



4 Affected Environment



INTRODUCTION

This chapter describes the existing environment of Sleeping Bear Dunes National Lakeshore. The focus is on elements (natural and cultural resources, visitor opportunities, socioeconomic characteristics, etc.) that would be affected by the actions proposed in the alternatives, should they be implemented. These topics were selected on the basis of federal law, regulations, executive orders, NPS expertise, and concerns expressed by

other agencies or members of the public during project scoping.

The first section in this chapter discusses impact topics that are analyzed in detail in this *General Management Plan / Wilderness Study / Environmental Impact Statement*. The next section discusses impact topics that are not analyzed in detail and explains the rationale for these decisions.

Impact Topics Considered in this Plan	Impact Topics Eliminated from Detailed Analysis in this Plan
<i>Alternatives in this plan have potential to affect these resources or topics.</i>	<i>These resources or topics are important, but alternatives in this plan would have only positive impacts on them, and/or any adverse impacts would be negligible to minor.</i>
Cultural Resources	Cultural Resources
<i>Historic Resources</i>	<i>Museum Collections</i>
Natural Resources	<i>Ethnographic Resources</i>
<i>Soils and Geologic Resources</i>	<i>Archeological Resources</i>
<i>Vegetation</i>	Indian Trust Resources
<i>Wildlife</i>	Natural Resources
<i>Federal Threatened and Endangered Species</i>	<i>Air Quality</i>
<i>Michigan State-listed Species*</i>	<i>Michigan State-listed Species (northern goshawk, grasshopper sparrow, least bittern, calypso or fairy-slipper, beauty sedge, and broad-leaved sedge)*</i>
<i>Wetlands</i>	<i>Floodplains</i>
<i>Water Quality</i>	<i>Coastal Zone Management</i>
Visitor Opportunities and Use	<i>Water Quantity</i>
<i>Visitor Opportunities</i>	<i>Prime or Unique Farmland</i>
<i>Visitor Use</i>	Energy Requirements and Conservation Potential
Wilderness Character	Environmental Justice
Regional Socioeconomics	Wild and Scenic Rivers
NPS Operations	

* The northern goshawk, grasshopper sparrow, least bittern, calypso or fairy-slipper, beauty sedge, and broad-leaved sedge, all state-listed species, were dismissed from further analysis. The reasons for dismissing these species can be found in the discussion of topics eliminated from detailed analysis.

IMPACT TOPICS CONSIDERED AND ANALYZED IN DETAIL

HISTORIC RESOURCES

Cultural resources as a group include historic structures, cultural landscapes, archeological resources, ethnographic resources, and museum collections. The latter three categories have not been analyzed in detail because they would not be affected under any alternative; these categories are described in the “Impact Topics Dismissed” section later in this chapter.

Historic Property Definitions

Within the topic of historic resources there are several historic property types defined under 36 CFR 800. They are defined as “any historic district, site, building, structure, or object included in or eligible for inclusion in, the National Register of Historic Places.” The following definitions are used by the National Park Service:

- **Building:** created principally to shelter any form of human activity such as a barn, house, church, or hotel
- **Site:** the location of a significant event; a prehistoric or historic occupation or activity; or a building or structure, whether standing or ruined or vanished, where the location itself possesses historic, cultural, or archeological value, regardless of the value of the existing structure
- **Structure:** a functional construction usually made for purposes other than creating human shelter, such as tunnels, bridges, oil wells, or dams
- **Object:** primarily artistic in nature or is relatively small in scale and simply constructed — Although an object may be moveable by nature or design, it is associated with a specific setting or

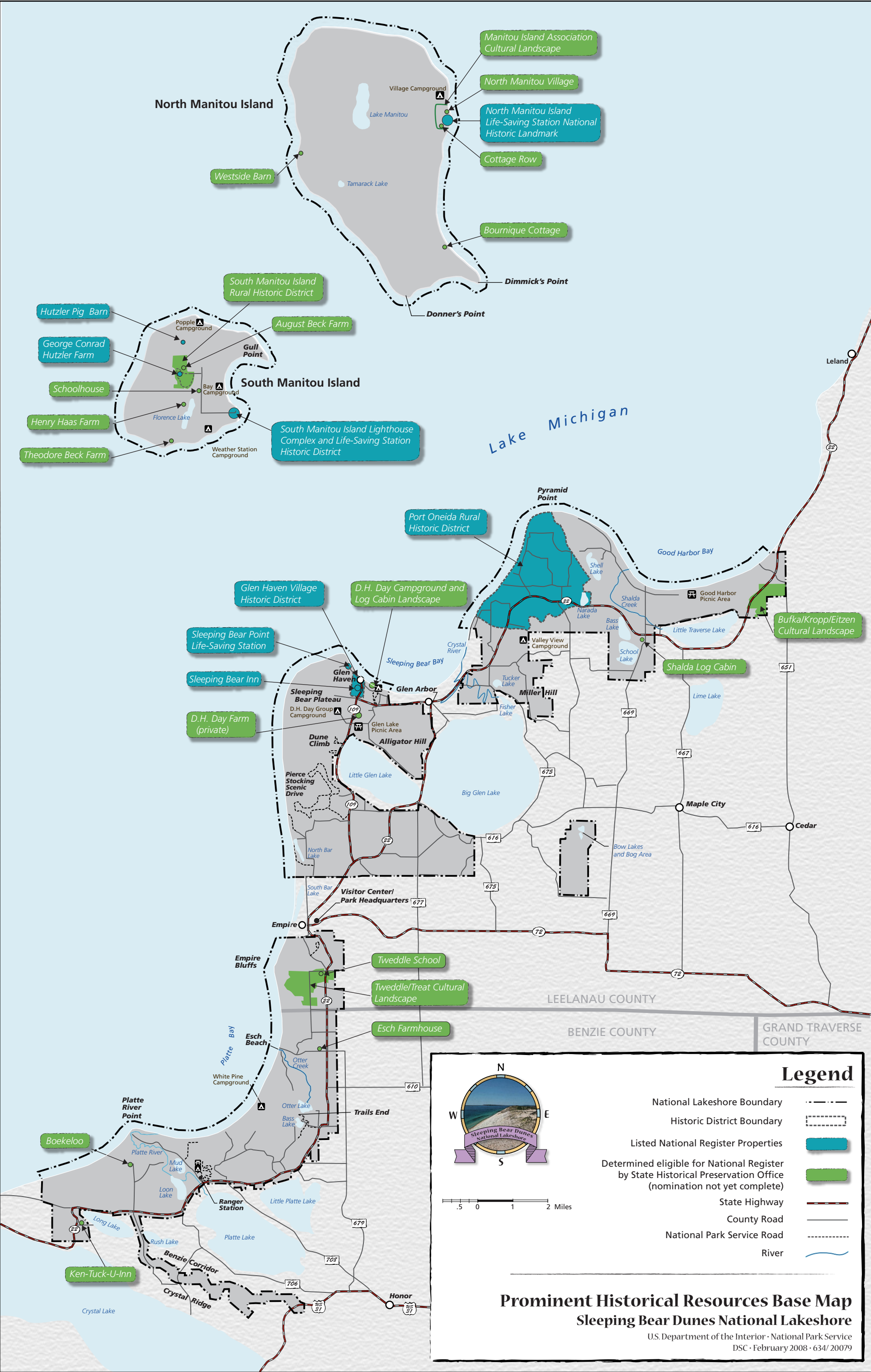
environment, including sculptures, boundary markers, or statues.

- **District:** possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development, such as a college campus, central business district, fort, or sprawling ranch
- **Landscape:** geographic area associated with events, persons, design styles, or ways of life that are significant in American history, landscape architecture, archeology, engineering, or culture

Each of the property types above is represented at Sleeping Bear Dunes National Lakeshore. However, not all of these property types will be affected by actions described in this plan. Therefore, within the historic resources topic, the property types to be discussed include cultural landscapes, sites, buildings, structures, and districts.

All historic properties in Sleeping Bear Dunes National Lakeshore have been or will be surveyed and evaluated for eligibility for the National Register of Historic Places by the National Park Service. Currently eight structures or groupings of structures or cultural landscapes have been listed on the national register (see Prominent Historical Resources Base map).

Within Leelanau County the listed historic properties are as follows: the Glen Haven Village Historic District, the George Conrad Hutzler Farm, the George J. and Margaretha Hutzler pig barn, the North Manitou Island Life-Saving Station (also a designated national historic landmark), the Port Oneida Rural Historic District, the Sleeping Bear Inn, the Sleeping Bear Point Life-Saving Station, and the South Manitou Island Lighthouse Complex and Life-Saving Station Historical



District. In Benzie County, no historic properties listed on the national register exist within the boundaries of the National Lakeshore.

Numerous other properties have been determined eligible for listing on the National Register of Historic Places by the National

Park Service and the Michigan state historic preservation officer. Many of these properties, however, have not yet had their significant features or time periods described on a nomination form for submission to the keeper of the national register for official listing.

A Note about the National Register of Historic Places and the National Historic Preservation Act

The National Register of Historic Places (national register) is a comprehensive list of districts, sites, buildings, structures, and objects of national, regional, state, and local significance in American history, architecture, archeology, engineering, and culture. The national register is maintained by the National Park Service under authority of the National Historic Preservation Act of 1966 as amended. Any property that appears eligible must be studied and documented and formally submitted to the state historic preservation officer for concurrence and to the keeper of the national register. The final decision on listing is made by the keeper of the national register.

During the time the proposed nomination is reviewed by the state historic preservation officer, property owners and local officials are notified of the intent to nominate and public comment is solicited. Once the property is listed on or determined eligible for the national register, all actions that could have an effect on the property, good or bad, must undergo the Section 106 process. Section 106 of the National Historic Preservation Act of 1966, as amended, requires that all actions affecting cultural resources listed on or eligible for inclusion on the national register be reviewed both by the state historic preservation officer and the Advisory Council on Historic Preservation before the undertaking. Should all parties concur, the action may proceed. Any disagreement requires additional consultation. Should no agreement be forthcoming following additional consultation, a formal decision to proceed may be made by the agency.

Once a property is listed on or determined eligible for the national register, the National Park Service is obligated to preserve and protect that property until a formal, conscious decision to do otherwise is made in consultation with the state historic preservation officer and the Advisory Council on Historic Preservation. Under Section 106 of the National Historic Preservation Act of 1966, as amended, the National Park Service has an obligation to request adequate funding for preservation maintenance of these properties — intentional neglect of a property under Section 106 is an “adverse effect” subject to consultation.

To preserve the historic properties in the National Lakeshore, the National Park Service intends to use a variety of means, such as NPS funding, grants, volunteers, and leasing of structures. Should these means prove inadequate to preserve all of the historic properties, the National Lakeshore would work with the state historic preservation officer when making decisions about preservation priorities.

By passage of the National Historic Preservation Act (NHPA), Congress established a comprehensive program to preserve the historical and cultural foundations of the nation as a living part of community life. Section 110 of the act identifies broad historic preservation responsibilities for federal agencies, such as the National Park Service, to ensure that historic preservation is fully integrated into all of their ongoing programs. Important benchmarks for federal agency preservation programs include the following:

- historic properties under the jurisdiction or control of the agency are to be managed and maintained in a way that considers the preservation of their historic, archeological, architectural, and cultural values;

- historic properties not under agency jurisdiction or control but potentially affected by agency actions are to be fully considered in agency planning; and
- agency preservation-related activities are to be carried out in consultation with other federal, state, and local agencies, Indian tribes, and the private sector.

Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their undertakings on historic properties either listed in or eligible to be listed in the national register. The historic preservation review process required by Section 106 is outlined in regulations (36 CFR Part 800, *Protecting Historic Properties*) issued by Advisory Council on Historic Preservation (ACHP), an independent federal agency established by the act in 1966 to promote the preservation, enhancement, and productive use of our nation's historic resources. The goal of the Section 106 review process is to seek ways to avoid, minimize, or mitigate any adverse effects on historic properties.

Federal agencies are responsible for initiating Section 106 review, most of which takes place between the agency and state and tribal officials. Appointed by the governor, the state historic preservation officer administers the national historic preservation program at the state level, coordinates the state's historic preservation program, and consults with federal agencies during Section 106 review. Federal agencies also consult with officials of federally recognized Indian tribes when tribal lands or historic properties of significance to such tribes are involved, as well as representatives of state and local governments, agencies, and organizations, the general public, and, as necessary, the Advisory Council.

Section 106 review encourages, but does not mandate, preservation of national register listed or eligible historic properties. The purpose of Section 106 review is not to stop proposed projects, but rather to ensure that federal agencies fully consider historic preservation values and the views of other agencies, tribes, organizations, and the public during project planning and decision-making. Sometimes there is no feasible and prudent way for a needed project to proceed without adversely affecting historic properties, and there may be overriding natural resource concerns or economic and social benefits that make it necessary for such a project to proceed as planned. Section 106 review does, however, ensure that preservation values are factored into federal agency planning and decision-making, and that federal agencies assume responsibility for the consequences of their actions on historic properties and are publicly accountable for their decisions.

Properties Listed in the National Register of Historic Places

The Glen Haven Village Historic District consists of 17 structures. It was first entered into the national register June 24, 1983, and the entry was subsequently modified on April, 19, 1990. The district is listed at a state level of significance as an excellent example of a frontier company-operated steamboat stop. Glen Haven Village is associated with David Henry Day whose entrepreneurial skills allowed the development of a lumber industry to supply cordwood for Great Lakes steamers and lumber for shipment to Chicago, dairy farming and livestock raising, fruit horticulture, and resort development. Its period of significance currently spans the years from 1857 to 1939, although a recently completed

cultural landscape report for Glen Haven recommends changing the period to 1864 to 1931, a period bracketed by the construction of the first structure, the Sleeping Bear Inn, and the last year that the steamboats stopped at Glen Haven.

The Sleeping Bear Inn was constructed circa 1864. It was individually listed on the national register on September 6, 1979, as a fine example of a frontier hotel with significance in the areas of commerce, entertainment recreation, and exploration and settlement. The inn served as home for area workers, an intermediate stop for settlers homesteading the area, and later as a resort hotel. The inn's period of significance is currently shown as 1857 to 1928. The Sleeping Bear Inn was later

also included in the Glen Haven Village Historic District nomination.

The Sleeping Bear Point Life-Saving Station is made up of five structures originally constructed between 1901 and 1931. The life-saving station was moved in 1931 to its current location and continued in operation until 1942. The station was added to the national register on April 26, 1979; its period of significance is 1901 to 1931. Since the nomination was entered, several additional landscape features have been identified as significant components of the complex and have been determined eligible for the national register. A modified nomination to include these features has yet to be prepared.

The Port Oneida Rural Historic District comprises 146 sites, structures, and buildings in a rural agricultural landscape reflecting the general settlement patterns of Northern European immigrants in the Upper Great Lakes region. The district was added to the national register in 1997 with a state level of significance. The district's period of significance is from 1880-1945. Since the nomination was entered, several additional landscape and archeological features have been identified as significant components of the district and are believed to contribute to the significance of the district. A modified nomination to include these features has yet to be prepared.

The North Manitou Island Life-Saving Station National Historic Landmark was entered on the national register on August 5, 1998. The station was operational from 1854 to 1938, first as a volunteer facility, then as part of the U.S. Life-Saving Service (1874-1915), and finally as a part of the U.S. Coast Guard. The station served as a key element in the network of rescue stations that provided humanitarian aid to shipwreck victims. Of the nearly 200 such stations, the North Manitou Island Life-Saving Station is the only remaining station

that represents the entire U.S. Life-Saving Service history from the volunteer era through the U.S. Coast Guard era. The 12 station structures retain a high level of integrity of design, material, and workmanship. The station's period of significance spans the years from 1854 to 1932.

The South Manitou Island Lighthouse Complex and Life-Saving Station Historical District was a strategic location on the Manitou Passage, providing the only harbor large enough for many ships transiting from Chicago to the Straits of Mackinac. The district consists of a lighthouse complex constructed 1858-1875, a life-saving station constructed 1901 to 1902, and two wood-frame houses constructed in 1902 and 1930. The period of significance is ca. 1858 to 1958. The historic district was entered on the state register on September 21, 1976, and the national register on October 28, 1983. Since the nomination was entered, several additional landscape features have been identified as significant components of the district, and have been determined eligible for the national register. A modified nomination to include these structures has yet to be prepared.

The George Johann and Margaretha Hutzler pig barn, built between 1856 and 1880 on South Manitou Island, was entered on the National Register of Historic Places January 3, 1978, with a designation of local significance. The structure is significant for its association with early settlement and agriculture on the island.

The George Conrad and Mary Ann Hutzler farm was listed on the national register May 3, 1992, with a designation of state significance for its association with scientific agriculture, particularly the development of Rosen rye and Michelite beans for Michigan Agricultural College in the 1920s. The period of significance is 1860 to 1930.

TABLE 6: EXISTING LISTED PROPERTIES

Property Name	Property Type	Structures Within	Significance Level	Period of Significance
Glen Haven Village Historic District	historic district	14 buildings, 2 structures, 1 site	state *	1857–1931
Sleeping Bear Inn	structure	1 building	state *	1857–1928
Sleeping Bear Point Life-Saving Station	buildings	4 buildings, 1 structure, 1 object	state *	1901–1958
Port Oneida	rural historic district	121 buildings, 20 structures, 5 sites	state *	1870–1945
North Manitou Island Life-Saving Station	national historic landmark	8 buildings, 4 structures, 1 object	national	1854–1932
South Manitou Island Lighthouse Complex and Life-Saving Station Historical District	historic district	13 buildings, 5 structures	state*	1858–1958
George Conrad and Mary Ann Hutzler Farm	district (160 acre tract)	9 buildings	state*	1860–1930
George Johann and Margaretha Hutzler Pig Barn	structure	1 building	local	

* Property was later determined by the National Lakeshore and concurred by the state historic preservation officer as meeting a national level of significance as part of a larger historic district. A description and recommended significance level has not yet been submitted to the keeper of the national register for nomination of these districts (see below).

Properties Determined Eligible for Inclusion on the National Register and Possible New National Register Districts

As cultural resources within the National Lakeshore continue to be studied, new themes have been proposed for national register listing that look at the resources differently. Although all historic properties have already been identified through initial survey and preliminary consultations, the proposed themes may result in some resources being included in more than one national register district.

Manitou Passage Maritime Landscape National Historic District. This district would be comprised of a concentration of maritime historic sites, geographic features, and native habitats with few modern intrusions. This district would exemplify the historic landscape features related to the Great Lakes transportation system more completely than any site on the Great Lakes. The Glen Haven Village Historic District, portions of the villages on North Manitou and South Manitou islands, and the three life-saving stations would be among the prominent contributing elements to this district. In 1999, the Michigan state historic preservation

officer concurred that such a district would be eligible for the register at the national level of significance. The Manitou Passage Maritime Landscape National Historic District has not yet been formally described or proposed to the keeper of the national register.

South Manitou Island Rural Historic District. This district would be significant for its association with the island's agriculture and pattern of settlement, and would span a period of about 1838-1940. The district would include contributing elements such as the August Beck, George Johann Hutzler, and George Conrad Hutzler farms; the South Manitou Island schoolhouse; and other properties. In 1999 the Michigan state historic preservation officer concurred that such a district would be eligible for the register at the state level of significance. The district has been described, but a nomination has not yet been prepared or submitted to the keeper of the national register for listing.

Several additional structures and building complexes within the National Lakeshore have been determined by the National Park Service, and the state historic preservation officer has concurred, as eligible for inclusion on the National Register of Historic Places as individual listings: at a state level of significance, the North Manitou Sawmill Complex; and at a local level of significance, the Bufka Farmstead (see also Bufka/Kropp/Eitzen Rural Historic Landscape below), the Shalda log cabin, the Esch house, the Swenson/Westside barn on North Manitou Island, and the Henry Haas and Theodore Beck houses on South Manitou Island. None have yet been documented on a nomination form for submittal to the keeper of the national register for listing.

Several other landscapes also have been determined eligible for inclusion on the national register by the National Park Service and the state historic preservation office, but have not yet been documented on a nomination form for submittal to the keeper of the

national register for listing. These include the following: at a state level of significance, the Boekeloo Wilderness Landscape, the D.H. Day Campground and Log Cabin Landscape; and at a local level of significance, the Tweddle/Treat Rural Historic Landscape (four farmsteads and a rural schoolhouse), the Ken-Tuck-U-Inn Historic Landscape, the Manitou Island Association Historic Landscape, and the Bufka/Kropp/Eitzen Rural Historic Landscape. See also table 3 on page 74.

NATURAL RESOURCES

Soils and Geologic Resources

Landforms of the National Lakeshore were shaped by the continental glaciation of the Wisconsin stage as well as earlier glacial periods of the Pleistocene Era. Additionally, fluctuating water levels of the ancient lakes that preceded Lake Michigan, along with wave and wind action, created the National Lakeshore's truncated headlands and fashioned the Lake-shore's perched dunes and embayment lakes.

The glacial ice of some 50,000 years ago followed ancient drainage patterns and excavated the basins that now form the lakes along the coastal area of this region. During the final advances of the Wisconsin stage of Pleistocene glaciation, the ice deposited large terminal and lateral moraines that form contemporary dunes and high points of the local geography. Ice Age glaciers, combined with enormous quantities of melt water and huge stranded blocks of ice, created entire valleys and left kettles or ice block lakes and depressions. (NPS 2005a.)

As the glaciers retreated, massive volumes of water either filled the Lake Michigan basin or were drained from it — depending upon the extent of glaciation and the development of drainage channels that allowed the waters of ancient Lake Michigan (Lake Algonquin, Lake Nipissing, Lake Algoma, and Lake Chippewa)

to deepen or drain away. New beaches were cut into the shorelines when the lake levels were high. As levels of Lake Michigan waters lowered, a succession of beaches was formed. These remnant beaches, examples of which can be seen at the Platte Basin, the Good Harbor Bay region, and the bay portion of South Manitou Island, reflect the shape of the ancient shorelines some distance from today's shoreline. The beaches that are the farthest from the current lake shoreline are the oldest. (NPS 2005a.)

Later, headlands such as the Empire Bluffs, Sleeping Bear Bluffs, Pyramid Point, and the western bluffs of North Manitou and South Manitou islands directed ice into the lowlands, sculpting many new lakes. These headlands are now truncated and continually eroding. In 1995 more than 35 million cubic feet (about a million cubic meters) of sand from the beach and bluff at Sleeping Bear Point disappeared into Lake Michigan in a huge landslide (USGS 1998).

