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A Breeding Bird Census of a Mature Red Pine Stand in Northwest Minnesota

ABSTRACT

We conducted a breeding bird census (BBC) of a 10 ha plot of mature red pines in Itasca State Park, Minnesota, following the guidelines put forth by Cornell Ornithology Laboratories. We use these data to compare species abundance between this and previous years on the plot. From these comparisons, we propose potential reasons for the relative abundances and point out the limitations of the study.

INTRODUCTION

There is substantial concern about factors that affect species diversity. In particular, recent studies (Askins, et al., 1990; Ehrlich, et al., 1988) indicate that populations of several species of songbirds are declining. Presumably, the decline in these species' numbers is due at least in part to habitat loss, either in their breeding range, their wintering range, or both.

David Blockstein (1991) began a census of four study plots at Itasca State Park, located at the headwaters of the Mississippi River in western Minnesota. The four study areas in Itasca State Park include the following habitats: a stand of mature red pines, a basswood-black ash forest, a mature aspen forest, and a young aspen forest. Observations on the study plots of species abundance provide information on how bird populations change with time and habitat. However, to accurately gauge the degree to which species' numbers are changing, comparisons of data are necessary, either from different locations or from different years at the same location. Such comparisons requires rigorous and

consistent sampling methods. The Breeding Bird Census (BBC), as outlined by Cornell Ornithology Laboratory (1991), provides one such sampling method.

Itasca State Park is especially interesting because it lies near the convergence of three broad habitat types--deciduous forest, coniferous forest, and prairie--and is thus a breeding area for a wide array of species. Also, because there has been little fragmentation of habitat within the park in the last century, any change in bird populations there may indicate a response to change in the wintering habitat rather than the breeding habitat.

This paper presents the results of a breeding bird census and a vegetative survey carried out on the red pine plot at Itasca State Park, and compares these findings to those of previous years.

METHODS

The red pine plot is located on Wilderness Drive in Itasca State Park (fig 1). The 10 ha plot is roughly rectangular, set along a 50 m grid that is 400 m north to south and 250 m east to west (fig 2). The habitat consists primarily of mature red and white pines (*Pinus resinosa* and *Pinus strobus*, relative dominance 37.3% and 19.2%, respectively; see appendix A and B). However, the plot is not homogeneous. There is a 1.0 hectare sedge meadow on the eastern border of the plot and a 2.0 hectare deciduous forest on the northwest corner. In addition, much of the plot has a well developed understory of maple and aspen (*Acer saccharum* and *Poplus tremuloides*, relative dominance 7.7% and 10.1%, respectively; see appendix A and B).

Vegetative Survey

Three members of the 1992 Ornithology class at the University of Minnesota

Biological Field Station surveyed the red pine plot using the methods outlined by James and Shugart (1970) and James (1980). We randomly chose ten 0.1 acre (0.04 ha) circular areas on the red pine plot (fig 2). Within these areas, we recorded the species and size class of all trees greater than three inches diameter at breast height (dbh). Using these data, we calculated for each species the number of trees per acre, frequency, relative density, and the relative dominance (percentage of total basal area each species accounts for; appendix A and B). For the purposes of this study, we considered trees less than three inches dbh as shrubs. We estimated shrub density by walking two perpendicular transects across the diameter of each circle with outstretched arms and tallying the number of shrubs touched. In addition, to estimate canopy and ground cover, a member from our group used a small tube equipped with cross hairs to make ten sightings at even intervals along each diameter transact (twenty sightings of canopy and twenty sightings of ground cover for each 0.04 ha circle). The individual looked vertically up and down through the sighting tube and noted if any vegetation was visible at the crux of the cross-hairs. Because the study plot was set along a north-south grid, these perpendicular transects ran northeast and southeast to avoid biasing our sample by using trails.

