

FOREST RESEARCH BRANCH



CHIBOUGAMAU RESEARCH FOREST, QUEBEC

(Project Q-120)

by

R.J. Hatcher and M.L.G. Jurdant

Quebec District
March 1965

Oxf.: 945.25

65-Q-5

TABLE OF CONTENTS

	<u>PAGE</u>
INTRODUCTION	1
COMPANY CO-OPERATION	1
THE FOREST SECTION	2
THE RESEARCH FOREST	3
Location	3
Forest Description	4
Climate	4
Geology and Ecology	5
WORK DONE 1964	6
Forest Inventory	6
Improvements	7
Forest Ecology	7
WORK PROPOSED 1965	11
APPENDIX: VEGETATION TABLE	13

CHIBOUGAMAU RESEARCH FOREST, QUEBEC

R.J. Hatcher and M.L.G. Jurdant^{1/}

INTRODUCTION

The establishment of observational or experimental forest research often requires the expenditure of considerable amounts of money and effort. To protect this investment, every effort must be made to insure that study stands are not destroyed or experiments upset by some unforeseen factor. Experience in Quebec has shown that to avoid difficulty, formal agreement should be arranged with private companies for the setting aside of research forests on their concessions.

Agreement was reached with the Consolidated Paper Corporation in March 1964 to establish the Chibougamau Research Forest in their Nicauba Management Unit for the study of black spruce ecology, silvics and silviculture. This paper describes the forest section involved and the Research Forest, and reports on progress during 1964.

COMPANY CO-OPERATION

Negotiations with company officers are proceeding smoothly and amicably. Three company departments are co-operating: The Forestry and Operations departments plus the Nicauba superintendant and his staff. The Forestry dept. has supplied maps and aerial photographs used in selecting the experimental forest and shown a keen interest in the progress of work. The Operations dept. has promised co-operation to execute field work requiring use of company machinery and personnel, and has already assisted in arranging for construction of access road. The superintendant at Nicauba arranged for accommodation of Forest Research Branch

^{1/} Research Officers, For. Res. Br., Dept. of Forestry, Box 35, Sillery, P.Q.

staff at Nicauba Depot, ordered and supervised the construction of access road at Branch request (and expense), and will arrange for experimental logging to be conducted within the research forest. The help of these company officials is gratefully acknowledged. The study area is recognized by all concerned as a Research Forest and has been set aside by the company as such.

THE FOREST SECTION

Forest Section B. 1b as delineated by Rowe^{1/} is an east-west band about 800 miles long by 100-170 miles wide containing 94,400 square miles,^{2/} 50,000 sq. mi. of which are forested.^{3/} The Section comprises south-facing slopes of the Laurentian Feneplain and is included in the vast physiographic region known as the Canadian Shield. Bedrock is mainly granodiorite, granite, quartz diorite and granite gneiss. The topography is somewhat rugged in the east where swift southward-flowing rivers cut deep valleys but is gently rolling in the west with rivers meandering westward to James Bay or southeastward to Lac St-Jean. Altitude above sea level in the western part of the Section varies from 1000 to 2000 feet, and in the east it varies from sea level along the Gulf of St. Lawrence to 2000 feet inland.

The dominant characteristic of the Section is the vastness of the black spruce forest, found on all sites from low peaty areas to rocky uplands. Balsam fir, although a frequent and often important associate, is scarce relative to forests further south, and jack pine,

^{1/} Rowe, J.S. 1959. Forest regions of Canada, Canada, Dept. Northern Affairs and National Resources, For. Br., Bull. 123

^{2/} Bickerstaff, A. 1964. Areas of forest sections and regions by provinces in Canada. Canada, Dept. of Forestry, Mimeo. Rep. 64-H-2

^{3/} Bedell, G.H.D. 1964. Productivity of the forests of Quebec. Canada, Dept. of Forestry, Ontario District Office File Report.

distributed over the western two-thirds of the Section, is scarce relative to Section B.3 to the southwest. Groves of white birch are common, particularly in forests of recent fire origin where this species also forms mixedwood stands with black spruce. Trembling aspen and balsam poplar are usually restricted to the vicinity of rivers and lakes.

