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ECOLOGICAL SURVEY OF A RED SPRUCE
FOREST AT ACADIA NATIONAL PARK

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Game Management Problem

Fy-305

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INTRODUCTION

The trend of Park Service research programs has recently been toward more ecologically-based studies. A great deal of information is needed about the ecology of our National Parks to provide guidelines for future management and preservation of animal and plant species.

In order to "open the door" to ecological studies at Acadia National Park, a small, mature spruce forest, was chosen for a general survey in June, 1969. The climax spruce forest was selected mainly because its ecological complexity was not as great as that of other habitats.

The objectives of this study were: 1) to determine the presence, abundance, and distribution of the plant and animal species in a spruce forest, 2) to examine some of the associations and interactions between the plants and animals and 3) to investigate methods and techniques which would provide insight to some of the plant and animal associations.

Finances for the project were provided by the Student Conservation Association and the National Park Service.

Acknowledgements are extended to Dr. Voit Richens, Assistant Leader of the Maine Cooperative Wildlife Research Unit, who served as advisor for the project, and to Acadia Park Personnel for their assistance in locating

the study area, and for the use of Park facilities. Acknowledgements are also extended to Dr. Sanford Schemnitz, Associate Professor of Wildlife, for his assistance with the project planning and to William Russell of the Federal Fish and Wildlife Service, for his assistance in the identification of bird calls. Special thanks are due my wife, Jane, for her encouragement, assistance with the field work, and for typing the preliminary and final drafts of this manuscript. I also wish to thank Raymond Lambert for his assistance with the field work.

DESCRIPTION OF STUDY AREA

The study area, a 17.1-acre mature red spruce ^{1/} forest, is located at Western Point in Acadia National Park, Mount Desert Island, Maine.

The topography of the area ranges in elevation from 80 to 140 feet above mean sea level. During the study soil moisture ranged from wet or poorly drained at low elevations to well drained. The overstory stratum is predominantly red spruce with northern white cedar, white birch, red and sugar maple as minor associates.

The stand is even-aged containing trees 70-90 years of age. The main crown canopy averages 54 feet in height, with 95 percent crown closure. "The Society of American Foresters" classification for the red spruce stand is Type 32 (S.A.F., 1967).

METHODS

Sampling Design

A traverse was made around the study area (Figure 1) and a base map prepared by method of latitudes and departures (Davis and Foot, 1953).

A base line was established from the southwest corner

^{1/} Scientific names of plants and animals are presented in Appendix I.

of the study area N 40° E. Along this line 11 parallel transects were established at 150 foot intervals. The first transect line was chosen at random. Sample plots were located at 100 foot intervals along each transect line. Again, the first plot on each line was selected at random. Nested sample plots were established in the following manner: two concentric circular plots, 1/20-acre, and 1/40-acre in size, were constructed by marking off four quadrants of an imaginary circle. Along each of the four quadrants within the 1/40-acre plot a 1/1000-acre plot was established for intensive vegetation measurements. A total of 46 nested plots were located throughout the stand (Figure 2).

Vegetation Survey

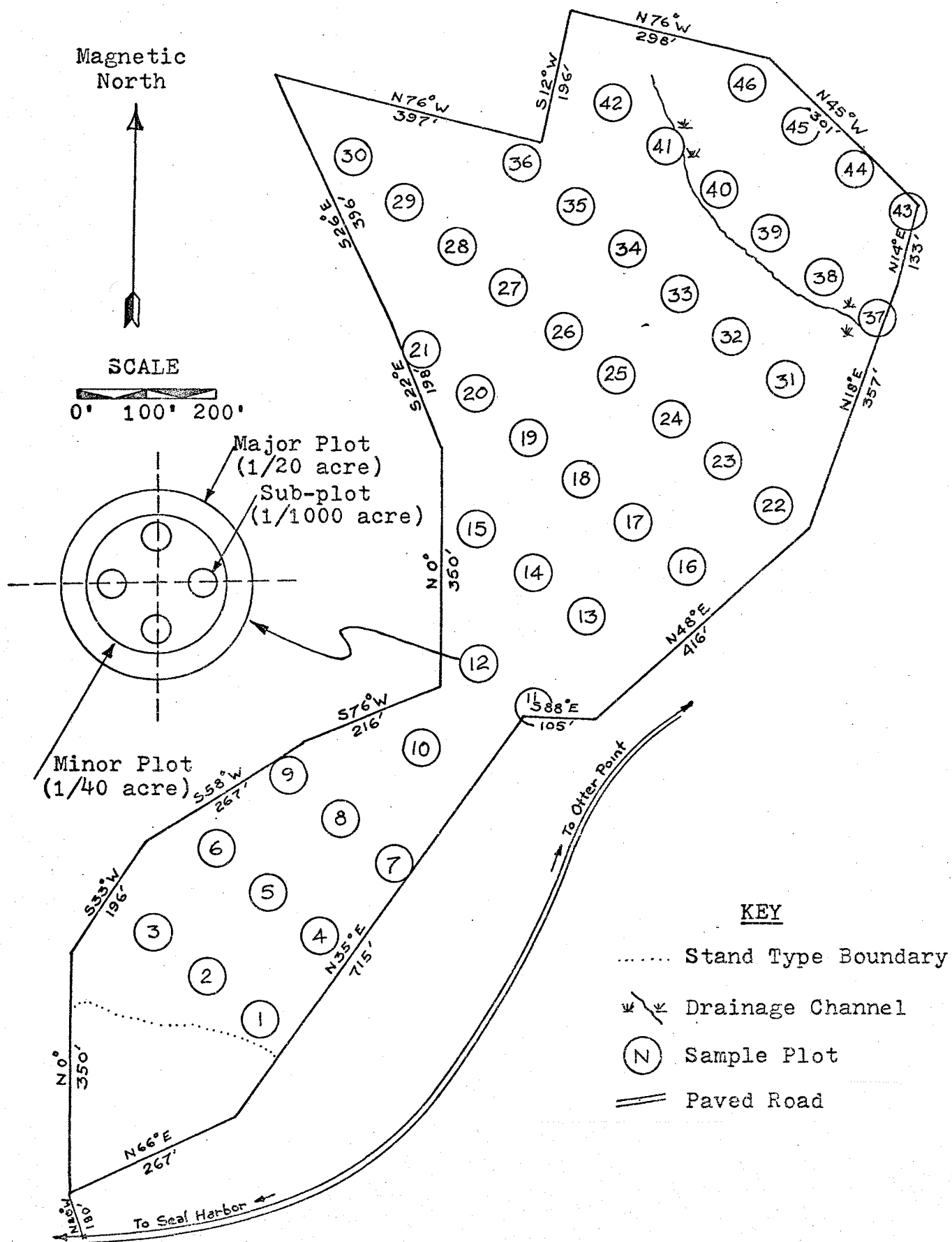
On the major plots, 1/20-acre in size, all tree diameters 4" d.b.h. and above were measured, recording number, species, position in canopy, and mortality.

On the minor plots, 1/40-acre in size, the same data were collected for all trees 1-3" d.b.h.

On each of the four mil-acre plots established within the minor plot the following data were gathered: tree species in the reproduction stratum (includes all trees 0.5 inches in height to 0.5 inches d.b.h.) were separated into four height classes; 1) 0.5' to 1.49'; 2) 1.5' to 3.49'; 3) 3.5' to 5.49'; 4)

FIGURE 2

STAND MAP OF SPRUCE FOREST TYPE, ACADIA NATIONAL PARK



5.5' to 0.5 inches d.b.h. The percent of crown closure over each of the mil-acre plots was measured with a spherical densiometer. Duff thicknesses were measured to the nearest $\frac{1}{4}$ inch (Figure 3). Humus type (mor or mull), drainage, and the amount of slash and rock present were estimated by inspection. The low ground vegetation on the mil-acre plots was separated into three groups; mosses, ferns, and herbs; and was recorded as percent cover by ocular estimation.

Deer and snowshoe hare pellet groups were counted on the 1/20-acre plots as were other animal signs such as browsing, scats, and predation. Scats were collected for food habits analysis.

Location and measurement of sample trees:

A total of 92 spruce trees were selected in the stand for intensive examination, 46 in the overstory and 46 in the understory. An attempt was made to choose a well-formed tree from each stratum on every major plot. Total height was measured for each tree with a Suunto clinometer. Increment borings at d.b.h. were also taken from each sample tree. The increment cores were examined under a binocular microscope for age, and the amount of growth during the last 20 years.

Small Mammal Survey

Forty six Sherman live traps, 104 museum special snap traps and 46 rat snap traps were used to capture small mammals on the study area. Traps were spaced at 50-foot intervals along the transect lines.

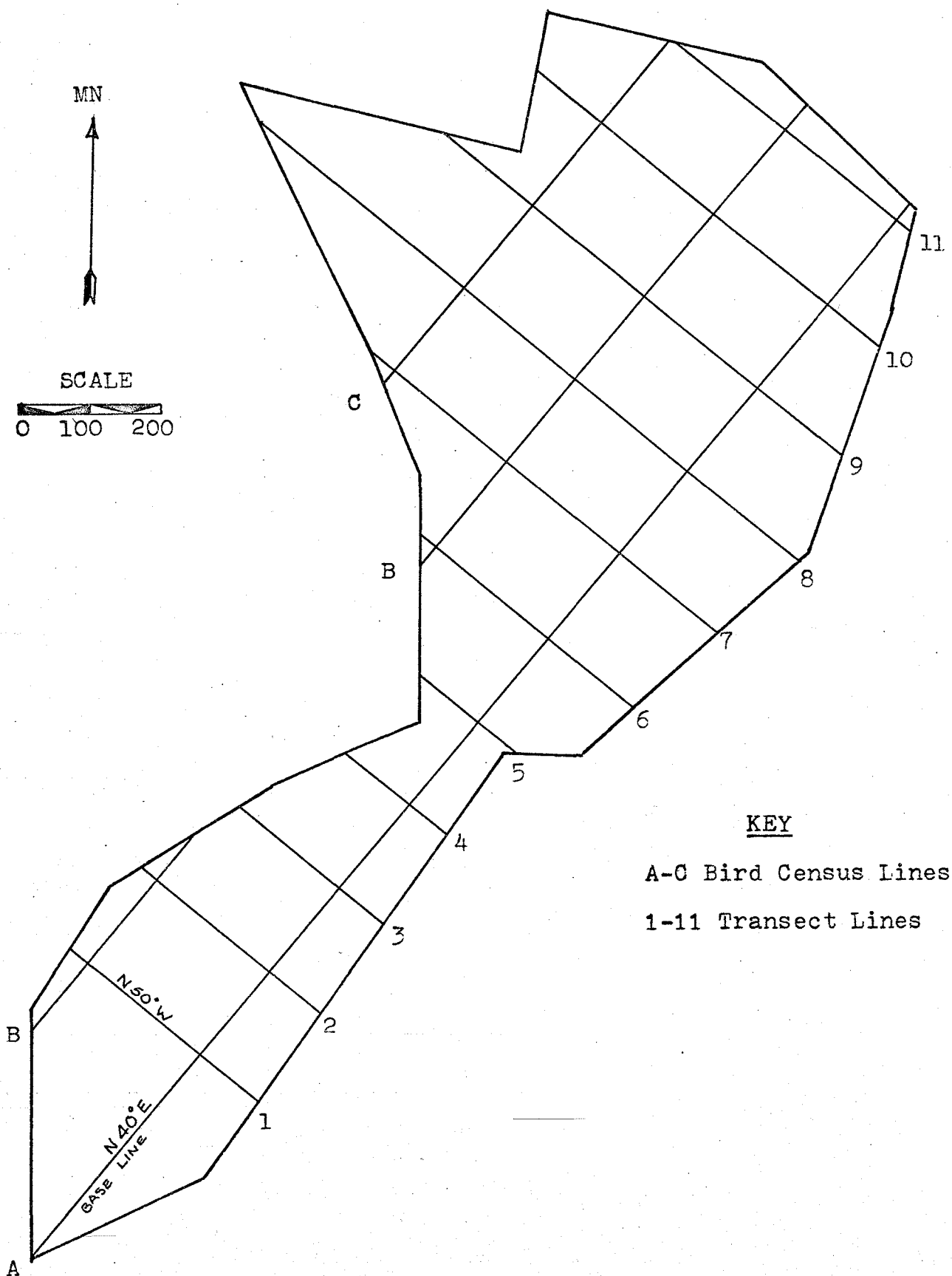
All traps were located at the most suitable sites within a 5-foot radius of each location point. A mixture of peanut butter, bacon grease, and ground meat was used for bait. Trapping was conducted for a 5-day period beginning on June 24th. Animal species were identified according to Blair, et.al., (1968).

Bird Survey

Bird populations were estimated by a modification of the method outlined by Pough (1947). Two additional lines were established at 200-foot intervals parallel to the base line and perpendicular to the transect lines (Figure 4). These lines divided the study area into 150 by 200-foot blocks. The three lines (including the base line) were walked once each day for a 3-day period, and the location of all birds heard or seen from each intersection was noted. The activity of the birds was also recorded when possible. The lines were walked at different times each day, beginning at 5:30 a.m. the first day, 6:30 a.m. the second day, and 9:30 a.m. the last day.

