

STATE
♦ OF THE ♦
PARKS®

july 2007

NATIONAL PARKS OF THE GREAT LAKES

RESOURCE ASSESSMENTS OF:
PICTURED ROCKS NATIONAL LAKESHORE • APOSTLE ISLANDS NATIONAL LAKESHORE
ISLE ROYALE NATIONAL PARK • KEWEENAW NATIONAL HISTORICAL PARK
SLEEPING BEAR DUNES NATIONAL LAKESHORE • INDIANA DUNES NATIONAL LAKESHORE

A Resource Assessment



National Parks Conservation Association®
Protecting Our National Parks for Future Generations®

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Center for State of the Parks

More than a century ago, Congress established Yellowstone as the world's first national park. That single act was the beginning of a remarkable and ongoing effort to protect this nation's natural, historical, and cultural heritage.

Today, Americans are learning that national park designation alone cannot provide full resource protection. Many parks are compromised by development of adjacent lands, air and water pollution, invasive plants and animals, and rapid increases in motorized recreation. Park officials often lack adequate information on the status of and trends in conditions of critical resources.

The National Parks Conservation Association initiated the State of the Parks® program in 2000 to assess the condition of natural and cultural resources in the parks, and determine how well equipped the National Park Service is to protect the parks—its stewardship capacity. The goal is to provide information that will help policy-makers, the public, and the National Park Service improve conditions in national parks, celebrate successes as models for other parks, and ensure a lasting legacy for future generations.

For more information about the methodology and research used in preparing this report and to learn more about the Center for State of the Parks®, visit www.npca.org/stateoftheparks or contact: NPCA, Center for State of the Parks®, P.O. Box 737, Fort Collins, CO 80522; Phone: 970.493.2545; E-mail: stateoftheparks@npca.org.

Since 1919, the National Parks Conservation Association has been the leading voice of the American people in protecting and enhancing our National Park System. NPCA, its members, and partners work together to protect the park system and preserve our nation's natural, historical, and cultural heritage for generations to come.

- * More than 325,000 members
- * 9 regional offices
- * 35,000 activists

A special note of appreciation goes to those whose generous grants and donations made this report possible: Dr. Dorothy Canter, Ben and Ruth Hammett, Mark and Joan Strobel, 3M Foundation, Efroymsen Fund of the Central Indiana Community Foundation, MSST Foundation, The Wege Foundation, and anonymous donors.

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INTRODUCTION



The Great Lakes are a priceless resource for our nation. They hold one-fifth of the world's fresh-water supply, so ensuring their health is of the utmost importance. The Great Lakes also support a variety of fish and wildlife, and they have long played a crucial role in the lives of the people who live in communities along their shores. The Great Lakes are aesthetic resources, they provide abundant recreational opportunities, and they drive regional economies.

With creation of the National Park Service in 1916, the federal government began in earnest to provide for the long-term protection of some of the nation's most important natural and cultural resources. Since then, several national parks have been established along the Great Lakes to protect natural wonders and preserve facets of our nation's history.

Recognizing the significance of the Great Lakes, the Center for State of the Parks endeavor

National parks along the Great Lakes, including Apostle Islands National Lakeshore, protect beautiful scenery as well as natural and cultural resources.



Larvae of the gypsy moth, a non-native species that has invaded several Great Lakes parks, can defoliate entire trees.

DIVERSE RESOURCES, SHARED THREATS

National parks hold and protect our nation's most significant resources for future generations. They are also places where Americans can go to escape the hustle and bustle of their daily lives, reconnect with nature, and learn about different facets of our shared history. Park visitors expect to find healthy ecosystems, clean air, and well-maintained historic resources, but this is not always the case. Pollution from near and far can affect park air and waters, non-native species can invade park ecosystems, and funding shortfalls can prevent park staff from giving historic and natural resources the care they deserve. Each of the Great Lakes national parks assessed in this report suffers from one or more of the above threats.

ored to determine the conditions of natural and cultural resources at six parks along the lakes: Sleeping Bear Dunes National Lakeshore, Indiana Dunes National Lakeshore, Pictured Rocks National Lakeshore, Isle Royale National Park, Apostle Islands National Lakeshore, and Keweenaw National Historical Park. This sampling includes all of our nation's national lakeshores, as well as an iconic national park and a national historical park. Are resources in these parks well protected and interpreted for visitors?

Center for State of the Parks® researchers used established, peer-reviewed methodologies to systemically rate conditions of both natural and cultural resources at five of these six parks; only cultural resources were assessed at Keweenaw National Historical Park (see Appendix). The following pages describe these sites and their significance, and summarize resource conditions. Also noted are funding and staffing considerations, park planning efforts, resource education opportunities, and external support provided by volunteers and partner organizations.

Cat Island is part of Apostle Islands National Lakeshore.



NATIONAL PARKS OF THE GREAT LAKES



AIRBORNE POLLUTANTS CAN AFFECT PARK RESOURCES

Indiana Dunes National Lakeshore is downwind of Gary, Indiana, and Chicago, Illinois, a region of heavy industry.



JOHN BURDE / SOUTHERN ILLINOIS UNIVERSITY

National park visitors expect to breathe clean air, yet many pollutants that enter the atmosphere can travel hundreds and even thousands of miles before they fall from the air in precipitation or as dry particulates. Sometimes these pollutants are deposited on park lands and in park waters. Following is information on some air quality concerns at five of the six Great Lakes parks included in this resource assessment report.

At Sleeping Bear Dunes, the toxic chemicals most present in the air are toluene, xylene-iso, benzyne, formalde-

hyde, and trichloroethylene, xylene-m, and perchloroethylene. The sources of these pollutants have not been determined. Wet deposition of both sulfates and nitrates are higher than national averages, and additional research is needed to better understand the effects these pollutants could be having on park resources. Although the nearest ozone detector is five miles south of the park, staff at Sleeping Bear Dunes indirectly monitor ozone levels by surveying plants that are sensitive to this chemical.

Indiana Dunes National Lakeshore is

downwind of Gary, Indiana, and Chicago, Illinois, in a region of heavy industry, including steel mills, power plants, and factories. Atmospheric nitrogen deposition is of concern because the park's sand dunes and bogs are nitrogen-limited ecosystems—places where nitrogen naturally occurs in limited quantities, thereby limiting plant growth. Atmospheric deposition increases the amount of nitrogen that is available to plants and can unnaturally accelerate succession to later stages, alter species composition, and reduce species richness. Acid deposition is also of concern at Indiana Dunes because changes in soil pH can lead to changes in vegetation. In a study of 22 national parks in the Midwest, Indiana Dunes was considered to be the fourth most polluted park for ozone, sulfur dioxide, and sulfate levels. Mercury and other particulates are also found at critically high levels within the park.

At Pictured Rocks National Lakeshore, an assessment during the 1990s, based on lichens and elemental analysis, suggested that air quality in the vicinity of the park is generally good. Although large-scale heavy industry is quite distant from the lakeshore, some long-range/global atmospheric transport of pollutants to the Pictured Rocks area has been documented, and acid deposition in the central Upper Peninsula is a well-established phenomenon. No baseline information exists on any ambient air quality parameters, however, because the park lacks its own monitoring stations. The closest ozone monitoring station is in Marquette, Michigan, about 45 miles west of the park, while Seney National Wildlife Refuge, in the county adjacent to the park, has the nearest wet and dry deposition sampling station.

At Isle Royale, mercury is foremost on the minds of park managers who have focused monitoring efforts on this heavy metal. A

study of 32 inland lakes found that 20 percent of the fish sampled exceeded Michigan's mercury consumption advisory level (500ng/g). Persistent organic pollutants that travel to the park through the atmosphere include dioxins, polychlorinated biphenyls (PCBs), chlorinated pesticides, fluorinated compounds, and brominated flame retardants. These pollutants have been found in fish and other aquatic organisms, while chlorinated organic residues produced by incinerating chlorinated waste have been found in sediments from Siskiwit Lake and Lake Superior.

Some terrestrial locations at Isle Royale showed elevated sulfur levels, though levels were not high enough to visibly damage or eliminate sensitive lichens. Sulfur levels still warrant frequent monitoring, particularly on ridgetops from the center of the island and toward the northeast. The closest source of this pollution—Thunder Bay, Ontario—is only about 30 miles from the park. Visibility is affected by industry at Thunder Bay, specifically from its production of sulfate emissions, though long-term trends have not yet been determined.

Apostle Islands generally has outstanding air quality, though contaminants from coal- and wood-fired power plants in Ashland and Duluth, 12 and 70 miles away, respectively, may reach the park. In a study of 22 national parks in the Midwest, Apostle Islands was grouped in the low risk category for vulnerability to pollution and pollution levels of ozone, sulfur dioxide, and sulfate. The park has focused its monitoring efforts on biological indicators of air quality. Cliff Wetmore, a scientist from the University of Minnesota, conducted lichen surveys and elemental analysis in 1987, 1995, and 2001. Wetmore's results indicate decreasing levels of lead and copper, but increasing levels of sulfur, cadmium, iron, and nickel, which are indicative of anthropogenic pollution.



PICTURED ROCKS NATIONAL LAKESHORE



Part of Grand Sable Dunes is designated as a research natural area. The dunes harbor several protected species of plants and animals.

By the mid-20th century, urban centers and industry dotted much of the shoreline of the Great Lakes, and public places for recreation and ecological preservation were dwindling. Congress had to act quickly to preserve some of the region's unique features for the future. In 1958, the National Park Service completed a survey of nearly 5,500 miles of Great Lakes shoreline, titled *Our Fourth Shore*, which identified opportunities for preservation. The report

strongly urged that several special places along Lake Superior and Lake Michigan be acquired and preserved for the enjoyment of future generations. In answer to this recommendation, Congress created a new kind of national park—a national lakeshore. In 1966, Congress established Pictured Rocks National Lakeshore on Michigan's Upper Peninsula to "preserve for the benefit, inspiration, education, recreational use, and enjoyment of the public, a significant

portion of the diminishing shoreline of the United States and its related geographic and scientific features."

In addition to being our nation's first national lakeshore, Pictured Rocks was set up differently than any other park in the National Park System. Of the park's 73,235 total acres, 33,929 acres and 42 miles of Lake Superior shoreline are managed as the Shoreline Zone, of which all but 10 acres is federally owned. This zone is sandwiched between the towns of Munising and Grand Marais. The park's administrative boundary also extends one-quarter mile out over the surface of Lake Superior. The remaining 39,306 acres are part of an Inland Buffer Zone (IBZ) that is predominantly privately owned. The Nature Conservancy purchased an easement on 17,500 acres in this zone, which limits the kinds of activities that can occur. To date, Pictured Rocks is the only national park with a buffer zone within its legislated boundary. The Park Service manages all activities in the Shoreline Zone. Local planning and zoning ordinances determine land use in the IBZ. Natural resource management activities such as sustained-yield timber harvests are *(continues on page 10)*

The Au Sable Light Station attracts many visitors.



JOHN BURDE / SOUTHERN ILLINOIS UNIVERSITY



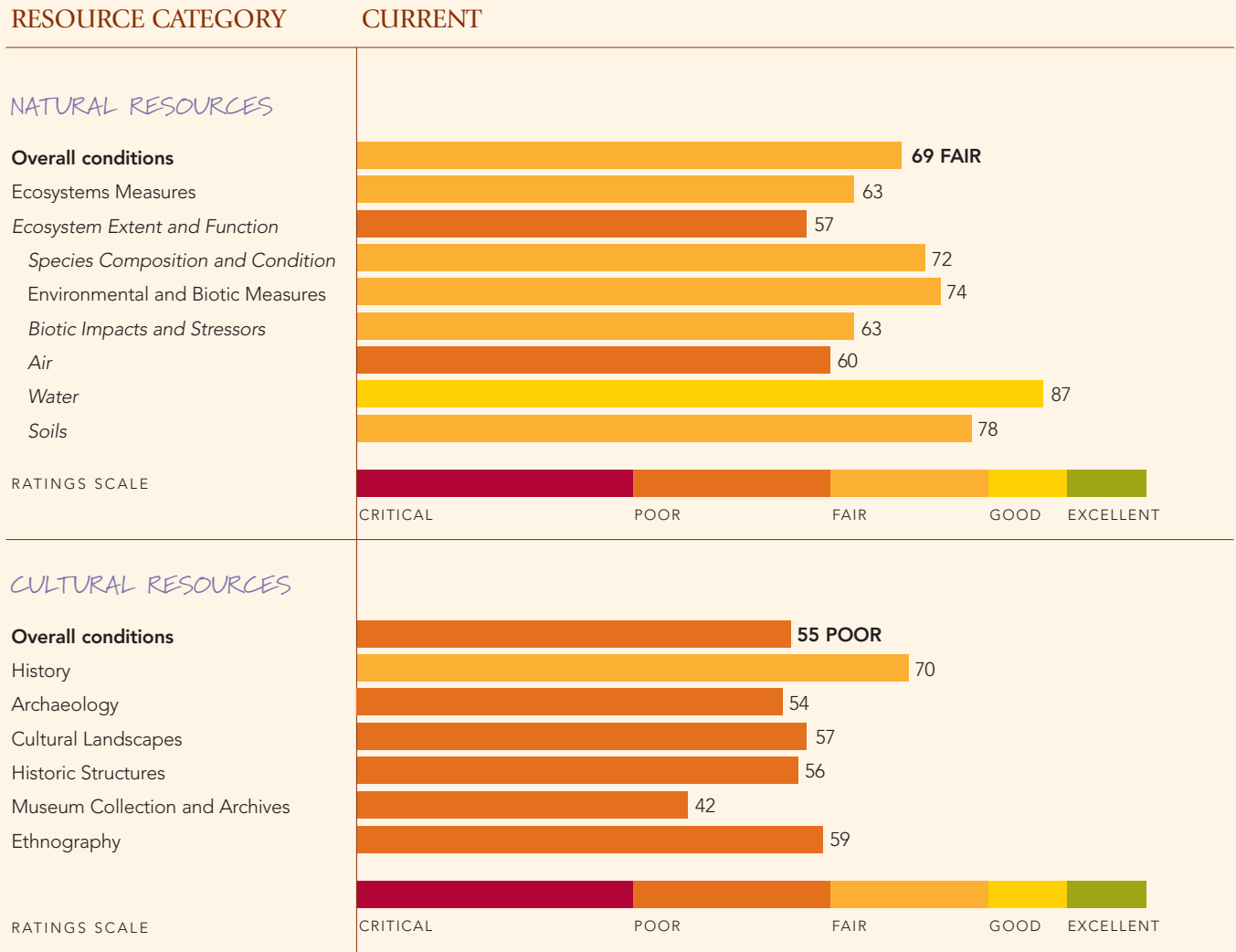
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In 2000, the park developed a comprehensive sustainable vehicle and equipment operation and maintenance program using soy-diesel and other vegetable-based fluids.

RESOURCE MANAGEMENT HIGHLIGHTS

- Pictured Rocks National Lakeshore has developed a successful program of sustainable practices, including photovoltaics, reduced toxins, green procurement (purchasing products and services that are better for the environment), and a significant number of field-based best management practices. In 2000, the park developed a comprehensive sustainable vehicle and equipment operation and maintenance program using soy-diesel and other vegetable-based fluids. The park is nationally recognized for its environmental leadership program and has received several agency, department, and national awards for leadership in implementing and demonstrating sustainable practices.
- In 1994, 1,830 acres of Grand Sable Dunes were designated as a research natural area (RNA) because they are home to a suite of federally and state-listed threatened and endangered species and good habitat. Such areas are part of a national network of permanent tracts having little habitat disturbance that are set aside for research. RNAs are designated, in part, to maintain biological diversity.
- The Au Sable Light Station, which the park has restored, is the premier cultural attraction. It is the focal point of interpretation, with summer tours attracting about 5,000 visitors annually. An additional 5,000 people visit the historic site during the rest of the year.

Note: When interpreting the scores for natural resource conditions, recognize that critical information upon which the ratings are based is not always available. This limits data interpretation to some extent. For Pictured Rocks National Lakeshore, 61 percent of the information required by the methodology was available.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases pre-dating the park's creation. The intent of the Center for State of the Parks is to document the present status of park resources and determine which actions can be taken to protect them in the future.

KEY FINDINGS

- In the last ten years, Pictured Rocks has lost seven permanent positions because of insufficient funding. Such shortfalls prevent the park from addressing natural and cultural resources management priorities. The park needs a wildlife biologist, landscape ecologist, data management specialist, geographic information systems (GIS) specialist, full-time and seasonal biological science technicians, and a historian or curator.
- Past activities such as logging and land clearing significantly affected the habitats and hydrology at Pictured Rocks. Evidence of past logging is still found in the Shoreline Zone of the park today and is indicated by various early seral stages of forest in the landscape.
- Sensitive dune habitats are threatened by heavy visitor use. Aerial photos taken during the past 50 years show an increase in unvegetated sand, which has been attributed, in part, to foot traffic and snowmobiles.
- Non-native species threaten native plants and animals at Pictured Rocks by displacing, parasitizing, or competing for resources with them. It is believed that competition with non-native salmon and trout has contributed to the decline of native coaster brook trout populations, while invasive plants such as spotted knapweed and white sweet clover threaten to disrupt native dune communities. Park staff cooperate with other federal and state agencies and nonprofit organizations to target non-native invasive species.
- Pictured Rocks has one cultural resources staff person who is responsible for coordinating a wide variety of management tasks without the assistance of any specialists at the park level. Although several employees have various types of cultural resources expertise, other staff would benefit from cultural resources preservation training. Pictured Rocks has requested support for a full-time museum curator for three years, but the position has not yet been funded. A staff historian would also be a boon for cultural resources management.
- Greater knowledge about the park's cultural resources, which would contribute to better interpretation and protection of those resources, would be gained through additional research. Studies should include a combination of historic structure reports, cultural landscape reports, historic furnishings plans, updates to the historic resource study and administrative history, ethnographic studies, and an archaeological overview and assessment.
- Preserving historic structures and inspecting them annually is difficult at current staffing levels. In addition, the cost of deferred maintenance on historic structures tops \$1.4 million.

Past logging activities significantly affected the habitats and hydrology at Pictured Rocks. Today, species composition and tree size reveal areas that have been logged.



NATIONAL PARK SERVICE



This photograph of Miner's Castle, one of the park's most well known features, was taken prior to the natural collapse of the northeast turret (on the right) in April 2006.

allowed when watershed protection and other values consistent with preserving the national lakeshore are also ensured.

Fifteen miles of multicolored sandstone cliffs that get their colors from minerals such as iron, manganese, and copper give Pictured Rocks National Lakeshore its name and are some of its most distinctive features. Also noteworthy are the Grand Sable Dunes, perched dunes at the eastern end of the park. Spectacular waterfalls are common along the shoreline where fast-moving streams plummet down cliffs to mix with the deep, cold waters of Lake Superior.

An assessment by Center for State of the Parks researchers indicates that, overall, natural resources are in "fair" condition with a score of 69 out of 100. Non-native plants, animals, pests, and diseases threaten native species and communities, though the park is taking steps to combat these threats. Development in the IBZ is also of concern, as is damage caused by recreational uses at the sand dunes.

The cultural resources of Pictured Rocks National Lakeshore also contribute to the park's popularity as a tourist destination. Many reflect the Great Lakes' maritime heritage. Pictured Rocks is home to two lighthouses, the most notable of which is the Au Sable Light Station, and former U.S. Life-Saving Service/Coast Guard Stations. Offshore shipwrecks, which the park preserves and interprets in cooperation with the state of Michigan, span a range of historical periods and attract divers willing to brave Lake Superior's cold waters. Former logging camps and farms scattered throughout the park date from the mid-19th century to the early 20th century.

Cultural resources at the park, overall, rated in "poor" condition with a score of 55 out of 100. The park has just one staff member assigned to care for the diverse resources described above. Funds are needed to support additional staff and research to ensure resources are protected for the future.



NATIONAL PARK SERVICE

NATURAL RESOURCES

PARK HABITATS AND WILDLIFE— PLANTS, ANIMALS, FISH, AND LESS- NOTICEABLE SPECIES ABOUND

Pictured Rocks is rich in aquatic resources ranging from inland lakes and rivers to wetlands and bogs; Lake Superior is the park's major body of water. The Shoreline Zone contains eight inland lakes, while the IBZ has four. Sand Point, Beaver Lake, Legion Lake, and the Twelvemile Beach area feature bogs, while marshes surround Miners Lake, Little Chapel Lake, and an embayment of Grand Sable Lake. Numerous streams and creeks originate or flow

through Pictured Rocks. Miners River and Mosquito River are listed in the National Rivers Inventory, and thus are eligible to be considered for National Wild and Scenic River designation.

The park's diverse habitats include mesic deciduous forests, hydric forests and swamps, wetlands, lakes and ponds, xeric coniferous forests, sand dunes and beaches, and sandstone cliffs. American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), yellow birch (*Betula allegheniensis*), hemlock (*Tsuga canadensis*), and white pine (*Pinus strobus*) dominate about 80 percent of the park. The remaining 20 percent of the park's acreage is about equally split between

Pictured Rocks includes 42 miles of Lake Superior shoreline.

Black bears can be found in the swamps and dense forests of Pictured Rocks National Lakeshore.



R.I. BRIDGES / USFWS

coarse outwashes and coastal sands with red pine (*Pinus resinosa*), white pine, and jack pine (*Pinus banksiana*) and patches of wetland shrubs and forests that include black spruce (*Picea mariana*), white spruce (*Picea glauca*), white cedar (*Thuja occidentalis*), and larch (*Larix laricina*).

Scores of wildlife species make homes at Pictured Rocks. Black bears (*Ursus americanus*) inhabit forests, while songbirds call from trees just overhead, and raptors soar high above on winds blowing off the lake. Furbearers include coyote (*Canis latrans*), river otter (*Lutra canadensis*), long-tailed weasel (*Mustela frenata*), and red fox (*Vulpes vulpes*). Marten (*Martes americana*) and fisher (*Martes pennanti*) reintroductions in other parts of the Upper Peninsula have resulted in stable breeding populations within the park. Although the cold, northern climate limits numbers of amphibians and reptiles, American toads (*Bufo americanus*), painted turtles (*Chrysemys picta*), eastern garter snakes (*Thamnophis sirtalis*) and northern red-bellied

snakes (*Storeria occipitomaculata*) are present. The park's cedar swamps provide good habitat for terrestrial snails.

In sum, surveys of Pictured Rocks have identified six reptile, 13 amphibian, 56 fish, 178 bird, 42 mammal, and 754 plant species. Less noticeable and sometimes overlooked species include 33 gastropod and seven freshwater clam species, as well as 138 confirmed taxa of mosses and 38 liverworts.

