

sandy upland

THE ASPEN ASSOCIATION IN
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^
THE DOUGLAS LAKE AREA
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chbr to Michigan

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THE ASPEN ASSOCIATION IN THE DOUGLAS LAKE AREA

INTRODUCTION

The work on the sandy upland aspen association was done as class work under the direction of Dr. F. C. Gates at the University of Michigan Biological Station, Douglas Lake, Cheboygan County, Michigan, during the summer of 1947.

Studies were made of six areas near the Station camp called "Aspen Sets". Five of these were on sandy uplands, while the sixth was on a sandy area lying somewhat lower.

From these studies data were compiled for five of these areas and are used in the following discussion.

LOCATION OF AREAS

Five of the Aspen Sets studied are in Cheboygan County, four of them being quite close to the Station camp and one about a mile west of the camp. The sixth Set is in Emmet County about six miles from the Station camp, to the northwest. The accompanying map (Fig. 1) shows the exact location of these Sets in relation to the Biological Station camp.

The whole area around Douglas Lake is glaciated and, ecologically speaking, is in a transition belt between the Northeastern Coniferous and Central Deciduous provinces. When early settlers came to this part of Michigan they found about half of the Douglas Lake area forested with hardwoods, about a fifth covered with pines, and the rest bog and water areas.

Most of the original forests were removed by logging in the last half of the nineteenth century. For quite a period of years following the logging, fires denuded much of the area. Some parts were burned over several times. Recently, however, there has been an effective program of fire prevention and control, so that the vegetation has been allowed to develop again.

CLIMATE

According to the U.S. Weather Bureau records for Cheboygan, the mean temperature for this region ranges from 16° F. for the month of February up to 66° F. for the month of July. The absolute minimum temperature is a -38° F. for February and the absolute maximum is 101° F. in the month of July.

Precipitation in this area totals 28.57 inches and is well distributed throughout the year, six to nine days of each month having some precipitation. There is some snow from October until May with the three months, December, January and February averaging more than ten inches.

The growing season is from 87 to 126 days in length. Prevailing winds are from the northwest and violent wind storms are exceedingly rare.

Late spring frosts here often affect the seeding of early-blooming trees, such as beech, and summer drouths may lead to fire. In general, however, the well-distributed rainfall, moderate temperatures, and other climatic factors of this region are very favorable to the growth of trees.

DESCRIPTION OF REGION

The area around Douglas Lake is generally hilly or rolling and dotted with several small lakes and bogs besides the three large lakes, Douglas, Burt and Mullett, which are each several miles long.

South of Douglas Lake, between that and Burt Lake, is a sandy ridge covered with aspens and some pines. Southwest and west of Douglas Lake, near the village of Pellston, is an area of flat or nearly flat land, bordered on the west by a range of hills. Some of this flat ~~prairie~~ ^{prairie} has been under cultivation in the past, but much of it has reverted to meadow or is growing trees again.

To the north and east of Douglas Lake there is an area of farm land which is still under cultivation, with hay, potatoes, and some grain as the main crops. Along the shores of this lake there are some cottages, camps and summer resorts, but most of the land around its margin is forested.

With the exception of the ~~prairie~~ ^{prairie} and farming areas, most of the land is forested or in the process of becoming so. A large part of the forests, particularly on the sandy uplands, are now made up of aspen associations in the various stages of succession, although there are a few parts which have become reforested with pines, and some wooded areas which beech and maple are predominant.

This study, with the accompanying data, ^{methods} is based on observations and counts taken in representative parts of the reforested areas, with special reference to the aspen association on sandy uplands.

DESCRIPTION OF SETS

Aspen Set I is a small area northwest of the Cheboygan Road and just east of the entrance drive to the Biological Station camp. (Map. Fig. 1) The land slopes somewhat from the Cheboygan Road in the general direction of Douglas Lake. Since the original forest was removed by logging, this set has been burned several times, the last fire being in 1911.

Aspen Sets II and III are nearer to Douglas Lake, east of the Station camp, and along the baseline road, now a truck trail. The land here slopes toward the lake, too, with Set III showing a distinct series of three plateaus, the two lower formed by lake margins of earlier geological ages. Both of these Sets were burned over in 1901, but Set II was spared when in May, 1923, a bad fire destroyed all vegetation on Set III.

Set IV is on a somewhat higher area south of Douglas Lake and sloping slightly toward Burt Lake. In August of 1936, this area was prepared for controlled burning by plowing fire lines all around a piece 550 feet east and west by 300 feet north and south. This Set was then completely burned.

Sets V and VI are located almost directly south of the Station camp on land sloping toward Burt Lake. As very little work was done in these areas and the data accumulated was not comparable to the obtained from the other Sets, these two areas will be mentioned again only in connection with methods used in the study.

Aspen Set VII is in the rather flat area west of Bryant's resort on Douglas Lake. It is on the west side of the Maple River and north and east of Pellston. Along the west and south sides of this Set is a meadow formed after it was farmed for several years, then planted to pasture grasses and finally abandoned. To the east is an aspen-covered area, which was burned in 1919 and other years. To the north is an area which was formerly a bog, but was burned and destroyed as a bog several years ago. Formerly a stream ran from this bog thru the meadow toward the Maple River, but now this stream bed is dry most of the time. The last fire to affect Set VII was in 1901.

