (Red Maple), Betula alba var. papyrifera (Paper Birch), and scattered individuals of Pinus strobus (White Pine), Pinus resinosa (Red Pine), and Quercus maximus var. borealis (Red Oak). There is also considerable Rhus glabra borealis (Smooth Sumac) present in the edge; especially is this true along the south and west margins of section 34.

Present as ground plants in this edge are Apocynum androsaemifolium (Indian Hemp), Asclepias syriaca (Common Milkweed), Epilobium angustifolium (Fireweed), Agropyron repens (Quack Grass), Agrostis alba (Red-top), and Poa compressa (Blue Grass).

There are other open spaces to be considered in the area studied, also. Two of these open spaces are shown on Map 1; another is a softball field immediately south of the Biological Station campus; others occur in a series of valleys along the northern margin of the area. The latter open spots are very possibly the remnants of sphagnum bogs which were burned repeatedly by the Indians with the intentions

of increasing the production of blueberries, until the sphagnum, and, consequently, the water, was lost. The presence of Vaccinium pennsylvanicum and V. Canadense (Blueberries), Hieracium aurantiacum,(Orange Hawkweed), Rumex acetosella (Sheep Sorrell), Polytrichum sp. (a moss), and Cladonia sp. (Reindeer Moss), together with the stunted Pteris Aquilina (Bracken Fern), and the small and very sparse Populus grandidentata gives support to this theory of the past history of these areas.

Whatever their past history, these open areas are about one or two acres in size, and their vegetation is as described above. One of them has a specimen of Tsuga canadensis (Hemlock) about 65 feet high in it. This is the only representative of this species found in the entire area studied, and is an indication that the beech-maple woods were invading this area before the logging and fires which opened the entire area up to the aspen association.

In order to determine the densities and relative numbers of the various species of trees in the study area, tree counts were made in sample areas. The species were grouped according to their maximum heights in three groups: the mesophanerophytes--woody plants three to 55 feet tall; the microphanerophytes--woody plants three to 22.5 feet tall; and the nanophanerophytes-- woody plants three to seven and a half feet tall. The results of these tree counts are given in Tables 2-4. The predominance of Populus grandidentata among the woody plants is clearly shown in Table 2, 40% of all the woody plants being this species. Route 1 covered twice the area of each of Routes 2, 3, and 4; when this is taken into consideration, the homogeneity of the area as to vegetation

is evident, for with practically all the species occurring in any numbers the number per species per unit of area is fairly close.

The ground plants in the area fall into three general types:

1. The principal ground layer consists of Pteris aquilina, moss and lichen cover, Lycopodium complanatum (Ground Pine), with scattered plants of Vaccinium canadense, Vacciuium pennsylvanicum, and Diervilla lonicera, and covers the ground in most of the area studies.
2. In the burned "bogs" on the northern margin, the ground layer consists of stunted Pteris Aquilina, the two blueberries, Hieracium aurantiacum, Rumex acetosella, and moss and lichen cover.
3. The southwest corner of the study area is a good deal more moist than is the rest of the area; the Pteris aquilina there is three to four feet tall, the trees there are much larger, and present in the ground cover, in addition to the blueberries, is Diervilla lonicera (Bush Honeysuckle), Rubus allegheniensis, and Gaultheria procumbens (Wintergreen). This area is worthy of especial mention because not only did it differ in vegetational aspect, but some species of birds were found here which did not occur in the rest of the study area.

METHODS

The method used in censusing the birds was chiefly that of traversing four sampling routes through the area (between 6:30 and 10:00 a.m., Eastern War Time), and counting the singing males heard for a distance of 50 paces (approximately 250 feet) on either side of the route. The routes followed are indicated in red in Map 1. Each singing male counted was considered to be representative of one mated pair. Chickadees, Cedar Waxwings, and Cowbirds were counted as individuals; Ruffed Grouse broods were counted as one pair; nocturnal birds (Nighthawks and Whip-poor-wills) and birds of prey were not counted.

