The Distribution of the Ericaceae at Douglas Lake, Michigan.

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The Ericaceae of the Douglas Lake region are represented among the small shrubs and evergreen herbs. The total flora of the region includes some 921 species *(* An Annotated List of the Higher Plants of the Region of Douglas Lake, Michigan - E. C. Gates and J. H. Ehlers.), of which the Ericaceae have twenty-four representatives as compared with the total number of species described in Gray's Manual of Botany, which is eighty-nine. Fourteen of the twenty-seven genera listed in Gray's Manual are represented. Though not so important in number, the Ericaceae are important in the region because of the types of topographical situations in which they are found.

Douglas Lake is located in Cheboygan County, Michigan, and is situated about seventeen miles south of the Straits of Mackinac. The topography is level to rolling due to glacial ice and water action. Douglas Lake is drained by small streams into Burt Lake, about two miles to the south. The region furnishes a diverse amount of vegetation due to its morainic character, and can be topographically divided into three

distinct groups:

I. The Aspens or Pinelands.
II. The Bogs.
III. The Hardwoods.

The distribution of the Ericaceae will be discussed according to these groupings.

I. The Aspens.

The aspen area is very extensive in the Douglas Lake region. This part of the region was once covered with a heavy growth of pines, hence the name Pinelands. These pinelands were lumbered about fourty-five years ago. Since that time forest fires have occurred from time to time, clearing the area of herbs and shrubs. The present vegetation consists typically of the following trees: Populus grandidentata Michx., Populus tremuloides Michx., Betula alba papyrifera (Marsh.) Spach., Quercus borealis Michx. f., Prunus pennsylvanica L. f. and Acer rubrum L. The ground covering is mainly a dense growth of Pteris aquilina L., Dieteilla Lonicera Mill., several species of Vaccinium L., Gaylussacia baccata (Wang.) C. Koch, and Gaultheria procumbens L. The soil in the aspens is sandy, the sand is some places being many feet deep.

The Ericaceae in the aspens must exist with a scarcity of moisture, as

the moisture content of drainable sand is only 11%. Gaultheria procumbens is the most abundant representative of the Ericaceae here. It is very common, in some places forming an extensive mat with few other plants. It is found in the aspen area immediately surrounding the lake, and in all places where the aspens predominate and is a relic of the days when the pines covered the area.

With Gaultheria procumbens is found Chimaphila umbellata (L.) Nutt. It is not common in this area although fairly well represented. It too is a relic of the pine woods.

Epigaea repens L. is more abundant in patches. In Carp Creek Gorge, a deep depression in the aspens, it is becoming quite common. Although it can exist in sunlight, it spreads more rapidly in the shade, forming patches of considerable size.

Arctostaphylos Uva-ursi (L.) Spreng. is found in certain areas forming mats of considerable size. Along the shore of the lake, where ice and wind action have formed low dunes, it is particularly abundant. It adapts itself exceedingly well in such situations by its creeping habit. In the aspens proper it is noticeable as a representative of the Ericaceae that can

exist in xerophytic conditions.

In a certain restricted area near the Biological Station, several large clumps of Monotropa Hypopitys L. were found in the aspens in 1920. In 1925, one clump was found again in the same situation, and is very rare in such a situation as the aspens afford, since it is saprophytic on roots or grows on decomposing vegetable matter, which is not common in the aspens.

Three species of the genus Vaccinium are very abundant in the aspens, namely: Vaccinium canadense Kalm., Vaccinium pennsylvanicum Lam., and Vaccinium pennsylvanicum nigrum Wood. Of the three, Vaccinium pennsylvanicum is the most abundant because it thrives best in areas that are not too shady. The burnt-over places in the aspens therefore are especially favorable. With Vaccinium pennsylvanicum is found Vaccinium pennsylvanicum nigrum. It is quite abundant. Vaccinium canadense also is common in this association. A great deal of the low shrub covering in the aspens is afforded by these three species. With them occurs a rather abundant shrub, Gaylussacia baccata, the huckleberry. It is as frequent in its distribution as the Vaccinium species, forming extensive

patches.

Of the genus Pyrola, few species have been found in the aspens. Pyrola asarifolia incarnata (Disch.) Fernald has been found where the soil is richer, and in places where the aspens are giving way to denser lowland growth. Pyrola elliptica Nutt. is fairly frequent where the trees are taller and shade the ground better, and Pyrola chlorantha Sw., which is not common in the region, was found in three clumps in an area of lowland aspens, mixed with some hardwoods.

