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THE UNIVERSITY OF MICHIGAN
BIOLOGICAL STATION

THE AQUATIC VEGETATION AND FLORA
OF SLEEPING BEAR DUNES NATIONAL LAKESHORE
BENZIE AND LEELANAU COUNTIES
MICHIGAN

Technical Report No. 15

Brian T. Hazlett

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THE AQUATIC VEGETATION AND FLORA
OF SLEEPING BEAR DUNES NATIONAL LAKESHORE
BENZIE AND LEELANAU COUNTIES
MICHIGAN



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ABSTRACT

The vegetation and flora of the wetland and aquatic habitats of Sleeping Bear Dunes National Lakeshore was surveyed during the summers of 1986 and 1987. This report, the third in a series on the vegetation of the National Lakeshore, provides descriptions of the various lakes, streams, and their associated wetlands and includes a catalogue of 338 vascular plant species. The National Lakeshore distribution of *Berula erecta*, a species listed as threatened by the State of Michigan, is mapped. Locations of fragile aquatic and wetland habitats within the National Lakeshore are noted. Recommendations concerning the public use of, future research in, and monitoring of aquatic and wetland areas are made.

The Aquatic Vegetation and Flora
of Sleeping Bear Dunes National Lakeshore,
Benzie and Leelanau Counties,
Michigan

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INTRODUCTION

The lakes, streams, and wetlands scattered throughout Sleeping Bear Dunes National Lakeshore contribute to the diversity of the region's vegetation. Many of these features offer a variety of recreational opportunities including fishing, boating, and swimming. In contrast, other aquatic habitats and wetlands are ignored or overlooked by visitors intent on other destinations. Occasionally ornate flowers such as the water-lily, pond-lily, and showy lady-slipper may be noticed, yet the associated pondweeds, water-milfoils, and duckweeds tend to be overlooked, or are even despised as a nuisance.

Previous aquatic vegetation studies within the region encompassed by the National Lakeshore have been limited. On North Manitou, Coulter (1904) included descriptions and photographs of Tamarack Lake and the area around the outlet of Lake Manitou as part of a comparative survey of wetlands. Waterman (1922) briefly described the aquatic habitats along, and some swales west of, the Platte River.

This report, the third in a series on the vegetation of Sleeping Bear Dunes National Lakeshore, covers the vegetation and vascular plant flora of the aquatic and wetland habitats, which at the most, had only been briefly described from the Manitou Islands (Hazlett & Vande Kopple, 1983) and the mainland portion of the National Lakeshore (Hazlett, 1986). This study includes the lakes, streams, and their associated wetlands within Sleeping Bear Dunes National Lakeshore (Figure 1). The associated wetlands vary in size from year to year and might best be described as those sites where one would get wet feet. During 1986, an exceptionally wet year, flooding occurred in some marginal areas which have been dry in the past. In addition to the naturally high water levels, beavers were responsible for raising water levels in Narada and Tucker lakes.

The goals of this study were to assist in the resources management of Sleeping Bear Dunes National Lakeshore by

- 1) continuing the vegetation studies with an emphasis on aquatic vegetation,
- 2) searching for threatened and rare species,

- 3) identifying and describing sensitive regions,
- 4) noting vegetation changes occurring since Coulter's and Waterman's studies,
and
- 5) providing current information on aquatic and wetland areas from which
comparisons can be made in the future.

METHODS

I conducted intensive field work for this study of the entire National Lakeshore from May 8 to August 20, 1986. Vascular plant checklists for the Lakeshore's lakes and streams were made based on this field work. During May, July, and August 1987, I used these lists to note any additional species. The descriptions of the aquatic and wetland sites were compiled from my field notes and collections. Collecting and field observations were made on foot and from a canoe for bodies of water too deep to be explored wearing hip boots.

Lakes and streams examined at least four times by canoe during 1986 include Round Lake, Loon Lake, Deer Lake, Bass Lake, Otter Lake, Narada Lake, and the Platte River; three times - North Bar Lake, Day Mill Pond, Bass Lake (Leelanau Co.), School Lake, Shell Lake, and Otter Creek; twice - Lake Florence, Mud Lake, Tucker Lake, and the Crystal River. Lake Manitou, Hidden Lake, Taylor Lake and big Glen were checked only once by canoe. All Mainland lakes and streams, except Taylor Lake and the Mill Pond, were resurveyed at least once during 1987.

Field notes and some collections made during the island and mainland terrestrial studies have also been incorporated into this report. The occurrence and relative abundance of threatened species in wetland areas were noted. A checklist of vascular plants found during this investigation has been included at the end of this report. A list of species with common names is found in Appendix B.

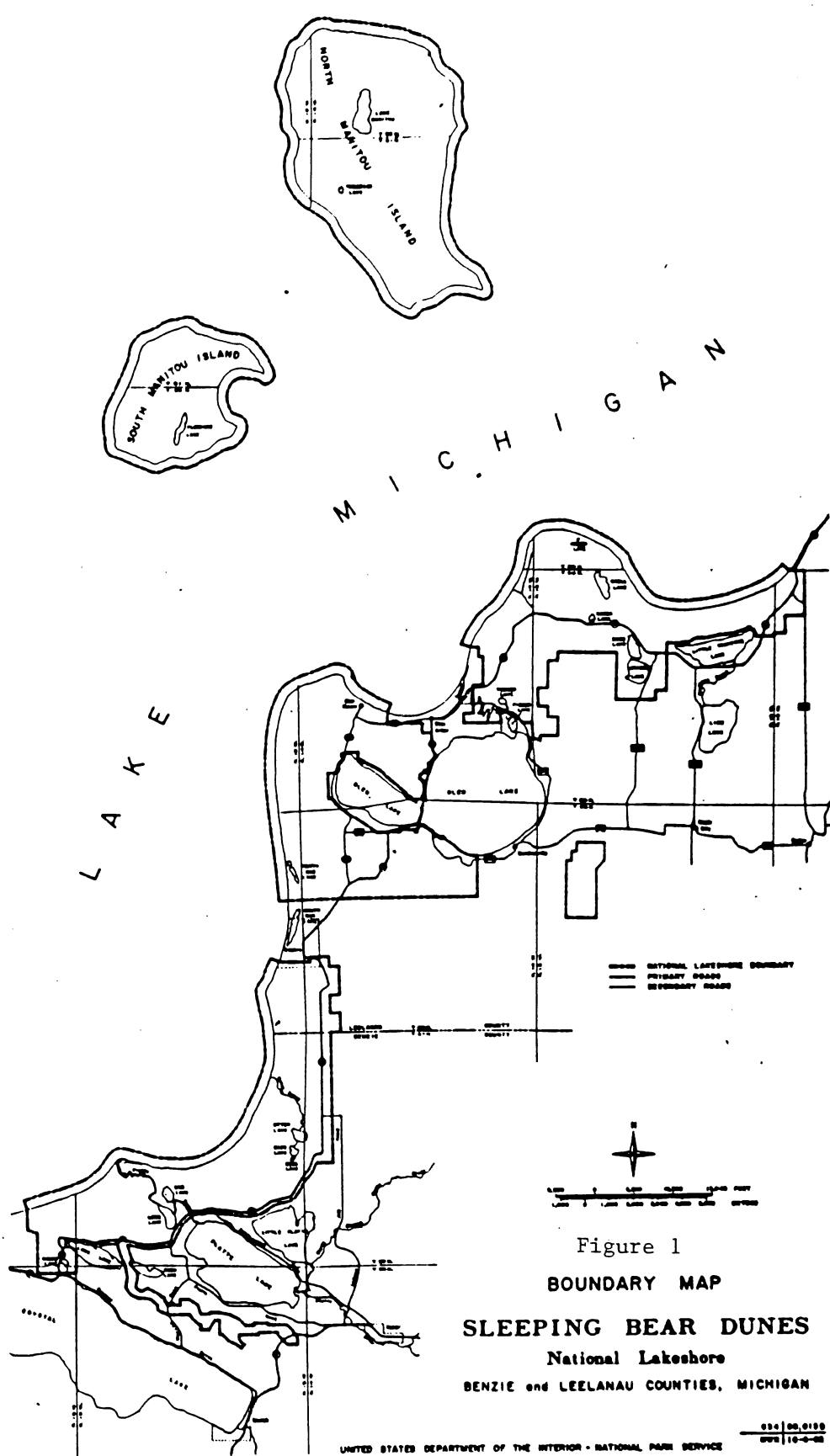


Figure 1
 BOUNDARY MAP
 SLEEPING BEAR DUNES
 National Lakeshore
 BENZIE and LEELANAU COUNTIES, MICHIGAN

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DESCRIPTION OF THE AQUATIC HABITATS

The following descriptions of the aquatic areas and associated wetlands are grouped by county beginning with the Mainland and then loosely according to geographic region and drainage system. Descriptions of Island aquatic habitats appear after those of the Mainland. Surface areas for lakes follow Humphys and Green (1962a, 1962b).

LEELANAU COUNTY

North Bar Lake Empire Twp. Secs. 12 & 13

North Bar Lake, known to some local residents as Perry Lake, covers approximately 35.2 acres. The lake's elevation is generally the same as Lake Michigan from which it is separated by a narrow sand spit. This oblong lake is bordered toward its north end by open sand and by northern hardwood forests on its west side. On the east side is a cedar swamp south of the North Bar Lake access road. North of the road is a black ash swamp, in which is the only known location within the National Lakeshore for *Dryopteris clintoniana*.

Floating and submerged aquatics of the lake include *Elodea canadensis*, *Myriophyllum heterophyllum*, *M. spicatum*, *Najas flexilis*, *Nuphar variegata*, *Nymphaea odorata*, *Potamogeton amplifolius*, *P. crispus*, *P. foliosus*, *P. gramineus*, *P. illinoensis*, *P. pectinatus*, *P. richardsonii*, and *Utricularia* spp. The largest concentrations of these occur at the south end of the lake. Emergent and shoreline herbs include *Asclepias incarnata*, *Calamagrostis canadensis*, *Eupatorium maculatum*, *Lobelia cardinalis*, *Lycopus americanus*, *Rumex verticillata*, and *Scirpus acutus*. Among the shrubby shoreline species are *Alnus rugosa*, *Myrica gale*, *Rosa palustris*, and *Salix exigua*.

Day Mill Pond
Glen Arbor Twp. Sec. 29

The Day Mill Pond is a shallow six acre extension of little Glen Lake. The Mill Pond was once used in the operation of a lumber mill and is separated from the rest of Glen Lake by M-109. A small outlet on the lake's east side passes under the highway and enters Glen Lake near the public beach. The Mill Pond is shallow, not more than three feet deep, and has a profuse growth of submerged and floating aquatics. These species include *Ceratophyllum demersum*, *Elodea canadensis*, *Lemna minor*, *L. trisulca*, *Myriophyllum exalbescens*, *Najas flexilis*, *Potamogeton illinoensis*, *P. natans*, *P. pectinatus*, *P. richardsonii*, *P. zosteriformis*, *Spirodela polyrhiza*, and *Utricularia vulgaris*. A dense expanse of *Nuphar variegata* covers the east side. The outer edge of the Mill Pond is densely ringed with *Typha latifolia*. Other emergent and shoreline species include *Asclepias incarnata*, *Cicuta maculata*, *Glyceria striata*, *Impatiens capensis*, *Phragmites australis*, *Polygonum amphibium*, *Potentilla palustris*, *Sagittaria latifolia*, *Scutellaria galericulata*, and *Sparganium chlorocarpum*. *Cornus amomum* and *Salix lucida* are common woody species around the Mill Pond.

A marshy area north of the Mill Pond, through which the Old Grade trail passes, is characterized by *Asclepias incarnata*, *Barbarea vulgaris*, *Epilobium ciliatum*, *Eupatorium maculatum*, *E. perfoliatum*, *Impatiens capensis*, *Phragmites australis*, *Ribes americanum*, *Scirpus cyperinus*, *Typha latifolia*, *Urtica dioica*, and several *Carex* species.

Glen Lake

Sleeping Bear Dunes National Lakeshore fronts little Glen Lake at Glen Lake Beach and on big Glen Lake east of the Narrows near Inspiration Pt. In the latter area no emergents were found. The only submerged aquatic in this area, *Potamogeton filiformis*, is thinly represented. Just outside the designated public swimming area at Glen Lake Beach, however, submerged and floating aquatics are more common with *Elodea canadensis*,

Najas flexilis, *Potamogeton filiformis*, *P. gramineus*, *P. richardsonii*, *P. zosteriformis*, *Sagittaria latifolia* and *Vallisneria americana*.

The shoreline east of the public beach includes herbs such as *Apocynum cannabinum*, *Asclepias incarnata*, *Aster latifolius*, *Bidens connatus*, *Carex aurea*, *C. interior*, *C. projecta*, *C. viridula*, *Calamagrostis inexpansa*, *Cladium mariscoides*, *Eleocharis erythropoda*, *Equisetum variegatum*, *Eupatorium maculatum*, *E. perforatum*, *Gentiana rubricaulis*, *Iris virginica*, *Juncus canadensis*, *Lathyrus palustris*, *Lobelia kalmii*, *L. siphilitica*, *Lycopus americanus*, *Mentha piperita*, *Osmunda regalis*, *Potentilla anserina*, *Prunella vulgaris*, *Scirpus americanus*, *Solidago graminifolia*, *Spiranthes cernua*, and *Thelypteris palustris*.

An open wet area lies in a depression around 50 yards from the beach. Species here include *Calamagrostis canadensis*, *Carex bebbii*, *C. crinita*, *C. retrorsa*, *C. vulpinoidea*, *Dulichium arundinaceum*, *Eleocharis* sp., *Eupatorium maculatum*, *Geum allepicum*, *Habenaria psycodes*, *Impatiens capensis*, *Iris virginica*, *Lysimachia thyrsiflora*, *Onoclea sensibilis*, *Osmunda regalis*, *Phalaris arundinacea*, *Potentilla palustris*, *Scirpus acutus*, *S. cyperinus*, *Solanum dulcamara*, *Thelypteris palustris*, *Triadenum fraseri*, and *Typha latifolia*. In areas of standing water are *Cicuta maculata*, *Lemna minor*, *Nuphar variegata*, and *Polygonum amphibium*. Woody species in this area include *Alnus rugosa*, *Betula papyrifera*, *Cornus amomum*, *Fraxinus nigra*, *Ilex verticillata*, *Rosa palustris*, *Rubus* sp., and *Salix* spp.

Tucker Lake Glen Arbor Twp. Sec. 24

Tucker Lake has an area of 15.6 acres. Its outlet flows south to Fisher Lake after passing through a powerline clearing and cedar woods before leaving the National Lakeshore and flowing under Co. 675. The level of this lake is slightly higher now than in recent years due to a beaver dam on the outlet. Flooding of the black ash swamp between the lake and Westman Rd. during 1986 and 1987 resulted in the death of most of the

trees. The remains of an old dump lies along the access road which arrives at the lake's southwest corner from Westman Rd. Submerged and floating aquatic species of the lake include *Lemna minor*, *Myriophyllum exalbescens*, *M. heterophyllum*, *Najas flexilis*, *Nuphar variegata*, *Nymphaea odorata*, *Potamogeton amplifolius*, *P. foliosus*, *P. gramineus*, *P. natans*, *P. pectinatus*, *P. richardsonii*, *Utricularia* spp. and *Vallisnaria americana*. *Nuphar* is most common near the northwest and east sides and narrow band of *Typha latifolia* rings the lake. Additional emergent and shoreline herbs include *Asclepias incarnata*, *Calamagrostis canadensis*, *Carex comosa*, *Potentilla palustris*, and *Thelypteris palustris*. Near the lake's outlet, *Sagittaria latifolia*, *Solanum dulcamara*, and *Osmunda regalis* are also found. Shrubs along the shore include *Alnus rugosa*, *Cornus stolonifera*, *Decodon verticillatus*, *Ilex verticillata*, *Rosa palustris*, and *Salix candida*. Shoreline trees include *Acer rubrum*, *Betula alleghaniensis*, *B. papyrifera*, *Fraxinus pennsylvanica*, and *Thuja occidentalis*.