These four strips give a total area, in which birds were actually counted, of 308 acres, or almost exactly one-third of the total study area. Therefore, when birds were found to be generally distributed, the total number on the entire area could be computed by multiplying the number counted by three. On the other hand, when birds were found only on the edge, the estimated number of pairs is the number actually heard singing.

The edge along the roads and in the open spots, and the wetter section in the southwest corner of the area, were carefully surveyed in order that all species in these areas might be observed. These counts were then taken as the total counts, for those species found only in these area, for the entire area.

Three broods of Ruffed Grouse were flushed. We cannot assume that we flushed all broods within 50 paces on either side of our transects; to say that all within 25 paces were

flushed would be a conservative estimate. Therefore, in estimating the total number of Ruffed Grouse broods, the number flushed was multiplied by six (two times three), making an estimated total of 18 pairs of Ruffed Grouse in the area. This number is admittedly subject to error, and the problem of censusing Ruffed Grouse is one not satisfactorily met in this study.

In the use of this method of counting of singing males, it was necessary to be able to ascertain the volume of the voice of the various species at 50 paces. The observers did this by walking 50 paces from a singing bird and making mental notes as to the loudness of the song. Another, and perhaps more reliable method, of determination of bird distance, is illustrated in Figure 1. The observer walks along his transect until the bird is, as nearly as he can determine, at a right angle to the line of the transect; Then, ~~counting 50 paces~~, he walks 50 paces forward or backward along the transect. If the angle between the transect line and the direction in which the bird is then heard is less than 45°, the bird is inside the territory; if it is more than 45°, the bird is "off territory".

Measurements of distance in the field were made by pacing, and for this reason it was necessary to pace a measured distance to determine the length of pace. This was done by pacing twice a surveyed line one and a quarter miles long, counting the paces, and dividing by two and a half fo determing the number of paces per mile. This was found to be 1024 paces.

Tree counts were made along all four routes on which

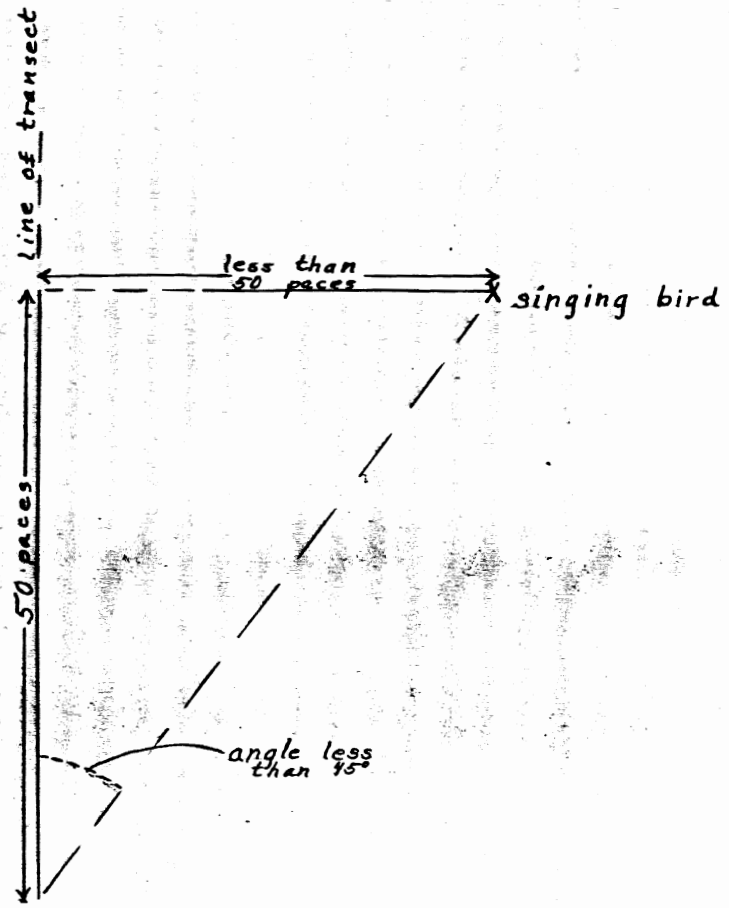

Fig. 1.a. To illustrate the triangulation method of determination of distance of a singing bird when the bird is within 50 paces.