FIGURE 4

ESTABLISHMENT OF BREEDING BIRD CENSUS LINES A, B, AND C.



Observations were made each day, over a three-week period for other bird species not recorded.

RESULTS AND DISCUSSION

Vegetation Survey

As illustrated in Table 1, the average d.b.h. of trees in the overstory is 7.6 inches and in the understory 3.6 inches. The differences resulted mainly from suppression. The mortality stratum (includes all dead standing trees) has an average d.b.h. of 2.9 inches. The basal area of the mortality stratum is 14 percent of the total basal area for the overstory and 49 percent of that for the understory. This high mortality resulted from the inability of many trees to compete for light and other growth essentials. As a result, 44 percent of the trees in the understory are dead. The understory shows a higher abundance of northern white cedar and balsam fir than the overstory, but with red spruce still predominating.

Figure 5 illustrates the number of trees per acre and the corresponding height classes in the reproduction stratum. Red spruce constitutes the highest number of trees per acre. Balsam fir, while unimportant in the other strata, does occur with some frequency here (see also Figure 6). Hardwood species are nearly absent in this stratum with only a small amount of mountain ash

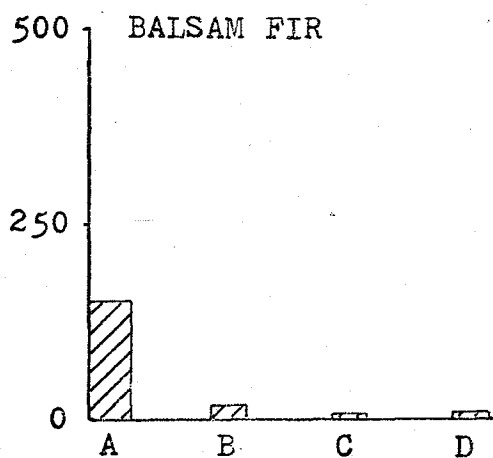
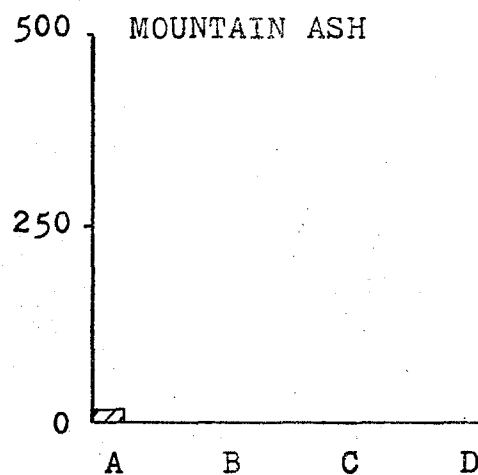
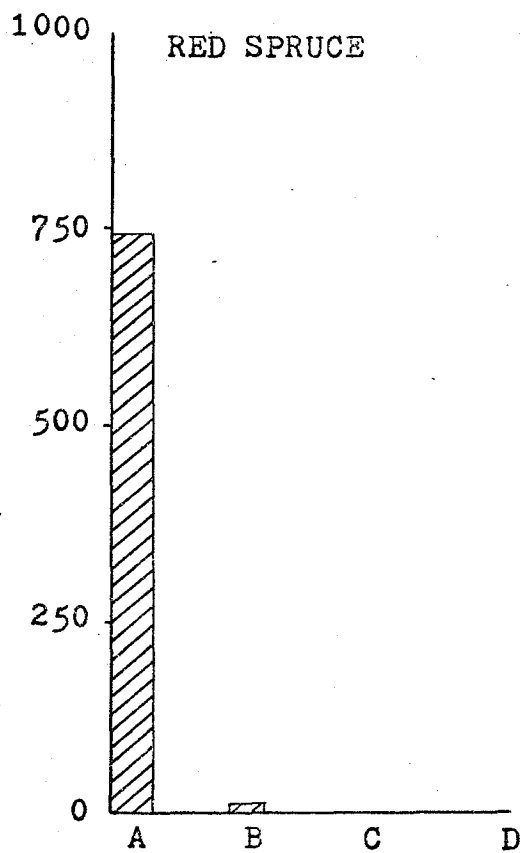
TABLE 1

NUMBER OF TREES PER ACRE, BASAL AREA PER ACRE, AND AVERAGE DBH BY SPECIES OF ALL TREES ONE INCH OR MORE AT DBH IN THE OVERSTORY, UNDERSTORY, AND MORTALITY STRATA RESPECTIVELY

Species	Overstory Stratum				Understory Stratum				Mortality Stratum			
	No. Trees	Basal Area Sq.Ft.	%	Avg. DBH (in)	No. Trees	Basal Area Sq.Ft.	%	Avg. DBH (in)	No. Trees	Basal Area Sq.Ft.	%	Avg. DBH (in)
R. SPRUCE	457	146.24	98.8	7.7	488	36.92	88.6	3.7	369	17.07	82.9	2.9
N.W. CEDAR	3	0.41	0.3	5.0	85	4.33	10.4	3.1	59	0.76	3.7	1.5
B. FIR	-	-	-	-	12	0.14	0.3	1.5	9	0.67	3.2	3.7
W. BIRCH	8	1.03	0.7	4.9	2	0.16	0.4	3.8	19	1.89	9.2	4.3
R. MAPLE	2	0.33	0.2	5.5	1	0.02	0.1	2.0	6	0.21	1.0	2.5
S. MAPLE	-	-	-	-	2	0.04	0.1	2.0	-	-	-	-
SERVICEBERRY	-	-	-	-	2	0.04	0.1	2.0	-	-	-	-
Totals	470	148.01	100	7.6	592	41.65	100	3.6	462	20.60	100	2.9

FIGURE 5

NUMBER OF TREES PER ACRE BY SPECIES AND HEIGHT CLASSES IN THE REPRODUCTION STRATUM (Number of trees per acre on vertical scale and height classes on horizontal scale).

KEY

A = 0.5 to 1.49 feet

B = 1.5 to 3.49 feet

C = 3.5 to 5.49 feet

D = 5.5 ft. to 6.5 ft. DBH

present. The majority of species are found in a height class of 0.5-1.5 feet. There are no cedar seedlings in the stand possibly due to deer feeding activity in fall and winter.

Little correlation exists between reproduction abundance and crown density (Figure 6). Many open areas receiving nearly full light intensity were dry mounds with a shallow duff and lichen cover. These areas did not support tree reproduction probably due to a lack of moisture. Most of the reproduction was evident at about 85 percent crown closure and dropped off rapidly as the crown density increased. No seedlings of any tree species were found at 100 percent crown closure.

The ground layer is composed of rock-laden mineral soil covered by a mor humus layer averaging 5.0 inches in thickness. The stand is well drained with only a few wet areas along the drainage channel. With the exception of mosses, which comprise 44 percent (Figure 7), the ground cover is very sparse (Appendix 2, Table 20). Tree reproduction and herbaceous ground cover occurred only in small confined areas (Figure 8 and 9) where there were openings in the crown canopy. These areas were created either by windthrows or mortality of overstory trees (Figure 10). In this stand windthrows were responsible for over 90 percent of these openings. Lichens, which averaged only 5 percent of the ground cover, were found pre-

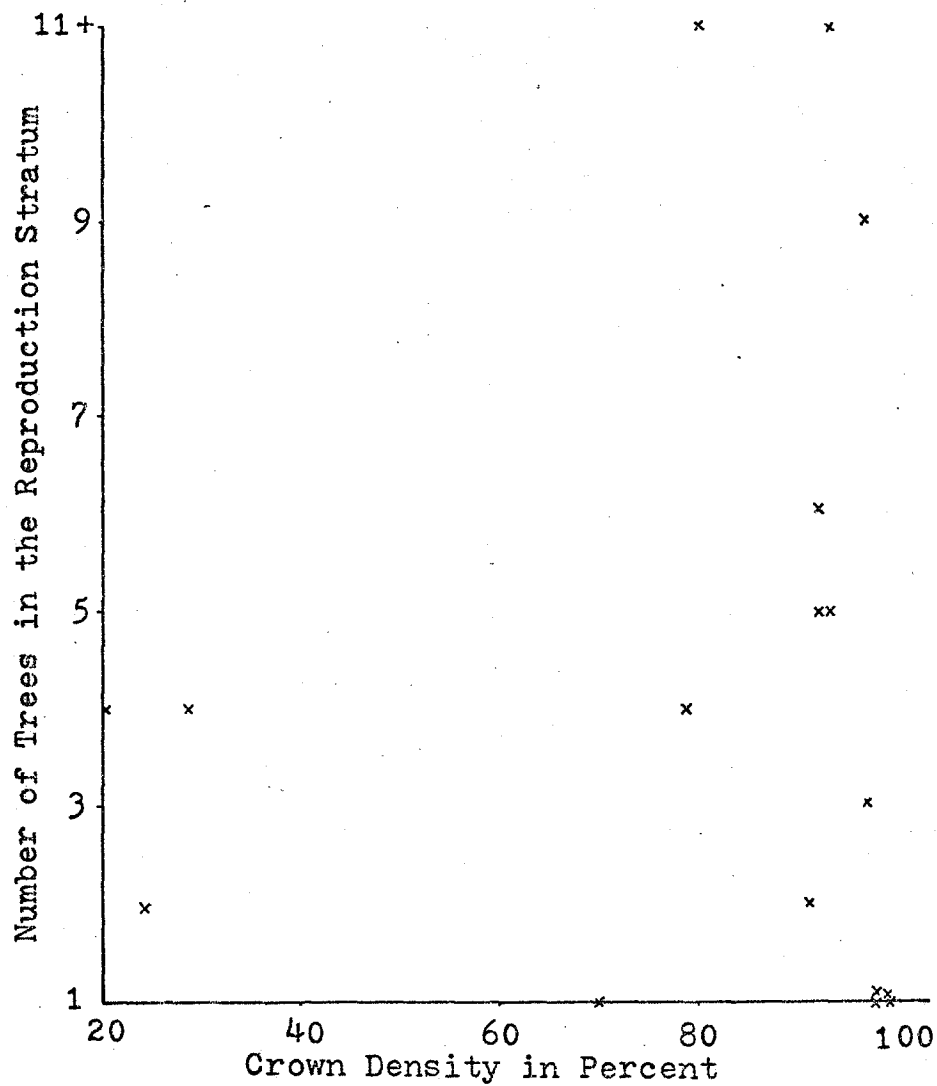


FIGURE 6

RELATIONSHIP OF TREE NUMBERS IN THE REPRODUCTION
STRATUM TO THE DEGREE OF CROWN CLOSURE

dominantly on the higher and usually exposed mounds (Figure 11). Slash which consisted of all dead twigs, branches, and trees lying on the ground surface composed 36 percent of the ground cover (Figure 12).

Figure 13 illustrates by a number of phytographs (Oosting 1942, Oosting and Reed 1944) the relative importance of the tree species in each stratum.

The criteria for assessing the relative importance of a particular species in each stratum for the axes of the phytograph were as follows:

Overstory and Understory:

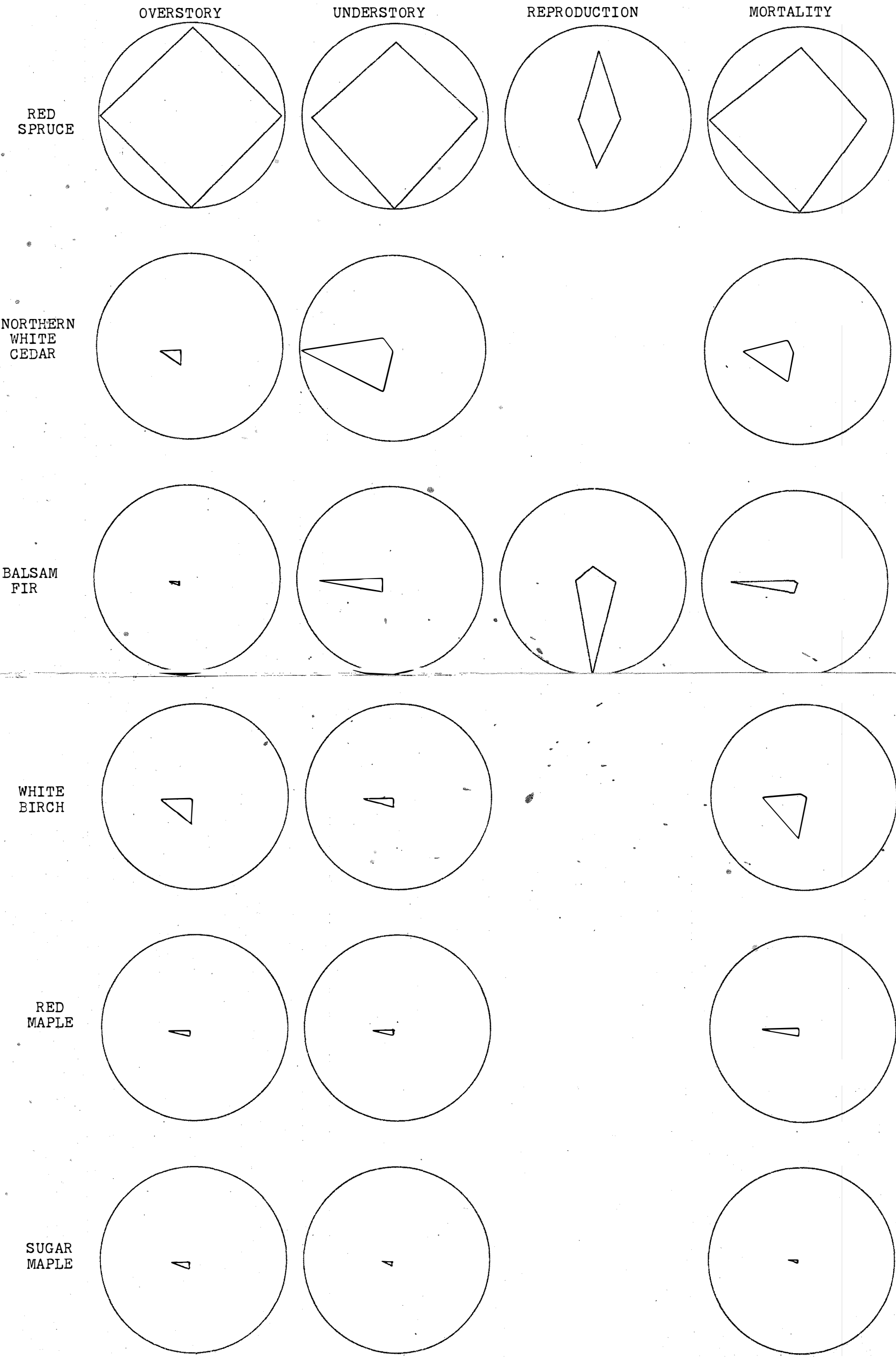
1. Number of trees per acre of a given species in a particular stratum expressed as a percentage of the total number of trees per acre of all species represented in that stratum.
2. The basal area per acre accounted for by a given species in a particular stratum expressed as a percentage of the total basal area per acre of all species in that stratum.
3. The frequency of occurrence of a given species in a particular stratum.
4. The number of one-inch d.b.h. classes occupied by a given species expressed as a percentage of the total number of d.b.h. classes represented in that particular stratum.

The criteria for assessing the relative importance of a particular species in the reproduction stratum were as follows:

1. The number of trees per acre of a given species expressed as a percentage of the total number of trees per acre of all

FIGURE 13

PHYTOGRAPHS SHOWING RELATIVE IMPORTANCE OF TREE SPECIES IN EACH STRATA



species represented in the reproduction stratum.

2. The frequency of occurrence of a given species in the reproduction stratum.
3. The number of height classes occupied by a given species expressed as a percentage of the total number of height classes represented in the reproduction stratum.
4. The number of mil-acre plots on which a given species is the dominant species expressed as a percentage of the total number of mil-acre plots examined in the stand.

Red spruce is found to be of greatest importance in all strata. Northern white cedar is most important in the understory stratum while balsam fir is most significant in the reproduction stratum. Balsam fir does not appear in the overstory. Hardwoods are of little importance except in the mortality stratum, where many of the trees are dying mainly from suppression. Spruce is more important in the mortality stratum than in the reproduction stratum, but this is due to the death of many understory trees (Figure 13). Tables 13 and 14 (Appendix 2) show very little reproduction of any type in the stand. However, as the overstory trees are removed allowing more light penetration of the crown canopy, spruce regeneration should increase.

Under the closed crown layer, trees are found to be well pruned, the slash accumulating on the ground. Much of the existing fir reproduction should die in 40-60 years if not given sufficient room to grow and develop.

The stand is a climax red spruce type with northern white cedar as a minor associate. Since height growth of white cedar in this area is less than the red spruce, it is expected that this tolerant tree species will remain primarily as an understory associate.

Growth of selected tree species:

Forty-six dominant red spruce trees were selected for intensive study from the overstory stratum and 46 intermediate to overtopped trees from the understory.

The average age of the sample trees in the overstory stratum was 86 years, and that in the understory was 83. The stand appears to be quite even-aged even though average tree diameters for the two strata differ by 4.0 inches (7.6 inches for the overstory and 3.6 inches for the understory).

Examination of increment cores taken from the sample trees revealed the history of growth patterns for the stand. The majority of trees sampled in the overstory showed fairly uniform growth for a period of 35-40 years followed by gradual reduction in growth as the stand became more crowded. It is of interest to note that the four trees sampled more than 130 years of age, showed marked suppression until about 90 years ago, followed by increased growth for 25-50 years. This increased growth rate was again followed by decreasing growth rate. It

was at this time of rapid growth that the original stand was probably removed, as indicated by the even-age of the present stand. In the understory stratum increment cores showed suppression beginning at 20-30 years of age, and gradually increasing until the yearly growth increment was practically negligible.

Figure 14 shows the relationship between overstory tree increments and the suppressed understory tree increments and age. In both cases however, little correlation can be drawn between increments at d.b.h. and age. In the overstory, the low growth rates were due to crowding in the crown canopy. Understory trees show a fairly uniform growth although greatly reduced for the 10-year increment, regardless of age. The declining growth rate noted in the sample trees of both strata appears to result mainly from crowding and competition rather than from maturity. The rate of red spruce growth is strongly influenced by light conditions (Fowells 1965), and competition for light is believed to be important here.

In Figure 15 the trend of the overstory trees is a progressive increase in d.b.h. increment for the last 10 years as the total d.b.h. increases. This is indicative of uniform growth with respect to each tree in the stand and the position it maintains in the crown canopy. The understory trees again appear lumped at a uniform growth increment regardless of d.b.h. This is because the larger

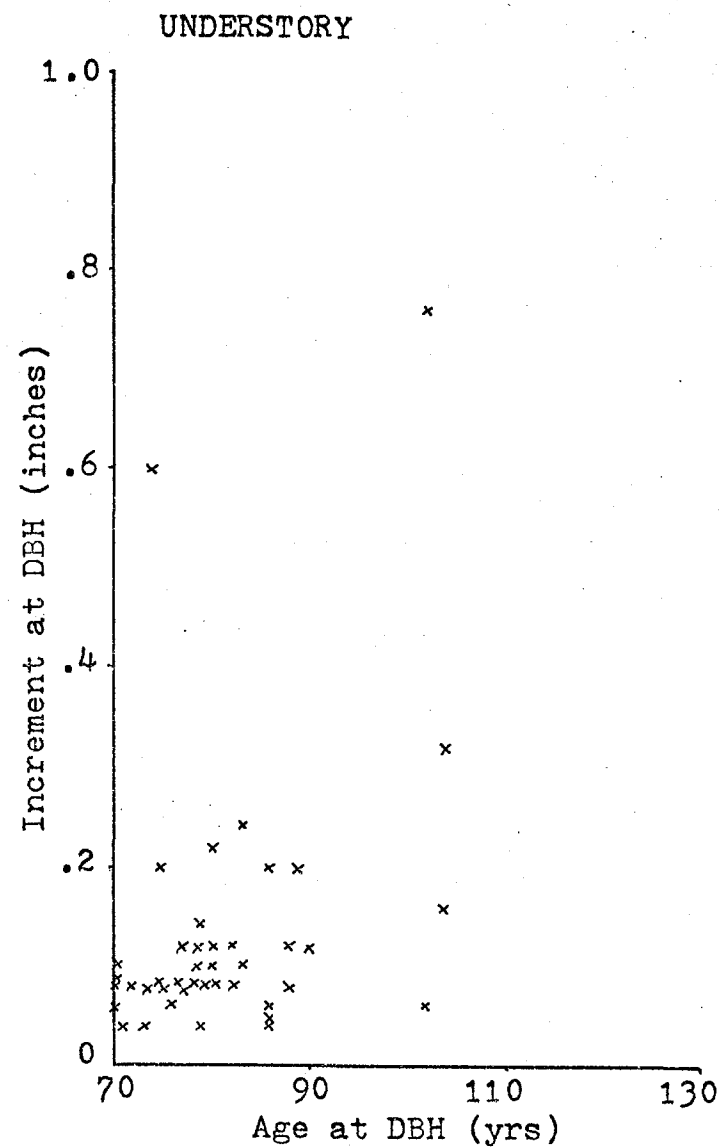
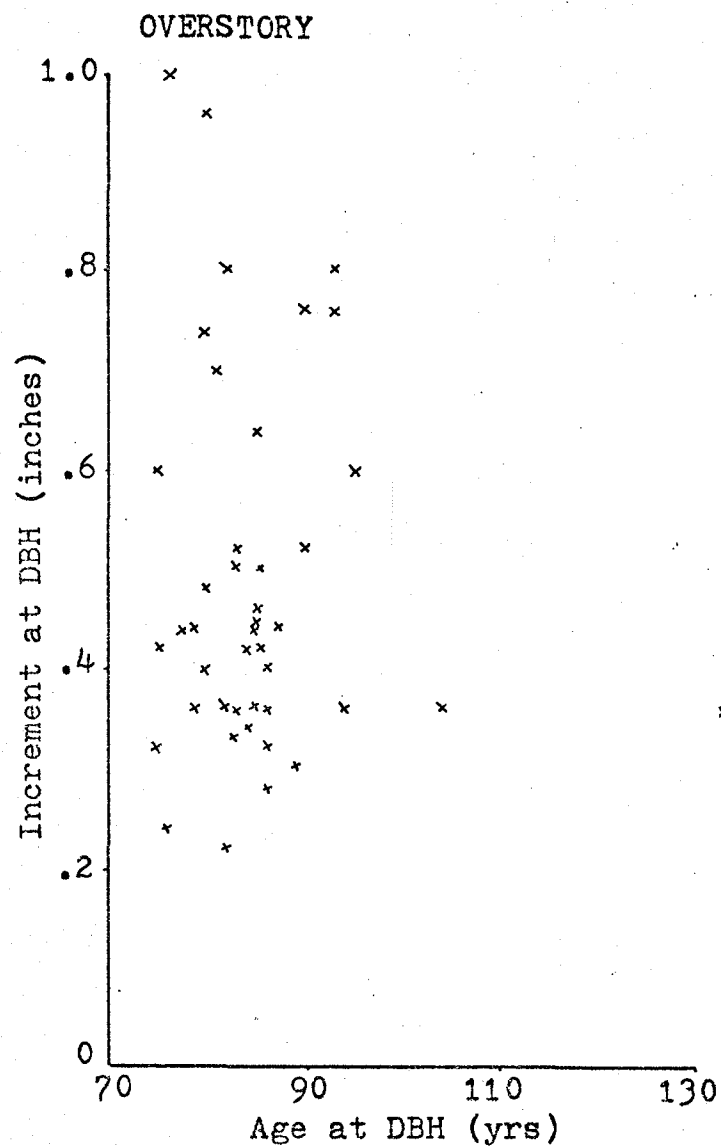


