THE UNIVERSITY OF MICHIGAN
Biological Station

The Terrestrial Vegetation and Flora of North and South Manitou Islands, Sleeping Bear Dunes National Lakeshore

Technical Report No. 11

Brian T. Hazlett
and
Robert J. VandeKopple

Douglas Lake

THE TERRESTRIAL VEGETATION AND FLORA OF NORTH AND SOUTH MANITOU ISLANDS, SLEEPING BEAR DUNES NATIONAL LAKESHORE, LEELANAU COUNTY, MICHIGAN

Brian T. Hazlett
Division of Biological Sciences
The University of Michigan

Robert J. Vande Kopple
The University of Michigan Biological Station

Report submitted in fulfillment
of contract CX-6000-2-0043

September, 1983

ABSTRACT

The vegetation and flora of North and South Manitou Islands in northern Lake Michigan were surveyed during the summer of 1982 and the spring of 1983, the first comprehensive study of both islands. The vegetation associations were mapped and described, and a catalogue of 490 vascular plant species was compiled. A noticeable difference in forest structure and floristic composition between the islands was observed, largely due to an introduced deer herd on North Manitou. Twenty permanent plots were established on the islands to observe any future changes at selected sites. The island distributions of eight native species listed as threatened or of special concern by the State of Michigan were mapped and fragile habitats were identified. Recommendations concerning the resource management of these islands are proposed.

The Terrestrial Vegetation and Flora
of North and South Manitou Islands,
Sleeping Bear Dunes National Lakeshore,
Leelanau Co., Michigan

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

North and South Manitou Islands are an outstanding laboratory for vegetation studies. As islands they are distinct units with easily defined boundaries and are also somewhat isolated. The Manitous are situated in northern Lake Michigan about seven miles from the nearest mainland (Figure 1). Together they occupy just over 31 square miles (20,013 acres) of Leelanau Co., Michigan. Geologically, both islands are glacial deposits which overlay Devonian limestone. North Manitou, the larger, is about 23 square miles (14,753 acres) in area and is situated about 3.5 miles northeast of South Manitou. It has two inland lakes, Lake Manitou and Tamarack Lake. South Manitou occupies a little over 8 square miles (5,260 acres) and has one inland lake, Lake Florence. Much of the island's western border is comprised of perched sand dunes. The 45th parallel skims the southern edge of South Manitou, placing both islands well within the hemlock-white pine-northern hardwood region of Braun (1950).

The vegetation of the islands has been influenced by human activity since the mid-1800s when the islands were the source of cordwood for passing steamers. Later, farmers settled and cleared the land further. As farming began to decline due to the difficulty of delivering produce to market, the islands attracted summer visitors. A private hunting preserve was operated on North Manitou under the direction of the Manitou Island Association beginning in the 1920s. As recreational demand in this region escalated during the 1960s, Congress placed these islands under

the administration of the National Park Service when it established Sleeping Bear Dunes National Lakeshore in 1970.

Previous vegetation studies of the islands have been limited. The dunes of North Manitou were briefly described in Henry C. Cowles's (1899) monumental vegetation study of Lake Michigan dunes. A brief description of the vegetation of the northern hardwood forests (Whitford, 1901) and the area around Tamarack Lake (Coulter, 1904) have appeared in studies completed by a few of his associates. Other studies of North Manitou have been confined to the field notes of a few investigators. South Manitou has had a few published studies (Thompson, 1974; Shugart, 1976), but most, however, have dealt with a small, yet botanically interesting area popularly known as the Valley of the Giants (Thompson, 1962a, 1962b, 1963, 1967). A short note on the vegetation of both islands was included by Hatt et al. (1948). Funding for this comprehensive study of both islands was provided by a grant from the National Park Service.

The study should assist Sleeping Bear Dunes National Lakeshore in its natural resource management of the islands by

1) providing baseline data on the present vegetation of the islands,

2) comparing the existing flora and vegetation of both islands to assess the effect of the non-native deer population on North Manitou, and forecasting the recovery of the flora and vegetation which may occur after a future reduction in that population,

3) identifying fragile habitats which might be damaged through misuse or development,

4) documenting the vascular flora of the islands and compiling a checklist of species to assess the status of the present flora,

5) mapping the locations of threatened species,

6) illustrating the special nature of the islands, and

7) recommending specific management alternatives from a botanical perspective.

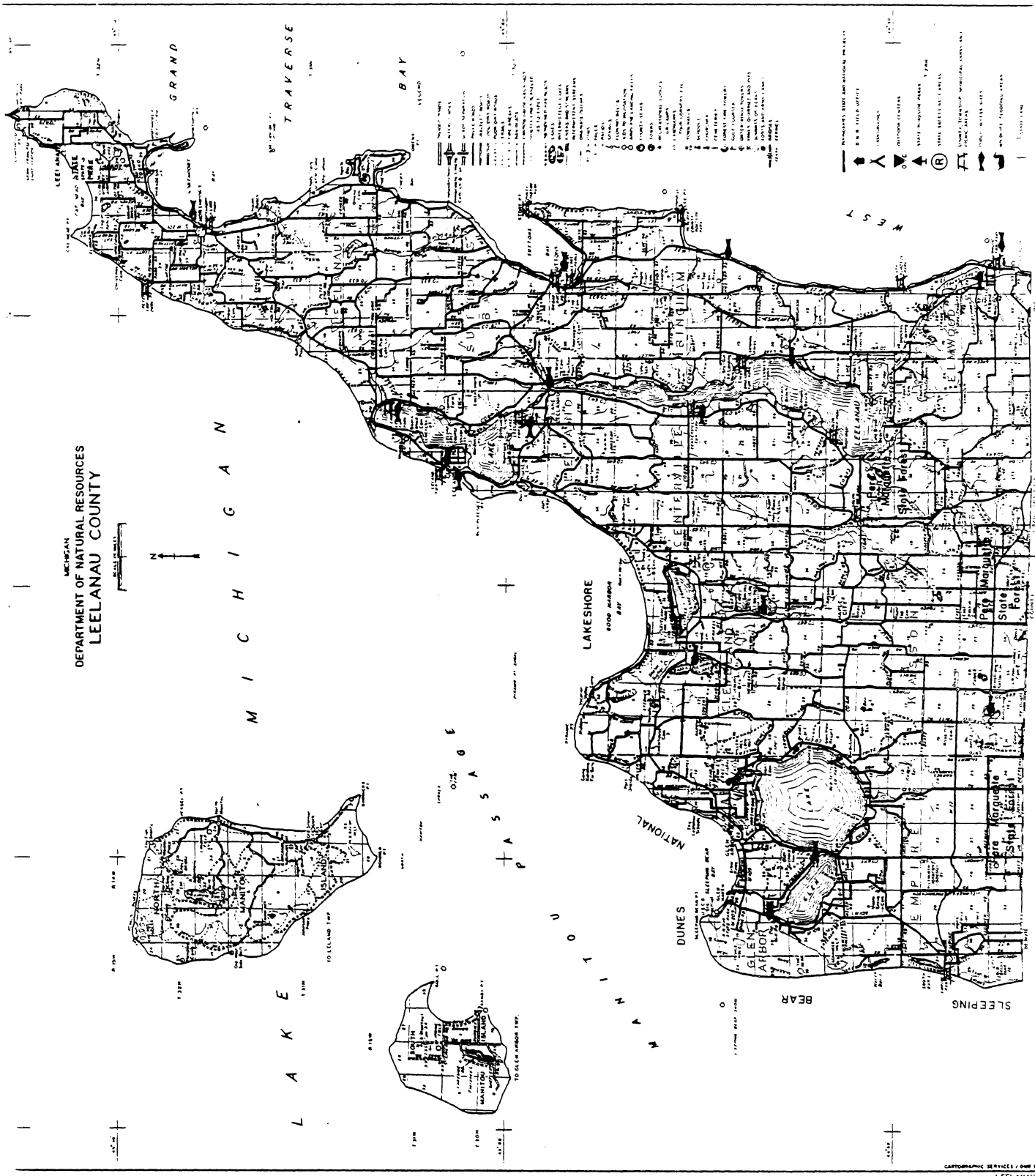


Figure 2. The location of North and South Manitou with respect to the mainland.

METHODS

The initial field work for this study continued from June to September, 1982, and covered two major areas: the survey of the vegetation, and the documentation of the vascular flora. The field investigator established residence on South Manitou on June 16 and remained until September 24. During this time two trips (July 5-July 9, August 6-August 9) were made to the Biological Station at Douglas Lake to consult with others associated with the project and to work on the identification of unknown specimens. Four trips (June 29-July 3, July 21-July 27, August 20-August 22, September 1-September 7) were made to North Manitou to establish permanent plots, to collect specimens, and to survey the vegetation. Two additional trips were made to the islands in 1983. The first (May 22 - June 11) was made to include the spring flora in this study. North Manitou was visited from June 1 - June 5. A second trip (July 8 - July 10) to South Manitou was made to confirm observations made during previous field work.

The terrestrial vegetation was mapped using both aerial photographs and ground verification. Maps began as mylar overlays drawn directly from Agricultural Stabilization and Conservation Service (ASCS) black and white (b/w) photographs taken in 1973 (1 in. = 660 ft.). Later, Michigan Department of Natural Resources (DNR) color infra-red photographs taken in 1977 and ASCS color slides taken during 1982 were consulted. Next, as much area as possible on both islands was covered on foot to correlate the overlay maps with the vegetation itself.

In the field, the vegetation was typed using the dominant species concept (Curtis, 1959). In each stand the two to four dominant species based on cover were identified for each layer of the vegetation. For mapping purposes the overstory was defined as trees taller than 12 feet; the understory as shrubs and trees shorter than 12 feet; and the ground layer as those herbaceous plants and seedlings of forest trees close to the ground. For the most part the overstory was given more importance in determining the final vegetation types. The minimum size of a stand was generally ten acres except in well defined areas such as fields and clearings. In areas where the dominance of a few species was not easily observed such as in wetlands, a more general classification was used.

Although the general pattern of the vegetation was mapped using the dominant species concept, a few permanent plots were established on both islands to gather data at selected sites. These plots were established primarily to allow the observation of any changes in the vegetation at a specific site rather that to quantitatively describe the vegetation. Twenty permanent plots (40 ft. x 40 ft.) were placed in representative habitats. This size was selected in order that all plots would conform to the size of the three deer exclosures already on North Manitou. Each corner post of a plot was marked with an aluminum tag on which was written the plot number and the orientation (ie. NE, SE, SW, NW) of that corner. Inside the plot a complete list of all herbaceous species was made, the species and diameter at breast height (dbh) of all trees over 1 in. dbh were recorded (as a means of classifying the overstory), and the number of stems of each

species (clumps in the case of Yew, Taxus canadensis) taller than three feet and under 1 in. dbh was counted. Tallies from each plot are found in Appendix B. To further document any future changes in the plots, four photographs, one from each corner looking toward the opposite diagonal corner, were taken of each plot using both b/w print and 35 mm color slide film. The deer exclosures on North Manitou were also examined in the same manner.

Nine permanent plots were established on North Manitou. Three of these plots were set as controls for the deer exclosures on the island. Seven-foot, orange-topped, metal snowfence stakes set to 3.5 feet high were used to mark the corners of these plots. Eleven plots were established on South Manitou. Three-foot, orange-topped rods (3/8 in. dia.) set to 1.5 feet high were used to mark the corners of these plots in an attempt to reduce their visual impact. The locations of the permanent plots on both islands are shown in Figure 2. A brief description of and specific directions to each permanent plot site can be found in Appendix A.

The vascular flora was documented by the collection of voucher specimens during the field investigation. The occurrence and relative abundance of threatened species were also noted. An annotated checklist of vascular plants compiled during this investigation has been included at the end of this report.

DESCRIPTION OF THE VEGETATION

SOUTH MANITOU

NORTHERN HARDWOODS

In the mid-1800s the forests of South Manitou were the source of cordwood for passing steamers. By the time of the General Land Office Survey of 1847, much of the Coastal Forest had already been cut. The Northern Hardwoods were not spared and few, if any, sites remain which have not been disturbed by lumbering activities. In later years the Northern Hardwoods provided maple syrup and building material for island residents in addition to firewood for themselves and for the lighthouse fog station. The Northern Hardwoods is the largest forest association on South Manitou. The dominant tree species are sugar maple (Acer saccharum) and beech (Fagus grandifolia). Subtypes of this association were determined by the occurrence and prevalance of associated tree species such as yellow birch (Betula alleghaniensis), white birch (Betula papyrifera), basswood (Tilia americana), ash (Fraxinus sp.) and hemlock (Tsuga canadensis). These subtypes are listed below:

1) Beech-Maple
2) Beech-Maple-Yellow Birch-Hemlock
3) Beech-Maple-Oak
4) Beech-Maple-Ash
5) Maple-Ash-Basswood

The Northern Hardwoods is rich in herbaceous species. The most common of these species throughout the association include Actaea pachypoda, Allium tricoccum, Arisaema triphyllum,

Botrychium virginianum, Caulophyllum thalictroides, Dryopteris marginalis, Hepatica acutiloba, Maianthemum canadense, Osmorhiza claytoni, Polygonatum pubescens, Trillium grandiflorum, and Viola canadensis. In the spring these forests abound with Dicentra canadensis, D. cucullaria, Dentaria laciniata, D. diphylla, and Erythronium americanum. Several Viola species are also in bloom including V. conspersa, V. pubescens, and V. rostrata. Trillium cernuum and Trillium erectum are readily observed as well.

Beech-Maple

The beech-maple subtype lies largely on the west and south sides of Lake Florence. Sugar maple and beech are the dominant species although an occasional hemlock, yellow birch, white birch, or ash might be encountered. The understory is composed of wild gooseberry (Ribes cynosbati), red elderberry (Sambucus pubens), maple-leaved viburnum (Viburnum acerifolium) with sugar maple, beech, and hemlock saplings. The ground layer is characterized by the common herbs mentioned earlier as well as Carex plantaginea, Galium sp., Habenaria orbiculata, Mitchella repens, Sanguinaria canadensis, Smilacina racemosa, Solidago flexicaulis, and Uvularia grandiflora.

Beech-Maple-Yellow Birch-Hemlock

In this subtype yellow birch and hemlock are more common than in the beech-maple subtype. White birch is occasionally found in some areas. This subtype occurs mainly on the east side of Lake Florence and extends to the north dunes area. The Coastal Forest borders much of its eastern edge. Generally, yew (Taxus canadensis) is also more common in this subtype than in the

beech-maple subtype. Red elderberry and saplings of overstory species complete the understory. Common herbs include the principal ones listed earlier plus Dryopteris spinulosa, D. intermedia, Habenaria orbiculata, Mitchella repens, and Trientalis borealis.

Perhaps the best explanation for the occurrence of the beech-maple-yellow-birch-hemlock subtype on one site and the beech-maple subtype on another would be different lumbering histories. The beech-maple subtype, however, tends to occur in higher, better drained areas, so topographic factors may have some influence.

A great deal of variability occurs within this subtype. In moist sites near Lake Florence, red maple (Acer rubrum) occurs in the overstory. Even a few young American elm (Ulmus americanus) are found near the south end of the lake. In the region between Lake Florence and the Coastal Forest, balsam fir (Abies balsamea) is a frequent understory species. In the woods near the north dunes, white birch and ironwood (Ostrya virginiana) are common while hemlock declines in abundance.

Beech-Maple-Oak

Red oak (Quercus rubra) regularly occurs within the Northern Hardwoods on some stabilized dunes near Popple Campground. Several other tree species such as hemlock, yellow birch, white birch, basswood, and ash occur here as well. Nearer Lake Michigan, beech declines while ironwood, quaking aspen (Populus tremuloides), and big-tooth aspen (P. grandidentata) commonly occur with sugar maple, red oak, ash, and white birch. Regular

understory species include yew, maple-leaved viburnum, hemlock, and beech. Other species which are frequently encountered include red elderberry and saplings of ironwood and sugar maple. Ground layer herbs include several of the common Northern Hardwoods herbs. The most common in the beech-maple-oak subtype are Dryopteris marginalis, Osmorhiza claytoni, Actaea pachypoda, Clintonia borealis, Maianthemum canadense, Smilacina racemosa, Solidago flexicaulis, and Polygonatum pubescens.

Beech-Maple-Ash

Ash is a common overstory species with beech and sugar maple in the Northern Hardwoods which occupy much of the moraine on the western regions of the island. Hemlock is often present as are an occasional yellow or white birch. The understory is largely composed of red elderberry with beech and sugar maple saplings. Choke cherry (Prunus virginiana) and ash saplings are not uncommon. Frequent ground layer herbs include Dryopteris spinulosa, Melica smithii, Sanguinaria canadensis, and Smilacina racemosa in addition to the common Northern Hardwoods herbs mentioned earlier. A small part of this subtype was lumbered around twenty years ago. Generally, the herbs and overstory species are the same as in the uncut areas, but the understory is less dense and the woods are more open where it was cut.

Maple-Ash-Basswood

This Northern Hardwoods subtype occurs on stabilized dunes close to the edge of the perched dunes on the island's west side. Sugar maple, ash, and basswood are the prominent species in this subtype, but ironwood, white cedar (Thuja occidentalis), and white

birch may also occur, especially in areas near dune edges. Beech and hemlock might also be found throughout the subtype. The understory layer consists mainly of a substantial yew cover, as well as maple-leaved viburnum and mountain maple (Acer spicatum). Some ironwood and red elderberry also occur. Solidago flexicaulis and Aralia racemosa frequently occur in the ground layer with the common Northern Hardwoods herbs.

CEDAR-MAPLE-ASH (Valley of the Giants)

The Valley of the Giants, or "Cedars" as they are called by islanders, has the most interesting vegetation association on the Manitous. The casual visitor is awed by the size of the trees and by the lush appearance of the ground cover. A trained observer is also impressed with the diversity of the flora and with the presence of rare species. This small grove is shadowed by sugar maple, ash, and white cedar. At one time cedar had a greater cover value in this area, but as the older cedars died, they were replaced by deciduous species. Basswood and white birch also occur here to a small extent. The understory is predominantly mountain maple and yew with some choke cherry, red elderberry, and overstory saplings.

The herbaceous species are very diverse and include many of the common Northern Hardwoods species such as Trillium grandiflorum, Osmorhiza claytoni, Arisaema triphyllum, Hepatica acutiloba, Aralia racemosa, Botrychium virginianum, Solidago flexicaulis, Thalictrum dioicum, Smilacina racemosa, Actaea pachypoda, Viola canadensis, Adiantum pedatum, Allium tricoccum, and Polygonatum pubescens. Additional species more common here

than in the Northern Hardwoods include Mitella nuda, M. diphylla, Actaea rubra, Polystichum lonchitis, and Cypripedium calceolus.

The Cedars is also the location of several rare species including Camptosorus rhizophyllus (walking fern) and Asplenium viride (green spleenwort). Two National Champion Big Trees (Acer spicatum, girth-16 in., height-48 ft., crown-34 ft.; Thuja occidentalis, girth-206 in., height-111 ft., crown-42 ft.) occur in this area (Michigan Natural Features Inventory, Lansing).

It appears that the Cedars encompassed a larger area in the past as witnessed by several white cedar stumps in the woods east of the grove. A few stumps even occur within the Cedars itself. Several ideas have surfaced regarding the survival of the huge white cedars. A few theories include the presence of sand in the wood which dulled saw blades, the difficulty in bringing the logs out, and the sentimental preservation of the largest trees by lumbermen. For whatever reason this unique grove remains, it is a significant feature in the natural history of the Manitou Islands. It is a national treasure which merits the utmost in protection.

NORTHERN CONIFERS

The Northern Conifers are a small, yet distinct association which occurs on the steep south-facing lake bluff on the southwest corner of the island, and on the exposed slopes bordering the east edge of the open perched dunes. The Northern Hardwoods association borders the Northern Conifers on the opposite side. Occasionally, species from both the dunes and Northern Hardwoods occur within the Northern Conifers. Characteristic tree species include a dense growth of white cedar, balsam fir, and white birch

with an occasional white spruce (Picea glauca). On the dune side of the Northern Conifers, jack pine (Pinus banksiana), common juniper (Juniperus communis), balsam poplar (Populus balsamifera), red osier (Cornus stolonifera), and buffalo-berry (Shepherdia canadensis) are common. Northern Hardwoods tree species such as sugar maple and basswood may also be found. The understory is varied including yew, red elderberry, and mountain maple with some wild honeysuckle (Lonicera dioica), fly honeysuckle (L. canadensis), round-leaved dogwood (Cornus rugosa), pagoda dogwood (C. alternifolia), maple-leaved viburnum, and snowberry (Symphoricarpos albus) as well as saplings of overstory species.

Herbaceous species include Carex eburnea, Goodyera repens, G. oblongifolia, Linnaea borealis, Maianthemum canadense, and Cypripedium calceolus. Northern Hardwoods herbs such as Prenanthes alba, Arisaema triphyllum, Galium triphyllum, and Viola spp. are also encountered. Thompson (1974) describes the Northern Conifers as "boreal" and from quadrat data (sec. 5, SW 1/4) also notes the occurrence of highbush cranberry (Viburnum Opulus), Rosa blanda, Celastrus scandens, Trientalis borealis, Clintonia borealis, Aralia nudicaulis, and Polygala paucifolia.

COASTAL FOREST

The forest on the sandy flat region between the Northern Hardwoods and the bay on South Manitou's east side is a diverse mixture of conifers and broadleaved trees. Aerial photos of this area show a series of concentric ridges formed as post-glacial lakes receded to the current level of Lake Michigan. The

intermittent swales between the ridges are moist and occasionally support a different flora than the ridges.

The entire Coastal Forest as it is presented in this report has been typed as "pine plains" by Thompson (1967), but perhaps this may be too narrow a description for the entire forest. The principal subtypes are:

1) Mixed Pines
2) Cedar-Fir-Aspen
3) Hemlock-Hardwoods

The distribution of these subtypes might be due in part to soil moisture. The mixed pines subtype generally occurs on the most xeric sites. Conversely, the cedar-fir-aspen subtype occurs on mesic sites in the central region of the Coastal Forest where the relict beach ridges are most prominent. Perhaps this subtype's central location is protected from influences such as dune formation which are more likely to occur at sites closer to Lake Michigan.

The fringe of the Coastal Forest immediately along the bay may show the effects of its proximity to a cold body of water. Here a narrow band predominately of white cedar and balsam fir with some red pine (Pinus resinosa) and white pine (Pinus strobus) borders the sand. This conifer belt is most easily viewed from atop the lighthouse.

Mixed Pines

This subtype mainly occurs north of Chicago Rd. In some places the coniferous species are clearly predominant, while in other sites deciduous species are common as well. Principal

conifers are white pine, red pine, jack pine, and balsam fir with an occasional white cedar or hemlock. The most common deciduous species is white birch. There are a few red oak, sugar maple, and ironwood trees. Yew is usually present where understory has developed. Other regular understory species include balsam fir, white birch, and snowberry. Common herbaceous species are Diervilla lonicera, Pteridium aquilinum, Toxicodendron radicans, Oryzopsis asperifolia, and Trientalis borealis.

Cedar-Fir-Aspen

This Coastal Forest subtype has a very dense growth of both understory and overstory species. It occurs primarily in sec. 3 between the mixed pines to the north and the hemlock-hardwoods to the south. Throughout this subtype are several swale-like areas. The predominant trees are white cedar, balsam fir, and quaking aspen. Red pine, white pine, big-toothed aspen, sugar maple, and red maple are secondary associates. Hemlock and red maple increase in occurrence farther from the bay. The understory is largely balsam fir with a thick carpet of yew. Other understory species include white cedar, red maple, sugar maple, and quaking aspen. Common herbaceous species include Maianthemum canadense, Trientalis borealis, Pteridium aquilinum, and Aster macrophyllus.

The trees bordering the swales are often black ash (Fraxinus nigra), white birch, red maple, and quaking aspen. Just a few of the herbs found here include Iris versicolor, Onoclea sensibilis, Lycopus americanus, L. virginicus, Eupatorium perfoliatum, Scutellaria lateriflora, Thelypteris palustris, Potentilla norvegica, and several Carex species.

Hemlock-Hardwoods

The overstory composition of this portion of the Coastal Forest, situated mainly south of State Award (Burdick) Rd., is very similar to the island's Northern Hardwoods. Sugar maple, beech, and white birch as well as a few scattered red oak occur throughout this subtype. Hemlock, however, is more common in this subtype than in in the Northern Hardwoods. Secondly, balsam fir is a frequent member of the overstory. The understory is distinctive with widespread yew, balsam fir, red maple, and sugar maple. Common herbaceous species include Maianthemum canadense, Trientalis borealis, Pteridium aquilinum, Aralia nudicaulis, and Clintonia borealis. Other herbaceous species include Mitchella repens, Linnaea borealis, Polygala paucifolia, Goodyera repens, Cornus canadensis, and Dryopteris spinulosa.

DUNES

The most extensive dune region on South Manitou is the perched dunes on the island's west side. Here the dunes are "perched" atop the moraine at least 260 ft. above the lake. The largest dunes rise an additional 160 ft. in some places. While not as extensive as the perched dunes, some small coastal dunes occur along the bay from Lighthouse Pt. to Gull Pt. and to a small extent in sec. 27 on the north side. These coastal dunes are not located near large sources of sand, nor are they exposed to prevailing winds. Consequently they are much smaller. Both the coastal and perched dunes have a similar flora with only slight differences in species frequency. The dune grasses such as Calamovilfa longifolia, Ammophila breviligulata, Andropogon

scoparius, Koeleria macrantha, and Agropyron dasystachyum occur on both, although Koeleria is more common on the coastal dunes. Common shrubby species on both dunes are Juniperus communis, Shepherdia canadensis, Rosa, and Cornus stolonifera. In some protected areas, mats of Arctostaphylos uva-ursi, Juniperus horizontalis, and Prunus pumila have formed. These mats are well developed along the bay. Occasionally, balsam poplar, quaking aspen, white cedar, or white birch are found on the dunes.

Common herbaceous species of both areas include Arabis lyrata, Silene vulgaris, Zigadenus glaucus, Artemisia caudata, Anemone multifida, Lithospermum caroliniense, Asclepias syriaca, Aster praetalis, Lathyrus japonicus, Melilotus alba, Equisetum hyemale, and Oenothera Oakesiana. In protected sites, Smilacina stellata, Lilium philadelphicum, Coreopsis lanceolata, Arenaria stricta, Toxicodendron radicans, and Vitis riparia are found. Arabis Holbelii, Juncus balticus, and Cakile edentula are most common on the coastal dunes.