METHODS

The method of study in most of these areas was to take a tree count of five strips, each two meters wide, thru the area. Any woody plant over a meter in height was included in the tree count. Lists of the plants found in a number of quadrats spaced at definite intervals within the two-meter strips were compiled. The quadrats were square, one meter on a side, and the intervals between them varied from three paces in Set I to eight paces in Set IV. All species of ferns and flowering plants were listed for the quadrats. Moss and lichens were considered only if they covered a substantial part of the quadrat.

In Set IV all of the trees of the area were counted, ropes being used to mark off portions as the count proceeded.

Point-observation quadrats were taken in an area near Set VI. This method consisted in setting a stake at random, then putting ~~six~~ other stakes around this, each .8 meter from the center stake. This marked out an area of 200 units, each 10cm. square. Square cards, 10 cm. on a side, were used to estimate the number of units of the area covered by each type of vegetation at three levels, tree, Pteris, ground.

The Line-interception method was used for 15 meters or less at the east edge of Set VI territory. In this method, a line was established by laying a rope due west, then measuring with a caliper ruler all the plants that intercepted a centimeter-wide strip along one side of the rope, one centimeter above the surface of the earth. A second measurement was taken of all interceptions of the line by woody plants at tree level.

The two latter methods were used to familiarize the class with different methods of studying the plants of the area rather than to determine significant data for the study of the aspen association. As the data thus obtained served only to substantiate certain conclusions arrived at from the data on the other Sets and was of itself not significant, it has not been included in this paper.

FIELD WORK

Aspen Set I-- Five groups listed species in 20 quadrats each, five paces apart, and counted trees in two-meter strips.

Set II-- Five groups listed species in 15 quadrats each, five paces apart, and counted trees in two-meter strips from crest north to baseline.

Set III-- Five groups listed species in 15 quadrats each, seven paces apart-- five on lower plateau, five on slope, and five on middle plateau. Also counted trees in two-meter strips from baseline to foot of second slope.

Set IV-- Counted all trees in August, 1936, "burn" in five strips, east to west, with ropes. Instructor listed species in 50 quadrats, eight paces apart in five lines, east to west, west to east.

Set VI territory-- Five groups each took three point-observation quadrats and Line-Interception for 15 meters or less at east edge of territory.

Set VII-- Five groups listed species in 10 quadrats each, three paces apart, southward in former aspen area west of Maple River. Also counted trees in two-meter strips.

A summary of the data accumulated from the study of Sets I, II, III, IV, and VII is shown in Tables 1 and 2 (Appendix, Pages 1-5). Table 1 is a summary of the tree counts in these areas together with a few notes on habitat or associations in which these trees are commonly found. Table 2 is a summary of the frequencies of occurrence of ground plants in the quadrats studied in these five areas. Notes on habitat or association have also been added to this list.

A study of this data seems to indicate that several stages in the development and progress of an aspen association are demonstrated by these Sets. They will be described and discussed in the order in which they would succeed one another in the normal development and succession of the aspen association on sandy uplands.

SUBAREAS

Aspen Set IV.

This area was completely burned in August, 1936. Only one tree, a *Pinus resinosa*, was not killed by the fire. Certain fire plants such as *Epilobium angustifolium* and *E. adenocaulon*, the *Erigerons*, *E. annuus* and *E. canadensis*, and *Oenothera muricata* probably were some of the first ground plants to form a cover in this area. These plants were accompanied by sprouts from the roots of the aspens destroyed by the fire. By 1940 the area was completely dominated by these sprouts, which were mainly of *Populus grandidentata*, the large-toothed aspen.

As are the other aspens of this region, *Populus grandidentata* is a rather rapid-growing tree but comparatively short-lived, these trees seldom living to be older than 25 to 30 years. The wood is very soft and rots quickly after death. The tree reproduces both by seeds and root sprouts, so if a fire is not severe enough to destroy the roots, the sprouts re-vegetate the area quite rapidly. A picture of this "burn" of Set IV (Fig. 2) taken in 1940 shows almost a complete cover of *Populus grandidentata*.

Beginning in the summer of 1937 the Ecology classes at the Biological Station each year counted and recorded the number of sprouts and trees in Aspen Set IV. The 11,812 aspen sprouts of 1937 had developed into 6,149 trees by 1941. This number was reduced to 5,131 trees by 1946 and the 1947 count showed 4,811 aspen trees. *Populus grandidentata* at this time makes up 85% of the tree cover of the area.

Other trees now present on this Set are *Acer rubrum*, 9%, and *Quercus maxim borealis*, 2%. *Populus tremuloides*, which is usually associated with *P. grandidentata*, and *Betula papyrifera* are present in only small numbers, probably because these species seem to prefer lower areas near to bodies of water.

A careful search of the area revealed one young *Pinus Strobus* and three young *Pinus resinosa*, two of which were near the old *P. resinosa* tree. This indicates that invasion by the pines has started, though on a very small scale.