LAND USE—PAST AND PRESENT ACTIVITIES SHAPE PARKLAND

Prior to European settlement, Lake Superior Ojibwa were the main inhabitants of the Pictured Rocks region, having immigrated there in about 1100 A.D. Prior to that, aboriginal peoples occupied the area. Abundant natural resources eventually drew trappers, traders, and fishermen to the area as early as the 17th century. By the mid-19th century, logging became important, followed by agriculture at the turn of the 20th century.

These and other human activities have shaped the way the landscapes of Pictured Rocks and the surrounding Upper Peninsula of Michigan look today. Logging and land clearing for crop production and development are two of the most significant disturbances that have influenced or altered native vegetation, hydrology, and habitats. Much of the original forest in both the Shoreline Zone and IBZ was clear-cut or selectively cut. The hardwood trees in today's forests are generally smaller in height and diameter than if logging had not occurred, and structure and shrub diversity of hardwood forests may have changed since pre-European settlement. In some areas, forests have shifted from dominant white and red pines to grasses and scattered aspen.

Historic logging practices also affected the area's hydrology, as stream flows were altered, streamside shading diminished, and stream banks eroded. Loggers built slides to transport logs and dams to regulate stream flow and to release logs stored in backwaters. The Wisconsin Pipeline Company (WPC) owned and managed 4,000 acres as a company fishing and hunting retreat, built dams, and dug ditches for fishing ponds and a fish hatchery. These dams have been left to deteriorate. Periodic contemporary logging alters habitats for park wildlife such as invertebrates, fungi, salamanders, wood frogs, mammals, and birds.

Road expansion brings concerns of habitat fragmentation and increased visitor effects at some locations such as Twelvemile Beach and Grand Sable Dunes. Much of Alger County Road H-58 has been converted from gravel to pavement. Park staff are unsure what effects this will have on the watershed of the Hurricane River. High species richness found along the proposed Beaver Basin Rim Road could be compromised by road-related habitat destruction and traffic-induced mortality.

Visitors also have the potential to affect park resources. The Grand Sable Dunes, which sit 300 to 400 feet above Lake Superior and

FISH STOCKING PRESENTS PROBLEMS

The abundant fish found in Lake Superior and inland lakes were an important food source for American Indians, and eventually became commercially important to Euro-American settlers. Overfishing and logging took their toll, however, as some fish populations began to crash by the late 19th century. When evidence of these declines became obvious, people began to build fish hatcheries and stock fish in inland lakes and streams. Whitefish (*Coregonus clupeaformis*) and brook trout (*Salvelinus fontinalis*) were planted, as were non-native fish such as rainbow and brown trout.

State hatcheries introduced splake (*Salvelinus namaycush* X *Salvelinus fontinalis*), a brook and lake trout hybrid, to Pictured Rocks in the 1960s. They are present in most streams and nearshore waters today. Fisheries managers are concerned that splake will contaminate brook and lake trout gene pools by backcrossing with those fish in the wild or in hatcheries.

Competition between non-natives such as coho salmon (*Oncorhynchus kisutch*) and rainbow trout (*Oncorhynchus mykiss*) with native coaster brook trout (*Salvelinus fontinalis*) is the subject of current research. Coaster brook trout were stocked in the park until 2005, but stocking is currently suspended because of concerns about coaster brook trout genetics. Previously, coaster trout were defined as brook trout that attained a large size and inhabited both streams and a large lake. Because the park was thought to have appropriate habitat and because there were only anecdotal accounts of large brook trout, the park, in partnership with the U.S. Fish and Wildlife Service, decided to "reintroduce" coaster brook trout. The brood stock came from Isle Royale National Park, where the fish grow to large sizes. Coaster brook trout at Pictured Rocks National Lakeshore, however, are of unremarkable size. Until fish movement studies began in 2003, resource managers did not know that the park had its own populations of brook trout that migrated among streams.



ERIC ENGBRETSON / FISH AND WILDLIFE SERVICE



The park's dunes host delicate vegetation that can be harmed by foot traffic and off-road vehicles.

encompass four square miles, are home to uncommon ecosystems and rare plants. The dunes are a popular visitor attraction, too, but sometimes at the expense of natural resources. Aerial photos taken during the past 50 years show an increase in the amount of bare sand at Grand Sable Dunes, some of which has been attributed to off-road vehicles (snowmobiles and rarely all-terrain vehicles) and foot traffic. Social trails over the bluff at Twelvemile Campground have caused erosion and forced staff to close one campsite. Other sites are plowed to remove the sand blown in from destabilized areas and to reduce effects on trees. According to a 1995 backcountry campsite study, visitor effects on plant life, including tree damage and reduced organic matter and vegetative cover at campsites and trails, were particularly significant at Mosquito River, Beaver Creek, and the Coves.

Natural changes and disturbances such as water level fluctuations on Lake Superior have

further influenced the ecosystems of Pictured Rocks. Dune communities have developed and adapted to these fluctuations. The last several hundred years have seen an increase in the size of jack pine forest on Grand Sable Dunes, while aerial photos have documented a fivefold increase in forest cover during the past 50 years.

PROTECTED SPECIES—PARK HARBORS PLANTS AND ANIMALS

Pictured Rocks provides habitat for species listed as threatened under the Endangered Species Act: Pitcher's thistle (*Cirsium pitcheri*) and bald eagle (*Haliaeetus leucocephalus*). Pitcher's thistle, a plant endemic to the shoreline dunes of the western Great Lakes, is found at Grand Sable Dunes and at one other location along Lake Superior in Canada. Park staff have observed three active bald eagle nests since 2001.

Pictured Rocks is also home to 15 species listed by the state of Michigan as threatened or endangered, as well as 12 state species of concern. Dwarf bilberry (*Vaccinium caespitosum*), a plant eaten by larvae of the northern blue butterfly (*Lycaeides idas nabokovi*), lives at Pictured Rocks. Its presence could encourage the butterfly, which is listed by the state of Michigan as threatened, to breed in the park.

NON-NATIVE SPECIES—VIGILANCE REQUIRED TO KEEP INVADERS UNDER CONTROL

Invasive, non-native species create problems at Pictured Rocks by competing for resources with or directly killing native species. Aquatic species that are of the most concern include sea lamprey (*Petromyzon marinus*) and spiny water flea (*Bythotrephes longimanus*), which are already present in park waters. Other potential threats include zebra mussel (*Dreissena polymorpha*), river ruffe (*Gymnocephalus cernuus*), round goby (*Neogobius melanostomus*), threespine stickleback (*Gasterosteus aculeatus*), viral hemor-

ragic septicemia (VHS, a fish pathogen), and purple loosestrife (*Lythrum salicaria*). Lakes with boat ramps are the most at risk to aquatic invasions. Zebra mussels, round gobies, and spiny water fleas can all be transported unintentionally by anglers, especially those who use live bait. Park staff conduct surveys to watch for these invasive species.

Populations of the spiny water flea, a native of European freshwater lakes, have increased in park waters. The species was first collected from Beaver Lake in 1997 during plankton sampling, and it was found in Grand Sable Lake in 2002. Scientists and park managers are concerned because spiny water fleas could outcompete native fish for food. Round gobies, though not confirmed in the park yet, may displace native hosts for freshwater clams. Zebra mussels present a worse threat to native freshwater clams and mussels, however, as they can foul habitat and compete for food. Grand Sable Lake native freshwater mussel populations are small and vulnerable. Other factors such as road construction, clam harvest, lake trout stocking, and a decline in host fishes such as yellow perch (*Perca flavescens*) may be to blame for the current weakened state of Grand Sable Lake's clam populations.

Pictured Rocks participates in a cooperative program with the U.S. Fish and Wildlife Service to monitor and control sea lamprey populations in Lake Superior. While lamprey populations have declined since the 1960s, they continue to weaken and kill lake trout in Lake Superior each year.

Non-native plants that are of the most concern at Pictured Rocks include spotted knapweed (*Centaurea biebersteinii*), white sweet clover (*Melilotus alba*), red clover (*Trifolium pratense*), burdock (*Arctium minus*), periwinkle (*Vinca minor*), and several hawkweed species (*Hieracium* spp.). The shifting sands of the park's dunes are attractive habitat for spotted knapweed, a superior competitor that invades highly disturbed areas. Park staff attack spotted

knapweed by containing the larger populations and physically removing smaller infestations without the use of chemicals. This strategy helps protect native species such as Pitcher's thistle and Lake Huron tansy (*Tanacetum huronense*), a species listed as threatened in the state of Michigan.

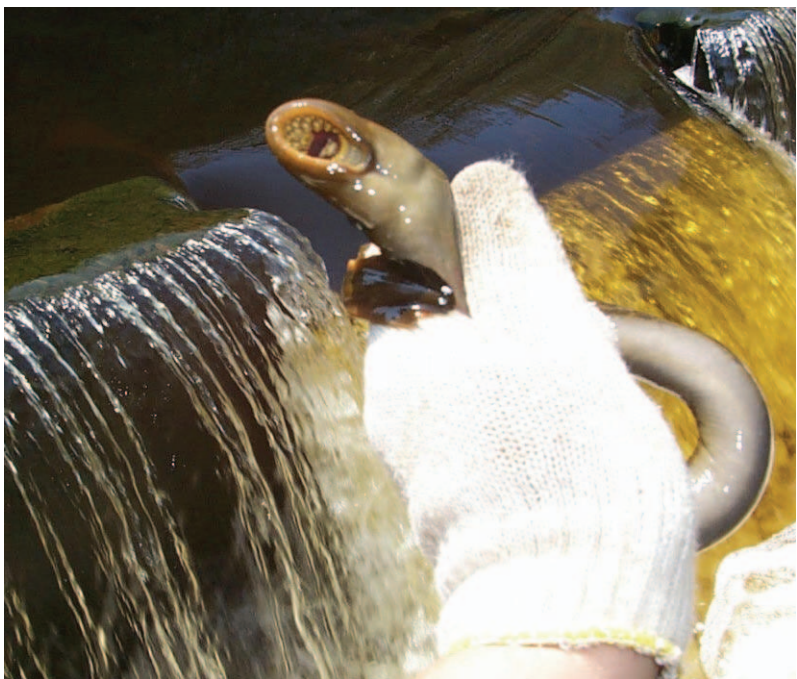
Pictured Rocks has a program in place to contain invasive plants and a system for monitoring the success of this program. By periodically mapping invasive plant coverage within the 1,976-acre dune ecosystem, park staff can track changes.

PATHOGENS AND CARRIERS—PARK WOODLANDS AT RISK

Beech bark disease was first identified in Michigan in the 1990s and was confirmed in the east end of the park in 2002. It is now widespread throughout the park. This disease is likely to cause changes in the composition of overstory and understory species in Michigan's forests.

Pictured Rocks staff worked with the U.S. Forest Service in the past to monitor gypsy moths (*Lymantria dispar*), which have been found in the park since 1990. Now that the Upper Peninsula of Michigan is generally infested with the moths, the park no longer monitors for them.

Non-native sea lampreys kill native fish by attaching themselves to their prey and sucking out blood and other fluids. The Park Service works with the U.S. Fish and Wildlife Service to monitor and control the lampreys, but they continue to kill lake trout each year.



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Hemlock woolly adelgids (*Adeleges tsugae*) are wind-borne insects that suck the sap from hemlock trees, eventually killing them. These insects have not been found in the park yet, but they could cause problems in the future. Jack pine budworm (*Choristoneura pinus pinus* Freeman), which kills trees in dense areas, could also become a problem as the park's pine stands get older.

Larvae of the emerald ash borer (*Agilus planipennis* Fairmaire) feed on the inner bark of ash trees, disrupting water and nutrient transport. The borers are present in the far eastern part of the Upper Peninsula, but are not believed to be in the park yet. If they do invade, ash trees around the Hurricane River and Little Beaver campgrounds could be at risk.

In 2004, park staff initiated a study to measure the impact of European earthworm invasions on vegetation and soil characteristics at Pictured Rocks. Earthworms can significantly change soil composition, which in turn can alter the type and number of plant species in a park.

WATER RESOURCES—FACING SEVERAL POTENTIAL THREATS

Although a recent Great Lakes Network Inventory and Monitoring Report indicates that water quality is relatively good at Pictured Rocks, primary potential threats to water resources include surrounding land uses and

development, atmospheric deposition, and invasive species. Residential development in the IBZ is of concern, but no research—except for some that focused on logging practices—has assessed the effects of current land uses and development on the park's streams. Atmospheric deposition poses a threat to water quality, fish, and other wildlife. Concentrations of most toxic chemicals are below guidelines in Lake Superior, but dieldrin, PCBs, and toxaphene exceed federal standards. Studies show, however, that levels of these contaminants in herring gulls have dropped since 1974. In addition, there is some concern about hydrocarbon pollution in the park waters of Lake Superior, some of which have been opened to personal watercraft use.

Water quality monitoring from the 1970s through the 1990s indicated water quality exceedances within the lakeshore for only three criteria: cadmium, pH, and lead. These exceedances were likely due to community development. Streams at Pictured Rocks do experience acidic precipitation, but are highly buffered and can rapidly neutralize the incoming water.

The Michigan Department of Environmental Quality (MDEQ) reports that the open waters of Lake Superior have excellent water quality. Within Pictured Rocks boundaries, Lake Superior has been designated an outstanding state resource water by the MDEQ.

Water quality at Pictured Rocks is relatively good, though personal watercraft could be polluting parts of Lake Superior.

NATIONAL PARK SERVICE





CULTURAL RESOURCES

HISTORY—RESEARCH NEEDED TO FILL GAPS

The Pictured Rocks region is rich with history that includes American Indians and Euro-American settlers. Hunting, fishing, logging, iron production, farming, and shipping are all pieces of this history. The park itself also has an interesting story. Researchers from the Great Lakes Shoreline Recreation Survey toured natural and cultural landmarks such as Miners Castle, Grand Sable Dunes, Au Sable Light Station, and the Pictured Rocks by boat, automobile, and helicopter during the late 1950s.

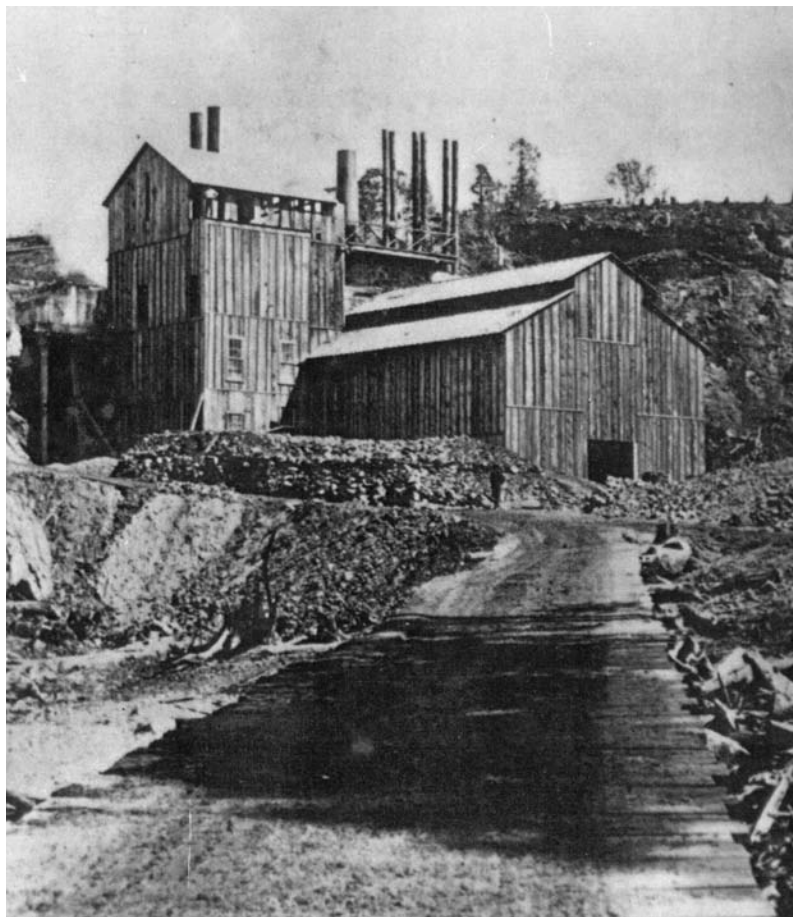
Their favorable reports led to authorization of Pictured Rocks as the first national lakeshore in 1966; 30 years later, amendments to the park's establishing legislation added former U.S. Coast Guard facilities to the park—Sand Point, Au Sable, and Grand Marais.

A historic resource study completed in 1981 provides important information on the park's main interpretive themes, including lighthouses, the U.S. Life-Saving Service, Great Lakes maritime history, and early peoples of the Great Lakes area. New information revealed in the last 26 years and the addition of U.S. Coast Guard facilities, however, warrant an updated historic resource study. Park staff have requested funds

Farmers once cultivated the land and raised livestock within Pictured Rocks National Lakeshore.

Schoolcraft Blast Furnace produced pig iron during the mid-to late 19th century, and was a major contributor to regional economic growth.

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for this update, but none have been provided so far. Updates to the park's administrative history are also needed.

Additional historical research on American Indians and precolonial life could fill several gaps in the understanding of cultural resources at Pictured Rocks. These topics have not been emphasized as major historical elements or interpretive themes. Detailed histories of former residents such as fishermen, farmers, and loggers should be recorded to capture their stories and their ties to the land. Pictured Rocks does not currently have anyone on staff devoted to historical research, though several staff members have some expertise in this field. The park has access to a regional historian at the Park Service's Midwest Regional Office, but this person also serves many other parks in the region, so time spent on historical research for Pictured Rocks is very limited.

ARCHAEOLOGY—FEW ACRES SURVEYED, BUT OVERVIEW AND ASSESSMENT UNDER WAY

Remains from an iron smelting furnace, hunting and fishing camps along Lake Superior's shore, former logging camps, and shipwrecks off the coast are some of the park's premier archaeological resources. Schoolcraft Blast Furnace produced pig iron during the mid-to late 19th century and was a major contributor to regional economic growth. The furnace and Au Sable Light Station are the only two archaeological sites at Pictured Rocks listed on the National Register of Historic Places, though other sites are eligible. The park is one of the only places where remains of the Great Lakes iron-smelting industry still exist. Shipwrecks are part of the Alger Underwater Preserve and are actually owned by the state of Michigan. Park staff work with preserve staff to interpret and preserve the wrecks.

Thirty-eight sites are listed in the park's Archeological Sites Management Information System, a database used to organize archaeological site information. Twenty-nine sites are in good condition, and nine are in fair condition.

A study is under way to gather information that can be used to predict which landforms in the park might contain archaeological resources. This will help park staff best protect areas likely to contain archaeological sites.

Additional archaeological work is needed to identify any other sites throughout the park. To date, only about 1 percent of the 33,929 acres under federal ownership has been intensively surveyed; within the Inland Buffer Zone, even fewer acres have been surveyed. Without comprehensive information on archaeological resources, park staff are unable to ensure the best protection for them and interpret them for visitors. To help remedy this situation, an archaeological overview and assessment is currently under way to summarize existing information and determine how to fill information gaps.

Park staff use archaeological artifacts from the



The Munising Coast Guard Station cultural landscape is eligible for the National Register of Historic Places.

museum collection to teach visitors about early explorers, miners, surveyors, loggers, farmers, scientists, and photographers. Archaeological resources that remain in situ throughout the park are threatened by illegal collecting, which is difficult to guard against because the park is large and has just four permanent full-time law enforcement rangers—not enough to provide adequate coverage. Artifacts that wash ashore from shipwrecks and those located at former logging camps are most at risk. Collectors who are caught are usually not prosecuted, but they must return any artifacts taken from the park.

Pictured Rocks has a paraprofessional archaeologist on staff, and additional support is available from the Midwest Archeological Center. The center's staff are shared among many parks throughout the Midwest, however, limiting the amount of time spent working for each. On an everyday basis, park staff members from several programmatic divisions work together to preserve archaeological resources, but only the chief of interpretation has attended formal archaeological training. Additional

funds are needed to provide training to other park personnel.

CULTURAL LANDSCAPES—ADDITIONAL REPORTS NEEDED TO GUIDE RESTORATION AND INTERPRETATION

The different groups of people who have called the Pictured Rocks area home have all left indelible marks. The cultural landscapes left behind connect today's visitors with the past.

Park and regional staff have identified several cultural landscapes within the lakeshore, including the U.S. Coast Guard Life-Saving Station, Au Sable Light Station, Grand Marais U.S. Coast Guard Station, Munising U.S. Coast Guard Station, and Sullivan's Creek Cabin. These landscapes are all related to Euro-American historic uses.

Au Sable Light Station is the only cultural landscape listed on the National Register of Historic Places, and is the only cultural landscape with a completed cultural landscape report. The report addressed shoreline erosion concerns that threatened the appearance of the



The park needs funds to rehabilitate and restore the Munising Range Lights, built in 1908 to guide vessels into Munising Bay.

light station. Park staff responded by installing wood retaining walls that have greatly reduced erosion. The report has also helped park staff understand how to restore vegetation to reflect the historical period the lighthouse represents, and has contributed to interpretation of the site, which is one of the most visited in the park. Interpretive tours teach visitors about the lives of Great Lakes light station keepers—lives that could often be isolated and lonely.

Additional cultural landscape reports would help guide restoration and interpretation of the park's other cultural landscapes. The Munising Coast Guard Station and Grand Marais Coast Guard Station are both popular landscapes that have been determined eligible for the National Register of Historic Places, though they have not yet been listed, and funds for cultural landscape reports have been requested but not yet awarded.

Pictured Rocks does not have a cultural landscape specialist on staff; instead, the park hires professional contractors to complete work such as the cultural landscape report for Au Sable Light Station. The park also relies on limited technical assistance from the Park Service's Midwest Regional Office. Budget constraints prevent the park from offering cultural landscape training to staff.

HISTORIC STRUCTURES—FUNDS NEEDED FOR ANNUAL INSPECTIONS AND STAFF TRAINING

The historic structures of Pictured Rocks National Lakeshore are some of the park's foremost attractions. Thirty-three are on the list of classified structures, and most of these are pieces of the park's maritime history. The Au Sable Light Station has guided ships since 1874 and is still an active navigation aid. The Grand Marais and Munising U.S. Coast Guard Stations were originally built to house the U.S. Life-Saving Service, which provided for the safety of the Great Lakes shipping industry. Today the Munising station houses the park's administrative offices.

Cultural resources staff at Pictured Rocks strive to re-create the historical appearances of both the exteriors and interiors of the park's historic structures. Park staff recently repaired and painted the front porch of the Au Sable Light Station's keepers' quarters, while volunteers have worked to rehabilitate the station's surrounding landscape. Funds have been requested to research the historic furnishings and interior appearance of the Munising U.S. Coast Guard Station, studies that would enrich interpretation of the site. Also needed are a number of historic structure reports that would help staff identify potential threats and prevent deterioration of the structures.