The dunes provide habitat for three Michigan species listed as threatened. Both Cirsium pitcheri (Pitcher's thistle) and Orobanche fasciculata (broom-rape) were found on the perched and coastal dunes. Bromus pumpellianus, a western grass species, was only found on the perched dunes.

Aerial photographs of the perched dune blowouts suggest that the sand is moving in an easterly directon. This movement, however, may have slowed in recent years, since some long term islanders have observed that the dunes are grassier now than in years past. Evidence of past dune movement is shown by old soil layers in the dunes and by "tree cemeteries". The tree cemeteries

are the remains of old conifer forests which were covered by moving sand and later exhumed as the sands moved on.

The steep, eroded bluffs which face Lake Michigan have several dune and field species eking out an existence on this unstable substrate. Vegetation is sparse. These bluffs occur mainly on the south and west sides of the island.

FIELDS

The fields on South Manitou are the remnants of originally forested land cleared for farms. The first agricultural activities were begun by George Hutzler in 1856, although some reports suggest that Putnam Burdick, an earlier resident, had done some farming. The maximum acreage cleared for agricultural uses on the island reached a peak around 1938. Almost forgotten family farms such as the Furst, Anderson, Price, and Foster Farms and the better known Hutzler, Beck, and Haas Farms recall the prosperous agricultural years on the island.

Historically, the fields have been used for cultivation, for grazing, and as orchards. The island was rather self-sufficient in growing vegetables such as corn, beans, and potatoes. The island's isolation made it an ideal location for the development of improved strains without the worry of cross pollination. The island produced prize-winning Rosen rye and aided in the development of the Michelite pea bean. Farms usually had a small orchard. Many, however, have succeeded to the bordering forests. The most extensive orchards which remain are found (secs. 4 and 33) near the airstrip.

The most commonly planted fruit tree was apple. Solitary fruit trees include apricots, pears, plums, cherries, and peaches. Perhaps the old orchards may even have a few living trees of varieties which have since been replaced on the mainland.

A few head of cattle were owned by each farm in the early part of this century. Charles Anderson recalls that cultivated crops were fenced to keep out the cattle. They were allowed to wander throughout the rest of the island during the summer, but in the fall most would find their way back to their home farm.

Cattle grazing was the the last commercial agricultural enterprize on the island. In the 195Øs William Boals introduced a large beef cattle herd. The grassy fields presently on the island were last used as part of that operation which ended in 1974. The cattle were allowed to openly roam almost anywhere on the island including the forests. Fences began to be erected around 196Ø to confine grazing to lands closer to the G. Conrad Hutzler and August Beck Farms.

The relative amount of time during which the fields have been abandoned can be determined by the extent of Juniperus cover. Four subtypes have been used to classify the fields. They are:

Dense Juniper -fields with Juniperus communis cover > 5Ø%

Medium Juniper - " " " " " = 25-5Ø%

Low Juniper - " " " " " < 25%

Past Juniper -J. communis declining/absent; some tree species

From observations of the fields on South Manitou, the general pattern for field succession begins with the invasion of woody species such as Rosa, Rhus typhina, Juniperus communis, and an

occasional Pyrus malus. Tallies for permanent plots 14 and 16 (Appendix B) list typical species for South Manitou fields. J. communis soon spreads, much to the dismay of some islanders who remember productive farms, and becomes the dominant species, often with J. horizontalis. J. horizontalis is especially extensive on the old beach ridges such as in the fields north of State Award and Chicago Roads. Later other tree species such as pin cherry (Prunus pensylvanica), choke cherry, white birch, and quaking aspen begin to establish themselves within the field as the forests bordering the fields continue to encroach. Eventually the field becomes forest. Small fields may skip a prolonged Juniperus stage and proceed directly to a tree stage such as in the two small orchards on the west side of Lake Florence. The fields on or close to the moraine appear to have succeeded to forest faster than on the sandier soils to the east. Perhaps the type and duration of human activity at a given site may also affect the rate of the natural process of succession on the island.

WETLANDS AND LAKE FLORENCE

The wetlands in the Lake Florence basin and the shores of Lake Florence received only casual attention during this study, and more time was spent in "terrestrial" areas. If an aquatic study is planned for the future, these areas should be included. Descriptions of these areas were made and several species were collected where there was ready access to these sites.

The wetlands occur in a narrow band extending from a small area just south of the lake north to the field near the site of the old sawmill (sec. 4, NE1/4, NE1/4). Sedges, especially Carex

aquatilis, are the dominant plants. Other common herbaceous species include Thelypteris palustris, Lycopus americanus, L. virginicus, Scutellaria galericulata, S. lateriflora, Epilobium ciliatum, Eupatorium perfoliatum, and Solidago graminifolia. Spiraea latifolia, Salix lucida, and S. petiolaris are the most common woody species.

The level of Lake Florence changes from year to year, so the species which grow along its margin must be able to survive this fluctuation. Among the many species collected around the lake are several Carex and Eleocharis species, Cladium mariscoides, Phragmites australis, Spiranthes romanzoffiana, Typha angustifolia, Eupatorium perfoliatum, Solidago graminifolia, Iris versicolor, Ranunculus reptans, Lobelia kalmii, Lysimachia thyrsiflora, and Gerardia purpurea. Similar to the wetlands, Salix lucidula, S. petiolaris, and Spirea latifolia occur along these shores.

NORTH MANITOU

NORTHERN HARDWOODS

The Northern Hardwoods is the largest forest association on North Manitou. At the time of the 1847 General Land Office Survey, only a small portion of the southeast part of the island had been lumbered. Later in the century the timber business boomed, giving rise to the village of North Manitou on the east side and Crescent City on the west side. A few camps and logging railroad beds remain from these early days. Reminders of these times are found in place names such as the Old Grade and Hatches, Davenport and Stormer Camps. The Northern Hardwoods today are either second or third growth timber. This association regularly consists of beech and sugar maple. Associated species include wild black cherry (Prunus serotina), yellow birch, white birch, ironwood, basswood, hemlock, big-tooth aspen, white ash, and red oak. The North Manitou Northern Hardwoods has been classified using the following subtypes:

1) Beech-Maple-Yellow Birch-Cherry
2) Beech
3) Maple
4) Beech-Maple-Aspen
5) Beech-Maple-Yellow Birch-Cherry-Aspen-Ash
6) Oak

A few beech saplings are the only understory species found under six feet, so the forests appear open and park-like. The ground layer is rich in overstory seedlings. Herbs are less common than on South Manitou, however, those most often encountered include Osmorhiza chilensis, Dryopteris marginalis, D.

spinulosa, Polygonatum pubescens, Arisaema triphyllum, Oryzopsis asperifolia, and numerous Carex species. Others include Allium tricoccum, Epifagus virginiana, Mitchella repens, Hepatica acutiloba, and Cynoglossum officinale. In the spring, however, herbs of these forests are most abundant. These species include Dentaria laciniata, D. diphylla, Dicentra canadensis, D. Cucullaria, and Erythronium americanum.

The introduced deer herd on the island is responsible for the present forest structure. Due to the poor representation of understory and ground layer species, the Northern Hardwoods subtypes were determined primarily from the overstory species.

A few small areas which are predominately white birch and big-tooth aspen are occasionally found throughout the Northern Hardwoods. Perhaps these sites were the locations of a local disturbance such as fire or logging. Much of the Northern Hardwoods on the island has been selectively cut for timber as recently as 1978 and large areas have yet to regenerate. Generally, the trees which were left standing are the same species as those in the nearby uncut areas. Common herbaceous species in these open areas include Dactylis glomerata, Cynoglossum officinale, Poa compressa, Veronica officionalis, Phleum pratense, Danthonia spicata, and several Carex species. Beech saplings are so thick in some places that very dense patches have formed.

Beech-Maple-Yellow Birch-Cherry

This subtype is found in the northern and western areas of the island. Some white birch occur regularly as well as an

occasional hemlock. Ash is commonly encountered in a narrow band which borders the bluffs on the island's north side.

Beech

Beech is clearly the predominant tree in this subtype which occurs on the high ridges east of Lake Manitou. Basswood, cherry, white birch, yellow birch, sugar maple, and some hemlock also occur. Beech saplings are common. This subtype shows the most diverse herbaceous layer of the Northern Hardwood forests, especially in the spring.

Maple

In this subtype maple is the dominant tree. This forest usually occurs on the low flat areas near the south end of the island. Other trees in this subtype include beech, cherry, white birch, yellow birch, and ironwood. Hemlock is most common as a subcanopy or understory species.

Beech-Maple-Aspen

On the western slopes of North Manitou and to a small extent east of Lake Manitou a mature forest occurs with beech, sugar maple, and big-tooth aspen as the dominant species. Cherry, white birch, and yellow birch are also found. A few tall sugar maple and beech occur in the understory.

Beech-Maple-Birch-Cherry-Aspen-Ash

The most diverse Northern Hardwoods forest occurs on the plateau and the adjoining gullies in the northwest corner of the island. A very good mix of beech, sugar maple, yellow birch, white birch, cherry, big-tooth aspen, and ash comprises this subtype. Hemlock and a few mountain ash (Sorbus americana) are also found in the canopy. Farther to the west basswood increases in occurrence.

Oak

Red oak is not common on North Manitou, but is easily found north of the airstrip and on the ridges near the site of Lt. Macumber's monument (Sec. 9, SE 1/4). A few scattered oaks also occur on the east side of Lake Manitou. Other trees found within the Oak subtype include sugar maple, big-tooth aspen, beech, white birch, and ironwood. Understory species include ironwood, striped maple, and red maple.

NORTHERN CONIFERS

The Northern Conifers association is limited to a few steep, north-facing slopes. The most common trees in this forest are white cedar, balsam fir, and white birch. Hemlock and striped maple are occasional associates. Ground vegetation is just as sparse as in the Northern Hardwoods, although a few species observed include Pyrola minor, Trientalis borealis, Goodyera repens, Maianthemum canadense, Carex eburnea, Thelypteris noveboracensis, and Botrychium virginianum.

One interesting Northern Conifer area is the Pot Holes. Broadly speaking, this area (sec. 19) is a group of three somewhat

circular concave slopes which have a northern exposure. The area is spring-fed. The typical Northern Conifer species, white cedar, balsam fir, and white birch occur here with some Northern Hardwoods species such as white ash, big-tooth aspen, basswood, ironwood, and yellow birch. The Northern Conifer herbs occur here as well, but many Northern Hardwoods herbs including Dryopteris spinulosa, D. marginalis, Galium sp., Athyrium filix-femina, Fragaria virginiana, Arisaema triphyllum, Viola selkirkii, Hepatica acutiloba, and Solidago flexicaulis are also found. A few weedy species which were found here and in other moist areas include Veronica officinalis, Leonurus cardiaca, Lamium maculatum, and Cerastium fontanum. Of special note is the occurrence of a sparse understory with a variety of species such as mountain maple (Acer pensylvanicum), striped maple, red elderberry, wild gooseberry, and some sugar maple.

LAKE PLAIN WOODS

A diverse open forest similar to the Coastal Forest of South Manitou occurs along the eastern shore. It runs from the blowouts near Dimmick's Pt. to a narrow strip in sec. 10. On the forest's west side is a relict beach ridge (605 ft.), probably of Nippising age. The region between this ridge and the sandy shore of Lake Michigan is rather flat, although a series of smaller ridges similar to those found on the east side of South Manitou do occur. These ridges are especially visible in the large open fields near the cemetery (sec. 15).

The overstory is an irregular mix of white pine, red maple, white birch, and hemlock with scattered sugar maple, big-tooth

aspen, white cedar, balsam fir, and red oak. Understory species include white cedar, red maple, mountain maple, striped maple, and choke cherry. The ground layer is just as varied with scattered Trientalis borealis, Maianthemum canadense, Oryzopsis asperifolia, Cynoglossum officinale, Veronica officinalis, Pteridium aquilinum, and Dryopteris spinulosa. Some field species such as Poa compressa, Hypericum perfoliatum, Asclepias syriaca, Verbascum thapsus, Satureja vulgaris, and Rumex acetosella also occur. This forest type is a transition from the dunes to the Northern Hardwoods and has a few swales where species such as Scutellaria galericulata, Agrostis hyemalis, Hypericum perforatum, Lycopus americanus, L. virginicus, and Dryopteris spinulosa occur.

FIELDS

The fields on North Manitou would be classified as Low Juniper on South Manitou. Many clearings are the sites of old orchards or homesteads such as the Maleski, Stormer, Fredrickson, and Carlson Places to name just a few. A large orchard, the Frank Farm (sec. 33) still has many apple trees remaining. Most former cherry orchards have been cut down. The largest open spaces occur near West Side Dock, the cemetery, and North Manitou Village with its large airstrip. These areas were once population centers of the island.

The vegetation changes little from one field to the next, although some dune species such as Andropogon scoparius and Elymus canadensis are found in fields close to Lake Michigan. The woody species are scattered individuals of Rosa and tufts of Juniperus communis. The field grasses include Poa compressa, Agropyron

repens, Dactylis glomerata, Danthonia spicata, Phleum pratense, and Festuca saximontana. Other herbs include Pteridium aquilinum, Rumex acetosella, Chrysanthemum leucanthemum, Asclepias syriaca, Verbascum thapsus, and Tragopogon dubius. Earlier in the season Vicia villosa, Silene vulgaris, Antennaria neglecta, Fragaria virginiana, and Satureja vulgaris are readily observed. Later in the summer, Anaphalis margaritacea, Centaurea maculata, Rudbeckia hirta, and Ambrosia artemisiifolia are easily found.

DUNES

The dunes on North Manitou occur to a small extent along some shores, but the island's most extensive dune areas occur at Dimmick's Pt. and Old Baldy. Some are also perched above the lake (secs. 25 and 30) on the west side. Although the dunes on North Manitou are not as extensive as the dunes on South Manitou, the dune floras are quite similar. Low shrubs such as Shepherdia canadensis, Prunus pumila, and Arctostaphylos uva-ursi, however, are missing on North Manitou. Juniperus communis and J. horizontalis do occur to a limited extent. Dune grasss such as Andropogon scoparius, Elymus canadensis, Koeleria macrantha, Agropyron dasystachyum, Calamovilfa longifolia, and Ammophila breviligulata are common. Other dune herbs including Asclepias syriaca, Arabis lyrata, Artemisia caudata, Campanula rotundifolia, Cirsium pitcheri, and Lithospermum caroliniense were found. Lathyrus japonicus is frequent nearer the lake shores.

Eroded bluffs similar to those on South Manitou occur predominaterly on the north side and in some local areas on the

west and south sides. Vegetation is sparse and composed mainly of field and dune species.

BLACK ASH SWAMPS AND WETLANDS

The Black Ash Swamps and other wetlands were only given casual attention during this study. Future investigations in these sites should discover additional species. The flora in these areas is so diverse that a permanent plot was erected just south of Lake Manitou (BTH no. 9). These sites are very open. The most common trees are black ash, white cedar, and white birch. Other trees which may be encountered include mountain maple, red maple, basswood, and balsam fir. Sedges are common. Lycopus americanus, L. uniflorus, Trientalis borealis, Maianthemum canadense, and Gymnocarpium dryopteris were found at both Tamarack Lake and Lake Manitou. Some species found nowhere else on the Manitous include Bidens connatus, Gaultheria hispidula, Impatiens capensis, Osmunda cinnamomea, Dryopteris cristata, and Equisetum sylvaticum.

A wetland area without trees occurs at the north end of Lake Manitou. This is probably due to repeated spring flooding as a result of the road which crosses the outlet at the Pole Bridge.

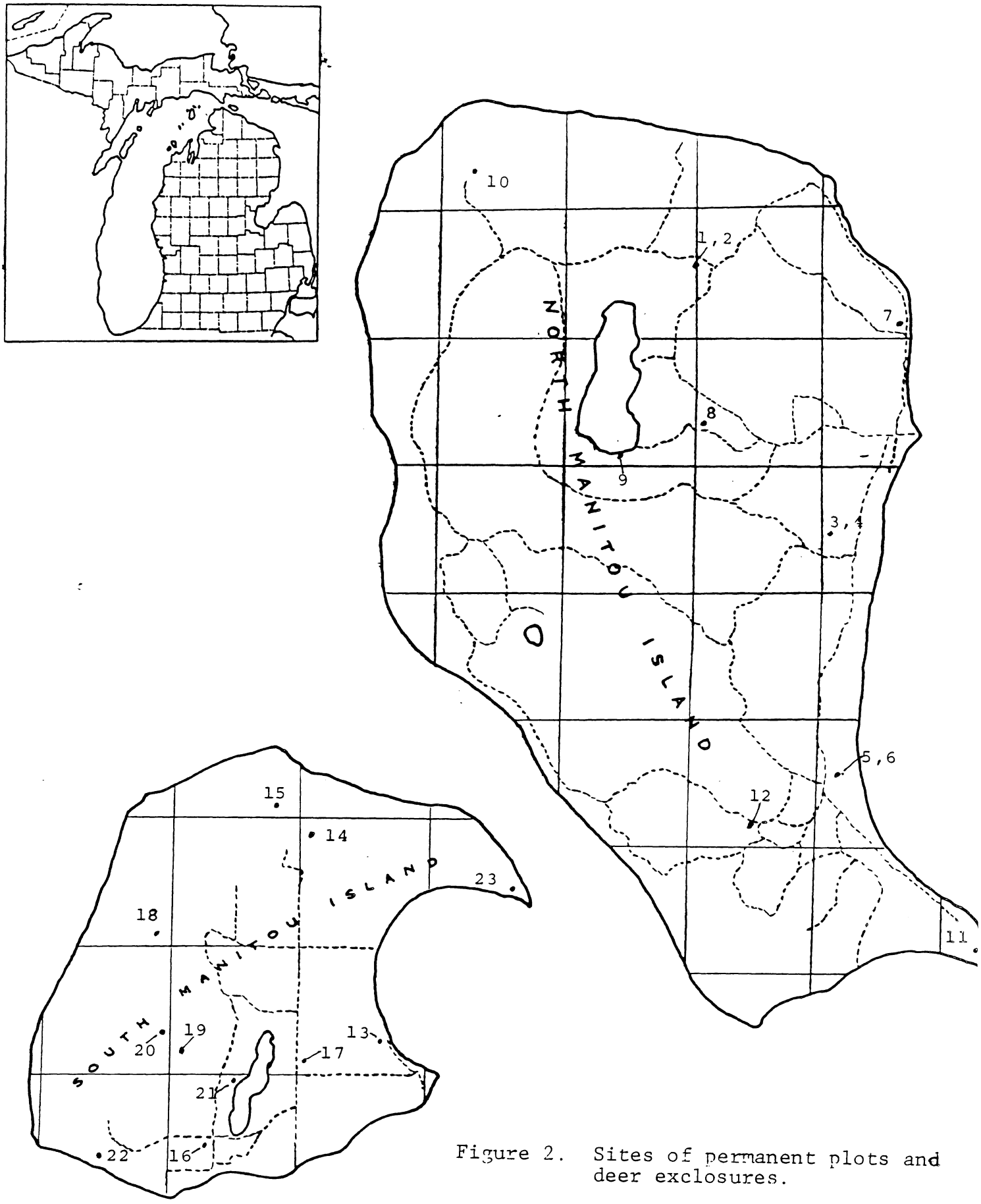


Figure 2. Sites of permanent plots and deer exclosures.

PERMANENT PLOTS

NORTH MANITOU

BTH Nos. 1 and 2. Pole Bridge Deer Exclosure and Control

This 40 ft. by 40 ft. deer exclosure was erected by the Michigan DNR in the spring of 1960. In 1982 it was repaired by the Park Service. A control plot was erected during the field investigation within 50 ft. of the original exclosure. One common overstory species in this area which does not occur inside the exclosure is Fagus grandifolia. The lush growth and species composition within the exclosure shows the potential for the understory and ground layers in the island's Northern Hardwoods when they are given a measure of protection from the voracious deer herd. The site on which the exclosure was erected originally was a treeless opening in the forest. The large basal areas of Prunus serotina and Betula papyrifera show the facility that these species have to colonize available sites safe from the deer. The profuse reproduction of Acer saccharum in the understory is not found any place else on the island. Scattered individuals of several of the exclosure species were observed throughout the forests on the island, but only here does a rich assemblage similar to that found on South Manitou ocur.

The control represents the status of most of the island's Northern Hardwoods. Herbs are low growing and widely spaced. Those native herbaceous species which remain such as Arisaema and Streptopus are diminutive and rarely reach reproductive maturity. Cynoglossum officinale, an introduced species, is readily found

throughout the Northern Hardwoods. Saplings are almost completely eliminated.

BTH Nos. 3, 4, 5, and 6. Carlson Farm and Stormer Dock Deer Exclosures and Controls.

The two 40 ft. by 40 ft. deer exclosures (3 and 5) were erected by the Park Service in 1982. The respective controls (4 and 6) were established later during the field investigation. Both sets of plots were set up in fields. In contrast to the DNR exclosure, the vegetation within both field exclosures and their respective controls is very similar since they were established at the same time. The solitary woody species occurring within 3 and 4 are Juniperus communis and Rosa. No woody species occur within 5 and 6, but J. communis does occur in the immediate vicintiy of the plots.

Both exclosures will probably follow the pattern of field succession which occurs on South Manitou. J. communis should soon dominate both exclosures and later decline as saplings arise. Perhaps only one field exclosure would have sufficed to observe this pattern on North Manitou. The basic difference between the two exclosures is topographic. Plots 3 and 4 occur on an upland site while 5 and 6 occur on old beach ridges. On some upland sites of South Manitou trees have invaded abandoned fields at a faster rate. If any future deer exclosures are established on North Manitou, they should be placed in the deciduous forest.

BTH Nos. 7, 8, and 1Ø. Vessel Pt., Beech Woods, and Pot Holes Plateau

These permanent plots were established in different Northern Hardwoods subtypes to observe any changes within these areas over time. The herbaceous growth within each plot is sparse, typical of most forested areas on the island. The overstory in 7 may contain the representative tree species of this area (mainly Quercus and Populus), but the large number of stems but small total basal area of Ostrya within the plot is the consequence of several small trees. This species also is well represented in the understory. Plot 8 was established in the upland Northern Hardwoods where Fagus grandifolia is predominant in both over- and understories. Trees found outside the plot which occur within this subtype include Prunus serotina, Tilia americana, Betula papyrifera, and Tsuga canadensis. Plot 1Ø occurs in the diverse upland hardwoods in the northwest corner of the island. Additional tree species which are part of this forest, which were not included within the plot, are Betula alleghaniensis, B. papyrifera, Populus grandidentata, and Fagus grandifolia. A few Sorbus americana trees, one measuring 9.7 in. dbh, were found just outside the plot. An understory is generally lacking throughout this region and herbs are few.

BTH No. 9. Lake Manitou South

This plot illustrates the diversity of herbaceous species which still can occur on North Manitou despite the impact of the heavy deer browse especially evident in the other forested areas on the island. The plot was placed in a low mucky area south of

Lake Manitou. The canopy is open and an understory absent. Fraxinus nigra and Betula alleghaniensis have the largest basal area. Moisture tolerant species grow directly on the soil. Fallen logs provide a suitable habitat for Northern Hardwoods species such as Cornus canadensis, Gymnocarpium dryopteris, Maianthemum canadense, and Mitchella repens. This site has had a history of spring flooding.

BTH No. 11. Dimmick's Pt.

This plot was established on the gravel lag behind the foredune at Dimmick's Pt. A similar habitat is also found at Donner's Pt. Some small sand mounds occur within the plot. The small tree which falls within the plot is one of several young Betula papyrifera growing in the open section of the point. The rest of the vegetation in this area is very low to the ground. Seedlings of B. papyrifera and Thuja occidentalis should be noted. During the field investigation most permanent plots were placed in undisturbed areas. After this plot was erected, however, a deer trail was discovered in the plot's southwest corner.

BTH No. 12. Cut Area.

This plot was erected on the edge of a recently lumbered portion of Northern Hardwoods. The only living tree within the plot is Betula alleghaniensis. The immediate uncut forest however, is predominately Acer saccharum and Fagus grandifolia, with some Betula papyrifera, B. alleghaniensis, and scattered Tsuga canadensis. Fagus grandifolia regeneration is very high both in the plot and in the adjacent cut area. Deer browse on the Fagus saplings is common. The most readily observable changes

over time will most likely be observed in this plot and in the new deer exclosures.

SOUTH MANITOU

BTH No. 13. Lou Raynor

This plot provides one view of the moist Coastal Forest found on the relict beach ridges on South Manitou's east side. Here a thick understory layer of Taxus canadensis, a favorite food for deer, occurs. Taxus is absent on North Manitou. This plot also shows a varied understory and productive ground layer, not occurring on North Manitou.

BTH Nos. 14 and 16. John Hutzler and Theodore Beck Fields

These plots represent extremes in the field vegetation on South Manitou. The field where the John Hutzler plot is located has been classified as a Dense Juniper field. The only other woody species within the plot is Prunus pensylvanica, but other trees in the area include Populus tremuloides, Ostrya virginiana, Acer saccharum, Betula papyrifera, and Rhus typhina. Rhus typhina, however, appears to be declining in this field. The Theodore Beck field was last used as a grain field as part of the cattle operation on the island which ended in 1974. Herbaceous species common to both plots include Hieracium piloselloides, Hypericum perforatum, and Poa compressa. The herbs in the Theodore Beck Field are diverse. Tall herbaceous species tend to occur within this plot. Only a few scattered Pyrus malus, Prunus virginiana, and Rosa occur in this plot and throughout the rest of the field. Although P. malus is not generally a successional

species, the absence of deer on South Manitou may permit its occurrence here.

BTH Nos. 15, 17, 20, and 21. Popple Trail, Burdick's Corners, Upland Woods, and Lake Florence West

Together these plots illustrate the diversity of the Northern Hardwoods forest on South Manitou. Plot 15 was established on a wooded dune just off the trail to Popple Campground. In this area Quercus rubra occurs within the Northern Hardwoods. Plots 17, 20, and 21 show the general change in vegetation from the low lying areas near the Coastal Forest (17) west across Lake Florence (21), and up the moraine close to the perched dunes (20). In plot 17 Acer saccharum and Fagus grandifolia predominate with a good mix of Tsuga canadensis. The understory includes Abies balsamea and Taxus canadensis. Westward to plot 21 both Abies and Taxus are less abundant, while Sambucus pubens and overstory saplings are more common. Tsuga also decreases in occurrence as an overstory species. Higher up the moraine, as illustrated by plot 20, Fraxinus americana increases in abundance in the overstory. Although not found within the plot, Sambucus is common, and Tsuga is found occasionally in the overstory. Herbaceous species are very diverse on the moraine.