As the moisture content of the soil in the aspen area is very scarce, as has been stated, most of the Ericaceae exist there because of their special water-absorptive structures and power to adapt themselves to xerophytic habitats. The following list explains the distribution of the Ericaceae in the aspens.

Table 1.

The Distribution of the Ericaceae in the Aspens		
1.	Arctostaphalos Uva-ursi.	Rather common on sand banks and low dunes of Douglas Lake and in the aspens in patches; one clump of considerable size near the Biological Station.
2.	Chimaphila umbellata	Gorge, Bryant's trail, Smith's Bog, Reese's trail, aspen hills east of Gorge. Frequent in pineland aspens.
3.	Epigaea repens.	Rather abundant, noticeably in aspens surrounding Gorge, near Smith's Bog and Reese's and Bryant's Bog.
4.	Gaultheria procumbens	Very common in aspens as a pine relict.
5.	Gaylussacia baccata.	Rather abundant with the Vaccinium species.
6.	Monotropa Hypopitys.	One clump in the vacinity of the Biological Station.
7.	Pyrola asarifolia incarnata.	In the lowland aspen areas, rather frequent near Reese's Bog, East Point Bog, and in open aspen spaces in Reese's Bog.
8.	Pyrola elliptica	Occasional in the aspens.
9.	Pyrola chlorantha	Several clumps in an Aspen-Hardwood area bordering the east shore of Burt Lake.
10.	Vaccinium canadense.	Common in aspens everywhere.
11.	Vaccinium pennsylvanicum	Very abundant in the aspens.
12.	Vaccinium pennsylvanicum nigrum.	Abundant in aspens with other Vaccinium species.

II. The Bogs.

In the Douglas Lake region a typical bog is a depression covered with water and usually lacking drainage. Surrounding the water is a mat formed by the tangling roots of plants and decaying material, which is more or less stable depending upon the depth of the open water. As the mat becomes grounded, the low and high bog-shrub associations invade it, and are followed by the lowland trees.

The mat of the bog is an excellent habitat for the Ericaceae. The soil is usually acid and, because of the little or no drainage, only such plants as can adapt themselves to such conditions can exist there. Carex filiformis L. is one of the first mat formers, as its roots tangle together easily. Sphagnum (Dill.) species also grow quickly in sun or shade and follow the Carex in succession. Along with the Sphagnum comes Chamaedaphne calyculata L., one of the most important stabilizers of the mat, and the most numerous specie of the Ericaceae in the bogs of the region. It is a quick grower and dominates the heath association, and is represented in every bog of the region.

On the mat with Chamaedaphne are

several other Ericaceous plants. Noticably among these is Ledum groenlandicum Oeder, which is fairly common in its bog distribution. Like Chamaedaphne and the other Ericaceae in the bogs, its leathery leaves and xeromorphic characteristics make it especially fitted for bog growth. Kalmia polifolia Wang. and Andromeda glaucophylla Link. also are found on the mat but are not as frequent except at Bryant's Bog, where Kalmia is fairly abundant, and at Mud Lake, where Andromeda is especially well established.

Both the small cranberry, Vaccinium Oxycoccus L., and the large one, Vaccinium macrocarpon Ait, are represented in the bogs of the region. Vaccinium Oxycoccus is common on the mat in the Chamaedaphne association, but Vaccinium macrocarpon is relatively rare in its distribution. Of the other Vaccinioideae heretofore recorded in the aspen area, Vaccinium canadense and Gaylussacia baccata are also occasionally found in the bogs.

While most of the Ericaceae in the bogs are found on the mat, a few are in the low or high bog shrub association, which invades the mat, and in the Larix (Tourn.) Adans. or Thuja L. forest surrounding, either of which may be the climax association. Of the genus Pyrola,

Pyrola asarifolia incarnata is found in the bogs as well as aspens, especially noticable in Reese's Bog. Pyrola secunda is by far the most abundant Pyrola in the bogs, in some places being found in areas of considerable size. It was noted in a Larix Bog, about one and one-half miles north of Mud Lake Bog, as well as in Thuja Bogs. Pyrola chlorantha also was noted in the same Larix Bog and at Reese's Bog.

Moneses uniflora (L.) A. Gray is locally abundant in the bogs, particularly so in Reese's Bog.

In the same sort of situation is found Chiogenes hispidula (L.) T. & G. This plant is fairly common in the Thuja bogs and can also grow in the more open sunny places, for it is often found creeping over mossy logs in the bogs and along bog roads. It is infrequently found in fruit in the region.