Known threats to historic structures include a lack of funds and personnel to conduct comprehensive, annual inspections of all historic structures; normal wear and tear from exposure to the elements; a lack of staff with preservation training; and the growing cost of deferred maintenance (nearly \$1.2 million). Staff have submitted multiple requests to address the need to paint structures, replace windows and roofs, and repair other features, but until funds are provided, historic structures are vulnerable to deterioration.

MUSEUM COLLECTION AND ARCHIVES—STORAGE FACILITY IMPROVEMENTS AND STAFF NEEDED

The museum collection at Pictured Rocks is primarily composed of archaeological evidence of Great Lakes maritime, logging, fishing, and farming history, as well as items that tell of American Indian life. A total of 36,155 items are in the collection (30,792 archaeological objects and 5,363 archival items). Artifacts from shipwrecks bring to life the historical significance of the Great Lakes shipping industry, while navigation and lifesaving equipment help visitors understand the essential safety and rescue services provided by the U.S. Life-Saving Service and U.S. Coast Guard.

Many of the park's archaeological objects are stored at the Park Service's Midwest Archeological Center in Lincoln, Nebraska. Those stored at the park are at risk because storage buildings do not meet museum standards. Exposure to temperature and humidity extremes throughout the year can damage artifacts. Some artifacts are at risk from exposure to bat guano, but this situation will be mitigated during 2007. Archives are stored in the upper level of the Grand Marais U.S. Coast Guard Station, which also serves as seasonal living

quarters. The archives are not readily available to researchers, and are not easily navigated without the help of experienced park staff. Constructing a new storage building is a high priority for park staff.

Museum collection management plans are outdated, condition assessments for the objects stored at the park are lacking, and about 28 percent of the archives have not been cataloged. Pictured Rocks does not have a museum curator or archivist on staff to complete this work and provide regular care to the collections, but has requested an increase in base funding to support such a position.

ETHNOGRAPHY—PARK STAFF BUILD RELATIONSHIPS AND PROTECT RESOURCES

American Indians have used the Pictured Rocks area for thousands of years. Even though the rocky shoreline of Lake Superior was not an ideal site for permanent camps, Ojibwa once used the Pictured Rocks area extensively for hunting and fishing. Several sites within the park were and continue to be of spiritual significance to the tribe. Park staff make efforts to restrict access to certain important sites in order to allow for ceremonial use by Ojibwa.

A report titled *Traditional Ojibwa Resources in the Western Great Lakes* identified several local bands of the Lake Superior Ojibwa as traditionally associated peoples of the park. Staff have used this report to help cultivate relationships with the Sault Ste. Marie Band of the Chippewa, Keweenaw Band Tribe, Bad River Tribe, and the Red Cliff Tribe.

Early European settlement, navigation, and life in the Great Lakes region dominate interpretation at Pictured Rocks. Additional research would enhance understandings of American Indian relationships to park resources, and would help park staff expand interpretation to include more aspects of American Indian cultural history.

Artifacts from the park's rich history are not fully protected and preserved, partly because Pictured Rocks lacks a curator or archivist. Funds are needed to support museum staff and bring storage conditions up to museum standards.



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Due to a lack of funding, space, and museum staff, some artifacts are not stored properly or cataloged.

STEWARDSHIP CAPACITY

FUNDING AND STAFFING—SHORTFALLS COMPROMISE RESOURCE PROTECTION

Although the annual operating budget at Pictured Rocks has generally increased over the last ten years (\$1.2 million in 1997 to \$1.9 million in 2007), funding and staffing shortfalls prevent the park from addressing natural and cultural resources management priorities. Long-term ecological monitoring and harvest management of fish and wildlife are not possible, while museum collections do not receive daily care and collection management reports are often left undone. There is no one to

monitor the environments within museum storage and exhibit spaces, while objects on loan to other institutions are not tracked.

In the last ten years, Pictured Rocks has lost seven permanent positions because of a lack of funding: landscape architect, information technology specialist, supervisory park ranger, maintenance foreman, maintenance worker, interpretive park ranger, and protection park ranger.

To address the backlog of natural resource management activities, the park would need a wildlife biologist, landscape ecologist, data management specialist, geographic information systems (GIS) specialist, and full-time and seasonal biological science technicians. The

cultural resource management program would need a historian or curator. In addition to these positions, the park would need one or two vehicles and annual funding for supplies.

The park has requested increases to its base operational budget, which have not been funded, and has a list of unfunded priority projects that include constructing an administration and public use building, relocating a wastewater septic field, removing hazard trees, and sustaining the volunteer program.

PARK PLANS—SOME NEEDED TO DIRECT MANAGEMENT EFFORTS

The park has a general management plan that was finalized in 2004, but a new Park Service process means that Pictured Rocks will not revise its natural and cultural resources management plan until 2009. Other plans and research have gone undone because of funding and staffing shortfalls; these include a number of cultural landscape and historic structure reports, which are needed to help park staff manage resources. In addition, a plan may be needed to address erosion around the Munising U.S. Coast Guard Station, which could jeopardize the boathouse. Staff are monitoring the erosion, and will need funds to act if the situation worsens.

RESOURCE EDUCATION—EDUCATIONAL OPPORTUNITIES ABOUND

Pictured Rocks provides abundant opportunities for people of all ages to learn about the park's natural and cultural heritage. Teachers can arrange for classroom visits combined with park field trips, with special programs geared toward students from preschool to high school. A wildlife management activity guide, produced with a grant from the National Park Foundation, enables high school teachers to educate students about management of wildlife in Michigan's Upper Peninsula. Traveling trunks filled with lesson plans and learning materials provide all that is needed to teach third through sixth graders about black bears, birds, beavers,

geology, non-native species, or the Au Sable Light Station. The park also loans schools everything from educational DVDs and videos to water quality testing kits and thermometers. For teachers, the park offers professional development workshops for course credit at Northern Michigan University.

Fireside chats at the Munising visitor center are given for several weeks during the winter and cover topics ranging from restoration of the Au Sable Light Station to the ecology of forest carnivores. In fiscal year 2005, the park provided 241 interpretive programs, which included educational outreach in area schools; interpretive walks and talks; Au Sable Light Station tours; and monthly interpretive programs in the winter. Three full-time staff and one seasonal interpreter are responsible for organizing and presenting these programs, with the assistance of volunteers. Hiring an additional seasonal interpreter would allow the park to augment summer program offerings.

The park's four visitor, information, and interpretive centers offer access to rangers who can provide advice on making the most of a visit to Pictured Rocks, though the Pictured Rocks National Lakeshore/Hiawatha National Forest Interagency Visitor Center in Munising is the only one that is open year-round. The other three—Grand Sable Visitor Center, Munising Falls Interpretive Center, and Miners Castle Information Station—are open from Memorial Day to Labor Day. Hiring an additional staff

Field trips and classroom visits provide opportunities for schoolchildren to learn about the park's natural and cultural heritage.



JOHN BURDE / SOUTHERN ILLINOIS UNIVERSITY

person would allow the park to keep these centers open every day during the summer. Keeping the visitor centers open past Labor Day would also allow the park to reach more visitors. Exhibits at Munising Falls and Grand Sable need to be rehabilitated, but those at Miners Castle are in good condition.

A new information center at the Au Sable Light Station is scheduled to open in summer 2007. It will be open Wednesday through Sunday from July 1 through Labor Day.

EXTERNAL SUPPORT—ASSISTANCE COMES FROM MANY SOURCES

Volunteers and partners make it possible for Pictured Rocks to provide better care for park resources and offer enhanced educational opportunities. In 2005, volunteers contributed 4,572 hours of service. They worked as campground hosts, presented programs at the Au Sable Light Station, and helped with trail maintenance, natural resource management, and visitor protection projects.

Eastern National, a nationwide nonprofit organization, runs the park's bookstores, develops interpretive materials, and funds the salaries

of store employees. In addition, the organization donates a percentage of bookstore proceeds to Pictured Rocks to support interpretive programs and the park newspaper.

Pictured Rocks also receives support from the National Parks of Lake Superior Foundation, a new friends group formed to raise funds for the four national parks on Lake Superior. This group hopes to provide funds for historic structure preservation, improved visitor services and facilities, enhanced environmental education programs, and more.

Support from local communities is also key at Pictured Rocks. Park staff are taking steps to engage these communities through Adopt-a-Trail and Adopt-a-Campsite programs, as well as special events and educational programs in local schools.

Park staff collaborate with university researchers and scientists from other agencies and organizations to study aquatic and terrestrial resources. Some past and ongoing projects include inventories of bats and nearshore fishes; studies of pitcher plants and emerald ash borers; and monitoring of coaster brook trout and non-native sea lamprey.

Volunteers contribute thousands of hours to the park each year, helping staff with trail maintenance, resource protection, and interpretation.





APOSTLE ISLANDS NATIONAL LAKESHORE

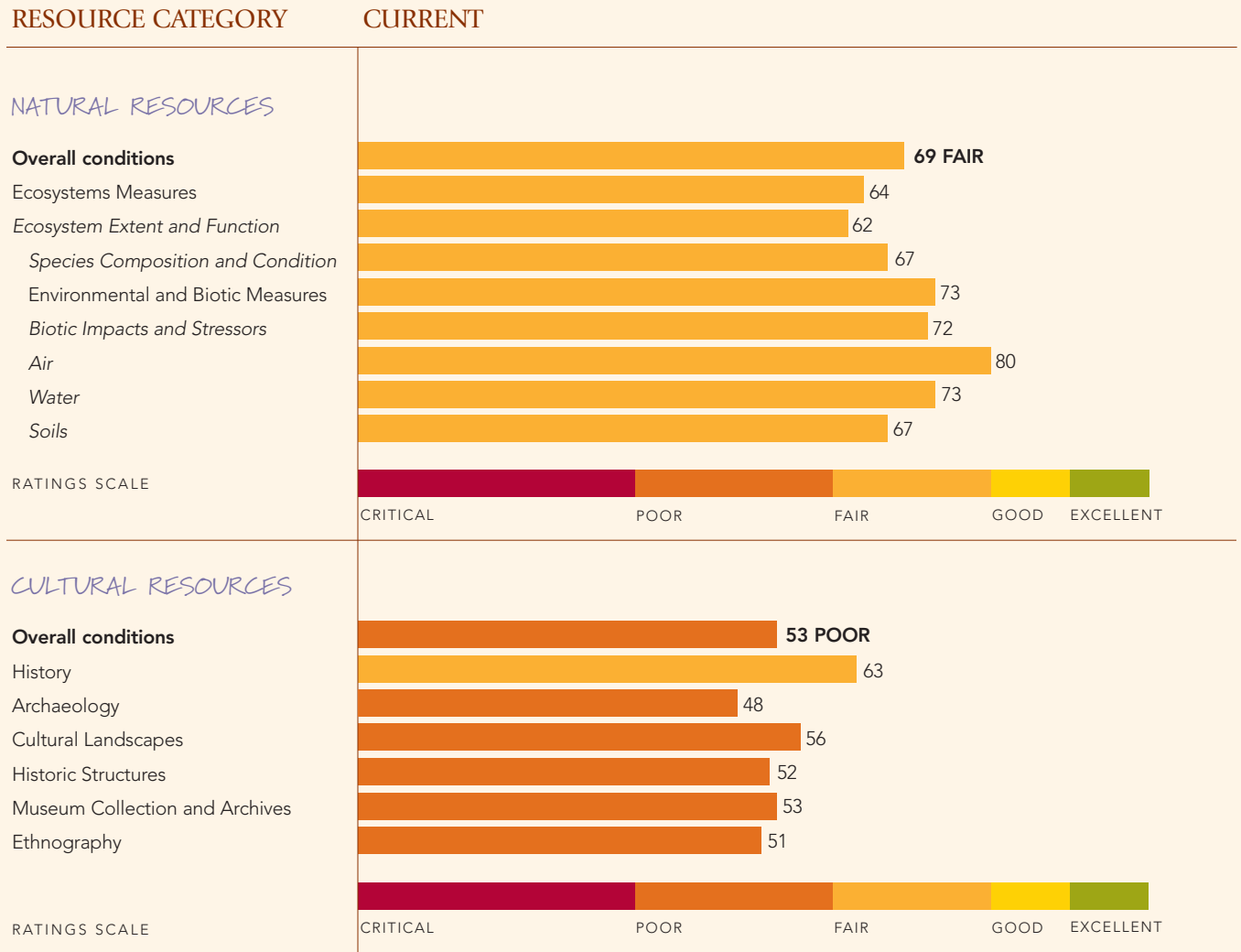


Apostle Islands National Lakeshore, established in 1970, sits at the southern edge of Lake Superior and is composed of a 21-island archipelago and a portion of northern Wisconsin's Bayfield Peninsula shoreline. The islands range in size from the tiny three-acre Gull Island to the 10,054-acre Stockton Island, while the mainland segment covers 2,546 acres. In sum, the park encompasses 42,160 acres of land and 27,232 acres of water.

The archipelago and mainland have rich and varied cultural and natural histories, serving as homes to different groups of people throughout the last several hundred years and as habitat for diverse fauna and flora. For the Ojibwe, the islands are a sacred place, considered the birthplace of their nation. For early European settlers, the peninsula and islands represented seemingly limitless natural resources that inspired the development of several commercial

Apostle Islands National Lakeshore is home to red sandstone sea caves, some of which become accessible when lake waters freeze in the winter.

Note: When interpreting the scores for natural resource conditions, recognize that critical information upon which the ratings are based is not always available. This limits data interpretation to some extent. For Apostle Islands National Lakeshore, 69 percent of the information required by the methodology was available.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases pre-dating the park's creation. The intent of the Center for State of the Parks is to document the present status of park resources and determine which actions can be taken to protect them in the future.



Apostle Islands National Lakeshore sits at the southern edge of Lake Superior.

logging and fishing camps. Since the late 19th century, the Great Lakes shipping industry has relied on the islands and their lighthouses and keepers for navigation and safe harbor in stormy weather. Soon after the turn of the 20th century, the Apostle Islands became a summer tourist destination. The heritage of the Apostle Islands was preserved in perpetuity with the establishment of the Apostle Islands National Lakeshore in 1970.

In addition to their important cultural meanings, the lands and waters within Apostle Islands National Lakeshore have significant ecological value, and increased emphasis has been placed on protecting the natural state of the lakeshore. In 2004, 80 percent of the park was designated as federally protected wilderness. The Gaylord Nelson Wilderness, named for the Wisconsin senator and governor who advocated on behalf of the park, was set aside to preserve the primitive nature of much of the islands.

An assessment by Center for State of the Parks researchers indicates that, overall, natural resources are in “fair” condition with a score of 69 out of 100. Deer and invasive species are primary concerns. Cultural resource conditions, overall, rated a “poor” score of 53 out of 100. The park lacks the funds to properly care for its world-class collection of light stations. Staffing shortfalls plague both resource programs, making it impossible to complete desperately needed research, monitoring, and reports.

RESOURCE MANAGEMENT HIGHLIGHTS

- In 2004, 80 percent of Apostle Islands National Lakeshore was designated as the Gaylord Nelson Wilderness, becoming Wisconsin’s largest wilderness area. The park has also been recognized by the Wisconsin Department of Natural Resources’ Natural Heritage Inventory Program for its impressive sandscapes and maritime cliffs and forests.
- In 2004, the park began an extensive vegetation mapping project. In addition, park staff have also been collecting native plant seeds to revegetate and restore dunes, beaches, and sandspits. Combined with deer management efforts, these activities will help maintain the park’s floral diversity.
- The park makes great use of volunteers to staff its lighthouses, which increases visitor access to personal interpretation and deters vandalism on the isolated historic structures.
- Restoration work at the Raspberry Island Light Station has protected the lighthouse and the associated cultural landscape from rapid shoreline erosion that threatened to destroy the resources. Work to rehabilitate the historic structures and landscape on the island to their historic appearance has recently been completed.
- Interpretation at the Hokenson Fish Camp, which incorporates information provided by family members, teaches visitors about the Great Lakes fishing industry from the 1920s through the 1960s. Opportunities to tour the camp, explore the historic buildings, and see actual tools used by the fishermen has made this fish camp one of the most innovative and popular park attractions.

The fish processing house at the Hokensen Fishery helps visitors better understand Great Lakes fishing history.



KEY FINDINGS

- The park suffers from funding and staffing shortfalls that translate to difficulties protecting resources. The park's size (21 islands spread out over an area the size of Rocky Mountain National Park) and the logistical challenges involved with getting to and from all the islands makes it impossible for a natural resources staff of just two permanent employees to properly monitor and study the entire Apostle Islands. Although the park is home to more historic structures than many other parks put together, there is just one staff member responsible for studying, monitoring, preserving, and documenting the park's wide array of cultural resources.
- Logging, mining, and agriculture over the past two centuries—compounded by the dispersal barriers—have altered natural forest succession, fire regimes, and biological communities. More contemporary landscape changes are driven by increasing deer populations, recreational visitor impacts, and non-native plant invasions.
- Sandscapes are vulnerable to damage from foot traffic. Monitoring has shown increases in bare ground and decreases in native species.
- Apostle Islands is an ideal location to examine island biogeography theory, which suggests that the distribution of species on islands is directly related to island size and distance from one another and the mainland. Studies at Apostle Islands lend support to this theory. Because of limitations imposed by island living, species are more variable and susceptible to direct anthropogenic influences such as pollution, visitor impacts, overhunting, and habitat loss, as well as more natural influences such as weather, disease, and predation.
- Cultural resources research at Apostle Islands, though limited by available staff and funds, has included important work such as a cultural landscape report and a historic structure report for the Raspberry Island Light Station. Additional work is needed, however, to comprehensively document other cultural resources. This work includes an archaeological overview and assessment, cultural landscape and historic structure reports for the other light stations, oral histories, and an ethnographic overview and assessment.
- Funding shortfalls prevent the park's maintenance staff from regularly maintaining historic structures, leaving them vulnerable to deterioration. Recurring maintenance duties such as roof replacement and repainting are pushed back, and the total cost of deferred maintenance now tops \$4.4 million (although this figure is considered low because numerous restoration projects are not included in the figure due to a chronic lack of historic structure and cultural landscape reports for the park's six light stations).
- The park's museum storage facilities lack fire suppression and climate control systems, exposing artifacts and archives to potential decay and destruction. Funds are needed to improve the protection of the park's collection.



ELIZABETH MEYERS

NATURAL RESOURCES

PARK HABITATS—SHAPED BY PAST AND PRESENT ACTIVITIES

Apostle Islands National Lakeshore contains a mix of regionally rare habitats such as sandstone cliffs, clay bluffs, sandscape lagoons, bogs, forested ridges and swales, forest seeps, old-growth forests, northern forests, boreal forests, and dunal communities. The park's current ecological health is tied to historical land uses. Since the mid-19th century, European settlers have farmed, logged, quarried, and fished in northwestern Wisconsin and Lake Superior. Stone quarries that operated on Basswood,

Hermit, and Stockton Islands between 1896 and 1893 supplied brown sandstone used in buildings throughout the Midwest. The logging industry surged during early settlement, with most timber being cut around the turn of the 20th century until about 1930. Limited logging continued through the 20th century until the islands became a national park in 1970.

Logging and fire have changed the composition and character of much of the coniferous and hardwood forests. Loggers first targeted white pine (*Pinus strobes*), red pine (*Pinus resinosa*), white cedar (*Thuja occidentalis*), and eastern hemlock (*Tsuga canadensis*). Although much of the forest has recovered or is in the

Foot traffic can harm fragile sandscapes at Apostle Islands.

The Apostle Islands sit in a heavily traveled migratory bird flyway and provide critical habitat to passerines, hawks, and falcons, as well as many waterfowl and shorebird species. Colonial birds have been monitored for more than 30 years.

process of recovering, in a few limited areas where these trees were once found, natural regeneration may no longer be possible because of the lack of seed sources. Hemlocks still occur on most of the park's islands, but the trees are less abundant than they were before logging. Today the virgin hemlock hardwood forest on Outer Island is thought to be one of the best examples of this type of habitat remaining in the Great Lakes region. Once white and red pine, white cedar, and eastern hemlock were depleted, focus shifted to hardwood species such as sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*).

Reserves set aside by the U.S. Lighthouse Service protected remnants of old-growth forests on Devils, Raspberry, Outer, and Sand Islands and prevented them from being logged. Boreal forest remnants exist on North Twin, Raspberry, Rocky, South Twin, Sand, and York, but the best example of boreal forest can be found on Devils Island.

Declines in pines and hemlock benefited aspen (*Populus* spp.), white birch (*Betula papyrifera*), sugar maple, red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), and white cedar, which have become the dominant tree species. As forests continue to mature in the absence of disturbances such as logging, however, trees such as aspen and white birch will likely become less dominant.

The park's highly diverse sandscapes are among the highest quality in the Great Lakes region. These outstanding natural features include sandspits, cusped forelands, a barrier spit, beaches, and tombolos—sandbars that connect islands to one another or the mainland. Many of the islands' shorelines display red sandstone sea caves, some of which become accessible when lake waters freeze in the winter.

The park's sandscapes are favorite places for visitors, but they are also home to sensitive plants that can be affected by foot traffic. Studies have shown increases in bare soil and declines in native species on sandscapes at Cat, Michigan, and Outer Islands between the early 1990s and 2002. More recent monitoring revealed similar results on Ironwood, Raspberry, Rocky, and South Twin Islands. The percent of bare ground has increased between 47 and 83 percent since monitoring began at sites on Devils, Oak, South Twin, and Stockton Islands. Foot traffic may also lead to shifts in species composition. To address this damage, park staff have restored sandscapes on Oak, Raspberry, and South Twin Islands.

PARK WILDLIFE—VARIETY OF SPECIES PRESENT

Apostle Islands National Lakeshore is home to six reptile, 14 amphibian, 34 fish, 245 bird, 31 mammal, and 758 plant species. The park also supports a variety of Lepidoptera; a 1996 inventory on Long Island documented 98 species. A 2000 survey of the sandscapes on Outer, Raspberry, Rocky, and Stockton Islands collectively recorded 174 species.

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Stockton and Sand Islands support reproducing bear populations of 26 and six bears, respectively, according to the most recent estimates, which were calculated in 2002. Research that compared bear populations on the mainland against those on Stockton Island concluded that those on park islands are small and densely distributed. A more recent DNA based study on Stockton and Sand Islands found that bears on Stockton Island may be genetically distinct and are influenced by individuals that migrate from the mainland.

Beaver (*Castor canadensis*) populations declined between the 1970s and early 1990s, likely because of habitat loss, bear predation, and the length of the winter season, which affects food availability, beaver body mass, and overall colony condition. Beaver populations have dramatically declined on Stockton and Outer Islands. Active beaver lodges on Stockton Island have not been found since 1994, and as of 2005, there was only one beaver lodge on Outer Island. There has, however, been recent activity on Michigan Island.

