

THE BEECH-MAPLE ASSOCIATION
IN
NORTHERN MICHIGAN

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INTRODUCTION

The class in Plant Ecology at the University of Michigan Biological Station in the summer of 1947 studied several areas of hardwood forest in northern Michigan. The work was under the direction of Dr. F. E. Gates and the data obtained form the basis for this paper.

LOCATION OF AREAS

Four of the hardwood forests visited are in the vicinity of the Biological Station, Douglas Lake, Cheboygan County, Michigan. These areas are called locally Colonial Point, Riggsville Hardwoods, Mud Lake Coppice and Mud Lake Hardwoods. See map, Figure 1, for their locations.

The road map of a portion of Emmet County, Figure 2, shows the location of the fifth area, which is at Bay View near Petoskey.

CLIMATE

The northern Michigan climate, which is particularly suitable for tree growth, has been described in previous papers on the Aspen Association and the Bog Situation in Northern Michigan. The climatic factor having some special significance to the beech-maple forests is that of late spring frosts, which frequently destroy the beech seeds. Thus the seeding of the beeches in this area is quite irregular.

SPECIAL FACTORS

Soil

There are many places in northern Michigan where the soil is a mixture of sand and clay that is well-drained. On such areas the beech-maple forests have developed as a climax of plant succession. It is here, too, that the early settlers first cleared land and started to farm, for they found the soil of the beech-maple woods well suited for agriculture.

Grazing

The use of the hardwood forests for grazing of farm stock is a factor of particular importance because cattle will readily eat the seedlings of the beech, Fagus grandifolia, but not those of the dominant maple, Acer saccharum. Trampling damages seedlings of all kinds so that normal replacement does not take place in a grazed forest.

METHODS

In studying the beech-maple forest areas the methods consisted of taking tree counts in two-meter strips and count quadrats of ground plants in two of the areas. In a third area, a survey of species was made. In the coppice growth, clumps of trees were recorded as to number of dead trees in each clump and number of living trees by size, measured by the diameter at breast height.

Some ring counts were taken on freshly cut stumps. This was done to help determine how long these hardwood trees have lived.

FIELD WORK

At Colonial Point Hardwoods, a tree count was taken for five two-meter strips, each 100 meters long, and a count quadrat taken at every 20th meter, giving a total of 25 quadrats. These counts were taken in lines west of the old road as shown on the sketch by Dr. Gates accompanying the data for this area, Page 14. Rings were counted on a stump where a new road is being put thru. The layers of the soil were examined and general observations were made on the species of plants to be found here.

At Bay View similar tree and quadrat counts were made, except that these quadrats were at 10-meter intervals instead of 20-meter. The lines of tree count averaged nearly 120 meters in length.

A general survey of species was made at Riggsville Hardwoods. At Mud Lake Coppice trees were counted in clumps formed around stumps left when the previous hardwood forest was cut. The old stumps are now gone, for the most part, but an attempt was made to find out how many living and how many dead trees there now are in each clump of original sprouts.

In the Mud Lake Hardwoods, a ring count was taken on the stump of a yellow birch, Betula lutea, thought to have been the largest individual of that species in Michigan, that was recently cut. The class also observed the remains of a hemlock, Tsuga canadensis, which was the oldest living thing ever found in this region.

Other general observations were made and a place found where a tree had been uprooted and the resulting depression, previous to this year, filled with water in which grew Potamogeton and other aquatic plants. It is now nearly filled with waste logs and brush from the felled trees.

DESCRIPTION OF SUBAREAS

Colonial Point Woods

On the west side of Burt Lake near the north end is a Beech-maple woods that has been allowed to grow in a natural state for quite a long period of time. Very little cutting

has been done and it is now the best example of hardwood forest to be found in this region.

The dominant species are Acer saccharum and Fagus grandifolia, with a very few Tsuga canadensis and a fair number of Acer rubrum of smaller size. The Tsuga may have been one of the dominants in earlier days and the Acer rubrum may become more numerous as time goes on.

Other deciduous trees and shrubs are Acer pennsylvanicum, Betula papyrifera, Betula lutea, Tilia americana, and Quercus borealis, and Ostrya virginiana. An occasional Pinus strobus is probably a relic of the pine association which preceded the beech-maple forest.

It is interesting to note that there are many seedlings of both Acer saccharum and Fagus in this woods. Because these young trees are tolerant to the shade of the parent trees, the Beech-Maple Association has a tendency to perpetuate itself and thus is called a climax association.

Characteristic ground plants, aside from seedlings of the tree species already mentioned, are Streptopus roseus, Trillium grandiflorum, Polygonatum biflorum, Mitchella repens, Viola eriocarpa, and Smilacina racemosa. Several ground plants that grow exclusively in beech-maple forests are found here. Among them are Carex arctata, Osmorrhiza claytoni, and the grass, Hystrix patula.

Several species of Poa were found here as well as in other hardwood areas. Poa sylvestris seems to be characteristic of the more shaded areas, while P. pratensis and P. compressa are found in openings or along edges of the woods.

Aspidium spinulosum and Botrychium virginianum appear to be characteristic ferns in the Beech-Maple Association.