Ground plants in Aspen Set IV seem to be dominated by the common brake, *Pteris aquilina*. *Carex umbellata*, *Poa compressa* and *Poa pratensis* are quite frequent, the two latter being introduced species of grasses. Two low-growing shrubs, *Diervilla lonicera* and *Vaccinium pennsylvanicum*, seem to be well established. Moss and lichen cover is much more widespread in Set IV than in any of the other areas.

The dominance of *Populus grandidentata*, the presence of much moss and lichen cover and a few fire plants, with the establishment of characteristic aspen association species such as the *Pteris*, *Diervilla* and *Vaccinium* seem to indicate that Aspen Set IV illustrates an early stage in the normal aspen succession.

Aspen Set III.

Set III was burned in 1901, then again in May, 1923. Data obtained on this area in 1947 indicates that Set III represents a somewhat more advanced stage in the aspen succession than Set IV. (See Fig. 3)

Here *Populus grandidentata* is still the dominant species, accounting for 35% of the tree growth. *P. tremuloides* makes up 7%. As the moist air needed by *Betula papyrifera* is adequately supplied by Douglas Lake, this species makes up a larger percentage of the tree cover of Set III than in any other area studied. *Acer rubrum* and *Quercus maxima borealis*, which seem to be characteristic of the intermediate stages of the aspen succession, are here well established.

As in Set IV, *Pteris aquilina* is the most frequent ground plant. Here, however, it is accompanied by *Gaultheria procumbens*, a low shrub of the heath type, *Melampyrum lineare* and *Maianthemum canadense*, two small herbaceous plants. The lat-

ter two plants are adapted to the shade found in Aspen Set III and, together with *Diervilla lonicera* and *Vaccinium pennsylvanicum*, carry on as characteristic ground plants throught the succession.

Melampyrum lineare is the only therophyte among these characteristic plants, but conditions in the sandy upland aspen association seem to favor the sprouting of its seeds. Other ground plants occurring frequently in Set III are *Aralia nudicaulis* and *Trientalis americana*, which seem to be adapted to a variety of plant associations, and *Polygala paucifolia*, which is characteristic of the pine association.

The grasses and sedges of Set IV are here replaced by *Oryzopsis asperifolia*, which appears as the characteristic grass throughout the succession. *Monotropa hypopytis*, a parasitic plant found exclusively in the aspen and pine associations, was found in this Set.

Aspen Set I.

The third step in the aspen succession is represented by Aspen Set I, which was last burned in 1911. Here the aspens are still dominant, though there is a higher percentage of *Populus tremuloides* than in either of the previous Sets. The ratio is about two *Populus grandidentata* to one *P. tremuloides*. A 1944 picture of Set I (Fig. 4) shows these dominant species and other typical ones of the area.

Other characteristic trees here are *Acer rubrum* and *Betula papyrifera*. *Rhus glabra borealis*, the common sumac of this region shows a high frequency. There are also some pines in Set I, *Pinus resinosa* and *P. Strobus* being about equally represented.

Characteristic ground plants in this Set are again the sub-dominants, *Pteris aquilina* and *Diervilla lonicera*, together with *Gaultheria procumbens* and *Melampyrum lineare*. The typical grass is *Oryzopsis asperifolia*, although *Danthonia spicata* was also found frequently. *Comandra umbellata*, a partial parasite on the roots of trees, was more plentiful here than in Set III, the only other area in which it was listed. *Solidago hispida* and *Aster laevis*, which were found in all the areas studied, were most frequent in Set I.

All of these ground plants may be said to be typical of the aspen association and were found pretty generally throught the areas studied.

Aspen Set II

Set II is not far from Set III and was burned in 1901, but not by the fire of 1923, which denuded the area of Set III. Consequently this area has had 22 more years in which to re-vegetate than has Set III, and 10 more years than Set I. Thus Set II represents a fourth stage in the aspen succession.

The aspens are still dominant in this area, though their percentage is lower than in the first three areas described. The pines and birch, *Betula papyrifera*, are present in greater numbers. *Acer rubrum* is also well established. Here again the nearness to the lake probably accounts for the incidence of *Betula papyrifera*. *Pinus Strobus* and *Pinus resinosa* have

been encouraged by the lack of fires and the shade for the young trees provided by the aspens and other deciduous species.

Ground cover in Set II is very similar to that in Sets III and I. *Pteris* and *Diervilla* form a higher level beneath which *Gaultheria procumbens*, *Polygala paucifolia*, *Melampyrum lineare* and *Maianthemum canadense* form a large percentage of the lower vegetation. *Vaccinium pennsylvanicum* is also found in the lower level.

The most outstanding development shown by Set II over Set I is the increase in the percentage of pines and the accompanying death and decay of the dominant aspens. Figure 5 shows an area in a similar stage of development in the Douglas Lake region.

Aspen Set VII

Representing the end of the aspen succession is Aspen Set VII, which can hardly be called an aspen set now because the pines are dominant in this area. The last fire to go over this particular spot was in 1892, although neighboring areas have been burned much more recently.

