

resource information base  
august 1979

# SLEEPING BEAR DUNES



NATIONAL LAKESHORE / MICHIGAN

SLEEPING BEAR DUNES  
NATIONAL LAKESHORE

RESOURCE INFORMATION BASE

AUGUST 1979

U.S. DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE  
DENVER SERVICE CENTER

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## O V E R V I E W

The information included in this Resource Information Base for Sleeping Bear Dunes National Lakeshore was collected for the 1977-1979 general management planning effort. During the planning process, the lakeshore was divided into six units--North and South Manitou islands, Good Harbor, Glen Lake, Empire, and Platte. (The boundaries of the four mainland units are defined generally by drainage basins; see Planning Units map.) Information for various aspects of the natural environment is discussed by planning unit wherever there is sufficient detail. Much of the information on the natural environment has been collected by Paul W. Thompson, Cranbrook Institute of Science.

### NATURAL ENVIRONMENT

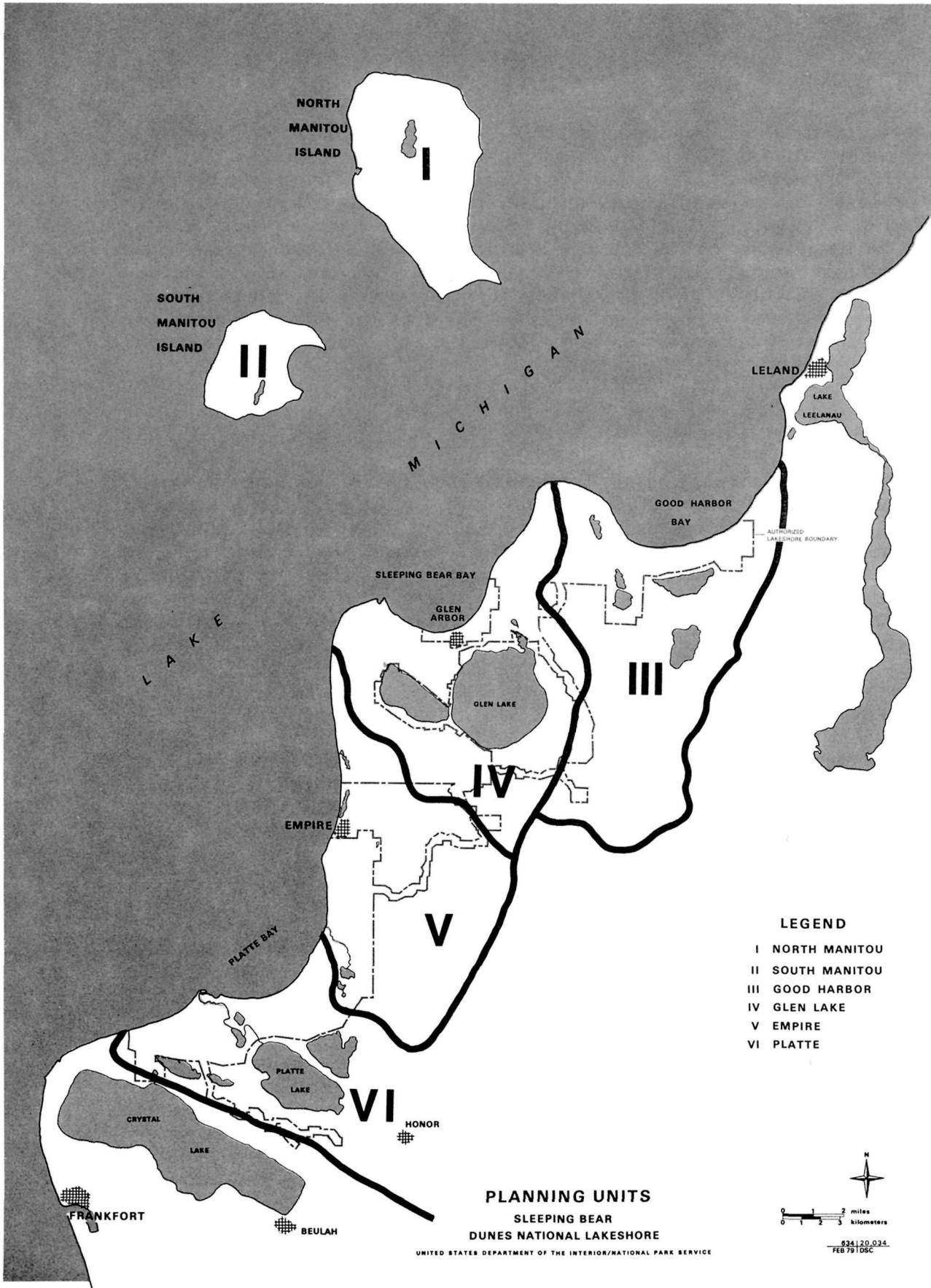
The topography of the Upper Great Lakes region--Michigan, Wisconsin, and Minnesota--has been and continues to be sculptured by geologic processes. The onset of continental glaciation thousands of years ago resulted in numerous glacial landforms in the area of Sleeping Bear Dunes--moraines, lakes, and drainage channels, all of which are easily observed. Post-glacial lake formations, although not highly visible, are part of the continuing sequence of geologic events. The filling of bays, the erosion and accretion of beaches, the wearing away of headlands, and the formation of sand dunes (such as Sleeping Bear Dune itself) are processes that continue to change the landscape.

Soils are predominantly sandy and well drained, making them conducive to outdoor recreational activities such as hiking, camping, and picnicking in most areas and agriculture in others. Despite steeply sloped hills, water runoff and erosion are not major problems because of the porous, sandy soils.

Climatic conditions along coastal zones and in open areas have a pronounced influence on resource management, as well as visitor use. Blowing sand in nonvegetated areas, cold winter winds, moisture, and fog all have a bearing on plants and animals, along with the visitor experience and the type of facilities that are provided.

The Sleeping Bear Dunes area exhibits a wide variety of plant associations--from open beach/active dune areas to canopied beech/maple forests. Plant succession and adaptation clearly illustrate the interrelationship of plants and soils, wind, and water.

Many wildlife species inhabit the Sleeping Bear Dunes area, with deer hunting and fishing for coho salmon and steelhead being popular recreational activities associated with these resources.



**NORTH  
MANITOU  
ISLAND**

**SOUTH  
MANITOU  
ISLAND**

**M I C H I G A N**

**LELAND**

**LAKE  
LEELANAU**

**GOOD HARBOR  
BAY**

AUTHORIZED  
LAKESHORE BOUNDARY

**SLEEPING BEAR BAY**

**GLEN  
ARBOR**

**GLEN LAKE**

**L A K E**

**EMPIRE**

**PLATTE BAY**

**PLATTE  
LAKE**

**CRYSTAL  
LAKE**

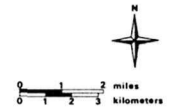
**FRANKFORT**

**BEULAH**

**HONOR**

**LEGEND**

- I NORTH MANITOU
- II SOUTH MANITOU
- III GOOD HARBOR
- IV GLEN LAKE
- V EMPIRE
- VI PLATTE



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## CULTURAL RESOURCES

Cultural resources found in the area reflect the lumbering, maritime, agricultural, and resort era history of northwestern Michigan, as well as prehistoric occupation. The establishment of lifesaving stations and lighthouses in the 1800s along the Lake Michigan shoreline indicates the importance of commercial shipping to the economic development of the region. Tourism became a major industry in the Sleeping Bear Dunes area after the turn of the century.

## USE BY VISITORS

Located within the five-county Grand Traverse Bay region, the national lakeshore is within an area of diverse recreation resources that is attracting growing numbers of vacationers and permanent as well as summer residents. Prior to the establishment of Sleeping Bear Dunes National Lakeshore, recreational opportunities in the area centered around two state parks--Benzie and D.H. Day. The integration of these parks and other areas into an area of the National Park System has significantly increased the land base for public recreation. This change will increase opportunities for use by visitors and will permit the separation of conflicting uses.

Traverse City, 20 miles east of Sleeping Bear Dunes, provides the majority of transportation (air and bus) and visitor facilities and services for the region. Communities nearer the national lakeshore, such as Empire and Glen Arbor, provide only a limited range of visitor services, although they have the potential for accommodating more public use.



# N A T U R A L   E N V I R O N M E N T

## GEOLOGY

### Surface

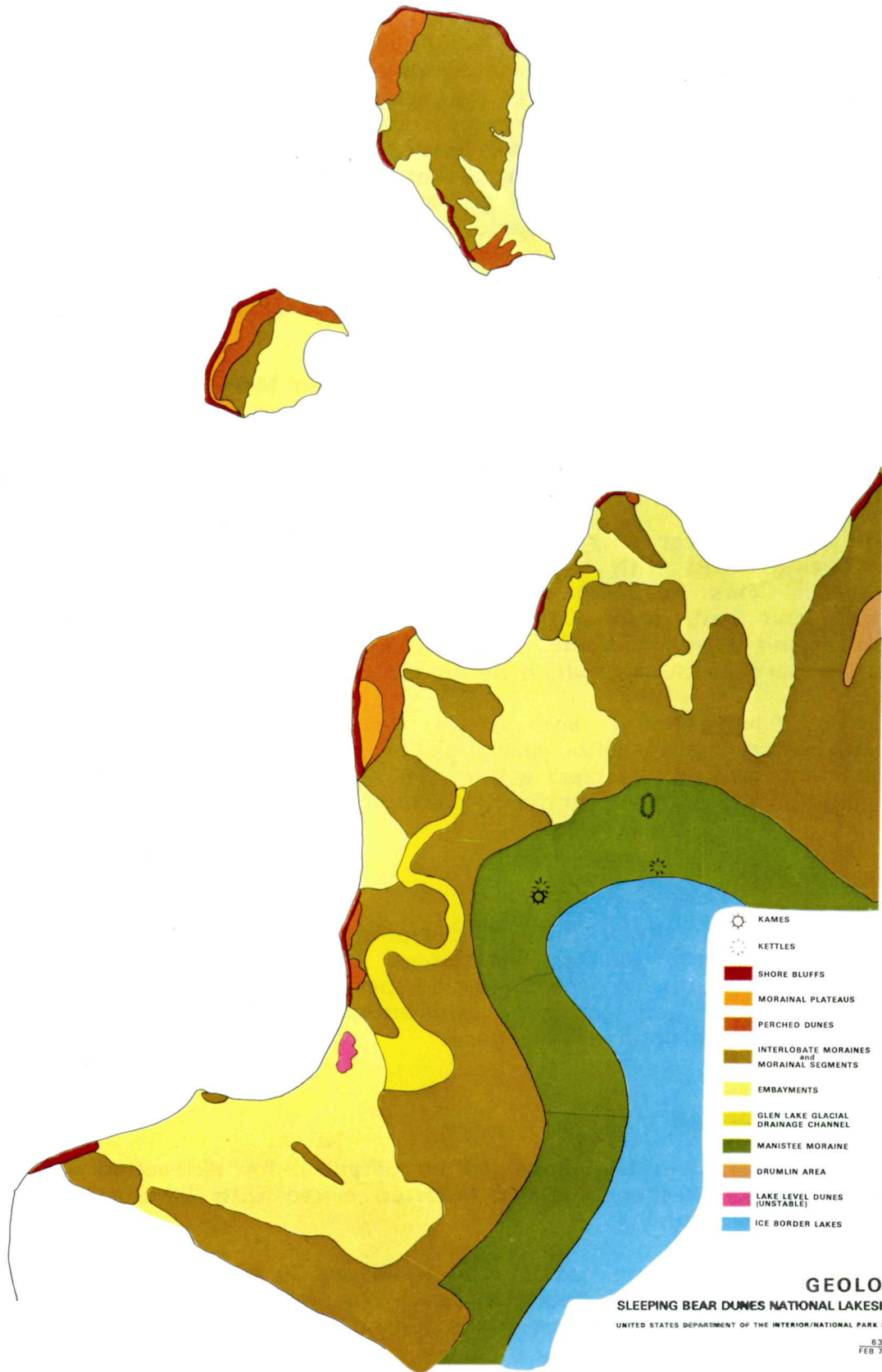
The land-sculpting effect of continental glaciation in northwest Michigan is clearly illustrated in the geologic features of the Sleeping Bear Dunes region. Fifty thousand years ago a tremendous mass of ice pushed slowly southward down the basin of Lake Michigan and spread out across Michigan. Where this glacial advance halted, huge quantities of debris -- sand, clay, and gravel -- were deposited as terminal hills, such as the Manistee moraine. The formation of this moraine is considered to be the climactic event of the glacial processes that shaped the Sleeping Bear Dunes area (see Geology map).

Immense headlands, characteristic of the Lake Michigan shoreline in the vicinity of Sleeping Bear Dunes, for the most part resisted the force of the advancing ice mass and steered the icy lobes into the valleys. The ice lobes gouged debris from the valley floors and deposited it along the sides of the valleys when the ice finally melted, creating prominent moraines. Generally, these moraines and the valleys between them are oriented in a north-south direction (see Elevations map).

As the ice began to melt, these valleys, whose entrances were still blocked by ice in the Lake Michigan basin, filled with water. The Glen Lake moraine (Alligator Hill) became an island between the unmelted ice in the Lake Michigan basin and the adjacent moraines -- Prospect Hill, Miller Ridge, and the Sleeping Bear plateau.

Meltwaters flowed southward from the glacier front and formed extensive outwash plains in southern Leelanau County and northern Benzie County. Where meltwater cut through the Manistee moraine, a drainage channel leading southward into the Platte plains area was formed. The meltwater in several channels flowed opposite to the direction in which the streams run today; when the ice blockage disappeared, the flow was reversed and the streams began to run into the Lake Michigan basin. South of the Manistee moraine, the southward movement of a thin sheet of ice formed drumlins--long, rounded hills oriented in the direction of the ice flow. Ice border lakes were also formed as the ice dropped below the level of the Manistee moraine. The drumlins and most of the ice border lakes are located outside the Sleeping Bear Dunes boundary.

As the glacial ice receded to the north, an immense volume of meltwater filled the Lake Michigan basin to form post-glacial lakes at



**GEOLOGY**

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four successive levels--Lakes Algonquin, Nipissing, Algoma, and Chippewa. The elevation and extent of these lakes were dependent on the elevation of the lowest outlet available during that period. Evidence of these lakes can be seen through features such as wave-cut bluffs, beach terraces, sand bars, ridge and swale formations, and old sandy lake plains. When water receded from the lake plains, many smaller lakes were left in the embayment areas. In addition to mixed glacial materials, tremendous amounts of sand accumulated at various points throughout the region. These were later shaped by wind into the unusual variety of dunes found between Point Betsie and Good Harbor Bay, which include ancient dunes associated with the post-glacial lakes and modern dunes.

Two types of dunes were and still are being formed: those at or near lake level, which are related to the shoreline, and perched dunes, which are related to eroding headlands. Storm waves cutting away at the base of morainal plateaus continue to provide sand for dune formation.

The Sleeping Bear shoreline is being slowly straightened--the bays are being filled with sand and the morainal headlands are being eroded. This headland erosion is continuing at Sleeping Bear Bluffs and South Manitou Island, and to a lesser degree, at Empire Bluffs and Pyramid Point. Sand blowing up the eroding slopes causes perched dunes, which lie on top of morainal bluffs.

Kettles (depressions) and kames (mounds) are other geologic features associated with glaciation of the Sleeping Bear region. Important features located within the national lakeshore are shown in table 1 and on the Significant Geologic Features map.