These headlands also provided the materials that wind and wave action transformed into the sandbars that cut off the embayment lakes (such as Platte Lakes, North and South Bar Lakes, Glen Lake, Shell Lake, and Little Traverse Lake) from the parent ancient lakes. The exposed sand and gravel in these truncated morainal headlands were separated by the winds. The sand was blown to the top of high glacial moraines and created even higher dunes on top of the glacial moraines. These are referred to as "perched dunes" because they developed on top of the glacial moraines. Sleeping Bear Dunes, Empire Bluffs, Pyramid Point, and the island dunes are examples of these perched dunes. Lower dunes between the headlands and moraines are found in the Platte Plains and Good Harbor areas (NPS 2005a). These perched and lower dunes, both the currently exposed dunes close to the shoreline and the ancient dune and swale complexes landward of the current shoreline,

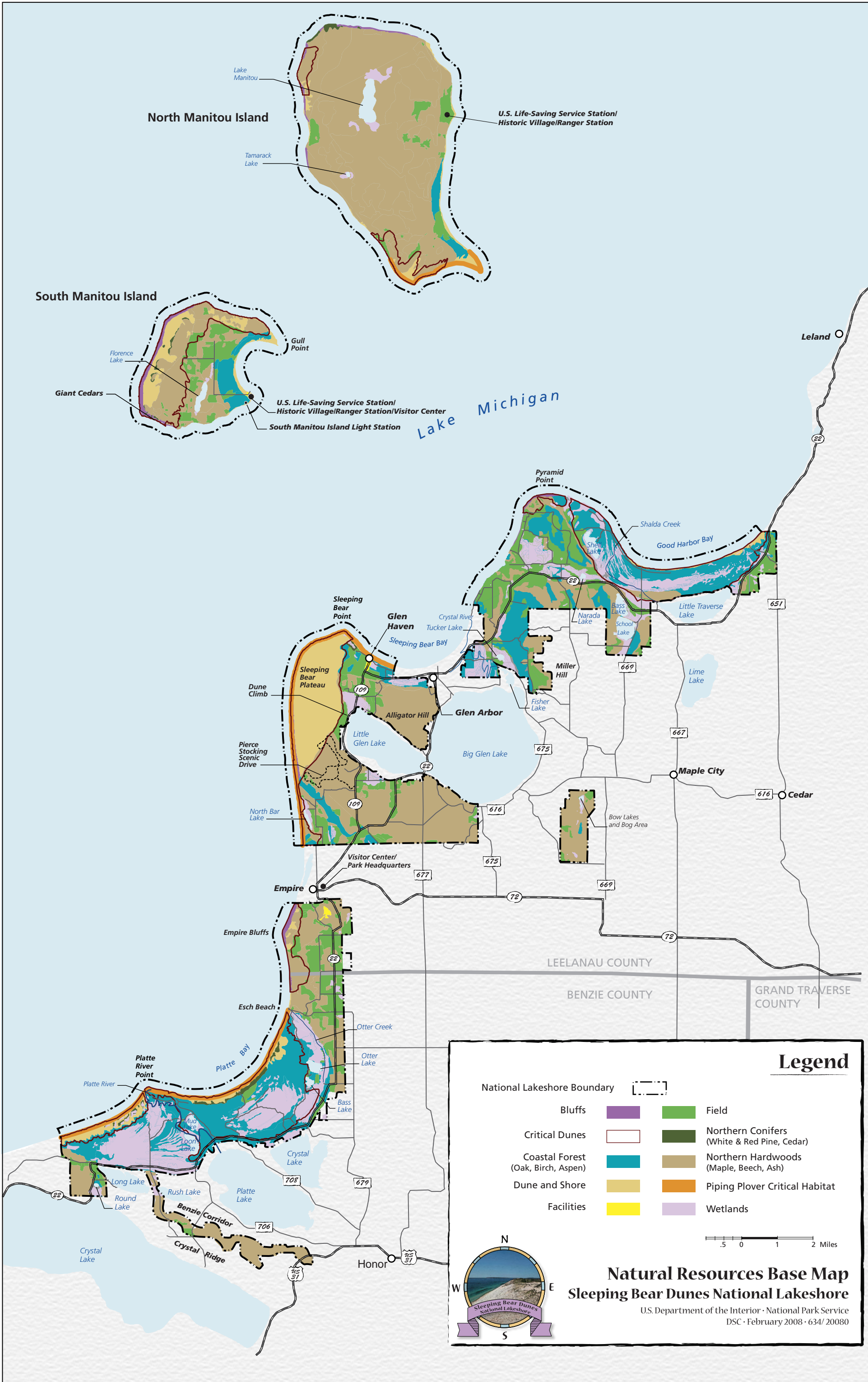
comprise designated critical dune habitat (see Natural Resources Base map).

The National Lakeshore's soils are predominantly sandy or sand mixed with gravel and are well drained. These soils are often found on steep slopes. In most areas soils are covered with thin topsoil that was depleted in many instances by unsustainable farming practices after the land was logged in the early 1900s. Duff layers covering the soils are extremely variable, ranging from no duff layer to a foot or more. (NPS 2005a.)

Vegetation

Pleistocene-era glaciers, glacial melt water, and subsequent wind and water erosion all shaped the landforms — including beaches, moraines, dunes, kettles, and embayment lakes — upon or around which plant communities are established (NPS 2005a). (See Natural Resources Base map.)

Lake Michigan moderates temperature fluctuations, influencing the climate, and therefore the vegetation, of the National Lakeshore. Winters are milder and summers are cooler along the shore of Lake Michigan than in more inland areas. The moderating effect of Lake Michigan, combined with regional air circulation patterns, provide a growing period of approximately 150 days near the shore — 50 days longer than areas several miles inland. Another lake effect on the National Lakeshore's climate is increased cloudiness in late fall and early winter. The cold, winter air mixing with warmer, moist air from the lake frequently produces greater amounts of snow, rain, and fog near the lake. This relatively temperate and humid climate of the near-shore environment strongly influences the plant communities within the Lakeshore. (NPS 2005a.)



Former land uses and resource exploitation or extraction have also impacted the Lakeshore's landforms and vegetative cover. The Lakeshore's protected landscapes and vegetation communities provide sanctuary to several threatened and endangered species as well as representative regional species of flora and fauna. At least 900 species of vascular plants, representing more than 100 taxonomic families, occur at the National Lakeshore (NPS 2005a). Major plant communities occurring in the Lakeshore are described below within broader vegetation categories, which are generally presented from the shoreline landward.

Shoreline Vegetation. Beaches and sand dunes present harsh growing conditions characterized by strong winds, shifting sand, seasonally high surface temperatures, and dry conditions. Approximately 4,800 acres (1,920 hectares) of beaches and sand dunes occur in the Lakeshore (NPS 2005a). Vegetation starts just behind the "storm beach" of Lake Michigan. No vascular plants grow on the "storm beach" proper because of high waves, ice, and moving sand. The first dunes behind this beach support some pioneer plants, including beach or Marram grass (*Ammophila breviligulata*), Pitcher's thistle (*Cirsium pitcheri*), sand cherry (*Prunus pumila*), and beach pea (*Lathyrus japonicus*). Further landward in more stabilized areas of the dunes, grass, forb, and shrub species such as little bluestem (*Schizachyrium scoparium*), hoary puccoon (*Lithospermum canescens*), and creeping juniper (*Juniperus horizontalis*) become established (NPS 2005a, MNFI 2006a).

Forest Resources. Landward of the grass- and shrub-dominated dunes area is typically a dynamic zone where the dunes and neighboring woodland or forest move back and forth as conditions change. In some sites containing actively moving dunes, the dunes zone encroaches directly onto the mature hardwood forest. More often, however, the dunes zone integrates with an open pine forest including red pine (*Pinus resinosa*), white pine (*Pinus*

strobus), jack pine (*Pinus banksiana*), creeping juniper, and common juniper (*Juniperus communis*). Alternatively, the dunes zone may grade into an oak-aspen woodland that is comprised of bigtooth aspen (*Populus grandidentata*), quaking aspen (*Populus tremuloides*), red oak (*Quercus rubra*), white oak (*Quercus alba*), birch species such as yellow birch (*Betula alleghaniensis*) or paper birch (*B. papyrifera*), and ground vegetation composed of bracken fern (*Pteridium aquilinum*), prince's pine (*Chimaphila* sp.), trailing arbutus (*Epigaea repens*), wintergreen (*Pyrola* sp.), blueberry (*Vaccinium* sp.), and partridgeberry (*Mitchella repens*). When lake levels go down and beach and dune area is increased on the lakeward side of the zone, wind speed and sand abrasion at the forest or woodland edge decreases, permitting forest development. Oak-aspen woods cover about 3,300 acres (1,320 hectares) of the National Lakeshore, and "coastal forest," of which oak-pine and birch-maple-aspen are two subtypes, covers an additional 11,000 acres (4,400 hectares). (NPS 2005a, MNFI 2006a.)

Further inland, beyond the dynamic zone, is found more mature forest. The climax forest of this region is primarily a beech-maple hardwood forest, known as the northern hardwood forest community. The trees are predominantly American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*), but also include black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), red oak, yellow birch, and green ash (*Fraxinus pennsylvanica*). Dwarf or bunchberry dogwood (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), sweet cicely (*Osmorhiza claytonii*), columbine (*Aquilegia canadensis*), trillium (*Trillium* sp.), and wild leeks (*Allium burdickii*) are represented in the understory and on the forest floor. Approximately 24,000 acres (9,600 hectares), or 42% of the National Lakeshore's land surface area, are covered with northern hardwood forest.

Approximately 578 acres (234 hectares) of the Lakeshore are in plantations of conifers, including the native Jack, white, and red pine and black spruce (*Picea mariana*), and nonnatives such as Douglas fir (*Pseudotsuga menziesii*), Scotch pine (*Pinus sylvestris*), Austrian pine (*Pinus nigra*), blue spruce (*Picea pungens*), and Norway spruce (*Picea abies*) (NPS 2005a, MNFI 2006a, USDA 2007).

Most of the forests in the National Lakeshore are considered second growth, having first been logged in the late 19th century. The total removal of forested areas is still evident in the open fields that remain from past agricultural ventures or pine plantations as noted above. Several forested tracts were managed by individual landowners as woodlots until the property was acquired by the National Lakeshore.

The southwestern corner of South Manitou Island supports a small area (less than 10 acres or 4 hectares) known by some as the “Valley of the Giants” or “Giant Cedars” because of a grove of giant northern white cedars (*Thuja occidentalis*) (Thompson 1962). This virgin stand of giant cedars escaped logging and now has the largest northern white cedar in the United States, at 110 feet (33 meters) tall with a girth of 206 inches (523 cm). Many of these cedars are more than 500 years old. This Giant Cedars area of South Manitou Island is also important in that four plant species, two of which are listed as threatened by the Michigan Natural Features Inventory, have been documented in the general vicinity. Other species in this area are mountain maple (*Acer spicatum*), striped maple (*Acer pennsylvanicum*), red trillium (*Trillium erectum*), and nodding trillium (*Trillium flexipes*), which is also known as Gleason’s trillium (NatureServe 2007). The vegetation community described for the Giant Cedars area is classified as boreal forest by the Michigan Natural Features Inventory (MNFI 2006a).

Agricultural Landscapes. The Lakeshore includes open areas consisting of former farm

fields and road edges. Native plants occasionally found in these areas include black-eyed Susan (*Rudbeckia hirta*); goldenrod (*Solidago* sp.); pussytoes (*Antennaria* sp.); pearly everlasting (*Anaphalis margaritacea*); yarrow (*Achillea millefolium*); common milkweed (*Asclepias syriaca*); staghorn sumac (*Rhus typhina*); and several grasses. Fields cover almost 7,900 acres (3,160 hectares) of the National Lakeshore, or about 14% of its land surface area. (NPS 2005a.) Some of these agricultural landscapes are maintained as cultural landscapes and provide important habitat for grassland wildlife species, particularly birds (see next section on wildlife).

Invasive Species. The National Lakeshore has embarked on a cooperative program with the U.S. Geological Survey Biological Resource Division to survey and assess exotic species in the Lakeshore. At least 150 exotic or nonnative plants or noxious weeds have been identified at Sleeping Bear Dunes (NPS 2005a). Some of the more invasive exotic plants in the Lakeshore are garlic mustard (*Alliaria petiolata*), leafy spurge (*Euphorbia esula*), purple loosestrife (*Lythrum salicaria*), and baby’s breath (*Gypsophila paniculata*). The Lakeshore placed a high priority on controlling these four plants and five others — black locust, common reed, myrtle, Scotch pine, and the tree of heaven or ailanthus in 1999 (NPS 1999b). Subsequent surveys revealed spotted knapweed, baby’s breath, bull thistle, blue lyme grass, bladder campion, hoary alyssum, and Lombardy poplar were establishing extensive populations in the open dune habitat that supports a number of sensitive species including the endangered piping plover and the threatened Pitcher’s thistle among others. A survey was conducted in 2005 to determine the extent of infestation by baby’s breath, and in 2006 the NPS staff developed an invasive species control plan and environmental assessment (NPS 2006a). Zebra mussels (*Dreissena polymorpha*), quagga mussels (*D. bugensis*), round goby (*Neogobius melanostomus*), and Cladophora (a

native green algae) are troublesome aquatic invaders in the National Lakeshore.

Wildlife

Michigan wildlife species are well represented at Sleeping Bear Dunes National Lakeshore, reflecting the variety of habitats found within the Lakeshore. Wildlife documented in the Lakeshore include 74 species of fish, 18 species of amphibians, 17 species of reptiles, 46 species of mammals, and 247 species of birds. The following discussion provides a brief description of common inhabitants in the various habitats found within the Lakeshore and is not intended as an exhaustive list of species present.

Beaver (*Castor canadensis*), otter (*Lontra canadensis*), mink (*Neovison vison*), and muskrat (*Ondatra zibethicus*) occur in the Lakeshore's wetlands/aquatic areas. Several species of ducks and geese nest at the National Lakeshore. Snapping turtles (*Chelydra serpentina*), painted turtles (*Chrysemys pictis*), leopard frogs (*Rana pipiens*), and spring peepers (*Pseudacris crucifer*) are some of the reptiles and amphibians found in and near aquatic and wetland habitats.

Common forest wildlife includes the white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), fox squirrel (*Sciurus niger*), flying squirrel (*Glaucomys sabrinus*), eastern chipmunk (*Tamias striatus*), and the deer mouse (*Peromyscus maniculatus*). Typical forest-dwelling birds include the ruffed grouse (*Bonasa umbellus*), pileated woodpecker (*Dryocopus pileatus*), downy and hairy woodpeckers (*Picoides pubescens* and *P. villosus*, respectively), red-breasted and white-breasted nuthatches (*Sitta canadensis* and *S. carolinensis*, respectively), black-capped chickadees (*Poecile atricapillus*), brown creepers (*Certhia americana*), barred owls (*Strix varia*), and great horned owls (*Bubo virginianus*). Wild turkeys (*Meleagris gallopavo*)

are also present, but this is probably due to the state feeding programs, because the National Lakeshore is north of their native range. Garter snakes (*Thamnophis* spp.) and salamanders (*Ambystoma* spp.) occur in the forest as well.

In the meadows, fields, and dunes of the National Lakeshore, representative birds include bobolinks, bluebirds (*Sialia sialis*), killdeer (*Charadrius vociferous*), meadowlarks (*Sturnella* spp.), horned larks (*Eremophila alpestris*), and northern harriers. Common mammals are deer, fox, and meadow voles (*Microtus pennsylvanicus*). The Lakeshore's open fields provide valuable habitat for grassland nesting birds in the summer and for other wildlife throughout the year. Throughout much of North America, populations of open land (grassland-shrubland-early successional forests) birds have been declining dramatically, primarily in response to the loss of available habitat. Corace et al. (2003) found the bird community associated with the Lakeshore's cultural open areas to include six open land species that are of conservation concern as designated by the U.S. Fish and Wildlife Service Region Three (Midwest) (USFWS 2002a) and shown in table 7). This habitat is maintained with an open field management mowing plan. In the absence of cultivation and grazing, grassland bird species in national decline such as grasshopper sparrows, bobolinks, and upland sandpipers flourish in these fields.

The National Lakeshore's approximately 160 species of nesting birds is one of the larger numbers among national park system units. This is because of the wide variety of undisturbed habitat and the lack of agriculture, grazing, and major development. The Lakeshore is an important area for the protection of nesting sites for vulnerable bird species and for stopover sites and resting for migratory birds. Migrant shorebirds like the semipalmated plover (*Charadrius semipalmatus*), ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris alba*), and others can be found on National Lakeshore beaches.

TABLE 7: BIRD SPECIES ASSOCIATED WITH CULTURAL OPEN LANDS IN SLEEPING BEAR DUNES NATIONAL LAKESHORE THAT ARE DESIGNATED BY THE U.S. FISH AND WILDLIFE SERVICE AS SPECIES OF CONSERVATION CONCERN

Common Name	Scientific Name
black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>
bobolink	<i>Dolichonyx oryzivorus</i>
Connecticut warbler	<i>Oporornis agilis</i>
Henslow's sparrow	<i>Ammodramus henslowii</i>
Le Conte's sparrow	<i>Ammodramus leconteii</i>
upland sandpiper	<i>Bartramia longicauda</i>

Other bird species that use cultural open areas in the Lakeshore included the field sparrow (*Spizella pusilla*), grasshopper sparrow (*Ammodramus savannarum*), sedge wren (*Cistothorus platensis*), eastern meadowlark (*Sturnella magna*), western meadowlark (*Sturnella neglecta*), northern harrier (*Circus cyaneus*), and whip-poor-will (*Caprimulgus vociferous*) (Corace et al. 2003).

The Manitou Islands are an interesting case study in "island biogeography." As would be expected, they support fewer species of wildlife than nearby mainland areas. The seven miles (11 km) of Lake Michigan between the islands and the mainland is a substantial barrier to animal migration and has been a major factor in the ecology and species composition of the islands.

South Manitou Island has dense ground vegetation rich in woodland wildflowers and Canada yew (*Taxus canadensis*). The vegetation developed in the absence of deer browsing. In 1994 however, deer tracks were observed for the first time on South Manitou Island. Their presence threatened the natural vegetation composition of this island and they were removed in 2001. New deer tracks were reported on South Manitou Island in 2003. These migrants probably came from North Manitou Island. The deer mouse is the only mouse species, compared to seven species of mice and voles on the mainland. Eastern chipmunks and fox squirrels are found on South Manitou Island, but none of the other

tree squirrels or flying squirrels occurs on the island.

The masked shrew (*Sorex cinereus*) has been documented on South Manitou Island, but not the short-tailed shrew (*Blarina brevicauda*), which is found on the mainland. Reptile and amphibian species are also limited. Leopard frogs, spring peepers, American toads (*Bufo americanus*), painted turtles, and garter snakes may all be observed on South Manitou Island.

South Manitou Island's bird life is rather diverse, with many woodland residents and migrating birds. The ruffed grouse, however, is not found on this island. There was a large ring-billed gull (*Larus delawarensis*) colony on South Manitou as well as a herring gull (*Larus argentatus*) colony. The combined rookery failed in 1990 and 1991, probably due to predation by red fox. The ring-billed colony has since returned, and there were an estimated 13,000 nests in 1998. It is unusual for gulls to nest where there is a substantial threat of predation, and it is thought that the gull colonies developed during short periods when the numbers of fox were severely reduced or eliminated by island settlers. The fox population has declined in recent years, and the snowshoe hare (*Lepus americanus*) population has increased.

The wildlife found on North Manitou Island is similar to South Manitou Island except that white-tailed deer, raccoons, and wild turkey were all introduced in the 1920s while the island was a private hunting preserve. The deer

herd exceeded the natural carrying capacity of the island because of an artificial feeding program. As a result, North Manitou's vegetation displayed classic symptoms of over-browsing. Natural browse was almost entirely eliminated, and sharp browse lines are evident at the level deer can reach. For a number of years, deer starved on the island because the artificial feeding program favored bucks and large does, leaving many of the young deer to die. In contrast, South Manitou Island has luxuriant understory and ground cover vegetation.

In response to this deer overpopulation and subsequent habitat degradation, the National Lakeshore initiated an intense public hunting program on North Manitou Island in 1985 to reduce deer numbers and restore natural native vegetation. The annual public deer hunt continues under regulation by the state and the National Park Service.

In the Lakeshore as a whole, trapping is prohibited. As a result, sightings of fox, coyote (*Canis latrans*), otter, and bobcat (*Lynx rufus*) have increased. In recent years, cougar (*Puma concolor*) sightings have been reported with increasing regularity. The National Park Service conducted a study from November 2004 through April 2005 to investigate whether cougars are present in the National Lakeshore. Using multiple survey methods, no physical evidence of cougars was found in the National Lakeshore (NPS 2006b).

Sleeping Bear Dunes National Lakeshore's aquatic habitats contain a number of fish species, including rainbow trout (nonnative) (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), suckers (*Catostomus* spp.), several genera of shiners, and rock bass (*Ambloplites rupestris*), among others. Smelt (*Osmerus mordax*), sea lamprey (*Petromyzon marinus*), alewife (*Alosa pseudoharengus*), and zebra mussels (*Dreissena polymorpha*) are nonnative species that have a pronounced impact on the aquatic environment and native biota. The invasion of the sea lamprey, a nonnative species to the Great Lakes, has harmed the native lake

trout stock. The alewife invasion of the Great Lakes has also caused major biological and shoreline fouling problems. A recent invader to the Great Lakes, the round goby (*Neogobius melanostomus*) is believed to be a prime factor in the recent waterfowl die-offs attributed to type E botulism along Lake Michigan beaches within the National Lakeshore.

The introduction of the coho (*Oncorhynchus kisutch*) and other nonnative species of salmon to the area has resulted in a large seasonal supply of these fish in area streams, providing for a large sport fishery every late summer and fall. Fishing for coho salmon is concentrated near the mouth of the Platte River and Platte Bay, but sport-fishing activity occurs in other bays of Lake Michigan and also in the inland lakes. The Michigan Department of Natural Resources maintains the Platte River State Fish Hatchery, located approximately 10 miles southeast of the Lakeshore. This facility raises coho and chinook salmon and is the main egg take station for coho salmon in the Upper Great Lakes. Another component of the state salmon program is the harvest weir that the Michigan Department of Natural Resources operates on the lower Platte River, on state land within the park boundary. This weir blocks the returning salmon swimming up the Platte River from Lake Michigan. The fish are harvested at this point during their fall run.