Other furbearers include snowshoe hare (*Lepus americanus*), coyote (*Canis latrans*), otter (*Lontra canadensis*), and fisher (*Martes pennanti*). Basswood, Sand, and Stockton Islands together may support up to ten total fishers, but more realistic projections are five to six. Competition for food with the high bear population on Stockton Island likely keeps fisher numbers down.

A wildlife biologist with the Bad River Band of Lake Superior Ojibwa studied river otters at the park, which can be trapped under park legislation, as can all of the park's furbearers. While no otters have been trapped in the park's history, there were signs of the animals on Michigan, Outer, Sand, and Stockton Islands.

The Apostle Islands sit in a heavily traveled migratory bird flyway and provide critical habitat to passerines, hawks, and falcons, as well as many waterfowl and shorebird species. Park staff periodically monitor migratory bird



TOM SMYLLIE / USFWS

populations on the Outer Island sandscape. These surveys point to great variability in total species populations.

Colonial nesting birds include herring and ring-billed gulls (*Larus delawarensis*), double-crested cormorants (*Phalacrocorax auritus*), great blue herons (*Ardea herodias*), and cliff swallows (*Petrochelidon pyrrhonota*). Colonial birds in the park have been monitored for more than 30 years. Numbers of nesting pairs of herring gulls and double-crested cormorants decreased between the mid-1990s and 2004.

An analysis of data on fish populations in Lake Superior collected between 1963 and 1995 by the USGS Biological Resources Division revealed positive trends in numbers of lake herring (*Coregonus artedii*), bloater (*Coregonus hoyi*), lake whitefish (*Coregonus clupeaformis*), trout-perch (*Percopsis omiscomaycus*), wild lake trout (*Salvelinus namaycush*), spoonhead sculpin (*Cottus ricei*), and ninespine stickleback (*Pungitius pungitius*). Stocked lake trout, pygmy whitefish (*Prosopium coulteri*), and burbot (*Lota lota*), however, showed negative trends. Slimy sculpin (*Cottus cognatus*) and deepwater sculpin (*Myoxocephalus thompsoni*) populations remained steady.

Habitat loss, bear predation, and long winters may have caused declines in beaver populations on Stockton and Outer Islands.

ISLAND LIVING AFFECTS SPECIES

Island size and location likely had and continue to have the most substantial effect on the park's terrestrial species. Island biogeography theory suggests that island size and distance to the mainland influence the distribution of plant and animal species. Apostle Islands represents an ideal location to examine this theory, and several researchers have done so.

A study of the distribution of ground-dwelling mammals on 20 park islands showed that island area correlates to the number of species present on an island, with larger islands supporting species with greater biomass than smaller ones. Another study found that colonization by deer mice seems to be restricted by distance from the mainland, as these animals were not found on some of the islands farthest from the mainland. Research has shown that small furbearing mammals, as well as bears, beaver, otter, fisher, and deer are affected by these habitat limitations and depend on immigration from the mainland for genetic variability. At the same time, biogeography is believed to have limited the spread of non-native mammals.

The upshot for managers is that island-dwelling species are more variable and susceptible to direct anthropogenic influences such as pollution, visitor impacts, overhunting, and habitat loss, as well as more natural influences such as weather, disease, and predation. Park staff have recognized these challenges, devoting great energy to researching, monitoring, and managing various species and their habitats.

Park staff collect hair from passing bears, which allows researchers to analyze genetic information and learn more about the animals' populations.



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PROTECTED SPECIES—HOME FOR FEDERALLY LISTED AND STATE LISTED SPECIES

Apostle Islands is home to two animals protected under the Endangered Species Act—bald eagle (*Haliaeetus leucocephalus*) and piping plover (*Charadrius melodus*)—as well as several species listed by the state of Wisconsin as threatened or endangered. These include the red-shouldered hawk (*Buteo lineatus*), osprey (*Pandion haliaetus*), peregrine falcon (*Falco peregrinus*), Henslow's sparrow (*Ammodramus henslowii*), loggerhead shrike (*Lanius ludovicianus*), Caspian tern (*Hydroprogne caspia*), Forster's tern (*Sterna forsteri*), common tern (*Sterna hirundo*), and red-necked grebe (*Podiceps grisegena*), which all may migrate through the park.

Long Island is the only location in Wisconsin where piping plovers have recently nested successfully. From 1998 to 2005, nesting was sporadic, but in 2006, the park had four nests—three on Long Island and, for the first time, one on Outer island. All three nests on Long Island successfully produced young, but the nest on Outer Island was unsuccessful. Long Island and the Michigan Island sandscapes are designated critical habitats for piping plover.

Bald eagle populations, which declined in the 1950s and 1960s as a result of toxic chemicals in their prey, began to recover in the 1980s. In 2006, there were ten active nests in the park that produced 15 young.

In addition to protected animals, Apostle Islands provides important habitat for many rare plants. The park harbors five species listed by the state of Wisconsin as endangered, 13 listed as threatened, and 26 designated as species of concern.

DEER—ECOSYSTEMS AT RISK

In the mid-19th century, the Apostle Islands had very few deer because dense, old-growth landscapes lacked the large openings needed by this edge-dependent species. Logging and land

clearing in the late 19th and early 20th centuries, however, facilitated deer population growth by changing ecosystems to better suit this species. Today park managers struggle with the challenge of managing deer, which like to browse on a variety of plants. In fact, deer have had a profound effect on park species such as Canada yew (*Taxus canadensis*), western hemlock, and white cedar. On the mainland and several islands, deer have nearly eliminated Canada yew, while islands without deer provide good examples of healthy northern Wisconsin forests. Concerns are rising because park managers have recently documented evidence of browsing on islands such as Sand and York that historically had not been colonized by deer. Park staff are conducting a browse study, have worked with partners to develop a wildlife management plan for harvestable species, and have encouraged hunting.

NON-NATIVE SPECIES—SEVERAL PLANTS AND AQUATIC SPECIES WARRANT ATTENTION

Non-native species can cause problems when they disrupt ecosystems by competing with, damaging, displacing, or even killing native species. The most problematic in the Apostle Islands include several plants and aquatic species.

Non-native, invasive plants such as purple loosestrife (*Lythrum salicaria*), orange hawkweed (*Hieracium aurantiacum*), and spotted knapweed (*Centaurea maculosa*) have threatened the park's native plant communities and spurred research, monitoring, and control efforts. Purple loosestrife is an extremely aggressive plant that invades wetlands, and has caused concern throughout much of the United States. Park staff have targeted it with herbicides and leaf-feeding beetles (*Galerucella pusilla*, *G. californiensis*).

Orange hawkweed thrives in disturbed, open areas such as trails, fields, sandspits, and developed areas on all 21 park islands. Orange hawkweed does not tend to spread into forested



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areas. Control efforts are limited to sandscapes where restoration is taking place.

Spotted knapweed poses a very large threat to the park's sandscapes, which contain highly sensitive plant communities. Until 2006, there was only one very small population of knapweed on the islands. In 2006, a small population was found at the north end of Outer Island and a large population was discovered on the mainland along Meyers Beach Road. Staff treat the invasive plants with chemicals.

Sea lamprey, an eel-like parasite, decimated lake trout populations in Lake Superior in the 1950s and 1960s. Control efforts and fishing restrictions, however, have led to a strong recovery of lake trout at Apostle Islands, and biologists with the Wisconsin Department of Natural Resources are optimistic that these trends will continue. The Sand River on the mainland is regularly monitored by the U.S. Fish and Wildlife Service for sea lamprey and is scheduled for treatment with lampricides, which kill larval lampreys, in 2007.

Zebra mussels (*Dreissena polymorpha*), which disrupt ecosystems and compete with native mollusks for food, have not been found within park boundaries, but have been found occasionally at Ashland, Wisconsin, and are present in

Park managers struggle with the challenge of managing white-tailed deer, which like to graze on a variety of plants and have nearly eliminated Canada yew on the mainland and several islands.



Purple loosestrife is an extremely aggressive plant that invades wetlands. Park staff have targeted it with herbicides and leaf-feeding beetles.

large numbers at Duluth, Minnesota. The low calcium content of Lake Superior is believed to slow the spread of the mussels, though continued monitoring is important.

Gypsy moths (*Lymantria dispar*) have greatly increased in number in recent years. Intensive monitoring was done in 2006 and gypsy moths were found on every island where traps were set. They were especially abundant on Basswood and Stockton Islands. Gypsy moths arrived in the Apostle Islands region several years ahead of schedule, and it is believed that they were introduced to the islands via imported firewood.

WATER RESOURCES—QUALITY GOOD, BUT SOME THREATS EXIST

According to a Great Lakes Network Inventory and Monitoring Report completed in 2005, water quality at Apostle Islands is considered to be good, with no documented problem parameters. In fact, Lake Superior is considered the cleanest of the Great Lakes. The report did identify several large-scale threats to water resources, however, that included atmospheric deposition, water traffic/recreational use, highly erodible soils, and severe spring runoff.

Issues with low dissolved oxygen and pH occur in the naturally acidic waters of Stockton, Michigan, and Outer Island lagoons. Recent studies indicate that there are also very high levels of mercury, especially methyl mercury, in the Stockton and Outer Island lagoons. In addition, at Oak, Outer, and Stockton Islands, surface waters are sensitive to acidification from atmospheric deposition. Stream sites on Oak Island have had measured pH values that are lower than the Environmental Protection Agency criteria for the protection of freshwater aquatic life.

Park staff occasionally find evidence of waste having been dumped from boats into Lake Superior's waters. This activity is illegal, but it is nearly impossible to monitor all boats and catch offenders. Spring runoff can also wash a variety of pollutants and sediments into park waters. Monitoring has shown bacterial levels to be low, overall, and spikes seem to be associated with runoff.



Lake Superior is considered to be the cleanest of the Great Lakes.



CULTURAL RESOURCES

HISTORY—ADDITIONAL STAFF NEEDED TO ENGAGE IN RESEARCH

The cultural resources of Apostle Islands National Lakeshore tell the stories of the people who visited, worked, and made homes on the islands. These stories relate to American Indian culture, commercial fishing, logging and lumber milling, quarrying, agriculture, Great Lakes shipping and navigation, and tourism and resorts. The park's premier cultural resource is the well-preserved collection of six lighthouses. Other important cultural resources include cabin sites, shipwrecks, and fish camps used mostly during

the 1930s and 1940s. Although the Apostle Islands are also closely tied to American Indian cultures, the park has not extensively interpreted these connections out of respect to associated groups. Changing attitudes have opened doors, however, and the park has now begun to teach visitors about Ojibwe heritage.

Apostle Islands has just one staff member, the branch chief of cultural resources, to tackle all aspects of cultural resources research, monitoring, documentation, and management, which means that time spent on historical research is limited by other responsibilities. Employing an on-site historic architect would allow for the additional research needed to

Park staff have submitted requests for funding to complete a cultural landscape report for the Long Island light station. Encroaching vegetation and shoreline erosion pose the most serious threats to cultural landscapes at Apostle Islands.

produce guidance documents, inform interpretation, and guide management decisions.

Apostle Islands National Lakeshore lacks a true administrative history to document park establishment, planning, and management, but a thorough history of the park's creation is recorded in *A Unique Collection of Islands*. Important park events that occurred after this work was published, such as establishment of the Gaylord Nelson Wilderness, warrant documentation in a comprehensive administrative history.

More research is also needed so park staff can appropriately interpret Ojibwe connections to the Apostle Islands. For example, American Indian fishing camps are located on the shores of several islands, but work has not been done to fully examine them.

Current research at Apostle Islands includes a historic resource study that will provide a complete analysis of the park's historic resources. This work will help park staff prioritize cultural resource protection efforts in a climate of limited fiscal resources, and it will help staff continue to develop interesting, informative, and accurate interpretive programs.

ARCHAEOLOGY—FUNDS NEEDED TO IDENTIFY AND PRESERVE RESOURCES

Archaeological sites at Apostle Islands span a period of 5,000 years, and include American Indian fishing camps, some of which were used at least 800 years ago, and 19th century logging camps such as Trout Point, which is listed on the National Register of Historic Places. The waters surrounding Apostle Islands contain archaeological remnants of Great Lakes maritime history—most notably several late 19th and early 20th century shipwrecks. The *Noquebay*, a schooner-barge that sank as a result of fire on October 6, 1905, is the best documented of these, having had a submerged cultural resources site report done in 1985. Additional research is needed for remaining shipwrecks; funds have been requested for this work, but have not yet been awarded.

Only about 5 percent of Apostle Islands' 42,160 terrestrial acres has been intensively surveyed for archaeological resources, while just two acres out of 27,232 submerged acres have been intensively surveyed. Most of this work was done in the 1970s; 61 known sites were revisited and assessed in 2006. Forty-nine are in good condition.

Apostle Islands has not had an archaeological overview and assessment, a required baseline report that would summarize known and potential resources and determine what additional archaeological work is needed. The park has requested funding, however, for several projects that would identify archaeological resources. One is under way now, and another study—an inventory of island sites—will begin shortly.

Accomplishing archaeological work at Apostle Islands is difficult, in part, because the park does not have an archaeologist on staff and must rely on support from the Midwest Archaeological Center in Lincoln, Nebraska, which also serves all parks in the Park Service's Midwest Region. Hiring a staff archaeologist would allow Apostle Islands to focus more time on evaluating and monitoring archaeological resources, though this may not be the highest priority cultural resources need.

Access to many of the park's islands also presents challenges because of the expense of running boats, people, and supplies. As a result, archaeological resources located on isolated islands do not receive regular attention. Archaeological resources are threatened because they are largely unknown, which limits the park's ability to protect them. Resources are also at risk from high winds and falling trees that cause damage that may go unnoticed for long periods of time because of infrequent site monitoring. Shoreline erosion could also be a problem for American Indian fishing camps and more recent historical fishing sites. Documenting at-risk sites is likely the best course of action, as attempting to

control erosion would require substantial shoreline manipulation.

CULTURAL LANDSCAPES—RESEARCH ENABLES APPROPRIATE RESTORATION

Cultural landscapes at Apostle Islands include each of the six light stations and their surroundings, fish camps, quarries, logging camps, and farms. Sixteen of them are on the National Register of Historic Places.

Some of the most significant and widely interpreted cultural landscapes at Apostle Islands are those that are associated with the light stations. Raspberry Island Light Station, the most frequently visited, is the only light station that has had a cultural landscape report and environmental assessment. This work, which was completed in 2004, guided a major rehabilitation project of the primary lighthouse structure in 2006. This report also helped park staff understand the challenges of maintaining the landscapes surrounding the light stations in a manner consistent with how they were originally kept by the U.S. Lighthouse Service and the U.S. Coast Guard, both of which had very strict rules about clearing vegetation from around the light stations.

Cultural landscape reports on the park's other light stations would provide information on the traditional appearances of the landscapes, helping managers understand how best to preserve or re-create them. Park staff have submitted requests for funding to complete cultural landscape reports for light stations on Sand, Outer, Devils, Long, and Michigan Islands and for the settlement on Sand Island. Other cultural landscape work that has been completed at Apostle Islands includes Cultural Landscape Inventory entries of Hadland and Manitou fish camps.

Encroaching vegetation and shoreline erosion pose the most serious threats to cultural landscapes at Apostle Islands. As mentioned previously, when the U.S. Coast Guard maintained the light stations, vegetation was kept at

bay by diligent lighthouse keepers who put much time and energy into maintenance. Much work is needed to manage and remove excess vegetation to return historic appearances, but a lack of funds for landscape maintenance limits this work. Shoreline erosion is a serious problem for light stations located near the edges of islands. The Raspberry Island and Outer Island Light Stations were in serious danger because they were built on bluffs that continue to erode. Recent restoration has stabilized the shorelines at these places.

HISTORIC STRUCTURES—FUNDING SHORTFALLS SLOW MAINTENANCE

Apostle Islands National Lakeshore is home to the most extensive collection of lighthouses within the National Park System: Old Michigan Lighthouse, Old LaPointe Lighthouse, Raspberry Island Lighthouse, Outer Island Lighthouse,

The Raspberry Island Light Station was rehabilitated in 2006. This photo was taken just prior to the commencement of that work.



The lens from the Michigan Island Light Station is displayed at the park's visitor center in Bayfield, Michigan, along with tools used by the U.S. Life-Saving Service and other implements from the Great Lakes fishing and sailing industries.

Sand Island Lighthouse, Devils Island Lighthouse, New LaPointe Lighthouse, Chequamegon Point Lighthouse, and New Michigan Lighthouse. Other historic structures in the park include the smaller sheds and outbuildings near the light stations, structures associated with the farmsteads that are scattered throughout the islands, and fish camp buildings. In sum, the park has 158 structures on its list of classified structures; 101 of these are on the National Register of Historic Places, and another 16 have been determined eligible for the register.

The park's lighthouses are prime visitor attractions, but garnering funds to restore them has proved difficult. Some historic structures have received needed treatment, but others lag behind. The total cost of deferred maintenance at Apostle Islands is more than \$4.4 million.

Natural phenomena such as heavy winter snows and falling trees can damage structures, while recurring maintenance such as roof

replacement and painting is long overdue for many buildings. For example, during the past 12 years, the park has received funds to replace about two roofs each year. If funds existed to replace ten roofs each year, it would take six years for the park to catch up to its ideal roof replacement schedule. The park's maintenance division simply does not have the funds or staff to adhere to a regular maintenance schedule. In addition, some of the structures are located on remote islands that are difficult and costly to access, further complicating maintenance efforts. The park has just one base-funded position—a six-month subject-to-furlough historic preservation specialist—to care for historic structures. All work depends on special project funds. The park needs a historic preservation team in order to be able to adequately care for historic structures.

Historic structure reports are necessary tools that guide management decisions and preservation efforts. Staff made good use of the historic structure report for the Raspberry Island Light Station during recent rehabilitation activities, but none of the park's other structures has been similarly studied. Staff understand the importance of these reports, however, and have requested funds to complete historic structure reports on the other light stations.

Staff at Apostle Islands have access to a historical architect who is stationed at the Park Service's Midwest Regional Office, but because this office serves parks in 13 states, little time is devoted specifically to the preservation of Apostle Islands' historic structures. The lack of full-time, professional restoration and maintenance guidance further underscores the need for historic structure reports that can be used by existing staff.

MUSEUM COLLECTION AND ARCHIVES—FULL-TIME STAFF NEEDED

Tools from family-run commercial fishing operations, artifacts from logging camps and brownstone quarries, items from the lighthouses, an

ELIZABETH MEYERS



insect collection, and furs and study skins collected from the islands' animal inhabitants are all parts of Apostle Islands' extensive museum collection and archive, which include more than 112,000 items. Particularly noteworthy are two Fresnel lenses. The lens from the Michigan Island Light Station is displayed at the park's visitor center in Bayfield, Michigan, along with tools used by the U.S. Life-Saving Service and other implements from the Great Lakes fishing and sailing industries. The Devils Island lens is still in place at the lighthouse; a lack of funds for preservation threatens the long-term integrity of this lens.

Totalling more than 91,000 objects, archaeological artifacts make up most of the museum collection. These are stored at the Midwest Archeological Center. Other museum objects are stored at locations throughout the park, most of which were not designed for that purpose. These facilities lack fire suppression and climate control systems, which leaves museum objects vulnerable to decay. Improved curatorial facilities are essential to protecting the collection and improving its accessibility.

A subject-to-furlough collateral duty curator provides care to the park's museum collection and archive for six months of each year. With full-time museum staff, the park would be able to improve museum collection access to researchers, address the backlog of uncataloged items, and complete a full inventory and condition assessment of the entire collection, which has not been done since 1990.

ETHNOGRAPHY—PARK TAKING STEPS TO UNDERSTAND AND INTERPRET RESOURCES

The Apostle Islands were not only the historic home of many Ojibwe tribes, but Madeline Island is recognized as the center of the Ojibwe nation. Park managers have begun to partner with the Ojibwe to interpret the importance of the area, and the recent

employment of an Ojibwe education specialist at the park will ensure interpretive programs are respectful and accurate.

Although progress is being made to begin illuminating Ojibwe connections to the Apostle Islands, very little ethnographic research has been done at the park to date. A report, *Traditional Ojibwe Resources in the Western Great Lakes*, completed by University of Arizona researchers provides a partial inventory of ethnographic resources of Apostle Islands, but a comprehensive ethnographic overview and assessment is still needed. A request for funds to complete this work has been submitted, and funds will likely be available in 2011. Other ethnographic research on the horizon includes an oral history project to collect memories and information from local residents, though funds have not yet been received for this project. This work will help staff more effectively interpret human connections to the Apostle Islands.

The Red Cliff and Bad River Bands of the Lake Superior Ojibwe are two groups with traditional associations to the Apostle Islands, and both have reservations nearby. The waters and forests of the islands continue to play important roles in the lives and cultural traditions of these groups, which means that frequent and effective communication and cooperation between park staff and these bands are needed to influence resource management at Apostle Islands. Park managers work to involve local tribes in the collaborative development of park management documents. Although nurturing relationships with these groups is time-consuming, both park staff and local tribal contacts agree that their relationships are generally good. Completion of an ethnographic overview and assessment will facilitate further efforts to reach out to local communities of traditionally associated peoples.



Travel to and among the Apostle Islands requires boats, and is restricted by winter weather and rising fuel costs.

STEWARDSHIP CAPACITY

FUNDING AND STAFFING—RESOURCE PROTECTION SUFFERING

The operating budget at Apostle Islands has slightly increased in the last few years (from \$2.1 million in 2000 to \$2.5 million in 2005), but these numbers are misleading because they do not account for inflation. When adjusted, the park's budget has barely increased from \$2.1 million to \$2.25 million. The result is that the park suffers from funding and associated staffing shortfalls that translate to difficulties protecting and preserving park resources. In addition, rising fuel costs and the difficulties

associated with getting to and from the islands affect all aspects of natural and cultural resources management at Apostle Islands.

In 2005, the park lost a biotech position because of funding shortages, which has prevented remaining staff from keeping on top of resource threats. In 2006, staff discovered that deer had begun colonizing another island—two to three years after the fact. Staff also discovered that gypsy moths are far more widespread on the islands than first thought, and that invasive spotted knapweed has been infesting part of Outer Island for at least two years. The park's size (21 islands spread out over an area the size of Rocky Mountain National Park) and the

logistical challenges involved with getting to and from all the islands makes it impossible for a staff of just two permanent natural resources employees to properly monitor and study the entire Apostle Islands.

Although the park is home to more than 150 historic structures, there is just one staff member responsible for the park's cultural resource management program. Additional staff are needed to gather baseline information, complete critical historic structure and cultural landscape reports, care for historic structures, and ensure resources are protected for the future.