BTH No. 19. Mike Smith

This plot occurs within the last selectively logged area on South Manitou. This logging occurred bewtween 1956 and 1964. The trees are widely spaced and include Fagus grandifolia, Fraxinus americana, and Tsuga canadensis outside the plot as well as an abundance of Acer saccharum, the only tree occurring within the

plot. The understory is very productive. Herbaceous species within the plot are very diverse, and this shows the ability of the Northern Hardwoods to recover from previous disturbances.

BTH No. 22. Cedars Trail

This plot was established off the trail to the Cedars to record the diverse herbs in the area. Putting a plot within the Cedars itself would disturb the special habitat which occurs there. The size of some cedar stumps in this area suggests that this site was once part of the Cedars before logging occurred. Other overstory trees in this vicinity not included within the plot are Tilia americana, Betula papyrifera, and Fraxinus americana.

BTH Nos. 18 and 23. Dune Blowout and Gull Pt.

These are the dune plots for South Manitou. Plot 18 is situated on a small blowout on the perched dunes northeast of the G. Conrad Hutzler farm and contains several dune species. This site was selected because it would probably have less human influence than at a more accessible site. Plot 23 has even less chance of being disturbed since it is situated in the South Manitou gull colony, a restricted area. The plot was established in the fall after the gulls had finished nesting. The gulls have altered the dunes in that several weedy species which do not normally occur on dunes such as Potentilla recta, and Lepidium are common. Juniperus communis and J. horizontalis occur within the plot, but other woody species in the general area include Pyrus malus, Prunus pensylvanica, Toxicodendron radicans, Cornus stolonifera, Pinus banksiana, and Betula papyrifera.

COMPARISON OF THE VEGETATION AND FLORA

Distinct differences in the forest structure, floristic composition, and relative abundance of species can be noted between North and South Manitou. In a strict biogeographical sense we might expect the larger island to have the greater number of species. The South Manitou flora, however, has at least 72 more species than the flora on North Manitou (Table 2). The relative occurrence of different forest associations also varies between the islands. A few factors which might explain the differences between the terrestrial vegetation on both islands are:

1) geology and soils
2) human influences
3) wildlife influences

Although the actual vegetation on the islands is due to an interrelationship among these factors, the effects of each of these factors will be described.

Geology and Soils

Although both islands are glacial deposits overlying limestone bedrock, the type (i.e., moraine, outwash plain, etc.) and relative occurrence of these deposits are not the same (North Manitou has a large area of outwash plain which is not found on South Manitou (Weber, 1973)). We should, therefore, expect some corresponding variations in the vegetation.

The effect of post-glacial factors on the slightly different substrates has an additional influence on the vegetation as well.

A greater proportion of South Manitou is open sand dunes. This is largely due to the prevailing southwesterly winds. The high moraine on South Manitou shields North Manitou from the stiffest winds. On North Manitou, therefore, dune development has been minimal and is greatest in areas where the wind is not blocked such as the Old Baldy dune complex on the southwest side.

The changing post-glacial lake levels in the Lake Michigan basin have had a strong influence on the geomorphology, and therefore on the vegetation of both islands. Lake Algonquin (11,ØØØ years BP) at its height surrounded the Manitous at a point ca. 75 ft. higher than the present level of Lake Michigan. Consequently, the area of both islands was smaller than it is today. The richest Northern Hardwoods forest on South Manitou occur on the former Algonquin Island. A similar pattern is also observed on North Manitou. Perhaps the advanced soil development in these sites is an important factor affecting the richness of the Northern Hardwoods.

South Manitou has proportionately more relict sandy lake bed and beach ridges than North Manitou. These ridges were formed during the recession of Lakes Nipissing (5ØØØ BP) and Algoma (35ØØ BP) to the current level of Lake Michigan. In the Sleeping Bear region, Lake Nipissing had a level about 25 ft. higher than the present lake level; Lake Algoma about 15 ft. higher. Today the diverse Coastal Forest of mixed conifers and hardwoods occupies much of this area. Likewise, since the area of beach ridges is not as extensive on North Manitou, the development of the Lake Plain Woods has not been as great as the Coastal Forest.

Local geological factors may be primarily responsible for the occurrence of habitats unique to one island. The Black Ash Swamps common around North Manitou's inland lakes are absent on South Manitou. The circular configuration of Tamarack Lake suggests that it was a depression formed by a melting glacial ice block. This lake, however, was inundated by Lake Algonquin waters and might have a different origin. Nevertheless, a small bog-like area on the lake's north side has a few bog species such as Larix laricina, Chamaedaphne calyculata, and Vaccinium myrtilloides which do not occur on South Manitou. Likewise the occurrence of some rare ferns in the Cedars on South Manitou is due in part to adequate calcium levels in the soil and other microhabitat differences which may not occur on North Manitou.

Human Influence

The natural vegetation of both islands has been disturbed by human activity. The islands initially were a source of lumber and cordwood. These cleared areas opened the forests to farms and orchards. When agricultural enterprises failed, many fields were abandoned and the forest was allowed to reclaim some areas. The past land use on both islands is similar, but the extent and duration of some activities have varied.

Lumbering on South Manitou ceased in 1964 when Mike Smith ended his operations on state forest lands. The extent of recent lumbering on North Manitou has been greater because the island was privately owned and a larger proportion of the island is Northern Hardwoods. Sites of old logging camps and some large stumps on the island's north side are a few extant evidences of the booming

lumber activities at the end of the last century. Lumbering was revived in the 1950's and after several starts and stops ended in 1978. Evidence of this activity is still fresh.

In the settlements and on the homesteads several non-native species were planted. Fruit trees such as pear, apple, cherry, and apricot occur on both islands, yet peaches persist only on South Manitou. Either they were never introduced to North Manitou, or they have subsequently died out. Other introduced species found only on South Manitou include horsechestnut and mulberry. Conversely, Norway spruce and flowering quince occur only on North Manitou. The Lombardy poplars on South Manitou were brought to the island from North Manitou in the 1920's by Tracey Grosvenor. According to Glenn Furst, once these trees attained a certain height, they were evenly trimmed by Lifesaving Station personnel. The islanders would take the cuttings and plant them on their own property. The locusts on South Manitou were brought to the island at the turn of the century and have spread throughout the village. Locusts also occur on several homestead sites on North Manitou.

The clearing of the land opened up the island for agricultural species such as alfalfa and timothy as well as weedy species. The occurrence of one species on an island may be by pure chance. Bromus tectorum, an introduced grass, was only found on South Manitou and Erodium cicutarium was only found on North Manitou. In other cases, a plant may spread after new conditions arise. According to Marie Smith, Queen Ann's Lace was not abundant on the island until the end of active farming.

Wildlife Influences

The presence of an introduced deer herd on North Manitou has been responsible for the most visible vegetation differences between the islands including the reduction or elimination of some native species. A definite browse line is readily observed along the lake shores and along the borders of the fields. Within the forests the understory is almost absent. Generally, beech is the only sapling species under six feet which survives the selective deer herbivory. Although beech is not usually consumed by deer, in some places it is grazed into a bushy form when the terminal buds are removed. This occurs especially in forested areas which have been exposed to sunlight as a result of lumbering activities. In one recently cut area (sec. 16, SW 1/4, SE 1/4) the beech regeneration is so thick that a young red elderberry was able to thrive inside the beech hedge. Red elderberry was also observed growing atop the bases of fallen trees and on a large flat-topped limestone rock. In both cases the tender plants were thriving out of the reach of deer. In the latter example, this rock (sec. 31) also supported several woodland herbs and wild gooseberry.

The absence of an understory on North Manitou has endowed the forests with a park-like appearance. The lushness of the DNR deer exclosure and the forested permanent plots on South Manitou helps to further illustrate the damage wreaked by the deer on the island's vegetation.

The degree by which the deer have severely damaged the floristic composition of North Manitou is illustrated in Table 1. This table is a list of common native species which have been greatly reduced due to the impact of the deer. Most of these

species on South Manitou occur in the Northern Hardwoods. Others such as Arabis Holboelii, Celastrus scandens, Juniperus horizontalis, and J. communis are dune and/or field species on South Manitou.

Forest species occurring on South Manitou which are apparently absent from the North Manitou flora, include Botrychium matricariifolium, Polystichum acrostichoides, Taxus canadensis, Medeola virginiana, Smilacina racemosa, Uvularia grandifolia, Cypripedium calceolus, Habenaria orbiculata, Aralia racemosa, Diervilla lonicera, Lonicera canadensis, Viburnum acerifolium, V. Opulus, Lactuca biennis, Prenanthes alba, Cornus rugosa, Sanguinaria canadensis, Actaea pachypoda, Thalictrum dioicum, Pedicularis canadensis, and Heracleum maximum.

Whitford (1901) has indicated that North Manitou provided an ideal example of a climax forest of maple, beech, and hemlock, which in time would cover the entire island except for a narrow fringe of conifers near the lake shore. He especially notes a scanty undergrowth in the dense shade largely composed of beech, maple, and hemlock seedlings and young trees. Taxus canadensis and Mitchella repens were reported to be very abundant. Today Taxus is absent from the island while maple and hemlock saplings are exceedingly rare.

Dune species which are absent from North Manitou include Lilium philadelphicum, Smilacina stellata, Corispermum hyssopifolium, Shepherdia canadensis, Arctostaphylos uva-ursi, Hypericum kalmianum, and Prunus pumila. These species are easily found on South Manitou. A small terminal bud resembling Arctostaphylos was found in the sand at Dimmick's Pt., but not

Table 1. Common native species greatly reduced on North Manitou due to deer.

Adiantum pedatum	Juniperus communis
Arabis Holboellii	J. horizontalis
Arisaema triphyllum	Linnaea borealis
Athyrium filix-femina	Maianthemum canadense
Botrychium virginianum	Mitchella repens
Caulophyllum thalictroides	Mitella diphylla
Celastrus scandens	Polygonatum pubescens
Circaea alpina	Polypodium virginianum
Clintonia borealis	Ranunculus abortivus
Corallorhiza maculata	Sambucus pubens
C. striata	Streptopus roseus
Cornus canadensis	Symphoricarpos albus
Dryopteris intermedia	Thelypteris noveboracensis
D. marginalis	Trientalis borealis
D. spinulosa	Trillium grandiflorum
Geranium robertianum	Viola canadensis
Hepatica acutiloba	

Table 2. Comparison of native and introduced species occurring in the Manitou Island Flora based on field investigation data.

	North Manitou only	South Manitou only	North and South	Total
Native	60	131	165	356
Introduced	30	31	56	117
Total	90	162	221	473

enough of the plant was present to make a positive identification. A small colony of Salix cordata, however, was found at Dimmick's Pt. despite the intense deer browse. Another dune species remaining on North Manitou despite the deer browse is Hudsonia tomentosa, a low shrub. This species was found at Donner's and Dimmick's Pts. and was not found on South Manitou.

A brief description of extensive "heaths" of Juniperus and Arctostaphylos in association with Prunus pumila is included in Cowles's (1899) sketch of North Manitou dunes. These heaths bear a close resemblance to the dune vegetation along the bay on South Manitou and have been eliminated from North Manitou. Deer have severely grazed both Juniperus communis and J. horizontalis; Arctostaphylos and Prunus pumila are absent from the flora.

The fields on North Manitou have also been influenced by the deer. Species composition has not been reduced drastically, although South Manitou species such as Rhus typhina, Apocynum androsaemifolium, and Prunus pensylvanica were not found during the field investigation. The deer, however, have prevented the succession of the fields to forest by keeping out the tree saplings. Juniperus communis has invaded most of the old fields on South Manitou to become a dominant species in many places. J. communis is occasionally found in the fields on North Manitou, but generally only as small severely browsed tufts. Perhaps the appearance of the North Manitou fields is the same as it was almost fifty years ago.

The flora has some relief from the heavy deer herbivory in areas where there is a constant supply of water and where there are fallen logs or steep slopes. In the woods, species such as

Arisaema triphyllum, Maianthemum canadense, Dryopteris spp., Osmorhiza chilensis, and Ranunculus abortivus were found growing under the protection of fallen trees. Relatively lush growth occurs near springs such as those found along the trail between Vessel Pt. and the Fish Shanty. A few productive areas occur where a combination of these factors exists such as the swamps around the inland lakes and in the Pot Holes. These sites provide a refugium from the deer for several species.

Additional Notes

The possibility of overlooking some species is present in any field study. In any given season a species may be very abundant or may even disappear. For example, 11 species of monocots (Voss, 1972) cited for the Manitous were not encountered during the investigation. Linaria vulgaris, found during the field investigation only on North Manitou, had been photographed on South Manitou during a previous season. Later, a specimen of this species collected in 1983 on South Manitou was sent to the field investigator. Naturally, new species will be encountered during future field studies and the current species lists will be modified.

Of note are two common tree species which appear to be restricted to one island. Black cherry is a regular associate in the Northern Hardwoods of North Manitou, but it was only encountered once on South Manitou during the field investigation. Thompson (1974), however, states that it is a predominant tree in the hardwoods on the southern morainal hills. Jack pine appears to be limited to South Manitou. It is most common on, but by no

means restricted to, the relict beach ridges on the east side of the island. The General Land Office Survey notes taken by Orange Risdon in 1847 (available at the Lands Division, Department of Natural Resources, Lansing) do not mention either "Cherry" occurring on South Manitou or "Pitch Pine" occurring on North Manitou. If these species are largely restricted to only one island, it would be an interesting study to pursue in the future.

FRAGILE HABITATS

Due to the isolation of an island, certain habitats may be described as fragile which might not be considered as such on the mainland. The designation of fragile habitats in this report is based primarily on the potential damage to a limited island habitat through overuse or misuse of that area in light of its biological significance.

The Cedars (Valley of the Giants)

The biological significance of this small area has already been described in this report. Due to the unique size of the white cedars, the presence of two National Champion Big Trees, the occurrence of rare species, and the lushness of the flora, every effort must be made to preserve this unique habitat. Current levels of visitor use should not degrade the area any further. The most intense visitor use comes during the scheduled stop of the Manitou Island Tour. The tour vehicles park at the Dunes/Cedars turn-off, well away from the grove itself. Tourists are then permitted a few minutes to walk to the Cedars. They have little time to stray off the established paths and usually go only as far as the marked cedar. This tour is often the only opportunity for day-trippers to have a first-hand encounter with the island's natural heritage. During the rest of the day the Cedars are protected from overuse by their distance from heavy visitor use areas on the island. The development of additional trails or the incorporation of a nature trail within the Valley of the Giants should not be included in the management plans for this

area. A small pamphlet, however, describing some of the special aspects of this area might be of interest to the curious.

One site which merits direct attention by the Park Service is the dune bank behind the fenced cedar. A path has been formed leading to the top of the bank which only encourages others to make the trip to the top. Continued use of this path will degrade this slope further.

Perched Dunes

The perched dunes on the western edge of South Manitou have been described as "one of the best examples in the country of this type of dune" (Thompson, 1974). The primary reason for this assessment is the naturalness of these dunes, in part as a result of the island's isolation. On these relatively undisturbed dunes are ghost trees and old soil layers which may yield information on the island's vegetation history. Threatened species such as Pitcher's thistle, Pumpelly's brome-grass, and broom-rape are part of a large dune flora. An unspoiled view of the Sleeping Bear mainland and, on clear days, a view 43 miles to Washington Island, Wisconsin, is available here.

As a rule the perched dunes of the mainland have been readily accessable to more people. The South Manitou visitor, however, must usually hike many miles to and from the dunes, so the human impact is not as great. The natural character of these perched dunes could be threatened by a large increase in levels of visitor use. Any proposal to encourage access to these dunes by allowing the regular transport of visitors to the base of the dunes should

be discouraged. The best way to preserve this habitat would be to let it remain as remote as possible.

Shoreline Dunes

All dune habitats are fragile. On an island, however, the dunes which are apt to incur the most impact are those along the shore. On South Manitou the dunes along the bay are the most vulnerable. In some areas, such as the region from Bay Campground to the lighthouse, attempts have been made to minimze the wear on these dunes. One recent step has been the construction of boardwalks. Earlier measures to prevent degradation of these dunes have included a fire ring for boaters, the prohibition of camping and open fires on the beach and dunes, and ranger enforcement of these regulations. The remaining habitat should be protected by restricting human activities to those areas already heavily used. One especially important area is the border between the dunes and the Coastal Forest. This sensitive ecotonal area provides the only island habitat for Calypso bulbosa, Cypripedium arietinum, Geocaulon lividum, and Spiranthes lacera. Future developments in this habitat should be avoided.

North Manitou Habitats

The perched dunes and much of the shoreline dunes of North Manitou are just as fragile as those on South Manitou, but are protected by their remoteness. In an island sense the swamps at Tamarack Lake and Lake Manitou and especially the Pot Holes, are significant habitats. These sites exibit a large degree of species diversity and contribute to the floristic richness of the island. The Pot Holes and the Old Baldy dune area are classified

as outstanding natural feature subzones on the current lakeshore management plan (1979).

SPECIAL STATUS SPECIES

Eight species collected during the field investigation have either threatened or special concern (rare) status as designated by the State of Michigan. One of these species, Pitcher's thistle (Cirsium Pitcheri) is also a candidate for the federal list of threatened species. A threatened species in Michigan has a limited state-wide distribution (generally five counties or less) or is ecologically restricted to a vulnerable habitat such as prairies or dunes. Special concern species are uncommon, yet are more widespread than threatened species. State threatened species which occur in the Manitou Island flora are Pitcher's thistle, ginseng (Panax quinquefolius), calypso (Calypso bulbosa), broom-rape (Orobanche fasciculata), and a grass (Bromus pumpellianus). Three Michigan special concern species encountered during this study are green spleenwort (Asplenium viride), walking fern (Camptosorus rhizophyllus), and ram's head lady-slipper (Cypripedium arietinum). Chestnut (Castanea dentata) occurs on both islands and is listed as endangered in Michigan. Island distribution maps (Appendix C) are based on Michigan Natural Features Inventory (MNFI) records and the investigator's field notes and collections. State distribution inset maps of some species were supplied by the MNFI. Others were taken from Voss (1972).

PITCHER'S THISTLE — MI THREATENED
Cirsium Pitcheri Torr. (T. & G.) — US PROPOSED THREATEDED

This Great Lakes endemic is limited to the sand dunes of Lakes Michigan, Huron, and Superior. Its endemic nature and fragile habitat are reasons for its threatened status. The species is doing well on the dunes of both islands and does not seem to suffer adversely from the deer browse on North Manitou. Pitcher's thistle thrives on South Manitou and has even done well in some sites close to intense human use such as near the Marina. Herbarium records show that this species has been known from the islands since 1840.

GINSENG — MI THREATENED
Panax quinquefolius L.

This species, originally widespread in the deciduous forests of the eastern United States and adjacent Canada is threatened with extirpation throughout much of its range due to an intense collection for commercial pharmaceutical purposes. The root is eagerly sought as a general cure-all and aphrodisiac. On South Manitou this species occurs in small scattered stations on the richly wooded dunes in association with *Actaea pachypoda*, *Aralia nudicaulis*, *A. racemosa*, and *Osmorhiza claytonii*. Due to the ease by which the species could be removed from the island flora by root collectors, the locations of these populations should not be made available to the general public. Bertha Peth, a prominent character in the island's history, supplemented her income by selling roots she had collected on the island. Despite the prominence of ginseng in the island's folklore, the MNFI had no previous records for this species from South Manitou.

PUMPELLY'S BROME GRASS MI THREATENED
Bromus pumpellianus Scrib.

This species is a western disjunct from the Rockies and Black Hills with its main range in Alaska and northwest Canada (Voss, 1972). Its distribution in Michigan is scant. Its primary habitat is sand dunes where it was found on both islands. It had been previously recorded from the Leelanau Co. mainland (Voss, 1972).

BROOM-RAPE MI THREATENED
Orobanche fasciculata Nutt.

This species is parasitic on Wormwood (Artemisia caudata) and in Michigan is only found on Lake Michigan sand dunes where it is at the easternmost edge of its range (Guire and Voss, 1963). Its fragile habitat as well as its limited state-wide distribution qualifies this species for threatened status. On South Manitou it was found on the dunes along the bay, on the north dunes, and on the perched dunes on the west side. It had been noted from South Manitou previously in MNFI site inventories.

CALYPSO MI THREATENED
Calypso bulbosa (L.) Oakes

This small, yet beautiful orchid is especially characteristic of old beach ridges under conifers near the shores of the Great Lakes (Voss, 1972). The largest station on South Manitou occurs near the old cemetery in the Coastal Forest near the site of Garden City. A common associate is Aster macrophyllus. Several former island residents recall a flower matching the description of Calypso growing in the woods along the school house path just west of the village. The search for this species here was unsuccessful, but the habitat may have changed within the last

fifty years. The wider distribution for this species ranges from Labrador to Alaska south into New England and the northern Great Lakes region. The MNFI had no previous records for this species from the Manitous.

GREEN SPLEENWORT MI SPECIAL CONCERN
Asplenium viride Hudson

This small calciphilic fern at its southern limits of its range has a limited distribution in Michigan. Its wider distribution ranges north to Alaska and Greenland. On South Manitou it was found as a very small population of about 30 fronds in the Valley of the Giants on the sandy soil of the forest floor. Associated herbs include Trillium cernuun, Cystopteris bulbifera, Aralia nudicaulis, Actaea pachypoda, Arisaema triphyllum, and Polygonatum pubescens. It was discovered in 1959 growing on a mossy cedar stump by W. P. Stoutamire. Its occurrence on South Manitou is unusual (Thompson, 1962a) because it usually occurs in partially shaded areas on or near limestone. According to MNFI records, green spleenwort had not been collected on South Manitou since its discovery.

WALKING FERN MI SPECIAL CONCERN
Camptosorus rhizophyllus (L.) Link

This species is another calciphilic fern which has an unusual habitat (Thompson, 1962a). Generally, it is found on shaded limestone outcrops. On South Manitou, however, it occurs in the Cedars on mossy cedar logs or, infrequently, on the adjacent dune bank. The closest station for this fern in the Lower Peninsula is in Alpena Co. The fern's natural distribution ranges from Quebec to Minnesota, south to Georgia, Arkansas, and Oklahoma. According

to MNFI records this fern had not been collected on South Manitou since 1964.

RAM'S HEAD LADY-SLIPPER MI SPECIAL CONCERN
Cypripedium arietinum R. Brown

This orchid is the smallest native lady-slipper in Michigan. It grows best (Voss, 1972) on low dunes in partial shade of fringing conifers. This species was found in similar habitat along Gull Pt. trail and along the short trail just west of the village on South Manitou. Additional populations may exist in the woods at the border of the Coastal Forest and the bay dunes between these locations. The MNFI had no previous records of this plant from the Manitous.

CHESTNUT MI ENDANGERED
Castanea dentata (Marsh.) Borkh.

Although not native to this part of Michigan, the occurrence of this species on both islands should be noted. In Michigan it is in danger of extinction by the chestnut blight. The South Manitou population is severely blighted. It occurs near the wooded lake bluff in the old field west of the site of the Furst Homestead (sec. 9, SW 1/4). This station was established in the 1950's from seedlings grown from nuts collected from healthy trees near South Boardman (Kalkaska Co.). This planting was done by the Michigan DNR under the direction of Fred Haskin. The young trees had been grazed to ground level by cattle a few years later, but by the early 1960's were reported to be doing well. Today the population's decline appears to be due to combination of overcrowding and blight.

On North Manitou, however, the small station of nine good sized trees, a few with multiple trunks, situated in the woods

just west of the trail running south from the Frank Farm (sec. 33, SW 1/4, SE 1/4) appears to be healthy. The trees flower in July and old chestnut husks were found at the base of the trees. This stand was probably established by a farmer earlier in the century, a common practice as attested by the regular occurrence of chestnuts at the sites of old farms and orchards along Lake Michigan (Brewer, 1982). Most of the surrounding trees are big-tooth aspen, but other overstory species include sugar maple, black cherry, beech, and ironwood.

RECOMMENDATIONS AND CONCLUSIONS

1. The introduced deer herd on North Manitou has had a profound impact on the forest structure and floristic composition of the island. Several native plant species which occur on South Manitou are absent and many others have been considerably reduced in abundance. A large scale reduction in the deer population, if not their total removal from the island, should be a top priority if the declining quality of the vegetation is to be abated and later reversed. The forests themselves have the potential for regeneration as clearly demonstrated by the DNR deer exclosure. Many common Northern Hardwoods herbs were also found as solitary individuals in these forests and should multiply and spread in the absence of deer. Several forested areas on South Manitou have even been subject to cattle grazing in the past, but now have a full complement of woodland herbs. An understory layer would, of course, eventually arise from parent stock in the overstory as also illustrated by the DNR exclosure. The process of regeneration will take time, but will never occur unless radical measures are taken to control the non-native deer population.

2. The abundance and variety of both the herbaceous and understory species on South Manitou is due in a large part to the absence of deer on the island. Measures must be taken to maintain this condition. The purposeful introduction of deer to the island would be ludicrous. The remote danger, however, lies in the chance introduction of deer from North Manitou across the ice during the winter. Should this unlikely event occur, deer should not be permitted to remain on the island. The island's integrity

as a unique natural area would be compromised by the presence of deer. South Manitou Island has 5180 deer-free acres (excluding lakes) comprising a variety of habitats. In contrast, the total deer-free acreage on North Manitou totals 4800 square feet (0.11 acres). South Manitou not only can serve as a baseline for comparison with North Manitou (as it did in this vegetation study), but the island may be useful as a control for similar sites in mainland study areas.

3. Even without the threat of deer, precautions must be taken to maintain the naturalness of several fragile island habitats.

a) The Cedars should remain free of any additional trails and should not be incorporated as part of a nature trail. The dune bank behind the fenced cedar should be kept free of any improvised trails made by island visitors.

b) The perched dunes on the western edge of South Manitou should be kept as natural as possible. Limiting the regular motorized transport of island visitors to the base of these dunes would aid in this objective.

c) The shoreline dunes should also be protected from further degradation by confining human activities to those areas already used. The ecotonal area between these dunes and the Coastal Forest should remain free of any future developments.

4. The stations of special status species should also be protected. As a rule the locations of these species should not be made available to the general public. The species which would be the most threatened by public disclosure is

ginseng. Because of its commercial value, root collectors could soon remove the species from the mapped locations.

5. Manitou Island vegetation studies should be continued. The permanent plots established during this study and the three North Manitou deer exclosures should be monitored and visited at least every five years to record tree basal area, count understory species, and record the species in the ground layer. If any new deer exclosures are to be erected on North Manitou, they should be placed in the deciduous forests of the island. The aquatic plants of the inland lakes of both islands and the surrounding wetlands were not studied in detail for this report and should be incorporated in a future aquatic vegetation study. Additional terrestrial species should also be searched for during future field work.