Conopholis americana (Figure 3), a parasite on the roots of Quercus borealis, is quite frequent here but is not found to any extent elsewhere in the region. The seeds of this parasite have been found to germinate only in contact with a living root of red oak.

There is a complete cover of decaying leaves on the ground, beneath which is about nine or ten inches of dark soil gradually grading into a lighter-colored layer beneath. Roots go all thru both of these layers.

The Colonial Point woods, whose previous owners have protected it and cut very little, has recently changed ownership and its future is doubtful. A new, more direct road is now being put thru with a bulldozer and there is talk of selling lots on the lake front, so it appears that much of this fine beech-maple forest may be destroyed in the near future. It is to be hoped that the new owners will try to preserve a large part of these fine woods.

Bay View

Back of the village of Bay View near Petoskey (Figure 2) is a small hardwood area owned by the Bay View Corporation. It has been protected from cutting and fires for

many years, so there are some good-sized beech and maple trees.

The tree count of 1947 showed a large number of saplings of Acer saccharum, some Fagus grandifolia and Acer rubrum saplings, but very few seedlings of any of these dominants. Tsuga canadensis, which is very apt to be with beech and maple on the better uplands, is also well represented here in sizes up to 50 cm. in diameter. Betula lutea is also frequent. At the low tree level are Acer spicatum, Acer pennsylvanicum, and Fraxinus americana.

In the Bay View Hardwoods Taxus canadensis covers enough of the ground to be called a subdominant species. In fact, it was found in 84% of the quadrats taken and was more numerous than any other ground plant. It has been suggested that possibly the atmospheric moisture brought from Lake Michigan by the prevailing westerly winds accounts for the presence of so much Taxus in this forest. It forms a dense cover that precludes many other ground plants.

Other characteristic ground plants, in most cases few in number because of the Taxus cover, are Aralia nudicaulis, Maianthemum canadense and Lycopodium lucidulum, with an occasional specimen of Geranium robertianum. Typical ferns are Botrychium virginianum and Aspidium spinulosum. Poa sylvestris is the only grass that appeared in the quadrats counted.

As the Bay View Hardwoods is owned by a corporation rather than individuals, there is reason to suppose that it may remain uncut for some years to come. It is unfortunate that it is such a small area.

Riggsville Hardwoods

On the southeast corner where the Riggsville road crosses the Cheboygan-Pellston road, (Map, Figure 1) there is a small area of hardwoods where a species survey has been made by the Ecology classes for several years. Most of the virgin timber has been removed from this woods and at times it has been grazed until there was nothing left for cattle to eat. In recent years, therefore, no grazing has been carried on and the natural ground cover is being restored.

In comparing the numbers of species found in various years, it was noticed that 20 years ago there were 73 species listed, two years later 78, but in 1937 only 60 species. In 1940 and 1941 there were 69 species, this year 83. Presumably this reduction for the years of 1937-1941 resulted from the grazing activity while the subsequent rise in the number of species followed the cessation of grazing.

Here again the Acer saccharum and Fagus grandifolia are dominant, but the secondary tree, Ulmus americana rather than those listed in the above-mentioned areas. Sambucus racemosa is frequent among the young Acer trees. Rubus strigosus is common at the low shrub level.

Many characteristic ground plants are found here. Those occurring most frequently are Geranium robertianum,

which forms a veritable carpet in at least half of the woods, Osmorrhiza claytoni, Viola eriocarpa and Galeopsis tetrahit.

Two grasses, Poa pratensis and Melica smithii, seem to be most abundant here. Aspidium spinulosum and A. thelypteris are the common ferns.

Trillium grandiflorum, Caulophyllum thalictroides, Arisaema triphyllum, Allium tricoccum, Carex arctata, Polygonatum biflorum, Nepeta cataria and Actaea alba are other typical ground plants.

Mud Lake Coppice

A coppice growth is composed of sprouts that arise from the stumps after cutting. (Figure 4) The virgin hardwood timber was originally cut from this forest near Mud Lake about 1910. The stumps were then allowed to sprout freely and no thinning has been done at any time.

In 1927, 70 clumps of trees from the sprouts averaged 4.29 living trees and 0.97 dead trees per clump. All of these trees were Acer saccharum and were 12 cm. or less in diameter at breast height. This year 194 clumps were counted. They averaged 1.8 living trees and 0.8 dead trees per clump. Size range now is from 2 to 22 cm. in diameter. Table 4, Page 16, shows comparative percentages of the different size groups for the two periods twenty years apart. It will be noted that with the increase in diameter of the living trees there has been a corresponding diminution of living trees per clump, while the number of standing dead trees per clump has changed very little. The competition has been keen among the sprouts, which came up very thickly, and their number is being reduced by natural selection.

The owner of this woods might have improved his stand of hardwood by some careful thinning, but he has only started to do a little cutting in the west part of the coppice to obtain a little firewood. Of course, the dead trees have provided a little of this.

The area is now being grazed and shows the effect in a lack of undergrowth and ground plants. Along the edge there are some Rubus strigosus, from which the class harvested some fruit, but among the trees there is almost no ground cover. Probably the shade, too, contributes somewhat to this condition.