The fact that this area lies somewhat lower than any of the other Sets probably accounts for the *Populus tremuloides* making up the small percentage of aspens still remaining among the pines, rather than *P. grandidentata* found in the higher areas. *Amelanchier canadensis* and *A. spicata* are other remnants of the aspen association still found in Set VII.

About two-thirds of the pines here are *P. resinosa* and one-third *P. Strobus*. The two species make up about 40% of the tree growth of this area and show unusual thickness of stems for their height. Figure 6 shows some of these pines that have replaced the aspens.

Scattered thru this area there are a few *Abies balsamea*, a number of *Picea glauca*, an occasional *Picea mariana* or *Thuja occidentalis*, and some *Alnus incana* and *Salix discolor*, all typical bog trees or shrubs which may be invaders from the former bog area to the north.

The ground plants in Set VII include the characteristic aspen associates, *Pteris* (reduced in frequency), *Diervilla*, *Gaultheria*, *Vaccinium canadense* and *V. pennsylvanicum*. *Oryzopsis asperifolia* is still the typical grass. *Maianthemum canadense*, which seems to prefer the pine association, occurs more frequently here than in any other area studied.

Two other species of ground plants not mentioned heretofore occur quite consistently in this Set. These are *Rosa blanda*, which is very common on the prairie or meadow west and south of this set and *Cornus canadensis*, which is typically a bog plant and may have come in from the bog area near.

The most noticeable differences between this Set and the others are the predominance of the coniferous trees over the aspens and the occurrence of a number of bog species of both trees and ground plants.

GENERAL CONCLUSIONS

Following the burning of sandy upland areas of the Douglas Lake Region, the first tree growth is composed of aspens, chiefly *Populus grandidentata* ~~or *Populus grandidentata*~~ with some *Populus tremuloides*. These may start either as seedlings or as sprouts from the roots of burned trees. These aspens remain dominant over a period of 25 to 35 years, and form the nucleus of a plant society known as the aspen association.

In the aspen association two species of ground plants become subdominant. They are: (1) *Pteris aquilina*, which precedes the aspens in some areas, becomes subdominant in the aspen association and persists into the pine association, and (2) *Diervilla lonicera*, whose incidence and development is similar to that of *Pteris*, though its frequency is lower in the areas studied.

Other characteristic ground plants of the aspen association are: (1) *Gaultheria procumbens*, which establishes itself with the aspens and persists into the pine association, (2) *Melampyrum lineare*, an annual plant which appears to be typical of the intermediate stages in the aspen succession, (3) *Oryzopsis asperifolia*, a grass which develops in the shade after trees are somewhat grown, and (4) *Maianthemum canadense*, found typically in the aspen associations having some pines.

Trees commonly associated with the aspens are: (1) *Acer rubrum*, in the earlier part of the succession, (2) *Betula papyrifera* in the areas near water, (3) *Quercus maxima borealis*, a species intermediate in period of succession between the aspens and the pines, and (4) the pines, *P. Strobus* and *P. resinosa*, which gradually replace the aspens. *Amelanchier canadensis* and *A. spicata* are typical high shrubs.

In the early stages of the aspen succession, certain fire plants such as the *Epilobiums* and *Erigerons* may persist as the aspen association is developing. Moss-and-lichen cover is important only until it is destroyed by the shade of the trees.

The development of particular species in any given area of the aspen association may be influenced by humidity of the air, the moisture in the soil, the amount of shade, and many other local factors.

Any typical association of plants may be invaded by unusual types from dissimilar areas nearby.

The vegetation of sandy upland areas of the Douglas Lake region that have been burned changes gradually from an association in which *Populus grandidentata* is dominant, thru associations of aspens with some maple, birch, oak and pines, to an association in which the pines are dominant. Thus the aspens, which are quick-growing, but comparatively short-lived, are gradually replaced by the slow-growing, longer-lived pines. With protection from fire, this succession will proceed to its natural conclusion in 30 to 40 years.

As the climate of the Douglas Lake region is favorable for the growth of trees and undisturbed areas tend to develop the valuable pines following the aspen association, protection from fire over the years is of major importance in promoting the reforestation of the area to a maximum of economic value.

SUMMARY

1. The work described in this paper was done as class work in Plant Ecology at the University of Michigan Biological Station at Douglas Lake, Cheboygan County, Michigan, in the summer of 1947.
2. Five representative areas of aspen associations growing on sandy uplands were studied.
3. The dominant species of these upland aspen associations was found to be *Populus grandidentata*, a quick-growing, short-lived species of aspen. It is usually accompanied in these areas by *Populus tremuloides*.
4. Other deciduous tree species frequently associated with the aspens are *Acer rubrum*, *Betula papyrifera* and *Quercus maxima borealis*.
5. Characteristic ground plants of the aspen association are *Pteris aquilina*, *Diervilla lonicera*, *Gaultheria procumbens*, *Vaccinium pennsylvanicum* and *Melampyrum lineare*. *Panicum* *gamb.*
6. The vegetation on sandy uplands protected from fire changes gradually from an aspen-dominated association of plants to one in which the aspens are almost entirely replaced by pines.
7. As the Douglas Lake region has a climate particularly suitable to tree growth, the area should be protected from fire to allow it to become reforested with valuable pines.