FIGURE 14

THE RELATIONSHIP OF TEN-YEAR GROWTH INCREMENTS TO AGE OF THE SAMPLE TREES

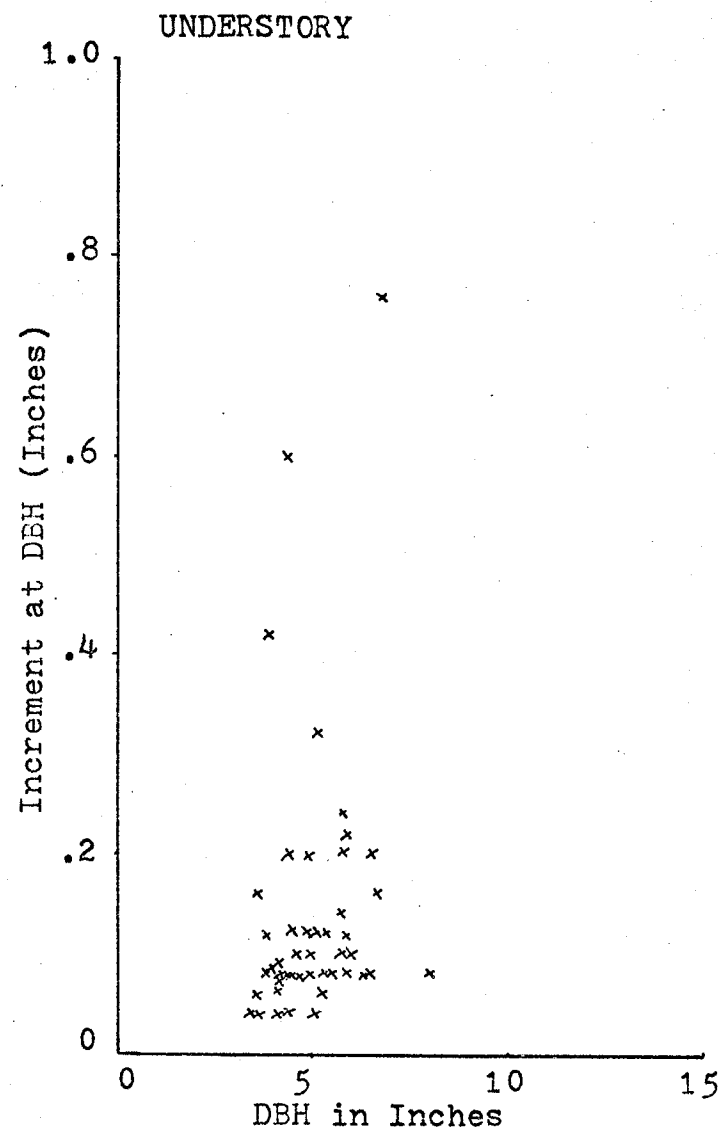
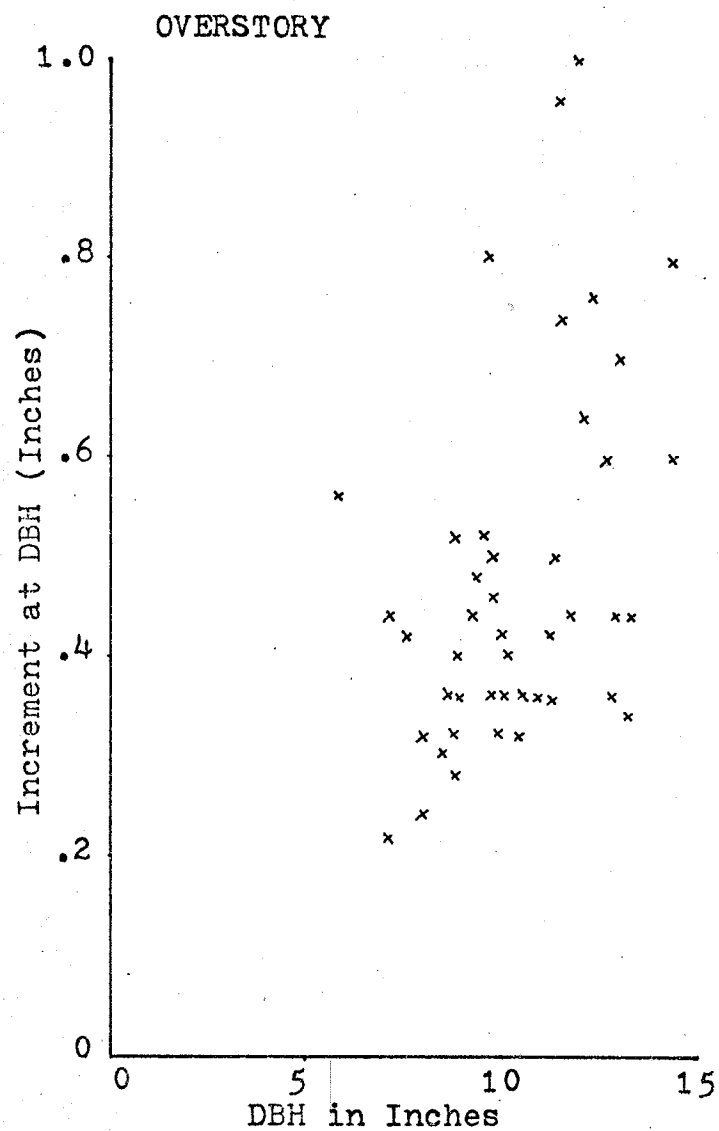


FIGURE 15

THE RELATIONSHIP OF TEN-YEAR GROWTH INCREMENTS TO THE TOTAL DBH OF THE
SAMPLE TREES

diameter trees are still overtopped by the crown layer as are the smaller trees, and therefore are equally suppressed. A similar relationship is also apparent in Figure 16 where growth increment is plotted against height for the understory trees. The overstory trees however, show an increasing trend in growth increment as total height increases.

Origin of stand:

The nature of the topography, soil and climatic conditions, favor growth and development of red spruce (Spurr 1964).

Because the stand is even-aged, and contains a few pioneer species, its origin might be explained as follows: the stand probably originated on mineral soil as a spruce type with some maple and birch association. As the dominant spruce canopy closed, the more intolerant species were replaced. The presence of moss and humus-covered mounds indicates that a mature stand was on this site prior to the existing one. Stephens (1956) states that the uprooting of trees is a natural forest process in the northeast and is indicated by the presence of hummocks and depressions. It is conceivable that either the stand was cut in the late 1800's or was windthrown. Because of the shallow soil layer and susceptibility to windthrow, which occurred in a similar stand at Otter Point, the latter choice is favored. The lack of white

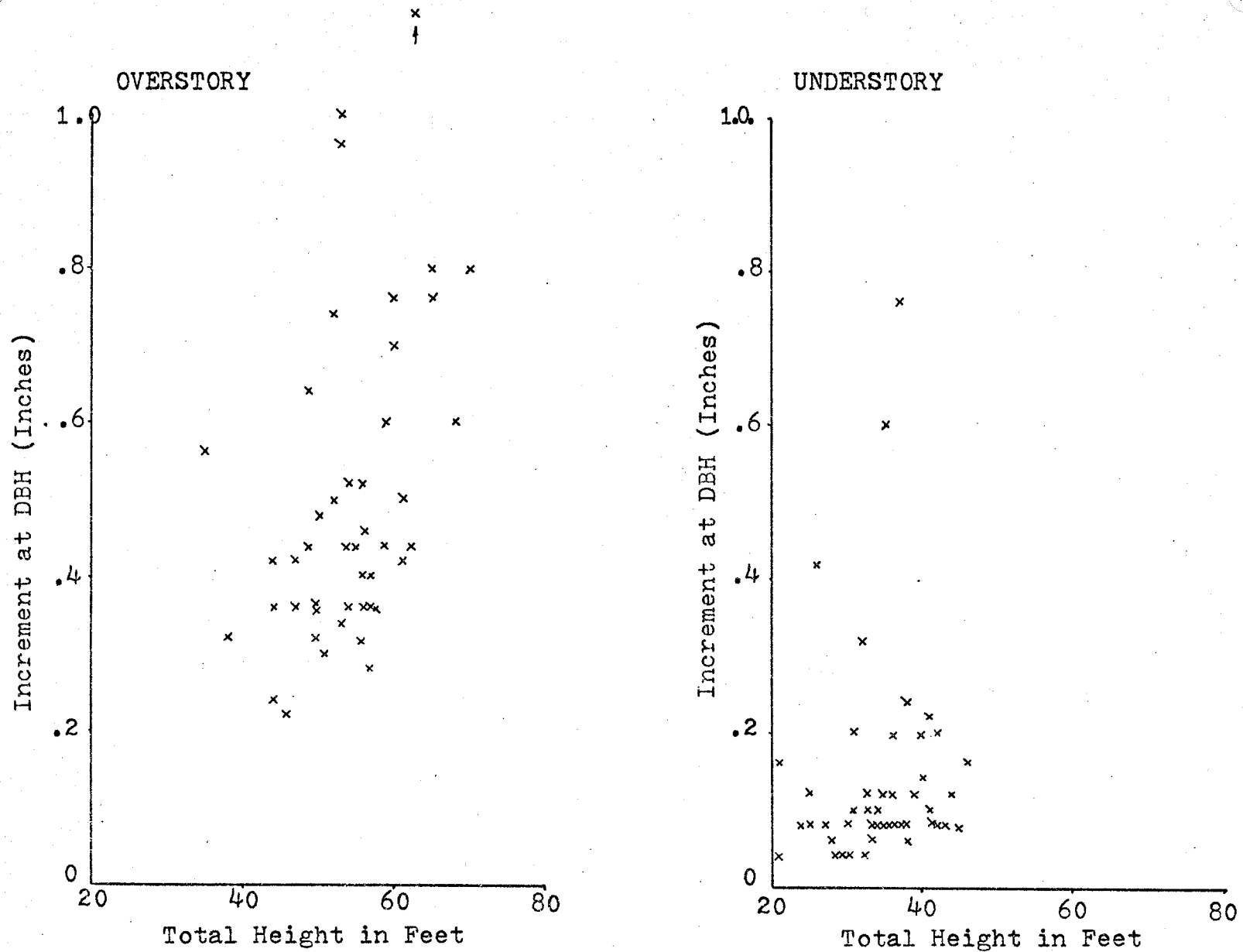


FIGURE 16

THE RELATIONSHIP OF TEN-YEAR GROWTH INCREMENTS TO THE TOTAL HEIGHT OF THE
SAMPLE TREES

birch (a species which increases following fire) and present thick duff conditions does not suggest fire as a cause for removal of the original stand.

Animal Survey

Breeding Birds:

Twenty-seven species of birds were found either within the spruce forest type or in association with it near the edge (Table 2, and Figure 17). Total number of birds per acre of all species averaged 2.9. The most abundant bird species on the study area were the black-throated green warblers with an estimated six nesting pairs, and the golden-crowned kinglets with five nesting pairs. Table 3 lists each bird species found in the study area and its associated stratum or strata (see also Figure 17a). Thirteen of the 27 species were found to be associated mainly with one stratum during the census period; six of these were in the overstory, two in the understory and five on the ground surface. The remaining fourteen species were found to be associated with more than one stratum. No species was found associated with all three strata. Several species characteristic of the spruce forest used the area for both feeding and nesting. These included chickadees, nuthatches, woodpeckers, and brown creepers, which utilized both live and dead trees for nesting sites. Other species such as juncos, and Swainson's thrushes

TABLE 2

BIRD SPECIES AND ABUNDANCE OBSERVED DURING CENSUS,
JUNE 25-28, 1969

Species	Symbol	Average Number Pairs Present
Catbird	1	1
Chickadee, Black-capped	2	1
Chickadee, Boreal	3	2
Cowbird, Brown-headed	4	1
Creepers, Brown	5	1
Crossbill, Red	6	-
Finch, Purple	7	-
Junco, Slate-colored	8	4
Kinglet, Golden-crowned	9	5
Kinglet, Ruby-crowned	10	1
Nuthatch, Red-breasted	11	2
Owl, Barred	12	-
Robin	13	-
Siskin, Pine	14	-
Sparrow, White-throated	15	2
Thrush, Swainson's	16	3
Warbler, Blackburnian	17	3
Warbler, Black-throated Green	18	6
Warbler, Magnolia	19	3
Warbler, Myrtle	20	2
Warbler, Nashville	21	2
Warbler, Parula	22	2
Warbler, Yellow	23	1
Woodpecker, Arctic Three- toed	24	-
Woodpecker, Downy	25	1
Woodpecker, Hairy	26	1
Wren, Winter	27	1