THE RESEARCH FOREST

Location

The Research Forest is in the southwest part of Forest Section B.1b (Lat. $49^{\circ}20'N$, Long. $74^{\circ}02'W$; elevation 1300 feet), 31.0 road miles northwest from Quebec. The area was tentatively selected after study of Company maps and aerial photos and was later confirmed in the field. The most difficult problem was that of accessibility. The highway to Chibougamau crosses the company concession but logging operations began along this road in 1951 and moved north and south from it. Logging roads seldom extend farther into virgin forest than the boundary of the next season's cut. The Research Forest is along the last $1\frac{1}{2}$ miles of a road that was constructed through virgin forest to reach a dam site on the Petite Chaudière River (Figure 1).

Presently the closest suitable accommodation for Branch personnel is at Nicauba Depot, 11 road miles and 40 minutes drive to the south. Adjacent to the Depot is a district headquarters of the Laurentide Forest Protective Association. Company operating plans for the near future include logging northward up the Petite Chaudière River and the building of a large camp near the Research Forest. If these plans are carried through, travel time from the Depot would be reduced by about 10 minutes. Accommodation possibly could be arranged for at the new camp. With company operations scheduled to move into proximity

of the Research Forest within the next few years, and to remain reasonably close for several years, no difficulty is anticipated in executing experimental logging requiring the co-operation of the company.

Forest Description

The Research Forest is dominantly mature black spruce (Table 1) over 100 years old according to the company management plan. Preliminary age sampling in 1964 suggests that the 101+ age classification contains two distinct age classes of approximately 110 and 160 years. Unfortunately it was impossible to select a forest that contained all the age classes present in the management unit. A second study area will have to be selected in the younger age classes.

The 1964 stand sampling has not been compiled and no details of present stand structure and volumes are available. Company data for 1961 for the four Cutting Areas that comprise the forest are presented in Table 2.

On one dry, sandy site, jack pine is a frequent associate of black spruce but as expected, regeneration of this species is non-existent. On shallow till soils over granite bedrock of knolls elevated 100-200 feet above the general elevation balsam fir and white birch are common associates of black spruce.

Climate

Summarized climate data for approximately a 10 year period are provided by Lemieux ^{4/} and the Dept. of Transport for Chibougamau

^{4/} Lemieux, G.J. 1963. Ecology and productivity of the northern hardwood forests of Quebec. Univ. of Michigan, Ph.d. thesis dissertation.

(lat. $49^{\circ}54'N$, elevation 1234 feet) about 40 miles northwest of the Research Forest. Mean annual temperature was $30.7^{\circ}F$, mean January temperature $-3.2^{\circ}F$, mean July temperature $59.9^{\circ}F$, annual precipitation 39.67 inches (Jan. - April 9.00", May - Aug. 16.25", Sept.- Dec. 14.42"), growing season 145 days. In short, the weather is cold and wet; on June 16, 1964, 8 inches of heavy snow fell and remained on the ground for about 20 hours.

Geology and Ecology

The region belongs to the Grenville Geological Sub-Province.^{5/} The bedrock is dominated by biotite and hornblende gneisses of precambrian age. Bedrock outcrops are relatively rare as the Pleistocene glaciations deposited a drift mantle of variable thickness. The region could be broadly described as a bedrock controlled fluted till plain. Glacial till covers more than 50% of the area; it may occur as shallow deposits on the higher hills, as deep basal till sometimes with a drumlin appearance at the lower elevations or as recessional moraines in various locations. Peat bogs cover about 10-20% of the area and numerous lakes another 10-20%. Fluvio-glacial deposits, kames, eskers and sandy lake deposits are also common throughout the region.

All these landforms are represented in the Research Area.

Because the area is covered with mature forests, it can be assumed that the ecological conditions are mostly the results of the three factors: soil parent material, topography and climate.

^{5/} Laurin, A.F. 1955.- Rapport préliminaire sur la Région de Ducharme - Bouteroue, Prov. de Québec, Min. des Mines, Service de la Carte Géologique. - R.F. No. 310.