Federal Threatened and Endangered Species

The Endangered Species Act of 1973 prohibits the harming of any species listed by the U. S. Fish and Wildlife Service (USFWS) as being either threatened or endangered. Harming such species includes not only directly injuring or killing them, but also disrupting the habitat on which they depend. Section 7 of the act also requires federal agencies to consult with the U. S. Fish and Wildlife Service when any activity permitted, funded, or conducted by that agency may affect a listed species or designated critical habitat, or is

likely to jeopardize proposed species or adversely modify proposed critical habitat.

Table 8 displays federal and state-listed species (threatened, endangered, and species of concern) whose occurrence has been documented in the Lakeshore and in one or both of Benzie and Leelanau counties, the two counties in which Sleeping Bear Dunes National Lakeshore occurs (MNFI 2006b).

Piping Plover. The Great Lakes population of the piping plover (*Charadrius melodus*) is a federally endangered species and is listed as endangered by the state of Michigan as well. The piping plover is a small shorebird (length about 7 inches) with a black collar, orange legs, and a short, stubby tail (USGS 2000).

Piping plovers breed in three locations in North America — along the Atlantic Coast from North Carolina to Southern Canada, along the shores of the Great Lakes, and along rivers and wetlands of the northern Great Plains. In Michigan, piping plovers prefer wide, sandy, open beaches along the shores of the Great Lakes. Nesting territories generally have sparse vegetation and scattered cobblestones and may include river, lagoon, or other wetland habitat to provide additional food for chicks (Hyde 1999a). In the winter, piping plovers migrate to the Gulf Coast between Florida and Texas and on into Mexico and the Caribbean, as well as migrating to the Atlantic Coast between southern North Carolina and Florida. Initial declines of the species in the late 1800s and early 1900s were caused by hunting. Declines in the 1950s were attributed to habitat loss, recreational pressure, predation, and contaminants. In the 1970s and mid 1980s high water levels in the Great Lakes reduced available breeding habitat in that region (Hyde 1999a). Habitat destruction and alteration and human development along the shores of the Great Lakes continue to impact the piping plover and have lead to their extirpation over much of their former Great Lakes nesting range.

Protecting current, past, and potential piping plover nesting habitat from development is essential for expanding the Great Lakes population. Protection from predators at nesting sites and the reduction of human-related disturbance to nesting piping plovers is needed to expand the breeding population in the Great Lakes region.

The U.S. Fish and Wildlife Service has designated critical habitat for the piping plover along certain shorelines within the National Lakeshore (see Natural Resources Base map), including 2.1 miles (3.3 km) along North Manitou Island and 14.2 miles (22.5 km) along the mainland lakeshore (USFWS 2001). These are areas that must be protected because they are considered essential to the conservation of the Great Lakes breeding population of the species. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species is carried forward as an impact topic under “Federal Threatened and Endangered Species” in chapter 5.

Indiana Bat. The Indiana bat (*Myotis sodalis*) is on the federal list as endangered and is listed as endangered by the state of Michigan. Habitat requirements for this species can be divided into summer habitat characteristics and winter hibernating habitat characteristics. In the summer, female Indiana bats roost singly or in maternity colonies where they raise their single offspring (Humphrey et al. 1977). Maternity colonies use several roost trees each season in closed canopy floodplain, riparian and upland forests. Males roost individually or in small groups as well, generally near female colonies (NJDFW 2007). Preferred roost sites are in cavities or under the exfoliating bark of dead tree snags or in trees exposed to warm sunlight (MNFI 2007). In Michigan, a reproductively active colony roosted under the bark of eight different trees, all of which were sunlit green ash (*Fraxinus pennsylvanica*) trees (Kurta et al. 1993). At night Indiana bats emerge to forage

TABLE 8: SPECIAL STATUS PLANT AND ANIMAL SPECIES

REASONS FOR DISMISSING FROM DETAILED ANALYSIS, IF DISMISSED						
HABITAT COMMENTS AND OTHER NOTES						
MICHIGAN STATUS						
FEDERAL STATUS						
COMMON NAME						
SCIENTIFIC NAME						
INSECTS						
Analyzed	<i>Stenelmis douglasensis</i>	Douglas Stenelmis riffle beetle	—	Species of Concern	Found in the shallow, unpolluted bodies of water including lakes, spring-fed bodies of water, large to small streams and tributaries with soft or sandy substrates. Adults often found on pieces of wood. Documented in Lakeshore and Benzie County.	—
Analyzed	<i>Trimerotropis huroniana</i>	Lake Huron Locust	—	Threatened	Found in undisturbed, high-quality sand dunes with sparse vegetation on the shores of the Great Lakes. Often found with Pitcher’s thistle (<i>Cirsium pitcher</i>). Documented in Lakeshore and Benzie and Leelanau counties.	—
AMPHIBIANS						
Analyzed	<i>Acris crepitans blanchardi</i> .	Blanchard’s cricket frog	—	Species of Concern	Inhabits areas of permanent water in marshes, marsh ponds, lakes, bogs, and slow-moving streams in open wetland areas. Prefers areas of low emergent vegetation to submergent vegetation. May range into surrounding non-wetland habitats. Documented in Lakeshore and Leelanau County.	—
REPTILES						
Analyzed	<i>Glyptemys insculpta</i>	Wood turtle	—	Species of Concern	Generally found within 500 feet (152 m) of water. Prefers clear, moving, hard-bottom streams, rivers, or creeks with sand or gravel substrates. Also found in a variety of shallow wet-land habitats, including woodland bogs and mar-shy pastures. Will use a range of terrestrial habi-tats including wet mesic forest, riparian shrub forests, deciduous forests, and cultivated fields. Needs sunny sand banks or gravel bars in streams or similar human-disturbed sites for nesting. Documented in Lakeshore and Benzie County.	—

SCIENTIFIC NAME		COMMON NAME	FEDERAL STATUS	MICHIGAN STATUS	HABITAT COMMENTS AND OTHER NOTES	REASONS FOR DISMISSING FROM DETAILED ANALYSIS, IF DISMISSED
Analyzed	<i>Terrapene carolina carolina</i>	Eastern box turtle	—	Species of Concern	Prefers forested areas with sandy soil near a source of water (pond, stream, lake, marsh, or swamp). Also found in forest-brush, fields, and marshy meadows. Requires unshaded sandy sites for nesting. Documented in Benzie and Leelanau counties.	—
BIRDS						
Dismissed	<i>Accipiter gentilis</i>	Northern goshawk	—	Species of Concern	Inhabits forested habitats including deciduous, coniferous, and riparian forests and conifer plantations. Prefers forest stands with intermediate canopy cover, small forest clearings, and an open understory. Documented in Lakeshore and Benzie County.	The only documented occurrence of northern goshawk in the Lakeshore is in the area south of the Platte River and on South Manitou Island. Minor differences between the alternatives relative to management of or potential activities in this area are not anticipated to differentially affect the suitability of this area for northern goshawks.
Dismissed	<i>Ammodramus savannarum</i>	Grasshopper sparrow	—	Species of Concern	Prefers grasslands, including cultivated fields, fallow fields, and hayfields where tall grassy vegetation occurs. Documented in Lakeshore and Benzie and Leelanau counties.	Known from the southern portion of the mainland. Alternatives do not differ relative to the management of the cultural landscapes in this area. Management zones common to all alternatives would conserve the habitat supporting this species.
Analyzed	<i>Buteo lineatus</i>	Red-shouldered hawk	—	Threatened	Nests are typically in mature deciduous trees in relatively mature deciduous or mixed forest complexes. Wetland areas and upland open areas are used for hunting. This species is observed throughout the park.	—

Table 8: Special Status Plant and Animal Species

	SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	MICHIGAN STATUS	HABITAT COMMENTS AND OTHER NOTES	REASONS FOR DISMISSING FROM DETAILED ANALYSIS, IF DISMISSED
Analyzed	<i>Charadrius melodus</i>	Piping plover	Endangered	Endangered	Found on wide sandy lakeshore beaches with scattered cobbles and sparse vegetation. Also found on Lake Michigan islands in areas with same characteristics. Nesting area may include intertidal wetland or small stream. Documented in Lakeshore and Benzie and Leelanau counties.	—
Analyzed	<i>Cygnus buccinator</i>	Trumpeter swan	—	Threatened	Use marshes and wetlands associated with ponds and lakes. Nests are frequently placed on muskrat houses. Reintroduced in the southern area of the park in 2006 and 2007.	—
Analyzed	<i>Dendroica discolor</i>	Prairie warbler	—	Endangered	Found in early successional habitats, including young pine plantations, clear-cuts in oak forest, upland scrub, fallow fields, young jack pine stands, Christmas tree farms, powerline rights-of-way, and areas of brush or thickets. Documented in Lakeshore and Benzie and Leelanau counties.	—
Analyzed	<i>Falco columbarius</i>	Merlin	—	Threatened	Typically nest in boreal forest in lakeshore and island contexts, open areas of which provide hunting opportunity. Reported by Lakeshore staff to nest on both islands and the mainland portions of the Lakeshore.	—
Analyzed	<i>Gavia immer</i>	Common loon	—	Threatened	Found on inland lakes and rivers. Nest where fish populations are good. Prefer lakes with islands, bog mats, or undeveloped shoreline on which to build nests. Quiet sheltered coves and limited boating activity are also important. Documented in Lakeshore and Benzie and Leelanau counties.	—
Analyzed	<i>Haliaeetus leucocephalus</i>	Bald eagle	—	Threatened	Found near coastal areas, rivers, lakes, or other bodies of water with a supply of fish, waterfowl, or seabirds. Generally nest within about 13,000 feet (4 km) of water in dead snags or live trees. Documented in Lakeshore and Benzie and Leelanau counties.	—

SCIENTIFIC NAME		COMMON NAME	FEDERAL STATUS	MICHIGAN STATUS	HABITAT COMMENTS AND OTHER NOTES	REASONS FOR DISMISSING FROM DETAILED ANALYSIS, IF DISMISSED
Dismissed	<i>Ixobrychus exilis</i>	Least bittern	—	Threatened	Uses a variety of freshwater and brackish marshes with dense tall growths of aquatic or semiaquatic vegetation interspersed with clumps of woody vegetation and open water. Reported by park staff as nesting at the Mill pond.	Actions proposed in alternatives would not be expected to impact suitable habitat.
Analyzed	<i>Sterna caspia</i>	Caspian tern	—	Threatened	Although nesting habitat is sandy or pebble beaches, no nests are known for the Lakeshore. This species is reported by Lakeshore staff to use the area around the mouth of the Platte River for courtship.	—
MAMMALS						
Dismissed	<i>Myotis sodalis</i>	Indiana bat	Endangered	Endangered	Summer roosts and forages are in riparian, bottomland, and upland forests with trees that have loose or exfoliating bark. Not documented in either Benzie or Leelanau counties.	Not documented in either Benzie or Leelanau counties. Actions proposed in alternatives would not be expected to impact suitable habitat.
PLANTS						
Analyzed	<i>Asplenium rhizophyllum</i>	Walking fern	—	Threatened	Found on shaded, moss-covered boulders and ledges, usually on limestone or other basic rocks, but occasionally on sandstone or other acidic rocks, rarely found on fallen tree trunks. Documented in Lakeshore and Leelanau County.	—
Analyzed	<i>Asplenium trichomanes-ramosum</i>	Green spleenwort	—	Threatened	Found on limestone and other basic rocks. Documented in Lakeshore and Leelanau County.	—
Analyzed	<i>Berula erecta</i>	Cut-leaved water-parsnip	—	Threatened	Found in wet areas; springs, streams, shallows; or often found in water in valleys and plains. Documented in Lakeshore and Benzie and Leelanau counties.	—
Analyzed	<i>Botrychium campestre</i>	Prairie moonwort	—	Threatened	Found in prairies, dunes, grassy railroad sidings, and fields over limestone. Extremely inconspicuous. Documented in Lakeshore and Benzie and Leelanau counties.	—

Table 8: Special Status Plant and Animal Species

	SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	MICHIGAN STATUS	HABITAT COMMENTS AND OTHER NOTES	REASONS FOR DISMISSING FROM DETAILED ANALYSIS, IF DISMISSED
Analyzed	<i>Bromus pumpellianus</i>	Pumpelly's brome grass	—	Threatened	Found on sandy and gravelly stream banks and lake shores, sand dunes, meadows, dry grassy slopes, and road shoulders. Documented in Lakeshore and Leelanau County.	—
Dismissed	<i>Calypso bulbosa</i>	Calypso or fairy-slipper	—	Threatened	Found in mesic to wet coniferous forests, mixed forests, and bogs. Documented in Lakeshore and Benzie and Leelanau counties.	No actions proposed in the alternatives would be anticipated to affect this species.
Dismissed	<i>Carex concinna</i>	Beauty sedge	—	Species of Concern	Found in moist to dry meadows; riverbanks; thickets; floodplains; and open spruce, pine, cedar, birch, aspen, and willow woodlands, usually on calcareous substrates. Documented in Lakeshore and Leelanau County.	No actions proposed in the alternatives would be anticipated to affect this species.
Dismissed	<i>Carex platyphylla</i>	Broad-leaved sedge	—	Threatened	Found in rich, moist deciduous forests; on rocky or gravelly slopes; soils above limestone, shale, or calcareous metamorphic rocks; and often on clay soils. Documented in Lakeshore and Leelanau County.	No actions proposed in the alternatives would be anticipated to affect this species.
Analyzed	<i>Cirsium pitcheri</i>	Pitcher's thistle	Threatened	Threatened	Found only on the open sand dunes along the shores of the western Great Lakes. Documented in Lakeshore and Benzie and Leelanau counties.	—
Analyzed	<i>Cypripedium arietinum</i>	Ram's head lady's-slipper	—	Species of Concern	Found in dry to moist open coniferous and mixed forests, coniferous forested fens, beach thickets. Documented in park and Benzie and Leelanau counties.	—
Analyzed	<i>Mimulus glabratus</i> var. <i>michiganensis</i>	Michigan monkey-flower	Endangered	Endangered	Occurs in sunny areas, roots in silty, sandy, alkaline mud, and grows out of a stream of cool, running water. Documented in Lakeshore and Benzie and Leelanau counties.	—
Analyzed	<i>Orobanche fasciculata</i>	Fascicled broom-rape	—	Threatened	Found in drier areas — foothills to rocky ridges, prairies, inland sands; in sandy soil; and as parasites on a variety of plants. Documented in Lakeshore and Benzie and Leelanau counties.	—

CHAPTER 4: AFFECTED ENVIRONMENT

SCIENTIFIC NAME		COMMON NAME	FEDERAL STATUS	MICHIGAN STATUS	HABITAT COMMENTS AND OTHER NOTES	REASONS FOR DISMISSING FROM DETAILED ANALYSIS, IF DISMISSED
Analyzed	<i>Panax quinquefolius</i>	Ginseng	—	Threatened	Found in cool moist woods; shade; in rich soil. Documented in Lakeshore and Benzie and Leelanau counties.	—
Analyzed	<i>Pterospora andromedea</i>	Pine-drops	—	Threatened	Found in deep humus of coniferous forests. Documented in Lakeshore and Leelanau County.	—
Analyzed	<i>Triphora trianthophora</i>	Three-birds orchid	—	Threatened	Found in rich, mesic woods, swamp edges, and floodplains. Documented in Lakeshore and Leelanau County.	—

Analyzed = impact topics considered and analyzed in detail in this environmental impact statement

Dismissed = impact topics considered but not analyzed in detail in this environmental impact statement

Four federally listed or candidate species were historically found in the National Lakeshore but are no longer present — the endangered gray wolf (*Canis lupus*), the endangered eastern puma (*Puma concolor cougar*), the threatened Canada lynx (*Lynx canadensis*), and the candidate eastern massasauga (*Sistrurus catenatus catenatus*).

on flying insects. Reproductively active females prefer to forage in closed-canopy floodplain forest and around farm ponds. In the late summer, northern populations move as much as 480 km to winter hibernating caves in Alabama, Tennessee, Kentucky, Indiana, Missouri, and West Virginia (NatureServe 2007). A new hibernating population has been identified at a hydroelectric facility in northern Michigan (MNFI 2007). Typical hibernation sites are limestone caves with a mean midwinter temperature of 4-8°C and an average humidity of 87% throughout the year (NJDFW 2007). Females leave the hibernacula first, in late March to April. Males leave later, with some males spending the summers in the area of the hibernacula (USFWS 1991). Declines in the population of Indiana bats can be attributed to human disturbance at hibernacula, including caving, vandalism, and research (USFWS 1991, MNFI 2007). Alterations to the cave environment can also cause the abandonment of hibernacula and can result from the opening of additional entrances, blocking entrances, or improperly designed or installed gates (intended to protect hibernating bats) that alter airflow or exclude Indiana bats (USFWS 1991). The losses of forested riparian habitat and suitable roosting snags, along with stream alteration and agricultural development, have also affected Indiana bats in their summer foraging range (MNFI 2007).

The breeding range of the Indiana bat occurs within the southern half and western coastal counties of the Lower Peninsula of Michigan, including Benzie and Leelanau counties (USFWS 2006). However, even with suitable habitat in the Lakeshore (highly variable forested landscapes in riparian, bottomland, and upland areas that have roosting trees with crevices or exfoliating bark), this species has not been confirmed within the Lakeshore. The Indiana bat is dismissed from detailed discussion as an impact topic because any potential impacts on suitable habitat would be negligible to minor and because the Indiana bat has not been confirmed in the Lakeshore.

Michigan Monkey Flower. The Michigan monkey-flower (*Mimulus glabratus* var. *michiganensis*) is listed as endangered under the Endangered Species Act, and by the state. This aquatic to semi-aquatic plant is known from only 15 extant occurrences in northern Michigan, 12 of which are currently considered viable (USFWS 1997). This plant is restricted entirely to Michigan, where it occurs in the Grand Traverse and Straits of Mackinac regions (Voss 1996). It is concentrated in Charlevoix, Cheboygan, Emmet, and Mackinac counties, with outliers in Benzie and Leelanau counties. There is a single large, exemplary occurrence in the National Lakeshore. The plant blooms from about mid-June to mid-July and occasionally to mid-August. However, pollen viability is low, suggesting that var. *michiganensis* is primarily dependent on vegetative (asexual) reproduction (USFWS 1990). Crispin and Penskar (1989) report that var. *michiganensis* is narrowly restricted to cold, saturated soils of seepages on forest edges and in small openings along streams and lakeshores. It is usually associated with Northern white-cedar (*Thuja occidentalis*) swamps. Other typical associates include touch-me-not (*Impatiens biflora*), forget-me-not (*Myosotis scorpioides*), water-cress (*Nasturtium officinale*), spearmint (*Mentha arvensis*), and liverwort (*Conocephalum conicum*) (USFWS 1990).

The primary threat to this species is the destruction and adverse modification of its habitat. Its historic range in the Mackinac Straits and Grand Traverse regions in Michigan are being rapidly developed for recreational and residential purposes. The monkey flower appears to be highly dependent on continuous supplies of cold spring water. It is also particularly vulnerable because of the low numbers of individuals occurring at most sites and because of its tendency for asexual reproduction (USFWS 1990). Critical habitat has not been designated for this species. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species

is carried forward as an impact topic under “Federal Threatened and Endangered Species” in chapter 5.

Pitcher’s Thistle. Pitcher’s thistle (*Cirsium pitcheri*) is listed as threatened under the Endangered Species Act and by the state. It is endemic to beach and dune habitats around Lakes Huron, Michigan, and Superior and requires active sand dune processes to maintain its early successional habitat (USFWS 2002b). The range of this Great Lakes thistle falls primarily within Michigan’s borders, occurring along the entire shoreline of Lake Michigan. Pitcher’s thistle populations are concentrated in the major dune landscapes of the northern Lake Michigan basin, especially in the Lower Peninsula counties of Emmet, Charlevoix, Leelanau, Benzie, Manistee, and Oceana (Higman and Penskar 1999a).

Although the plant is still widespread in Michigan, it depends on dynamic dune processes that have largely disappeared (USFWS 1988). One of the world’s largest populations of *Cirsium pitcheri* is within Sleeping Bear Dunes National Lakeshore (Higman and Penskar 1999a). Associated plants include beach grass, little bluestem, wild rye (*Elymus canadensis*), common milkweed, dune willows (*Salix cordata* and *S. myricoides*), and many other common dune species (Higman and Penskar 1999a). Development, loss, and disturbance of dunes by people are the principal threats to the species (USFWS 1988). Critical habitat has not been designated for this species. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species is carried forward as an impact topic under “Federal Threatened and Endangered Species” in chapter 5.

Bald Eagle. The Bald Eagle (*Haliaeetus leucocephalus*) was recently delisted as a federal species, but it is discussed below under Michigan state-listed species.

Michigan State-Listed Species

Plant and animal species listed as threatened, endangered, or species of special concern by the state are not afforded the same formal protection provided by the federal Endangered Species Act, but they are monitored and may one day become candidates for the federal list if their numbers continue to trend downwards. As such, those state-listed species that have been documented in the National Lakeshore (table 8) have been considered for dismissal or detailed discussion in this document. Species that are analyzed in detail are discussed below, and species dismissed from detailed analysis are discussed in the “Impact Topics Considered but Not Analyzed in Detail” section of this chapter.

Douglas Stenelmis Riffle Beetle. The Douglas Stenelmis riffle beetle (*Stenelmis douglasensis*) is a small aquatic beetle and a Species of Concern in Michigan. This little beetle inhabits spring-fed lakes, shore lines, streams, and river margins where the water is shallow, clear, and unpolluted and has high dissolved oxygen content and a sandy substrate. Individuals are frequently observed on pieces of wood. This species has a limited range and is only found within a 150-mile radius of Lake Michigan and in a few locations in the Lower Peninsula of Michigan. The beetle is vulnerable to the degradation of aquatic habitats, including alterations to the shore structure, dams, increased siltation, changes in nutrient inflow, and reductions in dissolved oxygen levels. Suggested management includes maintaining forested buffer zones around aquatic habitats and avoiding altering stream characteristics. (MNFI 2007, NatureServe 2007.)

In the Lakeshore, these beetles are associated with the Platte River and Otter Creek corridors. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Lake Huron Locust. The Lake Huron locust (*Trimerotropis huroniana*) is listed as a threatened species in Michigan and is confined to high-quality, sparsely vegetated coastal sand dunes along northern Lake Michigan and Lake Huron and eastern Lake Superior. Its primary diet includes beach grass, wormwood, dune grass (*Calamovilfa longifolia*), and dune wheatgrass; however, it is also known to feed on the federally protected Pitcher's thistle. In Michigan, the Lake Huron locust is found in 18 counties of the eastern Upper Peninsula and northern Lower Peninsula. The primary cause of this species' decline is loss and degradation of dune habitat from residential and recreational development. This dune-obligate species can tolerate some human disturbance, but conservation efforts should focus on preserving sand dune habitat to the degree that the natural process of dune blowout and revegetation maintain sufficient preferred habitat. *Note:* Most of this information came from Rabe 1999.