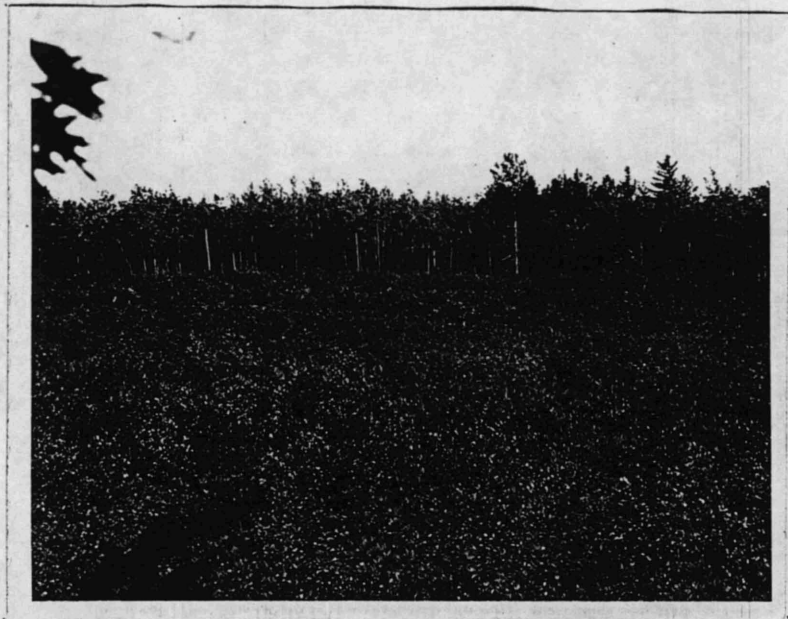


Figure 2 - Aspen Set IV, showing cover of
Populus grandidentata sprouts, 1940.
Photograph by C.H. Blair, 1940



Figure 3 - Aspen Set III from the Baseline
Road, 1944, showing dominant aspens and
sub-dominant *Pteris aquilina*.
Photograph by C.H. Blair, 1944



Figure 4- Aspen Set I , showing dominant *Populus grandidentata*, *P. tremuloides*, and other species.

Photograph by C.H. Blair, 1944



Figure 5 - Aspen Area Untouched by Fire since 1901, showing replacement of aspens by pines.

Photograph by C.H. Blair, 1944

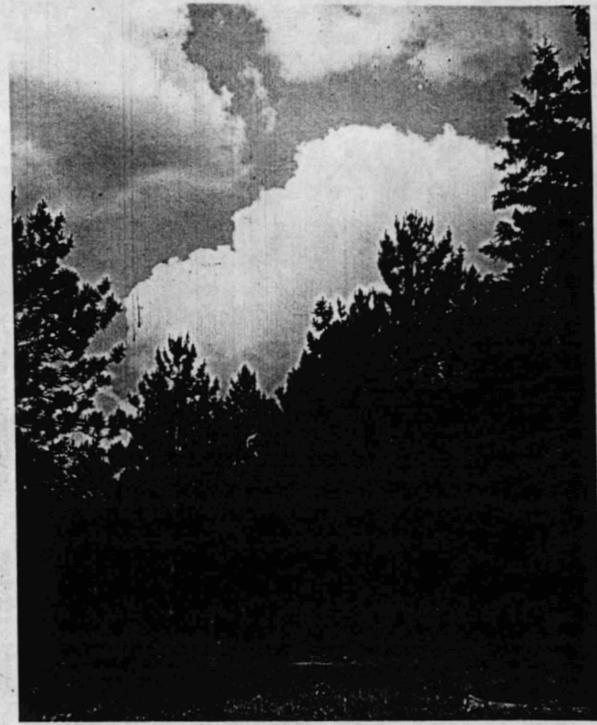


Figure 6 - Pines Replacing Aspens
in Set VII.

Photograph by C.H. Blair

Table 1 - Tree Counts in Aspen Sets I-IV and VII, with Annotations on Species and Percentages of Total Trees. Page 1