Crystal River
Glen Arbor Twp. Sec. 23

The Crystal River, its source in big Glen Lake, enters the National Lakeshore after flowing under Fisher Rd. and meanders 2 miles before leaving the Lakeshore. After entering the Park, it flows over a dam before making long loops through the corrugated lake plain. The river is narrow, but navigable by canoe. After six turns it eventually flows under Co. 675. It makes one short 1/4 mile bend before swinging by Co. 675 and departing the National Lakeshore. The surrounding vegetation is largely moist coastal forest, but some swales and cedar swamps occur along the river especially at the bends. Submerged and floating aquatics include *Elodea canadensis*, *Lemna minor*, *Myriophyllum exalbescens*, *Najas flexilis*, *Nymphaea odorata*, *Potamogeton crispus*, *P. illinoensis*, *P. pectinatus*, *P. richardsonii*, *P. zosteriformis*, *Utricularia* spp., and *Vallisnaria americana*. Shoreline herbs include *Apocynum cannabinum*, *Asclepias incarnata*, *Calamagrostis canadensis*, *Caltha palustris*, *Campanula aparinoides*, *Carex* spp., *Eleocharis* spp., *Equisetum fluviatile*, *Eupatorium maculatum*, *Impatiens capensis*, *Iris virginica*, *Juncus* spp.,

Lathyrus palustris, *Lobelia cardinalis*, *L. kalmii*, *Lycopus uniflorus*, *Mimulus ringens*, *Myosotis scorpioides*, *Onoclea sensibilis*, *Osmunda regalis*, *Parnassia glauca*, *Sagittaria latifolia*, *Scirpus* spp., *Scutellaria galericulata*, *S. lateriflora*, *Solanum dulcamara*, *Solidago uliginosus*, and *Thelypteris palustris*. Bordering shrubs include *Hypericum kalmianum*, *Myrica gale*, *Rosa palustris*, and *Salix* spp. Riverside trees include *Acer rubrum*, *Fraxinus nigra*, and *Thuja occidentalis*.

M-22 Bog
Empire Twp. Sec. 13

The small depression in which this *Sphagnum* bog has developed is readily observed from M-22 east of Westman Rd. At the southern end of the bog, some open water with *Nuphar* and *Utricularia geminiscapa* is ringed by *Decodon*. The rest of the bog is dominated by *Chamaedaphne calyculata*. Other shrub species here include *Andromeda glaucophylla*, *Gaylussacia baccata*, *Kalmia polifolia*, *Ledum groenlandicum*, and *Vaccinium myrtilloides*. Dominant trees scattered around the bog are *Pinus strobus* and *Larix laricina*. *Picea mariana* is most common as an understory species. Dwarf mistletoe, *Arceuthobium pusillum* grows on the *Picea*. A bog moat has developed on the southwest side where *Nemopanthus mucronatus*, *Ilex verticillata*, and *Betula papyrifera* are common. Herbaceous species throughout the bog include *Carex trisperma*, *Cypripedium acaule*, *Drosera rotundifolia*, *Eriophorum spissum*, *E. virgatum*, *Gaultheria hispidula*, *Habenaria blephariglottis*, *Sarracenia purpurea*, *Smilacina trifolia*, and *Vaccinium oxycoccos*. *Monotropa uniflora* (Indian pipe), an upland species, even occurs on the *Sphagnum* hummocks.

Port Oneida Bog
Cleveland Twp. Sec. 6 & Glen Arbor Twp. Sec. 1

The wetland largely situated northeast of the intersection of Port Oneida and Kelderhouse roads is best described as a bog due to the predominance of *Chamaedaphne*

calyculata in most places. On the east, west, and south sides the area is bordered by wet woods composed of *Pinus strobus*, *Betula papyrifera*, *Populus tremuloides*, and *Acer rubrum*. As one approaches the open areas of this wetland, the shrub and sapling species encountered include *Acer rubrum*, *Alnus rugosa*, *Aronia prunifolia*, *Chamaedaphne calyculata*, *Cornus stolonifera*, *Ilex verticillata*, *Larix laricina*, *Ledum groenlandicum*, *Nemopanthus mucronatus*, *Populus tremuloides*, *Salix exigua*, *Vaccinium angustifolium*, and *V. myrtilloides*. Herbaceous species in this area are *Cypripedium acaule*, *Dryopteris spinulosa*, *Eupatorium perfoliatum*, *Lysimachia thyrsiflora*, *Mentha arvensis*, *Onoclea sensibilis*, *Osmunda cinnamomea*, *O. regalis*, *Rubus hispidus*, *Scutellaria galericulata*, *Solanum dulcamara*, and *Thelypteris palustris*. The largest area of open water, a rectangular pond which appears to be man-made, lies on the wetland's west side, bordering an open field which runs along Port Oneida Rd. Species of emergents here include *Juncus* spp., *Phalaris arundinacea*, *Scirpus cyperinus*, *Triadenum fraseri*, and *Typha latifolia*. *Brassenia schreberi*, *Elodea canadensis*, *Potamogeton natans*, *P. pectinatus*, and *Utricularia* spp. are among the submerged aquatic species. *Potamogeton oakesianus*, a rare pondweed, was found here and in a small pool in woods of the same wetland south of Kelderhouse Rd.

School Lake
Cleveland Twp. Sec. 16

School Lake is the largest inland lake on the Mainland. For much of its 179 acres it is quite shallow, perhaps no more than 5 feet deep with a sandy bottom. A small deep cove, hidden by *Typha*, occurs at the lake's southwest corner. The lake has no outlet, but a small inlet enters the lake on the southeast after passing through a black ash swamp. Submerged and floating aquatics are especially common on the east side and near the inlet. These include *Lemna minor*, *Najas flexilis*, *Nuphar variegata*, *Nymphaea odorata*, *Potamogeton amplifolius*, *P. crispus*, *P. foliosus*, *P. gramineus*, *P. natans*, *P. pectinatus*, *P. zosteriformis*, *Sagittaria latifolia*, and *Vallisneria americana*. *Juncus* and *Carex* are common

on the north shore. *Typha* is common on the southwest corner and along the west side. Other herbaceous emergent and shoreline species include *Calamagrostis canadensis*, *Cladium mariscoides*, *Eleocharis elliptica*, *E. smallii*, *Equisetum fluviatile*, *Eupatorium maculatum*, *E. perforatum*, *Habenaria psycodes*, *Hypericum majus*, *Iris virginica*, *Juncus brachycephalus*, *J. nodosus*, *Lobelia cardinalis*, *L. kalmii*, *Lycopus uniflorus*, *Lythrum salicaria*, *Mentha arvensis*, *Onoclea sensibilis*, *Panicum virgatum*, *Polygonum amphibium*, *Potentilla anserina*, *Sagittaria latifolia*, *Scirpus acutus*, *S. americanus*, *Scutellaria galericulata*, *Solidago graminifolia*, *Thelypteris palustris*, *Solanum dulcamara*, and *Triadenum fraseri*. The only location of *Sium suave* found during this study was at the edge of this lake near the inlet. Among the woody species around School Lake are *Alnus rugosa*, *Cephalanthus occidentalis*, *Cornus amomum*, *Fraxinus pennsylvanica*, *Hypericum kalmianum*, and *Potentilla fruticosa*. The black ash swamp south of the lake is the only known locality within the National Lakeshore for *Hydrocotyle americana* and *Sparganium americanum*.

Bass Lake
Cleveland Twp. Secs. 9 & 16

Bass Lake covers 93.5 acres. The lake has a sandy bottom and is separated from School Lake by a small isthmus. Having no inlet or outlet, the lake's water level is dependent on seasonal precipitation. In August 1987 the lake level was at least 1 foot lower than the previous summer. Submerged and floating aquatic species include *Myriophyllum exalbescens*, *Najas flexilis*, *Potamogeton amplifolius*, *P. foliosus*, *P. gramineus*, *P. illinoensis*, *P. natans*, *P. pectinatus*, *P. zosteriformis*, *Sagittaria latifolia*, and *Vallisneria americana*. Emergent and shoreline species include *Asclepias incarnata*, *Cladium mariscoides*, *Eleocharis smallii*, *Iris virginica*, *Phragmites australis*, *Scirpus acutus*, *Solidago graminifolia*, and *Triadenum fraseri*. Woody shoreline species are *Cephalanthus occidentalis*, *Cornus amomum*, *Fraxinus pennsylvanica*, and *Populus deltoides*.

Narada Lake
Cleveland Twp. Sec. 8

Narada Lake, shown as Prouse's Lake on old DNR maps, covers around 14 acres. Its outlet flows east to Shalda Creek through a cedar swamp. The lake has had a slightly higher level in recent years due to a beaver dam built along an old road just east of the lake. Flooding as a result of this dam is changing the vegetation along the lake's shore especially through the death of trees. Flooded areas include a cedar swamp on the east side and a black ash swamp on the west side. Floating and submerged aquatics of Narada Lake include *Ceratophyllum demersum*, *Lemna minor*, *Myriophyllum heterophyllum*, *Nuphar variegata*, *Nymphaea odorata*, *Potamogeton berchtoldii*, *P. natans*, *P. praelongus*, *Utricularia* spp., and *Wolffia punctata*. Emergent and shoreline species include *Calamagrostis canadensis*, *Carex* spp., *Decodon verticillatus*, *Impatiens capensis*, *Lycopus uniflorus*, *Lysimachia thyrsiflora*, *Mentha arvensis*, *Onoclea sensibilis*, *Phalaris arundinacea*, *Rosa palustris*, *Salix discolor*, *Scirpus acutus*, *Solanum dulcamara*, *Sparganium chlorocarpum*, and *Typha latifolia*. Woody species around the immediate edge of the lake include *Salix* spp., *Cornus amomum*, *C. stolonifera*, *Larix laricina*, *Thuja occidentalis*, and *Fraxinus nigra*.

Shell Lake
Cleveland Twp. Sec. 5

Shell Lake, known to some as Briggs Lake, has a sandy bottom and covers 98 acres. The lake has no outlet. Submerged and floating aquatics are rather sparse with *Lemna minor*, *Najas flexilis*, *Nuphar variegata*, *Nymphaea odorata*, *Polygonum amphibium*, *Potamogeton gramineus*, *P. illinoensis*, *P. natans*, *P. pectinatus*, and *Utricularia* spp. Emergent and shoreline species include *Calamagrostis canadensis*, *C. inexpansa*, *Carex aquatilis*, *Cladium mariscoides*, *Eleocharis* sp., *Eupatorium maculatum*, *Iris virginica*, *Phragmites australis*, *Scirpus acutus*, *Solidago graminifolia*, *Thelypteris palustris*, and *Typha latifolia*. Trees and shrubs along the shore include *Acer rubrum*, *Cornus amomum*,

Fraxinus pennsylvanica, *Populus balsamea*, *P. tremuloides*, *Potentilla fruticosa*, *Salix candida*, and *Thuja occidentalis*.

Hidden Lake and vicinity
Cleveland Twp. Secs. 31 & 32

Hidden Lake is the best known of the small ponds found between Shell Lake and Pyramid Pt. Hidden Lake, lying east of the perched dunes at Pyramid Pt., has a small amount of open water (2.2 acres). Floating and submerged aquatics include *Polygonum amphibium*, *Potamogeton amplifolius*, *P. natans*, and *Nuphar variegata*. A small fen-like area borders the edge of the lake on the south side. Species here include *Cladium mariscoides*, *Cyrtopodium reginae*, *Eupatorium maculatum*, *Habenaria hyperborea*, *Menyanthes trifoliata*, and *Triglochin palustre*. *Thuja occidentalis* surrounds much of the lake, forming a well developed cedar swamp on the south side.

A small pond occurs north of the turn circle at the end of Lake Michigan Rd. Aquatic species here include *Nuphar variegata*, *Polygonum amphibium*, *Potamogeton gramineus*, *P. natans*, and *Utricularia* spp. Shoreline species are *Carex aquatilis*, *Cornus stolonifera*, *Dulichium arundinaceum*, *Lysimachia thyrsoflora*, *Potentilla palustris*, *Rosa palustris*, *Salix candida*, *Thelypteris palustris*, and *Typha latifolia*. Bordering woods include *Acer rubrum*, *Betula papyrifera*, *Larix laricina*, *Populus tremuloides*, and *Thuja occidentalis*.

The smallest of the wetlands in this area are two depressions along the two-track between Hidden Lake and the end of Lake Michigan Rd. These have standing water for much of the season and are largely dominated by *Salix* with *Alnus rugosa*, *Cornus amomum*, *C. stolonifera*, *Fraxinus nigra*, *Ilex verticillata*, *Larix laricina*, and *Rosa palustris*. Emergent species include *Carex stipata*, *Cicuta maculata*, *Dulichium arundinaceum*, *Equisetum fluviatile*, *Glyceria striata*, *Iris virginica*, *Lysimachia thyrsoflora*, *Potentilla palustris*, *Solanum dulcamara*, *Thelypteris palustris*, and *Typha latifolia*. Floating aquatic species include *Lemna minor*, *Utricularia* spp., *Potamogeton natans*, *Polygonum amphibium*, *Nuphar variegata*, and *Spirodela polyrhiza*.

Shalda Creek
Cleveland Twp. Secs. 4, 9, 10

Shalda Creek, shown as Sucker Creek on some maps, leaves Little Traverse Lake and flows west to enter Sleeping Bear Dunes National Lakeshore about a 1/4 mile later. After another 1/4 mile it flows under Co. 669 and after two more miles eventually flows into Lake Michigan. After Co. 669 the creek passes south of a small cat-tail dominated marsh before entering a moist coastal forest. The creek then becomes shallow at this point (1-1.5 ft.), but becomes deeper as it begins to meander before entering Lake Michigan.

Large swales have developed along Shalda Creek south of Lake Michigan Rd. Alternating with these swales are dune ridges dominated by *Acer rubrum*, *Betula papyrifera*, *Populus tremuloides*, and *Quercus rubra* (red oak). Shrubby vegetation of the swales includes *Alnus rugosa*, *Cornus amomum*, *C. stolonifera*, *Myrica gale*, *Potentilla fruticosa*, *Rosa palustris*, and *Salix* spp. Herbs include *Calamagrostis canadensis*, *Campanula aparinoides*, *Carex* spp., *Cicuta maculata*, *Cinna latifolia*, *Eupatorium maculatum*, *E. perfoliatum*, *Iris virginica*, *Lobelia cardinalis*, *Lycopus uniflorus*, *Lysimachia thyrsoiflora*, *Mentha arvensis*, *Mimulus ringens*, *Nasturtium officinale*, *Onoclea sensibilis*, *Osmunda regalis*, *Parthenocissus quinquefolia*, *Proserpinaca palustris*, *Sagittaria latifolia*, *Scutellaria galericulata*, *Sparganium minimum*, and *Thelypteris palustris*. The creek flows under Lake Michigan Rd. and then into Lake Michigan.

The cedar swamp along Shalda Creek near Co. 669 has an overstory of *Abies balsamea*, *Betula papyrifera*, *Fraxinus nigra*, *Larix laricina*, *Picea mariana*, and *Thuja occidentalis*. Understory species include *Abies balsamea*, *Acer pensylvanicum*, *A. rubrum*, *Alnus rugosa*, and *Thuja occidentalis*. The herb layer is diverse. Ferns include *Athyrium filix-femina*, *Botrychium virginianum*, *Dryopteris cristata*, *Gymnocarpium dryopteris*, *Onoclea sensibilis*, *Osmunda cinnamomea*, *O. regalis*, and *Thelypteris palustris*. Among the other herbs are *Actaea pachypoda*, *Aralia racemosa*, *Arisaema triphyllum*, *Asclepias incarnata*,

Aster macrophyllus, *Caltha palustris*, *Campanula aparinoides*, *Carex* spp., *Circaea alpina*, *Clintonia borealis*, *Coptis trifoliata*, *Epipactis helleborine*, *Gaultheria hispidula*, *Geum rivulare*, *Habenaria hyperborea*, *H. viridis*, *Impatiens capensis*, *Linnaea borealis*, *Lysimachia thrysiflora*, *Maianthemum canadense*, *Mitchella repens*, *Mitella nuda*, *Prunella vulgaris*, *Ranunculus recurvatus*, *Smilacina trifolia*, *Solanum dulcamara*, and *Trientalis borealis*.