Mud Lake Hardwoods

Northeast of Douglas Lake toward Mud Lake is an area of hardwoods which formerly had the oldest tree known to exist in northern Michigan. In 1926, when much lumbering was going on in this region, ring counts were made on many stumps which showed that nearly all the big trees were about 375 years old at that time. Only two or three individuals were much older and one of those was a hemlock tree, Tsuga canadensis, which was found to be 525 years old after the top had broken out and it had been cut for lumber. A rotted portion of the tree and the decaying remains of the stump of this Tsuga are still to be seen. Atop the stump is growing a Betula lutea, about 19 or 20 years old, the tops of the roots showing how it straddled parts of the old stump to get a start there. (Figure 5) As Tsuga does not sprout, the Betula had no competition from that source.

The Mud Lake Hardwoods once contained the finest hardwood trees of the area, but now lumbering is being done there and many of the large trees are being cut. Among the many removed last year was a very large Betula lutea. Some members of the class counted the stump rings and found that it was at least 319 years old. It was the largest of that species known to have existed anywhere in the vicinity of Douglas Lake and was possibly the largest in Michigan.

Among the many large fine Acer saccharum and Fagus grandifolia of these hardwoods there were also several "hemlock knolls" at one time. On these knolls the Tsuga was dominant, but is has been cut off some of them. ~~They are~~ being cut from one of these "knolls" and some of the trees left will fall or break. These tall trees depend somewhat on the nearness of other large trees for support. When one is cut, there is then more space for neighboring trees to sway, so that a break in such a forest may lead to much tree damage in a few years.

The two species mentioned above and the Tsuga canadensis are again the dominant species. Secondary tree species are Betula lutea, Ulmus americana, Tilia americana, and in the lower areas, some Thuja occidentalis. The undergrowth, even on the "hemlock knolls" has mainly young Acer saccharum with a few Fagus trees. Very few ~~Tsuga~~ young Tsuga trees are apparent, probably because they do not withstand shade very well.

The ground cover is very similar to that in the Colonial Point and Riggsville hardwoods, all three being typical of the Beech-Maple Association.

The cutting being done in the Mud Lake Hardwoods is of the so-called "selective type", as only a part of the large trees are cut at a time. It appears to be a rather heavy cutting, however, and certainly is lessening the timber value of the woods considerably. At the same time, cattle and horses are being allowed to roam freely through the woods and are destroying some of the young trees which might eventually reforest the area. At any rate, this wooded area can no longer be said to be the finest hardwoods in the region.

CONCLUSIONS

Vegetation on some of the better upland soils in northern Michigan, through succession, reaches a climax in a Beech-Maple Association. It is a climax because this plant society can perpetuate itself if undisturbed by cutting or burning. The dominant, Acer saccharum, reproduces exceptionally well, while Fagus grandifolia reseeds well only in seasons when there are no late spring frosts and in areas where young trees are not destroyed by grazing.

Tsuga canadensis, which is often found as a dominant in the higher, richer parts of the hardwoods, does not reproduce as readily as the other dominants and is gradually disappearing. It is intolerant to dense shade and hence does not compete well with the other dominants. (Figure 6)

Prospects for hardwoods, in general, are not good. The older stands are being cut rather indiscriminately for

lumber and the forests of younger trees are small in extent and are often subjected to the damaging effects of grazing.

SUMMARY

The study of the Beech-Maple Association in the hardwoods of northern Michigan was done as class work at the University of Michigan Biological Station, Cheboygan County, during the summer of 1947.

The climate of northern Michigan is particularly favorable for tree growth, so that plant succession in some parts of the area leads to a climax in the Beech-Maple Association.

Dominant trees of this plant society are Acer saccharum, which reproduces abundantly, Fagus grandifolia, which needs protection from grazing to reforest an area normally, and Tsuga canadensis, which is disappearing from hardwood areas because of competition and cutting.

Secondary tree species of the Beech-Maple Association are Betula lutea, Ulmus americana, Tilia americana and Ostrya virginiana.

Characteristic ground plants are Trillium grandiflorum, Viola eriocarpa, Arisaema triphyllum, and Polygonatum biflorum. Carex arctata and Osmorrhiza claytoni are exclusive in the hardwoods.

The Beech-Maple Association may invade and replace the pine or the aspen association and form the climax of the vegetative succession.

A soil good for agriculture is built up by the Beech-Maple Association.

Protection from grazing, careful and moderate selection of trees for cutting, and judicious thinning of coppice growths would contribute much toward the well-being of the hardwoods of northern Michigan.

A

ANNOTATED SPECIES LIST

(Exclusive of plants already included in lists for aspens, bogs and sand dunes.)