FIGURE 17

BREEDING BIRD CENSUS

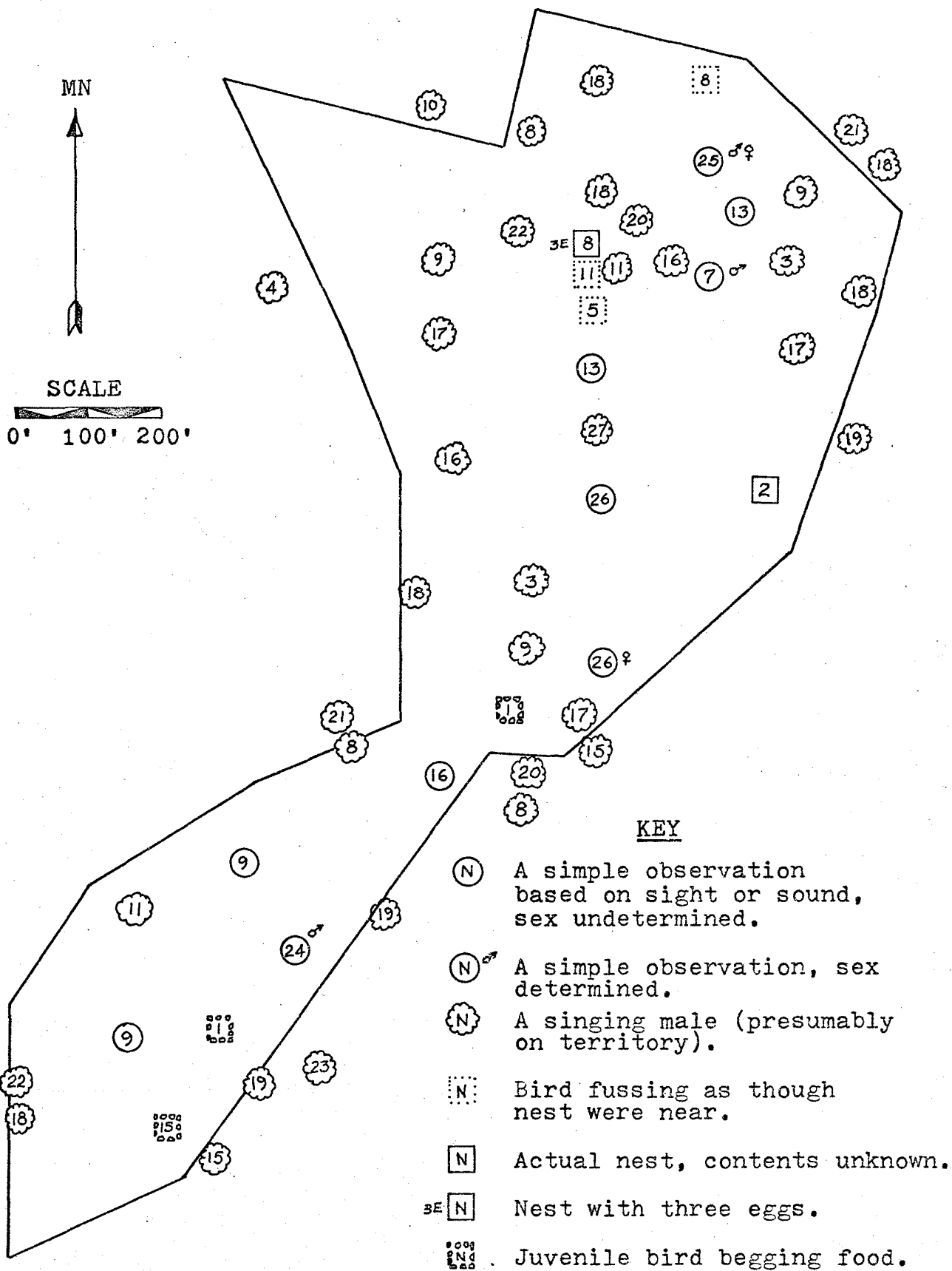
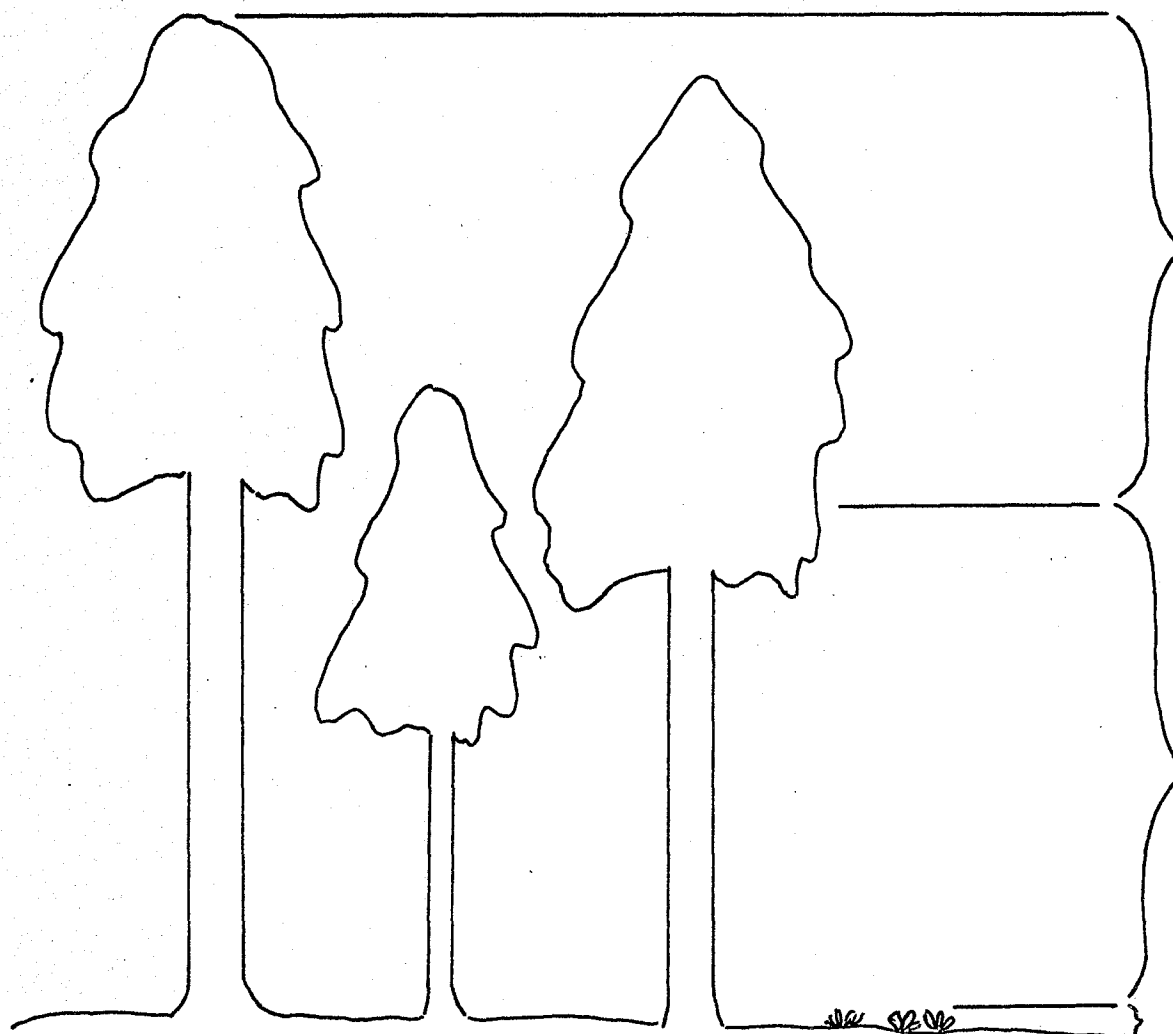


Table 3
BIRD SPECIES AND ASSOCIATED STRATA

Species	Associated Stratum		
	Overstory	Understory	Ground Surface
Black-capped Chickadee	x	x	
Boreal Chickadee	x	x	
Brown Creeper	x	x	
Catbird			x
Cowbird		x	x
Junco, Slate-colored			x
Pine Siskin	x		
Purple Finch	x	x	
Red-breasted Nuthatch	x	x	
Robin			x
Red Crossbill	x		
Swainson's Thrush			x
White-throated Sparrow			x
Winter Wren	x		
Golden-crowned Kinglet	x	x	
Ruby-crowned Kinglet	x		
Arctic Three-toed Woodpecker		x	x
Downy Woodpecker	x	x	
Hairy Woodpecker	x	x	
Blackburnian Warblers	x		
Black-throated Green Warbler	x		
Magnolia Warbler	x	x	
Myrtle Warbler	x	x	
Nashville Warbler	x	x	
Parula Warbler	x	x	
Yellow Warbler		x	
Barred Owl		x	x
Total Number of Species associated with the Stratum	18	16	8



Overstory - that area within the vertical limits of the dominant tree crowns.

Understory - that area extending from the lower limit of the dominant tree crowns to the ground surface.

Ground Surface - that area extending from the upper limit of the herbaceous vegetation to the duff.

FIGURE 17a

HEIGHT AND LOCATION OF EACH STRATUM ASSOCIATED WITH BIRD SPECIES.

utilized slash and ground cover for their nesting sites. The warblers on the other hand were found mainly in the dense spruce foliage. Habitat requirements for these species can be reviewed more thoroughly in Forbush (1929), Tyson (1941), and Palmer (1949). Some of the later nesters, the pine siskins and red crossbills, were often observed flying above the canopy layer stopping only periodically to feed in the tree tops. The purple finch and arctic three-toed woodpecker apparently used this stand only for feeding, since they were not observed again during the study period.

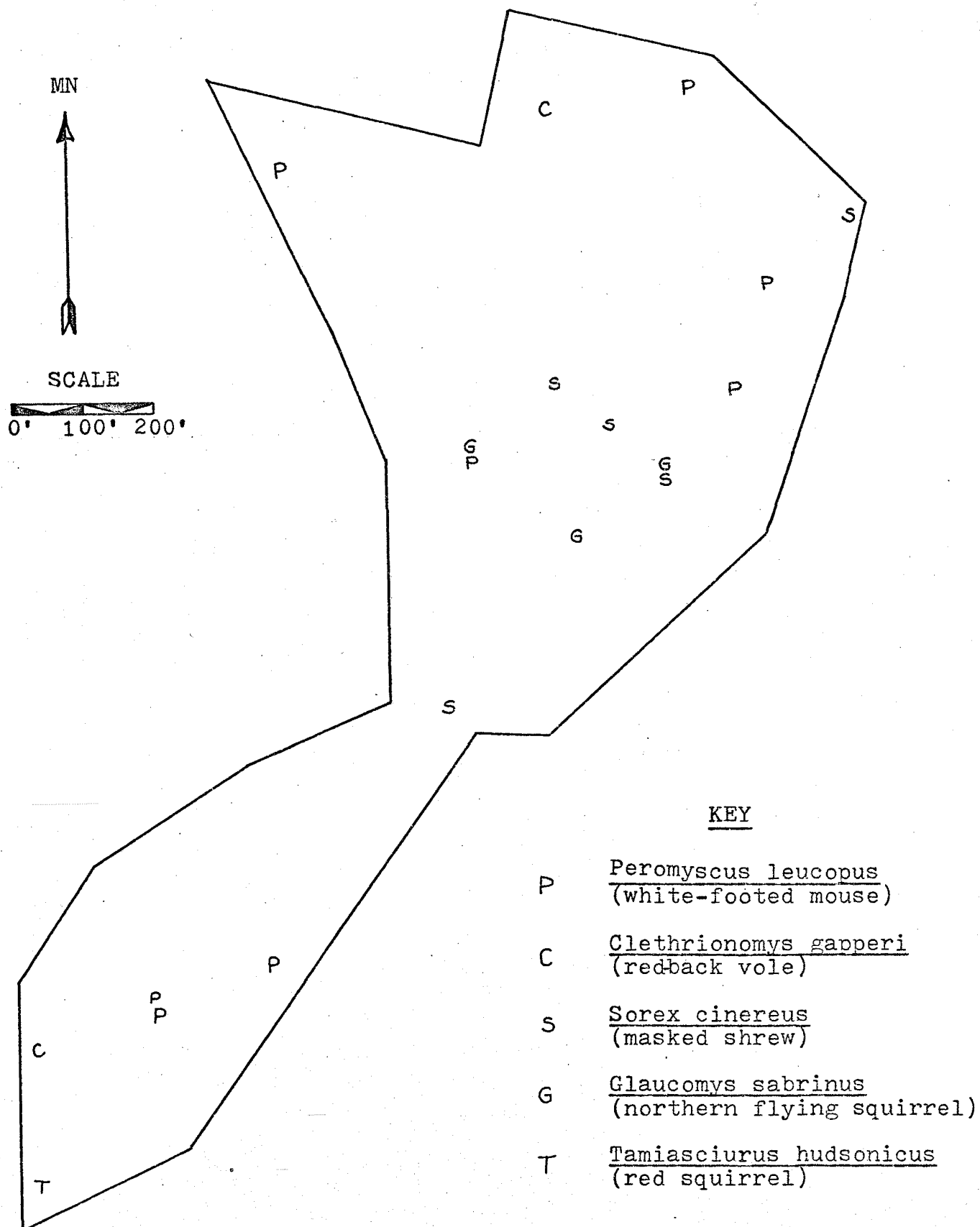
Because of the dense crown layer, the subcanopy environment was very moist. This continually moist climate favored an abundance of mosquitoes, spiders, and slugs. Slate-colored juncos and Swainson's thrushes, nesting within the stand, utilized this food supply. Robins, white-throated sparrows, and catbirds, nesting outside the stand, also made daily use of this food.

Small mammals:

Figure 18 shows the location and distribution of small mammal captures throughout the study area. The results for the five-day trapping period showed low use of the spruce forest type by small mammals. A total of 19 animals (Table 4) were captured throughout the 17-acre stand. The population density was less than one animal

FIGURE 18

DISTRIBUTION OF SMALL MAMMAL CAPTURE ON THE STUDY AREA



per acre. The white-footed mouse was the most abundant small mammal on the study area, followed by the masked shrew. Red-back voles were least abundant. Numbers captured of the above species were 8, 5, and 2 respectively. Quick (1954) found that populations of deer mice, red-back voles, and shrews in mature spruce forests in the north were considerably lower than in other more diversified habitats. An early successional growth of aspen-birch was found to be the most favored habitats of deer mice and red-back voles.

Table 4 lists the rodent species captured by numbers per trapping day. Five masked shrews were trapped on the last day. Some investigators have found that shrews are usually not captured the first few days of trapping (Quick 1954, and Rinaldi, 1968). Three flying squirrels and one red squirrel were caught during the trapping period.

In the spruce stand, shelters such as old logs, hummocks, holes under tree roots, etc., were abundant (Figures 19 and 20). However, food sources were found to be scarce. There was very little herbaceous vegetation in the study area available for consumption by small mammals (Appendix 2, Table 15). While deer mice were found to feed largely on seeds (Williams 1959, and Wagg, 1963), a small amount of succulent, herbaceous food was taken (up to 14%). Bailey (1936), and Smith and Aldous (1947) found that red-back voles also fed on seeds and

TABLE 4

SPECIES AND NUMBERS OF SMALL MAMMALS CAPTURED DURING
EACH DAY OF THE FIVE-DAY TRAPPING PERIOD

Trap Days	1	2	3	4	5	
Species	Number of Captures					Total
<u>Peromyscus leucopus</u> (white-footed mouse)	6	0	1	1	0	8
<u>Clethrionomys gapperi</u> (red-back vole)	1	0	0	0	1	2
<u>Sorex cinereus</u> (masked shrew)	0	0	0	0	5	5
<u>Glaucomys sabrinus</u> (northern flying squirrel)	0	1	0	2	0	3
<u>Tamiasciurus hudsonicus</u> (red squirrel)	0	0	0	0	1	1
Total						19

succulent vegetation. The main seed source found in the study area was spruce. Because of the competition between trees in the overstory, growth rates and vigor have been seriously reduced. Tree crowns are small and seed production as a result, is low. Seeds that do reach the ground surface are seasonal and not always available for consumption. The main seed fall for red spruce occurs between October and March (Fowells, 1965). Bendell (1959) found that the food supply regulates the abundance of white-footed mice by affecting the death rates and possibly the birth rates, and survival of young from birth to approximately one-month of age.