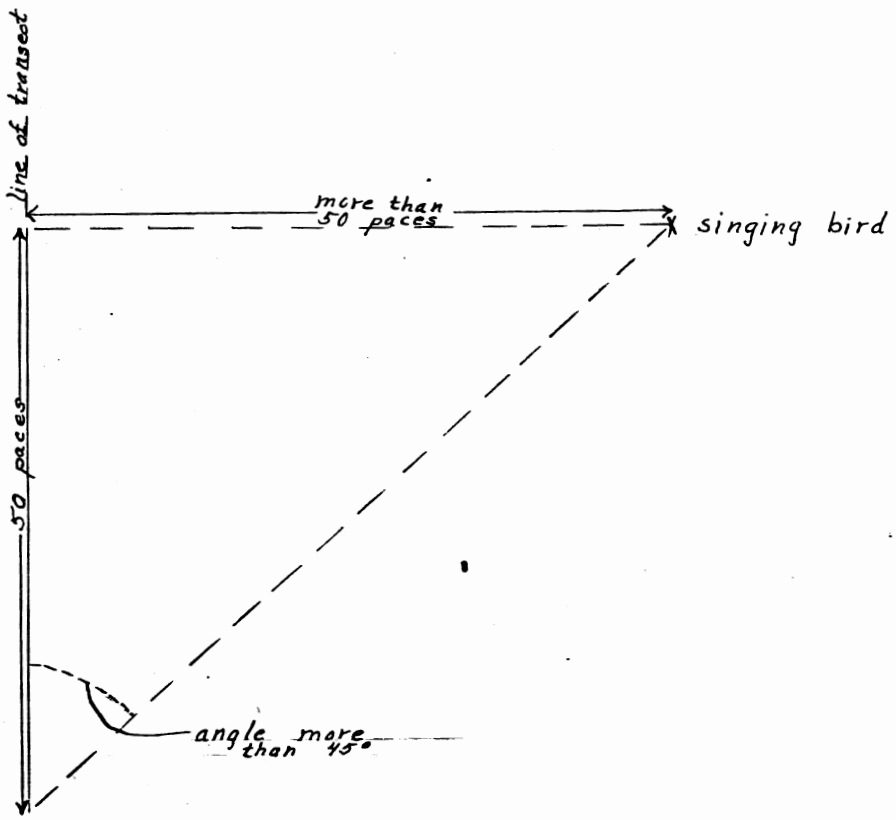

Fig. 1.b. To illustrate the triangulation method of determination of distance of a singing bird when the bird is farther than 50 paces away.

RESULTS OF TREE COUNTS IN AREA STUDIED

SPECIES	Route 1	Route 2	Route 3	Route 4	Total Number	% of Mesophytes	% of all Woody Plants
Populus Pgrandidentata	260	138	144	130	672	48%	40%
Acer rubrum	120	56	22	94	292	21%	18%
Quercus m. borealis	22	51	28	23	124	9%	8%
Populus tremuloides	64	29	2	23	118	9%	7%
Betula alba papyrifera	56	3	3	27	89	6%	5%
Pinus resinosa	13	8	7	9	37	3%	2%
Fagus grandifolia	4	4	2	16	26	2%	2%
Pinus strobus	6	2	6	5	19	1%	1%
Fraxinus americana	0	5	0	0	5	neg.	neg.
TOTALS	545	296	214	327	1382		

TABLE 2. Mesophanerophytes--woody plants 3-55 feet tall.