- Actaea alba*-- Rich woods. Few at Riggsville.
Agrimonia gryposepala -- Moist thickets. Riggsville.
Allium tricoccum-- Moist woodlands, Occasional at Riggsville.
Aquilegia canadensis-- open places in aspens and hardwoods.
Aralia racemosa-- Typical of rich woods. Colonial Point.
Arisaema triphyllum-- Frequent in rich moist woods. Common at Riggsville.
Aspidium spinulosum-- Common fern in hardwoods. Bay View and Riggsville.
thelypteris-- Marshes and low woods- Riggsville.
Betula lutea-- Typical in Beech-Maple woods of Northern Mich.
Botrychium simplex-- Hardwoods; infrequent.
virginianum-- Common in rich woods; Colonial Point, Bay View, and Riggsville.
Carex arctata-- Exclusive in hardwoods; Colonial Point, Riggsville.
Caulophyllum thalictroides-- Rich woods; Riggsville.
Chenopodium album-- Common in open places, rich soil; introduced; Riggsville.
Cynoglossum officinale-- frequent in pastures and waste land; introduced; Mud Lake Coppice.
Epilobium angustifolium-- fireweed; edges of hardwoods.
Fraxinus americana-- rich moist woods; Bay View, Colonial Pt.
Galeopsis tetrahit-- Common at Riggsville.
Galium lanceolatum-- Dry parts of hardwoods.
triflorum-- Frequent in rich woods; Riggsville.
Geranium robertianum-- Dense at Riggsville; occasional at Bay View.
Hepatica acutiloba-- Frequent in drier parts of hardwoods.
Hystrix patula-- Exclusive in hardwoods; Colonial Point.
Lactuca spicata-- Common in low ground.
Lonicera canadensis-- Frequent in hardwoods; Colonial Point, Bay View.
Lycopodium lucidulum-- Moist woods; Bay View.
Maianthemum canadense-- Characteristic of pine association; relic in hardwoods.
Mitchella repens-- Typical mat-forming plant in hardwoods; Colonial Point, Mud Lake Hardwoods.
Osmorrhiza elaytoni-- Exclusive and common in hardwoods; Colonial Point, Riggsville.
Ostrya virginiana-- Rich woods; Colonial Point and Bay View.
Poa compressa) Meadows and edges of woods.
pratensis)
sylvestris-- Typical of woods; Colonial Point, Bay View.
Polygonatum biflorum-- Characteristic; frequent in hardwoods.

- Rubus occidentalis*-- Infrequent in north; openings in woods; Riggsville.
- strigosus*-- Common in openings and around edges of hardwoods; Colonial Point, Riggsville, Mud L. Coppice.
- Sambucus racemosa*-- Typical shrub in hardwoods; Riggsville.
- Solidago caesia*-- Typical of hardwoods; Colonial Point.
- Streptopus roseus*-- Characteristic in hardwoods; Colonial Point, Bay View.
- Taraxacum officinale*-- Ubiquitous.
- Taxus canadensis*-- Characteristic ground shrub of coniferous forests; common at Bay View.
- Thalictrum dioicum*-- Typical hardwoods, occasional.
- Trillium grandiflorum*-- Frequent and characteristic in hardwoods; Colonial Point, Riggsville.
- Viola canadensis*-- Common in hardwoods; Riggsville, in bloom in Mud Lake Hardwoods.
- eriocarpa*-- Characteristic of hardwoods; Riggsville, Mud Lake Hardwoods.

Figure 1-- Map Showing Location of Hardwood Areas.
 UNIVERSITY OF MICHIGAN BIOLOGICAL STATION
 AND DEMONSTRATION FOREST
 CHEBOYGAN AND EMMET COUNTIES, MICH.

LEGEND
 CHURCH
 SCHOOLHOUSE
 BOUNDARY OF UNIV. LANDS
 RAILROAD

SCALE
 1/2 MILES
 1/2 MILES
 1/2 MILES
 R.M.S.