Two species of saprophytes of the Ericaceae are found in the bogs, namely: Monotropa Hypopitys L. and Monotropa uniflora L. Monotropa Hypopitys also is found in the aspens as recorded above. It is not at all common in the bogs and is found saprophytic on the roots of Thuja occidentalis L. at Reese's and

Mud Lake Bogs. Monotropa uniflora, the Indian Pipe, is occasionally found in the Thuja bogs where the soil is rich and the shade relatively dense. It also is saprophytic on roots or grows on decomposing vegetable matter.

Gaultheria procumbens is occasionally found in Thuja bogs but is not at all as common as it is in the aspens. It grows where the land is higher, as therefore the drainage is somewhat better. Epigaea repens also was noted in Mud Lake Bog where the aspens are more abundant.

The following annotations explain the distribution of the Ericaceae in bogs.

Table II.

The Distribution of the Ericaceae in the Bogs.

1.	Andromeda glaucophylla.	Frequent in Chamaedaphne association. Smith's Bog (scarce), Bryant's Bog, Mud Lake (in Chamaedaphne and Iris - Aspidium associations), Reese's Bog.
2.	Chamaedaphne calyculata.	Very common in bogs as the dominant specie in heath association. Smith's, Gleason's, Bryant's Elder's Reese's, Mud Lake Bogs.
3.	Chiogenes hispidula	Fairly common in Thuja Bogs. Bryant's, Reese's, Mud Lake Bogs.
4.	Epigaea repens	Only where the bog is drier as it is typically aspen in habitat. Noted at Mud Lake Bog.
5.	Gaultheria procumbens.	Found in same conditions as above. Bryant's Bog. Smith's Bog Mud Lake Bog.
6.	Gaylussacia baccata.	Not typical in a bog habitat. Gleason's Bog, Bryant's Bog, Mud Lake Bog - more abundant at the northern end.

Table II. (continued).

The Distributions of the Ericaceae in Bogs.		
7.	Kalmia polifolia.	In Chamaedaphne association. Smith's Bog - scarce. Bryant's and Gleason's Bogs.
8.	Ledum groenlandicum.	Abundant in Chamaedaphne association in Thuja and Larix Bogs. Reese's, Bryant's, Mud Lake, East Point and Gleason's Bogs.
9.	Moneses uniflora	Abundant in patches, noticeably in Reese's bog.
10.	Monotropa Hypopitys.	Three patches in Mud Lake Bog near N.W. trail. Reese's bog. Not common.
11.	Monotropa uniflora.	Pine Pt. lowland. Occasionally at Reese's Bog and Mud Lake Bog. Not common.
12.	Pyrola asarifolia.	Not common. Reese's Bog.
13.	Pyrola asarifolia incarnata.	In more open places in bogs. Fairly common in Reese's, East Point, Mud Lake Bogs, and Pine Point lowlands.
14.	Pyrola chlorantha	Not common in bogs. Mud Lake Bog and Reese's Bogs.
15.	Pyrola secunda.	Common. Gorge, Ruggleville Rd., Reese's Bog and Mud Lake Bog.
16.	Vaccinium canadense.	In Chamaedaphne association in Gleason's, Bryant's, Mud Lake Bog.
17.	Vaccinium macrocarpon	In Chamaedaphne association in Bryant's and Mud Lake Bogs. Not so common.
18.	Vaccinium Oxycoccus.	In Chamaedaphne association at Bryant's, Mud Lake, Reese's Bogs. Common.

III. The Hardwoods.

Where the land is more elevated, the amount of clay and humus in the sand is much more abundant. The hardwoods of the region, the beech-maple-hemlock stands, are found on these higher well drained elevations. However, beneath the humus the soil is always moist, so the vegetation is much denser than in the pinelands.

At present the hardwoods are not well distributed in the Douglas Lake region as the original areas were cut over and burned. Two areas are still representative of the past cut over areas, namely, one tract on the west shore of Burt Lake and an area known as the Mud Lake Hardwoods. In these areas Acer saccharum Marsh Betula lutea Michx f., Fagus grandifolia Ehrh., Tsuga canadensis (L.) Carr., and Tilia americana L. are the dominant trees, and the ground cover is largely made up of ferns and such representative herbaceous plants as Smilacina racemosa (L.) Desf., Polygonatum biflorum (Walt.) Ell., Trillium (L.) sp., Viola (Tourn) L. sp., Trientalis americana (Pers.) Pursh., Galium L. sp. and Circaea alpina L.