Bow Lakes Section Kasson Twp. Secs. 8 & 17

A few low depressions have collected water in the kettle topography of the Bow Lakes section. The most noteworthy aquatic habitats are the fen on the south side of the Bow Lakes, near the north end of the section, and the bog at the section's south end.

The fen is spring-fed. The area has an extensive sedge mat and is lined with *Thuja occidentalis* on its outside edges. Sedge species found here include *C. aquatilis*, *C. flava*, *C. garberi*, *C. hystericina*, *C. interior*, *C. lasiocarpa*, *Cladium mariscoides*, *Eleocharis elliptica*, *Eriophorum viridi-carinatum*, and *Scirpus acutus*. Other species include *Eupatorium maculatum*, *Iris virginica*, *Onoclea sensibilis*, and *Senecio pauperculus*.

The bog occurs in a depression in which the water table varies from year to year. In 1984 I was able to easily walk out to the bog mat. In 1986 I had to cross a moat filled with water 1-2 foot deep. The basin is largely covered by *Sphagnum*. A few small openings remain near the center of the mat with *Eriophorum virgatum*, *Juncus brevicaudatus*, *Polygonum amphibium*, and *Utricularia geminiscapa*. The rest of the mat is dominated by *Chamaedaphne calyculata*. Other species include *Andromeda glaucophylla*, *Aronia prunifolia*, *Drosera rotundifolia*, *Kalmia polifolia*, *Scheuchzeria palustris*, *Vaccinium oxycoccus*, and *Viola blanda*. Species found in or along the bog moat are *Carex atherodes*, *Epilobium ciliatum*, *Glyceria canadensis*, *Hypericum majus*, *Impatiens balsamea*, *Lemna minor*, *Lycopus uniflorus*, *Mentha arvensis*, *Osmunda regalis*, *Phalaris arundinacea*, *Polygonum amphibium*, *P. persicaria*, *Potentilla palustris*, *Ranunculus recurvatus*, *Scirpus*

cyperinus, *Scutellaria galericulata*, *Thelypteris palustris*, *Triadenum fraseri*, and *Utricularia* spp.

Taylor Lake
Empire Twp. Sec. 30

Taylor Lake is a small pond east of M-22 at the north end of the Platte River District. Northern hardwoods surround this pond which is characterized by a floating sedge mat encircled by an open moat. Aquatic species here include *Brassenia schreberi*, *Lemna minor*, *Nuphar variegata*, *Nymphaea odorata*, *Polygonum amphibium*, and *Potamogeton natans*. Sedges found on the mat include *Carex comosa*, *C. interior*, *C. lasiocarpa*, *C. limosa*, *Eleocharis erythropoda*, and *Dulichium arundinaceum*. Other mat species include *Acer rubrum*, *Eupatorium maculatum*, *Lycopus uniflorus*, *Menyanthes trifoliata*, *Potentilla palustris*, *Sagittaria latifolia*, *Salix discolor*, *Sparganium angustifolium*, *Thelypteris palustris*, *Triadenum fraseri*, *Typha latifolia*, and *Vaccinium macrocarpon*. *Osmunda intermedia* and *O. regalis* are found at the south end of the pond.

Aerial photographs show a circular area of open water surrounded in part by the sedge mat at the north end of the pond. This pattern suggests that the sedge mat began to cover the pond from the outer edges, but later a rise in water level interrupted this process and created the moat.

BENZIE COUNTY

Round Lake
Lake Twp. Sec. 36

Round Lake occupies 16.2 acres and has a marly bottom. A floating sedge mat occupies the rest of the lake basin on the south side and an outlet flows south through the mat to Crystal Lake. M-22 passes the lake on the west. Floating and submerged aquatics include *Myriophyllum exalbescens*, *Najas flexilis*, *Nuphar variegata*, *Nymphaea odorata*,

Potamogeton amplifolius, *P. friesii*, *P. illinoensis*, *P. pectinatus*, *Utricularia vulgaris*, and *U. minor*. Emergent and shoreline species include *Campanula aparinoides*, *Eupatorium maculatum*, *E. perforatum*, *Carex* spp., *Cladium mariscoides*, *Juncus* spp., *Scirpus acutus*, *S. americanus*, and *Typha latifolia*. Shrubs include *Cornus amomum*, *C. stolonifera*, *Myrica gale*, and *Rosa palustris*. Among the shoreline trees are *Acer rubrum*, *Betula papyrifera*, *Fraxinus pennsylvanica*, *Pinus strobus*, and *Thuja occidentalis*.

The sedge mat is largely composed of several *Carex* species including *C. aquatilis*, *C. buxbaumii*, *C. interior*, and *C. limosa*. Other species found on the mat include *Asclepias incarnata*, *Calamagrostis inexpansa*, *Campanula aparinoides*, *Cicuta maculata*, *Cladium mariscoides*, *Drosera rotundifolia*, *Eleocharis elliptica*, *Eriophorum viridi-carinatum*, *Eupatorium maculatum*, *E. perforatum*, *Juncus* spp., *Lobelia kalmii*, *Lycopus uniflorus*, *Menyanthes trifoliata*, *Osmunda regalis*, *Phragmites australis*, *Potentilla palustris*, *Scirpus acutus*, *Spiranthes romanzoffiana*, *Thelypteris palustris*, *Triadenum fraseri*, *Typha latifolia*, *Utricularia* spp. and *Viola blanda*. Woody species scattered across the sedge mat and around its outer edges include *Betula papyrifera*, *B. pumila*, *Cornus amomum*, *C. stolonifera*, *Decodon verticillatus*, *Myrica gale*, *Pinus strobus*, *Rosa palustris*, *Salix candida*, *S. discolor*, and *Thuja occidentalis*.

Mud Lake Lake Twp. Secs. 21 & 28

Mud Lake (59 acres) has a sandy bottom and is very shallow, perhaps no more than a foot deep. The lake is characterized by a suspension of black organic matter which has probably contributed to its local name. A short outlet to the Platte River passes through a cedar swamp. Submerged and floating aquatics are quite rare except for patches of *Nuphar variegata* and some *Nymphaea odorata*. Other submerged aquatics which were found include *Utricularia minor*, *Potamogeton gramineus*, *P. pectinatus*, and *Sagittaria latifolia*. Emergent and shoreline species include *Calamagrostis canadensis*, *Cladium mariscoides*, *Eleocharis erythropoda*, *Osmunda cinnamomea*, *O. regalis*, *Sagittaria*

latiflora, *Scirpus acutus*, *S. cyperinus*, *Sparganium minimum*, *Thelypteris palustris*, *Triadenum fraseri*, and *Typha latifolia*. Woody species along the shores include *Acer rubrum*, *Aronia prunifolia*, *Betula papyrifera*, *B. pumila*, *Decodon verticillatus*, *Hypericum kalmianum*, *Myrica gale*, *Populus tremuloides*, *Rosa palustris*, and *Viburnum lentago*.

Loon Lake
Lake Twp. Sec. 28

Loon Lake, identified as Round Lake on some maps, covers 95 acres. The Platte River enters the lake on its east side and exits on the north. The floating and submerged aquatics in this lake include *Ceratophyllum demersum*, *Myriophyllum spicatum*, *Nuphar variegata*, *Potamogeton crispus*, *P. natans*, and *P. pectinatus*. These are most common at the south end. Among the shoreline and emergent herbs are *Eupatorium maculatum*, *E. perforatum*, *Lobelia cardinalis*, *Osmunda regalis*, *Thelypteris palustris*, and *Carex* spp. A dense shrub zone borders the lake on the west and north sides consists of *Alnus rugosa*, *Aronia prunifolia*, *Betula pumila*, *Myrica gale*, *Rosa palustris*, and *Viburnum lentago*. Trees along the lake include *Acer rubrum*, *Larix laricina*, and *Thuja occidentalis*. *Larix* and *Thuja* with some *Picea mariana* are most abundant around a small stream which enters the lake on its southwest side.

Platte River
Lake Twp. Secs. 20, 21, 28, & 29

The Platte River enters the National Lakeshore about 1/8 mile upstream from the M-22 bridge. From there it proceeds about one mile to Loon Lake, entering on the lake's east side. It exits the lake on the north and flows about 2.5 miles to the river mouth near the end of Lake Michigan Rd. Just over a mile upstream from Lake Michigan, the river begins to meander in large loops. A few submerged aquatics occur along the stretch before Loon Lake, but they are most abundant between Loon Lake and Lake Michigan. Floating and submerged aquatics found in the river include *Ceratophyllum demersum*, *Elodea*

canadensis, *Heteranthera dubia*, *Lemna minor*, *Megalodonta beckii*, *Myriophyllum exalbescens*, *M. spicatum*, *Najas flexilis*, *Nuphar variegata*, *Nymphaea odorata*, *Polygonum amplifolius*, *Potamogeton friesii*, *P. gramineus*, *P. illinoensis*, *P. natans*, *P. pectinatus*, *P. richardsonii*, *P. zosteriformis*, *Utricularia* spp., and *Vallisnaria americana*. Shoreline herbs include *Caltha palustris*, *Carex* spp., *Chelone glabra*, *Eleocharis* spp., *Iris virginica*, *Lysimachia thyrsoflora*, *Lythrum salicaria*, *Osmunda regalis*, *Phalaris arundinacea*, *Potentilla palustris*, *Scirpus acutus*, *Solanum dulcamara*, *Sparganium* spp., *Thelypteris palustris*, and *Typha latifolia*. Shrubby species include *Alnus rugosa*, *Aronia prunifolia*, *Cornus stolonifera*, *Decodon verticillatus*, *Ilex verticillata*, *Myrica gale*, *Rosa palustris*, *Salix candida*, *S. exigua*, and *Vitis riparia*. Trees frequently found along the river include *Acer rubrum*, *Betula papyrifera*, *Fraxinus nigra*, and *Thuja occidentalis*.

As the Platte approaches Lake Michigan swales are found running perpendicular to the river, especially on its south side. Common trees of these wet interdunal areas include *Acer rubrum*, *Betula papyrifera*, *Fraxinus nigra*, *Larix laricina*, and *Thuja occidentalis*. The understory consists of *Alnus rugosa*, *Aronia prunifolia*, *Cornus rugosa*, *Decodon verticillatus*, *Ilex verticillata*, *Myrica gale*, *Rosa palustris*, and *Vaccinium myrtilloides*. Herbs of the swales include *Bidens connatus*, *Calamagrostis canadensis*, *Caltha palustris*, *Campanula aparinoides*, *Carex* spp., *Dryopteris cristata*, *Impatiens capensis*, *Iris virginica*, *Lycopus uniflorus*, *Lysimachia thyrsoflora*, *Mentha arvensis*, *Osmunda cinnamomea*, *Polygonum amphibium*, *Sagittaria latifolia*, *Scutellaria latiflora*, *Thelypteris palustris*, and *Typha latifolia*. Similar swales occur among the dune ridges between Loon Lake and Cooper Rd.

The development of the vegetation along the edges of the Platte River as it nears its mouth is not as extensive today as it was forty years ago. Waterman (1922, p. 28) included an oblique aerial photograph of the river looking eastward, upstream toward the present location of Lake Michigan Rd. (Lake Twp., Sec. 20). In the photograph the open water is narrower than it is today and bordered by "grass meadows", densely developed

mats of grasses and sedges. These grass meadows may be similar to vegetation now found south of Round Lake or upstream from the Otter Creek Bridge near the Marl Springs. A later photograph of the same area (Calver, 1946, p. 56) shows the Platte River to be even narrower. These photographs show encroachment of the marginal vegetation on the center of the river. Vegetation differences between the two photographs might be attributed to differences in the time of year they were taken or a different volume of water moving down the river in addition to the actual growth rate of the vegetation surface.

Today much of the areas appearing as grass meadows in these early photographs are flooded, but the outline of the river channels shown in these plates is still marked by vegetation (*Decodon verticillatus*). No doubt increased river traffic (e.g. canoes, motor boats) over the last 25 years has had some influence in preventing the development of grass meadows and other vegetation along the river, but the water level in the river may be a more important factor. Waterman (1922) suggested that the grass meadows along the Platte River formed rapidly and would grow as river level (dependent on Lake Michigan levels) dropped. If we could compare additional photographs of this region taken over the last 75 years with monthly mean levels of Lake Michigan, a correlation between vegetation growth and drop in lake level could be established. For the period covered by the photographs of Waterman (1922) and Calver (1948), U. S. Army Corps of Engineers records for Lake Michigan show a high level (580 ft.) in 1918 followed by a steady drop to 576 ft. in 1926. The Lake rose almost to 581 ft. in 1929, but had dropped back to 576 ft. by 1933. It rose to 580 ft. in 1943 and returned to 577 ft. in 1950.

In October 1987, I had the opportunity to see a drop in river level. Dredging of the river mouth earlier in the fall had allowed the river at the site of Waterman's and Calver's photographs to draw down at by least one foot. Over time grassy vegetation could develop along these stretches of the river under such conditions. An even lower drop in the river in response to a decrease in Lake Michigan level would further enhance the rate of growth.

Deer Lake
Lake Twp. Sec. 24

Deer Lake is the smallest (6 acres) and first lake in the Otter Creek drainage system. It is fed by springs and an intermittent stream. A short outlet connects Deer Lake to Bass Lake. Submerged and floating vascular aquatic species include *Elodea canadensis*, *Heteranthera dubia*, *Lemna minor*, *Myriophyllum heterophyllum*, *Nuphar variegata*, *Nymphaea odorata*, *Potamogeton amplifolius*, *P. natans*, *P. pectinatus*, *P. richardsonii*, *P. zosteriformis*, *Utricularia vulgaris*, and *Wolffia punctata*. The lake is characterized by large floating mats of *Chara*, an alga common in calcareous waters. Emergent and shoreline species include *Asclepias incarnata*, *Calamagrostis canadensis*, *Carex* spp., *Eleocharis smallii*, *Eupatorium maculatum*, *Iris virginica*, *Osmunda regalis*, *Phalaris arundinacea*, *Sagittaria latifolia*, and *Thelypteris palustris*. Along the shore at springs and inlet area on the lake's southwest side are *Aster lateriflorus*, *Athyrium filifemina*, *Bidens connatus*, *Campanula aparinoides*, *Cicuta maculata*, *Dryopteris cristata*, *Impatiens capensis*, *Lycopus uniflorus*, *Osmunda cinnamomea*, *Sagittaria latifolia*, *Scutellaria galericulata*, and *S. latiflora*.

Bass Lake
Lake Twp. Secs. 13 & 24

Bass Lake covers 29 acres and is emptied by an outlet on its north side which flows to Otter Lake. The inlet from Deer Lake enters on its south side. The upland vegetation around the lake is predominantly oak-pine. The greatest concentration of submerged and aquatic species occurs in and along the edges of the small bays on the lake's west side. These species include *Ceratophyllum demersum*, *Elodea canadensis*, *Heteranthera dubia*, *Myriophyllum heterophyllum*, *Najas flexilis*, *Nuphar variegata*, *Nymphaea odorata*, *Potamogeton amplifolius*, *P. berchtoldii*, *P. foliosus*, *P. gramineus*, *P. pectinatus*, *P. richardsonii*, *P. strictifolius*, *P. zosteriformis*, and *Vallisneria americana*. Emergent and shoreline species include *Asclepias incarnata*, *Carex* spp., *Eleocharis smallii*,

Equisetum fluviatile, *Eupatorium maculatum*, *E. perforatum*, *Osmunda regalis*, *Polygonum amphibium*, *Scirpus acutus*, *S. americanus*, *Scutellaria galericulata*, and *Thelypteris palustris*. Shoreline trees include *Betula papyrifera*, *Larix laricina*, *Pinus strobus*, *Populus grandidentata*, and *Thuja occidentalis*.