Shrews on the other hand are insectivores, feeding almost exclusively on insects, earthworms, other invertebrates, and small vertebrates. Because of the thin soil layer, and lack of herbaceous ground cover, insect and invertebrate fauna are restricted to only a few species. It is doubtful whether the quantity of these food types available could support more than a very limited population of shrews because of their voracious appetites.

Flying squirrels and red squirrels feed primarily on spruce buds and cones in the study area and are found in limited numbers. Red squirrels were found associated with the edge, and travelled between the edge habitat and the spruce forest to obtain food. Squirrels, being more arboreal than mice, are able to obtain their food from the

tree crowns as well as the ground. However, they may provide additional food for the smaller rodents by cutting and dropping buds and cones from the trees.

In conclusion, because of the lack of diversified habitat, food sources and production are greatly restricted and appear to be a limiting factor on the abundance of small mammal populations on the study area. The lack of spruce regeneration does not appear to be indicative of small mammal feeding pressures, but rather due to poor seedbed conditions and a lack of light necessary for growth and development of the seedlings (Fowell 1965).

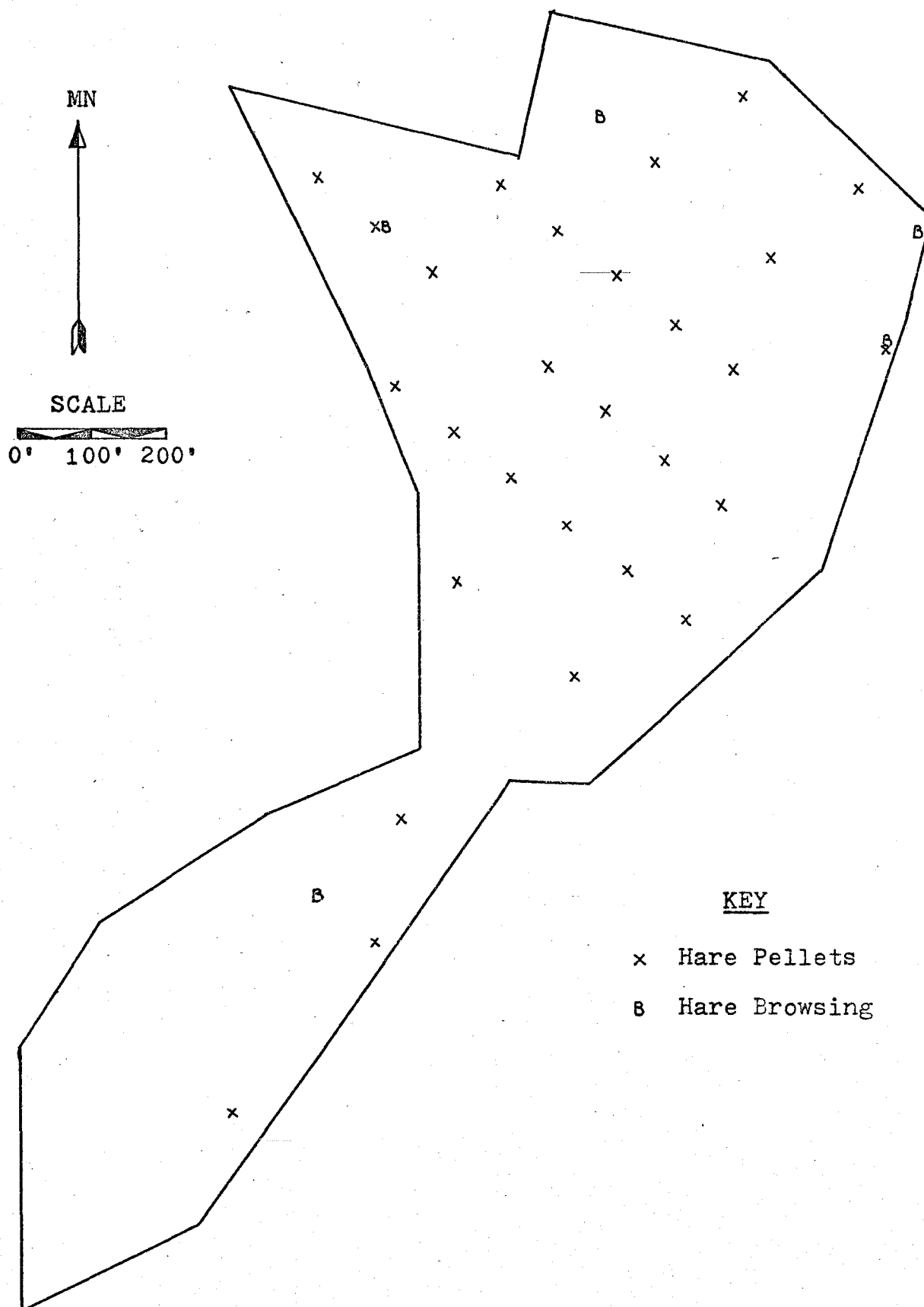
Deer and hare activity:

A number of deer pellet groups were found in the study area indicating some usage by deer. Because of the dense coniferous vegetation, it can be assumed that deer used the area for cover during the winter months. As illustrated by Figure 21, the greatest number of pellet groups or major deer activity occurred in areas where numbers of understory cedar trees were greatest. In areas where no understory cedar was found there was no indication of deer use. Since cedar is the primary food of wintering deer in this area, this correlation follows expectations.

Figure 22 shows the locations of hare pellets found

FIGURE 22

DISTRIBUTION OF HARE PELLETS AND BROWSING ON STUDY AREA BY PLOTS



in the study area. The area was apparently used more extensively by hares than by deer. This might be expected since deer are more restricted by deep snow during the winter months than are hares. Because of limited food supplies in this forest type hares can be expected to move over a greater area.

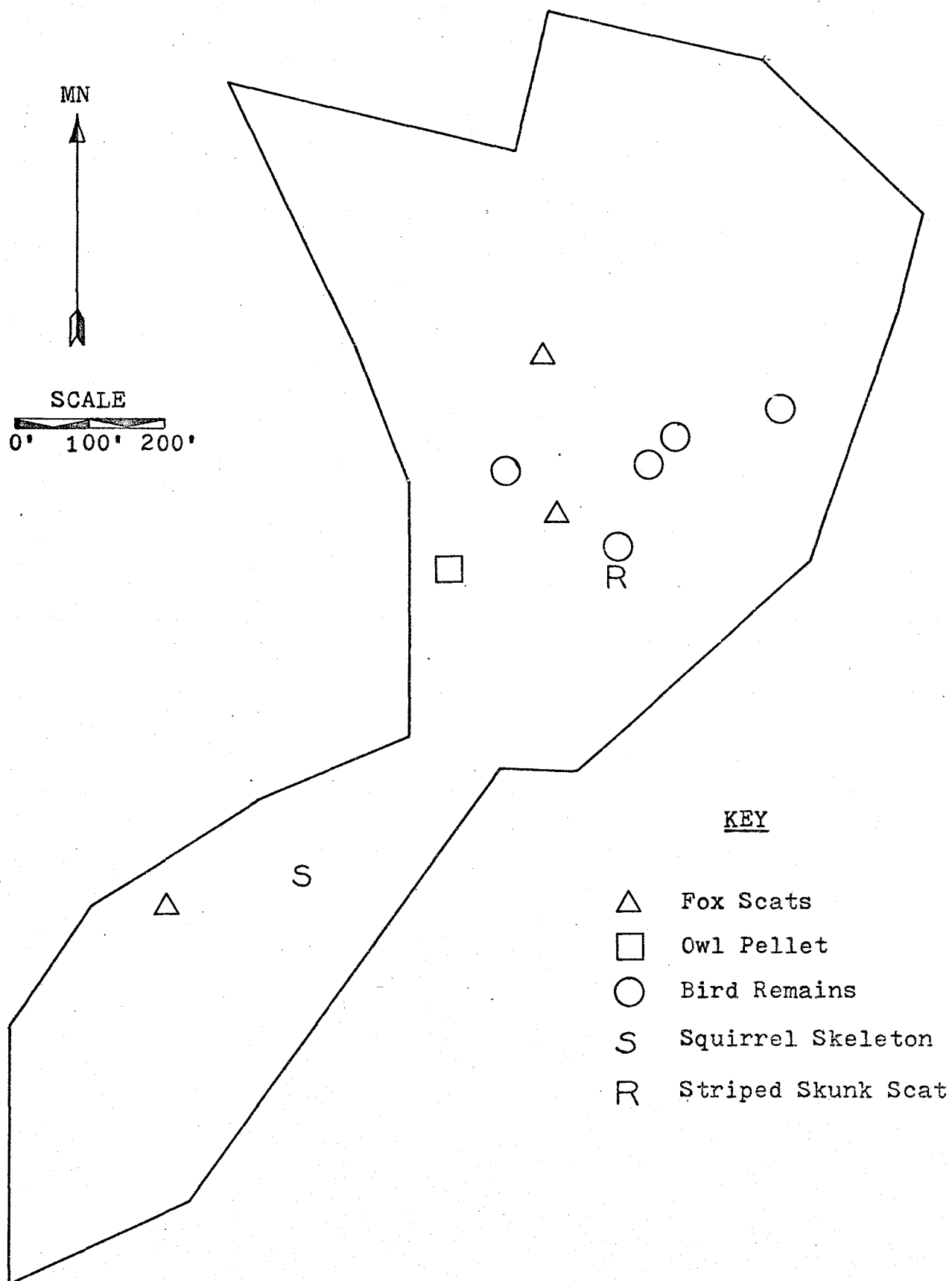
Other observations:

Three fox scats and one owl pellet were found on the study area. Five bird remains and one squirrel skeleton were also found (Figure 23). Analysis of the fox scats showed traces of raccoon and snowshoe hare while the owl pellet contained the remains of a junco. Judging from its size, the owl pellet was assumed to be that of a barred owl.

One striped skunk scat composed almost entirely of beetles (Coleoptera) was found in the study area. These insects were more likely found in the rocky ground of young growth spruce bordering the study area along the south side, rather than in the spruce forest type itself.

FIGURE 23

DISTRIBUTION OF ANIMAL SIGNS ON STUDY AREA BY SAMPLE PLOTS



SUMMARY

A pilot ecological survey was conducted on a 17-acre mature spruce forest in Acadia National Park, Mount Desert Island, Maine, from June to August, 1969. Nested sample plots were used to measure vegetation and locate animal signs. Small mammals were captured on the study area by trapping along transect lines. Census lines were used to record the species and numbers of birds using the area.

The study area, as a whole, was found to be a relatively simple community composed of limited numbers of plant and animal species.

Spruce was found to be the dominant tree species on the area with only a few minor associates. The stand is even-aged averaging 85 years. The crown closure averages 95 percent and prohibits the growth of much herbaceous ground vegetation. Slash and mosses together comprise 80 percent of the ground cover. Because of the shallow soil layer, the overstory trees are prone to windthrow. Windthrows provide openings which allow growth and development of seedlings.

Animal signs indicated use of the area by deer during the winter for food and shelter. Small mammal numbers were found to be low on the study area, with less than one animal per acre. Five species of small rodents were found inhabiting the stand. A total of 27 species of

birds were observed utilizing the study area for feeding or nesting.

The loss of vigor of the overstory trees, due to crowding has reduced the seed crop yield; and because of the high degree of crown closure, substantial amounts of other food sources are lacking. This food shortage appears to be an important limiting factor on the species and abundance of animals on the study area. The lack of light, a necessary growth essential, appears to be the most limiting factor on the species and abundance of plants on the study area.

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A P P E N D I X I
Scientific Nomenclature

SCIENTIFIC NOMENCLATURE*

ANIMALS

Deer, White-tailed	<u>Odocoileus virginianus</u> <u>borealis</u> (Miller)
Fox, Red	<u>Vulpes fulva</u> (Desmarest)
Hare, Snowshoe	<u>Lepus americanus</u> Erxleben
Mouse, Deer	<u>Peromyscus maniculatus</u> (LaConte)
Mouse, White-footed	<u>Peromyscus leucopus</u> (Fischer)
Shrew, Masked	<u>Sorex cinereus</u> Kerr
Skunk, Striped	<u>Mephitis mephitis nigra</u> (Peale & Beauvois)
Squirrel, Northern Flying	<u>Glaucomys sabrinus macrotis</u> (Mearns)
Squirrel, Red	<u>Tamiasciurus hudsonicus</u> Erxleben
Vole, Redback	<u>Clethrionomys gapperi</u> (Vigors)

*From Hamilton, 1943.