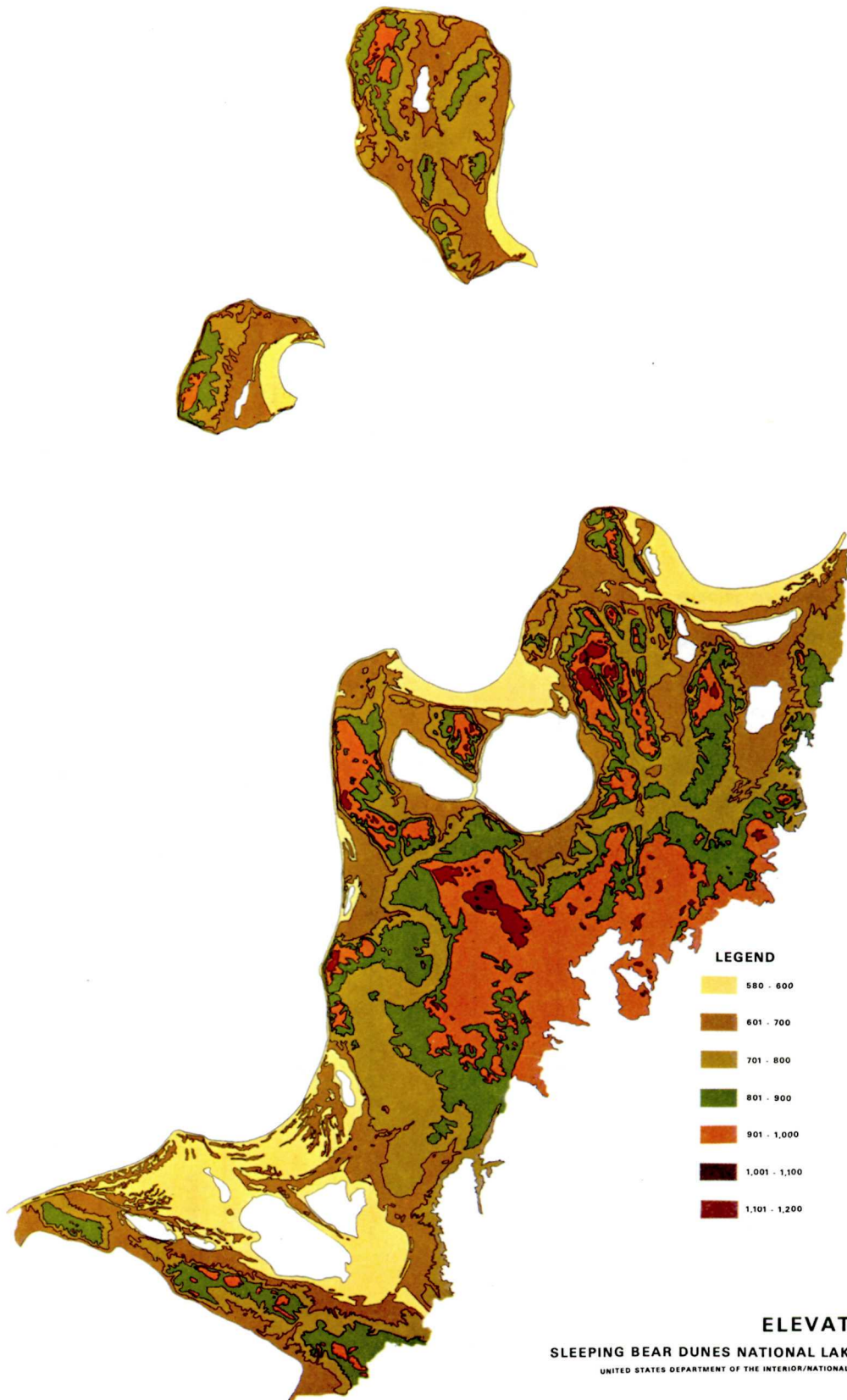
### Subsurface

The bedrock in the vicinity of Sleeping Bear Dunes consists of a series of slightly inclined limestones, gypsums, sandstones, and shales formed during the Devonian period. Because of a thick cover of glacial and lacustrine sediments, bedrock does not outcrop anywhere in the national lakeshore.

### Economic Potential

Sand, gravel, and clay have limited potential for extraction within the national lakeshore. Sand is often mixed with limestone, and clay is of poor quality.

The closest producing gas and oil wells are 30 to 40 miles east and southeast of Sleeping Bear Dunes. The reserves are associated with pinnacle reef development in Grand Traverse, Kalkaska, and Otsego counties.



**ELEVATIONS**

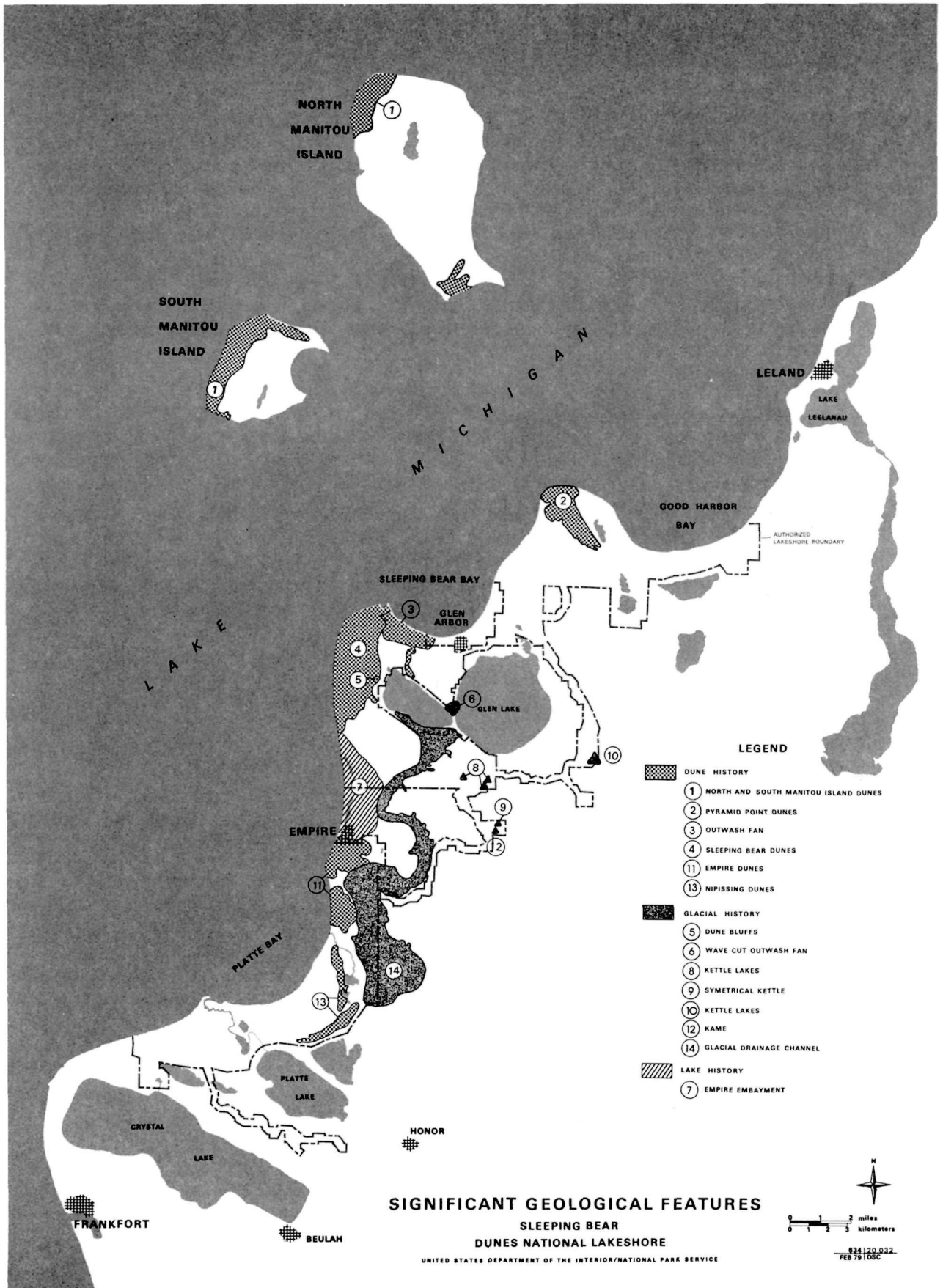
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Table 1: Significant Geological Features

PLANNING UNIT	Interlobate moraine	Morainal plateau	Terminal moraine	Kettle (fragile, loose sand)	Kettle lake	Kame	Wave-cut bluff (former lake level)	Shoreline bluff	Perched dunes	Glacial drainage channel	Embayment	Lake-level dunes (unstable)	Ice border lakes/drumlins	COMMENTS
North Manitou	X	X					X	X	X					Research needed concerning unit's resources
South Manitou	X	X						X	X		X			Excellent examples of perched dunes and shoreline bluffs
Good Harbor	X							X		X	X	X		A fine example of lake-level vegetated dunes at and near Good Harbor Beach; good example of glacial drainage channel
Glen Lake	X	X	X	X*	X	X	X	X	X	X	X		X	Good examples of recent and Pleistocene wave-cut bluffs, glacial history of area evident (outwash fan, glacial channel, notch); classic perched dune; good example of morainal plateau
Empire	X				X			X	X	X	X	X	X	Good example of glacial drainage channel and resultant cut bank; excellent examples of perched dunes and shoreline bluffs
Platte	X										X	X		Excellent examples of embayment geologic features and Nipissing dunes

\*Best kettle in area.



NORTH  
MANITOU  
ISLAND

SOUTH  
MANITOU  
ISLAND

M I C H I G A N

LELAND

LAKE  
LEELANAU

GOOD HARBOR  
BAY

AUTHORIZED  
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SLEEPING BEAR BAY

GLEN  
ARBOR

GLEN LAKE

EMPIRE

PLATTE BAY

PLATTE  
LAKE

CRYSTAL  
LAKE

FRANKFORT

BEULAH

HONOR

**LEGEND**

- DUNE HISTORY**
- ① NORTH AND SOUTH MANITOU ISLAND DUNES
- ② PYRAMID POINT DUNES
- ③ OUTWASH FAN
- ④ SLEEPING BEAR DUNES
- ⑪ EMPIRE DUNES
- ⑬ NIPISSING DUNES
- GLACIAL HISTORY**
- ⑤ DUNE BLUFFS
- ⑥ WAVE CUT OUTWASH FAN
- ⑧ KETTLE LAKES
- ⑨ SYMMETRICAL KETTLE
- ⑩ KETTLE LAKES
- ⑫ KAME
- ⑭ GLACIAL DRAINAGE CHANNEL
- LAKE HISTORY**
- ⑦ EMPIRE EMBAYMENT

**SIGNIFICANT GEOLOGICAL FEATURES  
SLEEPING BEAR  
DUNES NATIONAL LAKESHORE**

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## SOILS

Soils have been analyzed at two levels. For general planning, soil types of similar surface texture, particle size, slope, and drainage characteristics were grouped into soil associations. These associations enable areas of Sleeping Bear Dunes to be compared and the land uses these areas are most suited for to be identified. The soil types contained in these associations were then analyzed in detail to determine specific site locations for agricultural practices (cultivated and forage crops, orchards, etc.) and recreational development (trails, roads, picnic areas, campgrounds, and buildings). Significant associations and their characteristics are listed in table 2.

## HYDROLOGY/WATER QUALITY

### Surface

Surface drainage watersheds in the Sleeping Bear region were formed by glacial processes. Each watershed reflects a distinct area of lakes, streams, runoff patterns, groundwater storage, and water movement. This is an important hydrologic characteristic because development in one watershed will not necessarily affect water quantity and quality in another.

Lake Michigan is the sixth largest freshwater lake in the world and the third largest of the Great Lakes. Water quality is suitable for all water-oriented uses, although cold lake temperatures limit swimming opportunities to one or two months a year. Mild pollution (coliform count exceeding 1,000 organisms per 100 milliliters) occurs at Frankfort, Empire, Glen Haven, and Leland. Significant variations in water level and wave action on Lake Michigan have resulted in flooding and erosion along the shoreline, affecting recreation and residential development.

The surface waters of Benzie and Leelanau counties drain into Lake Michigan. Drainage basins within Sleeping Bear Dunes include the Platte River watershed, which drains most of the northern Benzie County and a small area in Leelanau County, and the Glen Lake watershed, which drains much of the Sleeping Bear Dunes area by means of the narrow, winding channel of the Crystal River. Other smaller watersheds are in the Empire and Good Harbor Bay areas.

There are over twenty lakes (mostly under 100 acres) and the mouths of one river and four creeks within and near Sleeping Bear Dunes (see table 3). All of the larger lakes (those over 300 acres) are outside the boundary, but some drain into Lake Michigan through the national lakeshore. Because of environmental factors (for example, shallow water and lack of sandy beaches), there are

Table 2: Soil Associations, Leelanau County

Association	Location	Drainage	Surface texture	Slope	Potential uses	Limitations and concerns
Deer Park/Dune	Wooded and active dunes	Well drained	Sandy	Strongly sloping to very steep	Recreation Woodland and wildlife	Low available water capacity Low fertility Low organic content Blowing soil
East Lake/Eastport/Lupton	Beach ridges and lake terraces	Well drained (East Lake and Eastport soils)	Sandy (East Lake and Eastport soils) Mucky (Lupton soils)	Nearly level to gently sloping	Orchards Cultivated and forage crops (moderately suited) Woodland and wildlife	Low available water capacity Erosion control Low fertility
Emmet/Omena	Moraines (drumlins are a common feature)	Well drained	Loamy	Nearly level to very steep	Orchards Cultivated and forage crops Woodland and wildlife	Low available water capacity Erosion control (uplands) Low fertility Frost (valleys)
Emmet/Leelanau	Moraines and till plains	Well drained	Loamy and sandy	Nearly level to very steep	Orchards Cultivated and forage crops (moderately suited) Woodland and wildlife	Low available water capacity Low fertility Erosion
Kalkaska/East Lake	Moraines	Well drained	Sandy	Moderately steep to very steep	Woodland and wildlife Recreation	Erosion Steep slopes Low fertility Low available water capacity
Kalkaska/Mancelona	Outwash plains	Well drained	Sandy	Nearly level to strongly sloping	Woodland and wildlife	Blowing soil Low fertility (uplands) Low available water capacity (uplands)
Kiva/Mancelona	Outwash plains	Well drained	Loamy and sandy	Nearly level to strongly sloping	Cultivated and forage crops Woodland and wildlife	High gravel content Low available water capacity Erosion Low fertility
Leelanau/Mancelona	Moraines	Well drained	Sandy	Strongly sloping to very steep	Cultivated and forage crops (only milder slopes) Pasture (steeper slopes if runoff and erosion are controlled) Woodland and wildlife	Erosion Steep slopes Low available water capacity Low fertility



only a few lakes within the lakeshore boundary that are suitable for swimming, notably Little Glen and North Bar lakes.

### Subsurface

The availability of groundwater is variable, with the depth to groundwater directly related to land surface elevations. Groundwater depths in the embayment areas within 1,000 feet of Lake Michigan are 4 feet or less, and they increase to 100 feet or more farther inland.

Data from several sources indicate an aquifer system (Silurian-Devonian) beneath a layer of glacial drift in the Sleeping Bear Dunes area. These glacial deposits generally increase the availability of groundwater. Surface deposits containing significant quantities of sand or gravel yield large supplies of groundwater, while those containing large amounts of clay and silt are poor retainers of groundwater. The sandy morainal and lacustrine sand deposits throughout most of Sleeping Bear Dunes have moderate water-yielding potential (100 to 500 gallons-per-minute yields expected of 8-inch and larger wells).

### Planning Units

A feasibility study of regional water and sewer systems was completed in 1973, and it related planned development within the national lakeshore to hydrologic characteristics of the sites. Baseline water data from this study are still applicable. Lowland (lake level to 900 feet) and highland (900 to 1,000 feet) hydrologic characteristics are discussed below for each planning unit.

North Manitou. Two inland lakes, Tamarack and Manitou, are on North Manitou Island. Because of Lake Manitou's size and potential for recreational use, it should be investigated to determine water quality and sensitivity to human disturbance.

South Manitou. Florence Lake is the only inland lake on South Manitou Island. This unique lake has no inlets or outlets, which precludes extensive development, but it appears to have excellent water quality at present. Nutrient concentrations and chloride levels are low, with high dissolved oxygen in the upper 12 feet of water. Groundwater should normally be available at depths of less than 200 feet.

Good Harbor. Numerous small lakes and three creeks constitute the surface hydrology of this planning unit. Lime Lake, which flows into Little Traverse Lake by means of Shetland Creek, is a clean oligotrophic lake with low concentrations of solids and coliform

bacteria and high levels of dissolved oxygen. School and Bass lakes, together with Hidden, Shell, and Narada lakes, should be investigated to establish baseline water characteristics.