Otter Lake
Lake Twp. Sec. 13 & Platte Twp. Sec. 18

Otter Lake is the largest (64 acres) lake in the Otter Creek drainage. The inlet from Bass Lake enters it on the south and Otter Creek leaves on its north side. In addition to the inlet the lake is spring-fed on the southeast side. A large underwater spring off the shore on the east side can be viewed from an airplane. Submerged and floating aquatics are found close to the edges of the lake and include *Myriophyllum heterophyllum*, *Najas flexilis*, *Nuphar variegata*, *Nymphaea odorata*, *Potamogeton amplifolius*, *P. berchtoldii*, *P. friesii*, *P. gramineus*, *P. illinoensis*, *P. natans*, *P. pectinatus*, *P. richardsonii*, *P. robbinsii*, *P. zosteriformis*, and *Vallisnaria americana*. Emergent and shoreline species include *Bidens connatus*, *Calamagrostis canadensis*, *C. inexpansa*, *Carex aquatilis*, *Eupatorium maculatum*, *E. perforatum*, *Impatiens capensis*, *Matteucia struthiopteris*, *Nasturtium officinale*, *Scutellaria lateriflora*, *Scirpus acutus*, *Thelypteris palustris*, and *Typha latifolia*. Shoreline trees include *Acer rubrum*, *Betula papyrifera*, *Larix laricina*, *Pinus strobus*, and *Thuja occidentalis*.

Otter Creek
Lake Twp., Secs. 12 & 13

Otter Creek begins its 1.5 mile course to Lake Michigan from the north side of Otter lake. It flows north through a cedar swamp before encountering an open marsh in the center of Sec. 12. Along this route the creek is joined by smaller spring-fed tributaries. The largest group of these, the Marl Springs, occurs just east of the marsh. The creek

narrows once past the marsh, flows under the two-track near Aral, and then empties into Lake Michigan.

Chara carpets much of the stream north of the marsh. Submerged and floating aquatic vascular plants are most common from the upper end of the marsh to the bridge. These species include *Heteranthera dubia*, *Hippuris vulgaris*, *Lemna minor*, *Myriophyllum heterophyllum*, *Nuphar variegata*, *Potamogeton friesii*, *P. natans*, *P. pectinatus*, *P. richardsonii*, *Ranunculus longirostris*, and *Utricularia vulgaris*. Emergent and shoreline herbs include *Calamagrostis canadensis*, *Caltha palustris*, *Campanula aparinoides*, *Carex* spp., *Phalaris arundinacea*, *Rumex verticillatus*, *Sagittaria latifolia*, *Scirpus acutus*, *Sparganium* spp., and *Thelypteris palustris*. Otter Creek is the only place where *Hippuris vulgaris* was found in the National Lakeshore and is the only Mainland locality for *Ranunculus longirostris*. Among the characteristic shoreline shrubs are *Alnus rugosa*, *Aronia prunifolia*, *Cornus stolonifera*, *Decodon verticillatus*, *Myrica gale*, *Rosa palustris*, and *Salix candida*.

Calver (1946) considered the basin now occupied by the marsh to be the remains of an extinct lake, perhaps from a higher level in Lake Michigan. Around 1900, it was flooded by the reservoir of a lumber mill dam built where the creek narrows. Today some of this area is covered by a sedge mat which has developed over a marly substrate. Some *Utricularia* species even occur in wet areas of the mat. Herbaceous species include *Potentilla palustris*, *Scirpus acutus*, and *Typha latifolia*. Scattered shrubs around the edge of the mat include *Alnus rugosa*, *Myrica gale*, *Rosa palustris*, and *Salix* spp. Bog species such as *Larix laricina*, *Sarracenia purpurea* and *Drosera rotundifolia* are found along the creek's edge upstream from the sedge mat.

Cedar swamps border the creek for much of its journey. One of the areas best representing this vegetation association is found on the west side of Otter Creek near the two-track bordering the wooded dunes. The dominant tree is *Thuja occidentalis*, but *Abies balsamea*, *Betula papyrifera*, *Pinus strobus*, and *Larix laricina* are easily found. Understory

species are predominantly *Abies balsamea* and *Thuja occidentalis*. Among the herbs are *Arisaema triphyllum*, *Atherium filix-femina*, *Botrychium virginianum*, *Carex* spp., *Circaea alpina*, *Clintonia borealis*, *Coptis trifolia*, *Corallorhiza striata*, *C. trifida*, *Cornus canadensis*, *Cystopteris bulbifera*, *Dryopteris cristata*, *Fragaria virginiana*, *Gaultheria hispidula*, *Geum rivale*, *Gymnocarpium dryopteris*, *Habenaria obtusata*, *Linnaea borealis*, *Maianthemum canadense*, *Mitchella repens*, *Mitella nuda*, *Osmunda cinnamomea*, *O. regalis*, *Polygala paucifolia*, *Thelypteris palustris*, *Trientalis borealis*, *Vaccinium myrtilloides*, and *Viola blanda*. A fen-like area within this cedar swamp provides habitat for *Andromeda glaucophylla*, *Chamadaphne calyculata*, *Eleocharis* spp., *Habenaria dilatata*, *Menyanthes trifoliata*, *Nymphaea odorata*, *Potentilla fruticosa*, *Sarracenia purpurea*, *Smilacina trifolia*, and *Utricularia cornuta*.

The vegetation of the Marl Springs area on the east side of the creek is similar to this cedar swamp. A few species found around the cold springs not found in the cedar swamp on the west side include *Chrysosplenium americanum*, *Mimulus glabratus*, and *Berula erecta*, a species listed as threatened in Michigan.

The vegetation of the Otter Creek vegetation is among the most diverse in the National Lakeshore. The region has experienced intense human disturbance in the past, but in many places the land has recovered from it. The National Lakeshore, therefore, should continue to keep this area in its natural state.

SOUTH MANITOU ISLAND

Lake Florence
Glen Arbor Twp. Secs. 4 & 9

Lake Florence occupies 71.7 acres. It is named for Florence Haas, a South Manitou islander who, according to island lore, was the first woman on the Great Lakes with a pilot's license. The lake has no inlet or outlet and its level varies from year to year according to annual precipitation. In 1986 the level was about 1.5 feet higher than when I first began observing the lake in 1982. Submerged and floating aquatic vegetation of the

lake is rather sparse and includes *Potamogeton amplifolius*, *P. berchtoldii*, and *P. gramineus*. Shoreline and emergent aquatics include *Calamagrostis canadensis*, *Cladium mariscoides*, *Eleocharis smallii*, *Eupatorium perforatum*, *Juncus* spp., *Iris virginiana*, *Lycopus uniflorus*, *Lysimachia terrestris*, *Phragmites australis*, *Scirpus acutus*, *Solidago gramineus*, and *Typha angustifolia*.

Marshes occur at both ends of the lake. The larger, on the north end, continues north in the narrow basin west of the schoolhouse. A few woody species such as *Hypericum kalmianum*, *Rosa palustris*, *Salix* spp., and *Spiraea alba* occasionally occur in these sites, but the vegetation is predominantly herbaceous with *Calamagrostis canadensis*, *Carex* spp., *Eupatorium perforatum*, *Habenaria psycodes*, *Iris virginiana*, *Juncus* spp., *Lycopus americanus*, *Onoclea sensibilis*, *Osmunda regalis*, *Phragmites australis*, *Polygonum amphibium*, *Potentilla palustris*, *Rumex obtusifolius*, *Scirpus* spp., *Solanum dulcamara*, *Thelypteris palustris* and *Typha latifolia*. *Utricularia vulgaris* is found in these sites in wet years.

NORTH MANITOU ISLAND

Tamarack Lake
Leeland Twp. Sec. 7

Tamarack Lake occupies 9.9 acres. A spring-fed stream with *Caltha palustris*, *Chrysosplenium americanum*, *Lemna minor*, *Matteucia struthiopteris*, and *Thelypteris palustris* flows into the black ash swamp on the west side. The lake's depression can readily be described as a bog lake. Familiar bog species such as *Chamaedaphne calyculata*, *Gaylussacia baccata*, *Kalmia polifolia*, *Larix laricina*, *Picea mariana*, and *Vaccinium myrtilloides* are found on the east side. A very narrow sedge mat with *Carex* spp., *Cicuta maculata*, *Drosera rotundifolia*, *Dulichium arundinaceum*, *Impatiens capensis*, *Iris virginica*, *Juncus* spp., *Lysimachia thrysiflora*, *Osmunda cinnamomea*, *Phragmites australis*, *Potentilla palustris*, *Rosa palustris*, *Thelypteris palustris*, *Triadenum fraseri*, and *Vaccinium oxycoccus*

is also found in this area. *Nuphar variegata* is the lake's only aquatic species. Other species around this lake many found in the black ash swamp include *Acer rubrum*, *A. spicatum*, *Betula alleghaniensis*, *Dryopteris spinulosa*, *Fraxinus nigra*, *Lycopus uniflorus*, *Onoclea sensibilis*, *Osmunda regalis*, and *Thuja occidentalis*.

Coulter (1904) described the zonation of vegetation from the hardwood forests to the open water of Tamarack Lake. The outer zone near the surrounding hardwoods was characterized by *Picea mariana* and *Larix laricina* with some *Thuja occidentalis*, *Acer rubrum*, *Betula alleghaniensis*, and *Sorbus americana* [*S. decora* ?]. Next came a shrub zone dominated by *Kalmia*, *Vaccinium*, *Gaylussacia*, *Ilex*, *Nemopanthus*, and *Aronia*. Open areas in the shrub zone held *Thelypteris palustris*, *Osmunda cinnamomea*, and *O. regalis*. Nearest the open water was a *Sphagnum* mat with several herbaceous species including *Potentilla palustris*, *Menyanthes trifoliata*, *Dulichium arundinaceum*, *Lysimachia thyrsiflora*, *Cicuta bulbifera*, *Scutellaria galericulata*, *Gaultheria hispidula*, *G. procumbens*, *Sarracenia purpurea*, and *Drosera rotundifolia*. In the open water *Polygonum amphibium*, *Phragmites australis*, *Typha latifolia*, and *Nuphar advena* [*N. variegata* ?] were found. Coulter's study includes several photographic plates (nos. 3,4,5) from Tamarack Lake. It appears that the succession of this bog has stopped, as now only a very narrow floating sedge mat can be found along the lake in some places. A dense shrub zone of sorts remains, but *Picea* and *Larix* are not common and *Sarracenia purpurea* is apparently absent.

Lake Manitou
Leeland Twp. Secs. 29 & 32

Lake Manitou, the largest lake in the National Lakeshore, covers 252.3 acres in the central portion of North Manitou. Surrounded on the east and west sides by northern hardwoods, the lake is bordered by black ash swamps on the north and south ends. A shallow outlet flows northeast to Lake Michigan from the north end of the lake through a black ash swamp then through a sedge-dominated marsh until it reaches the Pole Bridge. Floating and submerged aquatics of the lake include *Myriophyllum exalbescens*, *Najas*

flexilis, *Nuphar variegata*, *Potamogeton filiformis*, *P. foliosus*, *P. gramineus*, *P. illinoensis*, *P. natans*, *P. praelongus*, *P. richardsonii*, and *Ranunculus longirostris*. A small cove surrounded by *Phragmites australis* at the lake's northwest corner is the location for *Ranunculus longirostris*. Other emergent species are *Scirpus acutus* and *Typha latifolia*.

Near the Pole Bridge the outlet becomes deep enough to support *Potamogeton natans*. *Lemna minor* and *Wolffia punctata* are also found here. Beyond the Pole Bridge, the Outlet is bordered by *Calamagrostis canadensis*, *Carex* spp., *Cicuta maculata*, *Dryopteris spinulosa*, *Juncus effusus*, *Lycopus uniflorus*, *Mentha arvensis*, *Mimulus ringens*, *Polygonum punctatum*, *Scirpus acutus*, *S. cyperinus*, and *Scutellaria lateriflora*. The grassy vegetation bordering the outlet ends near Maleski's as the stream narrows and cuts through moraine before entering Lake Michigan.

The vegetation around the Outlet has undergone considerable change since Coulter visited the island. He described the wetland north of Lake Manitou as a thick cedar swamp. The largest individual trees were *Pinus strobus*, but *Thuja occidentalis* was the dominant species with some *Fraxinus americana* [*F. nigra* ?], *Betula alleghaniensis*, and *Abies balsamea*. Understory species included *Thuja occidentalis*, *Acer pensylvanicum*, *A. spicatum*, and *Taxus canadensis*. Photographs (plate 6 in his report) aptly illustrate how "this great tract of trees and undergrowth amid a mass of fallen logs and brush forms a dense jungle of vegetation which is almost impenetrable". The area today is vast marsh with woody species largely *Fraxinus nigra* with some *Betula alleghaniensis*, *Thuja occidentalis*, *Acer saccharum*, *A. rubrum*, and *Ulmus americana*. Initial changes in this area could have been induced by logging or perhaps some spring flooding as water backed up behind the road at the Pole Bridge, but the historical overpopulation of deer on North Manitou is likely to have inhibited the regeneration of saplings closer to Lake Manitou regardless of their species.

Throughout Coulter's description of this area are several references to another cedar swamp on Beaver Island. At places it is hard to tell the two descriptions apart.

Some species are mentioned as occurring only on Beaver Island, yet others which are noted as occurring on both islands only appear as North Manitou species in the comparative plant list of selected wetland areas which he studied. Among these questionable species is *Symplocarpus foetidus*, skunk cabbage. *Symplocarpus foetidus* is still found on Beaver Island (Voss, 1972). Coulter's identification of this species is not in doubt, but, as the island occurrence is, *Symplocarpus* has not been included in the North Manitou flora.

FRAGILE HABITATS

Among the wetlands within Sleeping Bear Dunes National Lakeshore are some relatively undisturbed sites which are outstanding in their floristic diversity and natural appearance. These sites include Taylor Lake, Round Lake, the M-22 bog, the wetlands in the Bow Lakes section, and the Otter Creek drainage from Otter Lake to Lake Michigan. The present undeveloped state of these areas should be preserved as much as possible, yet casual visitor use of these areas should not be discouraged. The average visitor to Sleeping Bear Dunes National Lakeshore would probably ignore these sites, but those with an interest in plants would find these areas fascinating. The Otter Creek area is very diverse and offers the curious the opportunity to explore fens, cedar swamps, and cold calcareous springs. *Berula erecta*, a species listed as threatened in Michigan, is found here. In some years the creek can be navigated upstream from the bridge at Aral by canoe to a secluded sites about half way to Otter Lake. The wetlands in the Bow Lakes section, the Bow Lakes, its small pools, and the bog at the south end, add to its diversity and enhance the exploration of this remote area. Those who venture out on the sedge mats of Round and Taylor lakes and on the *Sphagnum* substrate of the M-22 bog can experience the thrill of floating vegetation. The bogs and sedge mats are the most sensitive to degradation due to overuse by visitors.

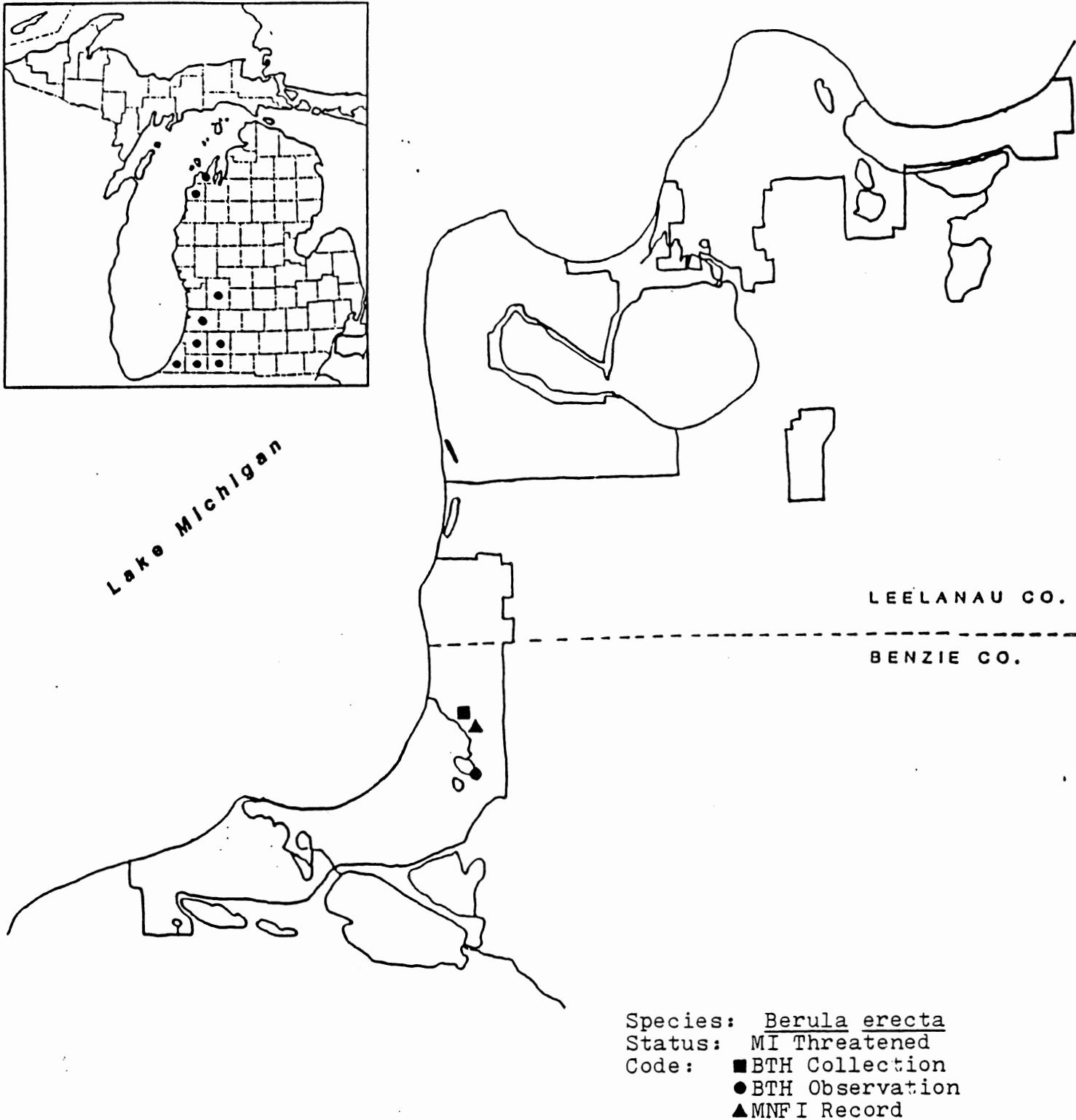


Figure 2. Distribution of *Berula erecta* in Sleeping Bear Dunes National Lakeshore.