	T R E E S A S P E N S					Notes		Total %
	I	II	III	IV	VII	NY	NY	
Abies balsamea	-	-	-	-	3	Bog		.04%
Acer pennsylvanicum	1	-	4	-	-	Hardwood		.06%
rubrum	249	114	112	534	10	Near water		12. %
saccharum	-	1	-	-	-	Hardwood		.01%
spicatum	-	-	-	-	-			
Alnus incana	-	4	-	-	3	Bog		.08%
Amelanchier canadensis	21	3	16	88	31	Pine, Hdw.	Bog	1.90%
complex	-	-	-	-	-			
huronensis	-	-	-	-	-			
sanguinea	-	-	-	-	-			
spicata	13	14	-	14	19	"	"	.71%
Aronia (Pyrus)	-	-	-	-	-			
Betula lutea	-	-	-	-	-			
papyrifera	117	124	141	13	9	Wet air needed		4.83%
Cornus rugosa	-	93	10	-	-	Aspen		1.23%
stolonifera	-	-	-	-	1	Aspen		.01%
Crataegus roanensis	-	-	-	-	-			
Fagus grandifolia	27	3	1	-	-	Hardwood		.37%
Fraxinus americana	-	-	-	-	-			
Hamamelis virginiana	-	-	-	-	-			
Ilex verticillata	-	-	-	-	-			
Larix laricina	-	-	-	-	-			
Lonicera canadensis	-	-	-	-	1	Aspen, p., hdw.		.01%
dioica	-	1	-	-	3	Asp., pine, "		.05%
oblongifolia	-	-	-	-	4	Bog		.05%
Nemopanthus mucronata	-	-	-	-	-			
Picea glauca (can)	-	-	-	-	12	Bog with Abies		.14%
mariana	-	-	-	-	1	Bog		.01%
Pinus banksiana	-	-	-	-	-			
resinosa	33	21	8	1	88	Pine		1.87%
strobis	34	37	5	-	41	P., Hdwood		2.59%
Populus balsamifera	-	-	-	-	1	Wet ground		.01%
grandidentata	219	186	232	4777	-	Dom. sand.up.		64.87%
tremuloides	107	49	44	34	36	Low Aspen		3.23%
Prunus nigra	-	-	-	-	-			
pennsylvanica	19	12	32	2	5	Asp., Hdwd. burn		.80%
virginiana	-	-	-	-	4	Wet		.05%
Quercus m borealis	9	26	48	121	-	Toward pines		2.00%
Rhus glabra borealis	56	8	2	-	-	Aspen		.80%
Rubus allegheniensis	1	-	-	-	-	Aspen		.01%
Rosa sp.	-	-	-	-	-			
Salix bebbiana (rostrata)	14	-	-	18	4	Aspen		.43%
discolor	21	-	-	-	33	Low or up.		.64%
bebbiana x discolor	-	9	5	-	-			.15%
Shepherdia canadensis	-	-	-	-	-			
Taxus canadensis	-	-	-	-	-			
Thuja occidentalis	-	-	-	-	2	Bog		.02%
Tsuga canadensis	-	2	-	-	4	Hdwd.		.06%
Ulmus americana	-	-	-	-	1	Low forest		.01%
Viburnum acerifolium	4	22	-	2	-	Aspen		.35%
cassinoides	-	-	-	-	-			
Total No. of Trees	945	829	660	5604	316	8,354 trees		

Table 2-- Frequencies of Occurrence of Ground Plants in Aspen Sets
I- IV and VII, with Annotations on Species.

G R O U N D P L A N T S

1936 ~~run~~ ASPENS

Notes

	I	II	III	IV	VII	VII/	VII//	VII///	Total	
<i>Abies balsamea</i>	-	-	-	-	4				4	Bog. with <i>Picea</i>
<i>Acer pennsylvanicum</i>	-	-	1	-	-				-	Hardwood
<i>rubrum</i>	16	28	20	*	-				-	Near water
<i>saccharum</i>										
<i>Achillea millefolium</i>										
<i>Agropyrum repens</i>										
<i>tenerum</i>										
<i>Agrostis alba</i>	-	-	-	6	4				10	Introduced
<i>hyemalis</i>										
<i>Alnus incana</i>										
<i>Amelanchier canadensis</i>	27	9	15	2	14				67	Pine, Hdwd., Bog
<i>sanguinea</i>	1	-	-	-	-				1	
<i>spicata</i>	7	14	8	-	4				33	Pine. Hdwd., Bog
<i>Anaphalis margaritacea</i>										
<i>Antennaria canadensis</i>	5	-	-	-	-				5	Characteristic in
<i>neodioica</i>	-	-	-	-	2				2	sandy places
<i>plantaginifolia</i>										
<i>Anemone canadensis</i>										
<i>cylindrica</i>										
<i>virginiana</i>										
<i>Apocynum androsaemifolium</i>	1	-	-	-	2				3	
<i>pubescens</i>										
<i>Arabis glabra</i>	-	-	-	*	-				-	Fire Plant
<i>Aralia hispida</i>	5	5	31	-	4				55	
<i>nudicaulis</i>	5	5	31	-	4				55	
<i>Arctostaphylos uvaursi</i>	2	-	-	-	14				16	Remnant of Heath Assoc.
<i>Arenaria leptocladus</i>										
<i>Asclepias phytolacoides</i>										
<i>syriaca</i>										
<i>Aster hirsuticaulis</i>	-	-	-	-	8				8	
<i>laevis</i>	36	3	13	4	10				66	Aspen assoc.
<i>lindleyanus</i>	-	-	-	-	20				20	
<i>macrophyllus</i>	-	1	-	-	34				35	
<i>Betula lutea</i>										
<i>papyrifera</i>	7	8	3	-	-				18	Needs wet air
<i>Botrychium</i> sp										
<i>Brachyelytrum erectum</i>										
<i>Bromus ciliatus</i>										
<i>Calamagrostis canadensis</i>										
<i>Carex communis</i>										
<i>foenea</i>										
<i>laxiflora</i>										
<i>lucorum</i>										
<i>umbellata</i>	-	-	-	46	-				46	Aspen
sp.										
<i>Cerastium</i> sp										
<i>Chimaphila umbellata</i>	4	3	15	-	4				26	Heath
<i>Cinna latifolia</i>	-	-	-	-	22				22	Low.
<i>Clintonia borealis</i>	-	-	1	-	-				1	Bog, hdwd., pine
<i>Comandra umbellata</i>	39	-	13	-	-				52	Aspen
<i>Convolvulus spithameus</i>	-	-	-	*	-				-	Char. Aspen
<i>Coptis trifolia</i>										
<i>Cornus canadensis</i>	-	-	-	-	32				32	Bog
<i>rugosa</i> (circ)	-	7	-	-	-				7	Aspen
<i>stolonifera</i>	-	-	-	-	2				2	Low.