LEGEND
 PAVED HIGHWAY
 GRAVELLED ROAD
 GRADED ROAD
 UNIMPROVED ROAD
 TRUCK TRAIL



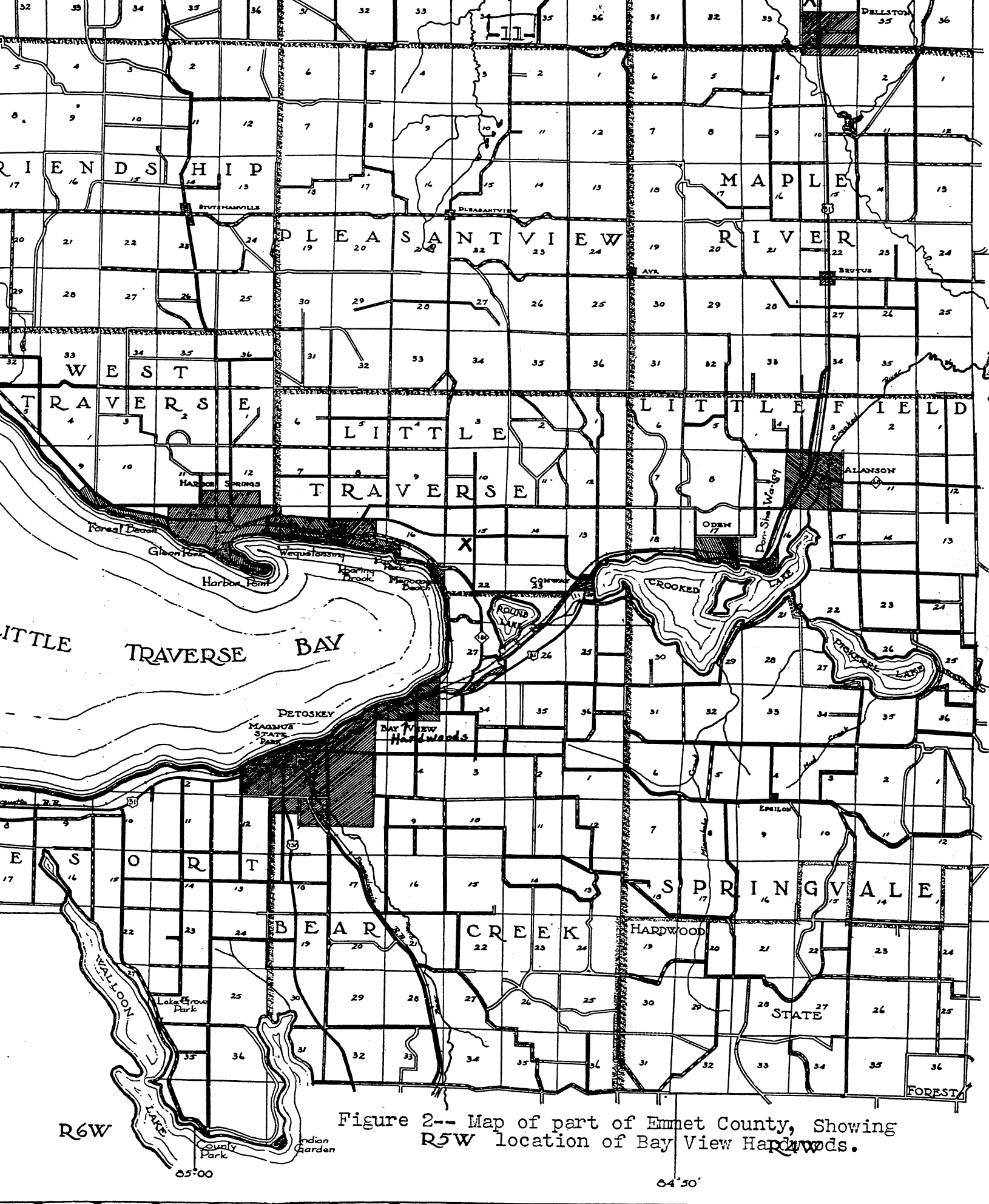


Figure 2-- Map of part of Emmet County, Showing R5W location of Bay View Hardwoods.



Figure 3-- *Conopholis americana* in
Colonial Point Hardwoods. It is
parasitic on roots of *Quercus*.
Photograph by C. H. Blair



Figure 4-- Coppice Growth near Riggsvill
Riggsville.
Photograph by C. H. Blair



Figure 5-- Betula Growing on Dead Tsuga
Stump.

Photograph by C. H. Blair.



Figure 6-- Tsuga Showing Effect of
Competition for Food and Light.

Photograph by C. H. Blair.

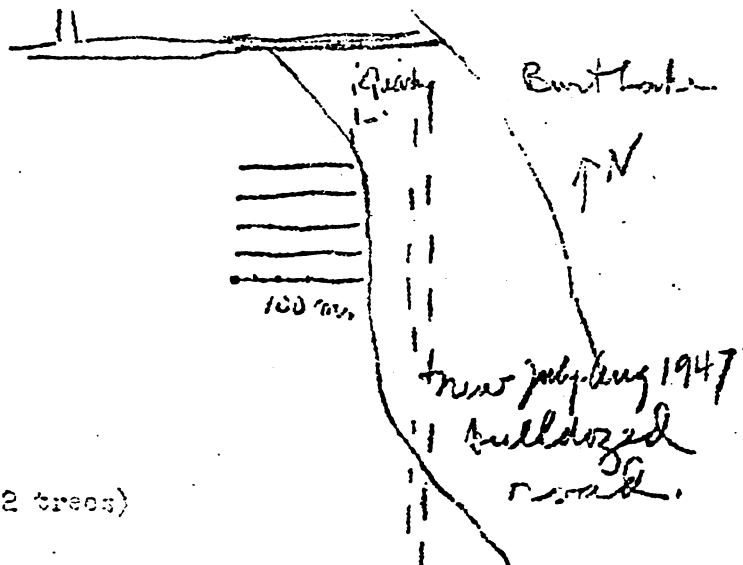
Table 1-- Data for Colonial Point Hardwoods.

Beech - Maple Association. Colonial Point west from old road. 1947
Ecology Class August 1, 1947

T R E E S	0-5,	5-10,	10-20,	20-30,	30-40,	40-50,	50-60	cm DBH.
Abies balsamea	2							
Acer pennsylvanicum	9	1						
Acer rubrum	18							
Acer saccharum	619	18	9	3	1	2	1	
Amelanchier canadensis	1							
Betula lutea	-	-	-	2				
Betula papyrifera	7							
Fagus grandifolia	63	3	5	3	5	8	4	
Fraxinus americana	1							
Ostrya virginiana	2	2	5					Trees in 5 2-meter strips 100 m long. = 1000 sq.m.
Populus grandidentata	1							
Quercus borealis	-	-	2	2	3	-	2	
Tilia americana	6							
near but not in line								
Pinus strobus								1
Tsuga canadensis								1

G R O U N D P L A N T S in 5 lanes, every 20th equals 25 quadrats
Count quadrats number of quadrats (number of plants)