PARK PLANS—STAFF NEEDED TO COMPLETE PLANS

With a diverse array of both natural and cultural resources protected within Apostle Islands National Lakeshore, park staff need a number of plans to guide management and preservation. Staff are currently engaged in updating the park's general management plan and developing wilderness management and harvestable wildlife management plans. This last plan is particularly overdue as hunting has been allowed in the park since its creation.

Historic structure reports and cultural landscape reports are needed for nearly all of the park's historic structures and cultural landscapes. Until that work is complete, nothing other than basic stabilization work can take place, and even that would be greatly aided with this critical documentation. Monitoring plans are also needed, but are low priorities because the park does not have the staff needed to implement such plans.

Staff shortages are the most critical concern. Even if funds were available, Apostle Islands does not have the staff necessary to complete needed plans and carry out the resulting directives.

RESOURCE EDUCATION—TOURS AND PROGRAMS REACH ADULTS AND SCHOOLCHILDREN

Visitors, local residents, and regional schoolchildren can learn about Apostle Islands resources through a variety of offerings. Guided tours of some of the park's lighthouses give insight into the lives of lighthouse keepers and the important roles they played ensuring the safety of ships traveling Lake Superior. Special programs such as the Bayfield Guest Lecture Series, Stockton Island Nature Walk, and Stockton Island Evening Program reach out to broader audiences with topics such as bog ecology, mushrooms, bears, fishing, and wilderness management. In partnership with the Park Service, Northland College's Sigurd Olson Environmental Institute operates an environmental education program called the Apostle Islands School. Each year during May, college students take fifth and sixth graders to the park and teach them about its natural and cultural resources.

With a permanent interpretive staff of just four people (one of them a six-month subject-to-furlough position), the park is unable to provide the desired level of visitor services, and the interpretive program has suffered cutbacks in recent years.

EXTERNAL SUPPORT—VOLUNTEER POSITIONS IN JEOPARDY

Understanding the history of the Apostle Islands enhances visitor experiences, but the park would be unable to provide many interpretive services without the help of dedicated volunteers. During summer months, trained volunteers live on several of the islands, lighting the light stations and interacting with visitors. The rising costs of transporting volunteers and supplies to and from the islands, however, means that these volunteer positions are threatened. Losing these opportunities for visitors to interact with park volunteers at the light stations would compromise visitor experiences.



ISLE ROYALE NATIONAL PARK



Isle Royale is an International Biosphere Reserve, and most of the terrestrial component is designated wilderness.

In the northwestern part of Lake Superior is Isle Royale National Park, a remote island archipelago about 60 miles north of Michigan's Keweenaw Peninsula and 35 miles south of Thunder Bay, Ontario. The park consists of one main island, which is about 45 miles long and nine miles wide, surrounded by about 400 smaller islands. Current park acreage is 571,790, though just 133,782 acres are terrestrial—the park includes submerged lands and aquatic

resources that extend 4.5 miles out into Lake Superior. Nearly all of the park's terrestrial acreage (99 percent) is federally designated wilderness. The park is also an International Biosphere Reserve, a designation given by the United Nations Educational, Scientific, and Cultural Organization to protected areas that "demonstrate a balanced relationship between humans and the biosphere."

Human use of Isle Royale includes copper

mining that began about 4,000 years ago and continued until the late 19th century. Isle Royale copper was traded widely by prehistoric peoples, and items made from it have been found throughout much of North America. Copper mining continued into historic times; Ojibwa people were mining Isle Royale copper when Europeans first passed through the region in the early 17th century. The Ojibwa called the island Minong (which could mean “a good place”), but its mineral riches prompted the French to give it the new name Isle Royale.

The Ojibwa retained ownership of Isle Royale until 1842, when it was ceded to Euro-American interests who worked to cash in on the island’s copper resources. Mining continued until it was no longer profitable; the last mine closed in 1893. In addition to copper, settlers made use of Isle Royale’s other abundant natural resources. In the early 18th century, fur companies began trapping furbearing mammals on the island, but fish eventually became the most important commercial product. Although corporate commercial fishing ended in 1841, family-run commercial fishing continued until 1994. Isle Royale was also logged, though the island had few large trees.

Recreational use moved to the forefront at Isle Royale in the mid-20th century. Pleasant summer weather and extraordinary scenery made the island an attractive place for resorts and private cottages.

The idea for a national park on Lake Superior began to gain momentum around 1920 after Albert Stoll, a writer for the *Detroit News*, visited the park and began publishing articles extolling the island’s beauty. Public support for the park grew, though a proposal for a state park and national monument failed. Eventually, Isle Royale National Park was authorized on March 3, 1931, though it wasn’t until April 3, 1940, that enough land had been acquired to officially establish the park.

RESOURCE MANAGEMENT HIGHLIGHTS

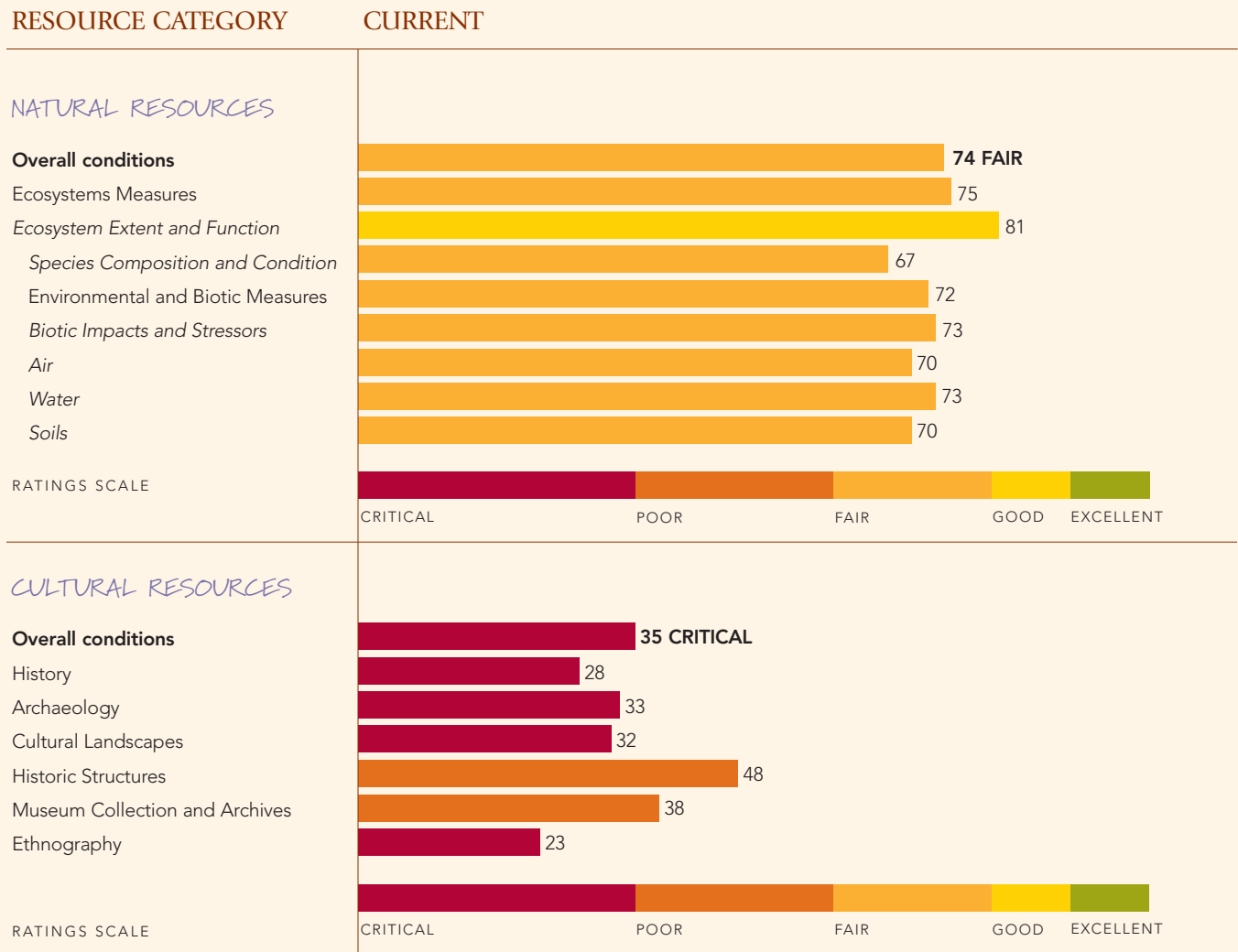
- Isle Royale is home to the longest-running study examining predator and prey relationships. Interactions between moose and wolves have been studied since 1958.
- Park staff use education and other efforts to minimize visitor effects on park resources. Interpretive rangers teach visitors about resources during boat rides to the island, campsites are located and designed to minimize ecological disturbances, boot brushes are provided to clean seeds from invasive plants off visitors’ shoes, and boaters are taught how to minimize the likelihood of transporting invasive aquatic species.
- Isle Royale has some of the largest and healthiest native freshwater mussel populations remaining in the Great Lakes. The park is also home to some of the most diverse and healthy lake trout populations in Lake Superior.
- Isle Royale has extensive freshwater sponge populations in some of its inland lakes. Little is known about these sponge colonies, except that, due to habitat loss and degradation in mainland lakes, they have become rare.
- Isle Royale is home to about one-third of the breeding common loon population in Michigan, where the species is listed by the state as threatened, and contains the only documented loon nesting areas on the Lake Superior shoreline.

Isle Royale is home to about one-third of Michigan’s breeding common loon population.



LEE KARNY / USFWS

Note: When interpreting the scores for natural resource conditions, recognize that critical information upon which the ratings are based is not always available. This limits data interpretation to some extent. For Isle Royale National Park, 80 percent of the information required by the methodology was available.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases before the park was established. The intent of the Center for State of the Parks is to document the present status of park resources and determine which actions can be taken to protect them in the future.

An assessment by Center for State of the Parks researchers indicates that, overall, natural resources are in “fair” condition with a score of 74 out of 100. Air and water quality are generally good, though concerns exist, while invasive plants are at a low enough level that park staff can successfully treat them and limit their spread. Cultural resources, however, rated an overall “critical” score of 35 out of 100. Important research and preservation projects are unfunded, cultural resources are not fully interpreted, and the park has just one cultural resources staff member who must also manage interpretive programs.

Isle Royale National Park is a remote island archipelago consisting of one main island surrounded by about 400 smaller islands.

KEY FINDINGS

- A history of human activities and natural disturbances has shaped the landscapes of Isle Royale. Two major events have significantly altered forest structure and composition. First, moose migration in the early 20th century introduced a large herbivore that browsed on island vegetation. Second, a fire in 1936 destroyed 20 to 30 percent of the forest overstory; evidence of this fire still remains in the island's forests.
- Mercury and persistent organic pollutants that are transported in the air and deposited in park waters are contaminants that have park managers most concerned.
- To meet natural resources management needs, Isle Royale needs funding for two more full-time, permanent positions (terrestrial ecologist and wilderness coordinator/database manager), one subject-to-furlough permanent position (geographic information systems/NEPA compliance), and two secure, base-funded seasonal positions (biotech and wilderness ranger).
- Just part of one staff person's time is devoted to cultural resources management at Isle Royale—a tall order given the size of the park and the extent of its cultural resources, which encompass 4,500 years of human history. Additional staff are needed to provide adequate care for cultural resources and to more fully address resource interpretation. Positions should include some combination of a cultural resource specialist, an education specialist, a museum or archival technician, a historical architect, and an archaeological technician.
- Limited cultural resources research has been done at Isle Royale. A variety of studies are needed to provide baseline knowledge of the park's archaeological, ethnographic, and historical resources so that park staff can develop plans to care for and interpret the resources. Important work to be done includes a historic resource study, historic properties management plan, historic structures reports, archaeological surveys, ethnographic overview and assessment, cultural affiliation study, and traditional use studies. Park staff have requested funds to complete a number of these studies, though it could be years before funds are available.
- Native peoples played a large role in the human history of Isle Royale for thousands of years, yet their stories are not interpreted as extensively as those of Euro-American settlers. Improved interpretive facilities and exhibits would allow the park to display more items from the museum collection and better communicate the park's history to the public. Currently, maritime history is the only theme portrayed in visitor center exhibits.





Lake Superior creates cool, moist environments near shorelines, which are favored by certain tree species. Forest composition changes inland as conditions become warmer and drier.

NATURAL RESOURCES

PARK HABITATS—AQUATIC AND FOREST ECOSYSTEMS DOMINATE

Aquatic habitats such as bogs, swamps, beaver ponds, streams, and lakes that range from a few acres to the almost 4,000-acre Siskiwit Lake dominate Isle Royale, and comprise more than 75 percent of the park's total acreage. This percentage also includes 408,173 acres of bays, nearshore waters, and offshore waters of Lake Superior. In addition, splash pools and rock pools dot the Lake Superior shoreline and host interesting species. Boreal chorus frogs (*Pseudacris maculata*), a state species of special

concern, are part of these communities on five islands. Arctic dragonflies (*Aeschna juncea*) are also found in splash pools where they prey on chorus frogs.

Isle Royale has two major types of bogs. Sphagnum bogs have little or no drainage, are dominated by mud sedge (*Carex limosa*), and feature sphagnum moss (*Sphagnum* spp.), Labrador tea (*Ledum groenlandicum*), black spruce (*Picea mariana*), and tamarack (*Larix laricina*). Cyperaceous bogs often have active water outlets, are dominated by woollyfruit sedge (*Carex lasiocarpa*), have less Labrador tea and sphagnum cover, and have a tamarack and northern white cedar (*Thuja occidentalis*) overstory.

Lake Superior plays a major role in governing forest vegetation patterns at Isle Royale. The lake creates cool, moist conditions near shorelines, which favor boreal forests of balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), aspen (*Populus* spp.), and mountain ash (*Sorbus americana*) with understories of large-leaved aster (*Eurybia macrophylla*), thimbleberry (*Rubus parviflorus*), and Canada dogwood or bunchberry (*Cornus canadensis*). Moving inland, this lake effect dissipates, and warmer, drier conditions favor northern hardwood forests of sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*). These forests are more widespread on the west end of the island where soils are deeper and the island is about eight miles wide. Perhaps the largest tract of undisturbed and unaltered forest on Isle Royale is the sugar maple forest centered on the west end of Greenstone Ridge.

Northern red oaks (*Quercus rubra*) grow along dry hillsides, while jack pines (*Pinus banksiana*) are typically found on dry, open ridges and bluffs with a past history of fire. Eastern white pines (*Pinus strobus*) and red pines (*Pinus resinosa*) also often grow along ridges mixed with jack pines or on lake shorelines as individual trees or grouped in small patches.

NATURAL DISTURBANCES AND HUMAN ACTIVITIES—ECOSYSTEMS AFFECTED

Although significant disturbances at Isle Royale have been minimal in recent years, fire, flood, drought, grazing by native wildlife, wind throw, logging, mining, and other natural disturbances and human activities have all affected park ecosystems to one degree or another at various times. Fires set by miners in the 1800s reduced forest cover and favored regeneration of early successional species. In 1936, a fire near a logging camp consumed 20 to 30 percent of forest cover on the island. Wind throw occurs predominantly on the

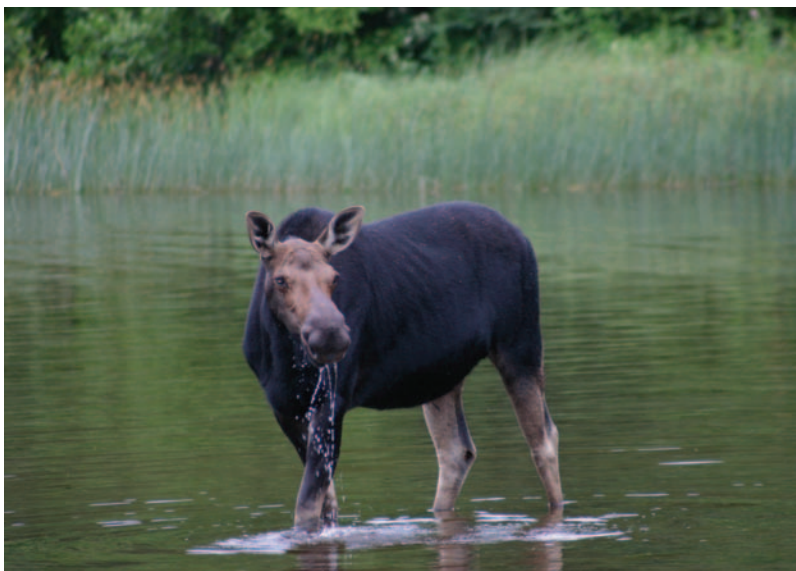
northeast side of the island; communities in this area seem to rebound quickly.

The arrival of moose (*Alces alces*), which likely swam 14 miles from the mainland in the early 1900s, set in motion dramatic ecosystem changes at Isle Royale. Without any significant predators to keep populations in check, moose began to overwhelm the natural carrying capacity of the island, eating palatable species and ultimately altering forest composition and structure.

Balsam fir, an important component of moose winter diets, was hit particularly hard. Once a dominant canopy tree species on the island, scientists predict that firs will never again dominate Isle Royale's forests if moose herbivory continues at the present rate. Moose have also affected other species such as aspen, mountain ash, willow (*Salix* spp.), and birch. Canada yew (*Taxus canadensis*) has been almost completely eliminated from Isle Royale's forests. Disappearance of this flammable species has likely contributed to changes in the park's fire regime.

Since Euro-American settlement, only 39 percent of Isle Royale's forests have not undergone major changes that were influenced by moose browse, fires, and other disturbances. Forests of pine, oak, and northern mesic species are now less than half the size they were before Euro-American settlement, while aspen-birch forest parcels and nonforested areas have more than doubled in size. These changes act as

Moose arrived at Isle Royale in the early 1900s. Their browsing has dramatically altered forest composition and structure.



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ISOLATION CAN BE PROBLEMATIC

Isle Royale's isolation and relative inaccessibility have served to protect resources, but to limit animal migrations, which has resulted in effects on genetic diversity and population structure in terrestrial and inland aquatic taxa. The island is inhabited by only about one-third of the mammal species found on the neighboring mainland. Isle Royale lacks porcupine (*Erethizon dorsatum*), coyote (*Canis latrans*, extirpated when wolves arrived), white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), bobcat (*Lynx rufus*), fisher (*Martes pennanti*), red-backed vole (*Clethrionomys gapperi*), short-tailed shrew (*Blarina brevicauda*), and chipmunk (*Tamias striatus*). Moose and gray wolves are present at Isle Royale, but are relatively recent immigrants that arrived around 1900 and 1950, respectively. The isolation of the island provides ideal conditions for studying population ecology. Researchers have been studying interactions between wolves and their primary prey (moose) since 1958.

The inability of island-bound species to migrate has resulted in a lack of genetic diversity. There are about 21 wolves on the island now, distributed across three packs. The wolf population continues to face a high rate of inbreeding that could lead to local extinction. Deer mice (*Peromyscus maniculatus*) populations on small islands surrounding Isle Royale are also very inbred and are more susceptible to extinction than those on the mainland. Because it is a national park and a federally designated wilderness area, management or alternation of naturally occurring phenomena such as extinction (through reintroduction of an extinct species, for example) is unlikely.

Isle Royale's isolation and relative inaccessibility have led to a lack of genetic diversity within wildlife populations.



BRENDA MORASKA LAFRANCOIS / NATIONAL PARK SERVICE

dispersal barriers and may influence the distribution and migration of plant and animal species on the island.

Although Isle Royale is remote and somewhat difficult to access, it is not completely isolated from its surroundings. When winds blow from the northwest, the odor of paper mills drifts across Lake Superior from the industrial port of Thunder Bay in Canada. At night, pollution from billowing smokestacks compromises views of starry skies. Other intrusions on the park's wilderness setting include contrails from aircraft and noise pollution from both air and watercraft. Isle Royale's remote location provides examples of the effects of human industrial activities on an isolated wilderness island. Researchers study the deposition of airborne pollutants such as mercury and sulfur dioxide and their movement through island food webs.

PARK PLANTS AND WILDLIFE—SOME POPULATIONS THRIVING, OTHERS STRUGGLING

Isle Royale is home to about 700 vascular plant, 482 lichen, 14 mammal, 3 reptile, 7 amphibian, 60 fish, and 240 bird species. Some of these are specially protected by federal or state designations. Isle Royale harbors one species federally listed as threatened (the bald eagle, *Haliaeetus leucocephalus*), and several federally listed species of concern. The gray wolf (*Canis lupus*) was recently removed from the endangered species list in the western Great Lakes. There are three fish, one mammal, 12 bird, and 48 plant species that are listed by the Michigan Department of Natural Resources as either threatened or endangered, and at least 22 other plants and animals listed as species of special concern, including the boreal chorus frog. In addition, Isle Royale ragwort (*Senecio insulae regalis*), a plant species endemic only to Isle Royale, was recently identified.

Species present in the Lake Superior fish community at Isle Royale appear to have



Wolves have inhabited Isle Royale since about 1950. Researchers have studied their interactions with moose since 1958.

changed little since a survey done in 1929. Isle Royale's lake trout (*Salvelinus namaycush*) population is the first one in the Great Lakes to have recovered from sea lamprey (*Petromyzon marinus*) predation. Sea lampreys are still in Lake Superior waters of the park, but control measures appear to have eliminated spawning in park streams. The park's lake trout population is also the most genetically diverse in the lake, possessing levels of genetic diversity found historically. Herring (*Clupea* spp.) populations have also rebounded in the park.

Overfishing and loss of spawning habitat across Lake Superior are thought to be the leading causes of the decimation of coaster brook trout in the lake. This anadromous (migrating from salt water to spawn in fresh water) version of the brook trout (*Salvelinus fontinalis*) has historically been a popular sport fish at Isle Royale. Currently, Isle Royale is one of the last known places where viable (but depleted) populations of coaster brook trout exist.

Some mammals also appear to be struggling.

Beaver populations (*Castor canadensis*) on Isle Royale have been declining since the mid-1980s. This has been attributed to a scarcity of food because of moose browsing and subsequent predation by wolves when beavers stray from their home territories in search of food. The moose population has fluctuated from record high numbers (nearly 2,500 in the mid-1990s) to the current estimate of under 400 individuals, the lowest number ever recorded during the annual wolf/moose study at the park. The major direct cause of mortality is wolf predation. The current ratio stands at about 18 moose for every wolf on the island, which means predation pressure on remaining moose is very high. Moose ticks also may be an important factor in the moose decline as they weaken the animals and make them easier prey for wolves.