WORK DONE 1964

Forest Inventory

The west half of the Research Forest is in Ducharme township and the east half in Mignault and fortunately the astronomic north line dividing the two was surveyed and cleared by the Provincial government in 1955. It served as a baseline for sample plots established to the west. A staff compass and chain survey was made along the east-west access road that crosses the south part of the study forest. Starting points for cruise lines in the eastern half of the forest were chosen along this survey.

To provide tie points for inventory cruise lines and future experimental work, an additional painted baseline of 170 chains was run through the forest parallel to, and 50-80 chains north of the access road. Ten-foot wide by two-chain long strips were cleared on this line at the starting point, at the one turning point and at the junction with the township line so that it will be visible on new aerial photos.

The forest was stratified on aerial photos into broad landform classes that were transferred to the basemap. From a company map, age classes and cover types also were transferred to this map. Within a given landform, stand age class and cover type, a one per cent random sampling was planned. Tenth-acre square sample plots were established on parallel lines whose starting points were chosen at random. Plots were located at random along these lines, at a density equivalent to one plot per ten-chains of line.

On each of the 94 plots established in 1964 the following data were recorded: 1) d.b.h. of living trees in one-inch-classes, by species, of trees 0.6 inch d.b.h. and over, 2) d.b.h. of trees judged

to have died between 1954 and 1964 3) three to five diameter/ height/ age measurements on dominant, co-dominant and intermediate trees, and 4) slope, aspect and location.

Improvements

Starting points for road surveys and baselines have been marked with 6-foot painted cedar posts and aluminum angle pickets. Cruise line starting points were marked with 6-inch square aluminum plaques nailed to convenient trees.

One-half mile of access road was built in the Research Forest in the fall of 1964 and most of the area is now within one mile walking distance from a road.

Forest Ecology

With the purpose of mapping the ecological conditions occurring in the area, a soil and vegetation study has been undertaken within a geomorphic framework. A broad landform map was drawn from air photos before the field season began. The map was used as a first approximation to delineate areas of uniform pattern of ecological conditions.

Twenty ecological transects were mapped. These transects were chosen in order to include all the broad landforms already delineated and to include as many of the established inventory plots as possible.

Thirty-nine ecological plots were studied (29 of which were at the same locality as inventory plots) and the following data recorded:

- 1) Exact location on air photo
- 2) Regional relief description
- 3) Local aspect and relief description
- 4) Description of the landform (relief, texture, petrography)
- 5) Description of the soil profile (Soil Survey Manual)
- 6) Vegetation relevé (Braun-Blanquet)

and on 7 of the 10 plots for which no inventory data were taken,

- 7) D.B.H. of living trees in one-inch classes
- 8) Five diameter/ height/ age measurements on dominant and co-dominant trees.

In addition, 152 soil and humus samples were taken. A total of 61 established inventory plots were visited and classified within the framework of the first classification obtained at the end of the field season. The preliminary classification obtained after the compilation of data is as follows:

- (1) Landforms
- bt: basal till
 - tg: shallow till over gneissic bedrock
 - wd: washed drift
 - sd: stratified drift
 - cd: ice contact stratified drift
 - km: kame moraine
 - ld: lake deposits
 - bg: peat bog.

(2) Soils series

Drainage Class Land form	v.w.dr.	w.dr.	m.w.dr.	i.dr.		p.dr.		v.p.dr.
				no seepage	seepage	no seepage	seepage	
bt	A		E	G	H	I	J	K
km-wd	B		F					
cd-sd	C							
ld								
tg	D							

(3) Vegetation types

COMMON NAME	SYMBOL	SCIENTIFIC NAME
b. Spruce - b. Fir	AP	Abieto-Piceetum
b. Spruce - Hypnum	HPk	Hypno-Piceetum kalmietosum
b. Spruce - Kalmia - Cladonia	KPtd	Kalmieto-Piceetum typicum - Variant Cladonia
b. Spruce - Kalmia	KPts	Kalmieto- " " - Variant Sphagnum
b. Spruce - Kalmia - Sphagnum	KPs	Kalmieto- " sphagnetosum
b. Spruce - Sphagnum-Chamaedaphne	SPc	Sphagneto Piceetum chamaedaphnetosum
b. Spruce - Sphagnum - Alnus	SPa	" " alnetosum
Sphagnum - Chamaedaphne	SC	Sphagno-Chamaedaphnetum
Alder swamp.	Aln	Alnetum rugosae

(4) Ecological types

The ecological types are integrated vegetation-soil units. They will be defined at a late stage when the three above classifications are completed.