THREATENED SPECIES

Berula erecta L.

MICHIGAN TREATENED

This delicate member of the carrot family (Umbelliferae) has a limited distribution in Michigan and according to Voss (1985) grows in "cold streams, marshes, and tamarack swamps; usually in calcareous areas." The known distribution of this species within the National Lakeshore and in Michigan appears in Figure 2. The cold calcareous waters of the Marl Springs provide the best habitat for this plant, although it was also found further south in a spring flowing into the southeast corner of Otter Lake. The plants are most readily found as a basal rosette of slightly toothed, pinnately compound leaves. It has small white flowers on the rare occasions when it blooms. The North American distribution of this species includes the region from New York and southern Ontario to Minnesota and British Columbia and south to Florida and Mexico (Gleason & Cronquist, 1963). If the American plant is considered distinct from the European species then the name *Berula pusilla* (Nutt.) Fern. applies. The species is listed as threatened in Michigan (Beaman et al., 1985) under its American name. The distribution map (Figure 2) is based on my own collections and observations and the records of the Michigan Natural Features Inventory (MNFI). The state distribution map was taken from Voss (1985).

RECOMMENDATIONS

The aquatic habitats within the National Lakeshore are subject to a wide range of human impact. Depending on their nature and location such habitats are either overlooked by most visitors or are subject to recreational activities such as boating, fishing, and swimming. Areas which have remained relatively pristine should be preserved in that state, yet the natural integrity of heavily used areas such as the Platte River must be maintained as well.

1. A few wetland sites which merit continued preservation based on their floristic diversity and naturalness include the Otter Creek drainage from Otter Lake to Lake Michigan, the lakes and bog in the Bow Lakes section, Taylor Lake, Round Lake, and the M-22 bog. These sites do not attract many visitors now and are not in immediate danger of being damaged.

2. One indicator of the fragility of some habitats in the Otter Creek drainage system is the occurrence of *Berula erecta*, a Michigan threatened species, in the cold spring-fed waters of the Marl Springs and near Otter Lake. The persistence of this species within the National Lakeshore is largely dependent upon suitable habitat. Currently such habitat is not under threat from human activities. More information on the reproductive health of these populations could be obtained by annual monitoring for at least three years. During this time data on this perennial could be collected on characteristics such as number of individuals, rosette size, and number of flowering individuals. The results from these three years would provide some indication of reproductive health of the species in the National Lakeshore and help in determining the frequency of future monitoring. Bowles et al., 1986 suggest that perennials be monitored every 2-3 years.

3. The Otter Creek drainage system has the distinction of being essentially within the National Lakeshore. The other major streams, the Platte River, Crystal River, and Shalda Creek, all have their proximal origins in a lake outside the boundaries of the Park. Thus the water quality of these streams is largely influenced by factors outside the

jurisdiction of the NPS. The NPS should establish regular long-term monitoring of these streams with sampling stations near their points of entrance and exit from the National Lakeshore, if such a program does not already exist. Factors including temperature, nutrients, dissolved oxygen, biological oxygen demand, pH, turbidity, and flow rates should be measured. I suspect that as land leases expire on properties along the Platte River the water quality will improve due to the potential decline in septic tank overflow, lawn fertilizer, and grass clippings entering the river from these homes. There is, however, no way to anticipate the magnitude of change caused by development and agriculture upstream whether it be on the Platte River or the other streams in the Park. Data on the water quality of the Platte and Crystal Rivers from the late 1960's has been published by the Michigan Water Resources Commission (1971, 1973).

The water quality of lakes and some streams could also be monitored by measuring the change in vegetation composition. Several studies (e.g., Lind & Cottam, 1969; Steggal & Judd, 1983; Stuckey, 1971; Volker & Smith, 1965) have noted the change in aquatic vegetation over time. Often the disappearance (or decline) of northern clear-water species such as *Potamogeton amplifolius*, *P. freisii*, *P. gramineus*, *P. natans*, *P. praelongus*, *P. zosteriformis*, and *Megalodonta beckii*) and the appearance (and increase) of alien species such as *Potamogeton crispus* and *Myriophyllum spicatum* have indicated a decline in water quality. The occurrence of the alien species, however, does not by itself denote poor water quality, but a baseline should be established to note the present health of these aquatic systems. The present distributions of *Potamogeton crispus* and *Myriophyllum spicatum* are similar, appearing in North Bar Lake, Loon Lake and the Platte River. *P. crispus* is also found in the Crystal River. Secondly, the Sleeping Bear Region can be considered well within the range of many "northern" pondweeds which have been used elsewhere as indicators of good water quality. Perhaps some species are better suited as indicators at Sleeping Bear than others. Suitability of a prospective indicator species could be determined

by a broad comparison of the flora of other bodies of water of known quality in northern Michigan.

Line transects could be established running perpendicular from the shore to sample the vegetation. At regular intervals (2-5 years) the species and height of each plant along the transect could be recorded. In some areas of very deep water scuba gear might be needed to be used. Another sampling technique would be a visual estimate of species abundance in quadrats along the transects. Based on high productivity, areas which would merit from such study include School Lake, the Crystal River, and deep areas of the Platte River from Loon Lake to its mouth.

4. The largest threat to native species in unspoiled environments comes from purple loosestrife, *Lythrum salicaria*. This aggressive alien has invaded and overtaken some wetland areas in the eastern United States. Stuckey (1980) has mapped the westward migration of this species from its introduction to North America in New England and adjacent Canada in the early 1800s to the present. The Missouri Department of Conservation has issued a flyer urging state residents to "Say no" to purple loosestrife and a flyer produced by the Wisconsin Department of Natural Resources has requested observations on the species' status across that state. Within the National Lakeshore it does not, at present, appear to be aggressive, appearing locally along the Platte River, in a ditch along M-22 north of Aral Rd., and at the boat launch at School Lake. If the NPS wishes to let nature take its course, then the status of this species within the Lakeshore should be monitored. We may be seeing only the start of the invasion of the Sleeping Bear area. Continued observation would document any future spread of this species.

If the NPS desires to act to prevent a possible infestation of this potentially aggressive alien, then eradication must begin now. Removal by hand pulling would be best now to avoid hand spraying with glyphosate in heavily infested areas (Thompson, et al, 1987). Care should be taken when removing plants as fragments can reproduce vegetatively. Continued monitoring is needed, especially along the Platte River where seeds

could flow in from populations upstream. Perhaps the public could become involved in monitoring. A pamphlet, describing the appearance of purple loosestrife and the need for its control, could also ask visitors to report any purple loosestrife sightings. The pamphlet could also be used for other areas within the Midwest Region where purple loosestrife is a potential problem.

5. Future research of aquatic and wetland vegetation is wide-ranging.

- a. This study has documented the flora of the region, but has not approached the factors influencing the floristic composition and productivity. The floristic composition and productivity of a given lake is influenced by factors such as its depth, area, isolation, substrate composition (e.g. marl, sand, gravel), pH, and dissolved ionic composition. Future studies may describe why Bass Lake in Benzie Co. appears to be richer in the number of submerged aquatic species and to have a greater biomass than neighboring Otter Lake. Why does Mud Lake still exist? Why haven't *Typha* and other emergents invaded this very shallow depression? The density of the submerged aquatic vegetation of the Platte River downstream from Loon Lake appears to be greater than upstream. How do these sections compare to other parts of the Platte River outside the National Lakeshore, or to similar sections of nearby rivers such as the Betsie?
- b. The major streams within the National Lakeshore, Shalda Creek, the Crystal River, Otter Creek, and the Platte River, all have their proximal origin in a lake. How are such streams different than streams without a lake origin?
- c. If the recommendation to acquire old 35-mm aerial photograph slides from the USCS office in Lake Leelanau (Hazlett, 1986) was followed, then the changes in vegetation patterns and succession in aquatic areas in Leelanau County such as the Mill Pond, Tucker Lake, Narada Lake, and the Crystal River can be observed as the slide collection grows.
- d. An investigation into the relationship of Lake Michigan levels to the vegetation along the edge of the Platte River is an ongoing research project suggested by Waterman (1922) over 65 years ago.

CATALOGUE OF VASCULAR PLANTS

The following list of 69 families, 164 genera, 338 species, and 2 hybrids was derived primarily from extensive documentation during the field investigation. Unless specifically noted, all species listed and numbered represent my own collections which have been deposited at the University of Michigan Herbarium (MICH). Some specimens have been added to the herbarium of Sleeping Bear Dunes National Lakeshore stored at the Visitor Center in Empire. SI denotes sight identifications. Records used in the preparation of Michigan Flora, Parts 1 and 2 (Voss, 1972, 1985) were consulted for collection data on species not encountered during this study. Collections made by Paul W. Thompson (PWT) are deposited at the Cranbrook Institute of Science Herbarium (BLH), those by Frederick Wislizenus at the Missouri Botanical Garden (MO), and those by William Overlease (WRO) are in his personal herbarium.

Nomenclature generally follows Mickel (1979) for ferns and fern allies, and Gleason & Cronquist (1963) for those groups not covered by Voss (1972, 1985). Abundance estimates based on collections and sight records follow Voss (1972, p. 24). The families within the four major groups and then the species within each family are listed in alphabetical order. Common names have been included. The largest family, the Cyperaceae, is represented by 59 species. *Carex*, the largest genus, has 42 species. Only seven alien species, *Cirsium arvense*, *Lythrum salicaria*, *Myriophyllum spicatum*, *Nasturtium officinale*, *Polygonum persicaria*, *Potamogeton crispus*, and *Solanum dulcamara* are found in this catalogue.

PTERIDOPHYTES (Clubmosses, Horsetails, and Ferns)

Equisetaceae (Horsetail Family)

Equisetum arvense L. FIELD HORSETAIL

Occasional. Swamps. 3609, 4047.

Equisetum fluviatile L. WATER HORSETAIL

Frequent. Swales and in wet field on west side of North Manitou. 3438, 4061a, 4144.

Equisetum hyemale L. SCOURING-RUSH

Frequent. Small streams and along dune pools. 3250, 4171, 4338.

Equisetum sylvaticum L. WOODLAND HORSETAIL

Occasional. Otter Creek cedar swamp; North Manitou black ash swamps. 1642, 3614, 4510.

Equisetum scorpioides Michaux DWARF SCOURING-RUSH

Occasional. Cedar swamps. 3274, 4450.

Equisetum x trachyodon A. Braun

Local. Dune pools. 4067, 4675.

Equisetum variegatum Schleich. VARIEGATED SCOURING-RUSH

Occasional. Shores and dune pools. 4081, 4239, 4327, 4441.

Ophioglossaceae (Adder's Tongue Family)

Ophioglossum vulgatum L. ADDER'S TONGUE

Local. Moist lawn at edge of Platte River downstream from M-22. 4176.

Osmundaceae (Royal Fern Family)

Osmunda cinnamomea L. CINNAMON FERN

Common. Swamps. 1677, 2274, 2570, 3512.

Osmunda claytoniana L. INTERRUPTED FERN

Local. Alder thicket west of Narada Lake; south end of Taylor Lake. 3518.

Osmunda regalis L. ROYAL FERN

Common. Swamps, swales, and edges of streams and lakes. 1583, 2571, 2870, 4141.

Polypodiaceae (Fern Family)

Dryopteris clintoniana (D. C. Eaton) Powell CLINTON'S WOOD FERN

Rare. Black ash swamp north of North Bar Lake. 4238.

Dryopteris cristata (L.) A. Gray CRESTED SHIELD FERN

Frequent. Cedar swamps. 2820, 3219, 3625.

Dryopteris x slossonae Wherry

Local. Marl Springs area. 4451.

Dryopteris spinulosa (O. F. Muell.) Watt. SPINULOSE WOOD FERN

Occasional. Black ash swamps and wet woods. 4123.

Gymnocarpium dryopteris (L.) Newm. OAK FERN

Frequent. Cedar swamps. 4231.

Matteucia struthiopteris OSTRICH FERN

Frequent. Swamps. 4150.

Onoclea sensibilis L. SENSITIVE FERN

Common. Swamps and edges of streams and lakes. 1676, 1860, 2869.

Thelyperis palustris Schott MARSH FERN

Common. Swamps and lake edges. 1675, 1757, 2866, 3505.

Woodwardia virginica (L.) J. E. Smith VIRGINIA CHAIN-FERN

Local. Black ash swamp near Tucker Lake and wet woods along Miller Rd. 2818.

GYMNOSPERMS

Cupressaceae (Cypress Family)

Thuja occidentalis L. WHITE CEDAR

Common. Cedar swamps. 1609, 1894, 2830.

Pinaceae (Pine Family)

Abies balsamea (L.) Miller BALSAM FIR

Frequent. Cedar swamps. 1617, 1927, 4727.

Larix laricina (Du Roi) K. Koch LARCH

Frequent. Cedar Swamps and bogs. 1415, 2425, 2702.

Pinus strobus L. WHITE PINE

Common. Shores of lake and streams; dominant woody species in M-22 bog. SI.

Picea mariana (Miller) BSP. BLACK SPRUCE

Occasional. Bogs. 3449.

MONOCOTS

Alismataceae (Water-plantain Family)

Alisma plantago-aquatica L. WATER-PLANTAIN

Local. Port Oneida bog. 4423.

Sagittaria latifolia Willd. DUCK-POTATO

Frequent. Edges of open water. 2649, 4346, 4585.

Araceae (Arum Family)

Arisaema triphyllum (L.) Schott JACK-IN-THE-PULPIT

Common. Swamps. 1325, 2163.

Cyperaceae (Sedge Family)

Carex aquatilis Wahl.

Common. Edges of open water; marshes. 2396, 3950, 4073, 4058, 4224.

Carex atherodes Sprengel

Occasional. Swamps and marshes. 4104, 4109, 4161, 4383.