In the Lakeshore, the Lake Huron locust is known only in the southern section of the Lakeshore. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species is carried forward as an impact topic under "Michigan State-Listed Species" in chapter 5.

Blanchard's Cricket Frog. Blanchard's cricket frog (*Acris crepitans blanchardi*), listed as a Species of Concern in Michigan, is considered one of the most aquatic of tree frogs. They can be found in habitats associated with a permanent or near permanent source of water, such as a lake, pond, slow stream, bog, seep, or man-made water source (Harding 1997 as cited in HerpCenter 2004). Polluted water is not tolerated well, but shoreline fen habitats with alkaline water are commonly used by this species in Michigan (Lee et al. 2000). They prefer open or partially vegetated mud flats, sandy or muddy shorelines, and emergent water vegetation. Blanchard's cricket frog is found from southern Michigan and western Ohio, west to southeast South

Dakota, east to northern Tennessee, and south to northern Mexico (Lee et al. 2000). This is a particularly short-lived frog, with most individuals surviving only one or two breeding seasons (Burkett 1984 as cited in Lee et al. 2000, Harding 1997 as cited in HerpCenter 2004). Mortality is generally through predation, parasitism, desiccation, winter kill, and natural death. The causes of Blanchard's cricket frog population declines in Michigan are not fully understood, but the loss and pollution of wetlands are likely important factors. In addition, reductions in habitat from vegetation succession and competition with other frog species have also likely influenced Blanchard's cricket frog populations.

In the Lakeshore, Blanchard's cricket frog is known only in the northern section of the Lakeshore. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species is carried forward as an impact topic under "Michigan State-Listed Species" in chapter 5.

Wood Turtle. The wood turtle (*Glyptemys insculpta*), listed as a Species of Concern in Michigan, is found in portions of the eastern U.S. and Canada. It lives in riparian floodplain habitat along moderately moving rivers and streams. Typical wood turtle habitat includes a hard-bottom stream substrate, herbaceous vegetation for foraging, and a sandy substrate for nesting (Lee 1999). In Michigan, wood turtles are found in the northern portion of the Lower Peninsula and throughout the Upper Peninsula. Primary threats to this species are poaching for the pet trade and collecting by the general public (Lee 1999). Minor threats include loss and degradation of habitat, road kill, and increased predation by natural predators that travel road corridors (Soule 1992 as cited in Lee 1999). Wood turtles can survive in areas of moderate human activities, provided that the essential characteristics of their habitat are maintained, water quality is maintained, and adult mortality is maintained at a natural rate. Predator

control may be necessary at some nesting sites (Soule 1992 as cited in Lee 1999). Stream channelization, dams, road construction near streams, and intense human activity at nest sites are detrimental to this species.

In the Lakeshore, wood turtles are known only in the southern section of the Lakeshore. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Eastern Box Turtle. Michigan’s only true terrestrial turtle, the eastern box turtle (*Terrapene carolina carolina*) is listed as a state Species of Concern. The eastern box turtle can be found in forested habitats with sandy soils and a source of water (Tinkle et al. 1979 as cited in Hyde 1999b). They can also be found in fallow fields, pastures, some wetland habitats, and vegetated dunes. Eastern box turtles also require sandy sites in full sun for laying eggs. They range along the east coast of the U. S. from Massachusetts to Georgia and west to Michigan, Illinois, and Tennessee. In Michigan they are found in the south and western portions of the Lower Peninsula.

Eastern box turtles are absent from much of their historic range due to the conversion of woodlands and wetlands to agriculture over the last century (Hyde 1999b). Today, continued development fragments the remaining habitat, cutting turtles off from nesting sites and increasing the risk of road kill (Hyde 1999b). Poaching for the pet trade has also reduced populations. Protecting large tracts of habitat on public lands from development and maintaining wetland hydrologic processes and water quality should benefit the eastern box turtle. Nesting locations should be identified and protected, and where necessary additional ones should be created. New roads should be constructed to avoid cutting turtles off from nesting sites (Hyde 1999b).

There were no document occurrences of eastern box turtles within the National Lakeshore until recently, when one individual was reported. Due to this recent observation, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Red-Shouldered Hawk. The red-shouldered hawk (*Buteo lineatus*) is listed as threatened by the state of Michigan. In Michigan red-shouldered hawks use mature forested flood-plain habitat, with most nests found in large (usually >300 acres), relatively mature deciduous or mixed forest complexes associated with or interspersed by wetlands. Wetland areas and upland open areas are used for foraging habitat. Although American beech is the most commonly documented nest tree in Michigan, a variety of nest trees have been used, including aspen, birch, ash, and oak, which seems to indicate that tree structure and not tree species is the most important factor that influences use of a tree for nest placement. Nests tend to be placed in dense stands of timber with a closed canopy structure and very near wetland habitat (typically within 1/8 mile). The primary threat to this species in Michigan is habitat alteration and destruction due to timber harvest, road construction, and residential development. (Cooper 1999b.)

Red-shouldered hawks are observed throughout the National Lakeshore. As such, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Trumpeter Swan. The trumpeter swan (*Cygnus buccinator*) is listed by the state as a threatened species. Trumpeter swans use marshes and wetlands associated with lakes and ponds for cover and food, and they require large open water areas for takeoff and landing (MNFI 2007). Nesting areas should be buffered by a no-activity zone to eliminate human disturbance by boats, personal watercraft, and birdwatchers (MNFI 2007b).

Competition from the Mute swan, a nonnative aggressive species, has been documented, and steps have been taken to reduce mute swan populations within the Lakeshore.

Trumpeter swans were reintroduced to the southern mainland portion of the Lakeshore in 2006 and 2007. Because of potential impacts of various activities proposed in the alternatives, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Prairie Warbler. The prairie warbler (*Dendroica discolor*) is listed as endangered in Michigan. This species is typically associated with old fields, shrublands, and coniferous woodlands (NatureServe 2007), as well as coastal dune areas (MDRN 2005).

In the Lakeshore, prairie warblers have been documented in the shrubby dune-forest interface along the mainland shoreline. Within the context of the dynamics natural to this shifting zone between dunes and encroaching forest, this habitat is thought to have been “stable” for thousands of years (NatureServe 2007). Because actions proposed in the alternatives have the potential for impacts to this habitat, the prairie warbler is carried forward as an impact topic in chapter 5.

Merlin. The merlin (*Falco columbarius*) is listed by the state as a threatened species. Merlins typically nest in boreal forest, preferring spruce forests near bogs or open water (Cuthrell 2002). Open to semi-open areas associated with lakeshores and islands are used most frequently, probably to facilitate hunting. Merlins are likely limited by adequate food items and a source of available nesting sites. The food base is normally provided by small- to medium-sized birds of grasslands, wetlands, or forest edges (Cuthrell 2002). Merlins do not build their own nests, typically using those of other birds such as crows or ravens. They will occasionally nest in tree cavities, on cliffs, or on the ground (Cuthrell 2002). Merlins return to Michigan in

early spring, following the main migration of small birds — their primary food source. Males arrive up to a month before females and usually establish territories in the same general area each year.

Merlins are reported to nest on both islands and on the mainland portion of the National Lakeshore. Therefore, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Common Loon. The common loon (*Gavia immer*) is listed as threatened in Michigan. Common loons are known to breed throughout northern North America and northern Europe, reflecting the general distribution of boreal coniferous and northern hardwood forests. Common loons breed on inland lakes that have an abundant population of fish and a large proportion of undeveloped shoreline. They prefer lakes with a small island or bog mat where it can hold the nest inaccessible to raccoons and other egg-eating predators and where there is little or no high-speed boat traffic (MNFI 2007). In Michigan, common loons are now known to breed only in the Upper Peninsula and the very northern portions of the Lower Peninsula. They are most common on Isle Royale and western portions of the Upper Peninsula (MNFI 2007). Adult common loons are easily disturbed and stressed and may desert their nest if approached too closely by a person, boat, or other water vehicle, or even the wake from such a vehicle (MNFI 2007).

In 2006 there was a large die-off of more than 2,900 water birds in the Lakeshore, including about 180 common loons, due to Type E Botulism toxin poisoning. This die-off continued in 2007, including an additional 60 loons and more than 1,000 other birds. A combination of invasive species (including quagga mussels and round gobies), enhanced native algae and Type E bacteria growth, and a rapidly changing lake ecosystem have led to conditions that are believed to be ongoing and

devastating to common loons as well as other native bird and fish species.

In the Lakeshore, common loons have been documented on several lakes. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, the common loon is carried forward as an impact topic for discussion in chapter 5.

Bald Eagle. The bald eagle (*Haliaeetus leucocephalus*), although recently delisted under the Endangered Species Act, is still listed as threatened by the state. The reason for historic declines in bald eagle populations in the 1950s and 1960s included the use of chemicals such as PCBs (polychlorinated biphenyls), DDT (dichlorodiphenyltrichloroethane), DDE (dichlorodiphenyldichloroethylene), and mercury, and disturbance and displacement by humans. DDT was the primary cause, and the banning of DDT in the early 1970s led to a resurgence in bald eagle numbers throughout the U.S. as well as the Great Lakes region. Although bald eagles are seen throughout almost all counties of Michigan during the winter, they nest mainly in the Upper Peninsula (especially the western portion) and the northern portion of the Lower Peninsula (MNFI 2007).

Because their primary diet consists of fish, bald eagles tend to feed, roost, and nest near water bodies (NPS 2005a). The nest is usually located in the tallest tree in the area, often a white pine or dead snag (MNFI 2007). Eagles in some parts of the country are particularly sensitive to human disturbance. Adult birds appear to flush more quickly when foraging than when on the nest (NatureServe 2007). In Michigan, 75% of all alert responses to human activity occurred when activity was within 1,640 feet (500 m) and flight responses occurred when activity was within 656 feet (200 m); vehicles and pedestrians elicited the highest response frequencies (NatureServe 2007).

Bald eagles have been documented in all but the central mainland portion of the Lakeshore, and nests have been identified in the northern and southern mainland portions of the Lakeshore as well as on both North Manitou and South Manitou islands. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, the bald eagle is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Caspian Tern. The Caspian tern (*Sterna caspia*) is listed by the state as threatened. Caspian tern nesting habitat is open sandy or pebble beaches, usually on islands in large bodies of water. Caspian terns are a migratory species. They arrive at their breeding grounds from mid-April to mid-May with most individuals returning to the same general breeding area for more than one season (Hyde 1996).

Caspian terns are not known to nest within the Lakeshore. However, they do perform courtship rituals on the shoreline in the southern section of the National Lakeshore. Therefore, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Walking Fern. Walking fern (*Asplenium rhizophyllum*) is listed as threatened in Michigan. It occurs in eastern North America, and in Michigan most occurrences are in the eastern Upper Peninsula. This fern typically occurs in association with shaded, moist boulders and outcrops of Niagaran limestone and dolomite. Typical canopy trees include sugar maple, basswood (*Tilia americana*), and balsam fir (*Abies balsamea*). Other associates include northern holly fern, common polypody (*Polypodium virginianum*), herb-Robert (*Geranium robertianum*), and maidenhair spleenwort (*Asplenium trichomanes*). Moist moss mats composed of several different moss species appear to be a critical element of this species’ microhabitat, as well as the availability of moist crevices and other depressions that

serve as colonization niches (Penskar and Higman 1997).

The occurrence of walking fern on South Manitou Island is in habitat that is atypical for this species. There are no rocks in the area it occupies, and it grows over decaying logs on the floor of the forest (Thompson 1962). This is the only known occurrence of walking fern within the Lakeshore. Because actions proposed in the alternatives have the potential to impact the area supporting this species, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Green Spleenwort. Green spleenwort (*Asplenium trichomanes-ramosum*) is listed as threatened in Michigan. This small evergreen fern prefers a moist, shaded environment, sometimes in sheltered crevices on rocky limestone bluffs or talus slopes. This fern is a circumboreal species of subarctic and alpine areas that favors limestone rock and, in Michigan, is best known from the limestone cliffs of the Niagara Escarpment. Green spleenwort is not limited to any one forest type and occurs in both conifer swamps and upland hardwood forests dominated by sugar maple and birch (*Betula alleghaniensis*). Associated fern species include maidenhair spleenwort, fragile fern (*Cystopteris fragilis*), bulbet fern (*Cystopteris bulbifera*), common polypody, and northern holly fern. The major existing and potential threats to this species in Michigan include overstory removal through logging activities and periodic defoliation of canopy vegetation by insect pests such as gypsy moths. (USFWS 2002c.)

The only known occurrence of green spleenwort within the National Lakeshore is on South Manitou Island, where it has been documented growing in sandy loam (Thompson 1962). Because actions proposed in the alternatives have the potential to impact the area supporting this species, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Cut-Leaved Water-Parsnip. Cut-leaved water-parsnip (*Berula erecta*) is listed as threatened in Michigan. This perennial aquatic plant grows in shallow, clear-flowing water, typically occurring within prairie fens where it grows in the unshaded marshy borders of cold streams and springs. This species’ primary ecological need is the protection of hydrologic processes and the perpetuation of cool groundwater sources. Prescribed burns to maintain open, grassy wetlands are also likely beneficial because this species requires a mostly open canopy. (MNFI 2007.)

Only one occurrence of this species is known from the Lakeshore, in the southern section of the mainland. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Prairie Moonwort. Prairie moonwort (*Botrychium campestre*) is listed as threatened in Michigan. In Michigan it occurs primarily in freshwater dune systems, especially perched dunes along the northern Lake Michigan shoreline, with one occurrence in southern Benzie County and seven occurrences in Leelanau County, including North Manitou Island, South Manitou Island, and South Fox Island, as well as mainland portions of Sleeping Bear Dunes National Lakeshore (Higman and Penskar 1999b). It also occurs in roadside habitats, abandoned orchards, and other disturbed grassy sites (MNFI 2007). Associated species include wormwood, bearberry, dune grasses (e.g., *Calamovilfa longifolia*), and other grape-ferns. This species requires protection of habitat and maintenance of natural dune processes (e.g., shoreline fluctuation, erosion, sand deposition, wind, water level fluctuation, and sand movement) that create the necessary micro habitats (MNFI 2007).

In the National Lakeshore, this species occurs in dune habitats on both islands and along the

shore of the mainland NPS units. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Pumpelly’s Brome Grass. Pumpelly’s brome grass (*Bromus pumpellianus*) is listed as threatened in Michigan. It occurs primarily in western North America and, in Michigan, is restricted to the northwestern Lower Peninsula in Emmet, Charlevoix, and Leelanau counties. This rare grass grows on low sand dunes and along beaches in Lake Michigan, usually in association with beach grass, bearberry, wormwood, dune wheatgrass (*Agropyron dasystachyum*), Pitcher’s thistle, and sand cherry. Pumpelly’s brome grass is a perennial that spreads vegetatively via rhizome growth. Its spikelets mature from late June to September. (Higman and Penskar 1996a.)

Pumpelly’s brome grass occurs near the shoreline throughout the National Lakeshore. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, it is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Ram’s-Head Lady’s-Slipper. Ram’s-head lady’s-slipper (*Cypripedium arietinum*) is listed as a species of concern in Michigan and is considered rare throughout its range. Eighty-one occurrences of this orchid have been reported in Michigan, scattered through northern Lower Michigan and across the Upper Peninsula from Drummond Island to Ontonagan County (Penskar and Higman 1999). Ram’s-head lady’s-slipper occurs on South Manitou Island and mainland areas of the National Lakeshore (MNFI 2006b). Michigan occurrences of this orchid are found either in dense balsam/white cedar/black spruce swamps and bogs or in conifer uplands characterized by pine or cedar needles over sand (Case 1987). It is a plant of

cool, sub-acid or neutral soil and occurs in three general situations — (1) cool, dense white balsam/cedar/spruce swamps (*Thuja occidentalis*/*Abies balsamea*/*Picea mariana*); (2) nearly pure sand over limestone beach cobblestones or bedrock mulched with juniper ((*Juniperus communis*, *J. horizontalis*), jack pine (*Pinus banksiana*), red pine (*Pinus resinosa*) or white cedar needles; and (3) mesic soils of sandy loam, or clay under the partial shade of mixed forest (USFS 2000). Ram’s-head lady’s-slipper flowers in late May to early June and is notoriously difficult to locate because of its small size, short flowering period, sporadic flowering nature, and sparseness (Penskar and Higman 1999). Threats to the viability of this orchid include habitat loss or alteration, competition, and collecting (USFS 2000).

Because actions proposed in the various alternatives could impact the habitat for ram’s-head lady’s-slipper, and thus its populations within the Lakeshore, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Fascicled Broom-Rape. Fascicled broom-rape (*Orobanche fasciculata*) is listed as threatened in Michigan. This parasitic plant species reaches its easternmost distribution in the Great Lakes region, and, in Michigan, is restricted to the Lake Michigan shore from Charlevoix to Oceana counties. Most occurrences are in Leelanau and Benzie counties. The species is relatively scarce at all sites except one occurrence in Sleeping Bear Dunes National Lakeshore where six colonies have been found (Higman and Penskar 1996c). In Michigan, this species flowers in late June and produces fruit in the latter part of July and August. Wormwood (*Artemisia campestris*) is its only known host plant in Michigan. Other associates include beach grass, little bluestem, common milkweed, dune willows, and Pitcher’s thistle.

Fascicled broom-rape occurs in near-shore habitat in all three mainland units of the

Lakeshore and on South Manitou Island (MNFI 2006b). Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, and thus its populations within the Lakeshore, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Ginseng. Ginseng (*Panax quinquefolius*) is listed as threatened in Michigan. Michigan occurrences of ginseng are concentrated in the southern Lower Peninsula, primarily in woodlots and wooded coastal dunes, where populations typically are small. There are scattered occurrences in the northern Lower Peninsula. Flowering and fruiting occurs from June to October. This species is found in rich hardwoods, often on slopes or ravines. It also occurs in wooded dune hollows and leeward slopes along the Lake Michigan shoreline. Associates include sugar maple (*Acer saccharum*), white baneberry (*Acetaea pachypoda*), maidenhair fern (*Adiantum pedatum*), and rattlesnake fern (*Botrychium virginianum*). The primary cause of decline for this species is exploitation by collectors. (Penskar and Higman 1996.)

Ginseng occurs in several areas in the National Lakeshore. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, and thus its populations within the Lakeshore, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Pine-drops. Pine-drops (*Pterospora andromedea*) are listed as threatened in Michigan. The majority of Michigan occurrences are associated with forested dune communities ranging from Ottawa to Keweenaw Counties, with concentrations in Keweenaw, Emmet, and Leelanau counties. Pine-drops are known from dry woods containing conifers such as pines, hemlock, spruce, balsam fir, or white cedar. Many occurrences are associated with dry to dry-

mesic forests of sand dunes along the Great Lakes shorelines. Associated herbaceous species include large leaved aster (*Aster macrophyllus*), Hepatica (*Hepatica* spp.), spotted coralroot (*Corallorhiza maculate*), wintergreen (*Gaultheria procumbens*), and various ferns. *Pterospora* is above ground from June through early September and flowers /fruits are in their prime from July through August. (Higman and Penskar 1999c.)

Pine-drops have been documented across the northern mainland portion of the Lakeshore. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, and thus its populations within the Lakeshore, this species is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Three-birds orchid. Three-birds orchid (*Triphora trianthophora*) is listed as threatened in Michigan. It is found in rich oak-hickory forests and old wooded dune forests with well developed humus layers. Natural community types include mesic southern forest (southern hardwood forest), dry-mesic southern forest (oak-hardwood forest), and mesic northern forest (northern hardwood forest; hemlock-hardwood forest) (MNFI 2007). Stems for this species do not appear above ground each year; plants may persist as subterranean tubers for extended periods. Periodic dormancy may result in a site containing hundreds of aboveground stems in some years and few or no stems in other years. This inconsistency and the fact that it grows, flowers, and fruits in about a month in late summer, makes determination of population trends very difficult (USFS 2005).

Three-birds orchid has been documented in the central portion of the Lakeshore mainland. Because actions proposed in the alternatives have the potential to impact the habitat supporting this species, and thus its populations within the Lakeshore, this species

is carried forward as an impact topic under “Michigan State-Listed Species” in chapter 5.

Wetlands

Wetlands in the National Lakeshore can be roughly categorized into three groups: classic bogs, interdunal wetlands, and wetlands associated with lakes or streams. The Lakeshore contains about 750 acres (300 hectares) of wetlands in total (NPS 2005a). (See also Natural Resources Base map.)

The Lakeshore contains a few classic bogs with floating mats. The plant species of these bogs include sphagnum peat moss (*Sphagnum* sp.), black spruce, water sedge (*Carex aquatilis*), cottongrass (*Eriophorum* sp.), speckled alder (*Alnus incana*), pitcher plant (*Sarracenia purpurea*), Labrador tea (*Ledum groenlandicum*), bog laurel (*Kalmia polifolia*) leatherleaf (*Chamaedaphne calyculata*), cranberry (*Vaccinium macrocarpon*), and sundew (*Drosera* sp.). Examples of such bogs can be found in the Bow Lakes area.

Interdunal wetlands occur in the low areas or swales between the ancient beach ridges, remain wet much of the year, and are a component of the dune and swale complex. These wetlands contain an association of rushes (*Juncus* spp.) and sedges (*Carex* spp.), willows (*Salix* spp.), gray dogwood (*Cornus racemosa*), Joe-pye weed (*Eupatorium* sp.), and cardinal flower (*Lobelia cardinalis*) (NPS 2005a, NatureServe 2007). The dune and swale complex is one of the dominant physiographic and vegetative features of the Lakeshore, paralleling the shoreline and extending 1 to 2 miles inland in many areas. The dune and swale complex comprises most of the area from Otter Creek to the southernmost border of the Lakeshore, and is found near Good Harbor Bay and the Crystal River areas as well.

Finally, wetlands are often found along the margins of streams, ponds, and lakes. Wetland plants in these settings may be submerged,

emergent, or floating. Plants typical of these wetlands include cattail (*Typha latifolia*), pondweeds (*Potamogeton* spp.), arrowhead (*Sagittaria* sp.), bulrushes (*Schoenoplectus* sp.), sedges (*Carex* spp.), yellow pond-lily (*Nuphar lutea*), grass of Parnassus (*Parnassia glauca*), marsh cinquefoil (*Comarum palustre*), fringed gentian (*Gentianopsis crinita*), and bladderwort (*Utricularia* sp.) (NPS 2005a, NatureServe 2007).