Acer pennsylvanicum	4 (5)
Acer rubrum	4 (6)
Acer saccharum seedlings	23 (179)
" " over 1 m high	3 (4)
Amelanchier spicata	1 (1)
Betula papyrifera	2 (4)
Botrychium virginianum	1 (2)
xxxxxxxxxxxxxxxxxxxxxxxxxxxx	
Carex acrotata	1 (8)
Fagus grandifolia	17 (59)
Fraxinus americana	6 (6)
Hepatica triloba	1 (3)
Moss cover	2 (100 cm ²)
Lonicera canadensis	1 (1)
Logs	3 (4 logs)
Leaf cover	25 (complete)
Mitchella repens	4 (38)
Ostrya virginiana	3 (11 including 2 trees)
Polygala paucifolia	1 (2)
Polygonatum biflorum	4 (8)
Mixt " + Streptopus	5 (16)
Populus grandidentata	3 (3)
Pyrola sp	1 (1)
Quercus borealis	2 (2)
Siliciana racemosa	1 (10)
Streptopus roseus	7 (59)
Trientalis americana	1 (3)
Trillium grandiflorum	5 (3)
Viola eriocarpa	4 (4)



Reicher, Bradley
Barger, Hunter
James, Zarsten
MacLennan, Murchie
Sturgeon, Watson

Table 2-- Data for Bay View Hardwoods.

1947

H A P L E - B E E C H ASSOCIATION. Edge of Bayview, west of Division St north of Old Indian Trail. In 5 acres running 70° from a path about 120 meters west of Division St.

Ecology Class		August 1, 1947						
T R E E S	0-5,	5-10,	10-20,	20-30,	30-40,	40-50,	50-60,	60-70 cm DBH
Acer pennsylvanicum	16	-	1					
Acer rubrum	29	15	11		4	3		
Acer saccharum	205	16	10	5	1	-	-	1
Acer spicatum	53							
Betula lutea	1	12	11	4				
Fagus grandifolia	12	3	-	-	-	2	-	1
Fraxinus americana	15							
Ostrya virginiana	1							
Tsuga canadensis	35	8	2	1	2	2		
SHRUBS								
Sambucus racemosa	1	5 lanes 5 1/4 m x 2 = 1100 sq. m.						
Taxus canadensis	176							

GROUND PLANTS in every 10th m = 25 quadrats.
number of quadrats (number of plants)

Acer pennsylvanicum	1 (45)	
Acer rubrum	1 (1 0-5 tree + 1 5-10 tree)	
Acer saccharum	trees 2 (1 0-5 + 1 5-10)	
" "	seedling 3 (3)	
Acer spicatum	3 (6)	
Aralia nudicaulis	2 (2)	E Belcher
Aspidium spinulosum	1 (1)	Bradley
Betula lutea	1 (1)	Burget
Botrychium virginianum	2 (4)	Hunter
" "	1 (1)	James
Clintonia borealis	1 (2)	Kaeston
Fagus grandifolia	4 (5)	MacLennan
Geranium robertianum	1 (1)	MacLennan
Leaf cover	25	Murchie
log	2 (2)	Sturgeon
Lonicera canadensis	1 (2)	W. Watson
Lycopodium lucidulum	2 (157)	
Maianthemum canadense	3 (10)	
Moss	1 (150 cm ²)	
Poa sylvestris	1 (5 clumps)	
Taxus canadensis	21 (252)	
Tsuga canadensis	trees 0-5 cm	3 (3)

Table 3-- Data for Mud Lake Coppice.

MUD LAKE COPPICE

August 8, 1947

Originally cut about 1910 and the stumps allowed to sprout with no thinning at any time.

On August 12, 1927. 70 clumps averaged 4.29 living + 0.97 dead. the oldest, as cut, exhibiting 14 increments.

DBH 0-2cm, 2-4cm, 4-6cm, 6-8cm, 8-10cm, 10-12cm

85 119 52 17 4 3 Acer saccharum

On August 8, 1947. 194 "clumps" had an average of 1.3 living stems + 0.3 dead standing stems.

~~DBH 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, 12-14, 14-16, 16-18, 18-20, 20-22, 22-24, 24-26, 26-28~~

DBH 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, 12-14, 14-16, 16-18, 18-20, 20-22, 22-24, 24-26, 26-28

	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28
Acer saccharum	1	30	82	91	63	50	21	14	5	0	1			
Ulmus americana									1				1	
Tilia americana														1
Fagus grandifolia														1

Ecology Class:

Becher, Bradley, Burget, Hunter, James, Karsten, MacLennan, Murchie, Sturgeon, Watson

Table 4-- Comparative Percentages of Size Groups, 1927 and 1947.

Dia. B. H.	H. (Cm.)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18
1927		30%	42%	19%	6%	14%	14%	0	0	0
1947		1%	8%	22%	25%	17%	14%	6%	4%	14%

Table 5-- Species Seen at Riggsville Hardwoods.