SPECIES	Route 1	Route 2	Route 3	Route 4	Total Number	% of Microphytes	% of all Woody Plants
Amelanchier canadensis	29	2	8	31	70	50%	4%
Acer saccharum	0	7	0	21	28	20%	2%
Prunus pennsylvanica	9	7	1	11	28	20%	2%
Acer spicatum	6	0	0	0	6	4%	neg.
Ostrya virginiana	1	3	0	0	4	3%	neg.
Prunus virginiana	3	0	0	0	3	2%	neg.
Amelanchier spicatum	0	3	0	0	3	2%	neg.
TOTALS	48	22	9	63	142		

TABLE 3. Microphanerophytes--woody plants 3-22.5 feet tall.

RESULTS OF TREE COUNTS IN AREA STUDIED, CONTINUED

SPECIES	Route 1	Route 2	Route 3	Route 4	Total Number	% of Nanophytes	% of all Woody Plants
Rhus glabra borealis	49	2	0	0	51	36%	1%
Pinus Banksiana	6	25	1	0	32	23%	neg.
Cornus circinata	27	0	0	0	27	19%	neg.
Crataegus sp.	10	0	0	0	10	8%	neg.
Salix sp.*	0	2	3	4	9	7%	neg.
Viburnum acerifolium	4	3	0	0	7	5%	neg.
Corylus rostrata	0	0	4	0	4	3%	neg.
TOTALS	96	32	8	4	140		

TABLE 4. Nanophanerophytes--woody plants 3-7.5 feet tall.

*Salix bebbiana, S. discolor, and S. discolor x bebbiana.

the birds were counted, to determine the species of woody plants present and their relative densities. These tree counts were conducted by traversing the transect line with two sticks each a yard long held horizontally at waist height, and counting all stems of woody plants (which appeared to have a reasonable chance of survival for the next few years) which were struck by the sticks. These tree counts were made in 100-pace strips, four of them to the mile, with 200 paces between each strip. In all, 20 such strips were counted.

RESULTS

The results of the bird censusing, both from the four transects and from cruising the roads and open spots, are given in Table 5. The great prevalence of Ovenbirds and Red-eyed Vireos in this area is clearly shown; Ovenbirds constitute 26% of the birds counted, and Red-eyed Vireos make up 17% of the birds counted. In fact, so prominent are they that they might be called the dominant species in the Ovenbird-Red-eyed Vireo association.

DISCUSSION

The scarcity of birds (only 52.6 pairs per 100 acres) is perhaps to be expected in an area where the vegetation is so limited in variety and so open in character. The almost complete lack of shrubby growth and the dry character of the area are also probably factors. Little is known of the insects in the area; ants are plentiful, as are also mosquitoes and blackflies, and many of the young Jack Pines (Pinus Banksiana) which have been planted in the area were being