Breeding Bird Census

We censused the red pine plot eight times from June 23 to July 11, 1992, using the methods outlined by Cornell Laboratory of Ornithology (1991). Except for one evening bout, censusing began from 5:00 am to 5:45 am and ended from 8:30 am to 11:30 am. Our eight visits ranged from 2 hours to 7 hours field time per censusing bout (appendix C). We followed a route going north along one grid line and then south along the grid line 100 meters away, and so on until we had censused the entire plot. Censusing often lasted longer than the most intense period of singing. To ensure that we accurately censused birds from all parts of the study area, we began our censuses at different points along the

southern edge of the plot. We censused the birds by walking along the north-south grid lines, stopping frequently (often moving less than 20 meters between stops) to listen for songs. We identified song to species and recorded the location of the singer on a map of the plot. We also noted any sightings of individual birds and their gender, any nests, and any interactions between conspecifics, including simultaneous song. In addition, we made note of visiting birds did not evidently nest on the plot. Before each bout of censusing we recorded the temperature, wind, and weather conditions.

RESULTS

From out breeding bird census, we found a total of seventeen species of birds holding territories on the red pine plot. In addition, we found ten species of birds that visited the plot without holding breeding territories there. Across all species, we found a total of 105 territories. We found 23.5 ovenbird territories on our 10 ha plot, or an average of 235 territories/km^2, thus making ovenbirds the most numerous on the red pine plot. Black-throated green warblers were next most numerous, with an average of 140 territories/km^2, followed by red-eyed vireos (130 territories/km^2) and pine warblers (110 territories/km^2). For a complete list of species and territories on the red pine plot, see table 1. Refer to appendix D for maps of the territories according to species. We also found two yellow-bellied sapsucker nests. Of special interest, we observed mixed flocks of blue and gray jays, some of them apparently immature, and observed one black-backed woodpecker.

DISCUSSION

Comparisons of breeding bird territories on the red pine plot between 1992 and the previous two years of D. Blockstein's study show largely similar numbers (table 1 and fig 3). Ovenbird, black-throated green warbler, and chestnut-sided warbler numbers are very

comparable, for instance. Although red-eyed vireos are almost half as abundant as last year, they are slightly more abundant than two years ago, leading me to conclude that either last year's population on the plot was high or that red-eyed vireo populations are highly variable, not that this year's population is especially low. Pine warbler numbers are less than half those of 1991 and 1990, but in 1980 there were only 71 territories per km^2 (Podezwa, 1991). Again, from this scant evidence I cannot conclude that there has been any real decline. Several species populations underwent steady but slight increases or decreases over the last three years. The data suggest that ovenbirds, hermit thrushes, common yellowthroats, scarlet tanagers, and ruffed grouse have decreased. Other species, such as the black-throated green warbler, the chestnut-sided warbler, the eastern wood pewee, and the brown creeper, have increased.

Data from the census plots is somewhat problematic. A given year's census for a plot can only be treated as a single data point; each plot's census has no mean or variance. Therefore, while the BBC provides a method to compare many plots and years, there is no way within one plot to distinguish between real changes in populations and random perturbations. Over longer periods of time, studies can show real trends in population change. However, over three years, this is not feasible. Therefore, for the purposes of this study, I will have to assume that some trends are real and hypothesize as to their existence.

One interesting finding from our censusing is the ample quantity of breeding ovenbirds. Ehrlich, et al. (1989), describe the ovenbird's breeding range habitat as "Deciduous, rarely pine forests ... Nests in open, on leaf-covered floor of deciduous wood. Always roofed with leaves" (p. 542). As the name implies, the red pine plot is not primarily deciduous, and yet ovenbird territories crowd almost all of our study area. Furthermore, ovenbirds have been the most prominent species for each of the last three years--although their numbers have declined very slightly (from 265/km^2 to 235/km^2, table 1).

Due to cowbird brood parasitism, ovenbirds tend to be very sensitive to forest fragmentation (Ehrlich et al., 1989, p. 497). The red pine plot, like the rest of Itasca State Park, suffers little of this. The lack of fragmentation may account for the relative stability of ovenbird population size, but it does not explain their abundance. In being protected as a state park, Itasca has also been largely protected from fire. Without fire, the mature pine stands have been slowly succeeded by deciduous trees. Such is the case in the red pine plot, and the aspen and maple understory may provide suitable habitat for ovenbirds. Indeed, at least 2 ha of the plot is mostly deciduous with open ground--exactly what ovenbirds prefer.