- Carex aurea* Nutt.
Occasional. Wet swales. 2347, 4082, 4279.
- Carex bebbii* (Bailey) Fern.
Occasional. 1828, 2721, 4089, 4242, 4304.
- Carex buxbaumii* Wahl.
Local. Dune pools and swales. 3429, 3931, 4096.
- Carex canescens* L.
Local. River edges and bogs. 2229, 4248.
- Carex castanea* Wahl.
Frequent. Cedar swamps. 2275, 3242.
- Carex comosa* Boott
Local. Wet swales. 3437, 4196, 4250, 4322, 4324.
- Carex crawei* Dewey
Local. Marl Springs. 4448.
- Carex crawfordii* Fern.
Dry bog Port Oneida, Cleveland Twp., Sec. 6. (PWT, L-3602)
- Carex crinita* Lam.
Frequent. Swamps and wetlands. 3417, 4085.
- Carex cristatella* Britton
Local. North Bar Lake. 4237.
- Carex cumulata* (Bailey) Fern.
Local. Port Onieda bog. 2822.
- Carex diandra* Schrank
Local. Otter Creek and Tamarack Lake. 4126, 4670.
- Carex disperma* Dewey
Frequent. Cedar swamps. 2265, 2482, 3239.
- Carex eburnea* Boott
Common. Cedar swamps. 2143, 4410.
- Carex flava* L.
Common. Streams, wet swales and cedar swamps. 2346, 2391, 2486, 3243, 3921.
- Carex gracillima* Schw.
Occasional. Swamps. 3418.
- Carex hystericina* Willd.
Common. Swamps, shores, and swales. 2206, 2392, 4236.

- Carex interior* Bailey
Common. Swamps, shores, fens, and swales. 2205, 2397, 3955, 4195.
- Carex intumescens* Rudge.
Occasional. Shores and swamps. 2266, 3419.
- Carex lacustris* Willd.
Occasional. Black ash swamps and marshes. 3413, 4091.
- Carex laevinvaginata* (Kuk.) Mack.
Local. Marl Springs. 3246.
- Carex lasiocarpa* Ehrh.
Occasional. Sedge mats and lake edges. 1333, 2398, 4193, 4294.
- Carex leptalea* Wahl.
Occasional. Cedar Swamps. 2490.
- Carex leptoneuria* Fern.
Occasional. Black ash swamps. 2158.
- Carex limosa* L.
Occasional. Sedge mats. 2715, 3952, 4131, 4194.
- Carex lupulina* Willd.
Occasional. Black ash swamps. 3414.
- Carex oligosperma* Michaux
Occasional. Bogs. 2228, 4424.
- Carex pallescens* L.
Local. Marl Springs. 3240.
- Carex pauciflora* Lightf.
Crystal River black spruce bog. (PWT, L-3432)
- Carex projecta* Mack.
Occasional. Black ash swamps and shores. 3415, 4083.
- Carex pseudocyperus* L.
Occasional. Swamps. 2708, 2864, 4129.
- Carex retrorsa* Schw.
Occasional. Wet woods and open areas. 3571, 4086.
- Carex rosea* Willd.
Occasional. Swamps. 3241, 3416.
- Carex scoparia* Willd.
Occasional. Wet woods. 3573, 4260.
- Carex stipata* Willd.
Common. Swales. 2204, 2366, 3435, 4092, 4480.

- Carex stricta* Lam.
Local. Marl Springs and marsh north of Lake Florence. 3248, 4100.
- Carex trisperma* Dewey
Occasional. Bogs and wet woods. 2225, 3539, 4373.
- Carex tribuloides* Wahl.
Dry bog, Port Oneida, Cleveland Twp., Sec. 6. (PWT, L-3607).
- Carex viridula* Michx.
Frequent. Sandy shores and dune pools. 1330, 1375, 1435, 4077, 4274.
- Carex vulpinoidea* Michx.
Frequent. Wet open areas and cedar swamps. 1401, 2856, 4243.
- Cladium mariscoides* (Muhl.) Torrey TWIG-RUSH
Common. Lake edges. 1751, 2610, 2637, 4367.
- Cyperus rivularis* Kunth
Occasional. Grassy shores. 4667a.
- Dulichium arundinaceum* (L.) Britton THREE-WAY SEDGE
Occasional. Lake edges. 2712, 4291, 4488.
- Eleocharis elliptica* Kunth
Frequent. Swales and dune pools. 1331, 2069, 4266, 4272, 4362.
- Eleocharis erythropoda* Stuedel
Frequent. Lake edges. 4080, 4192, 4442.
- Eleocharis pauciflora* (Lightf.) Link
Local. Dune pools. 4277.
- Eleocharis rostellata* Torrey
Local. Sedge mat along Otter Creek. 4436.
- Eleocharis smallii* Britton
Common. Lake edges. 1319, 4191, 4221, 4292, 4419.
- Eriophorum spissum* Fern.
Local. Bogs. 2226b, 2720, 3941, 4124.
- Eriophorum virginicum* L.
Local. Bogs. 2722, 4372, 4391.
- Eriophorum viridicarinatum* (Engelm.) Fern.
Occasional. Sedge mats. 2395, 2487, 3953.
- Scirpus acutus* Bigelow
Common. Emergent along lake edges. 1506, 3954, 4507, 4787.
- Scirpus americanus* Pers.
Frequent. Lake edges. 2656, 4084.

Scirpus atrovirens Willd.

Frequent. Wet open sites. 1417, 2511, 2573, 3411, 4543.

Scirpus cyperinus (L.) Kunth WOOL-GRASS

Frequent. Swamps, marshy sites and bogs. 2719, 2816, 3572, 4385, 4401, 4484, 4544.

Scirpus validus Vahl

Local. Tamarack Lake and Shalda swales. 2707, 4684.

Gramineae (Grass Family)

Agrostis gigantea Roth REDTOP

Occasional. Marl Springs and Lake Florence, South Manitou. 4447, 4485.

Calamagrostis canadensis (Michaux) Beauv. BLUE-JOINT

Common. Swamps and swales. 1576, 1678, 3410, 3440, 4208, 4359, 4463.

Calamagrostis inexpansa Gray

Frequent. Lake edges. 4363, 4666, 4678.

Cinna latifolia (Goepf.) Griseb.

Frequent. Swamps and edges of lakes and streams. 2640, 2700, 2703, 4395.

Festuca pratensis Hudson

Local. Wet swale on the West Side, North Manitou. 4145.

Glyceria canadensis (Michaux) Trin. RATTLESNAKE MANNA GRASS

Local. Bow Lakes bog. 4384.

Glyceria striata (Lam.) Hitchc. FOWL MANNA GRASS

Common. Swamps and edges of lakes and streams. 2518, 2859, 2896, 2997, 3420, 4074, 4233, 4302.

Hierochloa odorata (L.) Beauv. SWEET GRASS

Local. Moist field off Day Forest Rd. 3049.

Leersia oryzoides (L.) Sw. RICE CUTGRASS

Occasional. Edges of swales, streams, and lakes. 4481.

Panicum praecocius Hitchc. & Chase

Local. Sedge mat at south end of Bow Lakes. 2390.

Panicum virgatum L.

Occasional. Lake edges. 4464.

Phalaris arundinacea L. REED CANARYGRASS

Occasional. Lake edges. 2653, 4076.

Phragmites australis (Cav.) Steudel REED

Occasional. 1887, 2704.

Poa palustris L.

Local. Edge of Shell Lake. 4343a.

Spartina pectinata Link CORDGRASS
Local. Edge of Platte River. 4783.

Sphenopholis intermedia (Rydb.) Rydb.
Occasional. Swamps. 4399, 4508.

Hydrocharitaceae (Frog's-bit Family)

Elodea canadensis Michaux ELODEA
Common. Lakes and streams. 4044, 4229, 4473, 4580.

Vallisneria americana Michaux TAPE-GRASS
Frequent. Lakes and streams. 4456, 4582.

Iridaceae (Iris Family)

Iris pseudacorus L. YELLOW FLAG
Local. Edge of Platte River near M-22; small farm pond near Shell Lake. 4064,
4173.

Iris versicolor L. WILD BLUE FLAG
Local. Swales and edges of lakes on Manitou Islands. 1320, 1492, 1493.

Iris virginica L. SOUTHERN BLUE FLAG
Common. Swales and edges of lakes and streams. 1414, 2289, 2340, 2367.

Sisyrinchium angustifolium Miller BLUE-EYED-GRASS
Shaded bank of Otter Creek. (WRO 1000).

Juncaceae (Rush Family)

Juncus alpinus Vill.
Occasional. Swales and shores. 1603, 4275, 4672a.

Juncus balticus Willd.
Common. Dune pools and swales. 1456, 1505, 1827, 4095.

Juncus brachycephalus (Engelm.) Buch.
Local. Edge of School Lake. 4467.

Juncus brevicaudatus (Engelm.) Fern.
Local. Bow Lakes bog; shore of Glen Lake. 4389; EGV 2864.

Juncus canadensis LaHarpe SOFT RUSH
Occasional. Swales and lake edges. 4416, 4687.

Juncus dudlei Weig.
Frequent. Swales and lake edges. (PWT, L-3157, L-3229, L-3495).

Juncus effusus L.
Frequent. Swales and wet fields. 2512, 4125, 4259, 4672.

Juncus nodosus L.
Frequent. Shores. 4446, 4468.

Juncus pelocarpus Meyer
Local. South Manitou swales. 1743, 4325.

Juncus torreyi Cov.
Occasional. Wet fields. 4833.

Juncaginaceae (Arrow-grass Family)

Scheuchzeria palustris L.
Local. Bogs; Bow Lakes area and M-22 bog. 2900; PWT L-2109.

Triglochin palustre L.
Occasional. Dune pools and shores. 4278, 4406, 4670, 4814.

Lemnaceae (Duckweed Family)

Lemna minor L. DUCKWEED
Common. Pond and stream edges. 4427.

Lemna trisulca L. STAR DUCKWEED
Local. Day Mill Pond. 4227.

Spirodela polyrhiza (L.) Schleiden GREATER DUCKWEED
Local. Platte River, Mill Pond, and small ponds near Hidden Lake. 4412, 4845.

Wolffia punctata Griseb. WATER-MEAL
Local. Narada Lake and Lake Manitou outlet. 4547a, 4719.

Liliaceae (Lily Family)

Smilacina trifolia (L.) Desf.
Local. Cedar swamps and bogs. 2172, 3170.

Najadaceae (Naiad Family)

Najas flexilis (Willd.) Rostk. & Schmidt NAIAD
Common. Lakes and streams. 4217, 4255, 4581.

Orchidaceae (Orchid Family)

Corallorhiza striata Lindley STRIPED CORAL-ROOT
Frequent. Cedar swamps. 3926.

Corallorhiza trifida Chat. EARLY CORAL-ROOT
Frequent. Cedar Swamps. 2523, 3169, 3925.

Cypripedium acaule Aiton STEMLESS LADY-SLIPPER
Local. Bogs. 3940.

Cypripedium reginae Walter SHOWY LADY-SLIPPER
Occasional. Otter Creek, Hidden Lake, and marsh east of Little Traverse Lake.
2423.

Habenaria blephariglottis (Willd.) Hooker
Local. M-22 bog. SI; PWT L-1677.

Habenaria clavellata (Michaux) Spreng. CLUB-SPUR ORCHID
Occasional. Cedar swamps. 3608.

Habenaria dilatata (Pursh) Hook. BOG-CANDLE
Local. Fen in cedar swamp west of Otter Creek. 2522.

Habenaria hyperborea (L.) R. Br. TALL NORTHERN BOG ORCHID
Frequent. Cedar Swamps. 2481, 3611, 4396.

Habenaria lacera (Michaux) Lodd.
Local. Alder thicket west of Narada Lake. 4428.

Habenaria obtusa (Pursh) Richardson BLUNT-LEAF ORCHID
Local. Cedar swamps along Otter Creek and Crystal River. 2524, 2544.

Habenaria psycodes (L.) Sprengel SMALL PURPLE-FRINGED ORCHID
Occasional. In swamps and along shores of Lake Florence and Crystal River.
1707, 4393.

Liparis loesellii (L.) Richard FEN ORCHID
Local. Cedar swamps near Otter and Shalda Creeks and along Lake Florence.
2886, 3276.

Listera convallarioides (Sw.) Torrey BROAD-LEAVED TWAYBLADE
Local. Cedar swamp along Crystal River. 2545.

Pogonia ophioglossoides (L.) Ker ROSE POGONIA
Floating mat, Port Onieda bog lake near M-22, Glen Arbor Twp., Sec. 6N. (PWT,
L-2106)

Spiranthes cernua (L.) Rich. NODDING LADIES'-TRESSES
Local. Shore near Glen Lake beach. 4690.

Spiranthes romanzoffiana Cham. HOODED LADIES'-TRESSES
Frequent. Marly shores and sedge mats. 2872, 4364, 4407.

Pontederiaceae (Pickerel-weed Family)

Heteranthera dubia (Jacq.) MacM. WATER STAR-GRASS
Frequent. Lakes and streams. 4477, 4668, 4725.

Potamogetonaceae (Pondweed Family)

Potamogeton amplifolius Tuckerman
Common. Lakes. 4055, 4216, 4254, 4289, 4492, 4709.

- Potamogeton berchtoldii* Fieber
Frequent. Lakes. 4207, 4288, 4349, 4491.
- Potamogeton crispus* L.
Occasional. Lakes and streams. 4230, 4256.
- Potamogeton filiformis* Pers.
Local. Glen Lake and Lake Manitou. 3943, 4517.
- Potamogeton foliosus* Raf.
Common. Lakes. 4252, 4457, 4470, 4547, 4574, 4703, 4825, 4832.
- Potamogeton friesii* Rupr.
Occasional. Streams. 4430, 4475, 4707, 4711, 4830.
- Potamogeton gramineus* L.
Common. Lakes and streams. 4045, 4065, 4187, 4222, 4281, 4493, 4523, 4700.
- Potamogeton illinoensis* Morong
Common. Lakes and streams. 4212, 4258, 4316, 4361, 4583, 4680, 4708, 4824.
- Potamogeton natans* L.
Common. Lakes, streams, and swales. 4056, 4519, 4547b.
- Potamogeton oaksianus* Robbins
Local. Bog ponds Port Oneida area. 4265a, 4418.
- Potamogeton pectinatus* L.
Common. Lakes and streams. 4432, 4455, 4589, 4669, 4697.
- Potamogeton praelongus* Wulfen
Local. Narada Lake and Lake Manitou. 4350, 4525.
- Potamogeton richardsonii* (Benn.) Rydb.
Common. Lakes and streams. 4228, 4257, 4368, 4476, 4524, 4579.
- Potamogeton robbinsii* Oakes
Local. Otter Lake. 4369.
- Potamogeton strictifolius* Bennett
Local. Bass Lake (Benzie). 4831.
- Potamogeton zosterformis* Fern.
Common. Lakes. 4215, 4829.

Sparganiaceae (Bur-reed Family)

- Sparganium americanum* Nutt.
Local. Stream through black ash swamp south of School Lake. 4398.
- Sparganium chlorocarpum* Rydb.
Frequent. Lake edges and swales. 4348, 4534, 4588.

Sparganium eurycarpum Engelm.

Local. Along Platte River; also found on North Manitou. 4175; Wislizenus 601.

Sparganium fluctuans (Morong) Robinson

Local. Taylor Lake. 4199.

Sparganium minimum (Hartman) Fries

Occasional. Swales. 3453, 4342, 4413.

Typhaceae (Cat-tail Family)

Typha angustifolia L. NARROW-LEAVED CAT-TAIL

Frequent. Roadsides and lake edges. 1578, 3543, 4219.

Typha latifolia L. COMMON CAT-TAIL

Common. Lake and stream edges, marshes, and roadsides. 2701, 3426, 4218, 4220, 4295.

DICOTYLEDONS

Aceraceae (Maple Family)

Acer rubrum L. RED MAPLE

Common. Swamps and edges of lakes and streams. 3175.

Acer spicatum Lam. MOUNTAIN MAPLE

Occasional. Black ash swamps. 2165, 2279.

Apocynaceae (Dogbane Family)

Apocynum cannabinum L. INDIAN HEMP

Occasional. Near Glen Lake beach, Shalda Creek, and along Crystal River. 4691.

Aquifoliaceae (Holly Family)

Ilex verticillata (L.) Gray MICHIGAN HOLLY

Frequent. Bog edges and swales. 1810, 3019, 3441.

Nemopanthus mucronatus (L.) Trel. MOUNTAIN-HOLLY

Occasional. Bog edges. 2854.

Araliaceae (Ginseng Family)

Aralia nudicaulis L. WILD SARSAPARILLA

Occasional. Cedar swamps. 2276.

Asclepiadaceae (Milkweed Family)

Asclepias incarnata L. SWAMP MILKWEED

Frequent. Lake edges and swales. 2500, 3483.