RIGGSVILLE CORNERS HARDWOODS : Species noted in certain years (1927 etc)

Achillea millefolium	27	37		47	Mniamthemum canadense	27	37	40	41	47	
Acer pennsylvanicum	27	37		47	Melica smithii	31	37	40	41	47	
<i>A. spicatum</i> Acer rubrum	27	37	40	41	Mitchella repens	-	37	-	-	-	
Acer saccharum	27	37	40	41	47	Mitella nuda		37			
Actaea alba	27	37	40	41	47	Hepata cataria	27	37	40	41	47
Agrimonia gryposepala	27			41	47	Oenothera biennis	27	-	-	-	-
Allium tricoccum	-	-	40	41	47	Osmorrhiza claytoni	27	37	40	41	47
Amelanchier canadensis	-	37	40	41	47	Ostrya virginiana	27	37	40	41	47
Amphalis margaritacea	27	37	40	41		Pastinaca sativa	27	-	-	-	47
Antennaria neodioica	27	-	40	41	47	Phleum pratense	27	-	40	41	47
Apocynum androsaemifolium	-	-	-	41	47	Pinus strobus (seedling)				41	
Aralia nudicaulis	-	37	40	-	47	Polygonatum biflorum	27	37	40	41	47
<i>Aralia levata</i> Arotium minus	27	-	40	41	47	Poa compressa	27	37	40	41	47
<i>A. racemosa</i> <i>A. lindleyana</i> Arisaema triphyllum	27	37	40	41	47	Poa pratensis	27	37	40	41	47
Asplenias syriaca	-	-	40	-	47	Polygonum convolvulus	27	-	-	-	-
Aspidium spinulosum	27	37	40	41	47	Potentilla simplex	-	-	40	-	-
Aspidium thelypteris	27	37	40	41	47	Prunus serotina	27	37	40	-	47
Aster laevis	27	-	40	-	47	Prunus virginiana	-	37	40	41	47
Athyrium filixfoemina?	-	-	-	41		Pteris aquilina	27	-	40	41	47
Betula lutea	27	-	-	-	47	Ranunculus abortivus	27	-	40	41	47
Betula papyrifera	-	37	40	41	47	Rhus glabra borealis	27	37	40	41	47
Botrychium virginianum	27	-	40	-	47	Rhus toxicodendron	-	-	40	-	-
Carex acrotata	27	37	40	41	47	Ribes sp.	-	37	-	-	-
Carex patulifolia	27	37	40	-		Rubus allegheniensis	27	37	40	41	
Carex sp. Caulophyllum thalictroides	27	37	40	41	47	Rubus strigosus	-	37	40	41	47
Cerastium vulgatum	27	37	40	-	47	Rubus triflorus	27	-	-	-	-
Chenopodium album	27	-	40	41		Rumex acetosella	27	-	-	-	-
Chrysosplenium? Cirsium lanceolatum	27	-	40	-		Sambucus racemosus	27	37	40	41	47
Cornus alternifolia	-	37	-	-	47	Silene noctiflora	27	-	-	-	-
<i>Celastrus sp.</i> Cornus canadensis	-	37	-	-		Smilacina racemosa	27	37	40	41	47
<i>Daucus carota</i> <i>Sicentra comp.</i> Dactylis glomerata	27	37	-	-		Smilacina stellata	27	-	-	-	-
Danthonia spicata	31					Solanum tuberosum	27	-	-	-	-
Epiobium adenocaulon	27	-	40	-		Solidago canadensis	-	-	40	41	47
Epiobium angustifolium	27	-	-	-	47	Solidago hispida	27	37	40	41	47
Erigeron annuus	27	37	40	-	47	Sisymbrium altissimum	-	-	-	41	47
Erigeron canadensis	27	37	40	-	47	Stellaria media	27	-	40	41	
Fagus grandifolia	27	37	40	41	47	Stroptopus roseus	31	-	40	41	47
Fraxinus virginiana	27	37	40	-	47	Taraxacum officinale	27	37	40	-	47
Fraxinus americana	-	37	40	41	47	Taxus canadensis	27	-	-	41	47
Geleopsis tetrahit	27	37	40	41	47	Thuja occidentalis	-	37	-	-	-
Galium trifidum	-	-	40	-		Tilia americana	27	37	40	41	47
Galium triflorum	27	37	40	41	47	Trifolium repens	27	-	40	-	-
Geranium robertianum	27	37	40	41	47	Trillium grandiflorum	27	37	40	41	47
Gnaphalium decurrens	-	-	-	41		Tsuga canadensis	27	37	40	41	47
<i>Habenaria</i> <i>hyperborea</i> Helianthus annuus	-	-	40	-		Ulmus americana	27	37	40	41	47
Hepatica acutiloba	-	37	-	-	47	Viola canadensis	27	37	40	41	47
Lactuca canadensis	-	37	40	41	47	Viola eriocarpa	27	37	40	41	47
Lactuca sagittifolia	27	-	-	41	47	Viola hirsuticola	-	37	-	-	-
Lactuca spicata	27	-	-	-	47	Viola papilionacea	27	37	40	-	-
Lappula deflexa	27	-	-	-		Verbascum thapsus	27	37	-	-	47
Lychnis dioica	27	-	-	41	47						

Plantago major

47 R. occidentalis

Trifolium pratense 47
Syringa vulgaris 47
Total 83 species

Malva
Melilotus alba

1927	1929	1937	1940	41	47
73	78	60	69	69	83

BEECH - MAPLE ASSOCIATION.