A shallow groundwater aquifer is available to supply water; however, this water source is unprotected and subject to contamination. The depth to groundwater in highland areas is 100 to 300 feet.

Glen Lake. Water bodies in this drainage basin include Crystal River, Fisher Lake, Glen and Little Glen lakes, and Tucker and Brooks lakes. Results of a 1973 baseline survey indicate good water quality conditions. The Glen lakes, Fisher Lake, and the Crystal River show some aging (eutrophication), which may be associated with degraded water quality. Without domestic waste controls, eutrophication will continue to lower water quality at a faster rate in the future than in the past. Since water quality is generally good, visitor participation in primary contact recreational activities has not been affected.

Geological records show that a shallow water table aquifer, which is probably connected to Lake Michigan, exists in the bay area. A deeper aquifer, separated from the water table by semipervious or impervious clays, is also indicated. Thus, a suitable water supply to satisfy the short-range needs of the area is readily available. It is recommended, however, that wells into deeper aquifers be developed whenever possible. The depth to groundwater in highland areas is 100 to 300 feet.

Empire. Hydrologic data are lacking for North and South Bar lakes. Studies should be conducted to determine baseline water characteristics for North Bar Lake. Groundwater in the highland areas is from 100 to 300 feet beneath the surface.

Platte. Only 7 percent of the Platte River watershed is within the National Park Service boundary. The Platte embayment contains six lakes drained by the Platte River and three lakes drained by spring-fed Otter Creek. Because of rapid flushing characteristics, the water quality of the lakes and rivers in this unit is fairly high. However, because of a high water table and poor soils, extensive development in the Platte embayment would make the area especially susceptible to pollution.

Groundwater should be readily available, but wells should be deeper than 100 feet to avoid contamination of water supplies. Extensive development would require a public water and sewer system. The depth to groundwater is 100 to 300 feet in highland areas.

Table 3. - Hydrologic Characteristics

Lake	Lake area (acres)	Lake to watershed ratio	In-let	Out-let	Max. depth (ft.)	Water temp. (max.)	Water quality	Self-help program	Access	Facilities	Present uses	General
Florence	72				26		Excellent					
Manitou	248	1:11.83		X			Excellent				Fishing	
Tamarack	*											
Lime	670	1:10.51	X	X	67			X				Lake association
Little Traverse	640	1:3.92		X	54							
School	175	1:19.89	X	X	6						Fishing Boating	Largest lake to watershed ratio in Leelanau County.
Bass	94		X									
Narada	14											
Shell	93											
Hidden	*											
Fisher	42		X	X								
Tucker	16		X	X								
Little Glen	1,404	1:8.84		X	13		Good				Swimming Boating	Lake association
Glen	4,822	1:2.57	X	X	130		Good				Fishing Swimming Boating	Lake association
Taylor	5											
North Bar	*						Good				Fishing	
South Bar	78		X	X							Fishing	
Deer	*											
Bass	29											
Otter	64		X	X							Fishing	
Loon	95		X	X	65		Good				Boating	
Mud	59		X								Boating	
Long	320	1:2.19			20							
Rush	101	1:7.44										
Round	*											
Big Platte	2,504	1:2.91	X	X	90			X			Fishing Boating	Lake association Platte River State Hatchery discharges phosphorous into Big Platte
Little Platte	885	1:2.24	X	X	8							

\*Not available

## CLIMATE

### General Influences

Extreme seasonal temperature variations and a fairly even annual distribution of precipitation are typical of the Upper Great Lakes region, which is near the center of the North American continent. However, climatic conditions in the vicinity of Sleeping Bear Dunes National Lakeshore are strongly influenced by Lake Michigan, which has a stabilizing effect on air temperatures. Because of the prevailing westerly winds, winters (November through March) are milder and summers (June through August) cooler along the shoreline than in the interior areas. This moderating effect on air temperature, and the fact that air drainage patterns form micro-climates (localized air pockets) near the shore, result in a growing period of 150 days for agricultural crops, compared to a period of 100 days a few miles inland.

In spring, cool Lake Michigan water tends to level temperature extremes along the shoreline, reducing the incidence of frost damage. During summer, when the main storm track moves northward into Canada, differential heating between land and water areas frequently result in a lake breeze during periods of easterly winds, cooling temperatures during hot weather.

In the fall, warmed lake water moderates the arrival of the season's cold air masses moving southward from Canada, allowing vegetation to mature before the first frost. Another effect of Lake Michigan on the Sleeping Bear region is increased cloudiness in late fall and early winter. The cold, winter air mixing with warmer, moist air from the lake often results in snow, rain, and fog nine months of the year.

### Local Climatic Conditions

Climatic data on temperatures and precipitation were recorded in Frankfort, four miles south of the national lakeshore. Only when southerly winds are strong enough to overcome the lake breeze does the temperature climb to the 90°F level. From June through August, daily maximum temperatures are within the 71°F to 90°F range, making this the most suitable period for water-oriented recreation. In winter, temperature readings below zero are recorded on an average of only four days per year.

Average annual precipitation is between 28 and 32 inches. Infrequent thundershowers produce most of the summer precipitation within the national lakeshore. There are nearly 50% fewer days with measurable precipitation in summer than in winter months. Snowfall totals average about 95 inches on the shoreline and

increase to between 120 and 130 inches inland (Otsego County). Measurable snowfall occurs on an average of 15 days each month from December to March.

Data show a prevailing wind direction from the southwest, averaging 10.8 mph, throughout most of the year. In fall and early winter, the prevailing direction is northwest, and in late winter it is northeast.

In summary, climate has a pronounced influence on operations and development within the national lakeshore--especially in nonvegetated shoreline areas where wind and sand intermix to produce a blasting effect. Cold air temperatures and strong winds combine to create a chill factor that should be considered in the management of winter activities. Fog, especially in the fall, may disrupt boat service to the Manitou islands and limits visibility at scenic overlooks.

#### AIR QUALITY

According to the Michigan Department of Natural Resources, pollutant levels in Benzie and Leelanau counties have not been monitored. However, it is believed that the levels for suspended particulates, sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead are within the existing national ambient air quality standards. It is thought that the levels of ozone exceed the established standard in these counties, as in most counties in Michigan as well as in the Midwest.

#### VEGETATION

Because of its diverse geological character, the Sleeping Bear region exhibits a wide variety of plant associations, such as those associated with dune, forest, plain, meadow, swamp, and aquatic environments (see Vegetation map). The processes of plant succession and adaptation are clearly demonstrated at various sites throughout Sleeping Bear Dunes.

The effects of years of timber cutting after the arrival of settlers in northwestern Michigan in the mid-19th century are apparent today. Where infertile soils forced the abandonment of agricultural practices, trees either regenerated or were replanted, resulting in scattered second-growth forests.

Because of the diversity of ecological habitats within Sleeping Bear Dunes, it is difficult to categorize plant communities solely by dominant species. In the following section, geological terms have been used where a plant association is best described by the



**LEGEND**

- BEECH-MAPLE FOREST
- BEECH & ACTIVE DUNE (INCLUDING FOREDUNE, MORAINAL BLUFF & PLATEAU)
- STABILIZED DUNE
- HEATH
- PINE-OAK-ASPEN FOREST
- SWAMP-BOG-MARSH
- LAKE & POND
- ORCHARDS
- ASPEN-BIRCH
- CLEARED LAND (FARMLAND, OLD FIELDS, ETC.) (ELEVATION MAP)

**VEGETATION**

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accompanying landform. Plant succession in the region begins on the barren, sandy beach and climaxes in the beech/maple forest farther inland. The following series is typical of this successional series in embayment areas:

Beach/Active Dune--Beyond the beach, where wave action makes plant growth impossible, only a few plant species can be found--American searocket, seaside spurge, and beach pea. Various grasses grow adjacent to this zone and begin to stabilize the wind-blown sand.

Heath--Dominant plant species in this group include shrubs such as sand cherry, common and creeping juniper, buffalo berry, bearberry, chokecherry, and an occasional cottonwood tree, and flowering species such as dune wormwood, false heather, and evening primrose. This vegetational stage is commonly found inland from the beach and on morainal bluffs and plateaus.

Stabilized Dune--This group could not exist without the improved environmental conditions provided by the heath. Pine trees (red, white, and jack) are often scattered in this zone, resulting in a characteristic clumping of vegetation. Solitary trees are surrounded by low juniper and other shrubs, all ringed by masses of bearberry, mosses, and creeping juniper.

Pine/Oak/Aspen--This association is open woodland in character and is dominated by red oak mixed with conifers from the preceding association. Bracken fern, smooth aster, and cow wheat are often found growing beneath the oaks. On poor soils, aspen communities are found, with dominant species being the largetooth and quaking aspen.

Beech/Maple--The beech/maple hardwood forest occurs as a climax woodland in many parts of the northeastern United States. Commonly found on morainal hills, the dominant species are sugar maple and beech, mixed with basswood, ironwood, black cherry, red oak, and white ash. Where moisture is sufficient, hemlock and yellow birch are also found. Characteristic of this forest type is the dense cover of flowering plants in the spring and the colorful tree foliage in the fall.

Plant succession in old, abandoned fields (orchards, pastures, croplands) will eventually climax in a beech/maple forest. Apple trees and black locust (for example, at Glen Haven) have been introduced and have established themselves in some old fields.

Another successional series characteristic of Sleeping Bear Dunes begins near or in the water of inland ponds and lakes. These plant associations can be divided into the aquatic (lake and pond), swamp (swamp and bog), and aspen/birch groups.

Lake and Pond--Species found in shallow water include cattails, arrowgrass, arrowhead, water smartweed, and bulrush. Spearmint, marsh pea, sedge, bugleweed, and others are found near the water's edge.

Cedar Swamp--The dominant species in the cedar swamp is white cedar, mixed with yellow birch, balsam fir, and tamarack in damper areas. Where the trees grow close together, there is little vegetation; where they do not, they are interspersed with American elm, black ash, and green ash.

Black Spruce/Quaking-Mat Bog--In the black spruce/quaking-mat bog, black spruce trees mixed with tamarack occur in clumps, and the open spaces are usually filled with Canada blueberry, leatherleaf, bog rosemary, swamp laurel, and others. A thick mat of sphagnum or other mosses, mixed with sedges, extends over the water in the quaking-mat bog.

Aspen/Birch--The aspen, yellow and white birch, and white cedar are the dominant species in this group.

Other plant associations not discussed in the preceding two successional series include those related to the morainal bluff and plateau, sedge meadows, wetland swales, marsh, and river.

Significant plant communities in the Sleeping Bear Dunes area and their location are presented in table 4 and on the Significant Vegetative Features map. Endangered, threatened, and rare plants are identified in table 5.



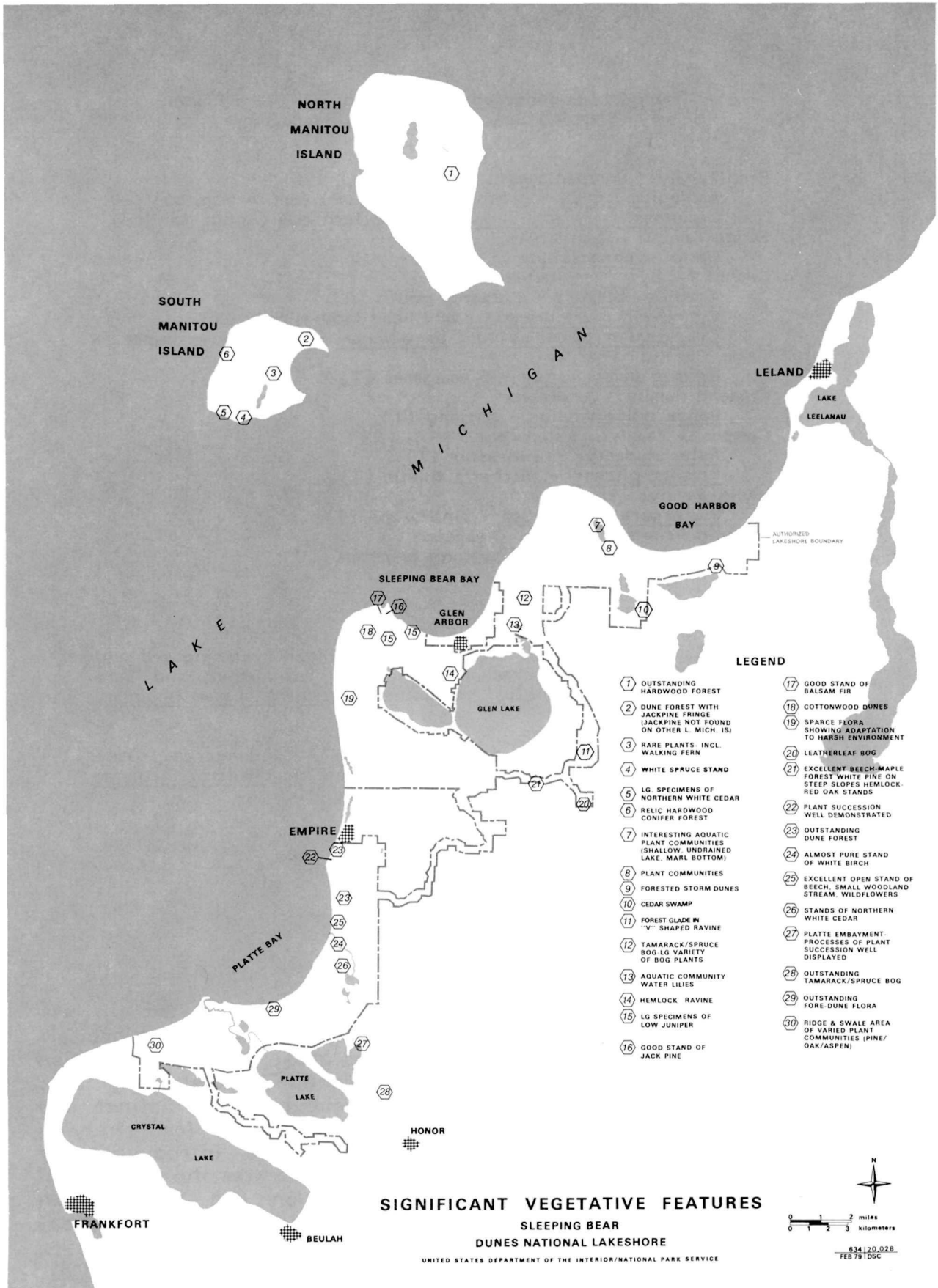
Table 4: Location of Major Vegetation Types

Planning unit	Beach and active dune	Heath	Stabilized dune	Pine/oak/aspens	Beech/maple	Lake and pond	Cedar swamp	Black spruce/quaking-mat bog	Aspen/birch	Significant plant communities*	Special features
North Manitou	X		X	X	X	X		X			
South Manitou	X	X	X	X	X	X	X			White cedar swamp White spruce Jack pine stand	The walking fern, green spleenwort, northern holly fern, nodding trillium, and white spruce found here but not on mainland Jack pine not found on other Lake Michigan islands Largest white cedar, common and red-berried elder, mountain maple in nation
Good Harbor	X	X	X	X	X	X	X	X		Forested storm dunes Cedar swamp Aquatic communities (Shell Lake) Woodland south of School Lake Forest glade in V-shaped ravine Dune and morainal forest (Pyramid Point)	Good successional series from beach to subclimax forest Largest bebb willow in nation
Glen Lake		X	X	X	X	X	X	X	X	Lost Lake bog (spruce) Jack pine stand Glen Lake pond Large specimens of <u>juniperus communis</u> (low juniper) Balsam fir stand Beech/maple forest Cottonwood dunes Hemlock ravine Beech/maple, white pine/hemlock, red oak complex Aquatic communities on Crystal River Leatherleaf bog (Bow lakes)	Largest old field juniper in nation Interesting relic cedar forest Wind, sand, dune grass interaction well illustrated The large ginseng (threatened) found in the Bow lakes area
Empire	X	X	X		X	X	X			Dune forests (with rich spring flora) Pure stand white birch (Otter Creek) Cedar swamp Marsh (Otter Creek)	Evening primrose only found here (at end of Dune Valley Road) Largest pagoda dogwood in nation found here Largest red elm in state found here Only mainland stand of holly fern in lower peninsula Most northern stand of woodland phlox and putty-root orchid Much of the land in this unit has been cleared for agricultural purposes.
Platte	X	X	X	X	X	X	X	X	X	Foredune flora east of Platte River ridge and swale communities (pine/oak/aspens)	Excellent successional series, starting 2 miles east of Platte River.