The most important ecological types are the following (provisional):

ECOLOGICAL TYPE	NUMBER OF PLOTS
$\frac{AP}{D}$	5
$\frac{HPk}{B}$	3
$\frac{KPtd}{A}$	5
$\frac{KPtd}{C}$	2
$\frac{KPts}{E}$	6
$\frac{KPts}{F}$	0
$\frac{KPs}{G}$	5
$\frac{SPc}{I}$	2
$\frac{SPa}{H}$	2
$\frac{SPa}{J}$	4
$\frac{SC}{K}$	3
$\frac{Aln}{J}$	1

(5) Mapping units:

These units will be based on the ecological types within a geomorphic framework. As the mapping will be made almost exclusively on air photographs, a 15-20% inclusions is to be allowed.

An example of mapping symbol will be as follows:

bt $\frac{kPtd}{A}$

It is an area of basal till of which more than 80% supports a black spruce-Kalmia-Cladonia type of vegetation growing on the soil series "A" which is a well to very well drained Iron Podzol. The 0 - 20% inclusions are likely to be by order of decreasing possibility of occurrence:

$\frac{KPts}{E}$, $\frac{KPs}{G}$, $\frac{AP}{D}$

WORK PROPOSED 1965

New aerial photos at a scale of 10 chs. = one inch have been requisitioned to replace 1949 20 chs = one inch photos. New photos will permit detailed site mapping and will be used for stand delineation for silvicultural research purposes.

Forest sampling was not completed in 1964 because of poor weather. About 50 additional tenth-acre sample plots will be established in 1965. When this work is completed, volume tables for the various important sites will be constructed and forwarded along with plot tally cards to Ottawa for I.B.M. compilation.

It is hoped that during the coming summer, an accessible area of young stands can be found and, by agreement with the company, be set aside as a second Block of the Research Forest.

The following work will be done in 1965 if the 1:7920 scale photography is available.

- (1) Completion of sampling in order to have a minimum of 4 plots in each of the 12 ecological types. (15 to 20 additional plots will be needed).
- (2) Preliminary ecological mapping in the field, using photos.
- (3) Completion of the vegetation table.
- (4) Soil analyses in the laboratory if personnel is available.
- (5) Completion of the ecological classification.
- (6) Final mapping at the scale 1:7920.

Table 1. Area distribution, Chibougamau Research Forest (Data from company records)

Cover Type	Site Class	Area in Acres			Total
		Stand Origin			
		Virgin	Cutover		
		Age Class-Years			
		81-100	101+	1-20	
Black	I	-	508	-	508
Spruce	II	2	853	33	888
	III	-	287	-	287
Spruce-	I	25	57	9	91
Fir	II	49	-	6	55
Softwood-	I	-	21	-	21
Hardwood	II	-	27	-	27
Hardwood-	II	-	68	-	68
Softwood					
Sub-Total Forested		76	1,821	48	1,945
Muskeg					412
Water					403
Total		76	1,821	48	2,760