Water Quality

Water quality discussion in this document pertains to inland lakes and streams. Although waters of Lake Michigan do occur within the Lakeshore boundaries, no actions proposed in the alternatives would result in effects on the water quality in Lake Michigan.

Sleeping Bear Dunes National Lakeshore waters include 26 named inland lakes of varying size and character; four sizable streams (all of Otter Creek and parts of the Platte River, Crystal River, and Shalda Creek); and many bogs, springs, and interdunal wetlands (Lafrancois and Glase 2005). All water bodies in the Lakeshore are designated Outstanding State Resource Waters (Ledder 2003). This designation indicates that no lowering of water quality is allowed for the designated high-quality water body (Ledder 2003).

During the mid-1980s, the U.S. Geological Survey collected water quality data on the Lakeshore's waters. It was found that the National Lakeshore had extremely good water quality with little or no excessive minerals or heavy metals. A biological study undertaken by NPS staff in 1988 showed that Lakeshore rivers and streams had all pollution-sensitive invertebrates present, indicating good water quality (NPS 2005a).

Ledder (2003) summarized a review of all available data for water resources in the Lakeshore for the period from 1962 to 1996. Only two lakes, Big and Little Glen Lakes, had

been issued non-compliance status, in both cases for fish consumption due to high levels of polychlorinated biphenyls (PCBs), mercury, and chlordane. Exceedances recorded at least once within the Lakeshore and during the time frame covered by the review were dissolved oxygen, pH, cadmium, copper, zinc, lead, and indicator bacteria. The overall conclusion of the Ledder (2003) review was that surface waters in the Lakeshore generally appeared to be of good quality. Potential man-made threats included wastewater, septic leakage, runoff, and recreational use.

The Platte River has been the subject of a number of studies addressing water quality, physical processes and integrity, and visitor perception (Lafrancois and Glase 2005). The Platte River is affected by a number of activities. Increased phosphorous levels have been attributed to the state fish hatchery on the Platte River, both from feeds provided for the salmon and the decay of returning salmon. Steps have been and continue to be taken to reduce this impact (Lafrancois and Glase 2005). Bank erosion and degradation of water quality occurs on the Platte River due to high visitor use. The occasional use of motorboats increases erosion issues and, at times, conflicts with other visitors using the river (Lafrancois and Glase 2005).

The Crystal River has also been studied relative to biological integrity and visitor use (Lafrancois and Glase 2005). Biological diversity in the Crystal River was considered relatively high, with 15 species of macrophytes and 35 species of fish documented in several studies (NPS 2002). The Crystal River has the highest number of riffles (four) of any stream reach in the Lakeshore. Canoeing, kayaking, and tubing are increasingly popular activities on the Crystal River (NPS 2002). Although many consider the Crystal River pristine, there is concern that increased wading and tubing in the channel, bottoming of canoes and kayaks, and disruption of the banks will degrade habitat to the detriment of the aquatic community (NPS 2002).

The Crystal River is the second largest stream in the park and drains the Glen Lake watershed down to Lake Michigan. Water levels in the river are controlled by a small low-head dam that regulates discharges from Glen Lake and Fisher Lake.

The NPS Inventory and Monitoring (I&M) Program conducted water quality sampling of the following nine lakes in the Lakeshore in 2005 — Manitou, Florence, Shell, Bass (Leelanau County), School, Tucker, North Bar, Loon, and Round. The following paragraphs summarize the relevant findings reported by Elias (2007).

With the exception of Florence Lake, lakes in the Lakeshore were generally well buffered and hard. All lakes were alkaline, with average lake pH values ranging from 8.3 for Tucker Lake to 8.8 for School Lake. Several lakes had high chloride and sodium ion concentrations, with Round Lake having concentrations twice those of the next highest lake (School for sodium and Loon for chloride). These lakes are close to roads and may be receiving road salt via runoff. Calcium concentrations were high enough to support zebra mussels at all lakes except Florence, and several lakes already host this exotic species. Several lakes also have relatively high sulfate concentrations, which is not unusual in calcareous regions. (Elias 2007.)

Most of the lakes sampled had surface water connections, with the exceptions of North Bar (which is intermittently connected to Lake Michigan), Shell, and Florence. The chemistry of Florence Lake suggests that this lake is isolated from the groundwater. Shell and North Bar lakes likely receive water from groundwater discharge as well as their immediate watershed. Round, Tucker, and at times, School and Bass (Leelanau County) lakes, receive inflow from surface water but do not have a surface outlet. These lakes likely have slower flushing rates than flow-through lakes. (Elias 2007.)

Total nitrogen and total phosphorus values exceeded EPA criteria for Ecoregion VII in

Shell and School Lakes consistently throughout the season. Criteria for the subecoregion in which the Lakeshore lies (Level III ecoregion 51) are 0.81 mg/L for total nitrogen and 20 micrograms/L for total phosphorus (USEPA 2000). High levels of nitrogen and phosphorous can lead to excessive aquatic plant growth, which interferes with wildlife and recreational uses while the plant populations thrive, and leads to reduced oxygen availability when bacteria break down large quantities of dead plant material. Nitrogen and phosphorous often enter water bodies from agricultural runoff.

Dissolved silica concentrations were below detection level at the beginning of the season at all lakes except North Bar and Loon. It is possible that low silica concentrations may have affected algal community composition, especially early in the season, at several lakes. (Elias 2007.)

Profiles of temperature and dissolved oxygen showed that a thermocline had not strongly developed in any of the sampled lakes (School Lake was omitted because it is too shallow, at <2 m, to collect profile data) during the May 2005 sampling. (Because warm water is less dense than colder water, it tends to rise toward the top of water bodies and colder waters settle toward the bottom. A thermocline is a relatively rapid shift in temperature as depth increases within a water body. Thermoclines tend to indicate layers across which exchange of nutrients, including dissolved oxygen, is greatly reduced. Thermoclines often develop in water bodies through the course of the open water season. The presence of thermoclines and related rapid shifts in dissolved oxygen (i.e., oxyclines) indicate a seasonal decrease in water quality due to reduced mixing of nutrients throughout the water column and reduced capacity of the water body to support aquatic life. Thermoclines typically form during mid to late summer and are then resolved by the fall turnover, which happens when temperatures drop for a long enough period of time to cool

the surface layers, causing water and nutrients to redistribute throughout the water column.)

Except for Shell and Tucker lakes, both of which are shallow, all lakes had begun to develop an oxycline in May although it was not yet strongly established. During the late June/early July and August sampling periods, most lakes had a clearly recognizable thermocline. Shell and Tucker Lakes remained fairly well-mixed throughout the season. Loon and Round lakes had an increase in dissolved oxygen concentration slightly below the Secchi depth in early July, suggesting a deeper layer of photosynthetic activity. Several lakes had dissolved oxygen concentrations below the EPA criterion of 4 mg/L for fresh water in a substantial portion of the lake. For example, in Loon Lake, the bottom 9-10 m, or nearly half of the total depth, was below the EPA criterion in July, August, and September. Most lakes had turned over by the time of the September sampling, with the exceptions of Lake Manitou and Loon Lake, both of which are relatively deep and both of which maintained an anoxic layer below the thermocline. (Elias 2007.)

The alternatives considered in this document could result in impacts to water bodies within the Lakeshore. Therefore, water quality is considered as an impact topic in chapter 5.

VISITOR OPPORTUNITIES

This section focuses on what visitors do at Sleeping Bear Dunes National Lakeshore — for example the variety of visitor activities and experiences.

Fundamental Resources and Values

Several aspects of visitor opportunities and experiences at Sleeping Bear Dunes National Lakeshore are among the “Fundamental Resources and Values” presented in chapter 1. These opportunities are fundamental because they are closely tied to the National

Lakeshore's purpose and significance (see chapter 1 "Purpose" and "Significance" sections). The National Park Service believes that the National Lakeshore should be managed to maintain these important opportunities for visitors. Fundamental visitor opportunities include the following:

- Dune Climb
- Pierce Stocking Scenic Drive
- scenic views of historic farmsteads, inland lakes, Lake Michigan shoreline (Empire Bluffs, Sleeping Bear Plateau, Pyramid Point), to/from the shoreline of Manitou Islands, and emergence from dense canopy to open dunes
- Lake Michigan beaches
- experiences of North Manitou and South Manitou islands
- opportunities for quiet, solitude, and naturalness
- Platte River and Crystal River experiences
- learning about the natural and cultural heritage of the area (glacial phenomena, diverse habitats, human history)
- the opportunity for visitors to understand the complex and rapidly disappearing natural history of the ecosystems that evolved along the Great Lakes shoreline

Primary Interpretive Themes

The National Park Service also believes that a key component of the National Lakeshore visitor experience includes the provision of opportunities to learn about the National Lakeshore's primary interpretive themes — the ideas and concepts communicated to the public about the Lakeshore that are the core of all interpretive programs and media (see chapter 1 section "Primary Interpretive Themes").

Information, Interpretation, and Education

The main center for information and visitor orientation is the centrally located Philip A. Hart Visitor Center in Empire, Michigan. The visitor center offers a wealth of information about the National Lakeshore and the natural and human history of the area. Open year-round and with rangers and volunteers to answer questions, visitors may purchase a park pass, find out about various areas to visit, view interpretive exhibits, obtain free informational brochures, and purchase educational and informational items from Eastern National. Campsites are available for a fee on a first-come basis, by phone or on-line reservations. The Dune Center Bookstore is staffed and open seasonally; visitors may purchase educational, informational, and convenience items from Eastern National at the Dune Climb.

The National Lakeshore also offers many interpretive programs and services centered around the interpretive themes, including ranger-guided walks, hikes, snowshoe tours, evening campground programs, and a variety of educational/interpretive programs for school groups of varying ages. Detailed information about these programs is available at the visitor center and on the National Lakeshore website.

The Glen Haven Village Historic District provides many informational, interpretive, and educational opportunities. The Glen Haven General Store is staffed and operated seasonally. The store appears much as it did in the 1920s and offers typical merchandise and items related to the history of the Glen Haven area, including kitchenware, packaged foods, toys, maritime items, and books from Eastern National. At the restored Glen Haven Blacksmith Shop, visitors learn about the blacksmith trade and local history from volunteers who seasonally staff the site. The Glen Haven Cannery Boat Museum is seasonally staffed by volunteers who interpret some of the historic boats used around Glen Haven and the

Manitou Islands. The Sleeping Bear Point Coast Guard Station Maritime Museum is open seasonally. Here visitors may see exhibits about the U.S. Life-Saving Service, the U.S. Coast Guard, and Great Lakes shipping history and participate in many popular interpretive demonstrations and talks.

The Port Oneida Rural Historic District encompasses a large collection of farmsteads, which provide interpretive opportunities related to the area's human history. Many visitors take scenic driving tours of the district, participate in interpretive activities offered on site, or attend the annual Port Oneida Fair. The National Lakeshore also contains many additional farmsteads that offer interesting insights into the area's history and culture.

On South Manitou Island, visitor interpretation and orientation are concentrated in the village and lighthouse complex area. The former general store for the island serves as a seasonally operated, unstaffed visitor contact station. It houses a collection of photos and artifacts that depict life of the loggers, farmers, and U.S. Life-Saving Service members who lived on the island. Motorized interpretive tours of historic island farms (farm loop tours) are offered by a concessioner. Interpretive tours are also available of the historic South Manitou Island Lighthouse. Upon arrival at North Manitou and South Manitou islands, overnight visitors receive basic orientation to the visitor rules and island resources.

Recreational Activities

Access to the National Lakeshore is facilitated through a network of state, county, and NPS roads; National Lakeshore trails; and concession-operated ferries that provide seasonal access to the Manitou Islands. The "NPS Facilities and Infrastructure" section of this chapter provides details on National Lakeshore facilities that support visitor access

and use (e.g., beach access points, roads, trails, and campgrounds). The scale of recreation-oriented development in the National Lakeshore is relatively modest, and most development is rustic.

The scenic resources in the National Lakeshore are predominately natural in character. The National Lakeshore purpose and significance statements (see chapter 1) refer to the area's natural features, setting, and character and also to its scenic beauty, publicly accessible resources, and cultural landscapes. Many scenic views are fundamental visitor opportunities as mentioned in the "Fundamental Resources and Values" section in chapter 1. National Lakeshore scenic resources also include features that reflect the area's history and culture (e.g., various farmsteads, a lighthouse, U.S. Life-Saving Service stations); these resources are described in the "Historic Resources" section of this chapter.

The varied access and settings provide for a wide range of warm and cold-weather recreational opportunities. Recreational activities include the following:

- scenic driving (e.g., Pierce Stocking Scenic Drive, Port Oneida, two-track dirt roads)
- climbing the dunes
- hiking or backpacking on about 100 miles of designated trails
- swimming, scuba diving, snorkeling, and beach activities on inland lakes and Lake Michigan
- canoeing, kayaking, tubing, or motorboating (as allowed) on rivers, inland lakes, and Lake Michigan
- bicycling on roads open to automobiles
- camping (e.g., Platte River Campground, D.H. Day Campground, and backcountry camping)
- fishing and hunting (per state, federal, and National Lakeshore rules and regulations)

- visiting North Manitou and South Manitou islands via ferry
- picnicking, wildlife viewing, and bird watching
- horseback riding on the Alligator Hill Trail or along state and county road rights-of-way
- snowshoeing and cross country skiing on more than 50 miles of ungroomed trails
- snowmobiling on state and county road rights-of-way
- launching and landing powerless flight craft (e.g., hang gliders, paragliders, and sailplanes) in designated areas

Trapping, off-road vehicle use, and personal watercraft use are not permitted in the National Lakeshore.

Only a small portion of the Benzie Corridor is owned by the National Park Service, so there are currently no visitor opportunities in this location.

Visitor opportunities related to wilderness are described in the “Wilderness Character” section of this chapter.

Natural Soundscapes and Night Sky

Natural sounds dominate the National Lakeshore except along roadways, in developed areas, and along rivers, specific inland lakes, and Lake Michigan where motorized boats are allowed. Vehicular lights from state, county, and NPS roads and residential, commercial, and National Lakeshore developed areas introduce light into the otherwise naturally dark night sky of the National Lakeshore.

VISITOR USE

This section focuses on visitor statistics and characteristics (e.g., how many people visit the

National Lakeshore and when, where they come from, and how long they stay).

An estimated 1,213,026 recreation visits occurred at Sleeping Bear Dunes National Lakeshore in 2006. Of that total, more than 1.1 million were day visits and 109,572 included an overnight stay in the National Lakeshore. The latter includes 17,889 backcountry camping visits, many of those on North Manitou and South Manitou islands.

Recreation visitation at the Lakeshore has been relatively consistent over time. Since 1990 the lowest level of visitor use of 1.09 million visits occurred in 1996, with the high of 1.36 million visits recorded in 1999 (see figure 1). The 17-year average of 1.19 million recreation visits, including about 110,000 overnight stays, nearly matches the visitation in 2006.

Recreation visitation to the Lakeshore is highly seasonal. Peak monthly visitation, averaging 388,200 visits over the past 17 years (33% of the annual average) occurs in July, followed by August (338,100 visits or 28%). The lowest use occurs during the winter with average monthly visitor use of 4,600 in January and 5,600 in December (see figure 2).

Origin of Visitors and Length of Stay

Recent visitor origin data are not available for the National Lakeshore. Visitor origin data for the region indicate that most travelers (70% to 80%) to the area are from Michigan. Other major origin states include Illinois, Indiana, Ohio, Missouri, and California. (Travel Michigan 2004 and Traverse City Convention and Visitors Bureau 2006).

Most use at the National Lakeshore is day use — an estimated 91%. Day use visitors include residents of the local area, Michigan residents from outside the local area, and residents from other states. Residents of the local area

Figure 1: Recreation Visits by Year at the National Lakeshore

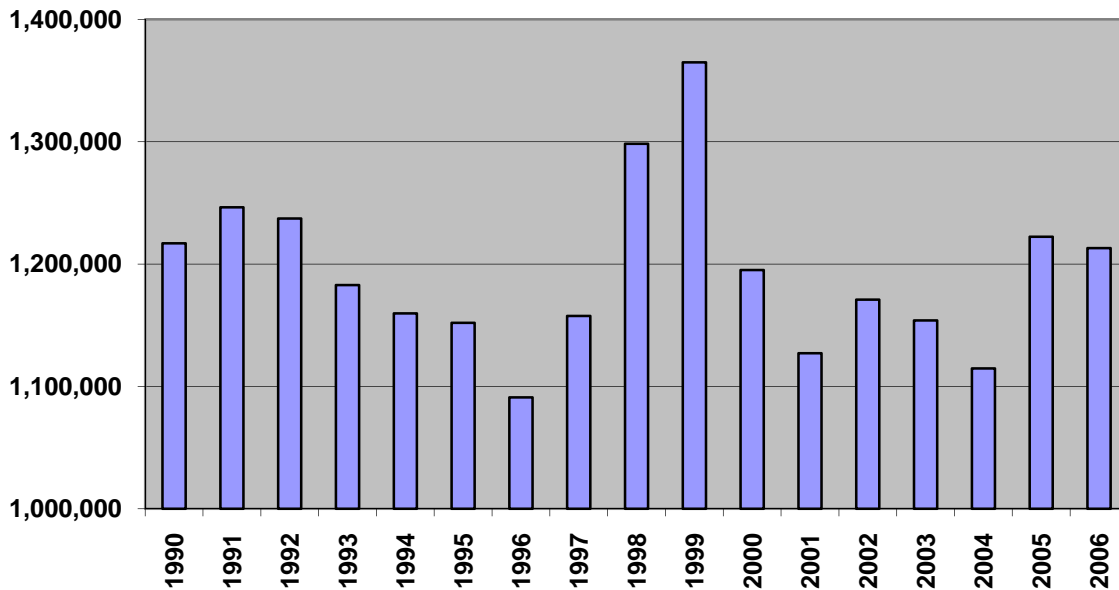
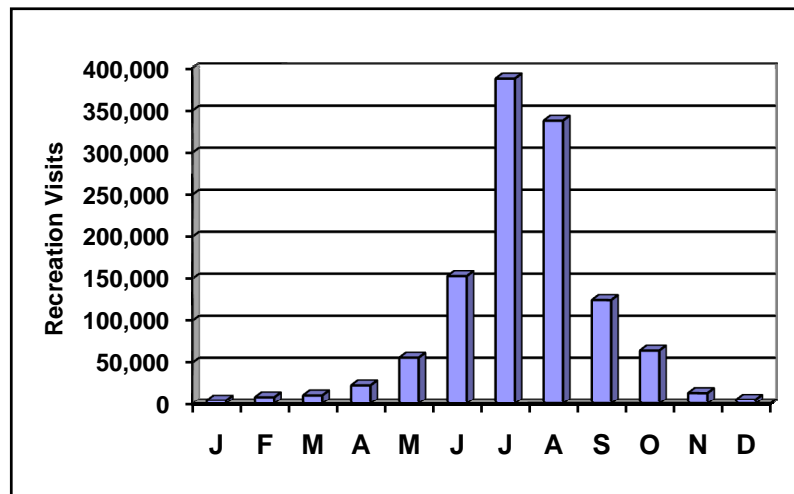
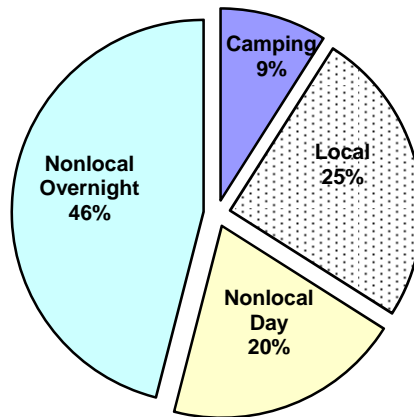


Figure 2: Average Monthly Recreation Visitation at Sleeping Bear Dunes National Lakeshore, 1990 to 2006



account for an estimated 25% of all use (see figure 3). Many of the day visitors to the National Lakeshore spend one or more nights in the area, either with friends or relatives, at vacation homes, or in local lodging accommodations. About 46% of all users spend at least one night in the area; another 20% are day

users from outside the area or nonlocals who continue their travels and spend the night elsewhere. Approximately 9% of the use is overnight use, primarily at the Platte River and D. H. Day campgrounds, but also including backcountry camping on the mainland and on the islands.

Figure 3: Types of Use at the National Lakeshore

Primary Destinations within Sleeping Bear Dunes National Lakeshore

Vehicle counters located throughout the park's mainland areas and ticket sales for the ferry provide insights into the primary destinations for visitor use at the National Lakeshore. These monitors show visitor use at the National Lakeshore is heavily concentrated at the Dune Climb, Pierce Stocking Scenic Drive, Philip Hart Visitor Center, and the Platte River area. Vehicle counts for August 2005 tallied 20,000 or more vehicles at each of those locations. Overnight camping at the Platte River and D.H. Day campgrounds and other locations also received substantial use (see figure 4). However, these data are not fully representative of use in the National Lakeshore, as not all locations are currently monitored (other beach accesses, and the Port Oneida area, for example).

WILDERNESS CHARACTER

The 1964 Wilderness Act refers to the following qualities that contribute to wilderness character:

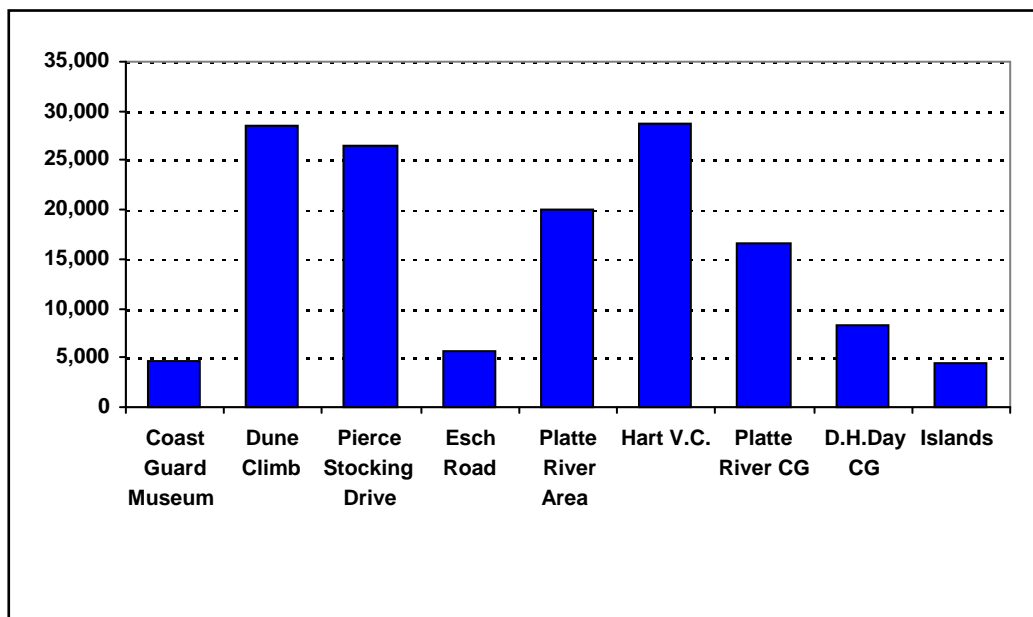
- Areas are largely natural and undeveloped.