LEGEND

- X = Vegetative type present in management subunit.
- [White box] = High potential for development and/or recreation.
- [Dotted box] = Moderate potential for development and/or recreation.
- [Stippled box] = Slight potential for development and/or recreation.

\*Significant indicates a species that is rare in the region, an outstanding example of a vegetative type, or other. Access to rare, threatened, and endangered plant communities should be limited since they are significant resources.



NORTH  
MANITOU  
ISLAND

SOUTH  
MANITOU  
ISLAND

M I C H I G A N

LELAND  
LAKE  
LEELANAU

GOOD HARBOR  
BAY

SLEEPING BEAR BAY

GLEN ARBOR

GLEN LAKE

EMPIRE

PLATTE BAY

PLATTE  
LAKE

CRYSTAL  
LAKE

FRANKFORT

BEULAH

HONOR

**LEGEND**

- 1 OUTSTANDING HARDWOOD FOREST
- 2 DUNE FOREST WITH JACKPINE FRINGE (JACKPINE NOT FOUND ON OTHER L. MICH. IS.)
- 3 RARE PLANTS, INCL. WALKING FERN
- 4 WHITE SPRUCE STAND
- 5 LG. SPECIMENS OF NORTHERN WHITE CEDAR
- 6 RELIC HARDWOOD CONIFER FOREST
- 7 INTERESTING AQUATIC PLANT COMMUNITIES (SHALLOW, UNDRAINED LAKE, MARL BOTTOM)
- 8 PLANT COMMUNITIES
- 9 FORESTED STORM DUNES
- 10 CEDAR SWAMP
- 11 FOREST GLADE IN "V" SHAPED RAVINE
- 12 TAMARACK/SPRUCE BOG LG. VARIETY OF BOG PLANTS
- 13 AQUATIC COMMUNITY WATER LILIES
- 14 HEMLOCK RAVINE
- 15 LG. SPECIMENS OF LOW JUNIPER
- 16 GOOD STAND OF JACK PINE
- 17 GOOD STAND OF BALSAM FIR
- 18 COTTONWOOD DUNES
- 19 SPARSE FLORA SHOWING ADAPTATION TO WET ENVIRONMENT
- 20 LEATHERLEAF BOG
- 21 EXCELLENT BEECH-MAPLE FOREST WHITE PINE ON STEEP SLOPES HEMLOCK-RED OAK STANDS
- 22 PLANT SUCCESSION WELL DEMONSTRATED
- 23 OUTSTANDING DUNE FOREST
- 24 ALMOST PURE STAND OF WHITE BIRCH
- 25 EXCELLENT OPEN STAND OF BEECH, SMALL WOODLAND STREAM, WILDFLOWERS
- 26 STANDS OF NORTHERN WHITE CEDAR
- 27 PLATTE EMBAYMENT. PROCESSES OF PLANT SUCCESSION WELL DISPLAYED
- 28 OUTSTANDING TAMARACK/SPRUCE BOG
- 29 OUTSTANDING FORE-DUNE FLORA
- 30 RIDGE & SWALE AREA OF VARIED PLANT COMMUNITIES (PINE/OAK/ASPEN)

**SIGNIFICANT VEGETATIVE FEATURES**  
SLEEPING BEAR  
DUNES NATIONAL LAKESHORE

UNITED STATES DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

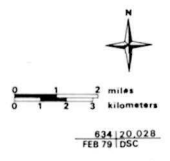


Table 5: Endangered, Threatened, and Rare Plants  
Sleeping Bear Dunes National Lakeshore

Fern Family: Polypodiaceae  
Asplenium viride - green spleenwort (R) (South Manitou)  
Camptosorus rhizophyllus - walking fern (R) (South Manitou)

Sedge Family: Cyperaceae  
Carex sychnocephala (T)

Orchid Family: Orchidaceae  
Arethusa bulbosa - dragon's mouth (R)  
Cypripedium arietinum - ram's head lady-slipper (R)  
Cypripedium calceolus var. parviflorum - yellow lady-slipper (R)

Grass Family: Poaceae  
Bromus pumpellianus - bromegrass (T)

Ginseng Family: Araliaceae  
Panax quinquefolius - ginseng (T)

Composite Family: Asteraceae  
Aster modestus - wild aster (T)  
Cirsium pitcheri - pitcher's thistle (T)

Heath Family: Ericaceae  
Pterospora andromedea - pine-drops (T)

Evening Primrose Family: Oleaceae  
Oenothera serrulata - evening primrose

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SOURCE: W. H. Wagner and others, "Michigan's Endangered and Threatened Species Program: Endangered, Threatened, and Rare Vascular Plants in Michigan," reprinted from The Michigan Botanist, vol. 16, 1977.

NOTE: (R) = Rare, (T) = Threatened, (E) = Endangered. None of the plants listed above is currently on the Federal Register listing of endangered and threatened species.

## WILDLIFE

Diverse wildlife populations are a reflection of the varied habitats that characterize the Sleeping Bear Dunes area. With the exception of birdlife, wildlife species on the islands are relatively few, compared with those found on the mainland. The distinct and isolated island populations present opportunities for studying distribution, adaptation, and evolution. The introduction of white-tailed deer on North Manitou Island illustrates the detrimental effect that an introduced wildlife population can have on an environment in that the deer have heavily browsed the area,

altering the flora so that it significantly differs from that of South Manitou.

Past studies in the Sleeping Bear Dunes area indicate around 326 species of birds, 49 species of mammals, 17 species of amphibians, 15 species of reptiles, 80 species of fish, and countless species of invertebrate forms. White-tailed deer, raccoon, white-footed mouse, and porcupine are common species in most areas of the national lakeshore. Other abundant species include the snowshoe hare, cottontail, red fox, woodchuck, striped skunk, and mink. Two species of flying squirrel and all three species of eastern tree squirrel are present at Sleeping Bear Dunes--red squirrel, gray or black squirrel, and fox squirrel. The eastern chipmunk is common in most forested areas, and the thirteen-lined ground squirrel takes over in open areas. The hunting of deer, cottontails, snowshoe hares, game birds, and squirrels is a popular recreational activity. The state of Michigan, through the Department of Natural Resources, sets regulations for all hunting and fishing within the national lakeshore.

Bobcat, gray fox, otter, badger, coyote, and beaver are present in northwest Michigan, but they are rarely seen in the vicinity of Sleeping Bear Dunes.

Birdlife is abundant and varied, particular species often being associated with lakes, hardwood forests, shore bluffs, morainal plateau, and dunes during the summer months. Species associated with some of these environments include the following:

Vesper sparrow, horned lark, gold finch, marsh hawk--morainal plateau and active dune  
Red-eyed vireo, red start, ovenbird--hardwood forest  
Shorebirds, grebes, herons, ducks, rails, loons--lake, marsh, and swamp

Often-observed winter residents include the pine grossbeak, chickadee, crossbill, and pine siskin. The herring and ring-billed gull colonies on South Manitou Island are some of the oldest and most protectable rookeries on the Great Lakes. Fox predation has reduced rookery numbers to the point that the gulls may abandon the site. The bald eagle (threatened) and peregrine falcon (endangered) are occasionally reported in the Sleeping Bear area. Birds suffering population declines or range diminution have been "blue listed" by the Audubon Society and include four hawks, (sharp-shinned, Cooper's, red-shouldered, and marsh), the osprey, American kestrel, piping plover, and yellow and common yellow-throated warblers.

Thirty-two species of reptiles and amphibians are found within Sleeping Bear Dunes. The eastern massasauga is the only poisonous species reported in the region and is seldom seen.

Largemouth and smallmouth bass, salmon, lake trout, bluegill, yellow perch, rock bass, and northern pike are popular game fish of Lake Michigan and the smaller inland lakes. Streams in the area provide habitat for rainbow, brown, and brook trout. Smelt ascend streams to spawn in spring, with many being taken by dip net. The predation of lake trout populations by the sea lamprey has been reduced through the use of a chemical, TFM, that selectively kills lamprey larvae.

Cyclical die-offs of alewives occur, polluting the water and beaches along Lake Michigan. To increase fish productivity in the Great Lakes and to curb alewife population fluctuations, the Michigan Department of Natural Resources introduced the coho salmon in the Platte River. The coho salmon, chinook salmon, and steelhead spend several summers in Lake Michigan before returning to spawn in the streams where they were released. The large size (5 to 30 pounds) of the spawning adults has attracted sports fishermen to Sleeping Bear Dunes--especially in the Platte River area. An anadromous fish hatchery and weir have been constructed on the Platte by the state of Michigan (anadromous refers to fish that spend most of their lives in the ocean or large lakes, but return to the rivers to spawn).

Significant wildlife populations and their general habitat in the Sleeping Bear Dunes area are summarized in table 6 and are shown on the Significant Wildlife Areas map.

## VISUAL QUALITY

Approximately 64 miles of Lake Michigan shoreline--31 miles along the mainland and 33 on the Manitou islands--are included within Sleeping Bear Dunes National Lakeshore. Most of the shoreline is relatively undisturbed, with wide sandy beaches, shoreline bluffs, and dunes. Natural conditions throughout portions of the national lakeshore will be fostered by managing certain areas as potential wilderness, pending congressional designation of these areas as wilderness.

North Manitou Island is predominantly primitive, with an extensive beech/maple forest, wave-cut and shoreline bluffs, perched dunes, lakes, cedar trees, and an introduced white-tailed deer population. There are outstanding views of South Manitou and the mainland from the southern portion of the island.

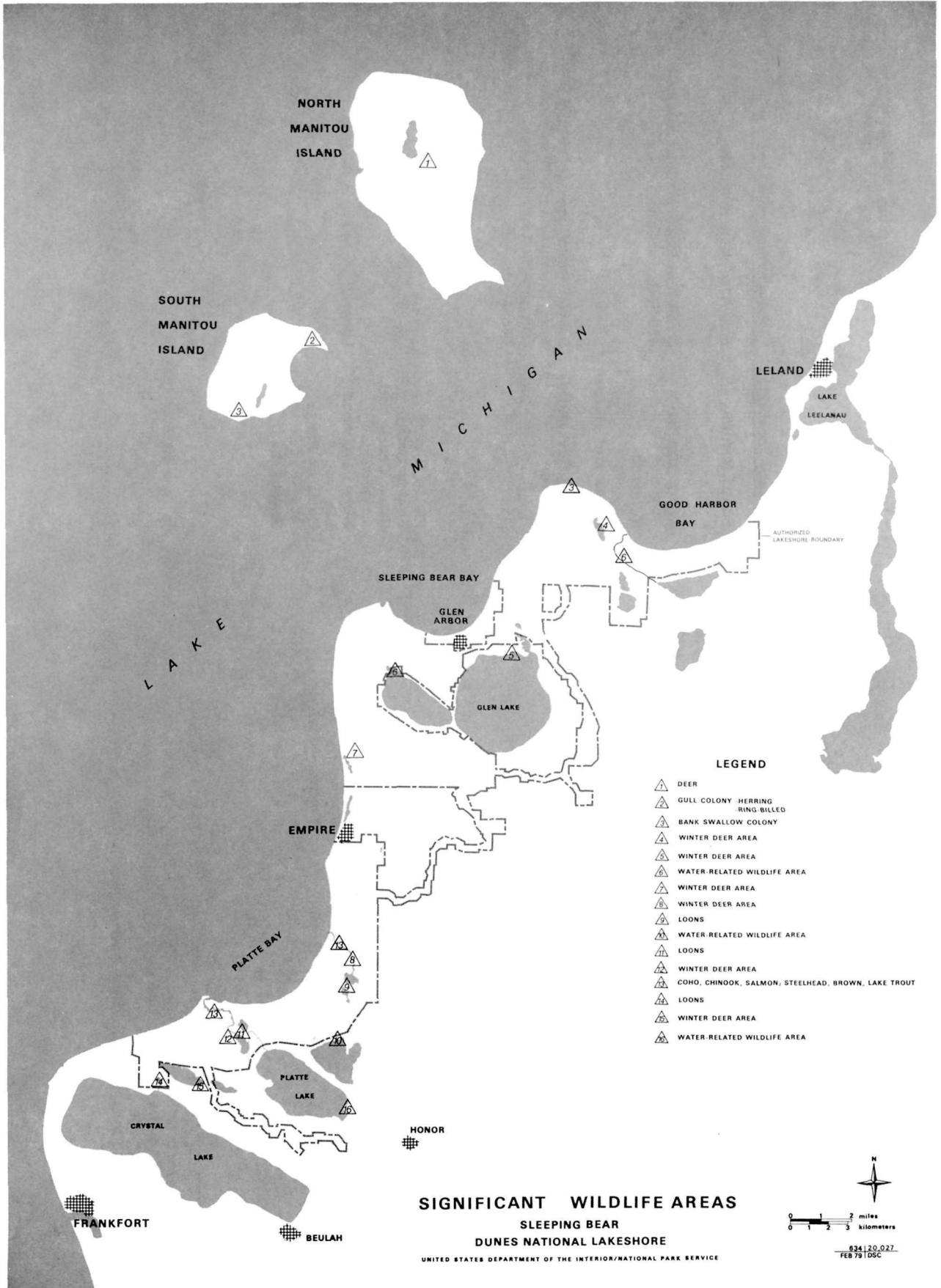


Table 6: Significant Wildlife Populations and Habitat

<u>Significant wildlife populations*</u>	<u>Reasons for significance</u>	<u>Primary locations</u>	<u>Management concerns</u>
Gull colonies (herring and ring-billed)	Oldest and one of the most protected (habitat not easily submerged) rookeries on the Great Lakes	South Manitou	Fox predation problem
White-tailed deer	Popular game species (hunting)	North Manitou	Overabundance of deer due to artificial feeding
Upland/small game	Popular game species (hunting)	Mainland	
Water-related wildlife		Lakes and rivers	
Fish (trout and salmon)	Popular game species (fishing)	Platte Bay and River	Salmon introduced to curb alewife fluctuations and increase fish productivity in Great Lakes
<u>Significant wildlife habitat</u>			
Platte River	Seasonal presence of trout and salmon	Platte River	
Shalda Creek	Marshy habitat, frequented by wildlife	Shalda Creek	
Otter Creek and marsh	Diversity of species	Otter Creek and marsh	
Glen Lake pond	Diversity of species	Glen Lake pond	Located in heavy use area
Deer areas	Occasionally used as wintering habitat by deer	See map	
Platte Lake**	Outstanding concentration of water-related wildlife (especially birdlife)	Delta of Platte	
Little Platte Lake**	Outstanding concentration of water-related wildlife (especially birdlife)	Swamp north of lake	

\*Significance relates to a species that is either rare or is especially noteworthy or to a habitat that is important to the preservation of a wildlife species

\*\*Outside boundary of Sleeping Bear Dunes National Lakeshore

South Manitou Island has record-sized trees (white cedar, common and red-berried elder, and mountain maple) and rare plant species not found on the mainland or other Lake Michigan islands. There are colonies of herring and ring-billed gulls.

The Good Harbor unit contains a glacial drainage channel with lake-level vegetated dunes. Plant succession is well illustrated, from beach communities to subclimax forest. There are also cherry orchards in the northeast corner of the unit. Pyramid Point overlooks the embayment and Lake Michigan, and from the School Lake knoll, School Lake, Bass Lake, and the bay can be seen.

The Glen Lake unit has the most geologic features of any area in Sleeping Bear Dunes, ranging from wave-cut bluffs and a classic perched dune to a glacial drainage channel, outwash fan, and symmetrical kettle. The vegetation includes the largest oldfield juniper in the nation and a relic (or ghost) cedar forest. From higher portions of the unit one can see Glen Lake, the Manitou islands, dunes, Sleeping Bear Bay, and Lake Michigan.