Much of the plot is characterized by extremely shrubby habitat and closed understory, however. This year's shrub index was much higher than last year's (6445 and 1915, respectively; see appendix A and B; Podezwa, 1991). Notice also that this year's vegetative survey has lower percentages of both ground cover (1992, 55%; 1991, 93.5%) and canopy cover (1992, 77%.; 1991, 95.5%). The lower coverage leads me to suspect that differences in shrubbage are merely artefacts of the locations chosen for the vegetative analysis (fig 2) and are not due to any real increase in shrubbiness. Much of this year's vegetative analysis was clumped toward the north-central to north-east corner of the plot. Part of this corner is particularly shrubby, and part is composed by the deciduous area. Thus this year's vegetative sample is both more shrubby and perhaps more variable than last year's. (Another problem with the BBC method is the vegetative survey, which does not take into account the variability of habitat within a plot. James, 1980.)

The high density of ovenbirds, it seems safe to speculate, is one outcome of the successional process overtaking the red pine plot and Itasca State Park as a whole. Actually, ovenbirds may be a suitable indicator of many of the attributes of the red pine plot in relation to bird populations. Neither this year's BBC nor the previous two years have spotted any cowbirds, and the red pine plot is not fragmenting. Therefore, any decrease in the ovenbird population might be attributable to other aspects of their life history, such as

wintering habitat loss. Increase in ovenbird populations may be attributable to successional change in habitat within the park.

Increases in populations of eastern wood pewee and black-throated green warbler are encouraging. Both are songbirds at high risk from habitat destruction (Ehrlich, et al., 1989, p. 499). Both live in deciduous-coniferous forests, a habitat that is prevalent in Itasca. It will be interesting to notice how these two species' populations continue to change over time. Chestnut-sided warbler numbers also appear to be increasing. According to Ehrlich (1989, p. 516), they prefer to live in "brushy thickets and second growth". I suspect that their increase is related to the lack of fire and the subsequent dense shrubby ground cover that covers much of the red pine plot (appendix A and B).

Hermit thrush populations may be decreasing rapidly on the red pine plot. Because they live in coniferous, mixed, or deciduous forests (Ehrlich, et al., 1989, p. 460), any decline is unlikely to be due to habitat change--the red pine plot has all three. Neither are they listed among species most likely to suffer the effects of habitat destruction in the tropics. I suspect, therefore, that the apparent decline in hermit thrush numbers is not due to any cause and is merely random flux. We frequently heard hermit thrushes in some abundance near, but not on, our plot, thus leading me to believe that their numbers are suffering no decline. To be fair, frequent observations of them elsewhere may be due to their obvious song. Future censuses will determine whether the recent decline will continue or whether hermit thrushes have simply been elsewhere the last two years.

The red pine plot has an abundance of species and territories. While most populations appear to be stable, some may be experiencing increases or decreases. Because the red pine plot is undergoing habitat change through succession, it is difficult to determine whether these increases and decreases are due to habitat change in wintering grounds or habitat change here. In addition, the red pine plot is fairly variable in habitat, thus affecting different species in different ways. Detailed microhabitat analysis might be able to tease apart these influences, but this seems somewhat beyond the scope of the

breeding bird census.