SCIENTIFIC NOMENCLATURE*

BIRDS

Catbird	<u>Dumetella carolinensis</u> (L.)
Chickadee, Black-capped	<u>Parus atricapillus</u> L.
Chickadee, Boreal	<u>Parus hudsonicus</u> Bryant
Cowbird, Brown-headed	<u>Molothrus ater</u> (Boddaert)
Creeper, Brown	<u>Certhia familiaris</u> Baraparte
Crossbill, Red	<u>Loxia curvirostra</u> Brehm
Finch, Purple	<u>Carpodacus purpureus</u> Gmelin
Junco, Slate-colored	<u>Junco hyemalis</u> (L.)
Kinglet, Golden-crowned	<u>Regulus satrapa</u> Lichtenstein
Kinglet, Ruby-crowned	<u>Regulus calendula</u> (L.)
Nuthatch, Red-breasted	<u>Sitta canadensis</u> L.
Owl, Barred	<u>Strix varia</u> Barton
Robin	<u>Turdus migratorius</u> L.
Siskin, Pine	<u>Spinus pinus</u> (Wilson)
Sparrow, White-throated	<u>Zonotrichia albicollis</u> (Gmelin)
Thrush, Swainson's	<u>Hylocichla ustulata</u> (Tschudi)
Warbler, Blackburnian	<u>Dendroica fusca</u> (Muller)
Warbler, Black-throated Green	<u>Dendroica virens</u> (Gmelin)
Warbler, Magnolia	<u>Dendroica magnolia</u> (Wilson)
Warbler, Myrtle	<u>Dendroica coronata</u> (L.)
Warbler, Nashville	<u>Vermivora ruficapilla</u> (Wilson)
Warbler, Parula	<u>Parula americana</u> (Wilson)
Warbler, Yellow	<u>Dendroica petechia</u> (Gmelin)

SCIENTIFIC NOMENCLATURE*

BIRDS (cont.)

Woodpecker, Arctic Three-toed	<u>Picoides arcticus</u> (Swainson)
Woodpecker, Downy	<u>Dendrocopos pubescens</u> (Swainson)
Woodpecker, Hairy	<u>Dendrocopos villosus</u> (L.)
Wren, Winter	<u>Troglodytes troglodytes</u> (Vieillot)

*From Palmer, 1949.

SCIENTIFIC NOMENCLATURE*

TREES, WOODY SHRUBS, AND HERBACEOUS PLANTS

Trees:

Ash, Mountain	<u>Sorbus americana</u> Marshall.
Birch, White	<u>Betula papyrifera</u> Marsh.
Birch, Yellow	<u>Betula alleghaniensis</u> Britton.
Cedar, Northern White	<u>Thuja occidentalis</u> L.
Fir, Balsam	<u>Abies balsamea</u> (L.) Mill.
Maple, Red	<u>Acer rubrum</u> L.
Maple, Sugar	<u>Acer saccharum</u> L.
Spruce, Red	<u>Picea rubens</u> Sarg.

Woody Shrubs and Herbaceous Plants:

Blueberry, Low bush	<u>Vaccinium angustifolium</u> Ait.
Bunchberry	<u>Cornus canadensis</u> L.
Cranberry, Highland	<u>Vaccinium Vitis-Idaea</u> L.
Fern, Bracken	<u>Pteridium aquilinum</u> (L.) Kuhn.
Holly, Mountain	<u>Nemopanthus mucronata</u> L.
Laurel, Sheep	<u>Kalmia angustifolia</u> L.
Sasparilla, Wild	<u>Aralia nudicaulis</u> L.
Serviceberry	<u>Amelanchier</u> spp.
Star Flower	<u>Trientalis borealis</u> Raf.
Twinflower	<u>Linnaea borealis</u> L.
Winterberry	<u>Ilex verticillata</u> L.

SCIENTIFIC NOMENCLATURE*

WOODY SHRUBS, AND HERBACEOUS PLANTS (cont.)

Witherod

Viburnum cassinoides L.

*From Fernald, 1950.

A P P E N D I X I I

Tables 1 to 20

(Supplementary Data Tables)

ACADIA ECOLOGY STUDY

TABLE 1

NUMBER OF TREES PER ACRE BY SPECIES AND D.B.H. CLASSES IN
THE OVERSTORY STRATUM

DBH	Species								TOTALS
	SPRUCE	CEDAR	B. FIR	W. BIRCH	R. MAPLE	S. MAPLE	Mtn. ASH	SERVICE-BERRY	
1									
2	1								1
3	1			1					2
4	11		TR	2					13
5	59	TR		3	1		TR	TR	63
6	92	3		2	1	TR			98
7	100	TR	TR		TR	TR			100
8	80	TR		TR	TR				80
9	52			TR					52
10	26								26
11	18								18
12	10								10
13	4								4
14	1								1
15	1								1
16	TR								TR
17	1								1
19	TR								TR
29	TR								TR
Tot	457	3	TR	8	2	TR	TR	TR	470
%	97.2	0.6	TR	1.7	0.4	TR	TR	TR	100

ACADIA ECOLOGY STUDY

TABLE 2

NUMBER OF TREES PER ACRE BY SPECIES AND D.B.H. CLASSES IN
THE UNDERSTORY STRATUM

DBH	Species								TOTALS
	SPRUCE	CEDAR	FIR	W. BIRCH	Y. BIRCH	R. MAPLE	S. MAPLE	SERVICE-BERRY	
1	31	13	9						53
2	83	35	2	1		1	2	2	126
3	130	16	1						147
4	136	11	TR	TR	TR	TR			147
5	79	6	TR	1					86
6	26	2	TR						28
7	3	2							5
8	TR								TR
9									
10									
11									
12									
Tot	488	85	12	2	TR	1	2	2	592
%	82.4	14.3	2	TR	TR	TR	TR	TR	100

ACADIA ECOLOGY STUDY

TABLE 3

NUMBER OF TREES PER ACRE BY SPECIES AND D.B.H. CLASSES IN
THE MORTALITY STRATUM

DBH	Species								TOTALS
	SPRUCE	CEDAR	B. FIR	W. BIRCH	R. MAPLE	S. MAPLE	MTH. ASH		
1	84	44	1						129
2	142	11	4		3				160
3	67	2		5	3				77
4	46	2	2	9	TR		TR		59
5	17		1	2	TR	TR			20
6	6	TR	TR	3					9
7	3		1						4
8	2		TR						2
9									
10	/								1
11	/								1
12									
Tot	369	59	9	19	6	TR	TR		462
%	79.8	12.7	1.9	4.1	1.2	TR	TR		100

ACADIA ECOLOGY STUDY

TABLE 4

BASAL AREA PER ACRE BY SPECIES AND D.B.H. CLASSES OF TREES
IN THE OVERSTORY STRATUM

DBH	Species								TOTALS
	Spruce	CEDAR	B. FIR	W. BIRCH	R. MAPLE	S. MAPLE	Mt. ASH	SERVICE-BERRY	
1									
2	0.022								0.022
3	0.049			0.049					0.098
4	0.960		TR	0.175					1.135
5	8.047	TR		0.409	0.136		TR	TR	8.592
6	18.060	0.409		0.393	0.196	TR			19.058
7	26.730	TR	TR		TR	TR			26.730
8	27.928	TR		TR	TR				27.928
9	22.974			TR					22.974
10	14.180								14.180
11	11.880								11.880
12	7.854								7.854
13	3.687								3.687
14	1.069								1.069
15	1.227								1.227
16	TR								
17	1.576								1.576
19	TR								
29	TR								
Tot	146.243	0.409		1.026	0.332				148.010
%	99	TR		1	TR				100

ACADIA ECOLOGY STUDY

TABLE 5

BASAL AREA PER ACRE BY SPECIES AND D.B.H. CLASSES OF TREES
IN THE UNDERSTORY STRATUM

DBH	Species								TOTALS
	SPRUCE	CEDAR	FIR	W. BIRCH	Y. BIRCH	R. MAPLE	S. MAPLE	SERVICE-BERRY	
1	0.170	0.071	0.049						0.290
2	1.809	0.763	0.044	0.022		0.022	0.044	0.044	2.748
3	6.383	0.786	0.049						7.218
4	11.873	0.960	TR	TR	TR	TR			12.833
5	10.775	0.818	TR	0.136					11.729
6	5.104	0.393	TR						5.497
7	0.802	0.535							1.337
8	TR								
9									
10									
11									
12									
Tot	36.916	4.326	0.142	0.158		0.022	0.044	0.044	41.652
%	89	10	TR	TR		TR	TR	TR	100

TABLE 6

IN THE MORTALITY STRATUM

DBH	Species								TOTALS
	SPRUCE	CEDAR	B. FIR	W. BIRCH	R. MAPLE	S. MAPLE	Mtn. ASH		
1	0.462	0.242	0.005						0.709
2	3.896	0.240	0.087		0.065				3.488
3	3.290	0.098		0.245	0.147				3.780
4	4.016	0.175	0.175	0.785	TR		TR		5.151
5	2.318		0.136	0.273	TR	TR			2.727
6	1.178	TR	TR	0.589					1.767
7	0.802		0.267						1.069
8	0.698		TR						0.698
9									
10	0.545								0.545
11	0.660								0.660
12									
Tot	17.065	0.755	0.670	1.892	0.212				20.594
%	83	4	3	9	1				100

ACADIA ECOLOGY STUDYTABLE 7

SPATIAL DISTRIBUTION OF SPECIES IN THE OVERSTORY
STRATUM

Species	Number Plots Occupied	Frequency Percent
SPRUCE	46	100
CEDAR	7	15
W. BIRCH	12	26
R. MAPLE	2	4
S. MAPLE	3	7
B. FIR	1	2
MTN. ASH	1	2
SERVICEBERRY	1	2

TABLE 8

DISTRIBUTION IN DIAMETER OF SPECIES IN THE OVERSTORY
STRATUM

Species	Number DBH Classes Occupied	Frequency Percent
SPRUCE	18	100
CEDAR	4	22
W. BIRCH	6	33
R. MAPLE	4	22
S. MAPLE	3	17
B. FIR	2	11
MTN. ASH	1	6
SERVICEBERRY	1	6

ACADIA ECOLOGY STUDYTABLE 9

SPATIAL DISTRIBUTION OF SPECIES IN THE UNDERSTORY
STRATUM

Species	Number Plots Occupied	Frequency Percent
SPRUCE	46	100
CEDAR	21	46
FIR	5	11
W. BIRCH	4	9
Y. BIRCH	1	2
R. MAPLE	2	4
S. MAPLE	2	4
SERVICEBERRY	2	4

TABLE 10

DISTRIBUTION IN DIAMETER OF SPECIES IN THE UNDERSTORY
STRATUM

Species	Number DBH Classes Occupied	Frequency Percent
SPRUCE	8	89
CEDAR	8	89
FIR	6	67
W. BIRCH	3	33
Y. BIRCH	1	11
R. MAPLE	2	22
S. MAPLE	1	11
SERVICEBERRY	2	22

ACADIA ECOLOGY STUDYTABLE 11

SPATIAL DISTRIBUTION OF SPECIES IN THE MORTALITY
STRATUM

Species	Number Plots Occupied	Frequency Percent
SRRUCE	45	98
CEDAR	15	33
FIR	5	11
W. BIRCH	20	43
R. MAPLE	3	7
S. MAPLE	1	2
MTN. ASH	1	2

TABLE 12

DISTRIBUTION IN DIAMETER OF SPECIES IN THE MORTALITY
STRATUM

Species	Number DBH Classes Occupied	Frequency Percent
SPRUCE	10	100
CEDAR	5	50
FIR	7	70
W. BIRCH	4	40
R. MAPLE	4	40
S. MAPLE	1	10
MTN. ASH	1	10

ACADIA ECOLOGY STUDYTABLE 13

NUMBER OF TREES PER ACRE BY SPECIES AND HEIGHT CLASSES IN
THE REPRODUCTION STRATUM

Species	Height Classes				Totals	Percent
	A	B	C	D		
SPRUCE	745	16			761	76
B. FIR	152	16	5	5	178	18
WITHEROD	43	5			48	5
MTN. ASH	11				11	1
Totals	951	37	5	5	998	100

TABLE 14

SPATIAL DISTRIBUTION OF SPECIES IN THE REPRODUCTION STRATUM

Species	Number Plots Occupied	Frequency Percent
SPRUCE	12	26
FIR	12	26
WITHEROD	7	15
MTN. ASH	1	2

ACADIA ECOLOGY STUDYTABLE 15

OCCURRENCE OF HERBACEOUS VEGETATION ON REPRODUCTION PLOTS

Species	Total Percent Coverage	Average Percent Coverage
BLUEBERRY	19	TR
BUNCHBERRY	24	TR
KALMIA	46	1
LILY OF THE VALLEY	11	TR
MTN. HOLLY	3	TR
STAR FLOWER	1	TR
CRANBERRY	56	1
TWIN FLOWER	-	
WINTERBERRY	-	
ARALIA	-	

TABLE 16

SPATIAL DISTRIBUTION OF HERBACEOUS VEGETATION IN THE REPRODUCTION STRATUM

Species	Number Plots Occupied	Frequency Percent
BLUEBERRY	8	17
BUNCHBERRY	8	17
KALMIA	2	4
LILY OF THE VALLEY	7	15
MTN. HOLLY	1	2
STARFLOWER	4	9
CRANBERRY	4	9
TWIN FLOWER	1	2
WINTERBERRY	2	4
ARALIA	1	2