- There are outstanding opportunities for solitude or "primitive, unconfined recreation."

Current Management of Areas Proposed for Wilderness

A brief history of wilderness evaluation at Sleeping Bear Dunes National Lakeshore is provided in the "Purpose and Need for the Wilderness Study" section in chapter 1. That section also provides information about uses and management in wilderness areas. See chapter 3 for information about the current wilderness study, which is a fresh look at wilderness options at the National Lakeshore.

An amendment (Public Law 97-361, passed in 1982) to the legislation that established the National Lakeshore stated that the lands identified in the 1981 "Wilderness Recommendation" "shall, until Congress determines otherwise, be administered by the Secretary so as to maintain their presently existing wilderness character." NPS *Management Policies 2006* reinforces this direction by stating that no action should be taken "that would diminish the wilderness eligibility of an area . . . until the legislative process of wilderness designation has been completed." By law and policy then, since 1981 the National Lakeshore has

Figure 4: Monthly Visitation at Selected Locations, August 2005

Units are in numbers of vehicles except for campgrounds (CG) and the islands, which are in numbers of individuals.

been managing 30,903 acres (see the No-action Alternative map) to maintain their wilderness character. Until the wilderness legislative process is complete (a congressional determination), these lands will continue to be managed to maintain their wilderness character.

Natural and Undeveloped

Much of Sleeping Bear Dunes National Lakeshore is largely natural and undeveloped, with large expanses of forest land, dunes, and wetlands. Some areas that were once agricultural fields are gradually returning to woodland. Numerous former home sites, buildings, and driveways have been removed and the sites restored to more natural conditions. Several large areas in the National Lakeshore, such as Good Harbor, Sleeping Bear Plateau, Otter Creek, and Platte Plains, have little if any noticeable human imprint other than hiking trails, backcountry campgrounds, and an occasional historic structure, all of which are consistent with the Wilderness Act and NPS

wilderness management policies. Most of the National Lakeshore's visitor support facilities, such as visitor contact stations, drive-to campgrounds, trailheads, and picnic areas, are clustered on the periphery of or well outside these natural and undeveloped areas.

North Manitou Island is by far the largest of the National Lakeshore's natural and undeveloped areas. This island is nearly all forested and has no roads. Development (other than hiking trails) is concentrated within easy walking distance of the ferry dock.

Most development on South Manitou Island is also concentrated within walking distance of the dock. However, this island has a few county roads that are used a few times per day during the summer by concessions tour vehicles and less often by administrative vehicles. Historic farmsteads and a historic schoolhouse are featured along the concessions tour route. Compared to North Manitou Island, this island has more old fields that the National Park Service is maintaining as cultural landscapes. Nonetheless, much of

South Manitou Island is relatively natural and undeveloped.

Outstanding Opportunities for Solitude

Areas where relatively large numbers of people (10-30+) occur at times include the Dune Climb; beach access areas and overlooks; drive-to campgrounds; picnic areas; popular historic areas such as Glen Haven, and the life-saving stations; the Platte River; and on the islands within walking distance of the ferry dock. Opportunities for solitude are often not available in these areas, particularly during the summer. Due to long sight distances or the tendency for sound to travel over water, solitude is sometimes hard to find on Lake Michigan beaches and some inland lakes. However, solitude can be found even in many of these areas early in the morning and during the spring, fall, and winter months.

In most other areas of the National Lakeshore, outstanding opportunities for solitude are available nearly year-round. In many places it is possible to walk or hike for miles without encountering another person.

Outstanding Opportunities for Primitive, Unconfined Recreation

There are opportunities for primitive, unconfined recreation in nearly every portion of the National Lakeshore. Backcountry camping opportunities are available in two locations on the mainland and on each Manitou Island. In 2006 there were nearly 18,000 visitor days of backcountry camping at the National Lakeshore. There are more than 50 miles of hiking trails on the mainland alone, and many more on the islands (see the “NPS Operations” section of this chapter for details.) It is unknown how many people use the National Lakeshore’s hiking trails, but the numbers are substantial and opportunities are plentiful.

Primitive, unconfined recreation at Sleeping Bear Dunes National Lakeshore also includes activities such as hunting, fishing, canoeing, kayaking, exploring, swimming, sand play, wildlife watching, snowshoeing, and cross-country skiing. Opportunities for these types of activities are plentiful and occur throughout the National Lakeshore.

REGIONAL SOCIOECONOMICS

The influence area for economic and social considerations associated with the Sleeping Bear Dunes National Lakeshore encompasses Benzie, Leelanau, and Grand Traverse counties on the upper northwest side of Michigan’s Lower Peninsula. Benzie and Leelanau are directly affected as portions of the National Lakeshore are within their boundaries, whereas Grand Traverse is indirectly affected due to its role as a regional trade and service center and a center of seasonal migration and tourism for the entire region. The region is largely rural, though along with neighboring Kalkaska County, the three counties comprise the Traverse City micropolitan statistical area.¹ Traverse City, the largest community in the region (2006 population 14,407), is about 25 miles east of the National Lakeshore. The communities of Empire, Glen Arbor, Leland, Beulah, and others are located in nearby areas surrounding the National Lakeshore. Timber, maritime commerce, and agriculture were important in the region’s economic development, with tourism and outdoor recreation emerging as more recent economic drivers.

¹ As defined by the U.S. Office of Management and Budget, a micropolitan statistical area (micro area) contains an urban core of at least 10,000 (but less than 50,000) population. Each micro area consists of one or more counties and includes the counties containing the core urban area, as well as adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core.

Population

All three counties have experienced long-term population growth, characterized by relatively rapid growth in the 1970s, tempered by state and national economic slowdowns in the early/mid 1980s, and growth resuming thereafter. Between 1990 and 2006, net population growth of 45%, 32%, and 34% occurred in Benzie, Grand Traverse and Leelanau counties, respectively, out-pacing the statewide growth of 9% for the same period. The pace of population growth has moderated in recent years (see table 9).

The three counties had a combined total of 124,716 residents in 2006, more than two-thirds of whom lived in Grand Traverse County. Benzie County's population of 17,652 accounted for 14% of the total, with Leelanau County having 18% of the total.

Most of the region's year-round residents live in rural, unincorporated areas. In addition to Traverse City, only Kingsley (Grand Traverse) and Frankfort (Benzie) have more than 1,000 residents. The remaining communities generally range from 250 to 650 residents. Population size in these communities has remained relatively constant in recent years because most of the new development and population growth has been in the outlying areas (U.S. Census Bureau 2007b).

In Leelanau County, Empire, Glen Arbor, and Leland are the three communities most

directly affected by the National Lakeshore — the first two because of proximity to key visitor use/activity centers in the National Lakeshore. Leland is the base for the ferry to the Manitou Islands. The portions of the Lakeshore in Leelanau County are located in Centerville, Cleveland, Empire, Glen Arbor, Kasson, and Leland townships.

In Benzie County, the communities of Benzonia, Beulah, Frankfort, and Honor are also affected by the National Lakeshore, because of their proximity to the Lakeshore and location along major roads that access the Lakeshore. The portions of the Lakeshore in Benzie County are located in Benzonia, Lake, and Platte, townships.

Economic Overview

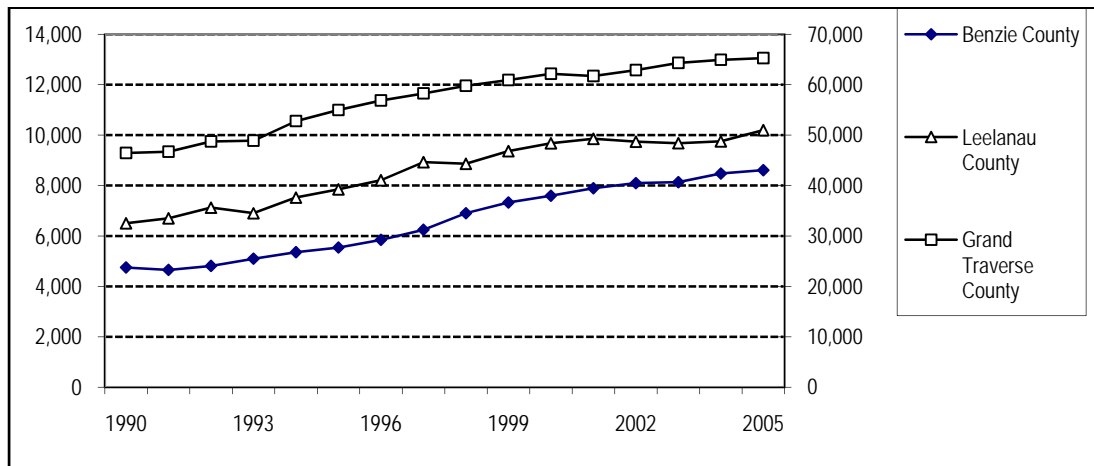
Strong economic growth accompanied the region's population growth. Total full- and part-time employment in Benzie County increased by 55% between 1995 and 2005. Employment gains in Grand Traverse County increased by 19% during the same 10 years. In Leelanau County employment increased by 30% during the same 10 years (see figure 5).

Recent economic growth and development has brought about differences in the economic structures of the individual counties. Employment data for 2005 highlight those differences (see table 10). Benzie County's economy tends

TABLE 9: POPULATION GROWTH TRENDS, 1990 TO 2006

	1990	2000	2006	Change 1990–2006	% Change 1990–2006
Benzie	12,200	15,988	17,652	5,452	45%
Grand Traverse	64,273	77,654	84,952	20,679	32%
Leelanau	16,527	21,119	22,112	5,585	34%
Michigan	9,295,297	9,938,444	10,095,643	800,346	9%

SOURCE: U.S. Census Bureau, 2002 and 2007(a)

Figure 5: Total Employment in the Region, 1990 to 2005

SOURCE: U.S. Bureau of Economic Analysis 2007

TABLE 10: EMPLOYMENT BY MAJOR CATEGORY, 2005

County	Total Employment	Agriculture*	Industrial**	Trade and Services***	Government****
Benzie	8,611	3%	27%	61%	9%
Grand Traverse	65,301	1%	24%	64%	10%
Leelanau	10,200	10%	17%	53%	20%

SOURCE: U.S. Bureau of Economic Analysis 2007

* Includes farming, forestry and logging, hunting and fishing, and agricultural support activities.

** Includes mining, utilities, construction, manufacturing, transportation & warehousing, and administration & waste services.

*** Includes wholesale and retail trade, information services, finance & insurance, real estate, professional & technical services, management of companies, educational services, health care, arts & recreation, accommodation & food services, and other services.

**** Includes federal, state and local government.

to be more industrial, that of Grand Traverse more trade and services oriented, and that of Leelanau more dependent on agriculture, government, and trade and services. Public sector employment, particularly local government employment, is important across the region, but particularly in Leelanau County. The latter reflects the substantial workforce employed by the Grand Traverse Band of Ottawa and Chippewa Indians (Grand Traverse Band).

Local employment and unemployment generally follow statewide trends, likely indicative of a correlation between statewide economic health and people's vacation/travel

patterns and spending. That pattern is evident over the past seven years as local unemployment rates climbed from 2000 through 2003/04, then stabilized or declined (see table 11). Unemployment rates are generally below the statewide averages in Leelanau and Grand Traverse counties; those in Benzie County tend to be higher. The latter is the result of multiple factors, including a less diverse economy base and higher reliance on seasonal industries.

In terms of employment, the federal government has a relatively modest presence in the regional economy. Federal agencies with the largest presence include the National Park

TABLE 11: UNEMPLOYMENT RATES, 2000 TO 2006

Area of Interest	Annual Average						
	2000	2001	2002	2003	2004	2005	2006
Benzie County	4.5%	5.8%	6.9%	7.9%	7.6%	7.7%	7.6%
Grand Traverse County	3.4%	4.7%	5.6%	6.2%	6.5%	5.9%	5.9%
Leelanau County	3.0%	3.7%	4.8%	5.6%	5.4%	5.1%	5.0%
Michigan	3.7%	5.2%	6.2%	7.1%	7.0%	6.8%	6.9%
United States	4.0%	4.7%	5.8%	6.0%	5.5%	5.1%	4.6%

SOURCES: U.S. Bureau of Labor Statistics, 2007

Service, U.S. Postal Service, U.S. Coast Guard, and Transportation Security Administration. Together these agencies reported a total of 1,105 (about 1.2%) of all jobs. The economic significance of these jobs is amplified by their relatively high average earnings and the associated operating, maintenance, and capital expenditures by the entities in the local economies.

Agriculture historically played a major role in the region, both in terms of land use and economics. Agriculture's economic significance has waned over time, but it continues to be important in terms of direct farm employment and indirectly through its support for agricultural services, trade, and tourism.

A total of 1,099 individual farms, encompassing a total of 147,729 acres, were operating in the three counties in 2002 (see table 12). Compared to five years earlier, those totals reflect 29 more farms but a reduction of more than 10,000 acres of farmland. These

changes reflect both recent subdivisions of large farms into smaller units, as well as the loss/conversion of farmland — typically to low-density rural residential uses (USDA-NASS 2004).

In 2002, 181 of the farms were in Benzie County, collectively covering 23,055 acres or 11% of the county's land area. Agricultural operations in Grand Traverse County involved 489 farms or about 21% of the county's land area, and the 429 farms in Leelanau encompassed 28% of the county's land area. (The calculations are based on the land area in each county. The area covered by lakes, streams, and other water bodies is excluded.) In 2002 sales of local crops and livestock generated more than \$60 million in the region. Fruit orchards and fields used to grow hay, corn silage, or other forage for livestock feed accounted for the largest uses of farm land. Apples, sweet cherries, tart cherries, and Christmas trees were the principal cash crops. Maple syrup is another

TABLE 12: OVERVIEW OF AGRICULTURAL OPERATIONS IN THE REGION, 2002

County	Number of Farms	Total Farm Employment	Acres in Farms	Average Size (Acres)	Market Value of Sales (Millions)
Benzie	181	200	23,055	127	\$ 8.0
Grand Traverse	489	594	62,268	127	\$ 20.6
Leelanau	429	662	62,406	159	\$ 32.8

SOURCES: USDA-NASS 2004 and U.S. Bureau of Economic Analysis 2007

important local farm product (USDA-NASS 2004). A local wine industry is emerging, with more than a dozen vineyards and wineries located on the Leelanau Peninsula. (Michigan Grape and Wine Industry Council 2007).

Outdoor recreation and tourism are vital cornerstones for the regional economy. In addition to the National Lakeshore, the following other recreation and tourism attractions are located in the Grand Traverse region:

- outstanding stream and lake fishing
- abundant boating and canoeing opportunities
- world-class golf courses
- museums and other heritage and cultural attractions, including the Point Betsie, Grand Traverse, and Old Mission lighthouses
- snowmobiling, along with Nordic and alpine skiing
- beaches
- natural areas, open space and state forests
- picnic areas; campgrounds; local, regional, and state parks; and trail systems
- winery tours on the Leelanau and Old Mission peninsulas
- casino gaming and entertainment
- local arts and cultural festivals

In addition, Michigan state routes M-22 and M-109 carry tourists who are following the Great Lakes Circle Tour. The tour connects all five Great Lakes and the St. Lawrence River and is a cooperative effort between the Great Lakes Commission, its eight member states, and the Canadian province of Ontario. Visitors and travelers support numerous jobs in the region's retail trade, accommodations and dining, and entertainment and other affiliated industries.

Commercial and Noncommercial Services Provided at Sleeping Bear Dunes National Lakeshore

A variety of necessary and appropriate commercial visitor services are provided in the National Lakeshore, including non-motorized watercraft rentals, ferry services to the islands, vending machine snacks, and campground firewood sales. These services will be provided through concession contracts and/or commercial use authorizations, as applicable. Two concessions currently operate in the National Lakeshore. Manitou Island Transit, based in Leland, offers ferry service for day trips to South Manitou Island and overnight camping trips to both North Manitou and South Manitou islands. The other concession provides beverages and snacks from vending machines at the Dune Climb. Commercial use authorization holders based in nearby communities provide incidental commercial services such as educational programs, guided fishing, professional photography, and other services.

The Eastern National cooperating association operates three bookstores in the National Lakeshore — at the visitor center in Empire, at the Dune Climb, and at the Glen Haven General Store (the latter two seasonally).

The Friends of Sleeping Bear Dunes, Preserve Historic Sleeping Bear, Manitou Islands Memorial Society, and the Glen Arbor Art Association partner with the National Lakeshore to provide informational materials, extensive volunteer interpretation, restoration and preservation efforts, and other activities in concert with NPS staff. Preserve Historic Sleeping Bear and the Glen Arbor Art Association occupy historic buildings in the National Lakeshore.

Income and Poverty

Total personal income in the three-county region was nearly \$4.0 billion in 2005 — \$469

million in Benzie County, \$804 million in Traverse County.² All three counties registered higher than average gains in total personal income, relative to the statewide average, between 2000 and 2005. The largest gains occurred in Leelanau County — 35% (see table 13).

More than 15% of all earnings paid by employers in Grand Traverse County, nearly \$375 million, was to workers commuting from outside the county. Residents of Benzie County benefited from a net inflow of \$87 million, while residents in Leelanau County generated a net inflow of \$221 million. In fact, such earnings by commuting workers were nearly 80% of wages and salaries earned by all workers within the county (see table 14). Net earnings inflows to Leelanau County have increased sharply in the past five years.

Dividends, interest, and retirement benefits and other nonearned income are significant sources of income for local residents — ranging from \$220 million in Benzie County to nearly \$907 million in Grand Traverse County. Such income actually exceeded total local wage and salary earnings of employees and proprietors in Benzie and Leelanau County. High levels of nonearned income are commonly indicative of a relatively high retired population in an area.

Recent favorable economic conditions are also manifested in local per capita incomes. Gains in per capita personal income ranged from 11% (Grand Traverse County) to 30% (Leelanau County) between 2000 and 2005 (see table 15). The statewide average increased

Leelanau County, and \$2.69 billion in Grand Traverse County by 13%. Per capita income in Leelanau County, which historically lagged behind the statewide average, is now 11% above the state average. Per capita incomes in Grand Traverse and Benzie counties continue to lag behind the statewide average (Benzie County residents by 19%). In terms of per capita income, Benzie, Grand Traverse, and Leelanau counties ranked 37th, 9th, and 4th in the state, respectively.

Another perspective on the economic welfare of residents is presented by data on median household incomes and poverty rates (see table 16). The incidence of poverty in all three counties is substantially lower than either the state or national averages. Grand Traverse and Leelanau counties have median household incomes that are above the state and national averages, and Benzie County has median household incomes that are below the state and national averages.

Demographics

Residents of the region tend to be older than the general population statewide, with median ages ranging from 37.7 years in Grand Traverse County, to 40.8 years in Benzie County, to 42.6 years in Leelanau County. Leelanau and Benzie counties have relatively higher proportions of residents 55 years and older, many of whom are retired or semi-retired (see table 17).

The resident populations of all three counties are predominately white, with low minority populations and few Hispanic and Latino residents. American Indians are the largest minority population in the region, with 2,449 residents identifying themselves as such in the 2000 census. Many are members of the Grand Traverse Band of Ottawa and Chippewa

²Personal income includes work-related earnings, social security, and other income maintenance payments, unemployment benefits, retirement, and income derived from investments. Total personal income is an indicator of the relative size of an economy, while changes in income over time may reflect changes in economic welfare, but also changes in the levels of economic activity, population, and inflation. Per capita, median, and other income measures provide a basis for comparing economic welfare between areas.

TABLE 13: TOTAL PERSONAL INCOME

Area	2000	2005	Percent Change 2000 to 2005
Benzie County	\$380,997,000	\$468,796,000	23%
Grand Traverse County	\$2,254,827,000	\$2,694,009,000	19%
Leelanau County	\$594,926,000	\$804,150,000	35%
Three-county total	\$3,230,750,000	\$3,966,955,000	23%
Michigan	\$294,226,742,000	\$331,348,575,000	13%

SOURCE: U.S. Bureau of Economic Analysis 2007

TABLE 14: COMPOSITION OF TOTAL PERSONAL INCOME, 2005 (IN MILLIONS)

	Benzie County	Grand Traverse County	Leelanau County
Earnings by Place of Work	\$183.1	\$2,430.5	\$281.7
Residency Adjustment	\$87.1	(\$374.6)	\$221.3
Social Security Deductions	(\$21.6)	(\$268.7)	(\$31.7)
Other Income to Residents	\$220.2	\$906.8	\$332.9
Total Personal Income — Residents	\$468.8	\$2,694.0	\$804.2

Notes:

1. A positive residency adjustment reflects a net inflow of earnings by residents of a county who are employed in another county, as compared to earnings paid by local employers to residents of other counties.
2. Other income includes dividends, interest, and rent, and personal current transfer receipts.
3. Social security deductions includes employee paid and employer paid social security taxes.

Source: US Bureau of Economic Analysis 2007

TABLE 15: PER CAPITA PERSONAL INCOME, 2000 AND 2005

	2000	2005	% Change 2000–2005	% of State Average	Statewide Rank (of 83)
Benzie County	\$ 23,647	\$ 26,676	13%	81%	37
Grand Traverse County	\$ 28,911	\$ 32,089	11%	98%	9
Leelanau County	\$ 27,978	\$ 36,502	30%	111%	4
Michigan	\$ 29,551	\$ 32,804	13%	NA	NA

SOURCE: U.S. Bureau of Economic Analysis 2005

TABLE 16: MEDIAN HOUSEHOLD INCOME AND INCIDENCE OF POVERTY — 2004

Area	Median Household Income	Individuals in Poverty (% of residents)
Benzie County	\$ 41,037	9.0%
Grand Traverse County	\$ 45,542	9.0%
Leelanau County	\$ 52,141	7.2%
Michigan	\$ 44,409	12.5%
United States	\$ 44,334	12.7%

SOURCE: U.S Census Bureau 2007d

TABLE 17: SELECTED DEMOGRAPHIC CHARACTERISTICS, 2000

Area of Interest	Median Age (Years)	Persons 19 or younger	Persons 55 years and older	Race: White	Race: Hispanic or Latino
Benzie County	40.8	25.4%	29.1%	97.6%	1.5%
Grand Traverse County	37.7	28.0%	21.9%	97.5%	1.5%
Leelanau County	42.6	26.6%	28.8%	94.4%	3.3%
Michigan	35.5	29.0%	20.1%	81.8%	3.3%

SOURCE: U.S Census Bureau 2002

Indians, given federal recognition as a tribe in 1980. The Grand Traverse Band has administrative headquarters in Peshawbestown, in Leelanau County, and holds lands in trust and in title in Benzie and Grand Traverse Counties. Tribal membership was 3,983 in 2005, though not all members reside on tribal lands or within the region (Grand Traverse Band 2007).