The Empire unit has a glacial drainage channel, wave-cut banks, perched dunes, and shoreline bluffs. Much of the land in this unit has been cleared for farming, but there are dune forests with rich spring flora, a pure stand of white birch, and record-sized pagoda dogwood and red elm trees. From various vantages, one can see the Empire Bluffs, Lake Michigan, Empire Bay, the Bar lakes, Platte Bay, and Platte River Point.

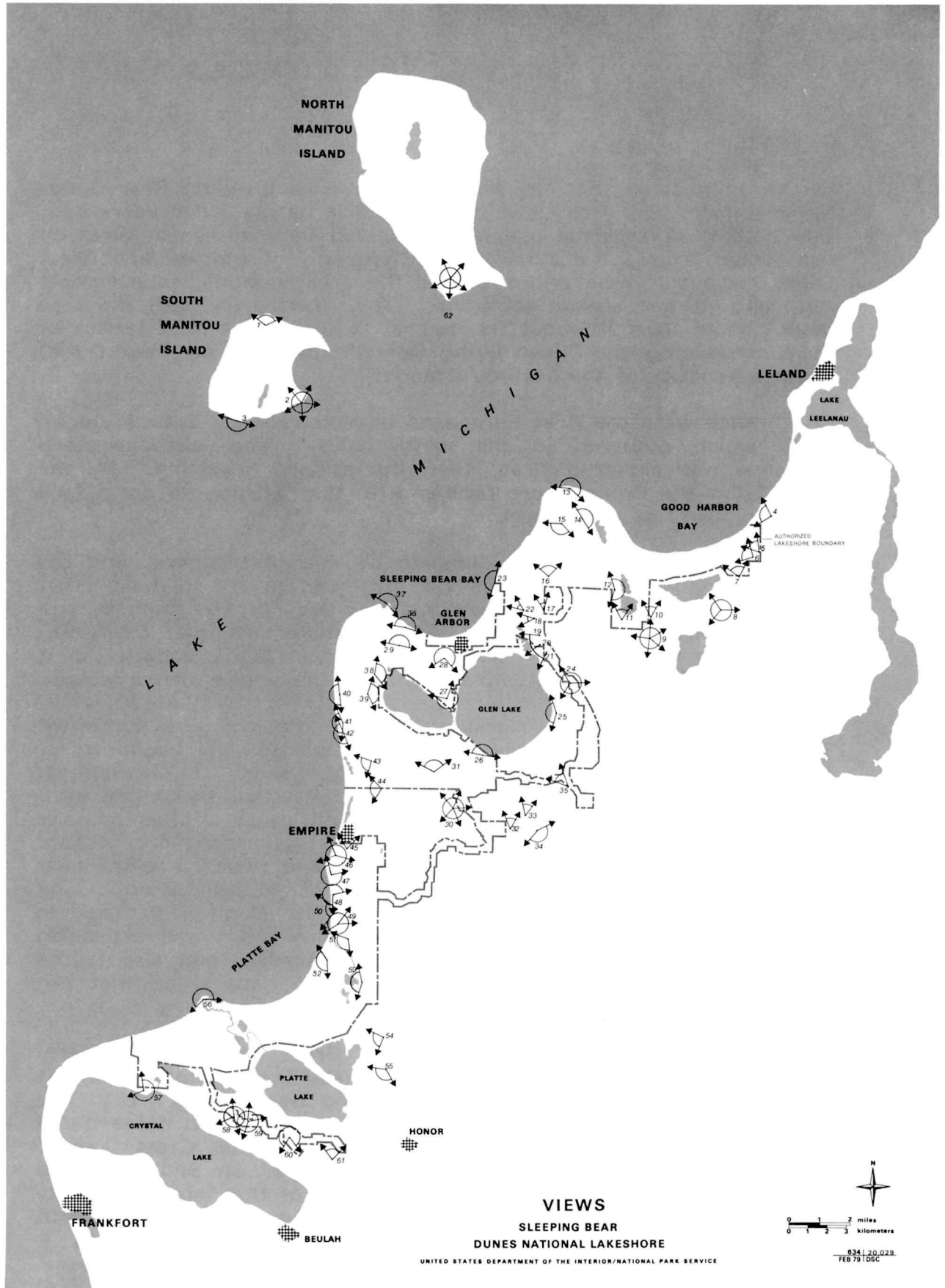
The Platte unit contains an excellent example of a glacial embayment. There is a well-illustrated plant succession series, with outstanding foredune flora and an extensive pine/oak/aspen forest. From the Crystal Highlands, there are outstanding views of the Platte, Crystal, Round, and Long lakes, Sleeping Bear and Empire bluffs, the Platte embayment, and Lake Michigan.

Table 7 lists the scenic viewpoints within the boundaries of Sleeping Bear Dunes and relates to the Views map. These points were selected on the basis of the principal features that can be seen from each location.



Table 7: Scenic Viewpoints

Viewpoints*	Features That Can Be Seen	Viewpoints*	Features That Can Be Seen
<u>North Manitou</u> 62. Old Baldy	South Manitou, North Manitou, U.S. Coast Guard crib, mainland	32. County Road 675 Lookout	Glen Lake, Lake Michigan, Day Hill
<u>South Manitou</u> 1. Gull Ridge	Gull rookery, lifeboat station, South Manitou lighthouse, North Manitou, mainland	33. Karnec Lookout	Glen Lake, Lake Michigan, Day Hill
2. South Manitou Island Lighthouse	South Manitou, North Manitou, mainland	34. Gilbert Ridge	Far inland view, moraine
3. Ship Point	Sunken freighter ship	35. Kettle Ridge	Glen Lake, Lake Michigan
<u>Good Harbor</u> 4. Overby Ridge	Good Harbor Bay, Cleveland moraine	36. Glen Haven	Sleeping Bear Bay, North Manitou, Lake Michigan
5. Cedar Road	Pyramid Point, Lake Michigan	37. Sleeping Bear Point	Manitou islands, Sleeping Bear Bay, Pyramid Point, Lake Michigan
6. Cedar Hill	Pyramid Point, Traverse Lake	38. Dune Slide	Glen Lake, dunes, Lake Michigan
7. Townline Knoll	Pyramid Point, Good Harbor Bay	39. Stocking Overlook	Glen Lake, dunes
8. Sugarloaf Mountain	Lake Michigan, Traverse Lake, Lime Lake, four islands, inland views	<u>Empire</u> 40. Pinnacle	Empire Bluffs, dunes, Lake Michigan
9. Towerview	Sugarloaf Mountain, Lime Lake, Lake Michigan, inland views	41. High Dune Lookout	Empire embayment, high dunes, Lake Michigan
10. Cleveland Knoll	Lake Michigan	42. Schauger	Empire embayment, high dunes, Bar lakes
11. School Lake Knoll	School Lake, Bass Lake, Good Harbor Bay	43. Valley Road	Bar lakes
12. Bass Lake Ridge	Bass Lake, School Lake, Little Traverse Lake, Good Harbor Bay	44. Empire Lookout	Lake Michigan
13. Pyramid Point	Good Harbor Bay, four islands, Shell Lake	45. Stormer Ridge	Bar lakes, Empire embayment, Sleeping Bear Bluffs
14. Pyramid Point Moraine	Good Harbor Bay, Lake Michigan	46. Empire Lookout	Bar lakes, Empire embayment, Sleeping Bear Bluffs, Platte Bay, Platte River Point
<u>Glen Lake</u> 15. Baker Road	Glacial drainage channel	47. Old Baldy Dune	Platte Bay, Platte River Point, alpine dunes
16. Wheeler Road	Pyramid Point, North Manitou, Lake Michigan	48. Thompson Tip Top	Platte Bay, Platte River Point, inland views
17. Juniper Ridge	Dunes, islands, Lake Michigan	49. South Ridge	Platte Bay, inland views
18. Miller Ridge (north)	Glen Lake, Lake Michigan, dunes	50. North Ridge	Platte Bay, Platte River Point
19. Miller Ridge (power lines)	Glen Lake, Sleeping Bear Bay, dunes	51. Algonquin Bridge	Otter Creek valley, dunes, Platte River Point
20. Miller Ridge (knoll)	Glen Lake	52. Lookout Dune	Platte Bay, alpine dunes, Aral dunes
21. Miller Ridge (south)	Glen Lake, Tucker Lake, dunes	53. Platte Ridge	Deer Lake, Bass Lake, Otter Lake
22. Hyland Road	Prospect Hill, Crystal River, Glen Lake	<u>Platte</u> 54. Indian Hill Ridge	Platte Lake, Point Betsie moraine
23. Sunset Haven	Manitou islands, Sleeping Bear Point, Sleeping Bear Bay	55. Indian Hill Road	Platte lakes, wetland area
24. Trumbull Hill	Glen Lake, moraines	56. Platte Point	Platte Bay, Sleeping Bear and Empire bluffs
25. Glen View Resort	Glen Lake, Sleeping Bear Bay	57. Winetka Point	Crystal Lake, Round Lake, Long Lake, Platte Bay
26. South Glen Lake Lookout	Glen Lake, Lake Michigan	58. Warren Lookout	Platte Bay, Lake Michigan, Empire high dunes
27. Alligator Hill (south)	Glen Lake, Sleeping Bear Dunes	59. Warren Knoll	Same as above
28. Alligator Hill (north)	Manitou islands, Sleeping Bear Bay, shoreline	60. Nichols Road	Same as above
29. Glen Haven Knoll	Sleeping Bear Bay, North Manitou	61. U.S. 31 Overlook	Lake Michigan, Empire moraine, Platte Bay
30. Inland Knoll	Distant inland views, alpine dunes		
31. Frederickson Hill	Lake Michigan		



**NORTH  
 MANITOU  
 ISLAND**

**SOUTH  
 MANITOU  
 ISLAND**

**M I C H I G A N**

**LELAND**  
**LAKE  
 LEELANAU**

**GOOD HARBOR  
 BAY**

AUTHORIZED  
 LAKESHORE BOUNDARY

**L A K E**

**SLEEPING BEAR BAY**

**GLEN  
 ARBOR**

**GLEN LAKE**

**EMPIRE**

**PLATTE BAY**

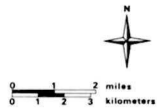
**PLATTE  
 LAKE**

**CRYSTAL  
 LAKE**

**FRANKFORT**

**BEULAH**

**HONOR**



## C U L T U R A L   R E S O U R C E S

### OVERVIEW

Evidence indicates that the area now known as Sleeping Bear Dunes National Lakeshore was used by prehistoric people 3,000 years ago. The pattern of seasonal use was continued in more recent times by two Indian tribes, the Ottawa and Chippewa, of the western Great Lakes region. These tribes visited the area to hunt, collect maple sap, and pursue similar activities. Their familiarity with the area gave rise to legends about its natural features, the most famous of them concerning the "Bear Lying Down" (the Sleeping Bear Dune) and the sanctity of the Manitou islands.

The French were the first Europeans to penetrate the Lake Michigan area, which occurred in the early 1600s. The lake's western shoreline was explored first, then the eastern shoreline. By the early 1700s the French were familiar with the "L'ours qui dort" (the Sleeping Bear) as a landmark.

French explorers were soon followed by French trappers, and the fur trapping era began. This era continued in the western Great Lakes until the mid-19th century and involved French, English, and American traders and trappers. The extent of use that these men made of the Sleeping Bear Dunes area is not clearly known, but it is certain that some furs did come from the area's dense woods.

The expansion of the American frontier into the old Northwest Territory in the early 1800s was responsible for the beginning of commercial shipping on the western Great Lakes. Lake Michigan became a major artery, with the Manitou Passage being the most important of its shipping lanes. The significance of this passage was recognized early, and in 1840 the U.S. Lighthouse Board completed a lighthouse on South Manitou Island, which had the only harbor of refuge between the Straits of Michillimackinac and Chicago. The continuing importance of the Manitou Passage to navigation on Lake Michigan led to the improvement and expansion of the lighthouse system in the following decades, and also to the establishment of lifesaving stations to assist those ships that ran aground or sank despite navigational aids.

The introduction of steamships on the Great Lakes in the early 1800s was an important development for lake transportation, and it led to the initial settlement of the Sleeping Bear Dunes area. The fact that steamships had an insatiable appetite for wood necessitated the location of cordwood docks throughout the Great Lakes. Around 1835 a cordwood dock was established on South Manitou Island, signaling the first known settlement of that island by white men. A decade later a similar operation was started on North

Manitou Island, and in the late 1850s wooding stations were established on the mainland.

Not long after these cordwood docks were located in the vicinity of Sleeping Bear Dunes, other settlers--fishermen, merchants, farmers, and most importantly, loggers--began to enter and establish themselves in the area. The lumber industry fast became the leading economic activity in the area, and it held that position until the eve of World War I. Most logging occurred on the mainland and North Manitou Island, and small communities sprang up around the sawmills that were built throughout the area.

When the forests were cut, the logging era in the Sleeping Bear Dunes area ended. However, instead of suffering the same fate as other former lumbering regions in Michigan, the area's agricultural potential and its natural beauty provided a new impetus for growth.

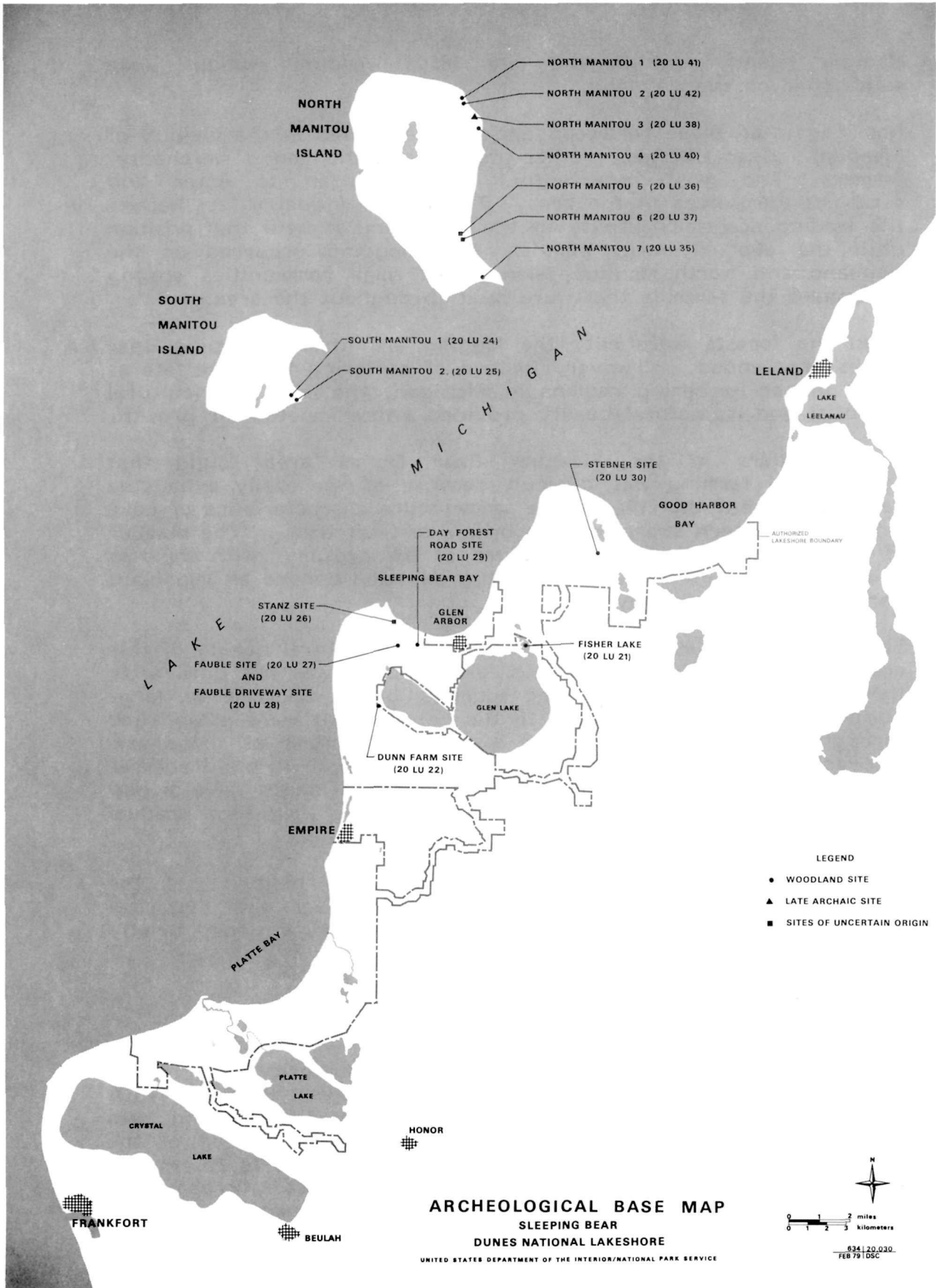
Early settlers in the Sleeping Bear Dunes area found that conventional farming was difficult because of the easily exhausted sandy soils, but that the unique temperature characteristics of Lake Michigan's eastern shore were favorable to fruit trees. The number of orchards multiplied after the turn of the century, with cherries being the dominant fruit, and fruit production became an important part of the local economy.