Table 2- Continued

	GROUND PLANTS				ASPENS		Page 3
	I	II	III	IV	VII	XX/III/XXX/	Notes XXXX/XXX/
Corylus rostrata							
Crataegus roanensis							
Cypripedium acaule	1	*	-	*	-		Pines
Danthohia spicata	14	1	4	12	18		Sandy
Diervilla lonicera	40	40	20	20	58		Aspen, subdominant
Epigaea repens	1	1	4	-	2		Pines
Epilobium adenocaulon	-	-	-	-	2		Fire plant
angustifolium	-	1	-	-	-		" "
Equisetum arvense							
praealtum (hyem)							
variegatum							
sylvaticum							
Erigeron annuus	4	1	3	2	-		Fire plant
canadensis	1	-	-	*	-		" "
ramosus	-	-	-	2	-		" "
Fagus grandifolia	-	-	3	*	-		Hardwood
Festuca ovina							
Fragaria virginiana	5	-	1	-	4		Low
Fraxinus nigra							
Gaultheria procumbens	63	75	88	-	64		Heath
Gemmes canadense secata	1	-	-	-	-		Low
Gnaphalium decurrens	-	-	-	*	-		Low
obtusifolium							
Hamamelis virginiana							
Helianthemum canadense							
Hepatica orbicula	-	3	1	-	-		Hardwood
Hieracium aurantiacum	-	-	-	4	4		Introduced
gronovii							
paniculatum							
scabrum	4	-	1	-	4		Aspen
venosum	7	-	4	-	-		Aspen
Hypericum perforatum	-	1	-	-	-		Introduced weed
Ilex verticillata							
Keigia virginica depressa	-	-	-	6	-		Introduced weed
Lactuca canadensis	1	-	-	-	2		Fire plant
sagittifolia							
Larix laricina							
Lepidium virginicum	-	-	-	2	-		Fire plant
Lilium philadelphicum	-	-	-	-	2		Low
Linnaea borealis	-	-	3	-	8		Bog
Lonicera canadensis	-	1	-	-	4		Aspen, pine, hwd.
dioica	8	1	-	-	12		Aspen, pine, hwd.
glaucescens							
hirsuta							
Lycopodium tristachyum	1	-	1	-	-		Aspen exclusive
Lysimachia terrestris							
Maianthemum canadense	3	32	39	-	44		Pine. hardwood
Melampyrum lineare	55	37	47	-	18		Characteristic Aspen pl.
Mitchella repens							
Monotropa hypopitys	-	1	3	-	-		Pine, aspen exclusive
Moss and Lichen cover	5	4	42	42	12		
Myrica asplenifolia							