At the time of the 2000 census, approximately one in four residents in the three-county region had moved to their residence since 1995. Most of the recently migrated residents moved from elsewhere in Michigan, though 30% migrated from other states or from another country.

Housing

At the time of the 2000 census, housing vacancy rates in all three counties were higher than the statewide average of 10.6%. Overall vacancy rates in both Leelanau and Benzie

counties were 37%, with more than 4,800 and 3,800 vacant units, respectively (see table 18). However, the majority of these units are second homes for seasonal, recreational, or occasional use, reflecting the region's vacation/tourism destination history.

Recent immigration and the region's continued attraction for vacation/second homes are reflected in new residential construction activity. Building permits were issued for more than 9,500 new housing units in the three counties from 2000 through 2006; the total represents a 16% increase over the total existing housing stock in 2000. Two-thirds of the permitted units were in Grand Traverse County, although Leelanau and Benzie Counties each issued permits for more than 1,600 new units. Many new units are located near the Lakeshore, including around Glen Arbor, Empire, and the areas near the southern portion of the National Lakeshore.

TABLE 18: SELECTED HOUSING CHARACTERISTICS

County	Total Units	Percent Occupied	Total Vacant Units	Vacant Units for Seasonal, Recreational or Occasional Use (Number / % of Total)	New Units Permitted, 2000 to 2006
Benzie	10,312	63%	3,812	3,181 / 31%	+ 1,625
Grand Traverse	34,482	87%	4,446	3,026 / 9%	+ 6,157
Leelanau	13,297	63%	4,861	4,111 / 31%	+ 1,725

SOURCE: U.S. Census Bureau 2002 and 2007c

Existing housing facilities at the National Lakeshore include 28 dwelling units used on a full-time or seasonal basis. The inventory includes 13 units on the mainland and the remainder on North Manitou or South Manitou islands. Most of the Lakeshore's housing resources are historic structures acquired by the National Park Service and renovated/ rehabilitated over time as part of the Lakeshore's ongoing cultural resource preservation efforts.

Highway Traffic and Emergency Services

The National Park Service owns and maintains about 25 miles of road in the National Lakeshore. All are two-lane roadways, with the exception of the Pierce Stocking Scenic Drive and numerous one-way segments within campgrounds.

The primary highway access to and through the Lakeshore is Michigan State Route 22 (M-22), which runs north-south through or adjacent to the full length of the Lakeshore. M-22 is a paved, two-lane facility, with paved shoulders varying from 1 to 5 feet in width.

Two other state routes, M-109 and M-72, are of particular importance to the National Lakeshore. Route M-109, branching from M-22 in Glen Arbor and reconnecting north of Empire, accesses Glen Haven, the Dune Climb, and Pierce Stocking Scenic Drive. Route M-72 provides the most direct highway connection between Empire and the Traverse City area. Both are two-lane, paved roads.

Leelanau and Benzie counties both have public road rights-of-way within the Lakeshore boundaries. These roads access private properties as well as providing access for many National Lakeshore recreational activities.

Traffic on the major state roads in the region, shown in table 19, is heaviest in the northern portion of the Lakeshore and near NPS headquarters in Empire. Traffic is highly seasonal, with peak traffic volumes of 40% to 50% above the annual average occurring in July and August during peak visitor use. Winter time traffic volumes are 30% to 40% below the annual averages.

TABLE 19: TRAFFIC VOLUMES 2005/06, SELECTED LOCATIONS NEAR THE NATIONAL LAKESHORE

Route/Location	Annual Average Daily Traffic (AADT)	Average Daily Commercial Traffic
M-22, north of the Lakeshore, south of SR 204	3,500	60
M-22, east of Port Oneida	2,000	60
M-22, south of Glen Arbor	1,300	50
M-22, north of Empire	2,700	40
M-22, south of Empire	1,300	NA
M-22, south of Benzie/Leelanau line	1,900	120
M-22, south of the Lakeshore, north of Frankfort	2,400	NA
M-109, west of Glen Arbor in the vicinity of Glen Haven	1,800	30
M-109, vicinity of Dunes Climb and Pierce Stocking Scenic Drive	1,300	20
M-72, east of Empire	2,400	300
US 31 north of Beulah and east of Honor	7,100	NA

SOURCE: Michigan Department of Transportation 2007

NA — commercial traffic volumes were not reported for this location

A 2001 transportation study analyzed then current and 20-year traffic forecasts for the major roads in the Lakeshore. The travel demand forecasts assumed a 1% annually compounded growth rate in traffic volumes. That analysis concluded that all of the major roads could accommodate the expected 2020 traffic volumes without expansions or major improvements. That analysis also examined the level of service at the key intersections in the National Lakeshore. At the time of the analysis, all major intersections were operating within the desired level of service, and with the exception of the intersection of M-22 and M-109 (in Glen Arbor) would continue to do so through 2020. (Robert Peccia & Associates 2001.)

The segments of M-22 and M-109 in Leelanau County through and near the Lakeshore comprise part of the state-designated Leelanau Scenic Heritage Route, a locally sponsored effort to preserve and enhance the natural, historic, cultural, and scenic resources and qualities in the area. The project has received approvals from the federal and state departments of transportation and has also received funding for further planning studies. The efforts include plans to develop a hard surfaced/paved 25-mile nonmotorized hike/bike trail along these roads. The hike/bike trail would generally be separated from the road shoulder.

Visitation to the National Lakeshore can increase highway traffic and subsequent public safety demands on local law enforcement and emergency medical service responders. The Benzie County Sheriff's Department responds to incidents in the Lakeshore from its office in Beulah. The Leelanau County Sheriff's Department responds to incidents in the Lakeshore from its office in Lake Leelanau. The Michigan State Police respond to incidents in the Lakeshore from a Post in Traverse City and Detachments in Honor and at the Leelanau County Sheriff's Office in Lake Leelanau.

NPS rangers and wildland firefighters also support public safety. NPS rangers respond to law enforcement, emergency medical service, and search-and-rescue incidents within the National Lakeshore. Federal law allows NPS rangers to respond to other emergency situations outside the Lakeshore's boundaries. The need for such response arises infrequently. Local fire departments and emergency medical responders provide additional capacity, including rescue capabilities. Emergency medical transport is via ambulance services associated with area hospitals. Hospitals are located in Manistee, Traverse City, and Frankfort.

NPS wildland firefighters respond to fires in and around the Lakeshore and also support wildland firefighting efforts throughout the United States.

Land Use and Landownership

The predominant land uses in the study area include agriculture, forested areas; natural areas supporting wildlife and ecological conservation; outdoor recreation and other open space; rural residential use; and developed residential, commercial, and industrial lands. Industrial uses are concentrated in and near Traverse City, other communities in the area, and along the major highway corridors through the region.

Land use adjacent to the Lakeshore is a combination of private forested and farm lands and rural residential development, the latter including clustered developments around private inland lakes. Most of the three counties are zoned as agricultural, with residential uses allowed. Other uses in unincorporated areas require approvals from the respective zoning administrators and commissions. The majority of lands in all three counties are privately owned, although the state and local governments manage substantial tracts of public lands as well.

As a result of the federal lands included in the National Lakeshore, Benzie and Leelanau counties receive payments in lieu of taxes, or PILT. The PILT program is administered by the U.S. Bureau of Land Management and distributes payments to county governments containing qualified federal lands within their jurisdictional boundaries. The payments, which are subject to congressional appropriations, are to help offset the diminished property tax receipts due to nontaxable federal lands within their boundaries. A total of 8,091 eligible acres were located in Benzie County in fiscal year 2007, 39,889 acres in Leelanau County, and 2 acres in Grand Traverse County. Of these PILT-eligible lands, all but 3 acres were in the National Lakeshore.

Fiscal year 2007 PILT payments were \$14,250 to Benzie County and \$71,795 to Leelanau County. Grand Traverse County did not receive PILT payments in 2007 due to the limited acreage of PILT entitlement land within its boundaries. In recent years, congressional appropriations have funded the PILT program at about 68% of the statutorily approved levels (US DOI 2007).

Economic Contributions of Sleeping Bear Dunes National Lakeshore

The Lakeshore is an important component of the regional economy. Spending by visitors to the Lakeshore, as well as NPS personnel and operating and maintenance expenditures, support local businesses and generate tax revenues to help support local governments.

Visitor Spending. An estimated 1,213,026 recreation visits occurred at Sleeping Bear Dunes National Lakeshore in 2006. Recreation visitation at the Lakeshore has been relatively consistent over time. The 17-year average of 1.19 million recreation visits, including about 110,000 overnight stays, nearly matches the visitation in 2006 (see

chapter 4 “Visitor Opportunities and Use” for more information on visitation).

Based on an estimated origin profile of Lakeshore visitors and typical spending patterns, a 2006 study of the economic contributions of national park system units estimated total annual visitor spending associated with the Lakeshore to be about \$33.4 million. The bulk of the total, about \$26.5 million (79%), is by non-local visitors staying overnight in area motels, bed-and-breakfasts, other lodging, and camping. (Stynes 2007).

Total spending by visitors includes entry and camping fees at the Lakeshore. In 2006, such receipts totaled about \$1,200,000. About 80% of the fees collected are retained by the Lakeshore for use in projects and programs that directly benefit visitors, such as facility maintenance and construction, visitor services and interpretive programs, and natural resource projects.

Visitor spending associated with the National Lakeshore supports an estimated 528 jobs across the region, generating \$9.2 million in annual personal income (Stynes 2007). Those sums are in addition to the NPS jobs at the Lakeshore and those supported indirectly by the payroll, operating expenses, and construction contracts issued by the National Park Service.

Lakeshore Operations. The annual budget for NPS operations at Sleeping Bear Dunes National Lakeshore helps the regional economy (utilities, supplies, and services support additional sales, jobs, and income). Spending of income by NPS employees also stimulates the regional economy. The effects of NPS operations are an addition to the effect of visitor spending associated with the National Lakeshore.

The annual base operating budget at the Lakeshore for fiscal year 2006 was \$3.51 million. The base budget was supplemented by funding for specific projects and funding

retained from entry and camping fees. These funds supported a staff of 46 full- and part-time, year-round employees and 84 seasonal employees. Annual payroll funding from the base budget was \$2.54 million in salaries and benefits, with another \$892,000 spent for utilities, services and travel, supplies, small equipment items, vehicles, and contracts for services. In addition, annual expenditures of about \$539,000 for salaries and personnel services and \$395,000 in other expenditures were funded via the portion of entry and camping fees retained by the National Lakeshore.

NPS payroll and spending in the local economy supports an estimated 25 to 30 additional jobs and \$1.4 million in personal income in the region.

Partner organizations and the large cadre of volunteers provide additional benefits to the regional economy in the form of purchases of goods and services, as well as spending by members and guests at events and activities hosted by the organizations. Many of the estimated 965 volunteers (FY 2007) active in the Lakeshore are themselves residents in the area, either year-round, or seasonal residents returning year after year. The economic value of the contributions by volunteers is estimated at \$600,000 and 17 full-time equivalent-employees per year.

Combined Effects of Visitor Spending and Lakeshore Operations. The combined effects of the visitor spending and NPS operations include nearly 700 full- and part-time jobs and \$13.6 million in personal income. Local spending supports local businesses and generates various fees and tax revenues to help support local government.

Attitudes and Lifestyle Issues Associated with the National Lakeshore

Although there is no single, established, defined gateway community associated with

Sleeping Bear Dunes National Lakeshore, there is a community comprised of the staff, visitors, partners, neighbors, and adjacent landowners, Lakeshore volunteers, American Indians, and many other interested individuals and entities. The latter include local, nonlocal, and even international residents, private enterprises, public interest groups, governmental agencies, and other institutions and organizations. The broader community also encompasses the residents and business owners of the surrounding region.

A wide spectrum of views, perspectives, and attitudes exist within that broad community regarding the Lakeshore and associated resources and opportunities. For some, the Lakeshore is seen primarily as an outdoor recreational resource; for others it is a unique and significant environment warranting conservation. Even among outdoor enthusiasts, attitudes regarding the Lakeshore vary among those who seek solitude and backcountry experiences commonly associated with wilderness, those who prefer enhanced motorized access to more of the Lakeshore (especially to Lake Michigan), and those who see the Lakeshore and the surrounding environs as contributing to their spiritual or emotional well-being.

Members of this community, be they individuals, groups, or institutions, ascribe to multiple views toward the Lakeshore, how it currently affects them, and how it could affect them if the Lakeshore were managed differently in the future. Moreover, many may see both benefits and adverse effects on their personal and community lifestyles, depending on how the Lakeshore is managed. For example, some residents of the Glen Arbor community may see economic development potentials associated with future recreation use while also being concerned about the potential traffic impacts of such use.

Among local residents, the subject of public access to various areas of the Lakeshore and the recreational opportunities afforded

thereby is perhaps the single most critical issue associated with future management of the Lakeshore, and resolution of that issue may shape their sentiments toward the Lakeshore over the long term. For others, efforts to preserve and interpret the historical and cultural resources in the Lakeshore are of paramount concern. And for others, preservation and protection of the natural environment and scenic vistas is of utmost importance.

The range and divergence of attitudes regarding the Lakeshore has been apparent in the high level of active participation in the GMP process, including attendance at open houses, comments during scoping, and responses to the GMP newsletters.

NPS OPERATIONS

Operations and Management

Sleeping Bear Dunes National Lakeshore is administered by a superintendent, assistant superintendent, and several division chiefs. Management of the Lakeshore is organized into the superintendent's office and five functional divisions. The functional divisions are discussed in the sections that follow. As of 2007, there were 66 full-time-equivalent (FTE) employees at the National Lakeshore.

The superintendent is directly responsible for the assistant superintendent, the environmental protection specialist, the superintendent's secretary, and indirectly for the five division chiefs. In addition to responsibilities for overall leadership and coordination, the superintendent's staff (four FTE employees in 2007) is responsible for public and external affairs, planning and compliance, and safety. The main base of operations for the superintendent's office is the leased visitor/administrative center building in Empire.

Interpretation and Visitor Services Division

Interpretation and visitor services includes education services for diverse audiences, interpretation of themes, staffing the visitor center, providing information and orientation for visitors through personal (guided) and nonpersonal services (e.g., web site, publications, exhibits, and Volunteer-in-the-Parks program). This division is also responsible for managing the library, fee collection, campground management, and museum collections. The main base of operations for interpretive and visitor services staff is the visitor/administrative center building in Empire. As of 2007, there were 14 FTE employees in this division.

Resource and Visitor Protection Division

The resource and visitor protection division is responsible for visitor and employee safety, resource protection, emergency response, park and facility patrols, security, emergency medical services, search and rescue, structural fires, law enforcement, air operations, resource protection education, dispatch, and concession operations in the Lakeshore. As of 2007, there were 12 FTE employees in this division. The main base of operations for this division is the visitor/administration center building in Empire, with district ranger offices at the Platte River Campground (Platte River District) and the D.H. Day Store in Glen Haven (Leelanau District). The Leelanau District has responsibility for protection operations on the Manitou Islands.

Facility Maintenance Division

The facility maintenance division is responsible for operation and maintenance of park facilities and equipment, including structures and grounds, utilities, roads and parking areas, trails and trailheads, picnic areas, signs, and vehicles. This division is also responsible for managing cultural resources (archeological

sites, historic structures, cultural landscapes, and ethnographic resources). The main base of operations for the division is the maintenance area located about a mile south of Empire. As of 2007, there were 26 FTE employees in this division.

Natural Resources Management Division

The natural resources management division is responsible for management of natural resources, including natural resource inventory and monitoring, managing natural resource research, protecting threatened and endangered species, restoring disturbed sites, managing invasive nonnative species, monitoring water quality, operating the Geographic Information System, and managing wildland fires. This division is operated out of the visitor/administrative center in Empire. Biological technicians work out of the natural resources field station in the central part of the Lakeshore. As of 2007, there were five FTE employees in this division.

Administration Division

The administration division is responsible for the Lakeshore's budget, fiscal, purchasing, property management activities, and the lands program. Administration also has responsibility for human resources, information technology, communications, and housing. The main base of operations for administrative staff is the visitor/administrative center building in Empire. As of 2007, there were five FTE employees in this division.

Volunteers and Partners

Sleeping Bear Dunes has an unusually large volunteer program that is coordinated by the interpretation and visitor services division. Volunteers contributed 35,544 hours of volunteer services in FY 2007. The National Lakeshore also benefits from the contribu-

tions of several cooperative partner organizations (see below).

Eastern National is a nonprofit cooperating association that provides educational products and services to Lakeshore visitors. A portion of proceeds are donated back to Lakeshore interpretive and educational programs. Eastern National operates bookstores at the visitor center in Empire, the Dune Center (at the Dune Climb), and the Glen Haven General Store.

Friends of Sleeping Bear Dunes helps with preserving and restoring the National Lakeshore's natural, historic, and recreational resources. This group raises funds via donations and grants, and helps by volunteering on a variety of projects, such as trail maintenance and revegetating disturbed areas.

Preserve Historic Sleeping Bear is a nonprofit organization committed to preserving historic structures and cultural landscapes of the National Lakeshore through fund-raising and volunteer services.

The Manitou Islands Memorial Society helps preserve the Manitou Islands' cultural traditions, provides educational materials and programs, promotes care and maintenance of the islands' historic assets, keeps island burial records, and provides volunteer help.

The Glen Arbor Art Association has been working with the National Lakeshore in recent years to restore the historic Thoreson Farm in Port Oneida. Through a special use permit, the association uses the farm for art and education programs.

Facilities and Infrastructure

Introduction. Infrastructure at Sleeping Bear Dunes National Lakeshore includes a diverse set of facilities or "assets" (e.g., structures, roads, parking areas, picnic areas, utility and wastewater systems, maintained landscapes,

campgrounds, and communication systems). Increased operational requirements, reduced funding, and lapsed staff positions have caused the staff to defer routine maintenance of some facilities. Deferred maintenance is work that should ideally have been done at specific times but was not, primarily due to budget constraints. Deferred maintenance often leads to costly repairs over time.

The National Park Service monitors deferred maintenance in park units using a facility management tracking system. The National Park Service is striving to reduce the deferred maintenance backlog throughout the national park system by prioritizing projects and funding them through various sources, including the Federal Lands Recreation Enhancement Act. During 2006-2007, the National Lakeshore updated information in the facility management tracking system relating to the condition and importance of its assets.

Structures. National Lakeshore staff is responsible for maintaining about 475 structures, more than 360 of which are historic. Examples include ranger and visitor contact stations, maintenance shops, employee residences, and historic Life-Saving Service stations and homesteads.

Roads. The primary vehicle travel corridor through the National Lakeshore is along state-managed M-22 and M-109. This road corridor is a state scenic heritage route. Most road rights-of-way in the National Lakeshore are managed by Benzie or Leelanau counties. Some of these roads provide access to Lake Michigan beaches or other Lakeshore features, while others provide access to private property. Some roads do not access any particular feature or property, having formerly served private properties that no longer exist.

A few roads are owned and managed by the National Park Service. Tiesma Road, located near the Platte River in the south part of the

National Lakeshore, is a 1-mile-long gravel road that approaches the Lake Michigan shoreline. Pierce Stocking Scenic Drive, in the central portion of the Lakeshore, is a popular 7.4-mile, one-way, slow-speed scenic loop road. Facilities along the scenic drive include an entrance station, parking areas, pull-offs, wayside exhibits, scenic overlooks, restrooms, and trailheads. The scenic drive includes a bicycle lane that is suitable for experienced cyclists. Interpretive pamphlets that highlight features along the scenic drive are available for visitors.

Trails. The National Lakeshore includes more than a dozen trails and trail systems, ranging in length from just over a mile to nearly 15 miles. The trails vary in terms of terrain and habitat. Table 20 summarizes characteristics of the mainland trails. In addition to the mainland trails, North Manitou and South Manitou islands have extensive trail systems.

Campgrounds and Camping. Platte River campground, in the south portion of the National Lakeshore, is the most developed campground in the Lakeshore. Amenities include paved roads, showers, flush toilets, water, a few sites with electrical hook-ups, and a canoe launch. The campground includes walk-in and group sites. Campsites can be reserved in advance.

The D. H. Day campground, in the central part of the National Lakeshore mid-way between Glen Haven and Glen Arbor, is more rustic. It has potable water, a small amphitheater, a nature center, vault toilets, dirt roads, and beach access. Campsites are assigned on a first-come, first-served basis.

A group campground is located northwest of Little Glen Lake. This campground is referred to as the D. H. Day group campground, but it is separate from the D. H. Day campground referred to above.