CATALOGUE OF VASCULAR PLANTS

The following list of 82 families, 271 genera, and 490 species was derived primarily from extensive documentation during the field investigation. Unless specifically noted, all species listed and numbered were collected by Brian T. Hazlett and later deposited in either the herbaria of The University of Michigan (MICH), The University of Michigan Biological Station (UMBS), or Sleeping Bear Dunes National Lakeshore headquarters presently at Frankfort, Michigan. Michigan Flora, Part 1 (Voss, 1972) was consulted for species presence records for gymnosperms and monocots. Although these records only refer to the Manitou Islands in general, all are supported by voucher specimens. Species lists by Paul Thompson were also examined. If voucher specimens exist for these species, they are probably deposited in the herbarium of Cranbrook Institute of Science (BLH).

Nomenclature generally follows Mickel (1979) for ferns and fern allies, Voss (1972) for monocots and gymnosperms, and Gleason and Cronquist (1963) for dicots. Abundance estimates follow Voss (1972). The families within each major group and then the species within each family are listed in alphabetical order. Common names have also been included. The following abbreviations are used: SI-sight identification, no voucher; MF-Michigan Flora, Part 1; PT-Paul Thompson; NM-North Manitou; SM-South Manitou; R-rare; L-local; O-occasional; F-frequent; C-common; and A-abundant.

The largest family in the Manitou Island flora, the Compositae, is represented by 42 species. Carex, the largest genus, has 29 species.

PTERIDOPHYTES (Clubmosses, Horsetails, and Ferns)

LYCOPODIACEAE (Club-moss Family)

Lycopodium annotinum L. STIFF CLUBMOSS
NM: O; Shaded borders of fields. 1664.

L. clavatum L. GROUND PINE
NM: F; Shaded borders of fields and clearings. 1666.
SM: F; Coastal Forest. 1796.

L. x zeilleri Rory (L. complanatum x L. tristachyum)
NM: F; Shaded borders of fields and clearings. 1663.

L. lucidulum Michx. SHINING CLUBMOSS
SM: L; Northern hardwoods west of Gull Pt., probably more common. 1732.

L. obscurum L. TREE CLUBMOSS
NM: F; Shaded borders of fields and clearings. 1665.
SM: F; Shaded borders of fields and clearings. 1233.

L. tristachyum Pursh.
SM: C; Clearings on old beach ridges. 1911.

EQUISETACEAE (Horsetail Family)

Equisetum arvense L. FIELD HORSETAIL
NM: C; Shady spring-fed areas. 1382.
SM: C; Shaded roadsides and moist depressions. 1523, 1571.

E. hyemale L. SCOURING-RUSH
NM: F; Shorelines along Lake Michigan. SI.
SM: C; On all dune areas. 1311, 1559, 1720.

E. scirpoides Michx. DWARF SCOURING-RUSH
NM: L; Moist sandy depression at Pot Holes. 1692.

E. sylvaticum L. WOODLAND HORSETAIL
NM: L; Black Ash Swamp at south end of Lake Manitou. 1642.

OPHIOGLOSSACEAE (Adder's Tongue Family)

Botrychium dissectum Spreng. DISSECTED GRAPE-FERN
SM: L; Old grown-over orchard near Hutzler grave site, sec. 33. SI.

B. matricariifolium (Doll) A. Braun DAISY-LEAVED GRAPE-FERN
SM: F; Moist Northern Hardwoods. 1545, 1895.

B. multifidum (Gmel.) Rupr. LEATHERY GRAPE-FERN
NM: L; Perhaps more frequent, but only found in field at Carlson Place near deer exclosure. 1993.
SM: O; Old fields on lake bed, secs. 3 and 34. 1856.

B. virginianum (L.) Sw. RATTLESNAKE FERN
NM: L; Pot Holes. SI.
SM: C; Northern Hardwoods. 1512.

OSMUNDACEAE (Royal Fern Family)

Osmunda cinnamomea L. CINNAMON FERN
NM: L; Black Ash Swamp at Tamarack Lake. 1677.

O. claytoniana L. INTERRUPTED FERN
NM: L; Collected at Rusco's (s. 3) from a transplant from the woods near Swenson's Clearing (sec. 6). 1854.

O. regalis L. ROYAL FERN
NM: L; Black Ash Swamp at south end of Lake Manitou. SI.
SM: L; Lake margin at south end of Lake Florence. 1583.

POLYPODIACEAE (Fern Family)

Adiantum pedatum L. MAIDENHAIR FERN
NM: L; Pot Holes. 1696.
SM: C; Rich Northern Hardwoods. 1770.

Asplenium platyneuron (L.) Oakes ex. D.C. Eaton EBONY SPLEENWORT
SM: L; In overgrown clearing near dunes, sec. 33, NW 1/4. 1544.

A. viride Huds. GREEN SPLEENWORT
SM: R; Cedars. 1896.

Athyrium filix-femina (L.) Roth. LADY FERN
NM: O; Northern Hardwoods and Pot Holes. SI.
SM: C; Northern Hardwoods. 1803, 1816.

Camptosorus rhizophyllus (L.) Link WALKING FERN
SM: R; Mainly on fallen cedar logs in the Cedars. 1726.

Cystopteris bulbifera (L.) Bernh. BULBLET FERN
NM: F; Shaded spring-fed areas. 1605.
SM: C; Rich Northern Hardwoods. 1872.

C. fragilis (L.) Bernh.
NM: L; Woods near Fish Shanty. 1608.

Dryopteris cristata (L.) A. Gray CRESTED SHIELD-FERN
NM: L; Black Ash Swamp bordering Tamarack Lake. 1837.

D. intermedia (Muhl. ex. Willd.) A. Gray EVERGREEN WOOD-FERN
NM: O; Northern Hardwoods. 1644.
SM: F; Moist Northern Hardwoods. 1859.

D. marginalis (L.) A. Gray MARGINAL SHIELD-FERN
NM: L; Pot Holes. 1690.
SM: C; Northern Hardwoods. SI.

D. spinulosa (O. F. Muell.) Watt. SPINULOSE SHIELD-FERN
SM: F; Moist Northern Hardwoods. 1906.

D. x triploidea Wherry (D. intermedia x D. spinulosa)
NM: L; Probably more frequent but only collected in Black Ash Swamp bordering Tamarack Lake. 1835.

Gymnocarpium dryopteris (L.) Newm. OAK FERN
NM: O; Forest floor in Northern Hardwoods. 1621.

Matteuccia struthiopteris (L.) Todaro OSTRICH FERN
NM: L; Stream bank northwest of Tamarack Lake. 1680.
SM: L; Moist Northern Hardwoods southeast of Lake Florence and on moraine, sec. 5. 1858.

Onoclea sensibilis L. SENSITIVE FERN
NM: L; Black Ash Swamp bordering Tamarack Lake. 1676.
SM: O; Moist Northern Hardwoods. 1860.

Polypodium virginianum L. COMMON POLYPODY
NM: L; Pot Holes. 1688.
SM: O; Cool Northern Hardwoods. 1235.

Polystichum acrostichoides (Michx.) Schott. CHRISTMAS FERN
SM: L; Northern Hardwoods near shipwreck. 1561.

P. braunii (Spenner) Fee BRAUN'S HOLLY-FERN
SM: L; Northern Hardwoods on morainal deposits, sec. 5. 1867.

P. lonchitis (L.) Roth HOLLY FERN
NM: L; Pot Holes. 1695.
SM: L; Cedars. 1574.

Pteridium aquilinum (L.) Kuhn. BRACKEN FERN
NM: O; Fields, and Lake Plain woods. 1598.
SM: C; Fields, roadsides, and Coastal Forest. 1910.

Thelypteris noveboracensis (L.) Neuwl. NEW YORK FERN
NM: O; Northern Hardwoods. SI.
SM: F; Coastal Forest. SI.

T. palustris Schott MARSH FERN
NM: F; Found at Black Ash Swamp bordering Tamarack Lake, probably occurring in other wetland areas. 1675.
SM: C; Wetlands and swales in Coastal Forest. 1757.

T. phegopteris (L.) Slosson NORTHERN BEECH-FERN
NM: L; Northern Hardwoods south of Lake Manitou. 1645.

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)

Juniperus communis L. COMMON JUNIPER (MF)
NM: F; Old fields. SI.
SM: A; Old fields and dunes. SI.

J. horizontalis Moench CREEPING JUNIPER (MF)
NM: O; Dunes. 1964.
SM: A; Old fields and dunes. 1514.

Thuja occidentalis L. WHITE CEDAR (MF)
NM: C; Lake Plain Woods, Northern Conifers, and near lake bluffs and dune borders. 1609.
SM: C; Northern Conifers, Coastal Forest, and Northern Hardwoods near dune borders. 1894.

PINACEAE (Pine Family)

Abies balsamea (L.) Miller BALSAM FIR (MF)
NM: F; Lake Plain Woods and Northern Conifers. 1617.
SM: C; Coastal Forest and Northern Conifers. 1927.

Larix laricina (DuRoi) K. Koch LARCH
NM: L; Tamarack Lake. 1415.

Picea abies (L.) Karsten NORWAY SPRUCE
NM: L; Ornamental, North Manitou Village. 1996.

P. glauca (Moench) A. Voss WHITE SPRUCE
NM: O; Lake bluff near Pot Holes. 1691.
SM: F; Northern Conifers. 1308, 1873.

Pinus banksiana Lamb. JACK PINE (MF)
SM: A; Lake plain, Coastal Forest, old fields, and dunes. 1903.

P. resinosa Aiton RED PINE
NM: F; Lake plain woods. 1982.
SM: C; Old fields and Coastal Forest. 1909.

P. strobus L. WHITE PINE (MF)
NM: F; Lake bluffs and lake plains. 1611.
SM: C; Coastal Forest and lake bluffs. 1908.

Tsuga canadensis (L.) Carr. HEMLOCK (MF)
NM: F; Northern Hardwoods. 1618.
SM: C; Northern Hardwoods and Coastal Forest. 1890.

TAXACEAE (Yew Family)

Taxus canadensis Marsh. YEW (MF)
SM: C; Northern Hardwoods and Coastal Forest. 1723.

MONOCOTS

AMARYLLIDACEAE (Amaryllis Family)

Narcissus poeticus L. NARCISSUS
NM: L; Paul Maleski Place. 1989.
SM: L; Island cemetery and in village area. 2003.

ARACEAE (Arum Family)

Arisaema triphyllum (L.) Schott JACK-IN-THE-PULPIT (MF)
NM: O; As small shoots in Northern Hardwoods especially in spring-fed areas. 1379.
SM: C; Northern Hardwoods. 1325.

CYPERACEAE (Sedge Family)

Carex aquatilis Wahl.
NM: O; Gravel shores. 1394, 1959.
SM: C; Wetlands. 2002.

C. arctata Boott
NM: F; Northern Hardwoods. 1388.
SM: O; Coastal Forest. 1289.

C. aurea Nutt.
SM: L; Low dunes near Lighthouse and on bluff south of Cedars. 1747.

C. bebbii (Bailey) Fern.
NM: O; Swales in Lake Plain Woods. 1828.

C. brunnescens (Pers.) Poiret
NM: L; Tamarack Lake. 1416.

C. communis Bailey (MF)
NM: F; Moist Northern Hardwoods. 1242, 1352.
SM: O; Moist Northern Hardwoods. 1409.

C. convoluta Mack.
NM: O; Moist Northern Hardwoods and Pot Holes. 1384.

C. crinita Lam. (MF)
NM: O; Wetlands and Black Ash Swamps, also in some moist Northern Hardwoods. 1399.
SM: L; Shores of Lake Florence. 1349.

C. deweyana Schw.
NM: O; Moist Northern Hardwoods. 1389.
SM: F; Northern Hardwoods and Coastal Forest. 2007, 1240, 1265.

C. eburnea Boott (MF)
NM: F; Northern Conifers. 1480.
SM: F; Cedars and Northern Conifers. 1230, 1312.

C. garberi Fern.
NM: O; Dune swales and gravel shores. 1374, 1434, 1786.

C. hitchcockiana Dewey
SM: O; Young Northern Hardwoods. 1287.

C. hystericina Willd. (MF)
NM: L; Near Fish Shanty. 1369.

C. intumescens Rudge
SM: O; Moist Northern Hardwoods. 1350.

C. lanuginosa Michaux
SM: F; Moist swales and shores. 1259.

C. lasiocarpa Ehrh.
SM: F; Moist open lake plain swales and shores of Lake Florence. 1333.

C. leptonervia Fern. (MF)

C. muhlenbergii Willd.
SM: L; Dunes on north side. 1336.

C. pedunculata Willd.
SM: O; Northern Hardwoods. 1943.

C. plantaginea Lam. (MF)
SM: F; Northern Hardwoods. 1502, 1954.

C. projecta Mack. (MF)
NM: O; Wetlands and Black Ash Swamps. 1398.

C. retrorsa Schw.
NM: F; Wetlands and Black Ash Swamps. 1400.
SM: O; Swales in Coastal Forest. 1892.

C. rosea Willd. (MF)
NM: O; Northern Hardwoods. 1478.
SM: O; Moist Northern Hardwoods. 1324.

C. scabrata Schw. (MF)
NM: O; Wetlands. 1386.

C. stipata Willd.
SM: L; Shores of Lake Florence. 1332.

C. trisperma Dewey
NM: O; Moist Northern Hardwoods. 1421.

C. tuckermanii Dewey (MF)
SM: O; Moist Northern Hardwoods. 1356.

C. viridula Michaux
NM: O; Gravel shores and dune swales. 1375, 1435.
SM: L; Shores of Lake Florence. 1330.

C. vulpinoidea Michaux
NM: F; Wetlands and Black Ash Swamps. 1401.

Cladium mariscoides (Muhl.) Torrey (MF)
SM: L; Shores of Lake Florence. 1751.

Eleocharis elliptica Kunth
SM: L; Shores of Lake Florence. 1331.

E. smallii Britton
SM: L; Shores of Lake Florence. 1319.

Scirpus acutus Bigelow HARDSTEM BULRUSH
NM: L; Lakeshore near North Manitou Village. 1468.
SM: L; Shores of Lake Florence. 1506.

S. atrovirens Willd.
NM: F; Wetlands and Black Ash Swamps. 1417.

S. cyperinus (L.) Kunth (MF)
NM: O; Wetlands and Black Ash Swamps. SI.

S. microcarpus Presl
NM: L; Gravel shore north of Vessel Pt., sec. 22. 1614.

GRAMINEAE (Grass Family)

Agropyron dasystachyum (Hooker) Scribner (MF)
NM: C; Sand dunes. 1403.
SM: C; Sand dunes, sandy banks, and shores. 1304.

A. repens (L.) Beauv. QUACKGRASS
NM: C; Fields. 1460.
SM: C; Old fields. 1247.

Agrostis gigantea Roth. RED TOP
NM: L; Wetlands, Black Ash Swamps, and gravel shores. 1612.
SM: F; Lake Florence, wetlands, and moist fields. 1568.

A. hyemalis (Walter) BSP. TICKLEGRASS
SM: O; Wetlands and moist Northern Hardwoods. 1750.

Ammophila breviligulata Fern. BEACH GRASS (MF)
NM: F; Sand dunes. 1658.
SM: C; Sand dunes. 1557.

Andropogon scoparius Michaux LITTLE BLUESTEM
NM: F; Sand dunes. SI.
SM: C; Sand dunes. 1715.

Bromus inermis Leysser SMOOTH BROME
NM: C; Old fields and lawns. 1452.
SM: C; Old fields and roadsides. 1355.

B. pumpellianus Scribner
NM: L; Old Baldy, sec. 21. 1659.
SM: L; Perched dunes, sec. 5. 1737.

B. tectorum L. DOWNY CHESS
SM: L; Old Coast Guard station grounds. 1741.

Calamagrostis canadensis (Michaux) Beauv. BLUE-JOINT
NM: O; Wetlands. 1678.
SM: O; Wetlands. 1576.

Calamovilfa longifolia (Hooker) Scribner
NM: F; Sand dunes. SI.
SM: C; Sand dunes. 1555, 1713.

Cinna latifolia (Goepp.) Griseb. (MF)

Dactylis glomerata L. ORCHARD GRASS
NM: C; Fields. 1454.
SM: C; Fields. 1250.

Danthonia spicata (L.) R. & S. OATGRASS
NM: C; Fields. 1467.
SM: C; Fields. 1533.

Echinochloa muricata (Beauv.) Fern. (MF)

Elymus canadensis L.
NM: O; Dunes. 1588.
SM: F; Dunes. 1734.

Festuca obtusa Biehler NODDING FESCUE (MF)

F. occidentalis Hooker WESTERN FESCUE
SM: O; Coastal Forest. 1296.

F. ovina L. SHEEP FESCUE
SM: C; Fields. 1249, 1334.

F. rubra L. RED FESCUE
NM: C; Fields and lawns. 1442a, 1457.

F. saximontana Rydb.
SM: C; Fields and some dunes. 1553.

Glyceria borealis (Nash) Batch.
SM: L; Shores of Lake Florence. 15Ø3.

G. striata (Lam.) Hitchc. FOWL MANNA GRASS (MF)

Hystrix patula Moench BOTTLEBRUSH GRASS
NM: L; Northern Hardwoods north of Paul Maleski Place, sec. 21. 1624.

Koeleria macrantha (Ledeb.) Schultes JUNE GRASS (MF)
NM: O; Dunes. 1436.
SM: F; Dunes. 1714.

Melica smithii (Gray) Vasey (MF)
NM: O; Northern Hardwoods. 1479, 1615.
SM: F; Young Northern Hardwoods. 1572.

Milium effusum L.
NM: O; Northern Hardwoods. 1423.
SM: C; Northern Hardwoods. 1323, 1861.

Oryzopsis asperifolia Michaux
NM: O; Pot Holes and Northern Hardwoods. 147Ø.
SM: F; Coastal Forest. 1297.

O. racemosa (Sm.) Hitchc.
NM: L; Found only on a wooded bluff, sec. 12, perhaps more common. 184Ø.

Panicum implicatum Britton
NM: O; Gravel shores and fields. 1371, 166Ø.
SM: L; Shores of Lake Florence. 15Ø4.

P. linearifolium Britton var. werneri (Britton) Fern.
NM: L; Field at Carlson Place, perhaps more common. 17Ø1.

Phleum pratense L. TIMOTHY
NM: C; Gravel shores and fields. 1396.
SM: C; Fields and roadsides. 1542.

Phragmites australis (Cav.) Steudel
NM: L; Tamarack Lake. SI.
SM: L; Lake Florence. 1887.

Poa alsodes Gray (MF)
NM: O; Along trails. 1387.
SM: L; Perhaps more common, but found only along trail to Cedars. 2011.

P. compressa L. CANADA BLUEGRASS (MF)
NM: C; Fields. 1601.
SM: C; Fields. 1532.

P. nemoralis L.
NM: O; Trails. 1477.

P. palustris L. FOWL MEADOW GRASS
NM: O; Wetlands. 1641, 1780.

P. pratensis L. KENTUCKY BLUEGRASS
NM: C; Fields. 1453, 1455.
SM: C; Fields and some dunes. 1246, 1552.

Schizachne purpurascens (Torrey) Swallen. (MF)
SM: L; Perhaps more common but found only along trail to Cedars. 1940.

Sphenopholis intermedia (Rydb.) Rydb. (MF)

IRIDACEAE (Iris Family)

Iris flavescens DC.
SM: L; Island Cemetery. 1283.

I. versicolor L. WILD BLUE FLAG
SM: L; Lake Florence. 1320.

I. virginica L. SOUTHERN BLUE FLAG
NM: L; Tamarack Lake and West Side Dock. 1414, 1492, 1493.

JUNCACEAE (Rush Family)

Juncus alpinus Vill.
NM: L; Perhaps more common, but only found on beach, North Manitou Village. 1603.

J. balticus Willd.
NM: F; Shores and dune swales. 1456, 1827.
SM: C; Dunes, shores, and swales on old lake bed and Coastal Florest. 1316, 1505.

J. pelocarpus Meyer
SM: L; Shores of Lake Florence. 1743.

J. tenuis Willd. PATH RUSH
NM: F; Trails in Northern Hardwoods and in some fields. 1687, 1699, 1834.
SM: F; Trails in Northern Hardwoods and some fields. 1709.

LEMNACEAE (Duckweed Family)

Lemna minor L. DUCKWEED
NM: L; Near The Spring, sec. 15, and in stream northwest of Tamarack Lake. 1490.

LILIACEAE (Lily Family)

Allium cernuum Roth NODDING WILD ONION (MF)

A. fistulosum L. WELSH ONION
NM: L; Persistent in garden patch near North Manitou Village. 1498.

A. schoenoprasum L. CHIVES
NM: L; Small patch in lawn near Halstead House, North Manitou Village. 1499.

A. tricoccum Aiton WILD LEEK
NM: F; Northern Hardwoods. 1600.
SM: C; Northern Hardwoods. 1511.

Asparagus officionalis L. GARDEN ASPARAGUS
NM: L; Near old shed at Paul Maleski Place. 1635.
SM: L; Old field across from island cemetery. 1536.

Clintonia borealis (Aiton) Raf. CORN-LILY (MF)
NM: L; Single vegetative plants encountered throughout Northern Hardwoods. SI.
SM: F; Northern Hardwoods. 1761.

Convallaria majalis L. LILY-OF-THE-VALLEY
NM: L; Planted beside old Coast Guard Station, North Manitou Village. 1408.
SM: L; Spreading throughout island cemetery. 1281.

Erythronium americanum Ker ADDER'S TONGUE
NM: C; Northern Hardwoods. SI.
SM: C; Northern Hardwoods. 1931.

Hemerocallis fulva (L.) L. ORANGE DAY-LILY
NM: L; North Manitou Village. SI.

Lilium philadelphicum L. WOOD LILY
SM: C; Sand dunes. 1344.

Maianthemum canadense Desf. CANADA MAYFLOWER (MF)
NM: L; In protected areas in Northern Conifers near Pot Holes. 1474.
SM: C; Northern Conifers, Northern Hardwods, and Coastal Forest. 1232.

Medeola virginiana L. INDIAN CUCUMBER-ROOT
SM: O; Northern Hardwoods around Lake Florence. 1814.

Muscari atlanticum Boiss. & Reuter GRAPE HYACINTH
NM: L; North Manitou Village. SI.

Polygonatum pubescens (Willd.) Pursh HAIRY SOLOMON'S SEAL
NM: O; Single plants throughout Northern Hardwoods. SI.
SM: C; Northern Hardwoods. 1238.

Smilacina racemosa (L.) Desf. FALSE SPIKENARD
SM: C; Northern Hardwoods and Coastal Forest. 1290, 1731.

S. stellata (L.) Desf. STARRY FALSE SOLOMON'S SEAL
SM: C; Dune fringes. 1266, 1299.

Streptopus roseus Michaux ROSE MANDARIN (MF)
NM: L; Scattered vegetative individuals throughout Northern Hardwoods. SI.
SM: C; Northern Hardwoods. 1763.

Trillium cernuum L. NODDING TRILLIUM
SM: F; Northern Hardwoods on moraine. 1936.

T. erectum L. STINKING BENJAMIN (MF)
SM: F; Northern Hardwoods on moraine. 1938.

T. grandiflorum (Michaux) Salisb. COMMON TRILLIUM (MF)
NM: F; Scattered throughout Northern Hardwoods. 1978.
SM: C; Northern Hardwoods. 1933.

Uvularia grandiflora Sm. BELLWORT
SM: F; Northern Hardwoods. 1932.

Zigadenus glaucus (Nutt.) Nutt. WHITE CAMAS
NM: O; Dunes. 1657.
SM: F; Dunes. 1551.

ORCHIDACEAE (Orchid Family)

Calopogon tuberosus (L.) BSP. GRASS-PINK (MF)

Calypso bulbosa (L.) Oakes CALYPSO
SM: L; Coastal Forest near old cemetery, sec. 3, NE 1/4. 2000.

Corallorhiza maculata Raf. SPOTTED CORAL-ROOT (MF)
NM: O; Northern Hardwoods. 1623.
SM: F; Northern Hardwoods. 1705.

C. striata Lindley STRIPED CORAL-ROOT
NM: O; Northern Hardwoods. 1393.
SM: F; Coastal Forest and moist Northern Hardwoods. 1268.

C. trifida Chat. EARLY CORAL-ROOT
SM: O; Northern Hardwoods and Coastal Forest. 1951.

Cypripedium arietinum R. Br. RAM'S HEAD LADY-SLIPPER
SM: L; Border of Coastal Forest and dunes. SI.

C. calceolus L. YELLOW LADY-SLIPPER (MF)
SM: O; Cedars. 2004.

Epipactis helleborine (L.) Crantz HELLEBORINE
NM: L; Trail near The Spring, probably more common. 1652.
SM: O; Coastal Forest and Northern Hardwoods. 1537, 1760.

Goodyeara oblongifolia Raf. GIANT RATTLESNAKE-PLANTAIN
NM: L; Pot Holes. 1704.
SM: F; Coastal Forest. 1822.

G. repens (L.) R. Br. DWARF RATTLESNAKE-PLANTAIN
NM: L; Pot Holes. 1787.
SM: O; Northern Conifers. 1729.

G. tesselata Lodd. CHECKERED RATTLESNAKE-PLANTAIN
SM: O; Coastal Forest. 1807.

Habenaria clavellata (Michaux) Sprengel CLUB-SPUR ORCHID (MF)

H. hyperborea (L.) R.Br. TALL NORTHERN BOG ORCHID
NM: L; Pot Holes. 1689.

H. lacera (Michaux) Lodd. RAGGED FRINGED ORCHID (MF)

H. orbiculata (Pursh) Torrey ROUND-LEAVED ORCHID
SM: O; Moist Northern Hardwoods. 1365.

H. psychodes (L.) Sprengel PURPLE FRINGED ORCHID (MF)
SM: L; Shores of Lake Florence. 1707.

H. viridis (L.) R.Br. BRACTED ORCHID (MF)
NM: L; Oak woods north of airstrip. 1992.
SM: O; In shade at edges of Northern Hardwoods. 1353, 1727.

Spiranthes lacera (Raf.) Raf. SLENDER LADIES'-TRESSES
SM: L; Forest border of bay dunes and Coastal Forest. 1718.

S. romanzoffiana Cham. HOODED LADIES'-TRESSES (MF)
SM: L; Sandy shores of Lake Florence. 1913.

SPARGANIACEAE (Bur-reed Family)

Sparganium eurycarpum Engelm. (MF)

TYPHACEAE (Cat-tail Family)

Typha angustifolia L. NARROW LEAVED CAT-TAIL
SM: L; Lake Florence. 1578.