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Figure 1

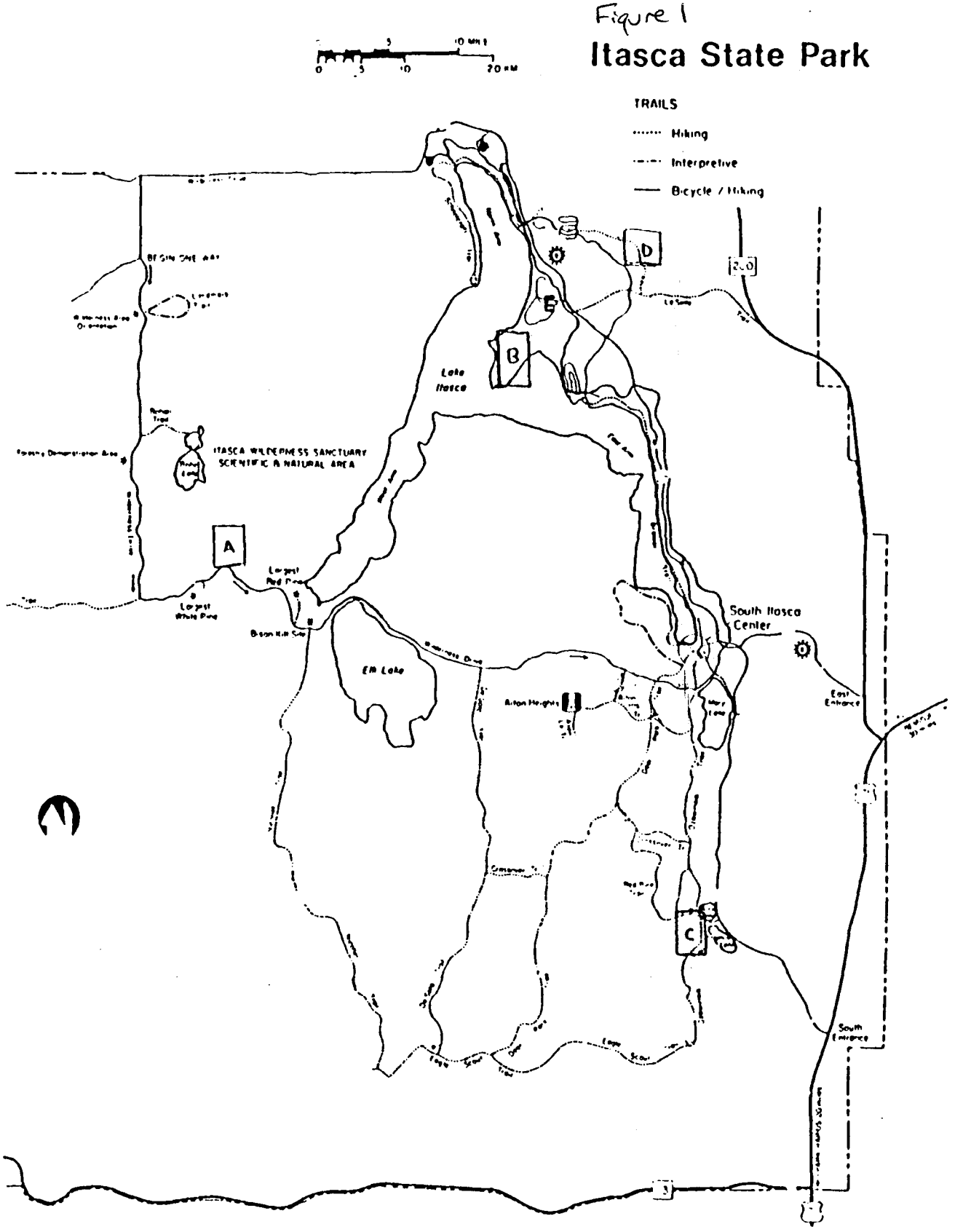

Figure 1. Map of Itasca State Park including study sites.

Legend: A — red pine
B — open basswood
C — mature aspen
D — young aspen
E — University of Minnesota Forestry and Biological

MAP Figure 2 Sample Points 1992.