Balsamaceae (Jewelweed Family)

Impatiens capensis Meerb. SPOTTED TOUCH-ME-NOT
Frequent. Black ash swamps. 2983, 3026, 4311.

Betulaceae (Birch Family)

Alnus rugosa (DuRoi) Sprengel SPECKLED ALDER
Common. Alder thickets and some black ash swamps. 2776, 4238a, 4749.

Betula alleghaniensis Britton YELLOW BIRCH
Frequent. Black ash swamps. 1912, 2445, 2893, 3586, 4136.

Betula papyrifera Britton WHITE BIRCH
Occasional. Cedar swamps. SI.

Betula pumila L. BOG BIRCH
Frequent. Edges of Loon Lake, Mud Lake, the Platte River, and swales west.
3448.

Boraginaceae (Forget-me-not Family)

Cynoglossum boreale Fern. NORTHERN WILD COMFREY
Occasional. Swamps. 2267, 3168.

Myosotis scorpioides L. TRUE FORGET-ME-NOT
Frequent. Edges of lakes and streams. 4177, 4210, 4453, 4578.

Campanulaceae (Harebell Family)

Campanula aparinoides Pursh MARSH BELLFLOWER
Frequent. Swamps and swales. 2575, 2831, 3519.

Caprifoliaceae (Honeysuckle Family)

Sambucus canadensis L. COMMON ELDERBERRY
Frequent. Wet open sites. 2556, 3392, 3404.

Viburnum lentago L. NANNYBERRY
Frequent. Swale and lake edges. 3177, 3442.

Ceratophyllaceae (Hornwort Family)

Ceratophyllum demersum L. COONTAIL
Frequent. Lakes and streams. 4474, 4717.

Compositae (Composite Family)

Aster lateriflorus (L.) Britton
Occasional. Shores of lakes and streams. 1836, 4813.

Bidens cernuus L.
Occasional. Edges of lakes and streams. 4718.

Bidens connatus Muhl.
Frequent. Black ash swamps and edges of lakes and streams. 1782, 2996.

Cirsium arvense (L.) Scop. CANADA THISTLE
Frequent. Marshes and roadsides. 1755, 2563, 2658, 4318.

Cirsium muticum Michaux
Frequent. Marshes. 3613, 4444, 4683.

Eupatorium maculatum L. JOE-PIE-WEED
Common. Marshes. 2888, 3544, 4483.

Eupatorium perforatum L. BONESET
Common. Marshes. 1752, 2871, 3545.

Megalodonta beckii (Torr.) Greene WATER-MARIGOLD
Local. Platte River. 4846.

Solidago graminifolia (L.) Salisb. GRASS-LEAVED GOLDENROD
Occasional. Lake and swale edges. 1885, 2943.

Solidago uliginosa Nutt.
Frequent. Edges of lakes and streams. 2877, 3022.

Cornaceae (Dogwood Family)

Cornus amomum Miller SILKY DOGWOOD
Frequent. Swales and edges of lakes and streams. 2514, 3443, 4107.

Cornus canadensis L. BUNCHBERRY
Common. Cedar swamps. 2263, 2895, 3568.

Cornus foemina Miller GREY DOGWOOD
Shore of Platte River. (WRO 2428).

Cornus stolonifera Michaux RED-OSIER
Common. Swales and edges of lakes and streams. 2171, 2203, 3179.

Cruciferae (Mustard Family)

Barbarea vulgaris R. Br. YELLOW ROCKET
Occasional. Black ash swamps and marshes. 2109, 2167.

Cardamine bulbosa (Muhl.) BSP.
Along edge of Otter Creek at Aral. (WRO, 789)

Cardamine pensylvanica Willd.
Occasional. Black ash swamps. 2166, 3909, 4137.

Cardamine pratensis L.
Local. Small stream flowing into Tamarack Lake. 4509.

Nasturtium officinale R. Br. WATERCRESS
Occasional. Roadside ditches and in small streams. 2470, 2981, 3249, 4343.

Rorippa palustris (L.) Besser
Occasional. Swales and lake edges. 1882, 2499, 2651.

Droseraceae (Sundew Family)

Drosera rotundifolia L. SUNDEW
Local. Bogs and sedge mats. 2714, 2852, 3617.

Ericaceae (Heath Family)

Andromeda glaucophylla Link BOG-ROSEMARY
Local. Bogs. 2223.

Chamadaphne calyculata (L.) Moench LEATHERLEAF
Common. Bogs and swales. 1419, 2077, 2169, 2343.

Gaultheria hispidula (L.) Muhl. CREEPING SNOWBERRY
Frequent. Cedar swamps and some bogs. 1640, 2851, 2894.

Gaultheria procumbens L. WINTERGREEN
Local. Bogs. 2723.

Gaylussacia baccata (Wang.) K. Koch BLACK HUCKLEBERRY
Local. Bogs. 1418.

Kalmia polifolia Wang. BOG-LAUREL
Local. Bogs. 2224, 4127.

Ledum groenlandicum Oeder LABRADOR-TEA
Occasional. Bogs and swales. 2853, 3279.

Pyrola asarifolia Michaux PINK PYROLA
Occasional. Cedar swamps. 2488, 3271.

Pyrola chlorantha Sw.
Common. 2422, 2521, 3444.

Pyrola elliptica Nutt. SHINLEAF
Local. Black ash swamps. 1638, 4232.

Vaccinium angustifolium Aiton LOW SWEET BLUEBERRY
Frequent. Bogs. 2817, 3920.

Vaccinium macrocarpon Aiton LARGE CRANBERRY
Local. Taylor Lake sedge mat. 4197.

Vaccinium myrtilloides Michaux VELVET-LEAF BLUEBERRY
Frequent. Bogs. 1679, 2823.

Vaccinium oxycoccos L. SMALL CRANBERRY
Local. Bogs. 2226, 2519, 2717.

Gentianaceae (Gentian Family)

Bartonia virginiana (L.) BSP.

Local. Wet woods between Port Oneida bog and Kelderhouse Rd. 2815.

Gentiana andrewsii Griseb. CLOSED GENTIAN

Low ground near Glen Lake Pond, Glen Arbor Twp., Sec. 29. (PWT, L-1235)

Gentiana procera Holm. FRINGED GENTIAN

Local. Dune pool west of Glen Haven. 3015.

Gentiana rubricaulis Schw. CLOSED GENTIAN

Local. Glen Lake Beach. 4834.

Menyanthes trifoliata L. BUCKBEAN

Frequent. Bogs and sedge mats. 2705, 3171, 4408.

Grossulariaceae (Gooseberry Family)

Ribes americanum Miller WILD BLACK CURRENT

Occasional. Black ash swamps. 3894, 4505.

Ribes glandulosum Grauer

Otter Creek. (WRO, 1874).

Ribes triste L. SWAMP RED CURRENT

Local. Cedar swamp along Otter Creek. 2492

Haloragaceae (Water-milfoil Family)

Myriophyllum exalbescens Fern.

Common. Lakes and streams. 4253, 4527, 4584, 4590, 4705.

Myriophyllum heterophyllum Michaux

Occasional. Lakes and streams. 4431, 4454, 4698.

Myriophyllum spicatum L.

Occasional. Platte River, Loon Lake, North Bar Lake, and coastal pool North Manitou. 4358, 4699, 4782, 4798.

Proserpinaca palustris L. MERMAID-WEED

Local. Swales. 4692.

Hippuridaceae (Mare's-tail Family)

Hippuris vulgaris L. MARE'S-TAIL

Local. Otter Creek. 4433.

Hypericaceae (St. John's-wort Family)

Hypericum kalmianum L. KALM'S ST. JOHN'S-WORT

Frequent. Dune pools and lake and stream edges. 2611, 4247.

Hypericum majus (A. Gray) Britton
Local. Bogs and edges of lakes. 4306, 4387, 4465.

Triadenum fraseri (Spach) Gl. MARSH ST. JOHN'S-WORT
Common. Marshes and edges of lakes and streams. 2652, 2711, 2819, 4388,
4462.

Labiatae (Mint Family)

Lycopus americanus Muhl. WATER HOREHOUND
Occasional. Swales and shores. 1607, 1749, 1809, 4240, 4415, 4486, 4577,
4689.

Lycopus uniflorus Michaux
Common. Swamps. 1783, 1801, 2710, 2862, 2882, 3510, 3570, 3612, 3623,
4466, 4545.

Mentha arvensis L.
Frequent. Edges of lakes and streams. 2899, 2950, 4313, 4341.

Mentha piperita L. PEPPERMINT
Occasional. Lake and stream edges. 1682, 4529, 4686.

Prunella vulgaris L. SELF-HEAL
Frequent. Lake shores. 2509.

Scutellaria galericulata L. COMMON SKULLCAP
Frequent. Swamps and swales. 1682, 1756, 2484, 2650, 3439, 4478.

Scutellaria lateriflora L. MAD DOG SKULLCAP
Frequent. Swamps. 1681, 1766, 1781, 2868, 4397, 4479.

Teucrium canadense L. AMERICAN GERMANDER
Occasional. Swales and lake edges. 3531, 3579, 3659, 4316.

Leguminosae (Bean Family)

Lathyrus palustris L. MARSH PEA
Occasional. Swamps and stream banks. 4238b, 4244.

Lentibulariaceae (Bladderwort Family)

Utricularia cornuta Michaux
Local. Dune pools and fens. 2766.

Utricularia gibba L.
Hidden Lake. (PWT, L-1419).

Utricularia geminiscapa Benj.
Frequent. Bog ponds. 4377, 4390.

Utricularia minor L.
Occasional. Lakes and swales. 3949, 4097, 4113, 4298, 4471, 4702.

Utricularia vulgaris L.

Common. Lakes and swales. 3948, 4045a, 4190, 4201, 4226, 4377, 4390.

Lobeliaceae (Lobelia Family)

Lobelia cardinalis L. CARDINAL FLOWER

Frequent. Wet woods along swales and streams. 2867, 2930.

Lobelia kalmii L.

Frequent. Dune pools and lake edges. 1579, 1746, 2765, 3014, 4365.

Lobelia siphilitica L. GREAT LOBELIA

Local. Shores near Glen Lake beach. 4688.

Lythraceae (Loosestrife Family)

Decodon verticillatus (L.) Ell. SWAMP LOOSESTRIFE

Frequent. Edges of lakes and streams. 2850, 4716, 4724.

Lythrum salicaria L. PURPLE LOOSESTRIFE

Occasional. Along the Platte River; some lake edges and roadside ditches. 2676, 4360, 4458, 4482.

Myricaceae (Bayberry Family)

Myrica gale L. SWEET GALE

Frequent. Edges of lakes and streams. 2199, 2543, 3897.

Nymphaeaceae (Water-lily Family)

Brassenia schreberi J. F. Gmelin WATER-SHIELD

Local. Taylor Lake; pond near Port Oneida. 4720.

Nuphar variegata Durand POND-LILY

Common. Lakes and streams. 4189, 4213, 4521.

Nymphaea odorata Aiton WATER-LILY

Frequent. Lakes and streams. 4188, 4200, 4214.

Oleaceae (Olive Family)

Fraxinus nigra Marsh. BLACK ASH

Frequent. Black ash swamps and edges of lakes and streams. 4394, 4586.

Fraxinus pennsylvanica Marsh. RED ASH

Frequent. Lake edges. 4223, 4710.

Onagraceae (Evening-primrose Family)

Circaea alpina L.

Frequent. Cedar swamps. 2860.

Epilobium ciliatum Raf.

Frequent. Swamps. 1580, 3511, 3550, 3622, 3677, 4489.

Epilobium coloratum Biehler
Occasional. Swamps. 1815, 3165.

Epilobium leptophyllum Raf.
Occasional. Cedar swamps. 2873, 2878, 4425, 4542.

Epilobium parviflorum Schreber
Local. Cedar swamp west of Co. 669. 2863.

Ludwigia palustris (L.) Ell. WATER-PURSLANE
Occasional. Swales and small streams. 4402, 4681.

Polygalaceae (Milkwort Family)

Polygala paucifolia Willd. FRINGED POLYGALA
Occasional. Cedar swamps. SI.

Polygonaceae (Smartweed Family)

Polygonum amphibium L. WATER SMARTWEED
Common. Emergent from, and along edges of, lakes and streams. 1808, 3454,
4046, 4060, 4487, 4693, 4723.

Polygonum persicaria L. LADY'S THUMB
Local. Bow Lakes bog; shore of Lake Florence. 1886, 2902; PWT L-1858.

Polygonum punctatum Ell.
Local. Outlet of Lake Manitou near Pole Bridge. 4530.

Rumex crispus L. CURLY DOCK
Frequent. Swamps. 3513.

Rumex obtusifolius L. BITTER DOCK
Occasional. Swamps. 4400.

Rumex verticillatus L. WATER DOCK
Occasional. Shores. 4696.

Primulaceae (Primrose Family)

Lysimachia ciliata L.
Low ground along Shell Lake, Cleveland Twp., Sec. 5. (PWT, L-1777)

Lysimachia terrestris (L.) BSP. SWAMP CANDLE
Local. Port Oneida bog and Lake Florence. 1582, 2821, 4421.

Lysimachia thyrsiflora L. TUFTED LOOSESTRIFE
Common. Swamps and lake edges. 1420, 2365, 3273, 3423, 4101.

Ranunculaceae (Buttercup Family)

Caltha palustris L. MARSH MARIGOLD
Frequent. Swamps and small streams. 1444, 2168.

Clematis virginiana L. WOODBINE
Occasional. Swamps and stream edges. 3245, 4823.

Coptis trifolia (L.) Salisb. GOLDTHREAD
Common. Swamps. 1637, 2070, 2234.

Ranunculus longirostris Godron WHITE WATER CROWFOOT
Local. Otter Creek and Lake Manitou. 4520, 4712.

Ranunculus recurvatus Poiret HOOKED CROWFOOT
Common. Swamps and some marshes. 1953, 2112, 2162, 2901, 4386.

Ranunculus reptans L. CREEPING SPEERWORT
Local. Lake Florence. 1348, 2014.

Ranunculus sceleratus L. CURSED CROWFOOT
Local. Lake Florence and Narada Lake. 1329, 4849.

Thalictrum dasycarpum Fisch. & Ave-Lall. PURPLE MEADOWRUE
Local. Along Platte River and Loon Lake. 4180.

Rosaceae (Rose Family)

Aronia prunifolia (Marsh) Rehder CHOKEBERRY
Frequent. Swales, bogs, and edges of lakes and streams. 2716, 2828, 3155,
3445, 4099.

Geum aleppicum Jacq.
Frequent. Swamps. 1748, 2417, 2455, 3124, 4088.

Geum canadense Jacq.
Occasional. Swamps. 2456, 3514.

Geum rivale L.
Occasional. Cedar swamps and alder thickets. 2262, 3272.

Potentilla anserina L. SILVERWEED
Frequent. Lake shores. 2448.

Potentilla fruticosa L. SHRUBBY CINQUEFOIL
Frequent. Swales, lake edges, and fens. 2879, 2947, 4461.

Potentilla palustris (L.) Scop. MARSH CINQUEFOIL
Common. Lake edges and marshes. 1811, 4053.

Rosa palustris Marsh. SWAMP ROSE
Common. Shores. 1753, 4264.

Rubus flagellaris Willd. NORTHERN DEWBERRY
Occasional. Cedar swamps. 2416.

Rubus hispidus L. SWAMP DEWBERRY
Frequent. Wet woods. 2164, 3574, 4414, 4426.

Rubus pubescens Raf. DWARF RASPBERRY
Occasional. Swamps. 3247, 4234, 4422.

Sorbus decora (Sarg.) C. K. Schneider MOUNTAIN ASH
Local. Edge of Otter Creek upstream from Aral. 4434.

Spiraea alba DuRoi MEADOWSWEET
Local. Swales of Platte section and shores of Lake Florence, South Manitou.
1581, 2568, 4847.

Rubiaceae (Madder Family)

Cephalanthus occidentalis L. BUTTON-BUSH
Local. Edges of Bass and School Lakes. 4469.

Galium palustre L.
Frequent. Stream and lake edges. 2447, 2454, 2718 4094.

Mitchella repens L. PARRIDGEBERRY
Frequent. Swamps. 2450, 2520, 4163.