ACADIA ECOLOGY STUDYTABLE 17SPATIAL DISTRIBUTION OF LESSER VEGETATION IN THE REPRODUCTION
STRATUM

Species	Number Plots Occupied	Frequency Percent
MOSESSES	46	100
FERNS	4	9
HERBS	23	50
LICHENS	31	67

ACADIA ECOLOGY STUDY

TABLE 18

MEASUREMENTS OF SAMPLE TREES OF SPRUCE OCCUPYING THE
OVERSTORY STRATUM

Sample Tree No.	Crown Class	Age At DBH	DBH Inches	Total Height Feet	Increment at DBH		
					Last 5 Years Inches	Last 10 Years Inches	Last 20 Years Inches
1	D	104	12.8	71	.14	.36	.92
2	D	95	12.6	68	.20	.60	1.50
3	D	93	14.3	70	.32	.80	1.80
4	CD	94	8.8	56	.12	.36	.94
5	D	95	15.1	63	.40	1.28	3.64
6	D	90	12.3	60	.24	.76	2.00
7	CD	90	9.5	54	.20	.52	1.20
8	CD	89	8.5	51	.10	.30	.84
9	D	85	11.2	61	.16	.42	1.14
10	D	93	17.0	65	.24	.76	1.86
11	CD	83	10.0	50	.12	.36	.88
12	D	84	13.2	53	.10	.34	.94
13	D	79	13.3	59	.16	.44	1.20
14	D	85	11.7	55	.12	.44	1.08
15	D	82	11.2	54	.12	.36	1.00
16	D	86	10.2	57	.16	.40	.96
17	D	75	9.9	56	.12	.32	.92
18	CD	76	8.0	44	.10	.24	.68
19	CD	78	7.2	49	.16	.44	1.20
20	D	152	8.0	38	.14	.32	.72
21	D	80	8.9	56	.14	.40	1.04
22	D	80	11.5	52	.28	.74	2.00
23	D	87	12.9	62	.16	.44	.92
24	D	85	9.3	54	.20	.44	1.08
25	CD	86	8.7	47	.12	.36	1.00

TABLE 18 (Continued)

Sample Tree No.	Crown Class	Age At DBH	DBH Inches	Total Height Feet	Increment at DBH		
					Last 5 Years Inches	Last 10 Years Inches	Last 20 Years Inches
26	D	80	11.5	53	.36	.96	2.28
27	D	79	10.5	50	.16	.36	.80
28	D	85	12.1	49	.24	.64	1.68
29	D	75	10.0	47	.16	.42	1.06
30	D	82	7.2	46	.08	.22	.60
31	D	83	11.3	61	.20	.50	1.16
32	D	75	14.4	59	.22	.60	1.40
33	D	133	9.7	44	.16	.36	.88
34	D	83	8.7	56	.20	.52	1.20
35	D	77	12.0	53	.36	1.00	2.52
36	D	42	5.8	35	.24	.56	1.80
37	D	80	9.4	50	.14	.48	1.86
38	D	85	9.7	56	.20	.46	1.28
39	D	82	9.6	65	.32	.80	1.64
40	D	81	13.0	60	.20	.70	1.84
41	D	86	10.4	50	.10	.32	.82
42	D	84	7.5	44	.18	.42	1.10
43	D	85	10.8	57	.12	.36	.96
44	D	86	8.7	57	.12	.28	.68
45	D	83	8.7	57	.12	.36	.88
46	D	85	9.7	52	.20	.50	.96
47							
48							
49							
50							
51							
Total		3957	486.8	2506	8.40	23.02	58.06
Average		86	10.6	54	.18	.50	1.26

ACADIA ECOLOGY STUDY

TABLE 19

MEASUREMENTS OF SAMPLE TREES OF SPRUCE OCCUPYING THE
UNDERSTORY STRATUM

Sample Tree No.	Crown Class	Age At DBH	DBH Inches	Total Height Feet	Increment at DBH		
					Last 5 Years Inches	Last 10 Years Inches	Last 20 Years Inches
1	0	74	4.4	35	.24	.60	1.32
2	0	104	6.7	46	.06	.16	.50
3	0	102	5.2	38	.02	.06	.24
4	0	86	4.3	29	.02	.04	.12
5	0	104	5.1	32	.14	.32	.74
6	0	102	6.8	37	.32	.76	1.20
7	0	89	5.7	42	.08	.20	.40
8	0	88	5.8	42	.04	.08	.26
9	0	78	5.3	43	.04	.08	.32
10	0	80	5.1	35	.04	.12	.26
11	0	74	4.1	25	.04	.08	.20
12	0	83	5.8	38	.08	.24	.64
13	0	79	5.7	40	.06	.14	.48
14	0	80	4.2	35	.04	.08	.16
15	0	83	5.9	33	.04	.10	.20
16	0	70	5.0	31	.04	.10	.24
17	0	70	3.5	28	.02	.06	.16
18	0	75	4.5	37	.04	.08	.26
19	0	86	4.0	30	.02	.04	.16
20	0	160	3.6	21	.04	.16	.36
21	0	86	4.1	33	.02	.06	.16
22	0	82	4.8	39	.04	.12	.36
23	0	88	5.3	44	.04	.12	.40
24	I	77	4.2	42	.04	.08	.36
25	0	73	5.0	21	.02	.04	.10

Sample Tree No.	Crown Class	Age At DBH	DBH Inches	Total Height Feet	Increment at DBH		
					Last 5 Years Inches	Last 10 Years Inches	Last 20 Years Inches
26	O	65	3.7	30	.04	.08	.20
27	O	82	4.5	34	.04	.08	.32
28	O	69	4.3	24	.04	.08	.20
29	O	76	6.5	27	.04	.08	.24
30	O	79	3.4	29	.02	.04	.16
31	O	70	6.4	45	.04	.08	.20
32	O	75	6.5	36	.08	.20	.54
33	O	146	4.9	31	.08	.20	.32
34	O	79	5.8	36	.04	.12	.44
35	O	77	3.7	25	.04	.12	.32
36	O	44	3.8	26	.14	.42	1.12
37	I	79	4.6	41	.04	.10	.28
38	O	80	5.9	34	.06	.10	.50
39	O	86	4.4	40	.04	.20	.52
40	O	72	8.0	35	.04	.08	.40
41	O	96	4.5	33	.04	.12	.42
42	O	78	4.1	34	.04	.08	.20
43	O	71	3.5	32	.02	.04	.12
44	O	79	5.4	36	.04	.08	.16
45	O	75	4.9	37	.04	.08	.24
46	I	80	5.9	41	.10	.22	.60
47							
48							
49							
50							
51							
Total		3825	228.8	1582	2.64	6.52	17.10
Average		83	5.0	34	.06	.14	.37

TABLE 20

SUMMARY OF OBSERVATIONS OF SEEDBED CONDITIONS

Major Plot Number	Crown Density %	Duff Thickness Inches	Humus Type	Drainage	Slash Coverage %	Rock Coverage %	Occupancy By Lesser Vegetation				
							Mosses %	Ferns %	LICHENS %	Herbs %	
1	99	5.2	MOR	GOOD	54	0	55	0	3	0	
2	99	6.1	MOR	GOOD	66	0	36	0	0	0	
3	97	5.6	MOR	GOOD	76	0	3	0	0	0	
4	98	6.1	MOR	GOOD	55	0	54	0	TR	TR	
5	98	6.3	MOR	GOOD	35	0	55	0	3	3	
6	97	6.6	MOR	GOOD	25	0	65	0	TR	TR	
7	100	5.8	MOR	GOOD	39	3	51	0	1	1	
8	100	6.3	MOR	GOOD	40	0	39	0	1	TR	
9	100	5.9	MOR	GOOD	48	3	38	0	1	0	
10	99	5.6	MOR	GOOD	40	0	35	0	0	8	
11	100	6.1	MOR	GOOD	25	0	63	0	5	0	
12	99	5.4	MOR	GOOD	45	1	49	0	TR	TR	
13	98	4.6	MOR	GOOD	51	0	50	0	0	0	
14	99	3.8	MOR	GOOD	26	3	69	0	TR	0	
15	99	4.4	MOR	GOOD	60	0	35	0	3	0	
16	99	5.9	MOR	GOOD	40	3	63	0	TR	0	
17	100	6.3	MOR	GOOD	46	0	23	0	0	0	
18	98	4.8	MOR	GOOD	16	0	78	0	0	TR	
19	98	4.8	MOR	GOOD	53	0	25	0	0	0	
20	76	2.5	MOR	GOOD	6	8	8	1	38	38	
21	99	3.8	MOR	GOOD	35	3	61	0	0	0	
22	97	6.4	MOR	GOOD	30	1	58	0	9	0	
23	100	6.9	MOR	GOOD	54	0	28	0	5	0	
24	100	6.3	MOR	GOOD	45	0	46	0	1	0	
25	100	3.3	MOR	GOOD	23	4	70	0	1	0	
26	100	4.6	MOR	GOOD	46	TR	44	0	5	0	
27	100	3.0	MOR	GOOD	40	0	46	0	3	TR	
28	100	3.8	MOR	GOOD	8	3	55	0	31	TR	
29	95	5.7	MOR	GOOD	45	0	44	0	3	TR	
30	100	4.6	MOR	GOOD	24	3	45	0	0	0	
31	98	3.7	MOR	GOOD	45	0	49	0	0	0	
32	56	2.6	MOR	GOOD	16	19	30	0	38	TR	
33	67	4.0	MOR	GOOD	1	1	10	4	44	39	
34	99	5.6	MOR	GOOD	29	1	55	0	8	0	
35	88	4.1	MOR	GOOD	44	0	35	0	18	0	
36	53	4.3	MOR	GOOD	0	1	26	0	4	65	
37	96	5.3	MOR	FAIR	44	1	61	TR	1	TR	
38	99	7.2	MOR	GOOD	11	0	14	10	0	1	
39	99	3.9	MOR	GOOD	35	0	28	0	0	TR	
40	98	2.5	MOR	GOOD	30	1	53	0	0	0	
41	79	2.8	MOR	GOOD	2	0	50	0	0	TR	
42	99	4.0	MOR	GOOD	2	0	5	0	0	0	
43	99	4.0	MOR	GOOD	40	0	4	0	0	0	
44	99	4.0	MOR	GOOD	40	0	4	0	0	0	
45	100	7.4	MOR	GOOD	20	1	85	0	1	1	
46	95	4.8	MOR	GOOD	15	1	70	0	0	1	

42	100	4.8	MOR	GOOD	55	0	20	0	1	1
43	100	8.5	MOR	GOOD	31	0	38	0	0	0
44	98	4.2	MOR	GOOD	66	3	19	0	0	0
45	100	4.4	MOR	GOOD	38	1	55	0	1	1
46	95	4.8	MOR	GOOD	18	1	74	0	5	1
47										
48										
49										
50										
51										
Total	4388	230.2	MOR	GOOD	1675	82	2024	15	243	158
Average	95	5.0	MOR	GOOD	36	2	44	TR	5	3

Minutes of meeting held on July 2, 1971

Re: Vegetation at Acadia National Park

Mr. Noddin, Mr. Goode, Dr. Brown and Fred Hutchinson.

The purpose of this meeting was to discuss some of the aspects in Acadia National Park of the high number of people traveling over the terrain. Last year for example, there were 2.8 million people visiting the park during the period June to September. Mr. Goode explained that they really have some key areas of damage at the present time. They are as follow:

1. Ocean Drive on the side next to the ocean - there are only 250 acres of land in this strip. People like to park their automobiles and walk to the edge of the water especially at Thunder Hole. This traffic has resulted in paths which have become worn and are now beginning to wash badly leaving the landscape rather cut-up and disfigured.
2. They are concerned about the dunes in back of Saddleback. These dunes are held by a species of grass that is very sensitive to foot traffic. They are wondering if they will have to prevent people from being able to walk up over the dune areas or whether they could plant some other vegetation.
3. Some alpine points on top of Mt. Cadillac are dying due to the high instance of foot traffic.
4. There are areas where people climb on the cliffs to look out over the ocean at Otter Head where vegetation is also dying.
5. There are campgrounds in the park where the high intensity use is causing soil compaction and plants are dying as a result. The Black Woods campground has been most severely affected at this point in time.

We discussed the scope of the problems and agreed that there are really several aspects which could be dealt with, especially:

1. The problem of planting or selecting vegetation in certain areas which would be more suitable for use being made of the park. I suggested that Cecil Brown and Lyle Littlefield be the ones to be involved in this aspect of the problem.
2. Problem of soil erosion in park and roadways. Here the problem is not due to select vegetation but instead it is to find ways of protecting the soil from erosion and leave it available for traffic. Here I would suggest that we involve Dr. Epstein and Charles Schomaker and F. Hutchinson.

Since it is difficult to get personnel together this time of year, it was agreed that we will form a delegation to visit the park sometime in late September. I am to select the people to go to the park and Noddin will set up the date after discussing with John Goode.