The type of vegetation is much more southern here, for the region is in the transition zone between the coniferous

forests of the north and the hardwoods of the central plains. Not many of the Ericaceae are found in the hardwoods, the genus Pyrola having the largest representation with four species. Pyrola americana Sweet is represented in the beech-maple forest though not abundantly and Pyrola chlorantha, which was found in the lowland aspen area at Fontanalis Run, is fairly frequent in the association also. It is found where the humus in the soil is rich enough to support a denser growth. Pyrola elliptica Nutt. is also found in such situations and is fairly frequent. Pyrola secunda is not common in the hardwoods as it is in the bogs. It seems to prefer the more acid soil to the higher better drained land.

Chimaphila umbellata is quite common in the beech-maple forest of the region. It is found growing in patches, the long running under-ground shoot producing short ascending stems bearing the flowers. It is much more abundant here than in the aspens.

In some places relatively large clumps of Monotropa uniflora are found. These clumps are never very numerous but are found more frequently in the hardwoods than in any other situation.

The Ericaceae in the hardwoods are distributed as follows:

Table III.

Distribution of the Ericaceae in the Hardwoods		
1.	Chimaphila umbellata.	Common in beech-maple association. Burt Lake, Gorge region.
2.	Monotropa uniflora.	Not uncommon in hardwoods. Burt Lake.
3.	Pyrola americana.	Rather infrequent.
4.	Pyrola elliptica	Not common. Burt Lake, Mud Lake.
5.	Pyrola chlorantha	In lowland aspens and beech-maple forests. In restricted areas on Burt Lake and Mud Lake hardwoods.
6.	Pyrola secunda.	On Riggsville road in an Acer Association. Not common in Burt Lake Hardwoods.

The Ericaceae of the Douglas Lake Region.

Subfamily I. - Pyroloideae (Pyrola Subfamily).

Tribe II. - Pyroleae.

Chimaphila umbellata.
Moneses uniflora.
Pyrola secunda.
Pyrola chlorantha.
Pyrola elliptica.
Pyrola americana.
Pyrola asarifolia.
Pyrola asarifolia incarnata.

Subfamily II. - Monotropoideae (Indian Pipe Subfamily)

Monotropa Hypopitys.
Monotropa uniflora.

Subfamily III - Ericoideae (Heath Subfamily).

Tribe I - Rhododendreae.

Ledum groenlandicum.
Kalmia polifolia.

Tribe II - Andromedeae.

Andromeda glaucophylla.
Chamaedaphne calyculata.
Epigaea repens.
Gaultheria procumbens.

Tribe III - Arbuteae.

Arctostaphylos Uva-ursi.

Subfamily IV. - Vaccinoideae (Whortleberry Subfamily)

Chiogenes hispidula.
Gaylussacia baccata.
Vaccinium canadense.
Vaccinium pennsylvanicum.
Vaccinium pennsylvanicum nigrum.
Vaccinium Oxycoccus.
Vaccinium macrocarpon.

Summary:

1. The Ericaceae of the Douglas Lake region, Cheboygan County, Michigan, are represented among the small shrubs and evergreen herbs.

2. Their distribution can be classed topographically into three distinct groups, namely: (1) The Aspens or Pinelands, (2) The Bogs, and (3) The Hardwoods.

3. Fourteen of the twenty-seven genera of the Ericaceae are represented with twenty-four species, and are important because of the types of topographical situations in which they are found.

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Pyrola americana

Chimaphila umbellata

Monotropa hypopitys

Monotropa uniflora

Table IV.

Frequency Indicies of Ericaceae in Aspens.

Species.	Pineland Aspens. 1925	Pineland Aspens. 1927	Aspens as Whole. 1918 to 1923
Arctostaphylos-Uva-ursi	.6	0	.3
Chimaphila umbellata	1.1	.7	1.3
Epigaea repens.	.9	.7	.5
Gaultheria procumbens	44.1	39.0	35.6
Gaylussacia baccata	1.7	.6	2.4
Monotropa hypopitys	.1	0	0
Pyrola elliptica	.1	.6	2.9
Pyrola secunda	.2	0	1.2
Vaccinium canadense	3.3	3.3	3.7
Vaccinium pennsylvanicum	27.2	22.3	15.0
Vaccinium pennsylvanicum nigrum.	.1	0	4.6

This table was compiled by the Ecology classes of the Biological Station under the direction of Prof. F. C. Gates. The data was procurred by the use of the quadrat method in certain aspen areas near the station.