DICOTS

ACERACEAE (Maple Family)

Acer pensylvanicum L. STRIPED MAPLE
NM: F; Pot Holes, Lake Plain Woods and shorelines. 1693.
SM: F; Coastal Forest. SI.

A. platanoides L. NORWAY MAPLE
NM: L; Planted throughout North Manitou Village. 1465.

A. rubrum L. RED MAPLE
NM: F; Black Ash Swamps and Lake Michigan shores. 1639.
SM: C; Moist Northern Hardwoods, Coastal Forest and lakeshores. 1291.

A. saccharum Marsh. SUGAR MAPLE
NM: A; Northern Hardwoods. 14Ø6.
SM: A; Northern Hardwoods and Coastal Forest. 1517, 1924.

A. spicatum Lam. MOUNTAIN MAPLE
NM: O; Moist Northern Hardwoods, Pot Holes and shores. 139Ø, 162Ø.
SM: F; Cedars and Northern Hardwoods near dune borders. 1346.

ANACARDIACEAE (Cashew Family)

Rhus typhina L. STAGHORN SUMAC
SM: C; Old fields. 1515.

Toxicodendron radicans (L.) Kuntze. POISON IVY
NM: R; Some dunes and sandy sites. SI.
SM: A; Dunes and in partial shade of the borders of woods and clearings. 19Ø2.

APOCYNACEAE (Dogbane Family)

Apocynum androsaemifolium L. SPREADING DOGBANE
SM: O; Borders of fields and forests. SI.

Vinca minor L. COMMON PERIWINKLE, MYRTLE
SM: F; Around old homesteads and grave sites. 1269.

AQUIFOLIACEAE (Holly Family)

Ilex verticillata (L.) Gray MICHIGAN HOLLY
SM: L; Wetland west of Schoolhouse. 181Ø.

ARALIACEAE (Ginseng Family)

Aralia hispida Vent. BRISTLY SARSAPARILLA
SM: L; Old field north of State Award Rd., sec. 3, S 1/2. 1771.

A. nudicaulis L. WILD SARSAPARILLA
NM: R; Pot Holes. SI.
SM: F; Coastal Forest and Northern Conifers. 1264.

A. racemosa L. SPIKENARD
SM: F; Northern Hardwoods. 1735.

Panax quinquefolius L. GINSENG
SM: L; Rich Northern Hardwoods on old dunes. 1897.

ASCLEPIADACEAE (Milkweed Family)

Asclepias syriaca L. COMMON MILKWEED
NM: C; Old fields and dunes. 17ØØ.
SM: C; Old fields and dunes. 1564.

A. tuberosa L. BUTTERFLY WEED (PT)

A. verticillata L. WHORLED MILKWEED
SM: L; Field across from Schoolhouse. 1889.

A. viridiflora Raf. GREEN MILKWEED
SM: L; Perched dunes. 1556.

BALSAMINACEAE (Touch-me-not Family)

Impatiens capensis Meerb. SPOTTED TOUCH-ME-NOT
NM: L; Black Ash Swamp at south end of Lake Manitou. SI.

BERBERIDACEAE (Barberry Family)

Caulophyllum thalictroides (L.) Michx. BLUE COHOSH
NM: O; Northern Hardwoods and Pot Holes. 1486.
SM: C; Northern Hardwoods. 1869.

BETULACEAE (Birch Family)

Betula alleghaniensis Britt. YELLOW BIRCH
NM: C; Northern Hardwoods. SI.
SM: C; Northern Hardwoods. 1912.

B. papyrifera Marsh. WHITE BIRCH
NM: C; Northern Hardwoods. 1485.
SM: C; Old fields, Northern Conifers, Coastal Forest, and Northern Hardwoods. 1548, 1922.

Ostrya virginiana (Mill.) K. Koch IRONWOOD
NM: C; Lake Plain Woods, Northern Hardwoods, and borders of dunes and fields. 14Ø7, 1684.
SM: C; Northern Hardwoods especially near dunes. 1337.

BORAGINACEAE (Forget-me-not Family)

Cynoglossum officinale L. COMMON HOUND'S TONGUE
NM: C; Northern Hardwoods. 1385.
SM: L; Roadside near turn to Shipwreck. 1575.

Lithospermum caroliniense (Walt.) MacMill. HOARY PUCCOON
NM: C; Dunes. 1432.
SM: C; Dunes. 1293.

Myosotis laxa Lehm. SMALLER FORGET-ME-NOT
NM: L; Northern Hardwoods near Pot Holes. 1469.

CAMPANULACEAE (Harebell Family)

Campanula rotundifolia L. BLUEBELL
NM: O; Dunes and in some fields. 1428.
SM: C; Dunes and bluffs. 1584.

CAPRIFOLIACEAE (Honeysuckle Family)

Diervilla lonicera Mill. BUSH HONEYSUCKLE
SM: O; Moist Northern Hardwoods. 17Ø6.

Linnaea borealis L. TWINFLOWER
NM: L; Northern Conifers. 1473.
SM: F; Coastal Forest and Northern Conifers. 1361.

Lonicera canadensis Marsh. FLY HONEYSUCKLE
SM: O; Northern Hardwoods and Coastal Forest. 1538.

L. dioica L. WILD HONEYSUCKLE
SM: O; Borders of forest and fields. 1234.

L. hirsuta Eat. HAIRY HONEYSUCKLE
SM: L; Trail behind South Manitou Village. 2Ø2Ø.

Sambucus canadensis L. COMMON ELDER (PT)

S. pubens Michx. RED ELDERBERRY
NM: R; Northern Hardwoods. 1422.
SM: C; Coastal Forest and Northern Hardwoods. 1518.

Symphoricarpos albus (L.) Blake. SNOWBERRY
NM: O; Pot Holes and near borders of woods and dunes. 1785, 1832.
SM: F; Northern Conifers, Coastal Forest, and Northern Hardwoods. 1765a.

Viburnum acerifolium L. MAPLE-LEAVED VIBURNUM
SM: C; Coastal Forest and Northern Hardwoods. 1524.

V. Opulus L. HIGHBUSH CRANBERRY
SM: L; Near trail to the Cedars. 1347.

V. wrightii Miq.
SM: L; Henry Haas Farm, sec. 4. 2016.

CARYOPHYLLACEAE (Pink Family)

Arenaria serpyllifolia L. THYME-LEAVED SANDWORT
NM: C; Sandy waste areas. 1462.
SM: C; Sandy waste areas. 1270.

A. stricta Michx. ROCK SANDWORT
NM: C; Dune habitats. 1429.
SM: C; Dune habitats. 1301.

Cerastium fontanum Baumg. COMMON MOUSE-EARED CHICKWEED
NM: O; Moist woods and swales. 1378.
SM: O; Moist woods and swales. 1351.

C. tomentosum L.
NM: L; Spreading in front yard of large lodge, North Manitou Village. 1410.

Dianthus Armeria L. DEPTFORD PINK
SM: O; Grassy fields. 1539.

D. barbatus L. SWEET WILLIAM
SM: L; Island cemetery. 1534.

D. plumarius L. GARDEN PINK
NM: L; Spreading across lawn of an old lodge, North Manitou Village. 1596.

Lychnis Coronaria (L.) Desr. MULLEIN PINK
NM: L; Woods near John Maleski Place. 1702.

Saponaria officionalis L. SOAPWORT, BOUNCING BET
SM: L; Sand in front of Marina. 1769.

Silene alba (Mill.) E.H. Krause WHITE CAMPION
NM: C; Open fields. 1634.
SM: C; Open fields. 1543.

S. vulgaris (Moench.) Garke. BLADDER CAMPION
NM: O; Open fields. 1447.
SM: C; Open fields and dunes. 1248, 1310.

Stellaria graminea L. COMMON STICHWORT
NM: L; Wet site near West Side Dock. 1405, 1496.

S. media (L.) Vill. COMMON CHICKWEED
NM: O; Woods near open dunes. 1424.

CELASTRACEAE (Staff-tree Family)

Celastrus scandens L. CLIMBING BITTERSWEET
NM: L; Climbing on porch of a lodge, North Manitou Village. 1412.
SM: F; Climbing on low trees near borders of fields and dunes. 1789.

CHENOPODIACEAE (Goosefoot Family)

Chenopodium album L. LAMB'S QUARTERS
SM: L; Confined to garden plots. 1742.

Corispermum hyssopifolium L. BUGSEED
SM: O; Perched dunes. 1880.

CISTACEAE (Rockrose Family)

Hudsonia tomentosa Nutt. BEACH HEATH
NM: O; Gravel lag at Dimmick's and Donner's Pts. 1656.

COMPOSITAE (Composite Family)

Achillea Millefolium L. COMMON YARROW
NM: F; Fields. SI.
SM: C; Fields. 1253.

Ambrosia artemisiifolia L. COMMON RAGWEED
NM: O; Fields and lawns. 1849.
SM: O; Fields and lawns. 1898.

Anaphalis margaritacea (L.) Benth & Hook. PEARLY EVERLASTING
NM: C; Fields. 1593.
SM: C; Fields. 1788.

Antennaria neglecta Greene FIELD PUSSYTOES
NM: C; Fields. 1442.
SM: C; Fields. 1288.

Arctium minus Schk. COMMON BURDOCK
NM: L; Lawn, North Manitou Village. SI.
SM: L; Trail near the Cedars. 1866.

Artemisia caudata Michx. TALL WORMWOOD
NM: C; Dunes. 1831.
SM: C; Dunes. 1904.

Aster ciliolatus Lindl.
SM: O; The Cedars and Northern Hardwoods. 1917.

A. macrophyllus L. LARGE LEAVED ASTER
SM: F; Coastal Forest. 1799.

A. praealtus Poir.
SM: C; Dunes and roadsides. 1736, 1871, 1899.

A. simplex Willd. PANICLED ASTER
SM: C; Fields, wetlands, shores of Lake Florence, and swales of Coastal Forest. 1806, 1883.

Bidens connatus Muhl. BUR MARIGOLD
NM: L; Black Ash Swamp. 1782.

Centaurea diffusa Lam.
NM: L; North Manitou Village and some clearings. 1779.

C. maculosa Lam. SPOTTED KNAPWEED
NM: C; Fields. 1592.
SM: C; Fields. 1733.

Chrysanthemum Leucanthemum L. OX-EYE DAISY
NM: C; Fields and gravel shores. 1377.
SM: C; Fields. 1252.

Cichorium Intybus L. COMMON CHICORY
NM: L; Old airstrip, North Manitou Village. 1847.

Cirsium arvense (L.) Scop. CANADA THISTLE
NM: O; Fields. 1591.
SM: L; Trailside near the Cedars. 1755, 1765.

C. Pitcheri (Torr.) T. & G. PITCHER'S THISTLE
NM: O; Dunes. 1367.
SM: C; Dunes. 1585.

C. vulgare (Savi) Tenore BULL THISTLE
NM: O; Coastal Forest. 1830.

Conyza canadensis (L.) Cronq. HOG WEED
NM: F; Fields. 1845.
SM: L; Island cemetery. 1914.

Coreopsis lanceolata L. LANCE-LEAVED COREOPSIS
NM: F; Shores and lake bluffs. 1372, 1494.
SM: C; Dunes and fields. 1282.

Erigeron strigosus Muhl.
NM: O; Fields. 1683.
SM: F; Shores of Lake Florence, fields, and trailsides. 1531.

E. philadelphicus L. COMMON FLEABANE
SM: F; Shores of Lake Florence, fields, and trailsides. 1531.

Eupatorium perfoliatum L. BONESET
SM: L; Shores of Lake Florence. 1752.

Hieracium aurantiacum L. ORANGE HAWKWEED
NM: O; Fields. 1439.
SM: O; Fields. 1341.

H. piloselloides Vill. KING DEVIL
NM: C; Fields and dune swales. 1433.
SM: C; Fields. 1340.

Krigia virginica (L.) Willd. DWARF DANDELION
NM: L; Fields. 1438.
SM: L; Fields. 1360.

Lactuca biennis (Moench) Fern. TALL BLUE LETTUCE
SM: L; Trail near the Cedars. 1764.

Prenanthes alba L. WHITE LETTUCE
SM: F; Northern Hardwoods. 1776.

Rudbeckia hirta L. BLACK-EYED SUSAN
NM: F; Fields. 1686.
SM: F; Fields. 1529.

R. laciniata L. var. hortensia Bailey GOLDEN GLOW
SM: L; Site of Furst Homestead, sec. 9, SW 1/4. 1793.

Senecio pauperculus Michx. BALSAM RAGWORT
NM: O; Dunes and gravel shores. 1373.
SM: F; Dunes. 1309.

Solidago canadensis L. CANADA GOLDENROD
SM: C; Fields and roadsides. 1805, 1870, 1888, 1905.

S. caesia L. BLUE STEM GOLDENROD (PT)

S. flexicaulis L. ZIG-ZAG GOLDENROD
NM: L; Pot Holes. SI.
SM: C; Northern Hardwoods. SI.

S. gigantea Ait.
SM: L; Trail near the Cedars. 1865.

S. graminifolia (L.) Salisb. GRASS-LEAVED GOLDENROD
SM: L; Shores of Lake Florence. 1885.

S. hispida Muhl. HAIRY GOLDENROD (PT)

S. nemoralis Ait. GRAY GOLDENROD
NM: O; Dunes. 1833, 1842a.
SM: F; Dunes. 1772.

S. rugosa Mill. PYRAMID GOLDENROD
NM: L; Big fields, sec. 7. 1841.
SM: O; Fields and roadsides. 1819.

S. spathulata DC.
SM: F; Dunes. 1712.

Taraxacum officinale Weber DANDELION
NM: C; Dune swales and roadsides. 1430.
SM: C; Roadsides and fields. 1263.

Tragopogon dubius Scop. GOAT'S BEARD
NM: F; Fields. 1448.
SM: C; Fields. 1363.

CONVOLVULACEAE (Morning Glory Family)

Convolvulus arvensis L. FIELD BINDWEED
NM: L; Sandy site on airstrip, North Manitou Village. 1500.

CORNACEAE (Dogwood Family)

Cornus alternifolia L.f. PAGODA DOGWOOD
NM: L; Borders of woods and gravel shores. 1391.
SM: O; Northern Conifers and near the Cedars. 1345.

C. canadensis L. BUNCHBERRY
NM: L; Black Ash Swamp south of Lake Manitou. SI.
SM: C; Coastal Forest. 1258.

C. rugosa Lam. ROUND-LEAVED DOGWOOD
SM: O; Coastal Forest. 1719.

C. stolonifera Michx. RED-OSIER
SM: C; Dunes, especially along bay shore. 1305.

CRASSULACEAE (Orpine Family)

Sedum album L.
SM: L; Island cemetery. 1513.

S. Telephium L. LIVE-FOREVER
SM: L; George Hutzler grave site, sec. 33, NE 1/4. 1920.

Sedum sp.
NM: L; Growing under driftwood of gravel shore north of Vessel Pt. SI.

CRUCIFERAE (Mustard Family)

Alyssum alyssoides L.
NM: L; In roads near airstrip. 1997.

Arabis Drummondii Gray
SM: L; Old field in woods north of road, sec. 8, SW 1/4, NE 1/4. 1569.

A. Holboelii Hornem.
NM: L; Dunes on east shore north of Dimmick's Pt. 1653.
SM: F; Dunes along bay. 1302.

A. lyrata L. SAND CRESS
NM: O; Dunes. 1437.
SM: C; Dunes. 1303.

Barbarea vulgaris R. Br. WINTER-CRESS
SM: L; Roadside SE of Lake Florence. 1357.
NM: L; Grassy sites around North Manitou Village. 1998.

Berteroa incana (L.) DC.
NM: C; Fields, roadsides, and waste places. 1458.
SM: C; Fields, roadsides, and waste places. 1549.

Cakile edentula (Bigel.) Hook. SEA-ROCKET
SM: C; Shores, especially along bay. 1730.

Capsella Bursa-pastoris (L.) Medic. SHEPHERD'S PURSE
NM: O; Waste areas and fields. 1483.
SM: O; Waste areas and fields. 1343.

Dentaria diphylla Michx. TWO-LEAVED TOOTHWORT
NM: L; Perhaps more common, but only found near Pot Holes in Northern Hardwoods. 1476, 1977.
SM: F; Northern Hardwoods. 1286, 1930.

D. laciniata Muhl. CUT-LEAVED TOOTHWORT
NM: O; Northern Hardwoods. 1980.
SM: C; Northern Hardwoods. 1950.

Erysimum cheiranthoides L. WORMSEED-MUSTARD
NM: L; Found only in Northern Hardwoods near Pot Holes. 1697.

Lepidium densiflorum Schrader PEPPER-GRASS
NM: C; Fields, roadsides, and waste places. 1495.
SM: C; Fields, roadsides, and waste places. 1745.

Rorippa palustris FIELD MUSTARD
SM: L; Shore of Lake Florence. 1882.

Sisymbrium officinale (L.) Scop. HEDGE MUSTARD
NM: L; Moist open sites near West Side dock. 1497.
SM: L; Gull Pt. 1915.

ELEAGNACEAE (Oleaster Family)

Shepherdia canadensis (L.) Nutt. BUFFALOBERRY
SM: C; Dunes. 1338.

ERICACEAE (Heath Family)

Arctostaphylos Uva-ursi (L.) Spreng. BEARBERRY
SM: C; Dunes. 1558.

Chamaedaphne calyculata (L.) Moench. LEATHERLEAF
NM: L; Tamarack Lake. 1419.

Chimaphila umbellata (L.) Bart. PRINCE'S PINE
SM: O; Near border of Coastal Forest and bay dunes. 1740.

Gaultheria hispidula (L.) Muhl. CREEPING SNOWBERRY
NM: O; Black Ash Swamps. 1640.

Gaylussacia baccata (Wang.) K. Koch
NM: L; Tamarack Lake. 1418.

Monotropa Hypopithys L. PINE SAP
NM: L; Perhaps more frequent, but only found in Northern Hardwoods north of Stormer Camp. 1649.

M. uniflora L. INDIAN PIPE
NM: O; Northern Hardwoods. 1703.
SM: O; Coastal Forest. 1724.

Pyrola asarifolia Michx. PINK PYROLA
SM: O; Coastal Forest. 1262.

P. elliptica Nutt. SHINLEAF
NM: L; Perhaps more common, but only found in Black Ash Swamp south of Lake Manitou. 1638.
SM: O; Coastal Forest. 1510.

P. secunda L. ONE-SIDED PYROLA
NM: L; Black Ash swamp near Tamarack Lake. 1673.
SM: O; Northern Conifers or Northern Hardwoods forest border near dunes. 1546.

P. virens Schweigg.
NM: L; Northern Conifers near Pot Holes. 1471.

Vaccinium myrtilloides Michx. VELVET LEAF BLUEBERRY
NM: L; Tamarack Lake. 1679.

EUPHORBIACEAE (Spurge Family)

Euphorbia cyparissias L. CYPRESS SPURGE
NM: L; In grass around several buildings, North Manitou Village. 1411.

E. polygonifolia L. SEA SIDE SPURGE (PT)

FAGACEAE (Beech Family)

Castanea dentata (Marsh.) Borkh. CHESTNUT
NM: L; South of Frank Farm, sec. 33. 1646.
SM: L; West of old Furst Homestead, sec. 9. 1565.

Fagus grandifolia Ehrh. BEECH
NM: A; Northern Hardwoods. 1402.
SM: A; Northern Hardwoods. 1530.

Quercus rubra L. RED OAK
NM: F; In Lake Plain Woods and locally in Northern Hardwoods. 1824.
SM: F; Coastal Forest, and locally in Northern Hardwoods. 1298.

FUMARIACEAE (Fumitory Family)

Dicentra canadensis (Goldie) Walp. SQUIRREL CORN
NM: C; Northern Hardwoods. 1968.
SM: C; Northern Hardwoods. 1929.

D. Cucullaria (L.) Bernh. DUTCHMAN'S BREECHES
NM: C; Northern Hardwoods. 1963.
SM: C; Northern Hardwoods. 1935.

GERANIACEAE (Geranium Family)

Erodium cicutarium (L.) L'Her. PIN-CLOVER
NM: L; In grass, North Manitou Village. 1449.

Geranium Robertianum L. HERB-ROBERT
NM: O; Northern Hardwoods. 1606.
SM: C; Northern Hardwoods. 1327.

HIPPOCASTANACEAE (Horse-Chestnut Family)

Aesculus Hippocastanum L. HORSE-CHESTNUT
SM: L; One tree at island cemetery and another at Theodore Beck Farm (The Lodge), sec. 9, S 1/2. 1284.

HYDROPHYLLACEAE (Waterleaf Family)

Hydrophyllum canadense L. BROAD LEAVED WATERLEAF
SM: L; Northern Hardwoods, sec. 33. 1762.

HYPERICACEAE (St. John's-wort Family)

Hypericaum Kalmianum L. KALM'S ST. JOHN'S WORT
SM: L; Dunes near boardwalk to lighthouse. 1744.

H. perforatum L. COMMON ST. JOHN'S WORT
NM: C; Old fields. 1587.
SM: C; Old fields. 1528.

JUGLANDACEAE (Walnut Family)

Juglans cinerea L. BUTTERNUT
NM: L; North Manitou Village. 1846.

J. cordiformis Maxim.
SM: L; G. Conrad Hutzler Farm. 1875.

J. nigra L. BLACK WALNUT
SM: L; G. Conrad Hutzler Farm, sec. 4, NW 1/4. 1878.

LABIATAE (Mint Family)

Lamium maculatum L. SPOTTED DEAD NETTLE
NM: L; Pot Holes, probably more common in moist Northern Hardwoods. 1694.

Leonurus Cardiaca L. COMMON MOTHERWORT
NM: F; Moist two-tracks. 1669.

Lycopus americanus Muhl. WATER HOREHOUND
NM: O; Wetlands and gravel shores. 1607.
SM: C; Wetlands. 1749, 1809.

L. uniflorus Michx.
NM: C; Wetlands. 1783.
SM: C; Wetlands and swales in Coastal Forest. 1801.

Mentha arvensis L.
SM: F; Roadsides and ditches. 1754.

Monarda punctata L. HORSEMINT
NM: L; Sandy sites near shore, North Manitou Village. 1594.
SM: L; Island cemetery. 1778.

Nepeta Cataria L. CATNIP
NM: O; Moist Northern Hardwoods. 1650.
SM: L; G. Conrad Hutzler Farm. 1876.

Prunella vulgaris L. SELF-HEAL
NM: O; Fields. 1630.
SM: C; Fields. 1570.

Satureja vulgaris (L.) Fritsch. BASIL
NM: C; Fields. 1597.
SM: C; Fields. 1525.

Scutellaria galericulata L. COMMON SKULLCAP
NM: O; Wetlands. 1682.
SM: O; Wetlands. 1756.

S. lateriflora L. MAD DOG SKULLCAP
NM: O; Wetlands. 1681, 1781.
SM: O; Wetlands. 1766.

LEGUMINOSAE (Bean Family)

Lathyrus japonicus Willd. BEACH PEA
NM: O; Dunes and shores. 1370.
SM: C; Dunes and shores. 1295.

L. latifolius L. EVERLASTING PEA
SM: L; In front of old island Post Office, South Manitou Village. 1795.

Medicago falca L. YELLOW ALFALFA
SM: O; Low juniper fields. 1540.

M. lupulina L. BLACK MEDIC
NM: F; Open roadsides and lawns. 1451.
SM: F; Open raodsides and lawns. 1364.

M. sativa L. ALFALFA
NM: L; Perhaps more common, but only found at John Maleski clearing. 1631.
SM: C; Roadsides and low juniper fields. 1516, 1541.

Melilotus alba Desr. WHITE SWEET CLOVER
NM: C; Fields and roadsides. 1589.
SM: C; Dunes and fields. 1567, 1821.

M. officionalis (L.) Desr. YELLOW SWEET CLOVER
NM: L; Found only at John Maleski Clearing. 1629.
SM: O; Fields and some dunes. 1820.

Robinia Pseudoacacia L. BLACK LOCUST
NM: L; Sites of family farms and North Manitou Village area. 1851.
SM: O; South Manitou Village. 1900.

Trifolium aureum Poll. HOP CLOVER
NM: L; Small field at John Maleski clearing. 1628.

T. pratense L. RED CLOVER
NM: F; Fields. 1413.
SM: F; Fields. 1245.

T. repens L. WHITE CLOVER
NM: F; Fields. 1441.
SM: F; Fields. 1245.

Vicia sativa L. VETCH
NM: C; Fields. 1661.

V. villosa Roth HAIRY VETCH
NM: C; Large patches in fields. 1445.
SM: C; Fields. 1244.

LOBELIACEAE (Lobelia Family)

Lobelia inflata L. INDIAN TOBACCO
SM: O; Swales, Coastal Forest. 1802.

L. Kalmii L. KALM'S LOBELIA
SM: L; Shores of Lake Florence and dunes at Lighthouse Pt. 1579, 1746.

MALVACEAE (Mallow Family)

Malva neglecta Wallr. COMMON MALLOW
SM: L; Woods near Schoolhouse. 1797.

MORACEAE (Mulberry Family)

Humulus lupulus L. HOPS
SM: L; Theodore Beck Farm, sec. 9, S 1/2. 1921.

Morus alba L. WHITE MULBERRY
SM: L; Theodore Beck Farm. 1918.

M. rubra L. RED MULBERRY
SM: L; Sprouting from stump at island cemetery. 1916.

OLEACEAE (Olive Family)

Fraxinus americana L. WHITE ASH
NM: C; Upland Northern Hardwoods and along some gravel shores. 1619.

F. nigra Marsh. BLACK ASH
NM: C; Swamps around Lake Manitou and Tamarack Lake. 1670.
SM: O; Swales, Coastal Forest. 1798.

F. pennsylvanica Marsh. RED ASH
SM: C; Upland Northern Hardwoods. 1526.

Syringa vulgaris L. LILAC
NM: L; North Manitou Village. 1464.
SM: L; South Manitou Village and old homesteads. 1280.

ONAGRACEAE (Evening Primrose Family)

Circaea alpina L. DWARF ENCHANTER'S NIGHTSHADE
NM: O; Moist Northern Hardwoods and Pot Holes. 1622.
SM: O; Moist Northern Hardwoods especially near the Cedars. 1573.

Epilobium angustifolium L. FIREWEED
SM: L; Roadside in clearing along State Award Rd., sec. 3, S 1/2. 1708.