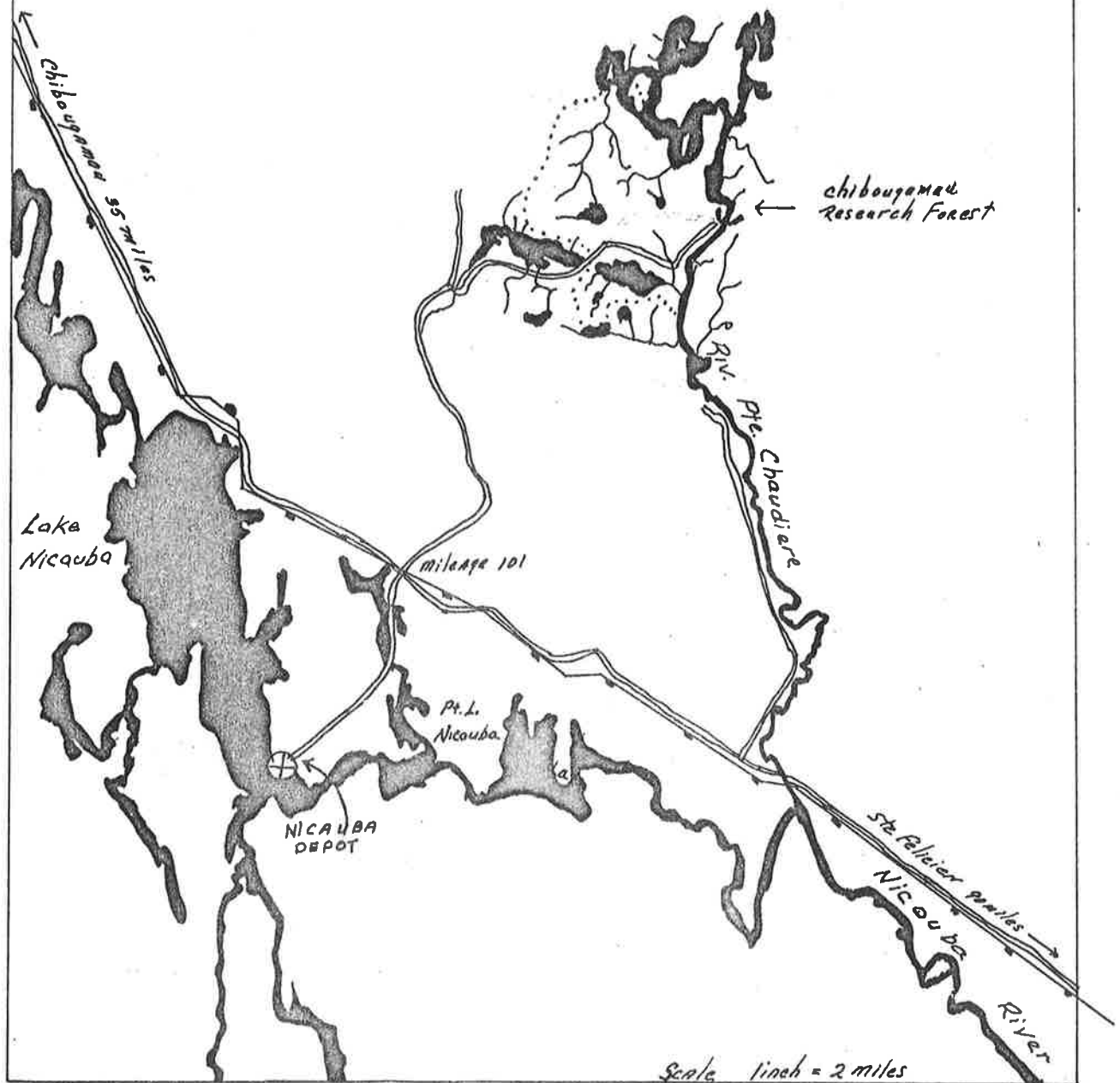
Table 2. Average volume and volume range per acre, 4 inches d.b.h. and over, for conifers in virgin stands in the Chibougamau Research Forest, by cover type, site and age class, 1951. (Data compiled from company records).

Cover Type	Site Class	Merchantable Conifer Volume, Cubic Feet per Acre, 4 Inches D.b.h. and Over			
		Age Class-Years			
		81-100		101+	
		Average	Range	Average	Range
Black	I	-	-	1264	872 - 1579
Spruce	II	1198	*	1072	558 - 1311
	III	-	-	676	270 - 1320
Spruce-	I	1625	*	1086	307 - 1307
Fir	II	1342	*	-	-
Softwood	I	-	-	883	*
Hardwood	II	-	-	1325	*
Hardwood	II	-	-	416	*
Softwood					

* One stand only

Figure 1.

Location map,
Chibougamau Research Forest
Roberval County, P.Q.