Settlers and visitors had long recognized the natural beauty of this area's islands, dunes, and inland lakes, but it was not until after the turn of the century that tourists began to come in large numbers. At first they went to the resorts that were established throughout the area, but after World War II some of those who enjoyed the beauty and solitude of the area began to build summer homes. The influx of tourists and summer residents gave a new life to some of the former sawmill towns, saving them from gradual deterioration.

The cultural resources, both prehistoric and historic, of the Sleeping Bear Dunes National Lakeshore reflect the historical development of the area, and the major ones are mentioned briefly below.

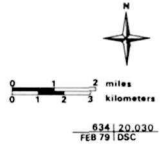
#### PREHISTORIC RESOURCES

The oldest cultural resources are the prehistoric sites found throughout the national lakeshore (see Archeological Base Map). A preliminary archeological survey of North Manitou Island was conducted in 1966 under the direction of Charles Cleland of the Michigan State University Museum. Approximately 15 to 20 percent of the total island area and 85 percent of the most favorable area for prehistoric occupation were surveyed. Seven sites were



**ARCHEOLOGICAL BASE MAP**  
**SLEEPING BEAR**  
**DUNES NATIONAL LAKESHORE**  
 UNITED STATES DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

- LEGEND**
- WOODLAND SITE
  - ▲ LATE ARCHAIC SITE
  - SITES OF UNCERTAIN ORIGIN



located, and three of these were test excavated. Following the survey, Cleland submitted a report to the William R. Angell Foundation, Detroit, Michigan.

In 1974-1975 an archeological inventory and evaluation of Sleeping Bear Dunes was undertaken by William Lovis of Michigan State University (Michigan State University, 1976). Approximately 71 square miles on South Manitou Island and the mainland were investigated. Seven prehistoric sites and one historic site were recorded. The recommendations for further investigation of sites on both islands and the mainland are as follows:

Conduct an intensive archeological survey in association with developments planned for areas not previously surveyed, including developments planned for areas outside the lakeshore boundary.

Evaluate selected sites.

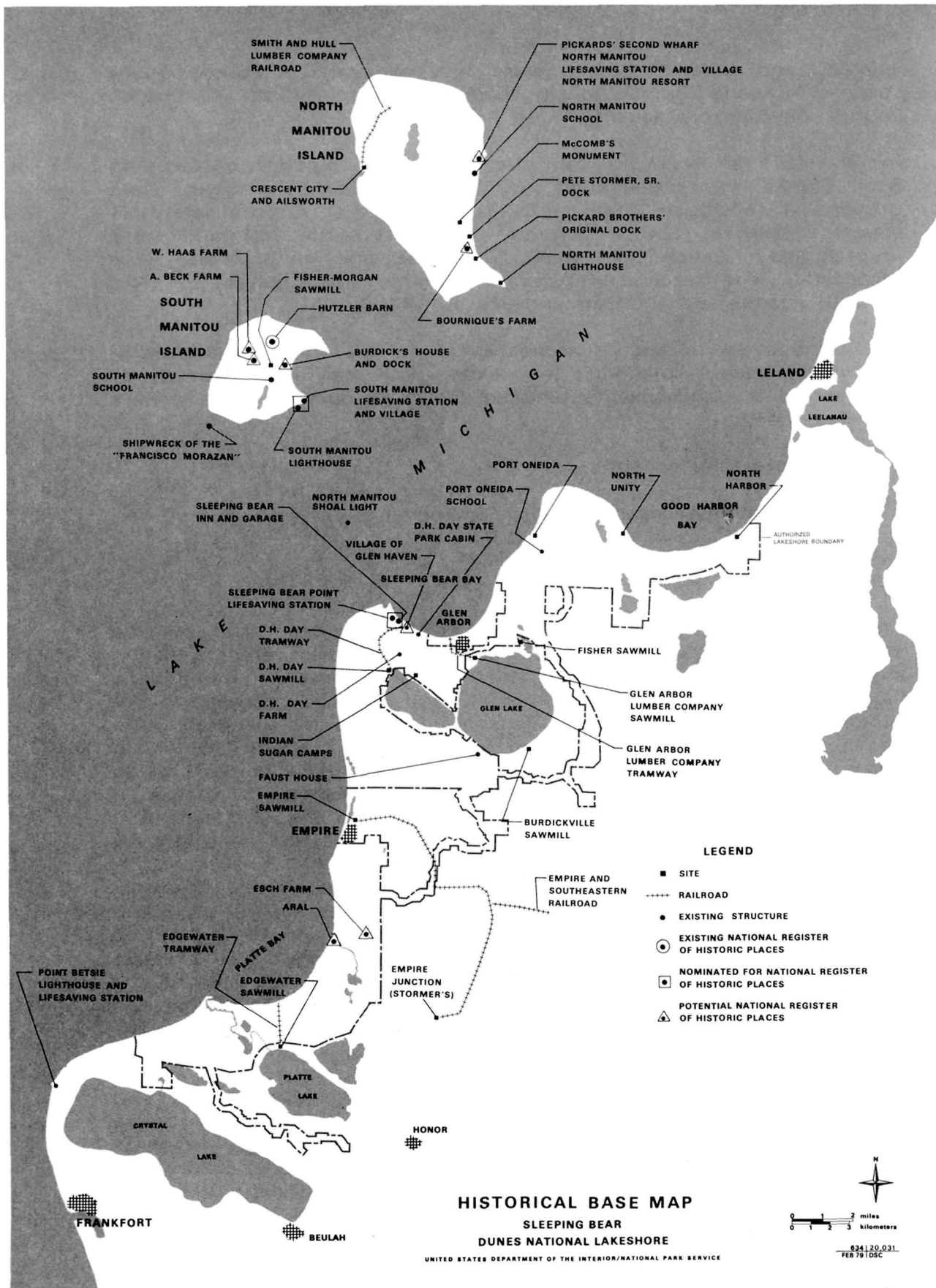
Avoid adverse impacts to sites whenever possible.

## HISTORIC RESOURCES

There are numerous historic archeological sites and historic structures throughout the national lakeshore that are culturally significant, and they represent the historical themes of navigation, logging, agriculture, the resort era, and outdoor recreation (see Historical Base Map). The lifesaving stations at Sleeping Bear Point, South Manitou Island, and North Manitou Island are all in good states of repair. (The station at Sleeping Bear Point is being rehabilitated for interpretive use; South Manitou's lifesaving building is now used as a ranger station; and the North Manitou facility was previously used by the Angell Foundation as a lodge.)

Two lighthouses were located within Sleeping Bear Dunes National Lakeshore, one on North Manitou Island and the other on South Manitou Island. The only remaining structures on North Manitou that were associated with the lighthouse are a barn, two privies, and a collapsed boathouse north of the lighthouse; the rest of the complex has been claimed by Lake Michigan. The South Manitou lighthouse was one of the first lighthouses constructed in the Sleeping Bear Dunes region.

Other historic sites consist mainly of former towns, docks, and sawmills. On the mainland these sites consist of the former towns of Aral, Port Oneida, Good Harbor, and North Unity; the remnants of docks at Aral, Glen Haven, Port Oneida, and Good Harbor; and the site of D.H. Day's sawmill. On South Manitou Island there are the sites of the old dock and the sawmill near the cemetery. On



SMITH AND HULL LUMBER COMPANY RAILROAD

**NORTH MANITOU ISLAND**

CRESCENT CITY AND AILSWORTH

PICKARDS' SECOND WHARF  
NORTH MANITOU LIFESAVING STATION AND VILLAGE  
NORTH MANITOU RESORT

NORTH MANITOU SCHOOL

McCOMB'S MONUMENT

PETE STORMER, SR. DOCK

PICKARD BROTHERS' ORIGINAL DOCK

NORTH MANITOU LIGHTHOUSE

W. HAAS FARM

A. BECK FARM

FISHER-MORGAN SAWMILL

HUTZLER BARN

BOURNIQUE'S FARM

BURDICK'S HOUSE AND DOCK

SOUTH MANITOU LIFESAVING STATION AND VILLAGE

SOUTH MANITOU SCHOOL

SHIPWRECK OF THE "FRANCISCO MORAZAN"

SOUTH MANITOU LIGHTHOUSE

M I C H I G A N

LELAND

LAKE LEELANAU

PORT ONEIDA

NORTH UNITY

NORTH HARBOR

GOOD HARBOR BAY

AUTHORIZED LAKESHORE BOUNDARY

SLEEPING BEAR INN AND GARAGE

NORTH MANITOU SHOAL LIGHT

PORT ONEIDA SCHOOL

D.H. DAY STATE PARK CABIN

VILLAGE OF GLEN HAVEN

SLEEPING BEAR BAY

GLEN ARBOR

FISHER SAWMILL

D.H. DAY TRAMWAY

D.H. DAY SAWMILL

D.H. DAY FARM

INDIAN SUGAR CAMPS

FAUST HOUSE

EMPIRE SAWMILL

GLEN ARBOR LUMBER COMPANY SAWMILL

GLEN ARBOR LUMBER COMPANY TRAMWAY

BURDICKVILLE SAWMILL

EMPIRE

EMPIRE AND SOUTHEASTERN RAILROAD

EMPIRE JUNCTION (STORMER'S)

ESCH FARM

ARAL

EDgewater TRAMWAY

PLATTE BAY

EDgewater SAWMILL

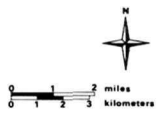
PLATTE LAKE

CRYSTAL LAKE

HONOR

- LEGEND**
- SITE
  - RAILROAD
  - EXISTING STRUCTURE
  - ⊙ EXISTING NATIONAL REGISTER OF HISTORIC PLACES
  - ◻ NOMINATED FOR NATIONAL REGISTER OF HISTORIC PLACES
  - ⚠ POTENTIAL NATIONAL REGISTER OF HISTORIC PLACES

**HISTORICAL BASE MAP**  
SLEEPING BEAR  
DUNES NATIONAL LAKESHORE



North Manitou there are sites of several logging camps and docks, as well as the site of Crescent City. The only physical remains of these sites are numerous surface and subsurface archeological materials; old dock pilings; foundations of the sawmill operations at Aral, Crescent City, and South Manitou (the latter has some old rusted machinery); and a few nonhistoric buildings at one of the logging camps on North Manitou.

Several remnants of logging period structures exist in Glen Haven. Logging was an important aspect to life in Glen Haven, although the community was not a sawmill town in the conventional sense because of its diversified economy. The Sleeping Bear Inn was originally a boardinghouse for loggers, and the old D.H. Day store was the company store for Day's employees, many of whom were engaged in his lumbering operation. Because of Glen Haven's association with logging, along with its ties to maritime and agricultural history, Glen Haven is one of the few towns of its kind in Michigan.

Most of the structural resources in the national lakeshore are related to agriculture, but many of the farms of historical significance are in private ownership. Only on North and South Manitou islands will the National Park Service own all the farms, most of which are deteriorating (a few farmhouses are in a relatively good condition), although they are still historically and architecturally interesting.

Although most of the farms within the mainland portion of Sleeping Bear Dunes are similar to other farms in Benzie and Leelanau counties, there are several structures of major importance. The D.H. Day farm is architecturally typical of many northern New York farms, and its connection with D.H. Day, an entrepreneur and pioneer conservationist, enhances its significance. A cabin at the nearby D.H. Day Campground is significant because it was built in 1923-1924 as part of the D.H. Day State Park, the first state park in Michigan. It was at this location that the first concern for preserving the Sleeping Bear Dunes area was shown.

In June 1977 the National Park Service engaged the Art Department of Michigan State University to conduct an inventory of historically and architecturally significant properties on South Manitou Island and the mainland. An evaluation of inventoried properties was carried out in consultation with the Michigan historic preservation officer, who prepared a list of cultural resources within the national lakeshore that appeared to meet the criteria for eligibility for the National Register of Historic Places. Excluded from this list were any properties on North Manitou Island, which until now has been inaccessible to the state historic preservation officer for the purposes of a survey of cultural resources.



The state historic preservation officer's recommendations for nominations to the national register are as follow:

South Manitou Island Planning Unit

George J. and John Hutzler farm complex  
Cemetery  
Putnam Burdick farm complex  
August Beck farm complex  
George C. Hutzler farm complex  
Old Schoolhouse complex  
Theodore Beck farm complex  
Willie Haas farm complex  
Henry Haas farm complex  
South Manitou Island historic district (including the lighthouse complex, lifesaving station complex, and village)

Glen Lake Planning Unit

D.H. Day farm  
U.S. Coast Guard station  
Sleeping Bear Inn and garage  
Port Oneida

Empire Planning Unit

Esch farm  
Aral townsite

In 1978 Jim Muhn of the National Park Service prepared a historic resource study for Sleeping Bear Dunes, which included an evaluation of historically and architecturally significant properties on both islands and the mainland. The study and its recommendations for nominations to the national register are currently in draft form and are being revised.

At present, Hutzler's Barn (part of the George J. and John Hutzler farm complex) on South Manitou Island is the only structure within the lakeshore listed on the national register. Two additional areas have been formally nominated to the register--the Sleeping Bear Point Lifesaving Station and the Sleeping Bear Inn.

## S O C I O E C O N O M I C   E N V I R O N M E N T

The basic industries in Benzie and Leelanau counties have shifted from fur trapping and logging to fruit growing and, more recently, tourism. Increased emphasis on tourism has produced several positive effects in the counties during the last decade: The population has been increasing more rapidly than in the northwest Michigan region; personal income has begun to increase at a relatively healthy rate in Leelanau County; and county revenues have increased as a result of the establishment of Sleeping Bear Dunes National Lakeshore.

With low per capita incomes and attractive economic opportunities elsewhere in the state during the 1950s, all of northwest Michigan, including Benzie and Leelanau counties, experienced high out-migration, particularly in the young and economically productive age groups. This high rate of out-migration caused an extremely slow overall population growth. Benzie County, in fact, experienced an overall population decline during that period (table 8).

As the recreational attractiveness of the region has increased, the population growth rate has increased and net migration patterns have been reversed. From 1970 to 1976, the populations of the two counties increased more rapidly than the rest of the region, with Leelanau County increasing by 21 percent (Wilbur Smith and Associates 1973c).

A large percentage of the population is seasonal, attracted by the environmental and recreational amenities of northwest Michigan. The Grand Traverse Area Data Center has estimated that for the five counties of Antrim, Benzie, Grand Traverse, Kalkaska, and Leelanau, the population during July 1975 was 2.18 times the area's permanent population. While increases of this nature undoubtedly affect the level of service that must be provided by the counties (e.g., roads and water), positive effects have resulted from the presence and spending patterns of tourists.

The Northwest Michigan Regional Planning and Development Commission has estimated that for Benzie and Leelanau counties 45 percent and 30 percent, respectively, of all 1972 receipts in the retail trade service sectors were directly related to tourism. It was estimated by Wilbur Smith and Associates that by 1978, 214,000 recreationists would visit Sleeping Bear Dunes in addition to the estimated 1 million visitors who would visit the two former state parks. From expenditure data derived from other National Park Service visitation studies, it has been estimated that the additional visitors by themselves would be spending approximately \$600,000 in each of the two counties, generating a total of over \$1.2 million.