Ecology classes.

R - Riggsville Corners Hwd. Age 45-50 yrs. Cheboygan Co. Aug 9, 1929.
 ML - Mud Lake Hwd. virgin,
 CL - Carp Lake Hwd virgin, Smet Co.

TREES	R		ML		CL		Large: Small Trees
	L	S	L	S	L	S	
Acer saccharum	359	192	174	6	42	519	
Acer pennsylvanicum	-	-	-	-	-	171	
Acer rubrum	-	-	-	-	-	26	
Acer spicatum	-	-	8	-	-	2	
Betula lutea	1	39	4	5	7		
Fagus grandifolia	15	125	157	141	329		
Fraxinus americana	1	2	-	-	-		
Quercus borealis	-	-	-	-	3		
Rhus g. borealis	4	-	-	-	-		
Tilia americana	2	14	2	-	-		
Tsuga canadensis	1	41	5	34	46		
Ulmus americana	39	23	21	-	-		

Ground Plants 100 quadrats each.

FI	R	ML	CL
Acer pennsylvanicum	1	1	21
Acer rubrum	-	-	7
Acer saccharum	89	99	89
Achillea millefolium	1	-	-
Actaea alba	1	-	-
Adiantum pedatum	1	-	1
Agrostis alba	1	-	-
Alnus incana	1	-	-
Aralia nudicaulis	-	1	56
Arisaema triphyllum	2	18	-
Aspidium spinulosum	-	24	-
Betula lutea	1	-	2
Betula papyrifera	3	-	1
Botrychium virginianum	1	-	-
Caulophyllum thalictroides	1	-	-
Carex acrotata	5	-	-
Carex pedunculata	4	-	-
Cerastium vulgatum	3	-	-
Chimaphila umbellata	-	-	5
Cirsium arvense	1	-	-
Clintonia borealis	-	-	9
Epilobium adnecaulon	1	-	-
Erigeron annuus	2	-	-
Erigeron canadensis	3	*	-
Fagus grandifolia	3	17	63
Fragaria virginiana	*	1	-
Galeopsis tetrahit	15	-	-
Galium triflorum	9	8	-
Gaultheria procumbens	-	-	27
Geranium robertianum	28	3	-
Lactuca canadensis	3	1	-
Lactuca sagittifolia	4	3	-
Lactuca spicata	3	-	-
Lappula deflexa	5	-	-
" virginiana	2	-	-
Lonicera canadensis	-	1	6
Lysimachia terrestris	-	-	1
Maianthemum canadense	8	4	73
Medeola virginiana	-	-	17
Mitchella repens	7	1	30
Moss cover	4	-	-
Osmorrhiza claytoni	59	18	-
Phleum pratense	3	-	-
Poa pratensis	13	1	-
Poa compressa	*	-	-

Polygonatum biflorum	7	-	-
Polygonum convolvulu	1	-	-
Polygala pauciflora	-	-	-
Ranunculus abortivus	7	-	-
Rhus toxicodendron	-	-	-
Rubus allegheniensis	1	*	-
Rubus occidentalis	1	-	-
Rubus strigosus	2	-	-
Rubus triflorus	-	-	-
Rumex acetosella	1	*	-
Sambucus racemosa	43	2	-
Smilicina racemosa	2	-	12
Streptopus roseus	1	2	5
Solidago canadensis	-	1	-
Stellaria media	-	4	-
Taraxacum officinale	19	2	-
Taxus canadensis	1	-	-
Tilia americana	5	1	-
Trifolium pratense	1	-	-
Trifolium repens	1	*	-
Trillium grandiflorum	11	9	-
Trientalis americana	-	-	32
Tsuga canadensis	-	-	5
Ulmus americana	8	2	-
Uvularia grandiflora	1	1	-
Viola canadensis	1	2	-
Viola ericarpa	24	2	1
Viola papilionacea	-	*	-
Epifagus virginiana	-	-	*
Monotropa uniflora	-	-	*

* means present not in quadrat

Mud Lake Coppice, Aug 12, 1927. Of 70 clumps
 aver 4.29 living + .97 dead. Oldest 14 yrs.
 0-20cm DBH 85, 2-40cm 119, 4-60cm 52, 6-80cm 17,
 8-100cm 4, 10-120cm 3.

Mud Lake HWD Trees. Aug 11, 1937.

0-10, -20, -30, -40, -50, -60, -70, -80, -90, -100

Acer saccharum	1238	80	47	1	5	4	2	3	2	1
Acer pennsylvanicum	2	-	-	-	-	-	-	-	-	-
Acer spicatum	13	-	-	-	-	-	-	-	-	-
Betula lutea	1	9	4	1	-	-	-	-	-	-
Fagus grandifolia	97	33	21	15	4	1	0	1	-	-
Fraxinus americana	2	-	-	-	2	-	-	-	-	-
Tilia americana	7	1	-	-	-	-	-	-	-	-
Ostrya virginiana	-	-	-	-	-	-	-	-	-	-
Tsuga canadensis	0	0	1	0	3	-	-	-	-	-
Ulmus americana	1	1	6	0	3	0	6	-	-	-