Table 2- Continued

	GROUND PLANTS				ASPENS			Page 4.
	I	II	III	IV ¹⁹³⁶	VII	VII/	VII/	Notes Total/V/V.
<i>Nemopanthus mucronata</i>	-	-	-	5	-	-	-	Fire plant
<i>Oenothera muricata</i>	-	-	-	5	-	-	-	Fire plant
<i>Oryzopsis asperifolia</i>	37	30	20	*	42	-	-	Pine, aspen
<i>pungens</i>	2	1	-	2	-	-	-	
<i>Panax trifolium</i>	-	-	-	-	-	-	-	
<i>Panicum depauperatum</i>	-	-	-	4	*	-	-	Characteristic aspen
<i>implicatum</i>	-	-	-	-	-	-	-	
<i>linearifolium</i>	-	-	-	-	-	-	-	
<i>meridionale</i>	-	1	-	4	4	-	-	Characteristic aspen
<i>perlongum</i>	-	-	-	-	-	-	-	
<i>tennesseense</i>	-	-	-	-	-	-	-	
<i>xanthophyllum</i>	7	*	1	-	-	-	-	
<i>Pedicularis canadensis</i>	-	4	3	-	-	-	-	Hemiparasitic on oak
<i>Petasites palmata</i>	-	-	-	-	-	2	-	Bog
<i>Picea glauca</i> (can)	-	-	-	-	-	4	-	
<i>mariana</i>	-	-	-	-	-	*	-	
<i>Pinus banksiana</i>	-	-	-	-	-	-	-	
<i>resinosa</i>	7	-	-	-2	2	-	-	Pine
<i>strobus</i>	9	16	7	*	10	-	-	Pine
<i>Poa compressa</i>	6	1	-	30	-	-	-	Introduced
<i>palustris</i>	-	-	-	-	-	-	-	
<i>pratensis</i>	-	-	-	8	-	-	-	Introduced
<i>Polygala pauciflora</i>	1	45	20	-	2	-	-	Pine
<i>Polygonatum biflorum</i>	-	-	-	-	-	-	-	
<i>Populus balsamifera</i>	-	-	-	-	2	-	-	Low, wet
<i>grandidentata</i>	9	3	7	42	-	-	-	Upland
<i>tremuloides</i>	3	1	3	2	4	-	-	Low
<i>Prenanthes racemosa</i>	-	-	-	-	-	-	-	
<i>Prunella vulgaris</i>	-	-	-	-	-	-	-	
<i>Prunus cuneata</i>	-	-	-	-	-	-	-	
<i>pennsylvanica</i>	1	1	1	-	-	-	-	
<i>virginiana</i>	-	-	-	-	-	-	-	
<i>Pteris aquilina</i>	998	100	99	94	76	-	-	Subdominant aspen
<i>Pyrola chlorantha</i>	-	-	-	-	-	-	-	
<i>epiliptica</i>	-	-	8	-	-	-	-	
<i>secunda</i>	-	1	-	-	2	-	-	Bog, pine
<i>Pyrus arbutifolia</i>	-	-	-	-	-	-	-	
<i>Quercus m. borealis</i>	28	19	11	6	-	-	-	Inter. aspen to pine
<i>Ribes cynosbati</i>	-	-	-	-	-	-	-	
<i>Rhamnus alnifolia</i>	-	-	-	-	2	-	-	Wet
<i>Rhus glabra borealis</i>	-	-	-	-	-	-	-	
<i>toxicodendron radicans</i> *	-	*	-	-	-	*	-	
<i>Rosa blanda</i>	-	-	-	-	42	-	-	Aspen
<i>Ranunculus recurvatus</i>	*	-	-	-	-	-	-	Bog
<i>Rubus allegheniensis</i>	5	1	-	-	-	-	-	
<i>canadensis</i>	-	-	-	-	-	-	-	
<i>strigosus</i>	1	-	-	-	-	-	-	
<i>triflorus</i>	-	-	-	-	-	-	-	
<i>Rumex acetosella</i>	*	-	1	*	-	-	-	Ubiquitous

Table 2- Concluded

	GROUND PLANTS				ASPENS		Page 5.
	I	II	III	IV	VII	YZ//YZZ/	Notes YZYZ/YIZ.
<i>Salix bebbiana</i> (rostr)	1	-	-	-	-	-	Aspen
discolor	-	-	-	-	8	-	Low or upland
discolor x bebbiana	*	1	-	-	10	-	
<i>Sambucus racemosa</i>	-	-	-	-	4	-	Bog
<i>Senecio balsamitae</i>	-	-	-	-	-	-	
<i>Shepherdia canadensis</i>	-	-	-	-	-	-	
<i>Silene antirrhina</i>	-	-	-	-	-	-	
<i>Smilicina racemosa</i>	1	1	5	-	2	-	Hardwood
stellata	-	-	-	-	-	-	
<i>Solidago canadensis</i>	-	-	-	-	*	-	Aspen to wet
graminifolia	-	-	-	-	-	-	
hispidula	21	7	13	16	4	-	Characteristic aspen
juncea	-	-	-	6	-	-	" "
rugosa	-	-	-	-	-	-	
<i>Taraxacum officinale</i>	1	-	-	-	2	-	Ubiquitous
<i>Tragopogon dubius</i>	-	-	-	*	*	-	Introduced
<i>Trientalis americana</i>	5	3	28	-	-	-	General, bog
<i>Thuja occidentalis</i>	-	-	*	-	-	-	Bog
<i>Trifolium hybridum</i>	-	-	-	-	-	-	
repens	-	-	-	-	-	-	
<i>Tsuga canadensis</i>	-	-	-	-	-	-	
<i>Ulmus americana</i>	-	-	-	-	-	-	
<i>Vaccinium pennsylvanicum</i>	9	20	32	16	10	-	Sandy
(angustifolium)	-	-	-	-	-	-	
penn. nigrum	-	-	-	-	-	-	
canadense	11	7	-	-	40	-	Bog
<i>Verbascum thapsus</i>	-	-	-	-	*	-	
<i>Viburnum acerifolium</i>	-	-	-	-	-	-	
cassinoides	-	-	-	-	-	-	
<i>Viola blanda</i>	-	-	-	-	-	-	
canadensis	-	-	-	-	2	-	Bog
eriocarpa	-	-	-	-	-	-	
pallens	-	-	-	-	-	-	
subvestita	-	-	-	-	-	-	
Unknown	-	-	-	-	-	-	
Total Number ground plants							
Number of Quadrats	100	75	75	50	50		