E. ciliatum Raf.
SM: O; Wetlands and moist woods around Lake Florence. 1580.

E. coloratum Biehler.
SM: O; Wetlands and moist woods around Lake Florence. 1815.

Oenothera Oakesiana Robbins EVENING-PRIMROSE
NM: O; Dunes. 1655.
SM: F; Dunes. 1725.

OROBANCHACEAE (Broom-rape Family)

Conopholis americana (L.) Wallr. SQUAWROOT
NM: L; Oak woods north of airstrip. 1604.

Epifagus virginiana (L.) Bart. BEECH-DROPS
NM: C; Northern Hardwoods. 1823.
SM: C; Northern Hardwoods. 1857.

Orobanche fasciculata Nutt. BROOM-RAPE
SM: O; Perched dunes and bay dunes. 1292.

OXALIDACEAE (Wood-sorrel Family)

Oxalis fontana Bunge
NM: O; Some fields and forest borders. 1647.

O. stricta L. WOOD SORREL
SM: O; Fields. 1527.

PAPAVERACEAE (Poppy Family)

Papaver orientale L. ORIENTAL POPPY
NM: L; Planted at old Coast Guard Station, North Manitou Village. 1446.

Sanguinaria canadensis L. BLOODROOT
SM: C; Northern Hardwoods. 1241.

PLANTAGINACEAE (Plantain Family)

Plantago lanceolata L. ENGLISH PLANTAIN
NM: F; Lawns. 1459.
SM: F; Lawns and some fields. 1254.

P. Rugelii Decne. PALE PLANTAIN
NM: O; Sandy shores. 1643.
SM: O; Sandy roadsides. 1577.

POLEMONIACEAE (Phlox Family)

Phlox subulata L. MOSS-PINK
NM: L; North Manitou Cemetery. 1981.

POLYGALACEAE (Milkwort Family)

Polygala paucifolia Willd. FLOWERING WINTERGREEN
SM: F; Coastal Forest. 1257.

POLYGONACEAE (Smartweed Family)

Polygonum cilinode Michx. BINDWEED
SM: L; Shores of Lake Florence. 1328.

P. coccineum Muhl. WATER SMARTWEED
SM: L; Wetlands north of Lake Florence. 1808.

P. Convolvulus L. BLACK BINDWEED
NM: L; Trailside, sec. 5. 1648, 1843.
SM: L; Garden plots. 1907.

P. Persicaria L. LADY'S THUMB
SM: L; Shores of Lake Florence. 1886

Rumex acetosella L. RED SORREL
NM: C; Fields. 1440.
SM: C; Fields. 1251.

R. crispus L. SOUR DOCK
NM: L; Roadside, North Manitou village. 1590.
SM: F; Swales of Coastal Forest. 1522.

R. obtusifolius L. BITTER DOCK
SM: O; Fields. 1586.

PORTULACACEAE (Purslane Family)

Claytonia caroliniana Michx. CAROLINA SPRING BEAUTY
NM: C; Northern Hardwoods. 1967.
SM: C; Northern Hardwoods. 1928.

Portulaca oleracea L. COMMON PURSELANE
SM: L; Confined to garden plots. 1919.

PRIMULACEAE (Primrose Family)

Lysimachia terrestris (L.) BSP. SWAMP CANDLE
SM: L; Grassy margin of Lake Florence. 1582.

L. thyrsiflora L. TUFTED LOOSESTRIFE
NM: L; Tamarack Lake. 1420.

Trientalis borealis Raf. STAR FLOWER
NM: O; Northern Hardwoods and its borders. 1636.
SM: C; Coastal Forest and Northern Conifers. 1231.

RANUNCULACEAE (Buttercup Family)

Actaea rubra (Ait.) Willd. RED BANEBERRY
SM: F; Northern Hardwoods. 1864.

A. pachypoda Ell. WHITE BANEBERRY
SM: C; Northern Hardwoods. 1767.

Anemone multifida Poir. RED WINDFLOWER
NM: O; Dunes. 1431.
SM: C; Dunes. 1554.

A. quinquefolia L. WOOD ANEMONE
SM: L; Cedars. 2012.

Aquilegia canadensis L. WILD COLUMBINE
NM: C; Shores. 1267.
SM: C; Coastal Forest. 1376.

A. vulgaris L. EUROPEAN COLUMBINE
SM: L; Along road west of Lake Florence and in Coastal Forest near site of Old Dock. 1321.

Caltha palustris L. MARSH MARIGOLD
NM: L; Black Ash Swamps and in stream northwest of Tamarack Lake. 1444.

Coptis trifolia (L.) Salisb. var. groenlandica (Oeder) Fassett GOLDTHREAD
NM: L; Black Ash swamps. 1637.

Hepatica acutiloba DC. SHARP-LOBED HEPATICA
NM: L; Scattered through Northern Hardwoods. SI.
SM: C; Northern Hardwoods. 1285, 1934.

Ranunculus abortivus L. KIDNEY LEAF BUTTERCUP
NM: F; Northern Hardwoods. 1239.
SM: O; Northern Hardwoods. 1489.

R. acris L. COMMON BUTTERCUP
NM: C; Open moist sites. 1397.
SM: C; Roadsides and moist fields. 1261, 1354.

R. recurvatus Poir.
SM: L; Shores of Lake Florence. 1953.

R. reptans L. CREEPING SPEARWORT
SM: L; Shores of Lake Florence. 1318, 1348, 2014.

R. sceleratus L. CURSED CROWFOOT
SM: L; Shore of Lake Florence. 1329.

Thalictrum dioicum L. EARLY MEADOWRUE
SM: C; Northern Hardwoods. 1314.

ROSACEAE (Rose Family)

Amelanchier laevis Wieg. JUNEBERRY
NM: O; Lake Plain Woods. 1484.

A. spicata (Lam.) K. Koch JUNEBERRY
SM: O; Coastal Forest. 1721.

Chaenomeles lagenaria Koidz. FLOWERING QUINCE
NM: L; North Manitou Village. 1995.

Fragaria virginiana Mill. STRAWBERRY
NM: C; Fields. 1472.
SM: C; Fields, Northern Hardwoods and some dunes. 1243, 1315, 1335.

Geum allepicum Jacq. CREAM-COLORED AVENS
SM: L; Woods east side of Lake Florence. 1748, 2013.

Potentilla Anserina L. SILVERWEED
NM: L; Gravel shores. 1381.

P. argentea L. SILVERY CINQUEFOIL
NM: O; Open fields. 1425.
SM: O; Open fields. 1891.

P. norvegica L. ROUGH CINQUEFOIL
SM: O; Swales, Coastal Forest. 1521, 1800.

P. palustris (L.) Scop. MARSH CINQUEFOIL
SM: L; Wetland west of Schoolhouse. 1811.

P. recta L. SULFUR CINQUEFOIL
NM: C; Fields and waste places. 1667.
SM: C; Fields and waste places. 1339.

P. simplex Michx. OLD-FIELD CINQUEFOIL
SM: L; West end of field, sec. 9, SW 1/4. 1560.

Prunus armeniaca L. APRICOT
NM: L; North Manitou Village below old beach ridge. 1853.
SM: L; Behind Lighthouse and also on Anderson Farm. 1901.

P. avium L. SWEET CHERRY
NM: L; Orchard, North Manitou Village. 1848.
SM: L; A few trees on G. Conrad Hutzler Farm. 1877.

P. cerasifera Ehrh. CHERRY PLUM
SM: L; Anderson Farm, sec. 33. 1790.

P. domestica L. PLUM
NM: L; Frederickson Place, sec. 10. 1838.
SM: L; G. Conrad Hutzler Farm. 2019.

P. pensylvanica L.f. PIN-CHERRY
SM: C; Old fields and woods borders. 1874.

P. Persica (L.) Patsch. PEACH
SM: L; Southwest corner of G. Conrad Hutzler Farm, sec 4, NW 1/4. 1775.

P. pumila L. SAND CHERRY
SM: C; Sand dunes. 1294.

P. serotina Ehrh. WILD BLACK CHERRY
NM: C; Northern Hardwoods. 1826.
SM: R; One tree found in Northern Hardwoods east of blowout sec. 33, NE 1/4. SI.

P. virginiana L. CHOKE CHERRY
NM: O; Old fields near shore. 1825.
SM: F; Old fields, dunes and in some Northern Hardwoods. 1306, 1759, 1774.

Pyrus communis L. PEAR
NM: L; Old homesteads and North Manitou Village. 1839, 1850
SM: L; Old homesteads. 1879.

P. Malus L. APPLE
NM: O; Old orchards and homesteads. 1852.
SM: O; South Manitou Village and old homesteads. 1758.

Rosa acicularis Lindl.
SM: O; Dunes. 1307.

R. blanda Ait.
SM: L; Moist roadsides, perhaps more common. 1519.

R. centrifolia L. CABBAGE ROSE
NM: L; Paul Maleski Place and North Manitou Village. 1599, 1633.
SM: O; Old homesteads. 2015.

R. Eglanteria L. SWEET BRIAR
NM: O; Shores. 1404, 1613.

R. palustris Marsh. SWAMP-ROSE
SM: O; Moist roadsides and wetlands. 1563, 1753.

Rubus allegheniensis Porter BLACKBERRY
NM: L; Borrow pit along trail west of airstrip. 1487.

R. pensilvanicus Poir.
SM: F; Moist sites and woods borders. 1322.

R. occidentalis L. BLACK RASPBERRY
SM: O; Roadsides and field borders. 1813.

Sorbus decora (Sarg.) C. K. Schneid. MOUNTAIN ASH
NM: F; Northern Hardwoods and near shores. 1392.
SM: O; Northern Hardwoods and lake shore bluffs. 1777.

Spiraea alba Du Roi. MEADOWSWEET
SM: O; Wetlands and around Lake Florence. 1581.

S. trichocarpa Nakai.
NM: L; Ornamental at North Manitou Village. 1463.

RUBIACEAE (Madder Family)

Galium Aparine L. CLEAVERS
SM: C; Northern Hardwoods. 1237.

G. trifidum L. SMALL BEDSTRAW
NM: L; Wet sites and Black Ash swamps. 1698, 1784.

G. triflorum Michx. SWEET SCENTED BEDSTRAW
NM: F; Northern Hardwoods. 1535.
SM: F; Northern Hardwoods. 1383.

Mitchella repens L. PARTRIDGEBERRY
NM: O; Patches in Northern Hardwoods. SI.
SM: F; Northern Hardwoods. 1236.

SALICACEAE (Willow Family)

Populus balsamifera L. BALSAM POPLAR
NM: O; Shores. 1368.
SM: F; Dunes and shores. 1300.

P. deltoides Marsh. COTTONWOOD
SM: L; Dunes and planted around South Manitou Village. 1313, 1358.

P. grandidentata Michx. BIG-TOOTH ASPEN
NM: F; Throughout Northern Hardwoods and Lake Plain woods. 1654.
SM: C; Coastal Forest and in some Northern Hardwoods near Lake Michigan. 1722.

P. nigra L. var. italica Du Roi LOMBARDY POPLAR
NM: L; Planted North Manitou Village. 1461.
SM: L; Planted South Manitou Village. 1366.

P. tremuloides Michx. QUAKING ASPEN
NM: O; Shores. 1626.
SM: C; Coastal Forest and borders of fields. 1817.

Salix cordata Michx.
NM: F; Shores. 1427, 1971.
SM: F; Dunes and shores. 1359, 1952.

S. exigua Nutt.
NM: F; Shores and dunes. 1602.
SM: C; Shores and dunes. 1739.

S. lucida Muhl.
SM: O; Wetlands. 1862, 2018.

S. petiolaris J. E. Smith
NM: O; Shores and beaches. 1990.
SM: F; Wetlands and moist fields. 1260, 1812, 2009, 2022.

SANTALACEAE (Sandalwood Family)

Comandra umbellata (L.) Mutt. BASTARD TOADFLAX
NM: L; On old beach ridges, sec. 15. 1984.
SM: L; Along border of Coastal Forest and dunes along the bay, and near north shore of Lake Florence. 1717.

Geocaulon lividum (Richards) Fern. NORTHERN COMANDRA
SM: L; Along border of Coastal Forest and dunes along the bay. 1716.

SAXIFRAGACEAE (Saxifrage Family)

Chrysosplenium americanum Schw. GOLDEN SAXIFRAGE
NM: L; Throughout Northern Hardwoods and in a cedar swamp-like site near Johnson Place, sec. 18. 1855, 1985.

Mitella diphylla L. BISHOP'S CAP
NM: L; Pot Holes. 1475.
SM: F; Northern Hardwoods. 1562.

M. nuda L. NAKED MITERWORT
NM: L; Black Ash Swamps. 1672.
SM: L; Northern Hardwoods near Cedars. 1566.

Philadelphus coronarius L. GARDEN SYRINGA
NM: L; Paul Maleski Place. 1632.
SM: L; Henry Haas Farm, sec. 4. 2017.

Ribes americanum Mill. WILD BLACK CURRANT (PT)

R. cynosbati L. WILD GOOSEBERRY
NM: R; On a large rock with other woodland herbs, sec. 25, 1975.
SM: F; Upland Northern Hardwoods. 1881.

SCROPHULARIACEAE (Figwort Family)

Gerardia purpurea L. PURPLE GERARDIA
SM: L; Shores of Lake Florence. 1884.

Linaria vulgaris Hill. BUTTER AND EGGS
NM: L; Moist two-track, sec. 7. 1668.
SM: L; South Manitou Village. 2024.

Melampyrum lineare Desr. COW WHEAT
SM: F; Shaded roadsides and Coastal Forest. 1711.

Pedicularis canadensis L. WOOD BETONY
SM: L; One station found in Coastal Forest. 1362.

Scrophularia lanceolata Pursh. HARE FIGWORT
NM: L; Near the Spring, sec. 15. 1651.

Verbascum Thapsus L. COMMON MULLEIN
NM: C; Fields. 1595.
SM: F; Fields. SI.

Veronica officinalis L. COMMON SPEEDWELL
NM: O; Open Northern Hardwoods. 1395.
SM: L; Along trail in field near Popple Campground. 1945.

V. serpyllifolia L.
NM: O; Wet sites such as The Spring, sec. 15. 1960.
SM: O; Springs and other moist sites. 2006.

SIMARUBIACEAE (Quassia Family)

Ailanthus altissima (Mill.) Swingle TREE-OF-HEAVEN
SM: L; At gate of island cemetery and at site of Furst Homestead, sec. 9, SW 1/4. 1791.

SOLANACEAE (Nightshade Family)

Physalis heterophylla Nees. CLAMMY GROUND CHERRY
SM: O; Open woods and some fields. 1728.

Solanum carolinense L. HORSE NETTLE
NM: L; Swenson's Clearing, sec. 6, SE 1/4. 1671.

S. Dulcamara L. NIGHTSHADE
NM: L; Black Ash Swamp. SI.
SM: O; Swales of Coastal Forest. 1804.

TILIACEAE (Basswood Family)

Tilia americana L. BASSWOOD
NM: F; Northern Hardwoods. 1627.
SM: F; Northern Hardwoods especially near borders of dunes. 1926.

ULMACEAE (Elm Family)

Ulmus americana L. AMERICAN ELM
SM: L; Small trees in moist Northern Hardwoods near south end of Lake Florence. 1520.

UMBELLIFERAE (Parsley Family)

Daucus Carota L. WILD CARROT
NM: F; Fields. SI.
SM: C; Fields. 1509.

Heracleum lanatum Michx. COW PARSNIP
SM: F; Northern Hardwoods. 1508.

Osmorhiza chilensis H. & A.
NM: F; Northern Hardwoods. 1380, 1491, 1991.

O. claytoni (Michx.) Clarke SWEET CICELY
NM: L; Perhaps more widespread, but found only in Northern Hardwoods near beach on south side. 1965.
SM: C; Northern Hardwoods. 1274, 1342, 1550.

Sanicula trifoliata Bickn. LONG FRUITED SNAKEWORT
SM: L; Previously lumbered area in Northern Hardwoods near dump, sec. 4, SW 1/4. 1768.

Taenidia integerrima (L.) Drude YELLOW PIMPERNEL
NM: R; One plant observed near site of Schoolhouse. SI.

URTICACEAE (Nettle Family)

Urtica dioica L. STINGING NETTLE
NM: L; Perhaps more common, but only found along old logging trail, sec. 5. 1844.

VERBENACEAE (Vervain Family)

Verbena bracteata Lag. & Rodr.
NM: L; North Manitou Village. 1450.

V. stricta Vent. HOARY VERVAIN
SM: L; Four corners. 1710.

VIOLACEAE (Violet Family)

Viola adunca Sm.
SM: L; Perhaps more widespread, but found only in dense juniper field, sec. 34. 2001.

V. blanda Willd. SWEET WHITE VIOLET
NM: O; Moist shady sites. 1973, 1986.
SM: F; Coastal Forest and wetland margins. 1942, 1948.

V. canadensis L. CANADA VIOLET
NM: O; Northern Hardwoods. 1970.
SM: C; Northern Hardwoods. 1326.

V. conspersa Reichenb. DOG VIOLET
NM: F; Northern Hardwoods. 1966.
SM: C; Northern Hardwoods and Coastal Forest. 1947, 2008.

V. pubescens Ait. YELLOW VIOLET
NM: F; Northern Hardwoods. 1481, 1969.
SM: C; Northern Hardwoods. 1941.

V. rostrata Pursh. LONG-SPURRED VIOLET
NM: F; Northern Hardwoods. 1979.
SM: C; Northern Hardwoods and Coastal Forest. 2010.

V. Selkirkii Goldie GREAT-SPURRED VIOLET
NM: O; Northern Hardwoods. 1501, 1974.
SM: O; Northern Hardwoods. 1547.

VITACEAE (Grape Family)

Parthenocissus quinquefolia (L.) Planch. VIRGINIA CREEPER
SM: L; Old Furst Homestead, sec. 9, SW 1/4. 1794.

Vitis riparia Michx. FROST GRAPE
NM: L; Only old climbing vines remain. 1829.
SM: F; Edges of dunes. 1773.

ACKNOWLEDGEMENTS

The contributions of several individuals during the field investigation and later during the preparation of a final draft should be recognized. Our first thanks go to the islanders who freely shared their knowledge of the islands' history and past land use. Special credit is due to National Park Service personnel for their participation. Max Holden has served well as a coordinator between the Park Service and the Biological Station. Rangers Don Hamilton and John Fekete were very cooperative during the field investigation. John's role in providing transportation between the islands even in adverse weather is greatly appreciated. An accurate species list could not have been included in this report without the advice of Edward G. Voss, University Herbarium, Division of Biological Sciences, University of Michigan, who examined and annotated voucher specimens. We also thank Ford Kellum for lending us photographs of North Manitou and for relating his knowledge of that island's deer herd. The University of Michigan Biological Station, now in its 76th season of providing an atomosphere for field research, provided the base of operations for this study. Mark W. Paddock, Administrative Manager and Assistant to the Director, contributed both technical and administrative assistance throughout the entire project.

LITERATURE CITED

Braun, E. L. 1950. Deciduous forests of eastern North America. Blakiston Co., Philadelphia. 596 pp.

Brewer, L. 1982. The present status and future prospect for the American chestnut in Michigan. Mich. Bot. 21:117-128.

Coulter, S. M. 1904. An ecological comparison of some typical swamp areas. Missouri Bot. Gard. 15th Ann. Rpt. pp. 38-71.

Cowles, H. C. 1899. The ecological relations of the vegetation on the sand dunes of Lake Michigan. Bot. Gaz. 27:95-117, 167-202, 281-308, 361-391.

Curtis, J. T. 1959. Vegetation of Wisconsin. Univ. Wisconsin Press. 657 pp.

Gleason, H. A. and A. C. Cronquist. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. Van Nostrand, New York. 810 pp.

Guire, K. E. and E. G. Voss. 1963. Distributions of distinctive shoreline plants in the Great Lakes Region. Mich. Bot. 2:99-114.

Hatt, R. T., et al. 1948. Island Life: A study of the land vertebrates of the islands of eastern Lake Michigan. Cranbrook Inst. Sci. Bull. 27. 179 pp.

Mickel, J. T. 1979. How to know the ferns and fern allies. Wm. Brown, Dubuque, Iowa. 229 pp.

Rogers, J. 1966. South Manitou Island. Northwestern Michigan College, Traverse City. 31 pp.

Shugart G.W. 1976. Effects of ring-billed gull nesting on vegetation. Jack Pine Warbler 54:50-53.

Thompson, P. W. 1962a. An unusual fern station on South Manitou Island, Michigan. Am. Fern J. 52:157-159.

-----. 1962b. The giant cedars of South Manitou. Cranbrook Inst. Sci. Newsletter. 32:26-30.

-----. 1963. The character of an ancient white cedar forest on South Manitou Island, Michigan. Pap. Mich. Acad. 48:177-186.

-----. 1967. Vegetation and common plants of Sleeping Bear. Cranbrook Inst. Sci. Bull. 52. 47 pp.

-----. 1974. Ecological Survey of South Manitou Island. Report prepared for USNPS. 23 pp.

Voss, E. G. 1972. Michigan Flora, Part I. Gymnosperms and Monocots. Cranbrook Inst. Sci. Bull. 55 and Univ. Michigan Herbarium. 488 pp.

Weber, H. K. 1973. Soil survey of Leelanau County, Michigan. USDA, Washington, D. C.

Whitford, H. N. 1901. The genetic development of the forests of northern Michigan. Bot. Gaz. 31:289-325.

Appendix A. Locations and descriptions of permanent plots.

Table 1. Permanent plots on North Manitou Island.

BTH no.	Name	Vegetation Type	Soil Series	T	R	Section
1	Pole Bridge Deer Exclosure (no.1, DNR)	Northern Hardwoods Beech-Maple-Birch Cherry	Kalkaska-East Lake loamy sand 0-6%	32N	14W	28 SW1/4 NW1/4
2	Control for BTH no. 1	Northern Hardwoods Beech-Maple-Birch Cherry	Kalkaska-East Lake loamy sand 0-6%	32N	14W	28 SW1/4 NW1/4
3	Carlson Farm Deer Exclosure(2,NPS)	Field-low juniper	Emmet-Omena sandy loam 6-12%	31N	14W	3 SW1/4 NW1/4
4	Control for BTH no. 3	Field-low juniper	Emmet-Omena sandy loam 6-12%	31N	14W	3 SW1/4 NW1/4
5	Stormer Dock Deer Exclosure (3,NPS)	Field-low juniper	wind eroded-sloping	31N	14W	15 NW1/4 SW1/4
6	Control for BTH no. 5	Field-low juniper	wind eroded-sloping	31N	14W	15 NW1/4 SW1/4
7	Vessel Point	Northern Hardwoods Oak	Mancelona-East Lake loamy sand 0-6%	32N	14W	27 SW1/4 SE1/4
8	Beech Woods	Northern Hardwoods Beech	Emmet-Omena sandy loam 6-12%	32N	14W	33 SW1/4 SW1/4
9	Lake Manitou S	Black Ash Swamp	Lupton-marly muck	32N	14W	32 SE1/4 SW1/4
10	Potholes Plateau	Northern Hardwoods Beech-Maple-Birch-Cherry-Aspen-Ash	Emmet-Omena sandy loam 6-12%	32N	14W	19 NE1/4 SW1/4
11	Dimmick's Point	Dunes	wind eroded-sloping	31N	14W	23
12	Cut Area	Northern Hardwoods Cut	Kalkaska-East Lake loamy sand 0-6%	31N	14W	16 SW1/4 SE1/4

Table 2. Permanent plots on South Manitou Island.

BTH no.	Name	Vegetation Type	Soil Series	T	R	Section
13	Lou Raynor	Coastal Forest	Deer Park-Roscommon sand 0-6%	30N	15W	3 NE1/4 SE1/4
14	John Hutzler Farm	Field-dense juniper	East Lake loamy sand 0-6%	31N	15W	34 NW1/4 NW1/4
15	Popple Trail	Northern Hardwoods Beech-Maple-Oak	Deer Park sand 18-45%	31N	15W	28 SE1/4 SE1/4
16	Theodore Beck Field	Field-low juniper	Mancelona-Richter sandy loam 0-6%	30N	15W	9 NE1/4 SW1/4
17	Burdick's Corners	Northern Hardwoods Beech-Maple-Birch-Hemlock	Eastport sand 0-6%	30N	15W	3 SW1/4 SW1/4
18	Dune Blowout	Dune	Dune	31N	15W	32 SE1/4 SE1/4
19	Mike Smith	Northern Hardwoods Beech-Maple	Mancelona-East Lake sandy loam 0-6%	30N	15W	4 SE1/4 SW1/4
20	Upland Woods	Northern Hardwoods Beech-Maple-Ash	Emmet-Omena sandy loam 18-25%	30N	15W	5 NE1/4 SE1/4
21	Lake Florence West	Northern Hardwoods Beech-Maple	AuGres-Kalkaska sand 0-4%	30N	15W	9 NE1/4 NW1/4
22	Cedars Trail	Northern Hardwoods Maple-Ash-Basswood	Deer Park sand 6-18%	30N	15W	8 NE1/4 SW1/4
23	Gull Point	Dune	wind eroded-sloping	31N	15W	35 SE1/4

Table 3. Specific locations of permanent plots on North Manitou Island

BTH no.	Directions
1	W ~.15 miles along road from Pole Bridge
2	20 feet S from BTH no. 1
3	at north end of easternmost arm of easternmost field on Carlson Farm
4	30 feet S from BTH no. 3
5	N ~.25 miles from island cemetery.
6	125 feet N from BTH no. 5
7	N 100 feet along trail from clearing north of airstrip, thence 185 feet west to SE corner of plot
8	N 50° E 140 feet from road to Lake Manitou at the crest of the hill to SW corner of plot
9	SE 400 feet along lakeshore from Boat Dock, thence ~66 feet S to NE corner of plot
10	once on plateau, continue NW ~200 feet along trail from fork, thence ~170 feet N to SE corner of plot
11	~600 feet S 30° W from first telephone pole on gravel lag
12	NW ~250 feet along trail from fork, thence 40 feet S 20° W to NE corner of plot

Table 4. Specific locations of permanent plots on South Manitou Island

BTH no.	Directions
13	N 165 feet to SW corner of plot from driveway near cottage in woods W of Lou Raynor's place
14	E 120 feet to SW corner of plot from intersection of trails to Popple Campground and north dunes
15	NW ~250 feet from woods edge along trail to Popple Campground, thence 22 feet W to NE corner of plot
16	S 155 feet along road from center of intersection just W of the S end of Lake Florence, thence 74 feet W to NE corner of plot
17	N .15 miles along road from intersection of Ohio and State Award Roads, thence 125 feet E to SW corner of plot
18	N 40° W ~300 feet from trail at top of leading edge of blowout
19	N 45° W ~180 feet from intersection of trail and fence-line just S of dump
20	NW along trail from no. 19, thence along S side of ridge, total ~ .25 mile
21	N .2 mile along trail on W side of Lake Florence from intersection of trail running east from small orchard along main road west of lake, thence 110 feet N 50° W to NE corner of plot
22	SW ~470 feet from base of fallen cedar across Cedars Trail, thence 150 feet S 15° E to NW corner of plot
23	compass bearings from SE corner: S 82° E to the Crib, S 23° W to South Manitou Island Lighthouse

Appendix B. Permanent plot data sheets.