INVASIVE SPECIES—PREVENTION IS KEY
Non-native aquatic species are of the most concern at Isle Royale and include Pacific salmonids, sea lamprey, Eurasian ruffe (*Gymnocephalus cernuus*), and spiny water flea

(*Bythotrephes cederstroemi*). These species have been found in the park's Lake Superior waters but not in the inland lakes of Isle Royale. Spiny water flea can disrupt the base of the food web by competing with filter feeders and small fish for food. Only large fish are able to consume the fleas because of their spines, so the population of this non-native species can grow rapidly. The park has instituted a prevention program to help keep spiny water fleas from being transported by visitors to inland lakes. (No data are available on the likelihood of inland transport by moose and aquatic bird species.) No zebra mussels (*Dreissena polymorpha*) or round gobies (*Neogobius melanostomus*) have been reported in the area yet, but are a concern for the future.

Invasive plants include spotted knapweed (*Centaurea biebersteinii*), creeping bellflower (*Campanula rapunculoides*), mountain bluet (*Centaurea montana*), garlic mustard (*Alliaria petiolata*), reed canary grass (*Phalaris arundinacea*), and narrow-leaf cattail (*Typha angustifo-*

lia). These non-natives only make up 15 percent of the park's total plant species, and they do not cover extensive areas, which means that they are at a low enough level to be successfully controlled. Park crews fight invasive plants with herbicides and physical removal. A team is mobilized once each season for 12 to 14 days to treat frontcountry and large outbreak areas. Seasonal staff assist with backcountry control efforts. Monitoring and research is also ongoing on rare plants thought to be most at risk from invasive species.

Visitors can unknowingly spread invasive plants by transporting seeds on their shoes, while fishing equipment and boats can harbor small animals such as spiny water fleas and zebra mussels. Park personnel tell visitors about these dangers, supply boot brushes at park docks to clean shoes of unwanted seeds, and focus on visitor and staff education and prevention to limit the spread of invasive species.

Boot brushes allow visitors to clean seeds off their shoes, which helps prevent the spread of unwanted invasive plants.





CULTURAL RESOURCES

HISTORY—DIVERSE CULTURAL RESOURCES DESERVE STUDY

Human history at Isle Royale dates back at least 4,500 years, and includes activities ranging from copper mining to hunting, fishing, fur-trading, navigation, shipping, and vacationing. Some of the park's historical resources include ten significant shipwrecks, four lighthouses, a restored fishing camp, resort-era cabins and homes, and several mining sites. Although Isle Royale has diverse historical resources, little work has been done to evaluate them. No historic resource studies have been done on the park's terrestrial

resources, other than an archaeological survey of a small portion of the park, but a study of the park's submerged resources—primarily shipwrecks—was completed in 1987. Additional studies are needed to round out understandings of Isle Royale's other important cultural resources so that park staff can adequately protect and interpret them. Park staff have identified several historical research projects that they would like to pursue, but all are contingent upon the availability of funding.

The park's chief of interpretation and cultural resources is a historian by training, but the time available to spend on historical research is limited because of other duties. This

Isle Royale's Minong Mine is a copper mine that dates to the 1870s. This shaft reaches back about 60 feet.

Rock Harbor Lighthouse, built in 1855, guided ships from Lake Superior to mining sites in the Rock Harbor Channel.



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staff member is responsible for all cultural resources matters at Isle Royale. Because there are no other cultural resources personnel on staff, the park relies on assistance from the Park Service's Midwest Regional Office. Hiring a cultural resource specialist and an interpretation/education specialist at Isle Royale would allow more time for the study, documentation, and interpretation of the park's history, which is virtually impossible now.

ARCHAEOLOGY—JUST 4 PERCENT OF PARK HAS BEEN INVENTORIED

Evidence of Isle Royale's human history is found throughout the park. Prehistoric miners left behind stone tools and nearly 1,000 pit mines, while artifacts from shipwrecks, fishing camps, and lighthouses tell of more recent inhabitants. Isle Royale does not have a staff archaeologist; instead, the park relies on assistance from the Midwest

Archeological Center (MWAC). An archaeological survey conducted by MWAC between 1987 and 1990 covered the Lake Superior shoreline, some inland lakes and portages, and interior trails. The survey documented 107 sites that included several prehistoric ones from the Archaic and Woodland Periods as well as historic fisheries, mines, and resort-era sites. Archaeologists collected a total of 7,400 artifacts such as ceramics, weapons, pottery shards, and mining tools; they are stored at MWAC.

In 1999, MWAC completed an archaeological inventory of Ghyllbank, an 1890s copper mining settlement. In the process of inventorying the site, researchers discovered an old dump that was once used by a private hunting club. China fragments that were found indicate the dump was used around the turn of the 20th century. Research at this site could provide further insight into the lives of the people who vacationed at Isle Royale's resorts. Nearby trails and roads make the site vulnerable to erosion and pot hunters.

The waters around Isle Royale proved perilous for ships on several occasions—there are ten shipwrecks within park waters. These sites were surveyed in 1987, and the information gained is especially useful to scuba divers interested in visiting the wrecks, but the park lacks a plan for managing the wrecks into the future. Partnering with the Great Lakes Shipwreck Preservation Society could be a great way to stabilize the shipwrecks and educate recreational divers about the preservation of submerged resources.

Counting the MWAC and shipwreck surveys, only about 4 percent (about 5,000 acres) of Isle Royale has been inventoried for archaeological resources, leaving undocumented resources vulnerable to unintentional damage from staff and visitor activities. Work is needed along the shoreline to identify sites that could be threatened by erosion; surveys are also needed in the island's interior to identify sites that could be

affected by hikers and campers. Twenty-five of the park's 36 current campgrounds are located on significant archaeological sites.

Of the 179 identified archaeological sites listed in the Archaeological Sites Management Information System, the conditions of 168 are unknown and just one—the Minong Mine—is on the National Register of Historic Places. This site is the park's largest continuous area of copper mining from the prehistoric era. Condition assessments are needed, and other prehistoric and historic sites should be evaluated for inclusion on the National Register.

Additional research is needed to contribute to greater knowledge of the island's cultural history. The park has requested funds to inventory aboriginal copper mining sites, historic fishing sites, light stations, submerged components of terrestrial sites, historic mining sites, and interior lakes and portage trails.

CULTURAL LANDSCAPES— MANAGEMENT STRATEGIES NEEDED

People have lived on Isle Royale for thousands of years, each group adapting to the landscape in some ways and changing the landscape in others. The park has identified 18 potential cultural landscapes, which include fishing camps, mining sites, lighthouses, summer

cabins, and resort sites. Just one landscape—Barnum Island, which has a resort and commercial fishing history—is listed on the park's cultural landscape inventory. No landscapes are listed on the National Register of Historic Places.

The park has requested funds to complete cultural landscape reports for Barnum and Washington Islands. Washington Island had a resort and numerous commercial fishing operations, including one belonging to the Sivertson family, which still has a commercial fishing special use permit that allows for continued fishing in the park. These reports will help park staff interpret and manage the cultural landscapes on these islands.

Other cultural landscapes include the Rock Harbor Lighthouse and the Edisen Fishery. The lighthouse, which is no longer illuminated, was built in 1855 and is the oldest among the park's four lighthouses. Edisen Fishery includes the home, fish house, and equipment of Peter and Laura Edisen, commercial fishers on Isle Royale from the 1910s to 1976.

Isle Royale does not have a landscape architect on staff, and park employees receive little cultural landscapes training. Isle Royale occasionally makes use of the landscape architect and historical architect on staff at nearby Keweenaw National Historical Park.

Washington Island had many commercial fishing operations. The Sivertson family still has a commercial fishing operation on the island.

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Wooden structures remaining from Wendigo Mine are susceptible to the gradual damage that results from exposure to the elements.

Cultural landscapes at Isle Royale are threatened primarily by a lack of management strategy and planning. Resources will benefit if the park receives requested funds to complete cultural landscape reports for Washington and Barnum Islands, funds to support invasive species control, and funds to support general cultural landscape management.

HISTORIC STRUCTURES—FUNDS NEEDED FOR PLANNING AND PRESERVATION

Isle Royale is home to about 180 structures, 145 of which are on the list of classified structures. The other 35 structures have not been determined to be significant or eligible for the National Register of Historic Places. Just four of the listed structures relate to the park's mining history—the Island Mine Powder House, the Rock Harbor Lighthouse, and the Wagon Road and Blacksmith Shop Ruins at Minong Mine. Most of the others were built by fishermen, farmers, or summer residents. Many of them were intended to be temporary structures.

Three other lighthouses in addition to Rock Harbor (1855) are among the park's historic structures—Isle Royale Light Station (1875), Passage Island Light (1882), and Rock of Ages Light (1908). Rock Harbor Lighthouse was built to serve the copper mining industry operating on Isle Royale at the time. It marked the passage from the lake to the mining sites in the Rock Harbor channel. Isle Royale Light, on Menagerie Island south of Isle Royale, guided ships to the Island Mine wharf in Siskiwit Bay. The Passage Island Light, on Passage Island off the northeastern end of Isle Royale, directed mariners to silver mines on Silver Inlet and marked the safe passage at the end of Isle Royale for ships running in and out of Port Arthur and Fort William. Today the light guides vessels to the port of Thunder Bay, Ontario. Rock of Ages Light, five miles off the southwestern end of Isle Royale, was built to warn Duluth-bound ships of the rocky shoals. In spite of the light, dense fog caused the passenger ship *George M. Cox* to strike the Rock of Ages Reef in 1933. All of the ship's 120 passengers took turns keeping warm in the lighthouse as they awaited rescue. Only the Rock Harbor Light is under Park Service control; the other three are owned and operated by the U.S. Coast Guard. All four are on the National Register of Historic Places.

The biggest threats to historic structures are the gradual damage that results from exposure to the elements and lack of funding for maintenance. Isle Royale does not have any base funding for historic building preservation and planning as required by the National Historic Preservation Act, and most of the park's historic structures show moderate to serious signs of deterioration. Deep snows and ice are common in winter, while summers are cool and damp—conditions that foster decay and rot, especially in log structures. Consequently, immense restoration efforts would be needed to preserve these sites as cultural resources.

There are no existing maintenance plans for historic structures, annual inspections and

monitoring programs are not in place, and a lack of funding means that the Park Service is unable to do much to improve the conditions of historic structures. But some help has come through the work of volunteers. During summer 2006, members of the Isle Royale Natural History Association completed necessary maintenance work on former resort homes to be used as housing for the park's Artist in Residence Program. In 2005, the group restored a resort cabin at Chippewa Harbor. Both projects were funded by the Park Service and the natural history association.

Research and planning are needed to guide historic structure preservation at Isle Royale. A top priority is creating a historic properties management plan, which would help staff manage cultural landscapes and historic structures. Also needed are historic structure reports. None of the park's historic structures has been evaluated through a historic structure report, though staff have submitted requests for funding to complete reports for several buildings.

Park resources would also benefit from the care of an on-site historical architect to develop preservation plans and maintenance schedules. Right now, the park relies on assistance from a historical architect, historical landscape architect, and historic preservation specialist from Keweenaw National Historical Park and the Park Service's regional office. Current staff members have good, basic knowledge of historic preservation, but access to specialized training would help existing staff better understand how to care for historic structures.

MUSEUM COLLECTION AND ARCHIVES—STORAGE CONDITIONS IMPROVING, STAFF AND EXHIBIT SPACE NEEDED

Commercial fishing gear, household items from resorts and farms, shipwreck artifacts, mining tools, handmade Ojibwa birch-bark baskets and a birch-bark and canvas canoe, spear and arrow points, pottery fragments, photos, and corre-

spondence are all parts of Isle Royale's museum collection and archives. In sum, the park's holdings include 89,668 items.

Archaeological artifacts, which make up the bulk of the collection, are stored at the Midwest Archeological Center in Lincoln, Nebraska, while the rest of the items are stored in a facility at park headquarters in Houghton, Michigan. Park staff recognized deficiencies in the Houghton storage facility, and they are taking action to remedy the situation. New cabinets, updated climate controls, repairs to the facility's doors, and reorganization to maximize available space will greatly improve conditions for the collections.

Proving adequate care for the museum collection and archives is difficult because the park lacks staff solely dedicated to these resources. Curatorial work is a collateral duty of the park's chief of interpretation and cultural resources, but many other duties limit the amount of time spent on the collections.



Although there is little space at the park to interpret museum objects, visitors can see the original Fresnel lens from the Rock of Ages Lighthouse displayed at the Windigo Visitor Center.

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Isle Royale used to have a museum technician to assist with cataloging and general care, but this position was cut because of a lack of funding. Staffing shortfalls translate to uncataloged collections and outdated museum management plans. Less than 20 percent of the museum collection has been cataloged, and there is no up-to-date plan in place to guide care of the museum collection and archives. Although museum professionals from nearby Keweenaw National Historical Park are happy to help at Isle Royale when needed, resources would benefit from the addition of on-site staff. Park staff have requested funds to support an archivist and a museum technician, as well as funds to complete cataloging and archival work.

There is little space at the park to interpret museum objects and archives. The Windigo Visitor Center on the southwest corner of Isle Royale houses some items, including the original Fresnel lens from the Rock of Ages Lighthouse, but access is limited to the summer months when the park is open. The park may partner with Keweenaw National Historical Park to build a new, shared visitor center.

ETHNOGRAPHY—AMERICAN INDIAN CONNECTIONS NOT STUDIED OR INTERPRETED

When Europeans arrived, Ojibwa lived throughout the western Lake Superior region. Isle Royale was a great location for hunting, fishing, trapping and maple sugaring. In the mid-19th century, four treaties ceded tribal lands to the U.S. government. Although the Treaty Cession of 1842 extinguished most American Indian rights to Isle Royale, the Ojibwa people still retain rights on the island for hunting, fishing, and gathering. Several groups of Ojibwa people remain in the Isle Royale region today in Michigan, Minnesota, and Wisconsin. Those living in Canada are referred to as First Nations Peoples. Other groups with ties to

Isle Royale include Scandinavian fishermen and owners of resort cabins.

The Park Service has a responsibility to protect park resources that are important to traditionally associated groups. Although the park consults with associated American Indian groups on major planning efforts, there are no regular meetings with them to cultivate meaningful relationships because of staffing and funding limitations. Isle Royale has access to anthropologists at the Park Service Midwest Regional Office, but on-site staff are not provided with any training related to the protection and preservation of ethnographic resources.

Very little work has been done to identify ethnographic resources at Isle Royale. Other than an ethnographic study of Scandinavian commercial fishermen, there is neither an ethnographic resource inventory nor an ethnographic overview and assessment in place, and there have not been any traditional use, ethnographic landscape, cultural affiliation, lineal descent, or ethno-history studies. Park staff have gathered oral histories from people associated with Isle Royale's fishing and resort eras. These are housed in the park's archive, though they have not yet been transcribed, indexed, or cataloged.

Interpretation of ethnographic resources is lacking, especially with regard to American Indian connections to Isle Royale. The park's interpretive programs do not include information on prehistoric mining activities, history and culture of the Ojibwa, or the modern lives of the Ojibwa. Native peoples have played important roles in the human history of Isle Royale for thousands of years, yet their stories are not well communicated to park visitors.



STEWARDSHIP CAPACITY

FUNDING AND STAFFING—CRITICAL NEEDS UNMET

Isle Royale is unable to meet critical needs as a result of insufficient funding, which results in staffing shortfalls. For natural resources, the park can no longer update and implement management plans, update geographic information systems (GIS) data, manage data generated by park research, survey rare species and monitor others, sustain the wilderness ranger program, monitor mercury, or study the long-range transport of airborne contaminants.

In 2003, Isle Royale's Natural Resources

Branch, which had been operating with a funding shortfall of 51 percent, was upgraded to division status without any increase in funds or staff. The division has two permanent, full-time staff, and it has become increasingly difficult to provide base funds for even one seasonal biotech to conduct in-house biological monitoring and provide research support. The division can no longer support its two seasonal wilderness ranger positions. To meet current needs, the Natural Resources Division needs funding for two more full-time, permanent positions (terrestrial ecologist and wilderness coordinator/database manager), one subject-to-furlough permanent position (geographic infor-

Isle Royale's interpretive division includes just two permanent staff, ten seasonal staff, and five volunteers—not enough to adequately serve visitors.

High school volunteers help salvage materials from the Savage Boathouse, which collapsed.



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mation systems/NEPA compliance), and two secure, base-funded seasonal positions (biotech and wilderness ranger).

Cultural resources also suffer as a result of funding and staffing shortfalls. Isle Royale is home to more than 140 historic structures that are eligible for the National Register of Historic Places, but lacks any carpenters with historic preservation training. Existing staff who have the skills to complete preservation work are inundated with other projects. The park also lacks base funding for historic building preservation and planning, though this is required by the National Historic Preservation Act. Finding other money to support historic preservation is difficult, with parks competing with one another for limited funds. During the past five years, Isle Royale has only received limited funding for critical stabilization projects.

The park needs an archaeological technician, historical architect, museum technician, and interpretation/education specialist to address cultural resources management needs and objectives. With these positions, the park

could implement a proactive cultural resources inventory and monitoring program, establish a historic preservation maintenance program, and reestablish a curatorial program.

PARK PLANS—STALLED BECAUSE OF FUNDING SHORTAGES

Isle Royale's general management plan provides little guidance for the long-term management of cultural resources. One of the park's highest priorities is to complete a historic properties management plan to guide the preservation, interpretation, and visitor use of cultural resources. A lack of funding and staffing stands in the way of this project, and has slowed down completion of several natural resources management plans that address wilderness and backcountry, water resources, fish, and oil spills.

RESOURCE EDUCATION—OPPORTUNITIES DECLINING AND SOME RESOURCES NOT INTERPRETED

In 2005, Isle Royale reached 64,521 people with personal interpretive programs that focused on

various natural and cultural resources themes. The interpretive division includes just two permanent staff, ten seasonal staff, and five volunteers—not enough to adequately serve visitors. As a result, the park no longer offers off-site interpretive services or environmental education on the mainland, and the number of evening programs on the island has declined.

Isle Royale has three visitor centers, which are located at Rock Harbor, Windigo, and Houghton. The Rock Harbor Visitor Center does not contain any exhibits, while the other two have limited exhibits. Only the Windigo Visitor Center, which was built in 1998, is large enough to adequately serve visitors. The Rock Harbor Lighthouse is the only location that has an up-to-date professional exhibit.

Interpretation of some cultural resources is lacking. For example, many hikers pass by the Siskiwit Mine as they travel along the Rock Harbor Trail, but there are no wayside interpretive panels (except for safety warnings) or brochures explaining the large holes in the ground and nearby tailings piles. Interpretive booklets that were written in the 1960s and 1970s were once available to teach visitors about lighthouses, mining, and fishing, but they are now out of print. Several copper mines are noted on park maps, yet no additional information is provided. Even the park's website makes no mention of any cultural resources. Additional cultural resources research would serve as a basis for expanding interpretation.

EXTERNAL SUPPORT—VISITOR SERVICES AND RESOURCES BENEFIT

Volunteers help with many aspects of park operations such as maintenance, interpretation, and resource management. They work on trails, maintain campgrounds, collect park fees, present evening programs, staff visitor centers, remove invasive plants, and survey breeding and nesting birds. Without this assistance, Isle Royale staff would be unable to provide the same level of visitor services and

resource protection. Other support comes from the Isle Royale Natural History Association, Isle Royale Boaters Association, and Isle Royale Institute. The Isle Royale Natural History Association publishes educational materials and funds park research projects, while the Isle Royale Institute partners with the Park Service, Michigan Technological University, and the University of Minnesota at Duluth to foster research and outreach.

The park has cut some interpretive services because of insufficient staff.



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KEWEENAW NATIONAL HISTORICAL PARK

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Keweenaw National Historical Park

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The Quincy Mining Company operated continuously from 1856 to 1931 and then again from 1937 to 1945.

The Keweenaw Peninsula is a finger of land in northern Michigan that is surrounded by the waters of Lake Superior. The peninsula's geological distinction is its location on what many consider to be the world's largest lava flow, which resulted in the largest concentration of pure copper in the world. People have long known about the mineral wealth of the Keweenaw Peninsula; for 7,000 years different groups mined its copper. Native peoples used

the ore to make tools, weapons, and decorative items, which were widely traded and have been found in many places across North America.

During the 19th and 20th centuries, Euro-American settlers created a copper industry of national and international importance. Two mining companies in particular rose to prominence. The Quincy Mining Company mined continuously from 1856 to 1931 and then again from 1937 to 1945, while the Calumet and

Hecla Mining Company, established in 1871, became one of the nation's most significant copper producers. It was also the backbone of the region's economy, providing employment for thousands of people, most of whom were immigrants drawn to the Keweenaw to work in the mines and related sectors.

When Calumet and Hecla closed in 1969, severe economic and social hardships followed in the Keweenaw region. Some mining structures were sold, to be torn down and scrapped, while others were lost through neglect. Some community members recognized the significance of the region's mining history, however, and worked to preserve the area's heritage.

In 1992, the federal government formally recognized the importance of Keweenaw copper mining to our nation's heritage and established Keweenaw National Historical Park (Keweenaw) to tell the story of copper production along Lake Superior's shores. Both the organization and administration of the park are unique within the National Park System. Although the park's boundary includes 1,869 acres, just 134 are actually owned by the Park Service. Other lands are owned and operated by local and state agencies, nonprofit organizations, and private entities. When the park was created, Congress directed the Park Service to work in partnership with these other entities to preserve and interpret copper mining history. The Keweenaw National Historical Park Advisory Commission administers a program of Keweenaw Heritage Sites, which are private, nonfederal places that contribute to telling the full copper mining story and are open to the public.

Keweenaw is composed of two units—Quincy and Calumet—that are separated by 12 miles. The park encompasses two National Historic Landmark (NHL) districts: the Quincy Mining Company NHL District and the Calumet and Hecla Industrial NHL District. These NHLs are the foundations of the park

RESOURCE MANAGEMENT HIGHLIGHTS

- During the 1970s and 1980s, many historic buildings in the Keweenaw region were demolished, destroying reminders of the region's copper-based cultural heritage. Creation of Keweenaw National Historical Park provided an opportunity for the National Park Service and community partners to step in and save some of the remaining structures. The Park Service has rehabilitated the exteriors of the Calumet and Hecla Mining Company General Office Building and the Union Building, and has stabilized the ruins of several other structures.
- Cooperation between Keweenaw National Historical Park and a host of heritage sites has drawn tourists to the region, and has helped ensure that all aspects of the region's mining history are preserved and interpreted.
- Park staff provide training and technical assistance to partner groups in museum management and interpretation, which helps ensure the story of copper mining is more comprehensively protected and shared.

Creation of Keweenaw National Historical Park provided an opportunity for the National Park Service and community partners to save some of the remaining structures related to the copper boom such as the Union Building.