Species	Pairs per 100 acres	Total males actual	Total males est.	Maximum no. heard on a trip Route 1	Route 2	Route 3	Route 4	Remarks
Ovenbird	13.8	43	129	20	7	9	7	Generally distributed.
Red-eyed Vireo	9.0	28	84	12	4	4	8	Generally distributed.
Cedar Waxwing	3.8	12	36	←3 individuals→				Generally distributed; 8 seen off routes.
Chipping Sparrow	3.2	10	30	2	5	2	1	Generally distributed.
Hermit Thrush	2.9	99	27	6	1	1	1	Generally distributed.
Wood Pewee	2.6	8	24	3	3	2	0	Generally distributed.
Robin	2.2	7	21	4	2	1	0	Somewhat localized; 4 at baseball field.
Ruffed Grouse	1.8	3	18	1	0	0	2	Generally distributed; see page 7.
Cowbird	1.8	17	17	←2 individuals→	8	2	4	Generally distributed; 17 indivs. on edge.
Chickadee	1.6	5	15	4	2	3	0	Generally distributed.
Crested Flycatcher	1.3	4	12	3	1	0	0	Generally distributed.
Vesper Sparrow	1.3	4	12	1	2	0	1	Generally distributed.
Purple Finch	1.0	3	9	1	1	0	1	In open spots only.
Least Flycatcher	0.6	2	6	1	1	0	0	Generally distributed.
Yellow-shafted Flicker	0.6	2	6	0	1	1	0	Generally distributed.
Hairy Woodpecker	0.6	2	6	0	0	1	1	Generally distributed.
Downy Woodpecker	0.6	2	6	1	0	0	1	Generally distributed.
Mourning Dove	0.5	5	5	0	1	0	0	4 pairs in open spots.
Scarlet Tanager	0.5	5	5	0	2	0	1	In wetter parts; 2 found when cruising.
Redstart	0.5	5	5	1	0	0	0	Localized; 1 on baseball field, 3 on Gr'vine Pt. Rd.
Bluebird	0.4	4	4	0	0	1	0	3 on Douglas L. Hotel Rd.
Pine Warbler	0.3	3	3	0	0	0	0	3 in baseball field area.
Indigo Bunting	0.3	3	3	1	1	0	0	Edge only; 2 in "bog hollow".
Kingbird	0.3	3	3	0	1	0	0	Edge only; 2 pairs found when cruising.
Brown Thrasher	0.3	3	3	0	1	0	0	1 in "bog hollow"; 1 at east end of study area.
Veery	0.2	2	2	0	1	0	0	1 in "bog hollow".
Towhee	0.2	2	2	0	0	0	0	1 in baseball field area; 1 on Douglas L. Hotel Rd.
Goldfinch	0.1	1	1	0	0	0	0	1 in baseball field area.
Black and White Warbler	0.1	1	1	0	1	0	0	(in wet southwest corner.)
Black-billed Cuckoo	0.1	1	1	0	0	1	0	Heard near the edge; probably the only one in area.
TOTALS	52.6	199	496					

TABLE5. Results of bird censusing, with estimates of pairs per 100 acres.

rapidly defoliated by sawfly larvae this summer, but other than these there are few insects in evidence.

The method of censusing the breeding birds by counting singing males has definite disadvantages. Hickey (1943: 101) hss shown that, in an area where the number of Red-eyed Vireo males was definitely known, only an average of 58% of the birds was singing on trips by an observer. The best time to hear these birds, as indicated in this study, appears to be from 7:00 to 9:00 in the morning. On the other side of the balances, not all birds singing may be mated males, and this is another source of error in this method.

Another disadvantage of the method is that nocturnal birds, birds of prey, and swallows feeding over the area but not nesting there, are omitted from the census. Then, too, some birds may be singing on the margin of the transect, and whether or not they should be counted is a problem.

A method suggested to offset some of the disadvantages of this one is to chart the positions of the singing males each time an area is traversed. Then, when an Ovenbird is known to have sung from a certain spot for four days, even though he be not singing there the fifth day, he may be assumed to be there; in this way, a more complete list of thebirds present bay be obtained.

PREVIOUS WORK

1913?

In 1914 James B. Compton made a survey of the birds in the Douglas Lake region, and made an attempt to list the species according to habitat and relative abundance. He found 47 species, but of these only 27 apecies are given as occurring either in the "aspens" or in "all habibats".

In his study, the Cedar Waxwing is the most prevalent bird. Part of the reason for the large numbers of this species is that they are found in all habitats--Compton made no attempt to estimate the number per square mile, and for this reason, his estimates are not of much value to us. It is interesting, however, to note the species present then and compare them with those present now. He lists such species as the Junco, the Canada Warbler, and the Crow. Other differences in his list and the present one might be explained on the basis of the shrubbier nature of the woods at that time.

Common in the region until about 1935-

Listed in Table 6, along with Compton's results, and the present writer's, are the results of a study made by Aretas A. Saunders in Allegany State Part, New York. He describes the woods as aspen-cherry, but describes it as being made up of open meadow, weedy open tracts, open spots with thick Pteris aquilina, aspen groves, willow thicket, clusters of cherry trees, Clematis, hemlocks, maples, beeches, and yellow birches. In other words, the area he studied is much more diverse in character than the Douglas Lake area, and it is not surprising that the two lists of birds vary so widely.

SUMMARY

1. This study was made to determine the species and relative numbers of birds in a sandy upland aspen area near the University of Michigan Biological Station, Cheboygan County, Michigan, in the period from July 5 to July 13, 1944.