PERMANENT PLOTS DATA SHEET

BTH no. 1 . North Manitou Island

Name Pole Bridge Deer Exclosure Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Prunus serotina	10	5.0	41.84	
Betula papyrifera	15	2.5	15.45	
Acer saccharum	2	4.5	8.81	
Betula alleghaniensis	2	3.3	3.29	
			→	69.39

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Acer saccharum	117
Sambucus pubens	11
Betula papyrifera	6
Prunus serotina	2
Fagus grandifolia	2
Betula alleghaniensis	1
Acer pensylvanicum	1

Ground Layer Species

Acer pensylvanicum
Acer saccharum
Allium tricoccum
Arisaema triphyllum
Athyrium filix-femina
Betula papyrifera
Botrychium sp.
Carex arctata
Carex sp.
Dryopteris spinulosa
Galium sp.
Osmorhiza sp.
Polygonatum pubescens
Prunus serotina
Rubus sp.
Sambucus pubens
Streptopus roseus
Trillium grandiflorum
Viola canadensis
Viola sp.

PERMANENT PLOTS DATA SHEET

BTH no. 2 . North Manitou Island

Name Control for BTH no. 1 Date Sampled 21 August 1982

Overstory: Trees > 1" dbh

Species	No. of stems	Mean dbh	(sq. ft./acre) Total basal area/species	Total basal area
Acer saccharum	7	5.4	33.86	
Fagus grandifolia	1	12.9	24.54	
			→	58.4

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Acer spicatum
Agrostis hyemalis
Arisaema triphyllum
Carex arctata
Carex rosea
Carex sp.
Cynoglossum officionale
Dryopteris spinulosa
Fagus grandifolia
Galium sp.
Gymnocarpium dryopteris
Chrysosplenium americanum
Osmorhiza sp.
Prunus serotina
Streptopus roseus
Thelypteris noveboracensis
Viola sp.

PERMANENT PLOTS DATA SHEET

BTH no. 3 . North Manitou Island

Name Carlson Farm Deer Exclosure Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area

→

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Agropyron repens
Ambrosia artemisiifolia
Anaphalis margaritacea
Antennaria neglecta
Asclepias syriaca
Danthonia spicata
Fragaria virginiana
Hieracium piloselloides
Hypericum perforatum
Juniperus communis
Panicum sp.
Physalis heterophylla
Poa pratensis
Rosa sp.
Rumex acetosella
Satureja vulgaris
Silene vulgaris
Tragopogon dubius

PERMANENT PLOTS DATA SHEET

BTH no. 4 . North Manitou Island

Name Control for BTH no. 3 Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area

→

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Agropyron repens
Ambrosia artemisiifolia
Anaphalis margaritacea
Antennaria neglecta
Asclepias syriaca
Danthonia spicata
Fragaria virginiana
Hieracium piloselloides
Hypericum perforatum
Oxalis stricta
Panicum sp.
Rosa sp.
Rudbeckia hirta
Rumex acetosella
Silene vulgaris
Tragopogon dubius

PERMANENT PLOTS DATA SHEET

BTH no. 5 . North Manitou Island

Name Stormer Dock Deer Exclosure Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area

→

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Anaphalis margaritacea
Antennaria neglecta
Asclepias syriaca
Fragaria virginiana
Hypericum perforatum
Poa compressa
Potentilla argentea
Rumex acetosella
Tragopogon dubius
Verbascum thapsus

PERMANENT PLOTS DATA SHEET

BTH no. 6 . North Manitou Island

Name Control for BTH no. 5 Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area

→

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Acer saccharum
Anaphalis margaritacea
Asclepias syriaca
Fragaria virginiana
Hypericum perforatum
Poa compressa
Rumex acetosella
Satureja vulgaris
Verbascum thapsus

PERMANENT PLOTS DATA SHEET

BTH no. 7 . North Manitou Island

Name Vessel Point Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Populus grandidentata	1	13.8	28.09	
Quercus rubra	5	4.9	21.18	
Ostrya virginiana	15	2.4	15.38	
Fagus grandifolia	1	1.2	.21	
			→	64.86

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Ostrya virginiana	5
Acer saccharum	1

Ground Layer Species

Carex sp.
Maianthemum canadense
Mitchella repens
Polygonatum pubescens

PERMANENT PLOTS DATA SHEET

BTH no. 8 . North Manitou Island

Name Beech Woods Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Fagus grandifolia	9	7.7	88.89	
Acer saccharum	2	5.9	16.21	
Ostrya virginiana	1	5.2	3.98	
			→	109.08

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Fagus grandifolia	20

Ground Layer Species

Acer saccharum
Carex sp.
Fagus grandifolia
Mitchella repens
Streptopus roseus

PERMANENT PLOTS DATA SHEET

BTH no. 9 . North Manitou Island

Name Lake Manitou South Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Fraxinus nigra	10	5.1	39.96	
Betula alleghaniensis	4	6.1	22.14	
Thuja occidentalis	1	6.4	6.05	
Acer rubrum	1	5.6	4.62	
			→	72.77

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Abies balsamea
Acer rubrum
Arisaema triphyllum
Bidens connatus
Carex brunescens
Carex crinita
Carex rostrata
Carex sp.
Coptis trifolia
Cornus canadensis
Dryopteris spinulosa
Fragaria virginiana
Galium trifidum
Gaultheria hispidula
Gymnocarpium dryopteris
Impatiens capensis
Lycopus virginicus
Maianthemum canadense
Mitchella repens
Onoclea sensibilis
Osmunda cinnamomea
Osmunda regalis
Pyrola elliptica
Rubus strigosus
Scirpus atrovirens
Scirpus cyperinus
Scutellaria lateriflora
Solanum dulcamara
Thuja occidentalis
Vaccinium myrtilloides
Viola sp.

PERMANENT PLOTS DATA SHEET

BTH no. 10 . North Manitou Island

Name Potholes Plateau Date Sampled 21 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Acer saccharum	7	11.7	151.63	
Prunus serotina	1	15.4	34.98	
Fraxinus americana	1	12.5	23.04	
			→	209.65

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Acer saccharum
Carex rosea
Carex sp.
Prunus serotina

PERMANENT PLOTS DATA SHEET

BTH no. 11 . North Manitou Island

Name Dimmick's Point Date Sampled 22 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Betula papyrifera	1	2.5	.92	
			→	.92

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Agropyron dasystachyum
Andropogon scoparius
Anemone multifida
Artemisia caudata
Betula papyrifera
Campanula rotundifolia
Carex garberi
Cirsium pitcheri
Thuja occidentalis
Zigadenus glaucus

PERMANENT PLOTS DATA SHEET

BTH no. 12 . North Manitou Island

Name Cut Area Date Sampled 22 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Betula alleghaniensis	1	16.8	41.63	
			→	41.63

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Fagus grandifolia	42

Ground Layer Species

Acer saccharum
Carex arctata
Carex sp.
Fagus grandifolia
Mitchella repens

PERMANENT PLOTS DATA SHEET

BTH no. 13 . South Manitou Island

Name Lou Raynor Date Sampled 23 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Betula papyrifera	2	9.0	24.24	
Acer saccharum	6	3.6	19.68	
Acer rubrum	13	2.7	17.13	
Populus tremuloides	1	7.2	7.64	
Abies balsamea	5	2.4	6.33	
			→	75.02

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Acer saccharum	12
Abies balsamea	5
Acer rubrum	4
Prunus virginiana	2
Taxus canadensis	>15 clumps

Ground Layer Species

Aralia nudicaulis	Lonicera canadensis
Arisaema triphyllum	Maianthemum canadense
Clintonia borealis	Mitchella repens
Diervilla lonicera	Polygonatum pubescens
Dryopteris intermedia	Trientalis borealis
Galium sp.	Trillium grandiflorum
Hepatica acutiloba	Toxicodendron radicans

PERMANENT PLOTS DATA SHEET

BTH no. 14 . South Manitou Island

Name John Hutzler Farm Date Sampled 23 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Prunus pensylvanica	1	1.2	.21	
			→	.21

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Juniperus communis	20
Prunus pensylvanica	1

Ground Layer Species

Acer saccharum
Anaphalis margaritacea
Aster sp.
Danthonia spicata
Fragaria virginiana
Hieracium piloselloides
Hypericum perforatum
Melampyrum lineare
Physalis heterophylla
Poa compressa
Prunus pensylvanica
Rhus typhina
Rosa sp.
Rumex acetosella
Toxicodendron radicans

PERMANENT PLOTS DATA SHEET

BTH no. 15 . South Manitou Island

Name Popple Trail Date Sampled 23 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Quercus rubra	11	5.8	83.66	
Betula papyrifera	6	8.1	64.75	
Acer saccharum	5	4.6	16.47	
Ostrya virginiana	1	1.8	.47	
			→	165.35

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Acer saccharum	6
Prunus virginiana	3
Ribes sp.	1
Viburnum acerifolium	1

Ground Layer Species

Acer saccharum
Diervilla lonicera
Fraxinus americana
Juniperus communis
Maianthemum canadense
Mitchella repens
Poa compressa
Polygonatum pubescens
Prunus serotina
Pteridium aquilinum
Rubus sp.
Solidago flexicaulis
Trientalis borealis

PERMANENT PLOTS DATA SHEET

BTH no. 16 . South Manitou Island

Name Theodore Beck Field Date Sampled 23 August 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area

→

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Prunus virginiana	present
Malus sp.	present
Rosa sp.	present

Ground Layer Species

Achillea millefolium
Agropyron repens
Asclepias syriaca
Bromus inermis
Daucus carota
Hieracium piloselloides
Hypericum perforatum
Medicago sativa
Panicum sp.
Poa compressa
Potentilla recta
Prunella vulgaris
Rudbeckia hirta
Silene vulgaris
Solidago canadensis
Trifolium pratense

PERMANENT PLOTS DATA SHEET

BTH no. 17 . South Manitou Island

Name Burdick's Corners Date Sampled 21 Sept. 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Acer saccharum	11	6.5	94.45	
Fagus grandifolia	1	16.6	40.64	
Tsuga canadensis	8	4.5	27.66	
			→	162.75

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Abies balsamea	6
Acer saccharum	2
Taxus canadensis	2 clumps

Ground Layer Species

Acer saccharum
Allium tricoccum
Carex spp.
Dryopteris intermedia
Fagus grandifolia
Galium sp.
Habenaria orbiculata
Hepatica acutiloba
Lonicera canadensis
Maianthemum canadense
Mitchella repens
Ostrya virginiana
Polygonatum pubescens
Prunus virginiana
Trientalis borealis
Trillium grandiflorum
Viburnum acerifolium
Viola canadensis
Viola sp.

PERMANENT PLOTS DATA SHEET

BTH no. 18 . South Manitou Island

Name Dune Blowout Date Sampled 21 Sept. 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area

→

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

Ground Layer Species

Andropogon scoparius
Anemone multifida
Arctostaphylos uva-ursi
Arenaria stricta
Aster sp.
Calamovilfa longifolia
Cirsium pitcheri
Coreopsis lanceolata
Equisetum hyemale
Lilium philadelphicum
Lithospermum caroliniense
Melilotus alba
Orobanche fasciculata
Senecio pauperculis
Silene vulgaris
Solidago spathulata

PERMANENT PLOTS DATA SHEET

BTH no. 19 . South Manitou Island

Name Mike Smith Date Sampled 21 Sept. 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Acer saccharum	9	7.3	84.69	
			→	84.69

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Acer saccharum	9
Sambucus pubens	6
Fagus grandifolia	4

Ground Layer Species

Acer saccharum
Actaea pachypoda
Allium tricoccum
Arisaema triphyllum
Botrychium virginianum
Carex spp.
Caulophyllum thalictroides
Dryopteris intermedia
Galium sp.
Hepatica acutiloba
Mitchella repens
Osmorhiza claytonii
Polygonatum pubescens
Ribes cynosbati
Sambucus pubens
Thalictrum dioicum
Viola canadensis

PERMANENT PLOTS DATA SHEET

BTH no. 20 . South Manitou Island

Name Upland Woods Date Sampled 21 Sept. 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Fraxinus americana	3	17.2	131.43	
Fagus grandifolia	1	10.5	16.26	
Acer saccharum	11	2.3	10.99	
Ostrya virginiana	1	7.5	8.30	
			→	166.98

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Acer saccharum	37
Ostrya virginiana	3
Fagus grandifolia	2
Prunus virginiana	1

Ground Layer Species

Actaea pachypoda
Arisaema triphyllum
Botrychium virginianum
Caulophyllum thalictroides
Dryopteris intermedia
Dryopteris marginalis
Epifagus virginiana
Galium sp.
Hepatica acutiloba
Heracleum lanatum
Osmorhiza chilensis
Sanguinaria canadense
Smilacina stellata
Thalictrum dioicum
Trillium grandiflorum
Viola canadensis
Viola sp.

PERMANENT PLOTS DATA SHEET

BTH no. 21 . South Manitou Island

Name Lake Florence West Date Sampled 21 Sept. 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Acer saccharum	15	5.1	84.05	
Fagus grandifolia	7	4.5	26.31	
Tsuga canadensis	1	2.5	.92	
			→	111.28

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Fagus grandifolia	6
Acer saccharum	1
Sambucus pubens	1

Ground Layer Species

Aralia nudicaulis
Carex sp.
Corallorhiza maculata
Dryopteris intermedia
Epifagus virginiana
Maianthemum canadense
Mitchella repens
Polygonatum pubescens

PERMANENT PLOTS DATA SHEET

BTH no. 22 . South Manitou Island

Name Cedars Trail Date Sampled 21 Sept. 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area
Acer saccharum	8	7.1	80.69	
Thuja occidentalis	1	6.8	6.82	
			→	87.51

Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems
Acer saccharum	1
Acer spicatum	1
Cornus alternifolia	1
Prunus virginiana	1
Taxus canadensis	4 clumps

Ground Layer Species

Actaea pachypoda
Allium tricoccum
Aralia racemosa
Arisaema triphyllum
Botrychium virginianum
Carex sp.
Caulophyllum thalictroides
Dryopteris intermedia
Galium sp.
Hepatica acutiloba
Heracleum lanatum
Lonicera canadensis
Mitella nuda
Osmorhiza claytonii
Rosa sp.
Solidago flexicaulis
Thalictrum dioicum
Uvularia grandiflora
Viola canadensis
Viola sp.

PERMANENT PLOTS DATA SHEET

BTH no. 23 . South Manitou Island

Name Gull Point Date Sampled 22 Sept. 1982

Overstory: Trees > 1" dbh (sq. ft./acre)

Species	No. of stems	Mean dbh	Total basal area/species	Total basal area

→

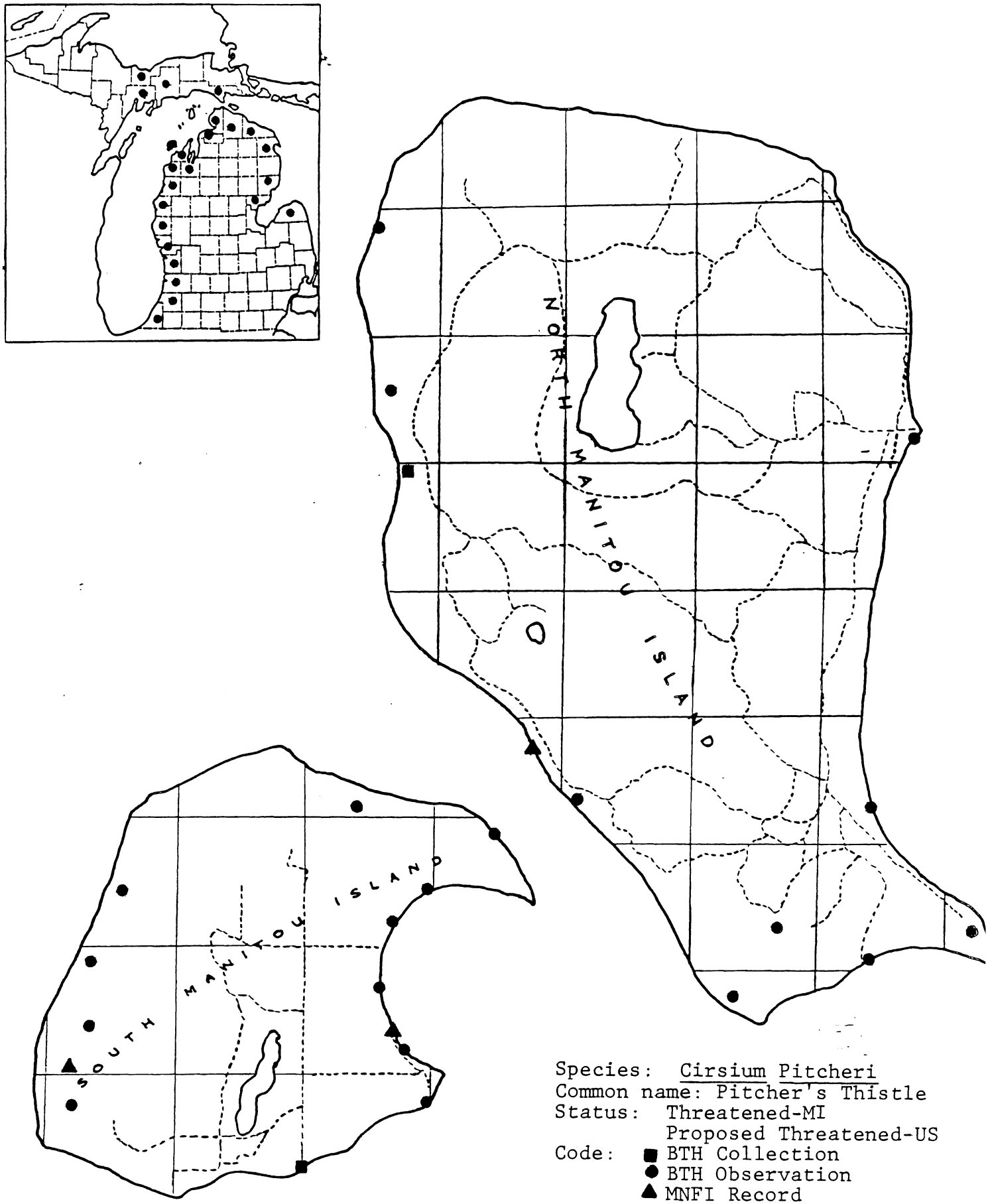
Understory: Trees and shrubs < 1" dbh and taller than 3.5'

Species	No. of stems

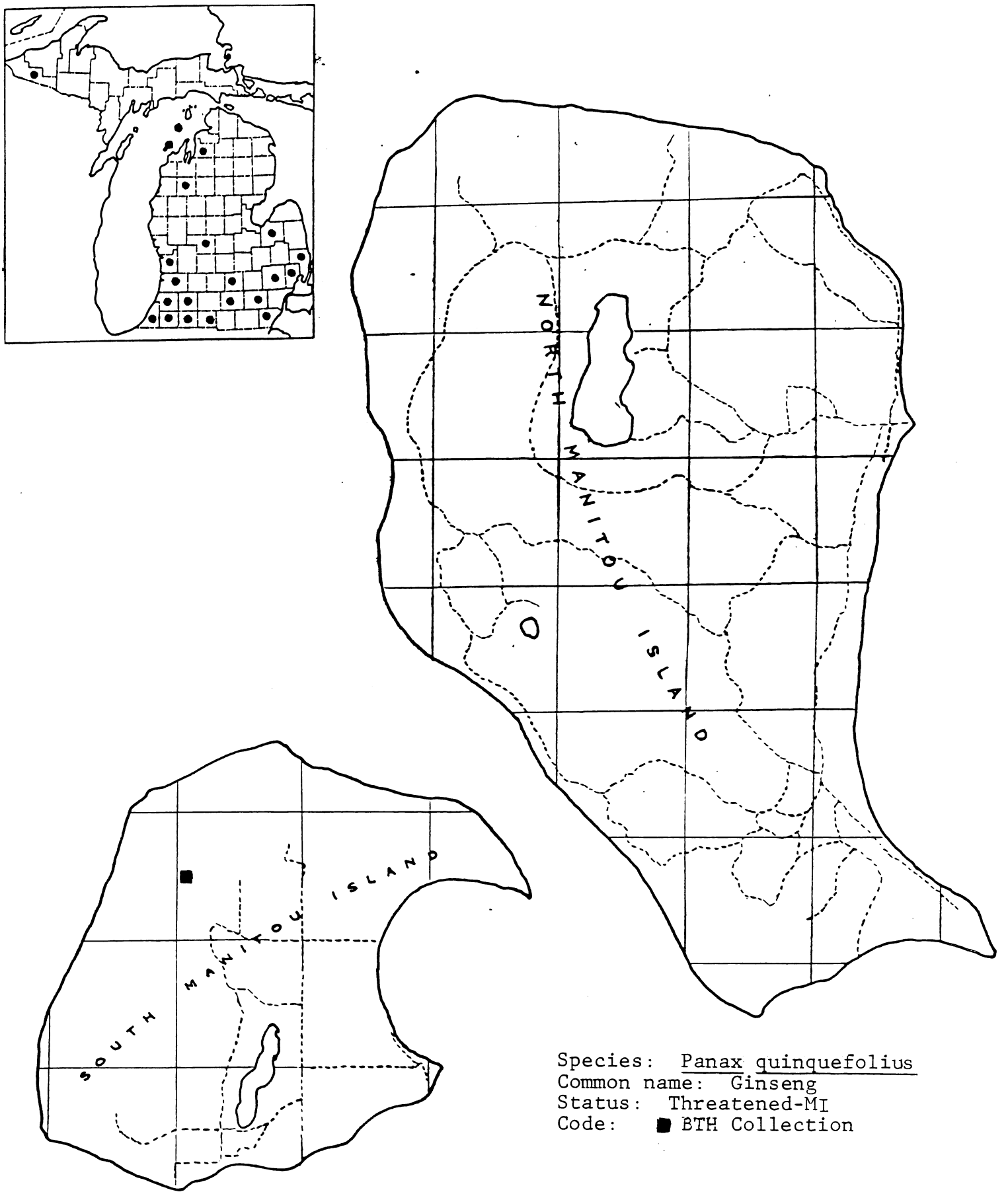
Ground Layer Species

Arenaria serpyllifolia
Artemisia caudata
Campanula rotundifolia
Fragaria virginiana
Juniperus communis
Juniperus horizontalis
Lepidium sp.
Poa compressa
Poa pratensis
Potentilla recta
Silene vulgaris
Sisymbrium officionale

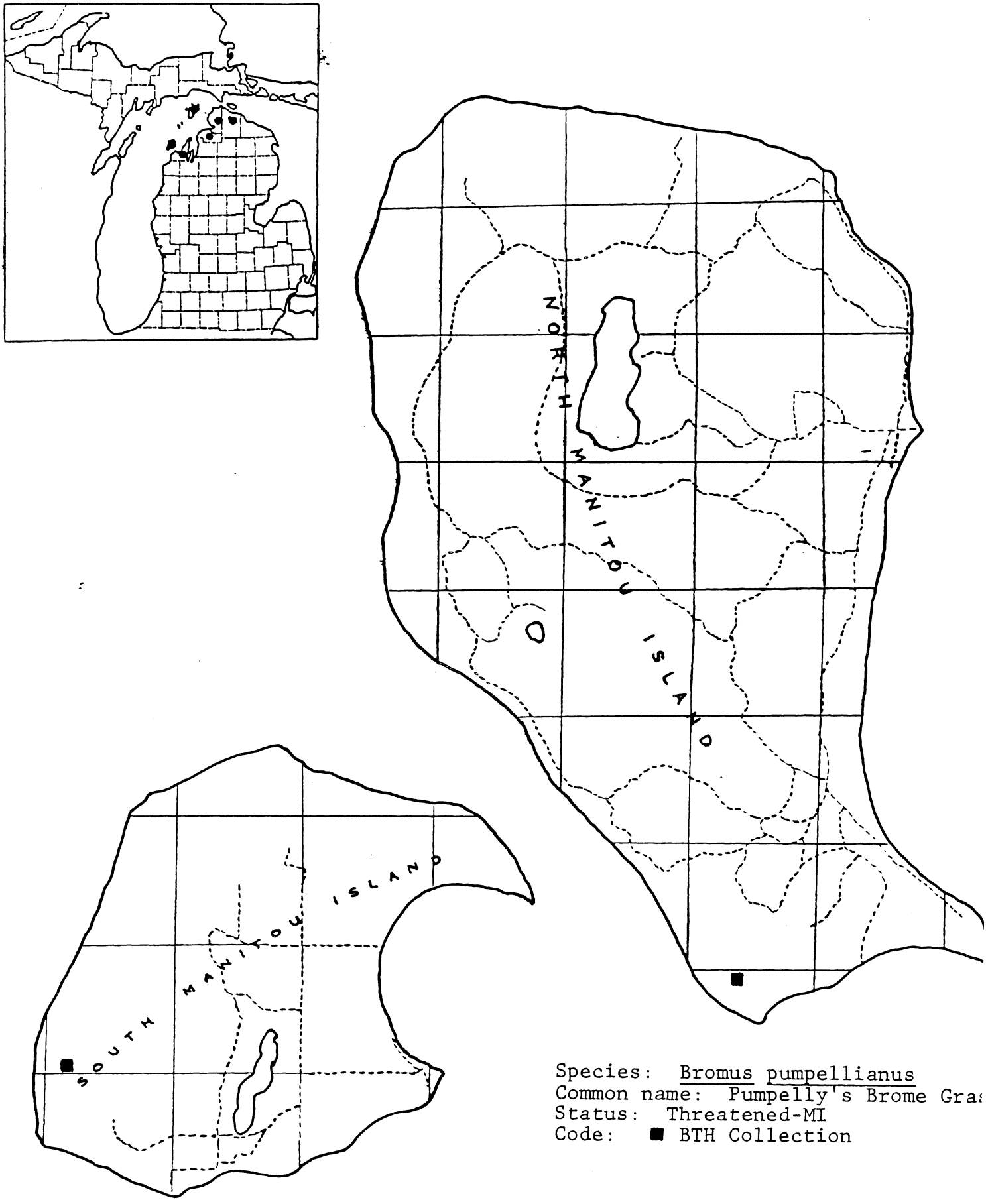
Appendix C. Island distribution of special status species with Michigan distribution inserts.