Table 8: Population Characteristics, 1950-1976

County	1950	1960	1970	Est. 1976	1950-1960			1960-1970			1970-76
					Percent change	Natural increase percent change	Net migration percent change	Percent change	Natural increase percent change	Net migration percent change	Percent change
Benzie	8,306	7,834	8,593	10,208	-5.7	9.3	-15.4	9.7	6.1	3.6	18.8
Leelanau	8,647	9,321	10,872	13,189	7.8	14.2	- 6.4	16.6	6.4	10.3	21.3
Region*	135,388	139,017	158,333	181,774	2.7	12.7	- 9.8	13.9	8.0	5.9	14.8

SOURCES: Northwest Michigan Regional Planning and Development Commission, Comprehensive Plan: Economic Base (Traverse City, 1976); U.S. Department of Commerce, Bureau of the Census, Gross Migration by County: 1965 to 1970, Population Estimates and Projections Series, (Washington, D.C.: U.S. Government Printing Office, 1977), and Estimates of the Population of Counties and Metropolitan Areas: July 1, 1974 and 1975 (Washington, D.C.: U.S. Government Printing Office, 1977).

\*The Northwest Michigan region is comprised of 10 counties--Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Kalkaska, Leelanau, Manistee, Missaukee, and Wexford.

This represents a general estimate of the economic impact of national lakeshore visitors based on data available at that time. However, based on 1978 lakeshore visitation figures (759,091 visits), it appears that research must be conducted to update expenditure figures for current visitation and to provide local governments with needed planning information on the economic impacts of visitors to Sleeping Bear Dunes.

Per capita income in Benzie and Leelanau counties and the northwest region has been consistently lower than in the state. However, recent trends appear to indicate that per capita income in Leelanau County is increasing faster than in the state. While growth in total personal income was quicker in the counties than the state from 1970 to 1974, per capita income increased at a slower rate, particularly in Benzie County (table 9). This reflects an increased proportion of lower wage earners in the population. However, per capita income in Leelanau County increased above the state level for the 1972-1974 period. Benzie County, for the same time period, showed a much slower rate of increase. This may be because of population growth in the 65 and older age group (as cited by the Regional Planning Commission), as well as because of shifting employment patterns.

There has been a greater shift toward operative and labor occupations in Benzie County since 1960, reflecting the slow per capita income growth rate (table 10). Leelanau County, while displaying a slight proportional increase in professionals and managers, has seen a greater increase in the proportion of service workers, which is another indication of the presence of the tourist industry.

The tourist industry in Benzie and Leelanau counties is seasonal in nature, as displayed by summer population increases and peaks in national lakeshore visitation (see discussion of use by visitors). The economic effects of this can be seen in unemployment rates in the immediate region. Unemployment in 1976 dropped from a high of 15.3 percent in May to a low of 10.7 percent and 9.9 percent in June and July, respectively (table 11). This occurred as the labor force increased to a July peak. It is apparent that within the region employment opportunities increase with more tourism as well as with the number of employable persons taking advantage of the opportunities.

Between 1966 and 1972, state equalized valuations in Benzie and Leelanau counties increased at average annual rates of 9.4 and 15.5 percent, respectively. This represented a rate nearly double that of the state as a whole, indicating a significant positive effect from the presence of Sleeping Bear Dunes. Valuation increases have increased available county revenues. Between 1966 and 1972, as state equalized valuations increased, county revenues increased at

Table 9: Total Personal Income and Per Capita Income, 1970-1974

	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1970-74 percent change</u>	<u>1972-74 percent change</u>
<u>Benzie County</u>							
Total personal income (in millions)	26.7	29.4	32.5	35.3	39.6	48	22
Per capita income	3,105	3,433	3,691	3,744	4,013	29	9
<u>Leelanau County</u>							
Total personal income (in millions)	35.0	38.7	43.2	48.7	55.5	58	29
Per capita income	3,218	3,564	3,757	4,025	4,481	39	19
<u>Region</u>							
Total personal income (in millions)	522.8	570.5	635.4	709.6	799.1	53	26
Per capita income	3,303	3,470	3,782	4,062	4,432	34	17
<u>State</u>							
Total personal income (in millions)	37,157.8	40,318.4	44,616.0	49,886.2	59,493.3	43	20
Per capita income	4,180	4,499	4,950	5,506	5,880	40	19

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SOURCES: Northwest Michigan Regional Planning and Development Commission, Comprehensive Plan: Economic Base (Traverse City, 1976); and U.S. Department of Commerce, Bureau of Economic Analysis, Quarterly Reports (Washington, D.C., 1978).

Table 10: Employment Characteristics  
(Percent of Labor Force)

<u>Occupation</u>	<u>Benzie County</u>			<u>Leelanau County</u>		
	<u>1960</u>	<u>1970</u>	<u>1976</u>	<u>1960</u>	<u>1970</u>	<u>1976</u>
Professional, technical	10.1	11.8	8.6	10.1	12.4	11.0
Managers, officials, proprietors	9.8	7.7	8.3	7.9	8.2	8.1
Sales workers	4.9	4.1	3.1	7.5	7.5	5.9
Clerical	10.0	11.0	15.9	9.8	12.4	17.0
Craftsmen	15.6	16.2	14.5	14.4	17.8	15.6
Operatives	21.7	20.0	24.5	16.2	16.6	17.1
Service workers	11.5	17.2	15.6	9.2	13.1	17.9
Laborers (except farm)	6.9	5.5	9.5	6.3	3.1	4.5
Farm laborers	9.6	6.5	*	18.5	8.9	2.9

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\*Included in previous category, "Laborers (except farm)"

an average compounded annual rate of 29.4 percent in Benzie County and 27.7 percent in Leelanau County.

While the presence of Sleeping Bear Dunes National Lakeshore and the tourist industry in general has had positive impacts on the two counties, each county still has problems when compared to the rest of the region and the state. Both counties have experienced increased population growth because of the recreational attractiveness of the area, but the age structure is influenced by a large proportion of elderly people, and employment is concentrated in lower wage occupations. The effect of this lower per capita income, but because of tourist spending, per capita income appears to be increasing somewhat more rapidly than in the past. Although county valuations have increased along with available county revenues, those people on fixed incomes may have experienced some negative effects because of rising real property taxes.

Table 11: Civilian Labor Force and Unemployment Estimate  
January-July 1976

	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>
<u>Region*</u>							
Labor force	35,425	35,000	35,025	35,125	35,875	36,550	37,625
Unemployment rate	14.8	13.5	15.3	14.2	12.3	10.7	9.9
<u>State</u>							
Labor force	3,858,100	3,846,700	3,854,000	3,845,400	3,870,500	3,911,400	3,003,800
Unemployment rate	14.2	11.7	11.4	10.2	9.7	10.2	10.6

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SOURCE: Michigan Employment Security Commission.

\*Benzie, Leelanau, Grand Traverse, and Kalkaska counties

## EXISTING DEVELOPMENT

Development within Sleeping Bear Dunes National Lakeshore consists of a variety of sites, most of which predate its establishment as a unit of the National Park System. D.H. Day State Park, the privately operated Stocking nature trail, Fife Lake State Forest, Benzie State Park, Sleeping Bear and Glen Lake State Park, and the town of Glen Haven, all preceded the establishment of the national lakeshore. Two U.S. Coast Guard lifesaving stations and a U.S. Air Force base are located within the National Park Service boundaries, as well as many private residential dwellings, some of which will be removed. Heavy residential development exists around the major lakes outside the Sleeping Bear Dunes boundary. Existing development within the national lakeshore is described below for each planning unit and is shown on the Existing Development map.

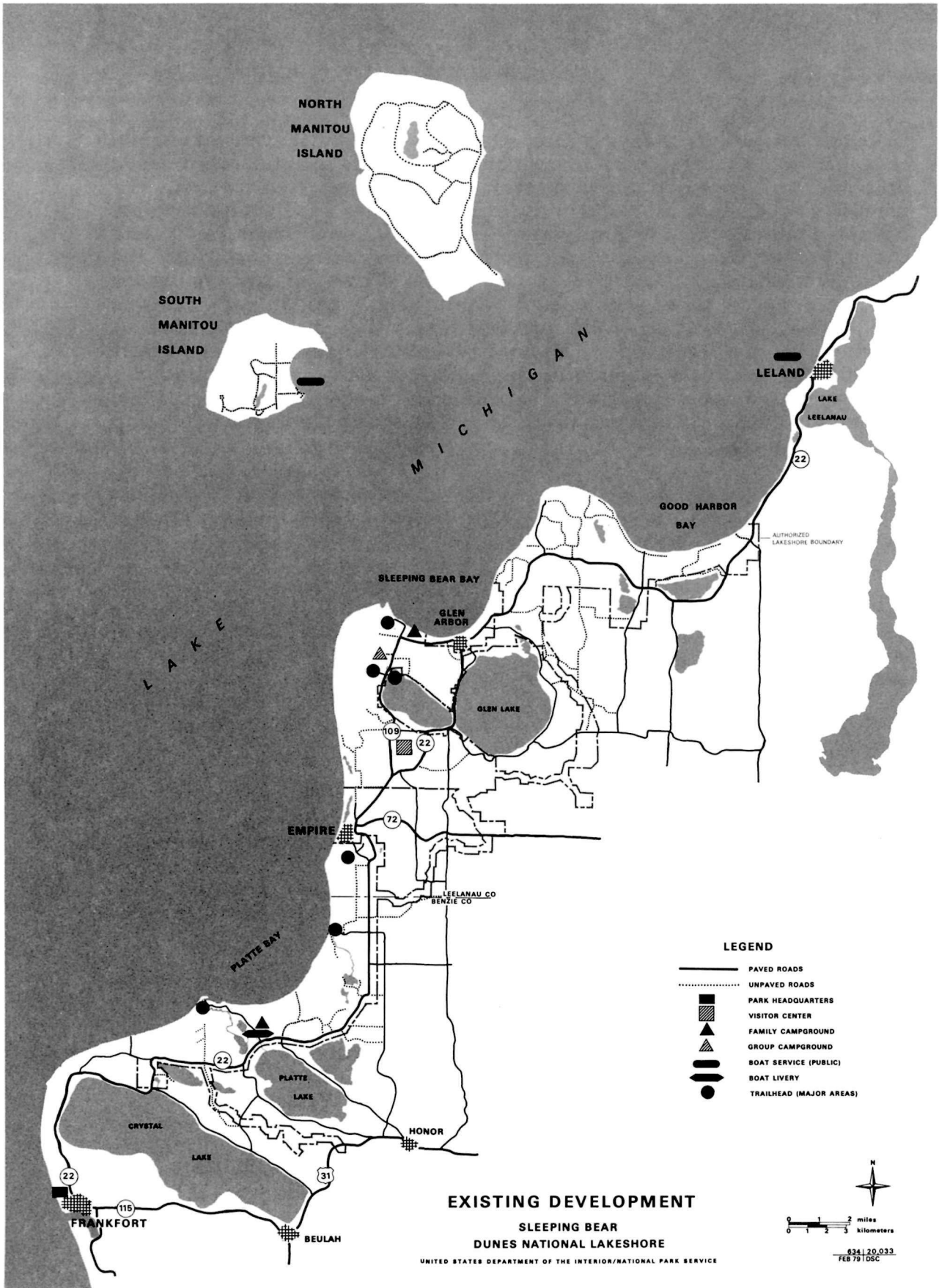
Development on North Manitou Island consists of a resort complex (the former lifesaving station, which is used as a lodge, several buildings, and an airstrip) and the remains of inland farms.

On South Manitou Island, there is a developed area at Sandy Point, with facilities owned by the National Park Service and private interests (these include a lighthouse, lifesaving station, beach residences, motel, and museum). A campground on the bay has 45 designated campsites, well water, and a pit toilet. A campground on the south shore has 36 sites, well water, and a pit toilet. A campground on the north shore has only 10 campsites. There are also inland farmsites throughout the island.

Facilities and development within the Good Harbor portion of the national lakeshore include picnic facilities in the former Fife Lake State Park (two pit toilets and a water pump); residential beach cottages; a concrete launch ramp, pit toilet, and cottages along the east side of School Lake; a gravel pit and target range at Bass Lake; a barn near Bass Lake that was decorated for the Bicentennial; and rural residential development.

The Glen Lake unit includes development at Pyramid Point (Camp Innisfree and a hang-gliding platform), D.H. Day Campground (100 designated campsites, pit toilets, maintenance facilities, and water), Glen Haven (dune-mobile concession, residential and commercial development), a lifesaving station, the Glen Lake swimming beach (parking, picnicking, and lifeguard facilities), the D.H. Day farm, the Old Grade Nature Trail and group camp area (designated campsites, pit toilets, and water pump), a dune-mobile trail, the Hart Nature Trail (parking area, pit toilets, two overlook platforms, and picnic tables), the dune-climb (designated parking area, picnic tables, concession building, and interpretive structure), the visitor





center and Youth Conservation Corps (YCC) camp, and residential development along the Lake Michigan shoreline and in rural areas. Administrative facilities include three ranger residences and a district ranger office. Adjacent to the Sleeping Bear Dunes boundary are residences along the Glen Lake shoreline, a condominium development, Lanphier Observatory, Leelanau School, and the town of Glen Arbor.

Within the Empire unit is the Aral townsite, the Esch farm, the U.S. Air Force base, and residential development along the Lake Michigan shoreline and in rural areas. Adjacent to the national lakeshore boundary is the town of Empire.

Facilities and development within the Platte unit include the Platte River Campground (180 designated campsites, administrative office, and pit toilets), a fish weir on the Platte River operated by the Michigan Department of Natural Resources, residential development along Lake Michigan Road and adjacent to Loon Lake, canoe liveries, Lake Township Park at the mouth of the Platte River (launching area, designated parking), and residential development adjacent to Deer and Bass lakes. District ranger offices and two ranger residences are also within the Platte unit. Near the boundary of Sleeping Bear Dunes there is residential development near Platte and Long lakes and a country club.

## U S E B Y V I S I T O R S

### RECREATIONAL ACTIVITIES

Visitors pursue a wide range of recreational activities at Sleeping Bear Dunes National Lakeshore, including hunting, fishing, swimming, hiking, cross-country skiing, and scenic driving. On North Manitou Island activities have traditionally focused on hunting, fishing, and boating, while on South Manitou there are opportunities for camping and interpretive activities. In the Good Harbor area, picnicking and hang-gliding supplement fishing, swimming, hunting, and cross-country skiing. The Glen Lake unit is an activity center for the national lakeshore, and there are opportunities for camping, swimming, interpretive tours, cross-country skiing, hang-gliding, hunting, scenic driving, and dune-climbing. Within the Empire unit, hang-gliding, hiking, interpretive activities, nature observation, and cross-country skiing are the major recreational pursuits; and in the Platte unit, activities include camping, river floating, fishing, swimming, hiking, hunting, and cross-country skiing.

The single most attractive feature in the lakeshore is Sleeping Bear Dune itself, located in the Glen Lake unit. Visitors climb the dune, hike, and take the concession-operated dune-ride. Swimming and dune-climbing are the two most popular summer activities, followed by sunbathing and hiking.

Winter recreational activities are also being emphasized, with 30 miles of cross-country ski trails and locations for ice-skating, snowshoeing, and snowmobiling. The area also offers year-round opportunities for solitude in a variety of settings and in areas where few visitors travel.

### GENERAL CHARACTERISTICS

The number of visits for 1976 was estimated at 790,615; by 1977, the total had reached 873,396 visits, representing a 10.5 percent increase. In 1978, however, visitation dropped to a reported 759,091 visits, a decrease of 13.1 percent from the previous year. In both 1977 and 1978, the reported park visits for July and August exceeded 205,000 visitors per month. This means that 61 percent of the annual visitation for each year occurred during these two months; 84 percent of the visitation occurred during the June through September period. During July and August, the average daily visitation each year was approximately 7,000.

Visitation projections made in the early 1970s estimated a total of 3 million annual visits by 1975. In light of the current rate of

growth, however, adjustments to this figure are called for. Valid projections are extremely difficult to make because of the limited amount of reported visitation and because of the lack of any real increases in visitation over the three years for visits have been recorded. Annual growth in visitation to typical National Park System units has averaged 2 to 3 percent since 1970. If this annual growth range is used for Sleeping Bear Dunes, between 855,000 and 906,000 annual visits can be expected by 1980.