2. The area studied comprises 936 acres; the soil is sandy and well-drained, and is deficient is humus. The climate is moderate, favoring the beech-maple climax forest.

3. The area studied was formerly forested with Pinus strobus and Pinus resinosa, but these have been lumbered off and the area repeatedly burned, resulting in a growth of Populus grandidentata and Acer rubrum about 25-30 years of age.

4. Birds were censused by counting singing males within 50 paces on either side of transect lines, by cruising along the roads bounding and through the area, and by cruising the open spots which occur in the area.

5. The species and density of woody plants was determined by tree counts along the transects traversed for birds.

6. Ovenbirds constitute 26% of all the birds found; Red-eyed Vireos, 17%. The number of birds found per 100 acres is 52.6 breeding pairs.

7. Birds omitted from the census are nocturnal birds and birds of prey.

8. A comparison is made between the present study and a previous one made by James B. Compton in the same region, and between the present study and one by Aretas A. Saunders in an aspen-cherry association in New York.

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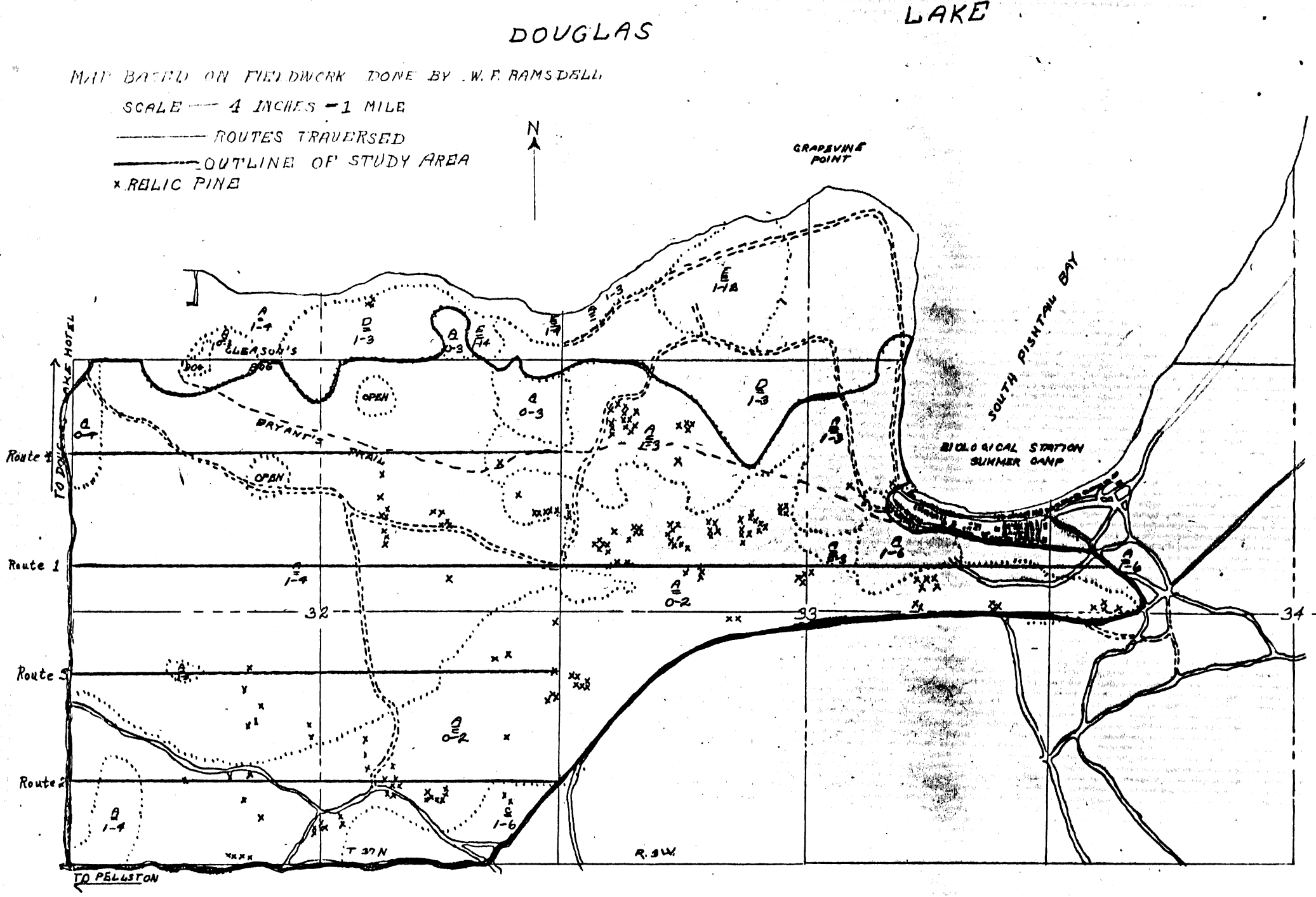