VEGETATION TABLE
CHIBOUGAMOU RESEARCH FOREST
Q-120

		AP					HP _K					KPtd					KPts					KPs					SR	SC	SPa										Aln	
FLOT N°		3	5	6	25	37	4	13	21	22	23	11	15	26	27	38	1	9	16	30	32	36	2	17	24	33	39	19	28	18	29	7	20	34	8	14	31	35	10	
<i>Picea Mariana</i>	A	3.4	3.3	3.3	3.3	4.3	4.5	4.5	4.4	3.3	3.3	4.4	5.5	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.5	5.5	4.4	4.4	4.4	4.4	4.4	4.4	4.4	3.3	3.3	1.1	5.5	5.5	4.4	4.4	5.5	5.5	.	
	a	3.4	3.3	2.3	+	2.2	1.2	2.3	2.2	2.2	2.2	1.2	1.1	2.2	2.3	2.2	2.2	2.3	2.2	2.2	1.2	+	2.2	2.2	1.3	3.3	2.3	2.3	1.3	3.3	2.2	2.2	1.2	1.2	1.2	2.2	2.2	2.2	+	
<i>Pinus Banksiana</i>	A	1.2	2.2	2.2	.	.	1.1	1.2	1.1	3.3	3.3	1.1	1.1	1.1	1.1	1.2	1.1	+	1.2
	a	
<i>Betula Papyrifera</i>	A	2.2	2.2	2.3	1.2	1.2	1.1	1.2	1.1	3.3	3.3	1.2	1.2	.	.	
	a	.	1.2	+	1.1	1.2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Abies Balsamea</i>	A	1.1	1.2	2.3	4.4	1.2	+	+	.	+	1.1	+	+	1.2	1.2	.	.	
	a	.	.	2.2	2.3	1.1	.	1.2	+	+	.	1.2	1.1	1.1	.	+	
<i>Larix Laricina</i>		+	.	+	
<i>Kalmia Angustifolia</i>		2.3	2.3	1.3	1.2	3.3	2.3	3.3	3.3	3.3	4.4	3.3	2.3	5.5	5.5	4.4	3.3	3.4	3.3	3.4	4.4	4.4	4.4	3.4	3.4	2.2	2.3	2.2	2.2	1.2	1.2	2.2	2.2	3.4	1.2	1.2	3.3	3.3		
<i>Vaccinium Pennsylvanicum</i>		1.2	1.2	1.2	.	.	1.2	1.2	1.2	1.3	2.3	1.2	.	2.3	2.2	1.1	1.2	.	2.2	2.2	2.2	1.2	1.2	1.2	2.2	2.2	2.2	1.2	2.2	1.2	1.2	2.2	2.2	2.2	1.2	1.2	2.3	2.3		
<i>Ledum Groenlandicum</i>		1.3	.	.	.	1.2	.	1.2	1.2	1.2	3.3	2.3	1.2	1.3	1.2	2.3	1.2	3.3	3.3	3.4	2.3	3.4	2.2	3.4	3.4	4.4	4.4	3.3	3.3	1.3	1.2	2.2	3.4	+	3.3	1.3	4.4	4.4		
<i>Sorbus Americana</i>		+	1.1	1.3	1.1	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	1.2
<i>Amelanchier Sp</i>		1.2	1.2	1.1	.	.	.	.	.	.	.	+	.	.	.	1.2	.	.	.	1.1	.	.	.	.	.	+	1.1	.	+	.	.	.	.	.	.	.	1.2	1.2
<i>Aralia Nudicaulis</i>		1.2	1.1	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lycopodium Obscurum</i>		1.2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pyrola Secunda</i>		1.2	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Acer Spicatum</i>		.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Bazzania Trilobata</i>		.	.	.	1.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dryopteris Spinulosa</i>		.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Streptopus Amplexifolius</i>		.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pteridium Latiusculum</i>		.	1.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hylocomium Proliferum</i>		1.3	2.3	1.3	1.3	2.2	.	.	.	.	.	.	1.2	.	.	.	1.2	.	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	.	2.3	1.2	4.4	3.3	3.4	1.2	3.3
<i>Listera Cordata</i>		.	+	
<i>Trientalis Borealis</i>		.	.	1.1	
<i>Alnus Rugosa</i>		.	1.3	1.2	.	.	1.2	1.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	.	2.3	1.2	4.4	2.3	2.2	1.2	5.5
<i>Equisetum Sylvaticum</i>																												