During the 1978 summer season, a questionnaire was given to visitors so that general use characteristics could be identified. A total of 336 questionnaires were completed through visitor contacts at five locations (the dune-climb parking area, the Platte River mouth, the Platte River Campground, the D.H. Day Campground, and the South Manitou Island dock). Most respondents (94.6 percent) indicated that recreation was the main purpose for their visit, and only 5 percent were visiting for business or commercial reasons (2.1 and 3.3 percent, respectively). The survey showed that 63.5 percent of the respondents traveled in groups of 4 or fewer people. Relatively few visits involved groups of more than eight.

This part of northwestern Michigan has traditionally been a highly attractive recreation area, as evidenced by the large seasonal population and the numerous seasonal homes. Because Sleeping Bear Dunes is a relatively new area of the National Park System, most visitors are from nearby states--90.1 percent of the visitors come from Michigan, Ohio, Indiana, Illinois, Minnesota, and Wisconsin (table 12). As would be expected, most visitors are from Michigan, primarily Detroit and Traverse City. While it is expected that this high level of regional use will continue, it is likely that more visitors will start to come from other areas of the country as Sleeping Bear Dunes becomes more well known.

Once in the region, the average visitor stays 3.79 days (table 13). A majority of visitors indicated on the questionnaire that they had visited the national lakeshore more than once, and only 17.9 percent said this was their first trip. Nearly one-third of all visitors came once a year, and two-thirds visited between one and three times per year (table 14). This seems to indicate that many of the visitors to Sleeping Bear Dunes are nonlocal residents who own or occupy seasonal housing within the area.

Once in the national lakeshore, 82.9 percent of the people visit the Glen Lake/Sleeping Bear Dune area, which offers the dune-climb, a swimming beach, and the Hart Nature Trail. This is a higher rate of visitation than any other area. The next most frequently visited area is the Platte River, where there is a campground, the river, and the beach. These two areas attract the greatest number of visitors because of the high level of visitor services offered and the

Table 12: Visitor Origins

<u>Origin</u>		<u>Percent</u>
New England		1.6
North Atlantic		4.2
South Atlantic		2.6
East North Central		
Ohio	10.4	90.1
Indiana	1.6	
Wisconsin	0.5	
Minnesota	0.5	
Illinois	5.2	
Michigan*		
Detroit	24.0	
Flint	6.7	
Saginaw	7.7	
Lansing	5.2	
Kalamazoo	3.1	71.9
Jackson	3.1	
Grand Rapids	6.7	
Traverse City	11.8	
Gaylord	3.6	
Mountain/Pacific		1.0
Other		0.5

NOTE: Regions represent those defined by the U.S. Bureau of the Census.

\*Data are based on zip code areas, not just specific cities.

Table 13: Length of Stay

<u>Time (Days)</u>	<u>Percent</u>
1	29.2
2	15.5
3	15.2
4 to 7	27.7
8 to 10	8.1
More than 10	3.9
N.A.	0.6

Average length of stay = 3.79 days

diversity of activities available. For similar reasons, the Sleeping Bear Bay area and the Glen Lake/Good Harbor Highlands area attract nearly one-fifth and one-quarter of the summer visitors, respectively (table 15). Located in the Sleeping Bear Bay area are the D.H. Day Campground, Glen Haven, the dune-mobile concession, and the Sleeping Bear Point lifesaving station; the Glen Lake/Good Harbor Highlands area contains the scenically attractive Alligator Hill and Pyramid Point.

Table 14: Frequency of Visits to Sleeping Bear Dunes National Lakeshore

<u>Frequency of Visits</u>	<u>Percent</u>
One time	17.9
Two times	4.4
Three times	3.2
More than three times	1.2
One time per year	31.3
Two times per year	18.3
Three times per year	11.9
More than three times per year	8.8
More than once a month	1.6
More than once a week	1.6

Table 15: Areas Visited During Trip

<u>Area</u>	<u>Percent Visitation</u>
North Manitou	0.0
South Manitou	9.1
Good Harbor Bay	8.8
Glen Lake/Good Harbor Highlands	18.9
Sleeping Bear Bay	26.4
Glen Lake/Sleeping Bear Dune area	82.9
Empire Plain	11.9
Empire Bluffs	6.0
Platte Bay	44.3

## USE AREAS

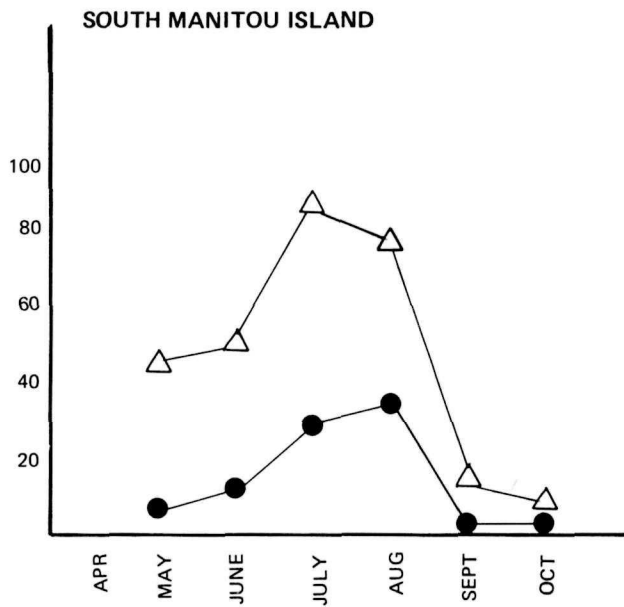
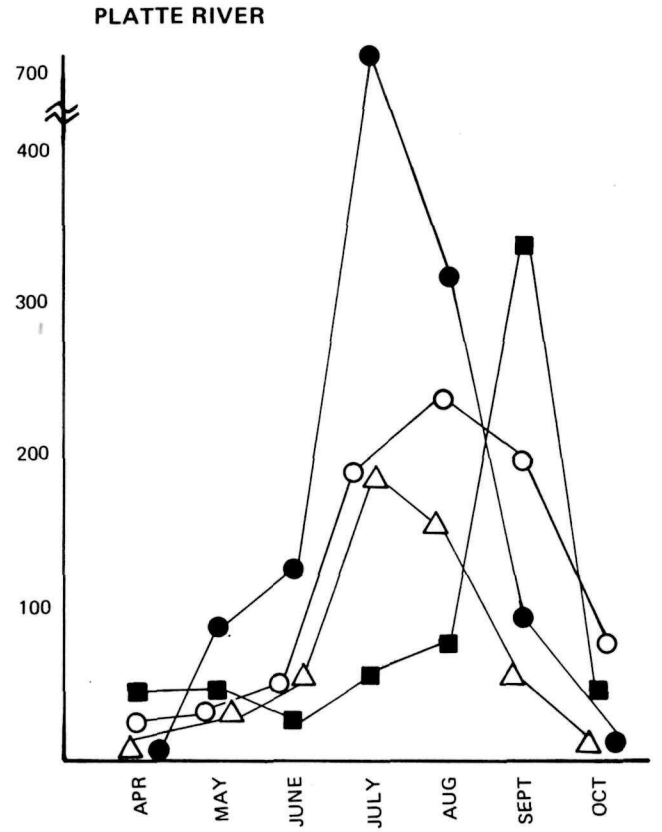
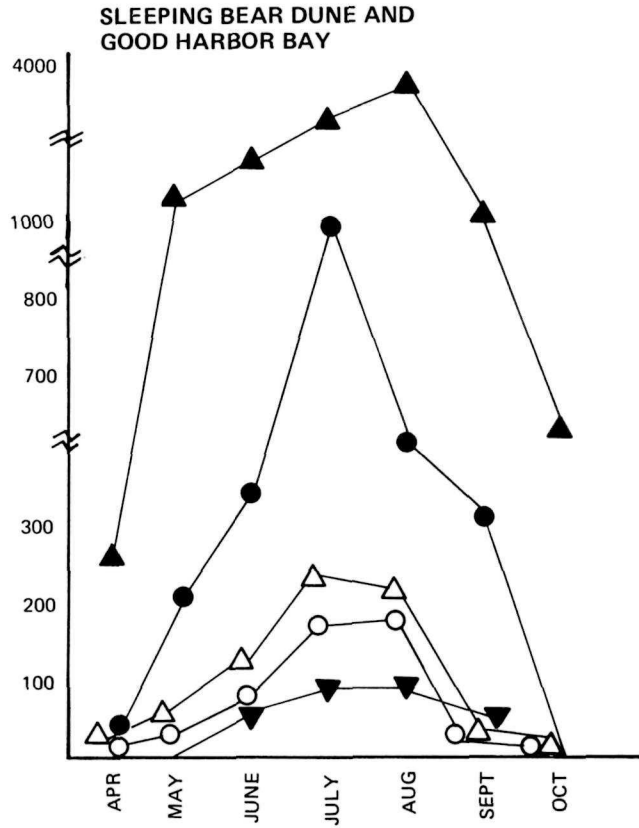
Records for Sleeping Bear Dunes, which are maintained primarily for all but winter use, show that there have been three major areas traditionally used by visitors--the Glen Lake/Sleeping Bear Dune area, the Platte Bay, and South Manitou Island. (These areas differ from the planning units, but they show existing visitation characteristics of the lakeshore.) In each of these areas, use climbed steadily through May and June to peak in July and August. Overall use then declined through September and October except for fishing, which peaked in September with the coho salmon and steelhead runs. The mainland areas attracted more use than South Manitou, and the Glen Lake/Sleeping Bear Dune area accommodated the greatest use of all three areas (see the Average Daily Visitation graph).

The dune-climb, at the west end of Glen Lake, was the single most attractive feature of the national lakeshore in 1977. During the peak period, an average of 3,500 people visited this area daily, more than triple the visits at any other area. Nearby sites also attracted swimmers (at the Glen Lake swimming beach), fishermen, and campers. During July, a daily average of 900 visitors participated in activities in the vicinity of Glen Lake and the campground other than dune-climbing. Participation in these activities dropped off quickly in August and September, while the number of visitors climbing the dune remained high through September.

Daytime use during the 1977 season in the Platte River area peaked in July, with a daily average of 713 visits. This was only slightly lower than the number of people in the Glen Lake/Sleeping Bear Dune area. During September, however, day use was more concentrated in the Platte River area, with an average of 335 fishermen per day attracted to the river.

Tabulations were also made of Good Harbor Bay users, including swimmers and beach users. Because access to Good Harbor Bay is limited by parking, the number of visits is considerably lower than in the other two areas. Also, there is not as wide a range of activities available, so use began as late as June (as water temperatures warmed) and peaked at only 90 to 100 visitors per day.

Use on South Manitou Island has been greatly limited by access. Boat capacity, operating times, and costs kept 1977 daily visitation to a maximum of only 120 visitors, and the emphasis was on overnight camping rather than day activities. An average of 87 visitors chose to camp on the island each night during July, which was nearly three times the number of people visiting the island during the day. It seems that the cost of the boat ride (both in



## AVERAGE DAILY VISITATION 1977

### SLEEPING BEAR DUNES NATIONAL LAKESHORE

- LEGEND**
- △ TENT CAMPERS
  - RECREATION VEHICLE
  - DAY USERS
  - FISHERMEN
  - ▲ DUNE CLIMBERS
  - ▼ GOOD HARBOR BAY USERS



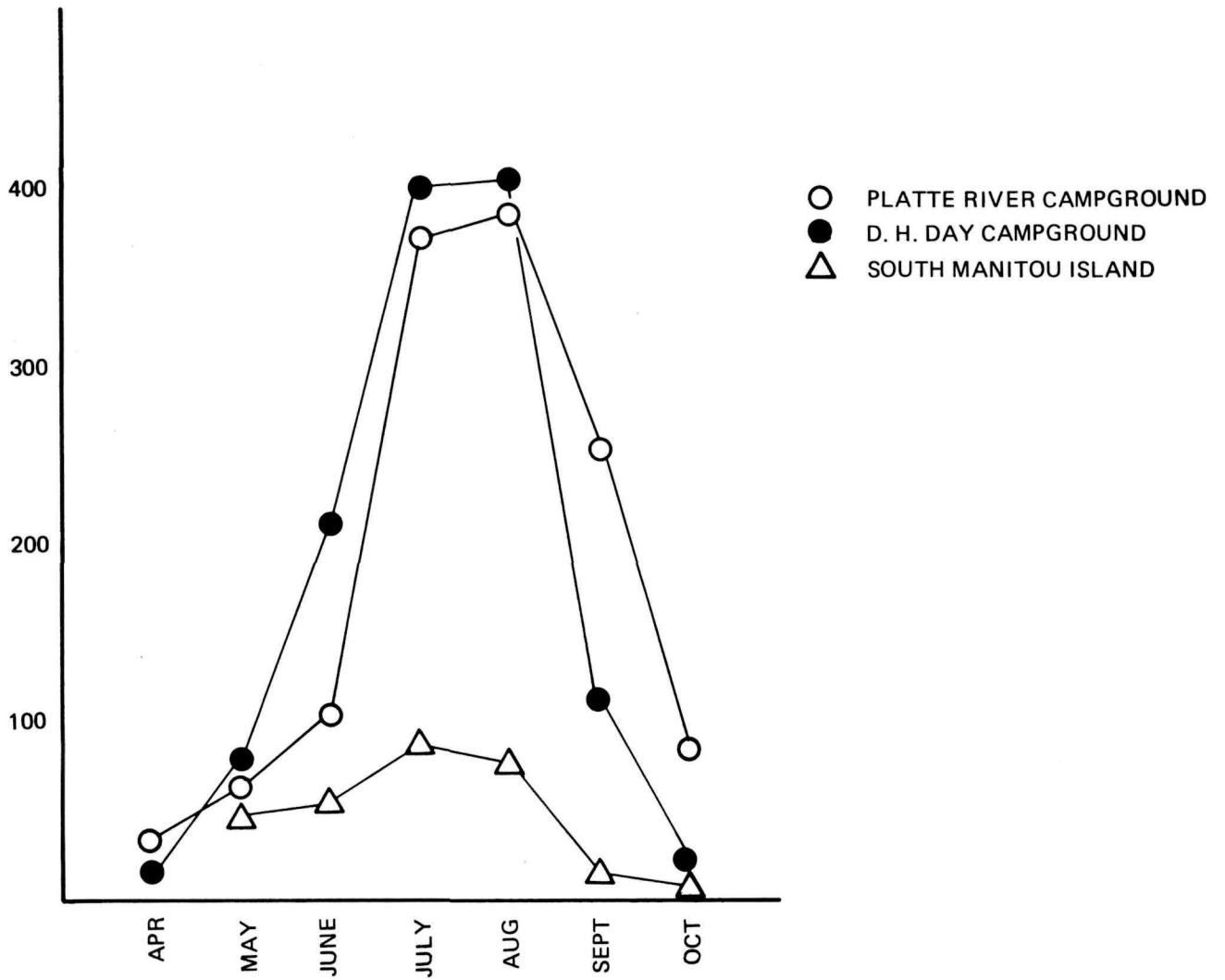
terms of time and money) prompts visitors to maximize their island visit, encouraging them to stay longer and take advantage of the dispersed recreational opportunities.

While the number of campers exceeded the number of day users on South Manitou Island, this was not the case on the mainland. The D.H. Day Campground and the Platte River Campground are the two mainland camping areas. During the heavy-use period in July and August 1977, an average of 775 campers per night stayed at the campgrounds (see Average Nightly Campground Use graph). This represents a very small portion of the total daily use, indicating that a large percentage of visitors find accommodations outside of the national lakeshore or travel from within a day's drive of their residence.

The D.H. Day Campground is used by more campers in peak months, while the Platte River Campground is used more heavily in the spring and fall. The D.H. Day Campground is also used more heavily by tent campers, while the Platte River Campground attracts more recreation vehicle campers. In both campgrounds, tent camping peaked in July and recreation vehicle camping peaked in August. In the D.H. Day Campground, both tent and recreation vehicle camping decreased rapidly in September; in the Platte River Campground, the number of tent campers fell off in September, but the number of recreation vehicle campers remained at an average level of 195 per day, primarily because of salmon fishing. This further indicates that during the fall use shifts to the Platte River area, although use at the dune-climb remains high.

# AVERAGE NIGHTLY CAMPGROUND USE 1977

SLEEPING BEAR DUNES NATIONAL LAKESHORE



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