NATIONAL PARK SERVICE / DAN JOHNSON

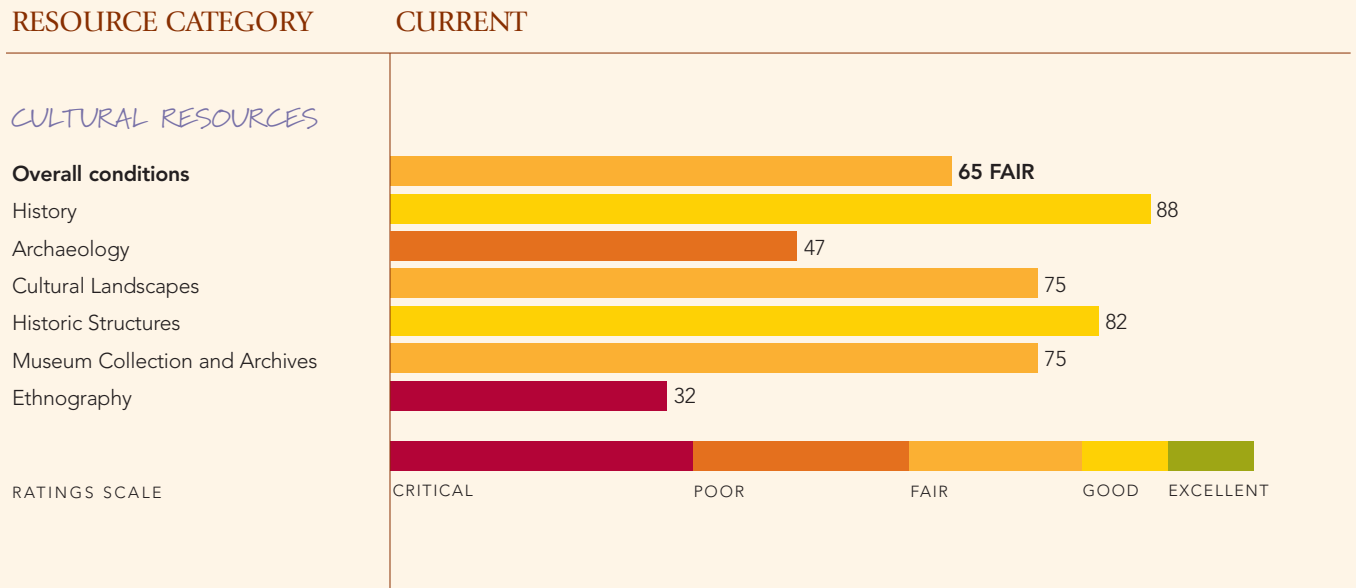
units and distinguish the resources contained in them from other historic districts found in the Keweenaw Peninsula.

The park’s Calumet Unit, which covers about 750 acres in Calumet, Michigan, includes administrative buildings, mine structures, and the associated landscape of the Calumet and Hecla Mining Company. The Park Service owns the company’s historic General Office Building, which now serves as the park headquarters and visitor contact station, as well as several other buildings. The Calumet Unit also includes four heritage sites and encompasses the Calumet Downtown Historic District.

The Quincy Unit, which covers about 1,120 acres just northeast of Hancock, Michigan, focuses on the Quincy Mining Company. Most of the unit is owned and interpreted by the Quincy Mine Hoist Association, a nonprofit organization and official heritage site. The Park

Service owns the Quincy Mine Office, which currently houses the Isle Royale Natural History Association (which also serves Keweenaw), Pine Mountain Music Festival offices, and the George Wright Society.

An assessment by Center for State of the Parks researchers indicates that, overall, cultural resources are in “fair” condition with a score of 65 out of 100. As the park does not have any significant natural resources, none were addressed by this assessment. The area’s history is well-studied, and rehabilitation work on two historic structures has returned their exteriors to their former appearances. The park’s archaeology program struggles, in part, because few acres are actually owned by the Park Service. Resources on these lands have not been identified and are vulnerable to development. The park’s ethnography program has yet to be developed.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases pre-dating the park’s creation. The intent of the Center for State of the Parks is to document the present status of park resources and determine which actions can be taken to protect them in the future.

KEY FINDINGS

- Keweenaw National Historical Park's boundary includes 1,869 acres, but just 134 are actually owned by the Park Service. Other lands are owned and operated by local and state agencies, nonprofit organizations, and private entities. Protecting resources on these nonfederal lands is complicated and often requires cooperative agreements. Development on private lands both within and adjacent to the park threatens historic structures, cultural landscapes, and archaeological sites.
- Very little archaeological work has been done at Keweenaw, and understanding resources is complicated by the Park Service's limited land ownership within park borders. Staff are monitoring these acres now, but effectively identifying and protecting archaeological resources on nonfederal lands is difficult, which leaves these resources vulnerable to threats such as development and looters.
- The park is home to many cultural landscapes; five of these are managed by the Park Service and have been inventoried. Others are owned and managed by park partners and private landowners. Park staff are working on a cultural landscape report for the Quincy Unit of the park, and will then focus efforts on a cultural landscape report for the Calumet Unit. The Park Service is charged with protecting cultural landscapes, yet few are within federal ownership. As a result, preserving the integrity of cultural landscapes proves challenging, and is complicated by the lack of guidelines, regulations, and land use planning on the part of local governments.
- Historic structures are key resources that make it possible for Keweenaw National Historical Park to interpret the region's mining history. Work has been done to rehabilitate exteriors of two of the park's historic structures and to stabilize several historic ruins, but additional funds are needed for interior rehabilitation and routine maintenance. At current funding levels, the park's maintenance staff are only able to react to problems once they have been identified, rather than to give structures the routine care needed to prevent the problems. The cost of the park's deferred maintenance and rehabilitation needs tops \$12.5 million.
- It has been nearly 40 years since Calumet and Hecla ceased operations, but many of their former employees, as well employees of other copper companies, still reside in the area and represent important resources. An active oral history program is collecting and transcribing interviews in order to enhance the understanding of historic resources and ensure that these stories are not lost.
- The museum collection and archives at Keweenaw include equipment from mining operations as well as an abundance of historic photographs, glass-plate negatives, and paper records from the mining companies and other sources. Park staff have requested funds to upgrade storage facilities and digitize and catalog the historic photo collection, which would allow them to make these resources available online.
- Keweenaw National Historical Park lacks a visitor center. Establishing one would allow the park to provide additional visitor services, such as an orientation film, year-round access to information and rangers, focused overview of the Keweenaw Heritage Sites, a history association sales outlet, and exhibits that interpret the park's primary themes and significance. There would also be space for exhibits that display museum objects. Currently, the Park Service relies on outside partners to interpret many facets of the copper mining story.
- An ethnographic overview and assessment is needed to determine connections to traditionally associated peoples and identify important ethnographic resources within the park. Such work could also lead to increased interpretation of American Indian history, which currently does not receive much attention.
- Visitors lack an understanding of the park and its identified boundaries due, in part, to a lack of gateway and boundary signs. Some signs do exist: park headquarters in Calumet, park information desk at Quincy, and Calumet directional signage on U.S. Highway 41.



The Calumet and Hecla Library, listed on the National Register of Historic Places, once housed books and public baths. Today it holds the Keweenaw History Center and park offices.

CULTURAL RESOURCES

HISTORY—COPPER HAS LONG DRAWN PEOPLE TO THE REGION

Keweenaw National Historical Park preserves and interprets the region's copper mining history. The park has a staff historian to complete research and support interpretive programs and publications, and several projects have been completed or are under way. A historic resource study that covers aspects of the historical mining period was finished under cooperative agreement in 2005, though it has not yet been published. The historian also contributed content to a project completed by

the J. Robert Van Pelt Library at Michigan Technological University—*Interior Ellis Island: Ethnic Diversity and the Peopling of Michigan's Copper Country*. Other planned research includes a study of Calumet's downtown business district, the Keweenaw Printing Company, and a history of local benevolent societies. Park staff also organize the Fourth Thursday in History monthly speaker series, participate in National Register nominations for neighboring communities, and have produced several historic structure reports.

The park historian manages and conducts the park's oral history program, which collects firsthand accounts from people who were a part

of the mining community. Their stories help park staff understand how the copper mining operations were run, and provide insight into the everyday lives of copper miners, their families, and others—information that helps park staff create compelling and accurate interpretive programs. Transcribing and archiving these oral histories ensures that these stories are never lost. The park also conducts oral history workshops by request to cooperating sites, local historical organizations, and student groups.

ARCHAEOLOGY—RESOURCES UNKNOWN ON PRIVATE LANDS

Very little archaeological work has been done at Keweenaw. Limited investigations have been conducted at two sites in Calumet—the Union Building and the Keweenaw History Center. Both were part of larger construction projects, and were undertaken to comply with the National Environmental Policy Act and Section 106 of the National Historical Preservation Act. There are more potential sites within park boundaries.

Understanding the extent of archaeological resources at Keweenaw National Historical Park is complicated by the fact that many structures and sites within the park are privately owned and operated. In spite of this challenge, park staff are working to gain a comprehensive understanding of sites within the 134 federally owned park acres. Funding has been requested for an archaeological overview and assessment. Such would be followed by an archaeological resource inventory, which should provide staff with the knowledge needed to examine, prioritize, and interpret archaeological resources on federal lands.

Even after this needed work is complete, however, the Park Service will still be unable to effectively monitor or assess potential threats on lands that are privately owned and operated. Development on private land is the most pressing concern for archaeological sites that have not yet been identified and documented.

A lack of regional zoning ordinances, coupled with a lack of archaeological surveys, means that archaeological sites could be unintentionally destroyed.

CULTURAL LANDSCAPES—ASPECTS OF COPPER MINING OPERATIONS PRESERVED

Cultural landscapes illustrate relationships between people and their surroundings. At Keweenaw, the park manages five cultural landscapes related to various aspects of historic copper mining operations. Historic structures are the focal points of each of these cultural landscapes, which include the Quincy Mine Office, Calumet and Hecla Library, Calumet and Hecla General Office Building, Union Building, and Calumet and Hecla Warehouse No. 1. A cultural landscape inventory has been completed at each of these five locations. All are

Future research at Keweenaw will include a study of Calumet's downtown business district.



NATIONAL PARK SERVICE / DAN JOHNSON



The park uses the Calumet and Hecla Warehouse No. 1 to store museum objects, park materials, and equipment.

in fair condition except the Quincy Mine Office, which is in poor condition, and the Union Building, which is in good condition. All are listed on the National Register of Historic Places. Other cultural landscape work at Keweenaw includes a cultural landscape report for the Quincy Unit. Once this is complete, park staff will begin work on a cultural landscape report for the Calumet Unit.

The Calumet and Hecla Library, built in 1898, was an important resource that housed everything from children's books to instructional materials for immigrants learning English. The library's basement held public baths. Today the building functions as the Keweenaw History Center, and houses offices of the park's Division of Museum, Archives, and Historical Services.

The Calumet and Hecla General Office Building was the Calumet and Hecla Mining Company's headquarters until 1968; it later served as the Calumet Clinic until the Park Service purchased the building in 2000. Today it is the park's headquarters and, in the absence of a formal visitor center, the Park Service uses the building as an information center. Visitors can get maps and interpretive materials, and the Isle Royale National History Association runs a small bookstore.

The Union Building, adjacent to downtown Calumet, was once a social center where fraternal groups such as the Odd Fellows and Freemasons met. Merchants, bankers, and postal officials occupied other space in the building. Work on the building's exterior has restored much of its historic appearance and rehabilitated the landscape, but work on the interior awaits additional funding. The park uses the storefront display windows for exhibits interpreting the history of the building and the exterior preservation work.

The Calumet and Hecla Warehouse No. 1, a large brick building next to the library, was used to store company materials and mining equipment. Now owned by the Park Service, the building is still used for storage, mainly of museum objects, park materials, and equipment. The open area surrounding the building includes a Russell snowplow used by the company to clear railroad tracks. It also provides for vehicle parking and snow storage in winter months.

The Quincy Mine Office is a prominent sandstone structure located on Quincy Hill, which overlooks the former mine site, the City of Hancock, and Portage Lake. Positioned between the mine superintendent's residence and a mining captain's home, the office occupies part of a distinct area associated with mine management in the Quincy Unit.

Although there is not a historic landscape maintenance plan in place for any of these properties, the park has experts on staff to care for cultural landscapes. Keweenaw has both a landscape architect and a historical architect.

HISTORIC STRUCTURES—SEVERAL REHABILITATED, BUT FUNDING SHORTFALLS HINDER ROUTINE MAINTENANCE

Although the mines closed decades ago, buildings and structures that remain tell the story of the industry and the people who built lives around their work in the mines. The Park

Service owns five important historic buildings, while others are under the care of affiliated heritage sites or private owners. All of them help tell the story of copper mining on the Keweenaw Peninsula. Preserving as many as possible—including those that are not currently owned by the Park Service—is critical to achieving the park’s mission.

Keweenaw’s list of classified structures includes the five buildings described in the Cultural Landscapes section, as well as six other stone masonry ruins: Quincy Mining Company Pay Office Ruin, Quincy Pay Office Site Ruin, Quincy Mining Company Dry House Ruin, Quincy Mine Office Building Ruin, Quincy Worker House Foundations, and the Franklin School Foundation Ruin. The Quincy Mine Office is the only structure in the Quincy Unit owned by the Park Service. Properties within park boundaries are listed on the National Register of Historic Places.

Much work has been done to rehabilitate building exteriors and stabilize ruins. Recent exterior rehabilitation projects include the Union Building and the Calumet and Hecla General Office Building. A comprehensive interior rehabilitation of the Calumet and Hecla General Office Building is planned for 2007. Additional exterior and interior rehabilitation is required in order to preserve and reuse the park’s other historic structures.

Keweenaw staff work with park partners to preserve and stabilize structures and ruins that are owned by cooperating heritage sites and informal partners. In 2003, staff worked to stabilize the roof of the Pattern Storage Building. It still houses 20,000 wood foundry patterns designed and used by the Calumet and Hecla Mining Company; the patterns are now owned by the Coppertown Museum but are inaccessible because of collapsed shelving inside the structure, which poses a serious safety risk. In 2004, the park also provided funding and technical assistance to the Quincy Mine Hoist Association to stabilize

HERITAGE SITES HELP TELL THE STORY OF COPPER MINING

Keweenaw National Historical Park has just one exhibit that displays items from the museum collection and archives, but heritage sites affiliated with the park expand on interpreting the region’s history with additional displays of historical artifacts.

Fort Wilkins State Park has an excellent collection of historical artifacts that date from the fort’s creation in 1844 and includes items from American Indians, military personnel, and early miners and settlers.

Visitors to the Quincy Mine Hoist Association site can go underground to tour mine workings and see period mining equipment still in place. Most impressive is the Nordberg Steam Hoist, which is the largest of its type in the world. It was used to lower miners nearly two miles below the earth’s surface and to lift copper rock up from those depths. Although the Quincy Mine Site is owned and operated by the Quincy Mine Hoist Association, the Park Service operates a seasonal information desk at the site. Visitors are able to talk with park rangers at this location seven days a week from June through September. The space is small and lacks any permanent exhibits or room for an orientation film.

Of the 18 current heritage sites, 14 have museum collections that contain artifacts from the copper mining period. The Coppertown Mining Museum, housed in the Calumet and Hecla pattern shop in Calumet, gives more insight into the company’s operations. The A.E. Seaman Mineral Museum on the campus of Michigan Technological University in Houghton highlights geology and has an extensive mineral collection. The visitor center at Porcupine Mountains State Park describes the natural ecosystems of the Keweenaw Peninsula. The park provides technical assistance to these sites on an as-needed basis.



JOHN BURDE / SOUTHERN ILLINOIS UNIVERSITY

the Quincy Mining Company Engine House and Boiler House.

The park's historical architect, architectural historian, and landscape architect provide technical and design assistance to cooperating sites that own other historically significant architectural resources, and help educate local citizens about the importance of preserving the historic appearances of downtown areas and structures near park boundaries.

Threats to historic structures include development both inside and outside the park's boundary, damage caused by the region's harsh winters, and a lack of funding that prevents routine maintenance. At current funding levels, the park's maintenance staff are only able to react to problems once they have been identified, rather than to give structures the routine care needed to prevent the problems. The cost of the park's deferred maintenance and rehabilitation needs tops \$12.5 million for park-owned structures.

MUSEUM COLLECTION AND ARCHIVES—ADDITIONAL EXHIBIT AND STORAGE SPACE NEEDED

Park collections exceed 429,000 items and include historic photographs, business records, family and personal papers, mine company office contents, mining tools and equipment, maps and drawings, benevolent society lodge records, furnishings, regalia, geologic specimens, recorded and transcribed oral history interviews, and many ceremonial, personal, and building-related artifacts. Most of these materials are directly related to either the Calumet and Hecla or Quincy Mining Companies whose former properties comprise the park's two units—the Quincy Unit and the Calumet Unit—or to the people, businesses, churches, and other entities associated with the two communities that developed around the mines.

Keweenaw is fortunate to have a cadre of trained staff—a chief of museum, archival, and historical services, a museum curator, an

archivist, and a historian—to care for these impressive holdings. Additional help preserving and cataloging the ever-growing collection is provided by seasonal employees and volunteers.

Funds are available for each permanent staff member to attend one training session each year to build on the knowledge and skills needed to care for the park's collection. In 2002, paper conservators from the Harpers Ferry Center visited Keweenaw to present a workshop on remedial paper conservation for archival collections.

Improvements are needed to bring some collection storage facilities up to established standards. Materials stored at the Keweenaw History Center are at risk because there is neither air-conditioning nor humidity control, though this site recently received a fire suppression system. Staff have put in funding requests for other needed improvements. There is also a funding request in place to rehabilitate the Calumet and Hecla Warehouse No. 1 so that it can be used for a multipark museum collection storage facility for Keweenaw, Apostle Islands, Isle Royale, and Pictured Rocks.

Exhibit space to display collection items is scarce at Keweenaw. There is currently just one museum exhibit in the park, in the Union Building storefront window. Research access to the collection is provided by appointment. Since hiring an archivist in 2006, research services have increased significantly. More public access to collections could result if the park's request to create an online historic photo database is funded.

The park's museum collection includes historic furnishings from mining company offices. Historic furnishing reports would help staff better interpret the lives of the miners and other company employees, and ensure that items placed in the park's historic structures are period representations of those that were once found in the buildings.



The park and cooperating heritage sites preserve a wide variety of historic objects and structures, including this Calumet and Hecla snowplow (now owned by the Park Service).

ETHNOGRAPHY—FUNDS NEEDED FOR OVERVIEW AND ASSESSMENT

The area encompassed by Keweenaw National Historical Park has a long history of human habitation and use, with copper mining activities going back 7,000 years. The park's focus, however, is the rich story of the region's historic mining industry. Immigrants from around the world moved to the area and created a unique local culture.

The park's ethnography program is the weakest among the six cultural resources disciplines assessed by the Center for State of the Parks. The park has not done any ethnographic planning such as an ethnographic overview, cultural affiliation study, or traditional use study to formally identify associated groups or park resources that may be important to them, but park staff have unofficially identified 30 to 40 traditionally associated groups. Funds have been requested for an ethnographic overview and assessment. Oral histories have been collected from area residents who were alive when the mines were in operation. In addition to capturing individual stories, oral histories

also help park staff understand and interpret the region's historic economic and social climate. Including interviews with the Ojibwa of the Keweenaw Bay Indian Community would supplement the park's oral history collection.

The park does not fully interpret prehistoric mining or later mining by the Ojibwa people and does not formally consult with any tribes, but works with the Keweenaw Bay Indian Community on projects of mutual interest such as the comprehensive interpretive plan. Park efforts to interpret the American Indian story more fully are complicated by an overwhelming and longstanding regional emphasis and interest in the historic period, a developing interpretive division, and a lack of information that an ethnographic overview and assessment and archaeological overview and assessment could provide. A boundary study would also help identify areas related to American Indian copper mining and justify their acquisition. Once the park completes an ethnographic overview, resource managers will better understand the potential role the Ojibwa could play in park management and interpretation.



Volunteers help park staff catalog and process museum collections, manage files, maintain the park library, and research historical information.

STEWARDSHIP CAPACITY

FUNDING AND STAFFING—ADDITIONAL SUPPORT NEEDED FOR PRESERVATION AND INTERPRETATION

Staff at Keweenaw National Historical Park have made great strides in preserving important pieces of the region's copper mining history. The park is fortunate to have an array of experts to ensure resources are well protected and preserved. With additional staff and funds, even more could be accomplished. Staff have requested increases to the park's base operational budget to support additional staff for the Keweenaw History Center, to preserve historic

structures, and to establish interpretive operations. Funds have also been requested to support a variety of rehabilitation and restoration projects and complete several cultural resource reports and inventories.

PLANNING—SOME UPDATES AND NEW PLANS NEEDED

Updates to the park's general management plan are needed to include buildings that have been acquired, development of a museum services staff, and changes in terminology (cooperating sites are now called heritage sites). The park also needs to complete a comprehensive interpretive plan and develop a wayside exhibit plan before

funds can be requested to upgrade existing waysides or create new ones. A lack of staff time hinders progress on these plans.

RESOURCE EDUCATION—VISITOR CENTERS WOULD EXPAND OPPORTUNITIES

Keweenaw National Historical Park works with 18 Keweenaw Heritage Sites and other community organizations to tell the story of the region's copper mining history. Each site provides brochures about the other sites and a certain level of interpretation.

Visitors to Keweenaw National Historical Park will not find an official visitor center staffed by rangers and filled with exhibits and information. Instead, the park currently relies on a small contact center at park headquarters and an information desk at Quincy Mine, an affiliated heritage site. Visitors can get park information at these two sites, as well as brochures for the other heritage sites, but establishing an official visitor center would allow park staff to reach more visitors by providing additional interpretive materials, general park orientation, and interpretive and educational exhibits that highlight park themes and the park's museum collection. The park's general management plan calls for a park visitor center in the Quincy Unit and another smaller operation in the Calumet Unit.

Although there is no official park visitor center yet, brochures and summer interpretive programs focus on historical themes such as peoples' lives and immigration, labor-management relations, mining technology, historic preservation, geology and mining, and the impact of the area's environment on the lives of associated people. In 2005, Keweenaw National Historical Park staff presented 31 interpretive programs both at the park and off-site, reaching 871 people. This was the first year that the park offered ranger-guided programs. Weekly offerings during the summer months include walking tours of downtown Calumet

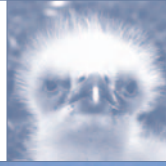
and tours of the Quincy Mine ruins. The park also has an interpretive trail, but wayside panels need to be replaced because of normal wear and tear and so that they can be amended to include updated themes.

The Fourth Thursday in History project is an opportunity to expand the scope of the interpretive program by providing presentations on a variety of regional themes at sites throughout the Keweenaw Peninsula. Different programs are offered monthly, except during November and December.