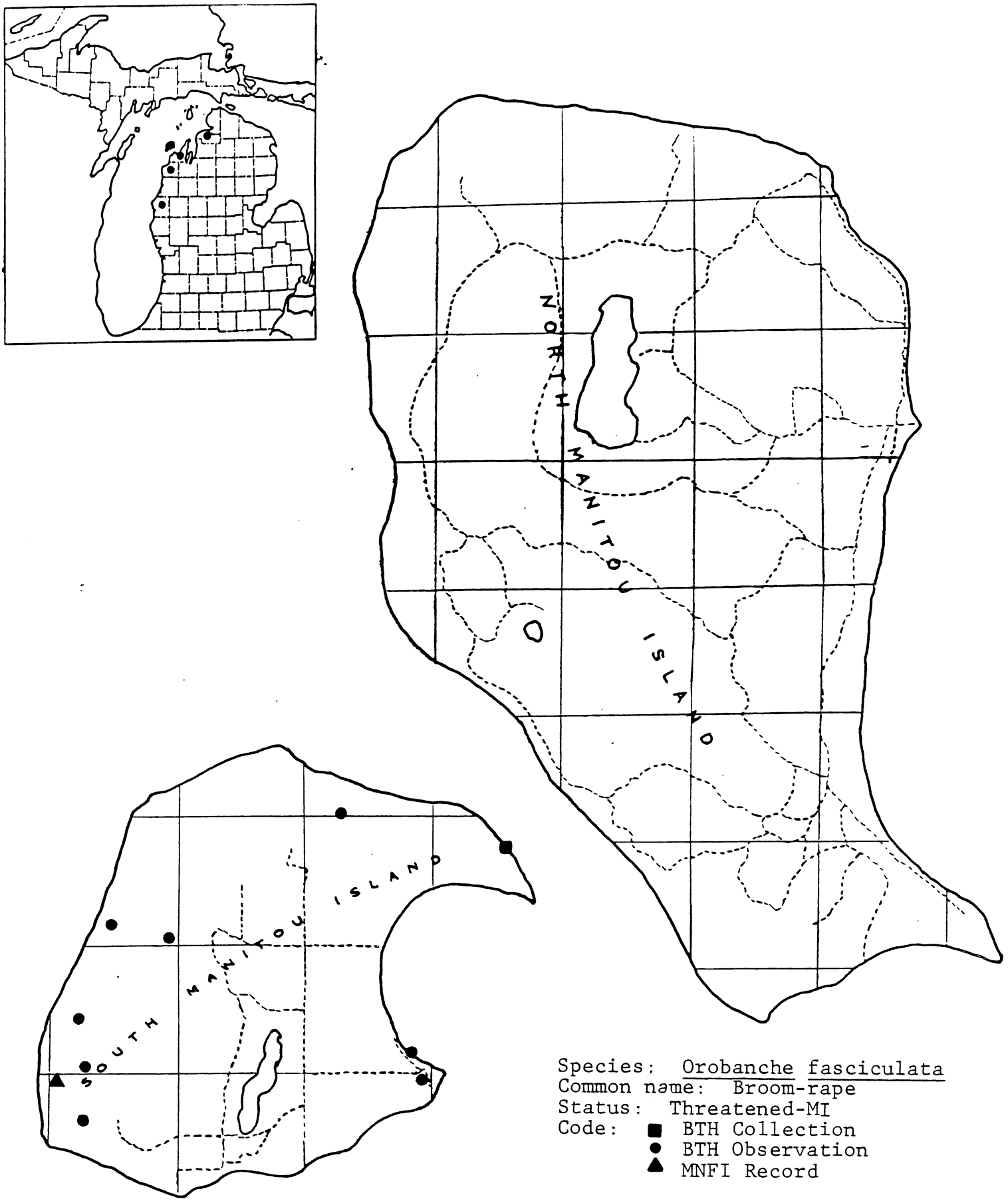
Species: Cirsium Pitcheri
Common name: Pitcher's Thistle
Status: Threatened-MI
Proposed Threatened-US
Code: ■ BTH Collection
● BTH Observation
▲ MNFI Record



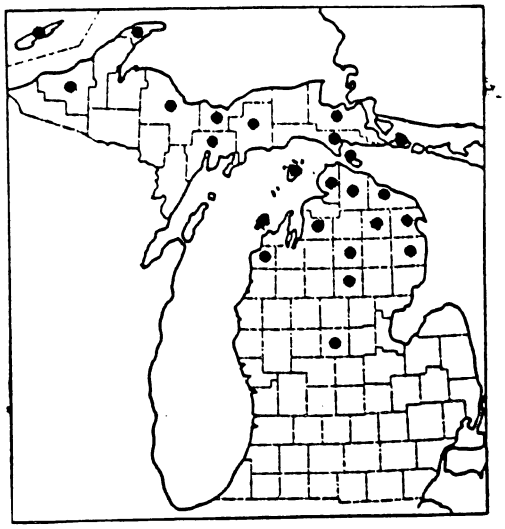
Species: Panax quinquefolius
Common name: Ginseng
Status: Threatened-MI
Code: ■ BTH Collection

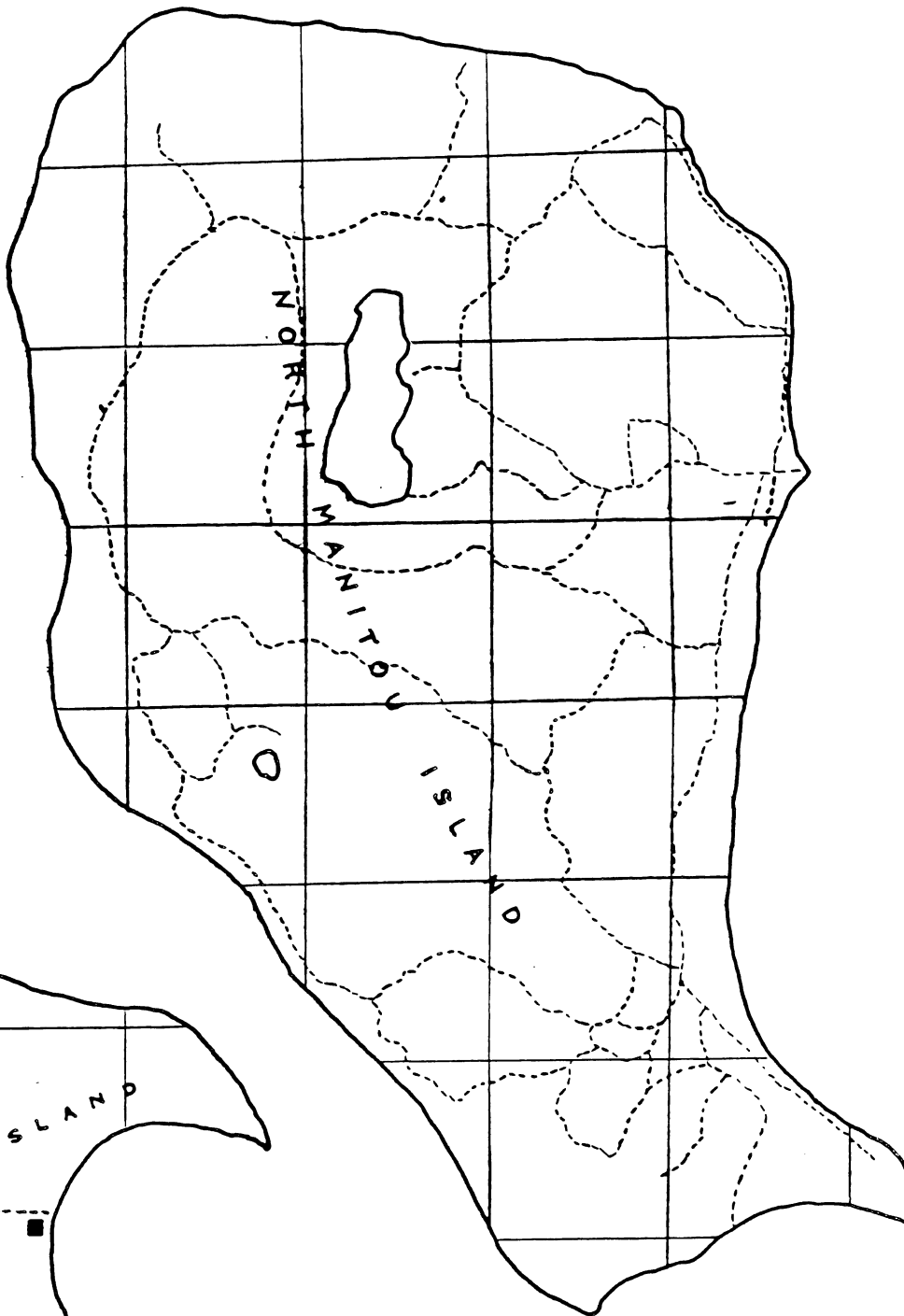


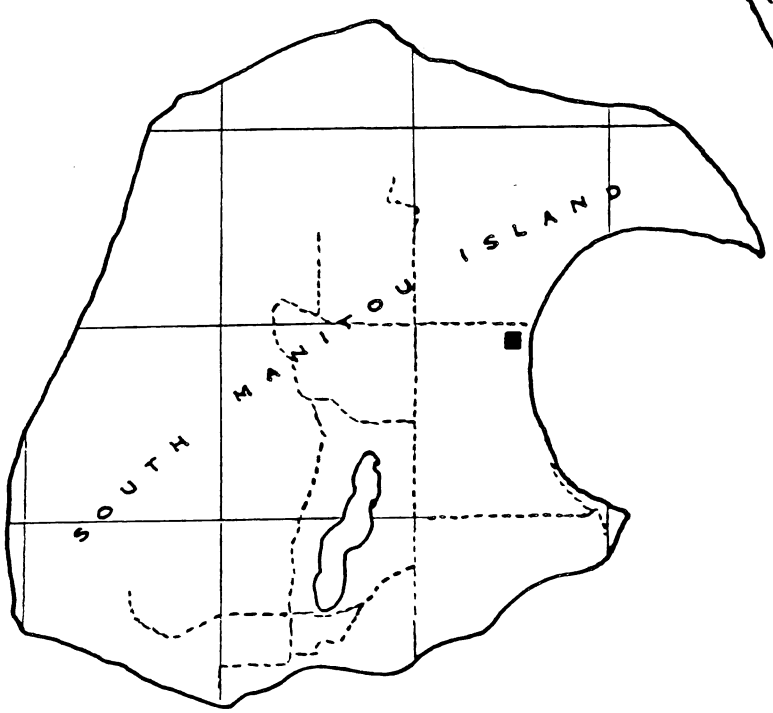
Species: Bromus pumpellianus
Common name: Pumpelly's Brome Gra
Status: Threatened-MI
Code: ■ BTH Collection



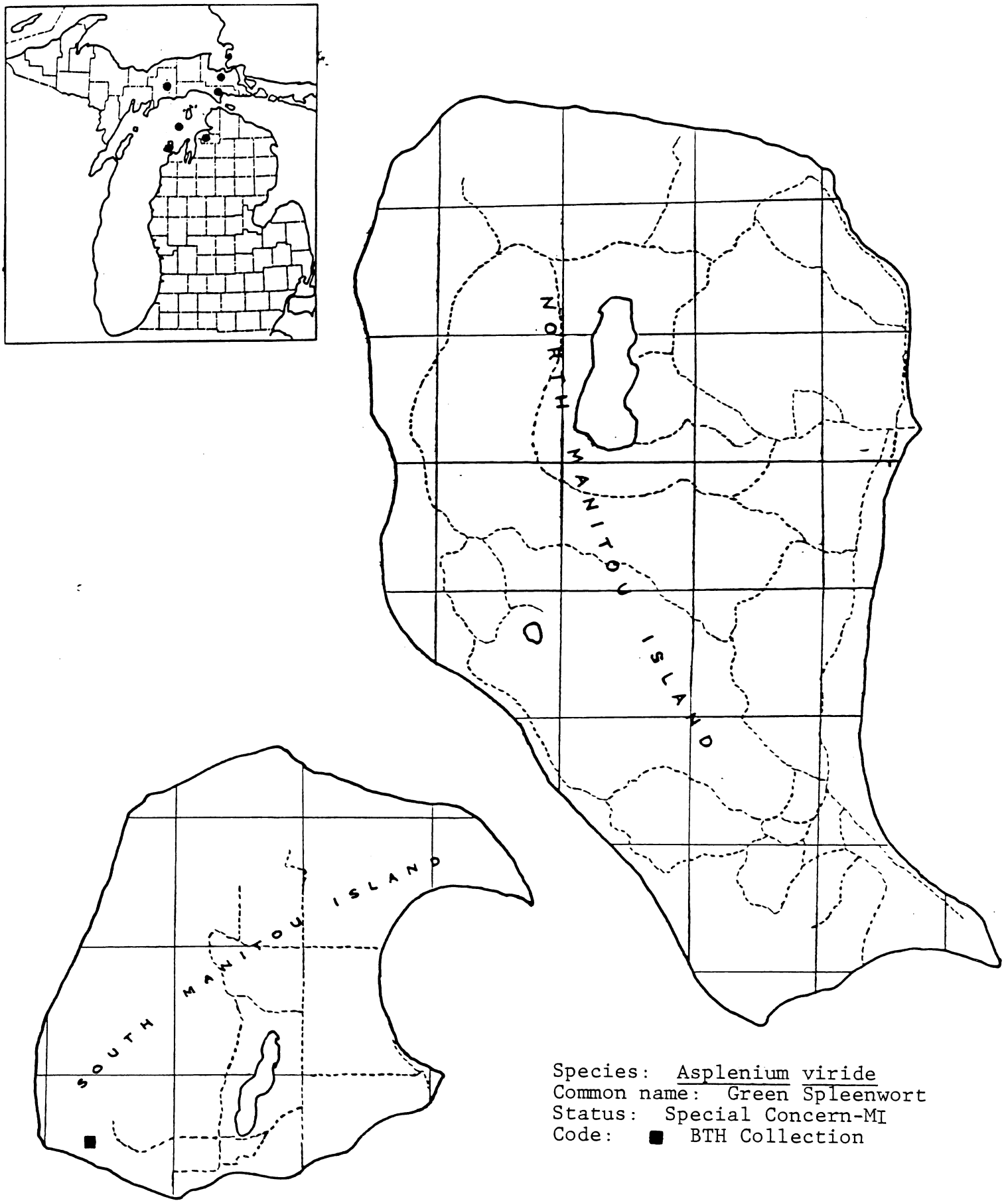
Species: Orobanche fasciculata
Common name: Broom-rape
Status: Threatened-MI
Code: ■ BTH Collection
● BTH Observation
▲ MNFI Record



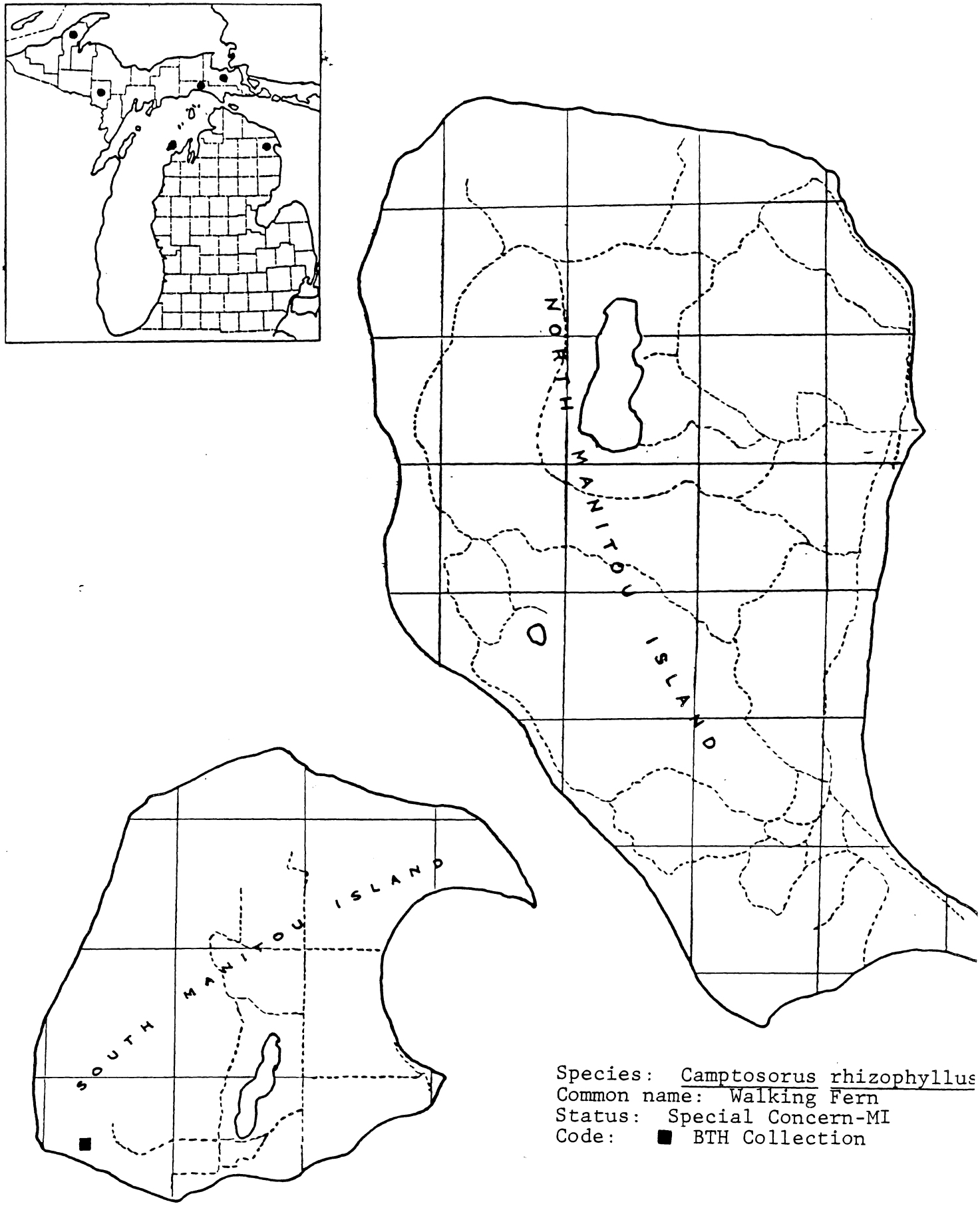




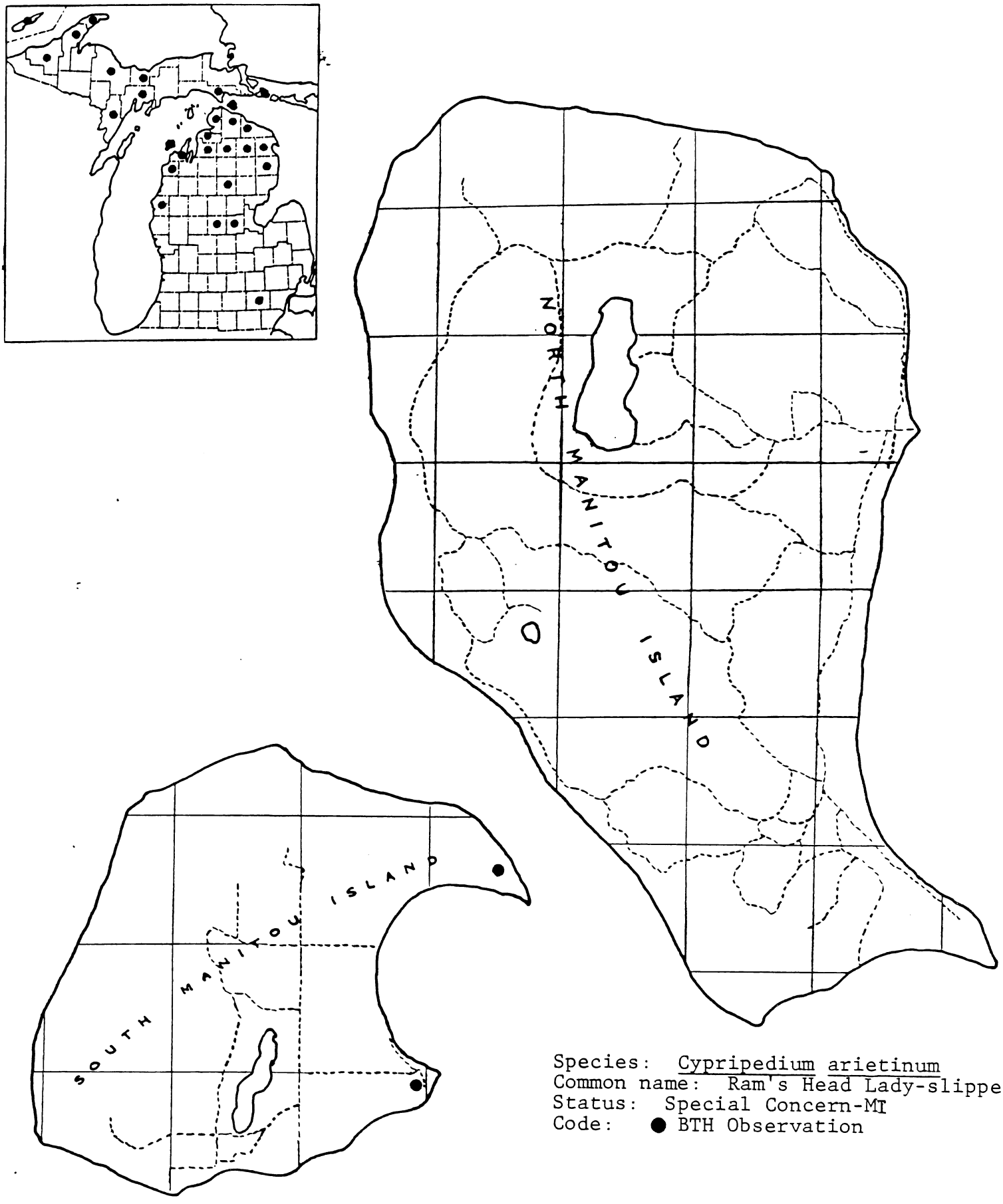
Species: Calypso bulbosa
Common name: Calypso
Status: Threatened-MI
Code: ■ BTH Collection



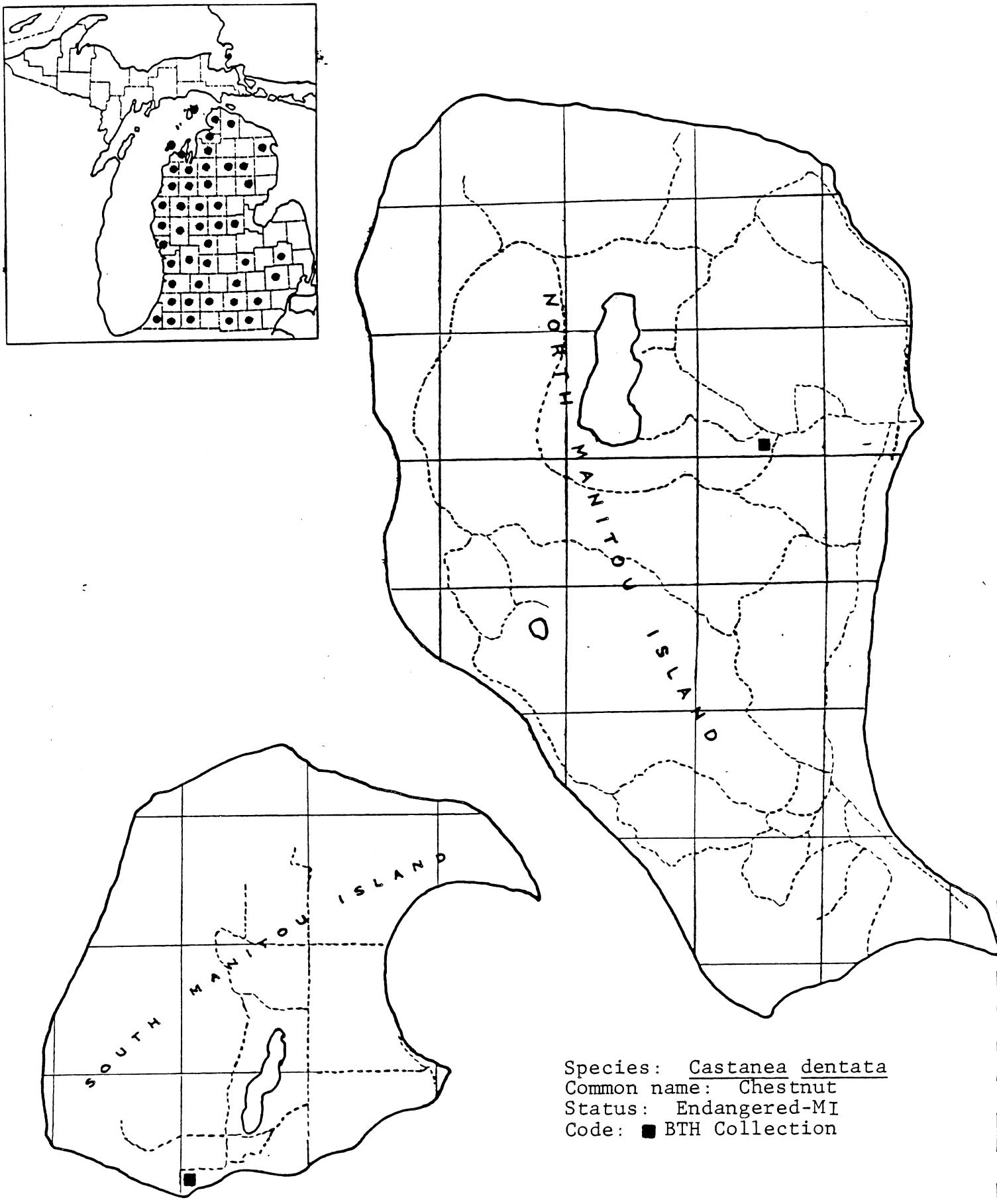
Species: Asplenium viride
Common name: Green Spleenwort
Status: Special Concern-MI
Code: ■ BTH Collection



Species: Camptosorus rhizophyllus
Common name: Walking Fern
Status: Special Concern-MI
Code: ■ BTH Collection



Species: Cypripedium arietinum
Common name: Ram's Head Lady-slipper
Status: Special Concern-MI
Code: ● BTH Observation



Species: Castanea dentata
Common name: Chestnut
Status: Endangered-MI
Code: ■ BTH Collection