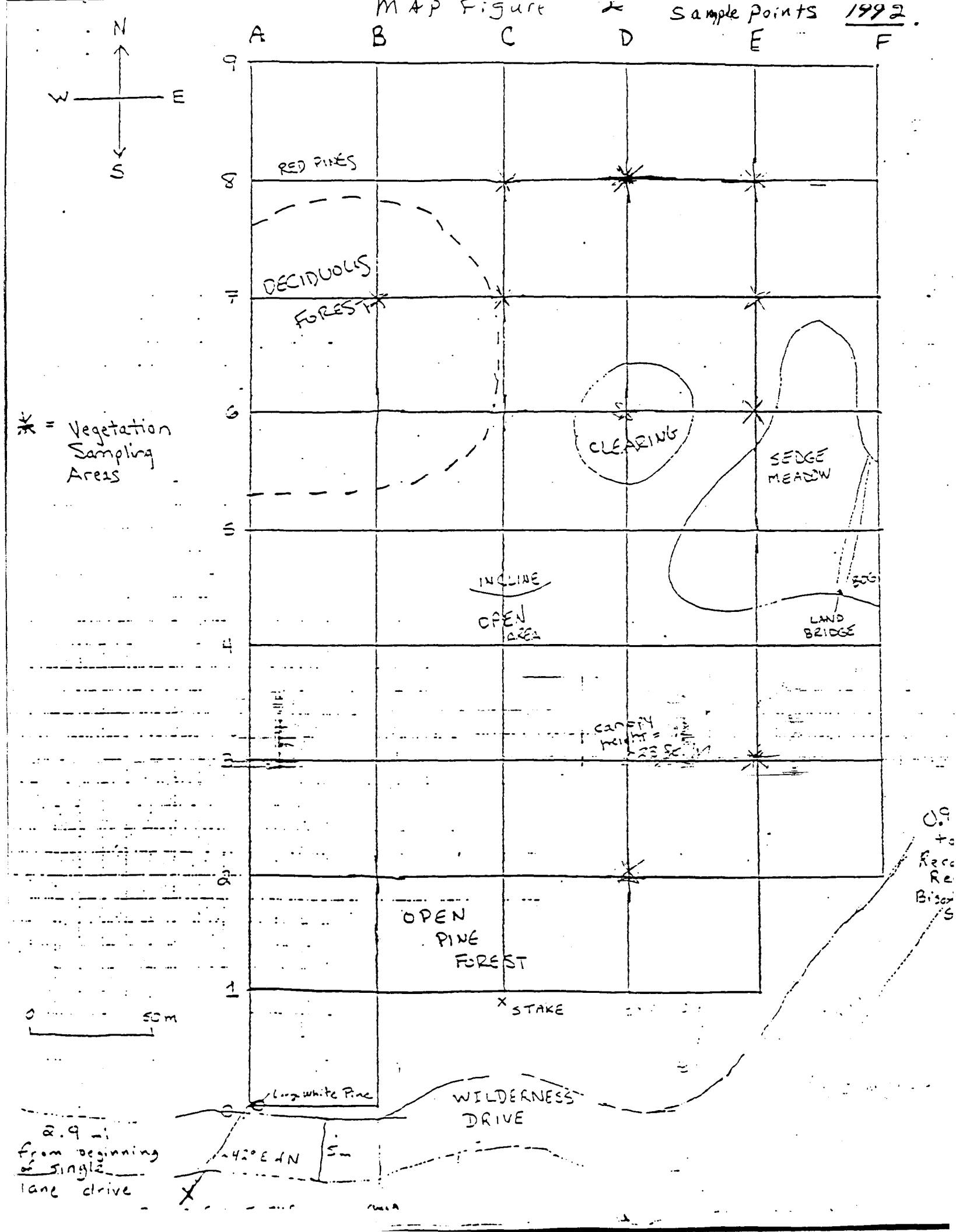

Figure 3: Number of Territories per Square Kilometer, 1990-1992. The abundance of breeding territories for three years, listed by 1992 abundance. Based on red pine plot BBC.