MAP 1. AREA STUDIED

Species	Saunders, 1936; pairs per 100 acres	Garst and Root, 1944		Compton,* 1914
		pairs per 100 acres	frequency ranking	
Ovenbird	---	13.8	1	11
Red-eyed Vireo	3.0	9.0	2	5
Cedar Waxwing	8.5	3.8	3	1
Chipping Sparrow	5.6	3.2	4	13
Hermit Thrush	3.5	2.9	5	9
Wood Pewee	---	2.6	6	19
Robin	6.0	2.2	7	17
Ruffed Grouse	1.2	1.9	8	20
Cowbird	---	1.8	9	--
Chickadee	6.4	1.6	10	21
Crested Flycatcher	---	1.3	11	6
Vesper Sparrow	---	1.3	12	8
Purple Finch	0.5	1.0	13	--
Least Flycatcher	3.7	0.6	14	--
Yellow-shafted Flicker	---	0.6	15	14
Hairy Woodpecker	---	0.6	16	--
Downy Woodpecker	1.9	0.6	17	25
Mourning Dove	0.9	0.5	18	46
Scarlet Tanager	1.8	0.5	19	--
Redstart	2.5	0.5	20	14
Bluebird	---	0.4	21	--
Pine Warbler	---	0.3	22	--
Indigo Bunting	1.4	0.3	23	23
Kingbird	---	0.3	24	--
Brown Thrasher	---	0.3	25	26
Veery	0.6	0.2	26	--
Towhee	7.8	0.2	27	4
Goldfinch	2.4	0.1	28	7
Black and White Warbler	---	0.1	29	--

Black-billed Cuckoo	0.6	0.1 52.6---30	30 species	--
Song Sparrow	17.7	---	--	--
Northern Yellowthroat	13.6	---	--	--
Chestnut-sided Warbler	9.8	---	--	--
Junco	6.8	---	--	15
Canada Warbler	5.4	---	--	43
Rose-breasted Grosbeak	3.4	---	--	--
Mourning Warbler	3.0	---	--	--
Catbird	2.7	---	--	42
Olive-backed Thrush	1.4	---	--	41
Blue-headed Vireo	1.4	---	--	--
Magnolia Warbler	1.2	---	--	--
Field Sparrow	0.8	---	---	--
Wood Thrush	0.7	---	--	--
Black-throated Green Warbler	0.7	---	--	--
Woodcock	0.7	---	--	--
Yellow-billed Cuckoo	0.1 127.4 (34 species)	---	--	--
Savannah Sparrow	---	---	--	45
Crow	---	---	--	3
Whip-poor-will	---	?	?	12
Marsh Hawk	***	?	?	42
Sparrow Hawk	---	?	?	45 (27 species)

*Compton ranked the birds found according to the number found, from one to 57. Only the birds he listed as being found in the "aspens", or in "all habitats" are included here.

Table 6. A comparison of the results of the present investigation and ones by J. B. Compton in the same region in 1914 and by A. A. Saunders in andAspen-Cherry association.