TABLE 20: TRAILS AND TRAIL SYSTEMS AT SLEEPING BEAR DUNES NATIONAL LAKESHORE

Trail Name	Length (miles)	Terrain	Vegetation	Location in the Lakeshore	Notes
Old Indian Trail	2.5	Flat to gently rolling with a few sections of steep hills	Evergreens and hardwoods	south	Trail leads to a view of Lake Michigan
Platte Plains Trail	14.7	Mostly flat	Pine-oak-aspen	south	Three views of Lake Michigan
Empire Bluff Trail	1.5	Hilly	Beech-maple, fields, dune plants	south	Overlook on a high bluff over Lake Michigan
Windy Moraine Trail	1.5	Hilly	Beech-maple, old fields, pine plantation	central	Views of Glen Lake
Shauger Hill Trail	2.4	Hilly	Beech-maple	central	Crosses Shauger Hill Road and Scenic Drive
Cottonwood Trail	1.4	Rolling Dunes	Grasses, shrubs, wildflowers of the dunes	central	Loose sand (strenuous). Views of Lake Michigan and sand dunes
Dunes Trail	3.5	Steep, rugged dunes	Grasses, shrubs and wildflowers of the dunes	central	Strenuous hike through dunes leads to Lake Michigan. 2–4 hour round trip.
Duneside Accessible Trail	0.9	Flat	Field and beech-maple, white cedar	central	Wheelchair accessible
Sleeping Bear Point	2.8	Rolling Dunes	Grasses, shrubs, wildflowers	central	Loose sand, views and access to Lake Michigan.
Alligator Hill Trail	9	Hilly	Beech-maple, fields, pine plantation	central	Several loops, overlooks of Lake Michigan and Glen Lake. Horses permitted.
Bay View Trail	8	Hilly	Beech-maple, fields, pine plantation	north	Panoramic view of Lake Michigan and fields of wildflowers
Pyramid Point Trail	2.7	Hilly	Beech-maple and fields	north	Overlook of Lake Michigan
Good Harbor Bay Trail	2.8	Flat, wet in places	Wooded, some dunes	north	Boardwalk over creek

There are two backcountry campgrounds on the National Lakeshore's mainland. White Pine campground is on the Platte Plains trail system near the Platte River campground, within walking distance of Lake Michigan. Valley View campground is northeast of Glen Arbor. This campground has no potable water service and relatively little use.

On South Manitou Island, camping is allowed at three designated campgrounds; backcountry permits are required. On North Manitou Island, backcountry camping in nondesignated areas is allowed in most areas (special restrictions apply and backcountry permits are required) and at the Village campground.

There are a variety of non-NPS campgrounds outside the National Lakeshore.

Dune Climb. The Dune Climb, located west of Little Glen Lake in the central part of the National Lakeshore, is one the Lakeshore's most popular family attractions. Facilities include an entrance station, large gravel parking area (scheduled for paving in 2008), picnic tables, Dune Center (bookstore and restrooms), and food and beverage vending area.

Beach Access Points. Lake Michigan beaches are accessible by motor vehicle at various points within the National Lakeshore. The beach access points are accessed via county-owned roads unless noted otherwise below.

In the south part of the National Lakeshore, the Platte River Point beach access area, near the mouth of the Platte River, is especially popular. Platte River Point has three paved parking lots (two NPS-owned and one owned by Lake Township), restrooms, picnic tables, paved paths, a boat ramp, and a canoe landing. Other beach access points in the south part of the National Lakeshore include one at the end of NPS-owned Tiesma Road, one at the end of Peterson Road ("Peterson Beach"), and one at the end of Esch Road ("Esch Beach"). These beach access points are minimally developed, with vault toilets (except Tiesma Road) and parking along the road ends.

Beach access points in the central part of the National Lakeshore include North Bar Lake, Glen Haven, and the Sleeping Bear Point maritime museum area. Facilities at North Bar Lake include a paved parking area, picnic tables, and vault toilets. Glen Haven has a restroom, picnic area, and parking scattered throughout the site, but a large parking area is being designed. Sleeping Bear Point access points are available along Sleeping Bear Drive and at the Maritime Museum. Also, more remote beaches at Sleeping Bear Point may be

accessed from the Sleeping Bear Point trailhead.

Beach access points in the north part of the National Lakeshore are the County Road 651 and 669 road ends at Good Harbor Bay. These beach access points are minimally developed, with vault toilets and uncontrolled parking along the road ends. Modest improvements (potable water, picnic facilities, and expanded parking) will soon be implemented.

Facilities at Inland Lakes and Rivers. There are 26 inland lakes in the boundaries of Sleeping Bear Dunes National Lakeshore. Motorized boats are permitted on Loon Lake, North Bar Lake, Bass Lake (Leelanau County), and School Lake. Lakes with motor vehicle access or facilities for visitors are described briefly below.

In the south part of the Lakeshore, Loon Lake has a boat ramp, dock, restrooms, and a picnic shelter. Bass Lake (Benzie County) has a dock, hand launch boat ramp, and restroom. Otter Lake has a small dock and a boat launch for canoes and kayaks.

North Bar Lake is in the central part of the Lakeshore. In addition to paved parking, restrooms, and picnic tables, North Bar Lake has a modest launch for small boats.

In the north part of the Lakeshore, School Lake has a launch for small boats and a vault toilet. Shell and Tucker lakes are accessible by vehicle but have no facilities.

National Lakeshore facilities at Platte River are fully developed, and at Crystal River are modestly developed (small parking area and put-in for paddlers).

Picnic Areas. Picnic areas in the National Lakeshore include Platte River picnic area in the south part of the Lakeshore, Glen Lake

picnic area in the central part of the Lakeshore, and Good Harbor picnic area in the north part of the Lakeshore. Picnic tables are also available at the Dune Climb, North Bar Lake, Glen Haven, Pierce Stocking Scenic Drive, and a few other locations around the Lakeshore.

Historic Sites and Areas. There are a variety of historic sites and areas in the National Lakeshore, such as Glen Haven, Port Oneida, and life-saving stations. These facilities are described in the “Historic Resources” section of this chapter.

Accessible Facilities. Most public facilities in the Sleeping Bear Dunes National Lakeshore are wheelchair accessible. Each campground has handicap-accessible campsites. The wheelchair-accessible Duneside Trail is available near the Dune Climb. Some locations are wheelchair accessible with assistance, such as the overlooks along the Pierce Stocking Scenic Drive. Sand wheelchairs are available at the Maritime Museum boathouse and at the

Dune Climb to enable disabled individuals to enjoy the dunes and beaches.

For visitors and staff who have some degree of hearing loss, the National Lakeshore has installed a permanent assistive listening device at the Philip A. Hart Visitor Center information desk. A compact text telephone (TTY) device is available at the visitor center’s pay telephone. Portable wireless FM assistive listening devices are also available for interpretive programs in the visitor center, ranger-led walks outdoors, and evening programs in the campgrounds.

Operational Facilities. The National Lakeshore’s main administrative offices are in the Philip A. Hart Visitor Center building in Empire, Michigan. The National Park Service leases this structure. The main maintenance facility is about a mile south of Empire, with smaller maintenance support facilities at Platte River Campground and on each of the Manitou Islands. Ranger stations are located at Platte River, Glen Haven, and on each of the Manitou Islands. A natural resources field station is located on Harwood Road.

IMPACT TOPICS CONSIDERED BUT NOT ANALYZED IN DETAIL

MUSEUM COLLECTIONS

The National Lakeshore's collections are made up of archeological objects, both prehistoric and historic, and natural history specimens that have been systematically recovered from within the Lakeshore's boundaries and historic items associated with the history and development of the agricultural and maritime economy of the region. The collections also include natural history categories on biology, paleontology, and geology associated with the origins of the National Lakeshore and its native flora and fauna. The museum collections and archives support the National Lakeshore's interpretive themes and assist in research and resource management programs.

The collection itself consists of more than 66,000 objects. Many are on display at the Philip A. Hart Visitor Center, the Cannery Boat Museum, the Sleeping Bear Point Coast Guard Station/Maritime Museum, and at various other locations throughout the National Lakeshore. Other curated items are stored in two climate-controlled structures in the National Lakeshore and at various off-site museums and universities.

The collections can be expected to grow with continuing archeological investigations, inventory and monitoring activities, and other permitted research. Moreover, archival collections can be expected to expand as historical research continues.

Under all alternatives, museum objects would be stored or exhibited outside the floodplain. Museum objects would continue to be acquired, accessioned and cataloged, preserved, protected, and made available for access and use according to NPS standards and guidelines (*NPS Museum Handbook* and Director's Order 24, "Museum Collections Management"). Museum objects would not be

affected under any of the alternatives, and this topic has been dismissed from further consideration.

ETHNOGRAPHIC RESOURCES

Ethnographic resources are defined by the National Park Service as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it."

Ethnographic studies are needed to formally identify groups of people with traditional associations to park lands and waters. Although no groups have been formally identified yet, several American Indian tribes were consulted about ethnographic resources and tribal concerns related to actions that might be proposed within the plan. No sacred sites were identified. A Consent Decree on the *U.S. v. Michigan 1836 Inland Treaty Rights* case was signed in November 2007. The Consent decree recognizes a treaty-retained right for tribal members to engage in certain hunting, fishing, and gathering activities in the ceded territory (including the National Lakeshore). The five Michigan Indian tribes involved in the agreement are the Bay Mills Indian Community, the Sault Ste. Marie Tribe of Chippewa Indians, the Little Traverse Bay Bands of Odawa Indians, the Grand Traverse Band of Ottawa and Chippewa Indians, and the Little River Band of Ottawa Indians.

It is likely that other ethnographic resources exist in the National Lakeshore. The National Lakeshore will conduct ethnographic studies when funding becomes available. Until such studies are conducted, there is insufficient information upon which to analyze ethnographic resources.

No actions are proposed in this plan's alternatives that would affect specific known ethnographic resources; therefore, the topic has been dismissed. Should any ethnographic resources be identified after the plan has been published, they would be treated according to the requirements of the applicable laws and policies.

Copies of the *General Management Plan* will be forwarded to each associated tribe for review and comment. If subsequent issues or concerns are identified, appropriate consultations would be undertaken. Because ethnographic resources would be unaffected, and because all provisions of the 1990 Native American Graves Protection and Repatriation Act (25 USC 3001) would be followed to protect any human remains, funerary objects, sacred objects, or objects of cultural patrimony inadvertently discovered, ethnographic resources were dismissed as an impact topic.

ARCHEOLOGICAL RESOURCES

Archeological resources — the physical evidence of past human activity — represent both prehistoric and historic occupations at Sleeping Bear Dunes National Lakeshore. A complete assessment and documentation of the National Lakeshore's archeological resources has not been undertaken; however, identification of such resources is ongoing.

Despite the lack of a comprehensive archeological survey, approximately 120 prehistoric sites have been identified over the years. By law and policy, prior to activities that require disturbance of previously undisturbed lands, an archeological evaluation is undertaken to ensure that no resources on or eligible for inclusion on the national register are lost or damaged due to NPS activities. As appropriate, archeological surveys and/or monitoring would precede any construction. Known archeological resources would be avoided to the greatest extent possible. If National Register eligible or listed archeological

resources could not be avoided, an appropriate mitigative strategy would be developed in consultation with the state historic preservation officer and, if necessary, associated American Indian tribes. Due to the avoidance of archeological resources during construction, few if any adverse effects would be anticipated.

If during construction previously undiscovered archeological resources were uncovered, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and an appropriate mitigation strategy developed in consultation with the state historic preservation officer and, if necessary, associated American Indian tribes.

At present, one American Indian-related archeological site within the National Lakeshore is listed on the national register. An archeological site in Benzie County was entered onto the National Register of Historic Places on April 27, 1990. It is a locally significant, multi-component campsite, with evidence of repeated prehistoric occupations over both the Middle and Late Woodland periods in addition to late historic Euro-American occupation. Its period of significance was from ca. AD 300–1100.

Because the National Park Service is required by law and policy to evaluate archeologically any site proposed for development, and because this plan does not entail actions that would affect specific known archeological resources, this topic has been dismissed from further consideration.

INDIAN TRUST RESOURCES

The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian

and Alaska Native tribes. Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by U.S. Department of the Interior agencies be explicitly addressed in environmental documents.

There are no Indian trust resources in Sleeping Bear Dunes National Lakeshore. The lands comprising the National Lakeshore are not held in trust by the secretary of the interior for the benefit of Indians due to their status as Indians. Therefore, Indian trust resources was dismissed as an impact topic.

AIR QUALITY

The Clean Air Act of 1955, as amended (42 USC 7401 et seq.) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act established specific programs that provide special protection for air resources and air quality-related values associated with NPS units. Section 118 of the Clean Air Act requires parks to meet all state, federal, and local air pollution standards. NPS *Management Policies 2006* addresses the need to analyze potential impacts on air quality during park planning.

The Clean Air Act and pursuant regulations classified areas of the country by existing and desired air quality conditions. Sleeping Bear Dunes National Lakeshore is listed as a Class II area by Congress. Class II areas of the country are protected under the act, but less stringently than Class I areas, which include a limited number of specially designated wilderness areas and national parks (such as the Grand Canyon) where outstanding visibility is critical.

Baseline air quality studies were conducted in the Lakeshore during 1987 and 1988 with indications that air was of very good quality. Examination of sulfur dioxide-sensitive lichens in the Lakeshore revealed very little

impact from this pollutant. White pine needles showed the least damage due to air pollution of all parks tested in Michigan. The area has only light industry, and as a result has extremely good visibility most of the time. Fog from Lake Michigan is the only occasional hindrance to good visibility at Sleeping Bear Dunes. (NPS 2005a.)

None of the actions described in the *General Management Plan* would violate any air quality standard or result in a cumulative net increase of any criteria pollutant under federal or state ambient air quality standards. Implementation of any of the alternatives described in the *General Management Plan* would have negligible effects on air quality, and the Lakeshore's Class II air quality would be unaffected. Therefore, air quality was dismissed as an impact topic.

MICHIGAN STATE-LISTED SPECIES

Northern Goshawk

The northern goshawk (*Accipiter gentilis*) is a Species of Concern and a resident in Michigan. Northern goshawks use a range of forest habitats that include conifers, deciduous stands, riverine forests, or plantation stands. These forest habitats are generally characterized by an intermediate degree of canopy closure, small gaps in the forest, and an open understory. Nest tree species will vary, but birch, maple, and conifers are common (Cooper 1999a). The northern goshawk ranges from Alaska and Canada in the north, down to central California, southeast Arizona, and southern New Mexico in the western United States. In the eastern United States, populations range along the Appalachian Mountains to Tennessee and North Carolina. In Michigan, the goshawk is found primarily in the northern Lower Peninsula and across much of the Upper Peninsula. Northern goshawk populations in Michigan suffer from habitat alteration and destruction, primarily as a result of timber harvest, road construction,

and urban development (Cooper 1999a). Fragmentation of forest habitats encourages invasion by nest competitors and predators such as red-tailed hawks (*Buteo jamaicensis*) and great-horned owls (*Bubo virginianus*). Management practices should aim to preserve large blocks of contiguous forest habitat with intermediate canopy closure and large trees for nesting.

The only documented occurrences of northern goshawk in the Lakeshore are in an area north of the Platte River and on South Manitou Island. Because none of the alternatives propose activities that are anticipated to have measurable impacts on the suitability of this area for northern goshawks, this species is not carried forward for detailed consideration as an impact topic in chapter 5.

Grasshopper Sparrow

The grasshopper sparrow (*Ammodramus savannarum*) is a Species of Concern in Michigan. It inhabits a range of grassland habitats including cultivated and fallow fields, hay fields, and other sites with tall dense grass (MNFI 2007). This species ranges from southern Canada and eastern Washington south through the plains states and along the East Coast down to the Gulf Coast. Breeding populations can also be found in coastal California and southern Idaho. The non-breeding range extends into Mexico and Central America and the Caribbean. In Michigan, the grasshopper sparrow is found primarily in the Lower Peninsula and a few counties of the central Upper Peninsula. This species is in decline due to the loss, degradation, and incompatible management of grassland habitats throughout its North American range. Grasshopper sparrow habitats should be managed to maintain grass-dominated habitat and prevent shrub encroachment. Prescribed burns or mowing for vegetation management should be conducted in the fall after birds have migrated (MNFI 2007).

Grasshopper sparrows are found in open, cultural landscapes in the northern section of the Lakeshore. Because all alternatives would conserve the habitat supporting this species, and no actions are proposed in the alternatives that would be anticipated to impact this species, this species is not carried forward for detailed consideration as an impact topic in chapter 5.

Least Bittern

The least bittern (*Ixobrychus exilis*) is listed as threatened by the state of Michigan. This species occupies a variety of freshwater and brackish marshes with dense, tall growths of aquatic or semiaquatic vegetation interspersed with clumps of woody vegetation and open water (Monfills 2003).

In the Lakeshore, this species is known only in the central section of the Lakeshore. As no alternatives include actions that may be anticipated to potentially impact this species, the least bittern is not carried forward as an impact topic.

Calypso or Fairy-slipper

The Calypso orchid or fairy-slipper (*Calypso bulbosa*) is listed as threatened by the state of Michigan. This widespread species nearly circles the globe in the northern hemisphere, ranging throughout North America, Europe, and Asia. Calypso is widely distributed in the northern Lower Peninsula and the Upper Peninsula of Michigan. At least eight counties have records dating since 1980. Most mainland — especially more southerly — colonies consist of few plants, but large colonies with hundreds of plants occur occasionally to the north, especially on Isle Royale. Calypso is an inhabitant of moist coniferous forests with cool soils. In Michigan, it is found in spruce balsam-cedar swamps, and also in drier cedar-fir thickets along the shores of the upper Great Lakes.

When found in boggy areas, it inhabits drier hummocks or the bases of old trees or stumps. It is nearly always in the shade (Higman and Penskar 1996b).

In the lakeshore, Calypso is known only from the eastern side of South Manitou Island. No actions within the alternatives would be anticipated to impact this location or species. Therefore, this species is not carried forward for further analysis as an impact topic.

Beauty Sedge

Beauty sedge (*Carex concinna*) is a species of special concern in Michigan. It is found on cobbly gravelly limestone shores of northern Lake Huron and northern Lake Michigan. It is also found inland in glades, especially where limestone bedrock is close to the surface, occurring at the edges and within coastal forests of cedar, fir, and spruce. Recent surveys have determined that this species is more common than previously thought, and it has been proposed for delisting.

In the National Lakeshore, beauty sedge is known from one location in the northern part of the central mainland section. None of the alternatives propose activities that would be anticipated to impact this location or species. Therefore, this species is not carried forward for further analysis as an impact topic.

Broad-leaved Sedge

This species (*Carex platyphylla*) is listed as threatened by the state of Michigan and is known from four Michigan localities, with one site each in Berrien and Van Buren counties, one St. Clair County record within a state game area, and a relatively recent discovery in 1988 in Leelanau County in Sleeping Bear Dunes National Lakeshore. Most of these populations were observed to be very sparse and localized. Over its broader

range, this sedge prefers well-drained to rocky slopes in rich deciduous woods.

In the National Lakeshore, broad-leaved sedge is known from one location in the central mainland section. None of the alternatives propose activities that would be anticipated to impact this location or species. Therefore, this broad-leaved sedge is not carried forward for further analysis as an impact topic.

FLOODPLAINS

Executive Order 11988, "Floodplain Management," requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with occupancy and modifications of floodplains, and to avoid direct and indirect support of floodplain development whenever there is a practicable alternative. Section 4.6.4 of NPS *Management Policies 2006* states that the National Park Service will manage for the preservation of floodplain values and minimize potentially hazardous conditions associated with flooding. NPS Director's Order 77-2 and the accompanying "Procedural Manual" (2003) provide guidance and procedures for implementing floodplain protection and management actions in units of the national park system.

Approximately 20 miles (32 km) of streams that contain floodplains traverse the National Lakeshore on the way to Lake Michigan. No episode of flooding has occurred in the Lakeshore within the past 13 years. Flooding is not typically a concern in this area because of the high porosity and rapid drainage of the sandy soils and the limited size of surrounding watersheds. This topic was therefore dismissed from detailed analysis.

COASTAL ZONE MANAGEMENT

Michigan established a coastal management program in response to the Coastal Zone Management Act (1972). The Michigan program was developed to improve protection of sensitive shoreline resources, identify coastal areas appropriate for development, designate areas hazardous to development, and improve public access to the coastline. The program includes grants, administration of sections of Michigan's Natural Resource and Environmental Protection Act that are related to coastal resources (1994 PA 451), and review of federal agency activities for consistency with Michigan's approved program. The three elements of the coastal zone management program — high-risk erosion areas, flood risk areas, and environmental areas — provide consumer protection from the natural hazards of coastal erosion and flooding as well as environmental protection.

The only designated Coastal Zone Management Area on the Lakeshore mainland is a narrow band in the south end of the Lakeshore. No actions proposed in the alternatives in this plan would alter the Lake Michigan shoreline. The National Park Service proposes no development in any area of the National Lakeshore that would conflict with the coastal management program. This topic was therefore dismissed from detailed analysis.

WATER QUANTITY

Analysis of potential impacts on water resources typically includes consideration of both water quality and water quantity. Because no water withdrawals, diversions, or other activities are proposed in the alternatives that would affect water quantity in rivers, ponds, or lakes, this topic was dismissed from detailed analysis.

PRIME OR UNIQUE FARMLAND

In 1980 the Council on Environmental Quality directed that federal agencies must assess the effects of their actions on farmland soils classified by the Natural Resources Conservation Service as prime or unique. Prime farmland is defined as soil that produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts.

Some prime and unique farmlands exist in the National Lakeshore, but these have essentially been removed from potential agricultural production in perpetuity due to creation of the Lakeshore. There could be some limited site-specific disturbance to prime and unique soils from development of an M-22/M-109 hike/bike trail, but because these soils are not in production, there would be no loss of agricultural production. Should it be determined that these soils qualify for consideration as prime and unique farmlands relative to potential construction of the M-22/M-109 hike/bike trail, they would be addressed in a future compliance document. This topic was therefore dismissed from detailed analysis.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

The implementing regulations of the National Environmental Policy Act require that energy requirements, natural or depletable resource requirements, and conservation potential be analyzed. Any differences between the alternatives in terms of these factors would be localized and negligible. Therefore, this topic was dismissed from detailed analysis.

ENVIRONMENTAL JUSTICE

Presidential Executive Order 12898, *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires all federal agencies to

incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. According to the Environmental Protection Agency, environmental justice is the

fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

Benzie and Leelanau counties contain both minority and low-income populations and communities; however, environmental justice was dismissed as an impact topic for the following reasons:

- The Lakeshore staff and planning team actively solicited public participation as part of the planning process and gave equal consideration to input from all persons regardless of age, race, income status, or other socioeconomic or demographic factors.

- The alternatives would not result in any disproportionate human health or environmental effects on minorities or low-income populations and communities.
- The alternatives would not result in any effects that would be specific to any minority or low-income community. Any anticipated impacts, such as increased traffic or demand for emergency services, would not disproportionately affect minority or low-income populations. Impacts would not occur all at one time but would be spread over a number of years.

WILD AND SCENIC RIVERS

The National Park Service maintains a Nationwide Rivers Inventory, which is a register of river segments that potentially qualify as national wild, scenic, or recreational river areas. The Crystal River and the Platte River are included on the National Rivers Inventory (see appendix E for more information). Through management zoning, user capacity management, and modest facility modifications or upgrades, the alternatives in this plan would enhance the qualities that make these rivers eligible or suitable for designation as wild or scenic rivers. This impact topic was therefore dismissed from detailed analysis.