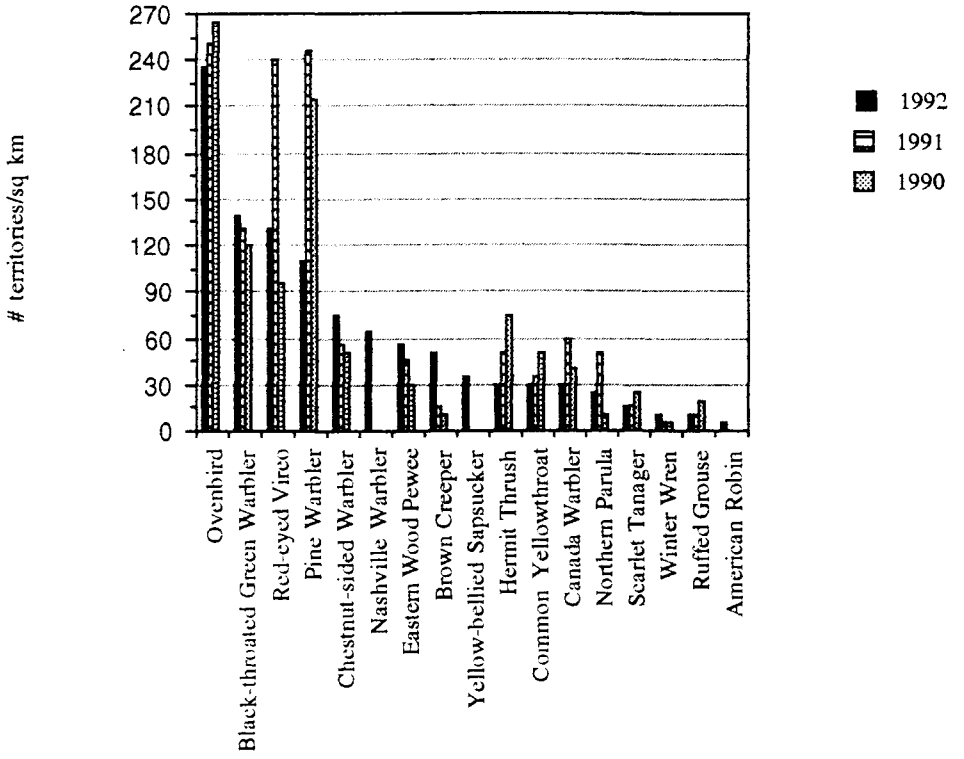

Table 1:
Bird Species, Territory Numbers and Densities for the Red Pine Plot, 1990-1992.
The following are the species holding breeding territories on a 10 ha plot, the breeding density (average number of breeding territories per square km), and species that appeared on the plot without holding territories there. (Information on previous years comes from Podezwa, 1991.)

1992 Species Holding Territories	1992 # /plot	1992 #/km^2	1991 #/km^2	1990 #/km^2	1992 Visiting Species
Ovenbird	23.5	235	250	265	Broad-winged Hawk
Black-throated Green Warbler	14	140	130	120	Hairy Woodpecker
Red-eyed Vireo	13	130	240	95	Black-backed Woodpecke
Pine Warbler	11	110	245	215	Gray Jay
Chestnut-sided Warbler	7.5	75	55	50	Blue Jay
Nashville Warbler	6.5	65	na	na	Common Raven
Eastern Wood Pewee	5.5	55	45	45	Red-breasted Nuthatches
Brown Creeper	5	50	15	10	Pine Siskin
Yellow-bellied Sapsucker	3.5	35	na	na	Black-capped Chickadee
Hermit Thrush	3	30	50	75	Mourning Warbler
Common Yellowthroat	3	30	35	50	
Canada Warbler	3	30	60	40	
Northern parula	2.5	25	50	10	
Scarlet Tanager	1.5	15	15	25	
Winter Wren	1	10	5	5	
Ruffed Grouse	1	10	10	20	
American Robin	+	5	na	na	

Appendix A

Summary Sheet A

Summary Sheet for Tenth-acre (0.04 / 0.4 hectare) Circles

Number of Circles = 10

Trees:

Species	Density[1] Number of trees in all circles by size class								Total	Trees/acre (by species)[2]	Relative Density (by species)[3]
	A 3-6	B 6-9	C 9-12	D 12-15	E 15-21	F 21-27	G 27-33	H 33		Trees/ha	
1 Acer saccharum	11	18	7	1	1				38	95	15.9 %
2 Tilia americana	3	Ø	2						5	12.5	2.1
3 Quercus rubrum	10	3	1	Ø	1				15	37.5	6.3
4 Populus tremuloides	6	4	8	5	3				26	65	10.9
5 Abies balsamea	8	13	4						25	62.5	10.5
6 Ostrya virginiana	13								13	32.5	5.4
7 Betula papyrifera	1	1	1						3	7.5	1.3
8 Pinus Strobus	Ø	6							28	70	11.7
9 Pinus resinosa	Ø	5	6	6	18	5			40	100	16.4
10 Ulmus americana	1								1	2.5	0.4
Dead	8	15	1	6	2	3			45	112.5	18.8
TOTAL	61	63	43	24	33	13			239	597.5	100%
Trees/acre by size class (Trees/ha)	152.5	157.5	125	60	82.5	25					
Relative Density by size class	25.5%	26.4	20.1	10.4	13.8	4.2					