Salicaceae (Willow Family)

Populus grandidentata Michaux BIG-TOOTH ASPEN
Common. Lake shores and bordering woods. SI.

Populus tremuloides Michaux QUAKING ASPEN
Common. Lake shores. 2778.

Salix amygdaloides Andersson PEACH-LEAVED WILLOW
Occasional. Swales and dune pools. 3936, 4111.

Salix bebbiana Sarg. BEAKED WILLOW
Frequent. Swales and lake edges. 1625, 1990, 2934, 4063, 4054, 4105.

Salix candida Willd. SAGE WILLOW
Frequent. Swales and lake edges. 3446, 3581, 3956.

Salix cordata Michaux SAND-DUNE WILLOW
Frequent. Edges of dune pools. 4673.

Salix discolor Muhl. PUSSY WILLOW
Occasional. Wetland edges. 2079, 3547, 3892, 3957, 4235.

Salix exigua Nutt. SANDBAR WILLOW
Frequent. Edges of lakes, streams, and dune pools. 2935, 4764.

Salix lucida Muhl. SHINING WILLOW
Common. Lake edges. 4061, 4093.

Salix myricoides Muhl. BLUE LEAF WILLOW
Common. Swales and stream edges. 3033, 3582, 4062.

Salix petiolaris J. E. Smith SLENDER WILLOW
Common. Swales and edges of lakes and streams. 1812, 2009, 2078, 2079, 3174,
3580, 3957, 4103, 4110.

Salix sericea Marsh. SILKY WILLOW
Frequent. Swales. 3447.

Sarraceniaceae (Pitcher Plant Family)

Sarracenia purpurea L. PITCHER PLANT
Local. Bogs and sedge mats. 2439, 2483.

Saxifragaceae (Saxifrage Family)

Chrysosplenium americanum Hooker. GOLDEN SAXIFRAGE
Frequent. Cedar swamps and along small cool streams. 2160, 2480.

Mitella nuda L. NAKED MITERWORT
Frequent. Swamps. 1672, 2098, 2233.

Parnassia glauca Raf. GRASS-OF-PARNASSUS
Occasional. Fens and stream edges. 2826, 4440, 4677.

Tiarella cordifolia L. FOAMFLOWER
Occasional. Swamps. 2101, 2159, 3923.

Scrophulariaceae (Figwort Family)

Agalinis purpurea (L.) Pennell
Local. Lake Florence and Round Lake. 1884, 4848.

Agalinis tenuifolia Vahl
Wet, sandy gravel along Crystal River, Glen Arbor Twp., Sec. 26. (PWT, L-1883).

Chelone glabra L. TURTLE-HEAD
Local. Edge of Platte River. 4722.

Mimulus glabratus HBK.
Local. Marl Springs. 3626.

Mimulus ringens L.
Local. Shores of Crystal River; along Outlet of Lake Manitou near Pole Bridge.
2541, 4531.

Veronica americana (Raf.) Schw.
Occasional. Swamps, springs, and edges of streams. 3924, 4178, 4209.

Solanaceae (Nightshade Family)

Solanum dulcamara L. DEADLY NIGHTSHADE
Frequent. Swales and edges of lakes and streams. 2932, 4135, 4174.

Ulmaceae (Elm Family)

Ulmus americana L. AMERICAN ELM

Frequent. Understory species in black ash swamps; swales. 3040, 4541.

Umbelliferae (Parsley Family)

Berula erecta (Hudson) Cov. WATER-PARSNIP

Local. Marl Springs. 4714, 4819.

Cicuta bulbifera L.

Local. Sedge mat at Otter Creek. 4435.

Cicuta maculata L.

Occasional. Edges of lakes. 4532, 4587.

Hydrocotyle americana L. WATER-PENNYWORT

Local. Woods between School Lake and School Lake Rd. 4404.

Sanicula marilandica L. BLACK SNAKEROOT

Local. Cedar swamps along Otter Creek. 2491, 3244.

Sium suave Walter WATER-PARSNIP

Local. Edge of School Lake. 4460.

Urticaceae (Nettle Family)

Boehmeria cylindrica (L.) Sw. FALSE NETTLE

Frequent. Black ash swamps. 2639, 4366, 4682.

Urtica dioica L. STINGING NETTLE

Frequent. Marshes and edges of wetlands. 2660, 2903, 3025, 4528.

Violaceae (Violet Family)

Viola blanda Willd. SWEET WHITE VIOLET

Common. Cedar swamps. 2071.

Viola conspersa Reichneb. DOG VIOLET

Frequent. Swamps. 3893, 3922.

Viola cucullata Aiton MARSH VIOLET

Frequent. Cedar swamps and edges of wetlands. 2110, 2192, 4049.

Viola macklowskeyi SMOOTH WHITE VIOLET

Frequent. Cedar swamps. 2243.

Viola nephrophylla Greene

Local. Marl Springs. 2099.

Viscaceae (Mistletoe Family)

Arceuthobium pusillum C. H. Peck. DWARF MISTLETOE

Local. Bog along M-22 east of Glen Arbor. 3218.

Vitaceae (Grape Family)

Parthenocissus quinquefolia (L.) Planchon

Occasional. Cedar swamps; moist woods bordering lakes and streams. 4429.

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Appendix A. Coastal Pools and Pannes

Among the most variable wetland habitats from one year to the next within Sleeping Bear Dunes National Lakeshore are the coastal pools and dune pannes. These small wetlands are scattered throughout the National Lakeshore, usually on coastal dunes. They have been collectively described in this appendix rather than individually within the main portion of the report. The best collection of coastal pools (areas of open water) and dune pannes (low, moist sites) is found on the open dunes of Platte Bay at the National Lakeshore's south end (Lake Twp., Sec. 25). Pool/panne complexes are also found along the rest of Platte Bay, just east of Sleeping Bear Pt. (Glen Arbor Twp., Sec. 17), along Good Harbor Bay northeast of Co. 651 (Centerville Twp., Sec. 6), and on South Manitou at Sandy Pt. near the village area. Dune pool depth is usually no more than two feet. The surface area of pools and pannes is largely determined by the level of Lake Michigan. During high water years, these areas are larger and sites which may have been pannes become pools. In some wet years even some jack pine stands, which may have developed on pannes, have areas of standing water. Conversely, in years of low water levels in Lake Michigan, dune pools may become pannes and pannes may dry up completely.

The floristic composition of dune pools and pannes is variable, sometimes including typical dune species. Typically, species occurring in and around dune pools, with the exception of an occasional *Potamogeton*, also are found on pannes. A few species such as *Utricularia cornuta* and *Triglochin palustre*, are most commonly found in these areas, but are not restricted to them. *Utricularia cornuta* is most easily found on the dune pool/panne complexes along Platte Bay both north and south of the Platte River, but it is also found in a cedar swamp near Otter Creek. The most frequently occurring woody species are *Salix exigua* and *S. cordata*. The vegetation of dune pool and pannes, however, is predominantly herbaceous with sedges (e.g. *Carex viridula*, *Eleocharis elliptica*, *E. pauciflora*) and rushes (e.g. *Juncus balticus*, *J. alpinus*) as dominants. Other common herbs include *Panicum*

implicatum, *Senecio pauperculus*, *Lobelia kalmii*, and *Zigadenus glaucus*. On South Manitou, *Typha latifolia* has even become established at Sandy Pt.

Although coastal pools commonly form on sand, they also occur on gravel shores. A large pool has formed behind the gravel beach near the Fish Shanty on the northeast side of North Manitou. *Potamogeton natans* and *Myriophyllum spicatum* are the submerged aquatics. Species found here which have also been found in association with dune pools and pannes include sedges (*Carex garberi*, *C. aurea*, *C. viridula*), *Panicum implicatum*, and *Senecio pauperculus*.

Appendix B. List of species with their common names.

Abies balsamea Balsam Fir
Acer rubrum Red Maple
Acer spicatum Mountain Maple
Agrostis gigantea Redtop
Alisma plantago-aquatica Water-plantain
Alnus rugosa Alder
Andromeda glaucophylla Bog-rosemary
Apocynum cannabinum Indian-hemp
Aralia nudicaulis Wild Sarsaparilla
Arisaema triphyllum Jack-in-the-pulpit
Aronia prunifolia Chokeberry
Asclepias incarnata Swamp Milkweed
Barbarea vulgaris Yellow Rocket
Berula erecta Water-parsnip
Betula alleghaniensis Yellow Birch
Betula papyrifera White Birch
Betula pumila Bog Birch
Bidens Bur-marigold
Boehmeria cylindrica False Nettle
Brassenia schreberi Water-shield
Calamagrostis canadensis Blue-joint
Caltha palustris Marsh Marigold
Campanula aparinoides Marsh Bellflower
Carex Sedge
Cephalanthus occidentalis Button-bush
Ceratophyllum demersum Coontail
Chamaedaphne calyculata Leather-leaf
Chelone glabra Turtle-head
Chrysosplenium americanum Golden Saxifrage
Cicuta Water-hemlock
Cirsium arvense Canada Thistle
Cladium mariscoides Twig-rush
Clematis virginiana Woodbine

Coptis trifolia Goldthread
Corallorhiza striata Striped Coralroot
Corallorhiza trifida Early Coralroot
Cornus amomum Silky Dogwood
Cornus canadensis Bunchberry
Cornus stolonifera Red-osier
Cynoglossum boreale Northern Wild Comfrey
Cypripedium acaule Stemless Lady-slipper
Cypripedium reginae Showy Lady-slipper
Decodon verticillatus Swamp Loosestrife
Dryopteris clintoniana Clinton's Wood Fern
Dryopteris cristata Crested Shield Fern
Dryopteris spinulosa Spinulose Wood Fern
Drosera rotundifolia Sundew
Dulichium arundinaceum Three-way Sedge
Eleocharis Spike-rush
Elodea canadensis Elodea
Equisetum arvense Field Horsetail
Equisetum fluviatile Water Horsetail
Equisetum hyemale Scouring-rush
Equisetum scorpoides Dwarf Scouring-rush
Equisetum sylvaticum Woodland Horsetail
Equisetum variegatum Variegated Scouring-rush
Eupatorium maculatum Joe-pie-weed
Eupatorium perforatum Boneset
Fraxinus nigra Black Ash
Fraxinus pennsylvanica Red Ash
Gaultheria hispidula Creeping Snowberry
Gaultheria procumbens Wintergreen
Gaylussacia baccata Black Huckleberry
Gentiana procera Fringed Gentian
Gentiana rubricaulis Closed Gentian
Glyceria canadensis Rattlesnake Mannagrass
Glyceria striata Fowl Manna Grass
Gymnocarpium dryopteris Oak Fern
Habenaria clavellata Club-spur Orchid
Habenaria dilatata Bog-candle
Habenaria hyperborea Northern Tall Bog Orchid
Habenaria obtusa Blunt-leaf Orchid
Habenaria psycodes Small Purple-fringed Orchid
Heteranthera dubia Water Star-grass
Hierochloe odorata Sweet Grass
Hippuris vulgaris Mare's-tail
Hydrocotyle americana Water-Pennywort
Hypericum kalmianum Kalm's St. John's-wort
Ilex verticillata Michigan Holly
Impatiens capensis Spotted Touch-me-not
Iris pseudacorus Yellow Flag
Iris versicolor Wild Blue Flag
Iris virginica Southern Blue Flag
Juncus Rush
Kalmia polifolia Bog Laurel
Larix laricina Larch
Lathyrus palustris Marsh Pea

Ledum groenlandicum Labrador Tea
Leersia oryzoides Rice Cutgrass
Lemna minor Duckweed
Lemna trisulca Star Duckweed
Liparis loeselii Fen Orchid
Listera convallariodes Broad-leaved Twayblade
Lobelia cardinalis Cardinal Flower
Lobelia siphilitica Great Lobelia
Ludwigia palustris Water-purslane
Lycopus americanus Water Horehound
Lysimachia terrestris Swamp-candle
Lysimachia thyrsiflora Tufted Loosestrife
Lythrum salicaria Purple Loosestrife
Matteucia struthiopteris Ostrich Fern
Megalodonta beckii Water-marigold
Mentha piperita Peppermint
Menyanthes trifoliata Buckbean
Mimulus Monkeyflower
Mitchella repens Parridgeberry
Mitella nuda Naked Miterwort
Myosotis scorpioides True Forget-me-not
Myrica gale Sweet Gale
Myriophyllum Water-milfoil
Najas flexilis Naiad
Nasturtium officinale Watercress
Nemopanthus mucronatus Mountain-holly
Nuphar variegata Pond-lily
Nymphaea odorata Water-lily
Onoclea sensibilis Sensitive Fern
Ophioglossum vulgatum Adder's Tongue
Osmunda cinnamomea Cinnamon Fern
Osmunda claytoniana Interrupted Fern
Osmunda regalis Royal Fern
Parthenocissus quinquefolia Virginia Creeper
Parnassia glauca Grass-of-parnassus
Phalaris arundinacea Reed Canarygrass
Phragmites australis Reed
Picea mariana Black Spruce
Pinus strobus White Pine
Pogonia ophioglossoides Rose Pogonia
Polygala paucifolia Fringed Polygala
Polygonum amphibium Water Smartweed
Polygonum persicaria Lady's Thumb
Populus grandidentata Big-tooth Aspen
Populus tremuloides Quaking Aspen
Potentilla anserina Silverweed
Potentilla fruticosa Shrubby Cinquefoil
Potentilla palustris Marsh Cinquefoil
Potamogeton Pondweed
Proserpinaca palustris Mermaid-weed
Prunella vulgaris Self-heal
Pyrola asarifolia Pink Pyrola
Pyrola elliptica Shinleaf
Ranunculus longirostris White Water Crowfoot

Ranunculus recurvatus Hooked Crowfoot
Ranunculus reptans Creeping Speerwort
Ranunculus sceleratus Cursed Crowfoot
Ribes americanum Wild Black Current
Ribes triste Swamp Red Current
Rosa palustris Swamp Rose
Rubus flagellaris Northern Dewberry
Rubus hispidus Swamp Dewberry
Rubus pubescens Dwarf Raspberry
Rumex crispus Curly Dock
Rumex obtusifolius Bitter Dock
Rumex verticillatus Water Dock
Sagittaria latifolia Duck-potato
Salix amygdaloides Peach-leaved Willow
Salix bebbiana Beaked Willow
Salix candida Sage Willow
Salix cordata Sand-dune Willow
Salix discolor Pussy Willow
Salix exigua Sandbar Willow
Salix lucida Shining Willow
Salix myricoides Blue-leaf Willow
Salix petiolaris Slender Willow
Salix sericea Silky Willow
Sambucus canadensis Common Elderberry
Sanicula marilandica Black Snakeroot
Sarracenia purpurea Pitcher-plant
Scirpus Bulrush
Scutellaria galericulata Common Skullcap
Scutellaria lateriflora Mad-dog Skullcap
Sium suave Water-parsnip
Solanum dulcamara Deadly Nightshade
Solidago graminifolia Grass-leaved Goldenrod
Sorbus decora Mountain Ash
Sparganium Bur-reed
Spartina pectinata Cordgrass
Spiraea alba Meadowsweet
Spiranthes cernua Nodding Ladies'-tresses
Spiranthes romanzoffiana Hooded Ladies'-tresses
Spirodela polyrhiza Greater Duckweed
Teucrium canadense American Germander
Thalictrum dasycarpum Purple Meadowrue
Thelyperis palustris Marsh Fern
Thuja occidentalis White Cedar
Tiarella cordifolia Foamflower
Triadenum fraseri Marsh St. John's-wort
Typha angustifolia Narrow-leaved Cat-tail
Typha latifolia Common Cat-tail
Ulmus americana American Elm
Urtica dioica Stinging Nettle
Utricularia Bladderwort
Vaccinium angustifolium Low Sweet Blueberry
Vaccinium macrocarpon Large Cranberry
Vaccinium myrtilloides Velvet-leaf Blueberry
Vaccinium oxycoccos Small Cranberry

Vallisneria americana Tape-grass
Viburnum lentago Nannyberry
Viola blanda Sweet White Violet
Viola conspersa Dog Violet
Viola cucullata Marsh Violet
Viola macklowskeyi Smooth White Violet
Wolffia punctata Water-meal
Woodwardia virginica Spatterdock

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