Shrubs: Percent of + readings for interception of woody vegetation < 3" d.b.h. Eg. total pluses (+) in 20 readings x 5. 47 (1289 x 100)/20 = 6.445

Ground Cover: Percent of plus + readings for green vegetation sighted in ocular tube. Eg. total pluses in 20 sightings x 5. 110/200 = 0.55 or 55 %

Canopy Cover: Percent of plus (+) readings. Eg. total pluses in 20 sightings x 5. 154/200 = 0.77 or 77 %

Appendix B 0.04 Summary Sheet B

Summary Sheet for Tenth-acre (0.4 hectare) circles

Number of Circles = 10

Trees

Species	Basal Area[5] Cross sectional area of the trunk at 4.5 feet from the ground (d.b.h.) in m^2								Total Basal Area ~~(sq. feet)~~ m^2	Relative[7] Dominance (by species)	No. of circles in which the species occurred	Frequency[8]
	A (0.1)	B (0.3)	C (0.6)	D (1.0)	E (1.8)	F (3.1)	G (4.9)	H (.005 d^2)				
1 Acer saccharum	0.0099	0.486	0.378	0.09	0.162				1.13 m^2	7.7%	6	60
2 Tilia americana	0.0027	ø	0.108						0.111	0.8	2	20
3 Quercus rubrum	0.009	0.081	0.054	ø	0.162				0.306	2.1	3	30
4 Populus tremuloides	0.0054	0.108	0.432	0.45	0.486				1.48	10.1	3	30
5 Abies balsamea	0.0072	0.351	0.216						0.574	3.9	6	60
6 Cotylus virginiana	0.0117								0.0117	0.1	1	10
7 Betula papyrifera	0.0027	0.027	0.054						0.054	0.4	3	30
8 Pinus Strobus	ø	0.162	0.432	0.36	1.296	0.558			2.81	19.2	4	40
9 Pinus resinosa	ø	0.081	0.324	0.72	2.916	1.395			5.441	37.3	5	50
10 Ulmus americana	0.0009								0.0009	0.01%	1	10
Dead	0.0072	0.405	0.594	0.54	0.324	0.857			2.71	18.6	6	60
TOTAL	0.0549	1.701	2.592	2.16	5.346	2.79			14.6 m^2	100%		~~100%~~
Trees/acre by size class m^2/ha	0.137	4.25	6.48	5.4	13.4	7.0						
Relative Density by size class	0.40	11.7	17.8	14.8	36.8	19.1						

Shrubs: Percent of + readings for interception of woody vegetation < 3" d.b.h. Eg. total pluses (+) in 20 readings x 5.

Ground Cover: Percent of plus + readings for green vegetation sighted in ocular tube. Eg. total pluses in 20 sightings x 5.

Canopy Cover: Percent of plus (+) readings. Eg. total pluses in 20 sightings x 5.

Appendix C: Times and Temperatures of Censusing Red Pine Plot

visit	start-end time	temp (C)	wind (mph)	sky
June 23	0515-1200	10	calm (0)	part cloudy
June 26	0500-1100	10	calm (0)	part cloudy
June 29	0510-1100	18	slight (1-3)	overcast
June 30	0510-0930	7	slight (1-3)	overcast
July 3	0515-0930	10	slight (1-3)	light rain
July 5	0500-0820	10	slight (1-3)	clear
July 7	0500-1000	18	slight (1-3)	overcast
July 11	1910-2120	24	slight (1-3)	part cloudy