Keweenaw National Historical Park employs two full-time, permanent staff and two summer, seasonal interpreters. This is not enough to adequately serve the more than 350,000 visitors that are drawn to the park and affiliated heritage sites. Park staff recognize this shortfall and have requested funds to hire more staff and expand interpretive offerings and park outreach. The park's draft resource stewardship plan calls for the addition of eight interpretive staff such as an education specialist, seasonal interpreters, media specialist, volunteer coordinator, and supervisory interpretive ranger. Expanding the staff will allow the park to offer more interpretive programs, establish an educational outreach program, and fulfill needs and deficiencies identified by park visitors and Keweenaw heritage site staff.

EXTERNAL SUPPORT—VOLUNTEERS HELP CARE FOR RESOURCES

Volunteers help park staff catalog and process museum collections, manage files, maintain the park library, and research historical information. In 2005, the park received 1,032 service hours from 47 volunteers. Partnerships with after school programs benefit both the park and local schoolchildren. In 2005, sixth and seventh graders spent a day in the park learning about history and participating in a cleanup event. In just an hour and a half of work, the children collected more than 500 pounds of garbage from the park's industrial center.



SLEEPING BEAR DUNES NATIONAL LAKESHORE

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Sleeping Bear Dunes National Lakeshore

NATIONAL PARK SERVICE



Sleeping Bear Dunes was established to preserve the "forests, beaches, dune formations, and ancient glacial phenomena.... for the benefit, inspiration, education, recreation, and enjoyment of the public."

According to American Indian legend, a terrible forest fire on the west side of Lake Michigan forced a mother bear and her two cubs to seek refuge by swimming across the lake to the eastern shore. Mother bear reached the shore first, and paced back and forth waiting for her cubs. But the journey had been too much for the young cubs, and they drowned not far from shore. Exhausted from her frantic pacing, mother bear eventually fell asleep on a bluff

high above the lake. The Great Spirit Manitou created North and South Manitou Islands to immortalize the cubs, while the Sleeping Bear Dunes represent their grieving mother.

When Europeans arrived in the 19th century, the Sleeping Bear Dunes region was home to the Ottawa, Chippewa (Ojibwa), and Potawatomi peoples. The Potawatomi eventually moved further south, but the remaining groups lived together mostly peacefully, sharing hunting and



Extensive lumbering began in the area in the late 19th century. By 1910, forest resources had been depleted.

fishing territory until 1836, when they signed the Treaty of Washington. This treaty ceded the tribes' rights to portions of both of Michigan's peninsulas, including the Sleeping Bear region.

New settlers made extensive use of the region's abundant natural resources. Trapping of furbearing mammals and logging were primary activities, followed by commercial fishing and agriculture. Extensive lumbering began in the area in the late 19th century, in large part, to fuel the steam-powered commercial shipping vessels that traveled the waters of the Great Lakes. By 1910, forest resources had been depleted.

As large-scale timber harvesting declined, agriculture took its place. Corn, hay, and potatoes were important crops, but because soils in the regions were not of high quality for agriculture, farming declined to low levels by the early 1920s. Since agriculture ceased, trees such as northern hardwoods, aspen, and pine have grown back on much of the cleared land.

During the early to mid-20th century, recreational development came to the forefront as a way to enjoy and profit from the region's lakes, *(continues on page 76)*

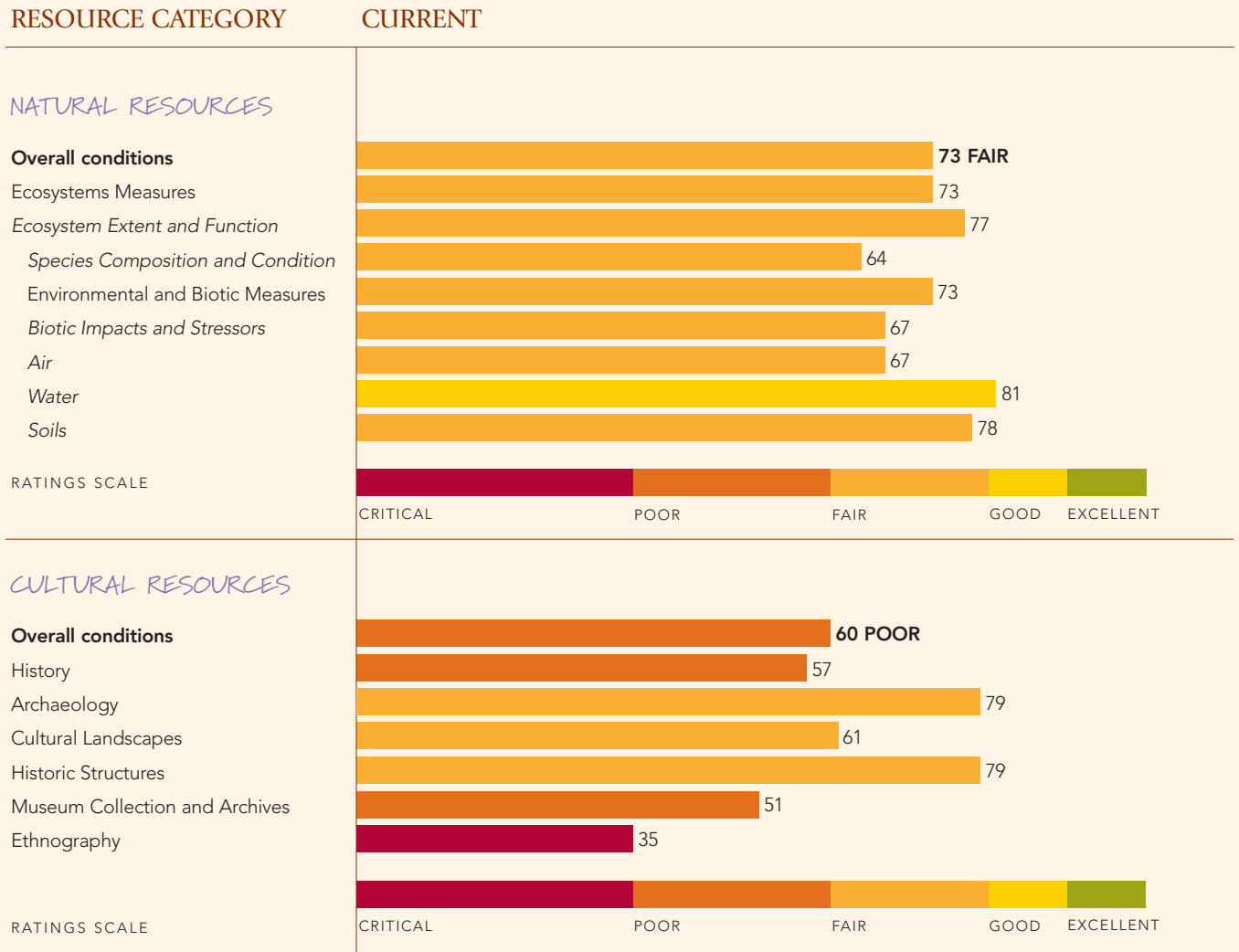
RESOURCE MANAGEMENT HIGHLIGHTS

- In 1986, Sleeping Bear Dunes initiated an extensive program to monitor piping plovers, a federally listed endangered shorebird that is affected by habitat loss and development. There are only three small populations of this bird remaining in the world, with an estimated 5,000 birds total. Park staff, in conjunction with researchers from several other federal and state agencies and universities, closely monitor the plovers' activities, build fences to protect their nests from predators such as gulls and raccoons, and document nest success. This program has shown much success as the number of nesting pairs of plovers in the Great Lakes region has increased from 17 pairs in 1986 to 59 pairs in 2005. This program relies on year-to-year funding through the coastal program of the U.S. Fish and Wildlife Service. Continued funding is always uncertain; without it, the park would be unable to continue to protect the plover.
- Park staff have restored five former gravel pits, and are working on restoring six more. Removing human-made structures from these and other sites, restoring their natural topography, and revegetating them with native plants is an important park goal.
- Park staff, volunteers, and partners work together to protect and maintain historic structures. For example, the Preserve Historic Sleeping Bear organization recently restored the Charles and Hattie Olsen Farmhouse in the Port Oneida Rural Historical District. The Michigan Barn Preservation Network offers training to the public and to park staff and volunteers about historic structure preservation, while participants help restore some of the park's historic barns.

A park program to monitor and protect endangered piping plovers has exhibited much success as evidenced by increasing numbers of nesting plovers. Continued funding is necessary to support the program.



Note: When interpreting the scores for natural resource conditions, recognize that critical information upon which the ratings are based is not always available. This limits data interpretation to some extent. For Sleeping Bear Dunes National Lakeshore, 83 percent of the information required by the methodology was available.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases pre-dating a park's creation. The intent of the Center for State of the Parks is to document the present status of park resources and determine which actions can be taken to protect them in the future.

KEY FINDINGS

- White-tailed deer pose problems for ecosystems on North and South Manitou Islands. The deer were introduced to North Manitou in the 1920s, and since that time have decimated palatable species such as yew. Migration onto South Manitou has park managers concerned for vegetation communities there.
- Invasive plants and animals, as well as forest pests and diseases, threaten biodiversity at Sleeping Bear Dunes. The park has plans in place for combating non-native plants, but lacks funds to put these plans into action. Sea lamprey and zebra mussels have wreaked havoc on native aquatic species, and more research is needed to determine how to best control them. By prohibiting visitors from bringing in their own firewood, park staff hope to prevent the spread of pests and diseases such as emerald ash borers and oak wilt.
- Overall, water quality in Lake Michigan has improved during the past few decades. Water quality in lakes and streams within Sleeping Bear Dunes is considered to be generally good, though there are concerns about eutrophication and mercury. In addition, nitrate deposition is high at the park.
- A 1984 historic resource study of Sleeping Bear Dunes delved into parts of the park's history, but updates are needed to incorporate new scholarship. Park staff have identified the need for additional work such as an ethnographic overview and assessment, American Indian traditional use study, collection of oral histories, and completion of a comprehensive interpretive plan to round out understandings of historic resources and guide interpretation. Hiring a staff historian would allow the park to pursue some of this research, but currently no funds are available to hire this position or begin work on additional historical research projects.
- An archaeological overview and assessment is currently under way, which will help park managers identify all archaeological resources, prioritize their preservation, and interpret them for visitors. Park staff have submitted funding requests for additional archaeological work to gain in-depth knowledge about specific sites throughout the park.
- A single staff person works just one day per week caring for the park's 75,383 museum objects, which range from historic fishing vessels to archaeological artifacts such as prehistoric pottery shards and chipped-stone tools. To better manage museum collections and update the scope of collections statement and collection management plan, a full-time position is needed.
- Sleeping Bear Dunes is home to 366 historic structures ranging from light-houses to outhouses. Even with assistance from volunteers and partners, the park still has a difficult time keeping up with maintenance needs. Deferred maintenance costs at Sleeping Bear Dunes are about \$11.2 million, while the cost of needed rehabilitation tops \$8.8 million.

streams, geological features, and landscapes. Sportfishing, hunting, swimming, and boating are still favorite activities.

In the late 1950s, the National Park Service conducted a survey titled *Our Fourth Shore*. The objective was to assess the possibility of creating recreational opportunities along the shores of the Great Lakes. Sleeping Bear Dunes was identified as one of the best sites, and, in 1970, Congress established Sleeping Bear Dunes National Lakeshore from more than 1,700 individual tracts of land to preserve the “outstanding natural features, including forests, beaches, dune formations, and ancient glacial phenomena...for the benefit, inspiration, education, recreation, and enjoyment of the public.” Each year, more than 1.1 million people visit the 71,290-acre park, located on Michigan’s Lower Peninsula, to hike, camp, swim, climb the dunes, and learn about the region’s history and culture.

An assessment by Center for State of the Parks researchers indicates that, overall, natural resources are in “fair” condition with a score of 73 out of 100. A history of logging and

farming left behind a changed landscape where large predators were missing and native forests were decimated. The land acquisition process resulted in a park unit that is fragmented with more than 100 privately owned tracts within the park boundaries. Invasive plants and diseases are of concern, but the park is taking steps to stem invasions and limit damage. Restoration efforts at former home sites, gravel pits, and timber plantations are helping bring back native ecosystems. Wildlife species diversity within the park is impressive, especially when it comes birds. More than 160 bird species nest in the park.

Cultural resources at the park, overall, rated in “poor” condition with a score of 60 out of 100. Ethnography rated the lowest, largely because the park has not formally identified traditionally associated groups of people, a key step to ensuring ethnographic resources are protected. Historic structures and archaeological resources at Sleeping Bear Dunes—which include evidence of the region’s maritime, logging, and agricultural history—received the highest cultural resource condition ratings.

Natural resource conditions at Sleeping Bear Dunes rated a “fair” score, overall.





NATURAL RESOURCES

PARK HABITATS—SAND DUNES AND VIRGIN FORESTS HARBOR SPECIAL PLANTS

The sand dunes of Sleeping Bear Dunes National Lakeshore are the most well-known and widely visited feature. The Sleeping Bear Plateau—a 15-square-mile dune field—contains some of the most prominent dunes, including the park’s namesake; dunes are also found at Empire Bluffs, Good Harbor, and both North and South Manitou Islands.

But the dunes are not just sand—parts of them house a variety of vegetation specially

adapted to life in this ever-changing environment, such as Marram grass (*Ammophila breviligulata*), bearberry (*Arctostaphylos uva-ursi*), sand cherry (*Prunus pumila*), beach pea (*Lathyrus japonicus*), and Pitcher’s thistle (*Cirsium pitcheri*), a federally listed threatened species. A new species of dunewort (*Botrychium* sp. nov.) was first identified on dunes within the park. Climbing the dunes is a favorite visitor activity, but staying on trails is important because dune plants are easily damaged, which results in increased wind erosion of the dunes. Social trails are problematic in some parts of the park.

Sleeping Bear Dunes National Lakeshore is home to the largest contiguous beech-maple

The sand dunes of Sleeping Bear Dunes National Lakeshore house a variety of plants and animals that can be disturbed by foot traffic.

PARK STAFF WORK TO RESTORE HABITATS

As a legacy of its previous uses, Sleeping Bear Dunes National Lakeshore contains more than 1,700 former home sites, hundreds of residential and commercial dump sites, 11 gravel pits, two known gas stations, five to six areas that were likely used as gas stations in the past, and more than 100 underground storage tanks from commercial, farming, and residential use. Removing human-made structures from these sites, restoring their natural topography, and revegetating them with native plants are important park goals. According to the park's 2003 business plan, 30 sites per year can be restored at a cost of about \$180,000 annually.

Park staff have restored five gravel pits, and the remaining six are in various stages of planning for eventual restoration. The return of natural vegetation has provided food and shelter for many bird species that depend on early successional habitat.

The park is looking to restore sites to mitigate the loss of historic white pine stands in the late 19th century. Many pine plantations are being cut to encourage natural succession, thereby reclaiming some areas for white pine-dominated habitat. But non-native species pose a challenge for this process. Invasives such as spotted knapweed (*Centaurea maculosa*) are quick to colonize disturbed areas, and non-native trees can prevent historically representative vegetation from reclaiming the former plantations.

Non-native species such as spotted knapweed are quick to colonize disturbed areas, which can make restoration efforts a challenge.



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forest of any national park, with the exception of Great Smoky Mountains National Park, and South Manitou Island is home to a small grove of giant white cedars (*Thuja occidentalis*) that was never logged, a rare resource in the region. Several cedar trees are more than 500 years old. These forests also contain mountain maple (*Acer spicatum*), striped maple (*Acer pensylvanicum*), and red trillium (*Trillium erectum*), as well as rare species such as walking fern (*Asplenium rhizophyllum*), green spleenwort (*Asplenium trichomanes-ramosum*), northern holly (*Polystichum lonchitis*), and Braun's holly fern (*P. braunii*). Michigan monkey-flower (*Mimulus glabratus*), a federally listed endangered plant, is also found at Sleeping Bear Dunes on cold water seeps of inland lakes.

PARK WILDLIFE—NESTING BIRDS FIND IMPORTANT HABITAT

Sleeping Bear Dunes provides habitat for a diverse array of wildlife species, including several protected under the Endangered Species Act. Federally listed species include piping plover (*Charadrius melodus*), bald eagle (*Haliaeetus leucocephalus*), and eastern massasauga rattlesnake (*Sistrurus catenatus catenatus*). The park is also in the historic range of the federally listed eastern cougar (*Puma concolor*) and Canada lynx (*Lynx canadensis*), but these species were extirpated from the area before the park was created, although reports persist of cougar sightings in the area.

Sleeping Bear Dunes National Lakeshore's diverse habitats provide suitable nesting areas for a large variety of birds. From waterfowl and woodpeckers to warblers and sparrows, 160 species nest in the park. Park staff contribute to this distinction by practicing late-season mowing on former agricultural lands, which provides valuable grassland and edge habitat for regionally declining species. As openlands and early successional forests become more limited throughout the Midwest, Sleeping Bear Dunes

will continue to play an increasingly large role in the conservation of regional biodiversity.

A wide variety of woodland mammals inhabit Sleeping Bear Dunes, including white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), fox (*Vulpes vulpes*), mink (*Mustela vison*), skunk (*Mephitis mephitis*), and beaver (*Castor canadensis*). The extirpation of large predators in the park, notably the wolf and cougar, has resulted in an abundance of smaller predators such as mink, skunk, and least shrew (*Cryptotis parva*). Mid-level predators such as coyotes (*Canis latrans*) and bobcats (*Felis rufus*) have assumed dominant roles within the park ecosystem, while black bear (*Ursus americanus*) sightings are also reported occasionally.

A systematic survey of amphibians and reptiles is nearly completed. Although reptile and amphibian populations within the park appear fairly stable, some staff have noted that turtle populations seem to be declining. These losses have been attributed to road mortality and could also be a result of increasing numbers of predators such as mink, skunks, and raccoons.

NORTH AND SOUTH MANITOU ISLANDS—HUNGRY DEER ALTER ECOSYSTEMS

During the 1920s, North Manitou was operated as a private hunting preserve, and it was stocked with raccoons, deer, and eastern wild turkey. These animals are still present there. The abundance of deer on North Manitou—there are probably about 200 deer on the island—has severely limited the regeneration of many forest species such as yew (*Taxus canadensis*). In addition, because deer prefer to browse on trees other than American beech (*Fagus grandifolia*), there are more beech trees on the island than would otherwise be present.

Historically, the lack of white-tailed deer on South Manitou had led to extensive growth of many woodland plant species. The migration of deer onto the island from North Manitou, which was first documented in 1994, poses a



significant threat to the vegetation of South Manitou. There are probably fewer than a dozen deer on South Manitou, but the island's yew is vulnerable to damage from overbrowsing.

The Park Service monitors deer populations, and has studied the effects of deer on vegetative succession and deer overpopulation and starvation. To protect park habitats and achieve healthy deer populations, the park has partnered with the Michigan Department of Natural Resources to design a public hunting program for North Manitou Island. Since the program's inception in 1984, a greater degree of natural vegetation succession has occurred.

ADJACENT LAND USE—AFFECTING PARK RESOURCES

The scenic resources and recreational values of Sleeping Bear Dunes National Lakeshore are

Sleeping Bear Dunes National Lakeshore's diverse habitats provide suitable nesting areas for a large variety of birds. From waterfowl and woodpeckers to warblers, including the prairie warbler; 160 species nest in the park.



Non-native zebra mussels have severely disrupted the aquatic ecology of the park's lakes and streams. They compete with native species for food and space, and they can grow on nearly any surface, clogging pipes and even smothering native mussels.

particularly vulnerable to activities in neighboring communities such as Empire and Glen Arbor. Park staff have observed that streetlights can compromise the park's dark night skies and detract from the quality of recreational experiences such as camping.

Privately owned forests surround much of the park, providing a buffer that maintains scenic integrity and protects park habitats. With more of these lands being subdivided and sold for development, the park's protected forests become further isolated, which compromises their function as wildlife habitat. In addition, park staff have difficulty preserving the park's viewshed, with wind energy developments posing a new threat. Research is needed to quantify the rate of land use change surrounding Sleeping Bear Dunes and effects on park viewsheds.

In nearby Benzie County, Christmas tree and pulpwood production are the major forest products, while fruits such as apples and cherries are the leading economic crops. Pesticides used on the fruit trees pollute groundwater,

Lake Michigan tributaries, and nearshore waters, though no studies have been done in the park. In addition, sewage from an adjacent pig farm may be seeping into park waters.

Road maintenance within the park has damaged some park wetlands and poses a significant threat to aesthetic resources. Roads can also encourage the spread of invasive plants and prevent dispersal of some native species. Benzie and Leelanau Counties are responsible for building and maintaining most roads in the park, within the rights-of-way that can range from 66 to 200 feet beyond the roadways. As a result, local highway departments manage a significant land area within the park. Roadwork entails extensive cutting to forests within the rights-of-way to meet new construction guidelines. The cutting of brush is done with an articulated brush hog, often leaving shredded, ragged branch ends on standing trees. In addition, park staff struggle with construction projects that want to plant non-native vegetation or native plants with genotypes not local to the area. Also damaging to natural resources, waste brine has been disposed along road rights-of-way, and salt is heavily used, affecting water resources.

A number of county road rights-of-way on South Manitou Island, nearly all of which is managed as wilderness, lack significant destinations. The county, however, is reluctant to abandon these rights-of-way.

PARK HEALTH—THREATENED BY INVASIVE PLANTS, PESTS, AND DISEASES

Non-native species are problems at many national parks, and Sleeping Bear Dunes is no exception. About 25 percent of the park's plant species are non-native, with garlic mustard (*Alliaria petiolata*), leafy spurge (*Euphorbia esula*), purple loosestrife (*Lythrum salicaria*), spotted knapweed, and baby's breath (*Gypsophila* sp.) being some of the worst invaders. The park has developed plans to control them, but funding

to conduct the work is sporadic. The ability to successfully target these species is a critical element of landscape restoration.

Non-native marine species such as zebra mussel (*Dreissena polymorpha*) and sea lamprey (*Petromyzon marinus*) have severely disrupted the aquatic ecology of the park's lakes and streams. The mussels compete with native species for food and space, and they can grow on nearly any surface, clogging pipes and even smothering native mussels. Sea lampreys kill native fish by attaching themselves to their prey and sucking out blood and other fluids. Additional research is necessary to better understand the most effective control measures for these invaders.

Forest diseases and pests also pose a threat to biodiversity at Sleeping Bear Dunes. Emerald ash borers (*Agrilus planipennis* Fairmaire) are Asian beetles that probably came to the United States on wood packing material. As larvae, they feed on the inner bark of ash trees. Since their discovery in 2002, the borers have killed 12 to 15 million ash trees in Michigan. Sleeping Bear Dunes is just 2.5 miles from the emerald ash borer quarantine boundary, and park staff are concerned that the beetle could infiltrate the park and destroy black and white ash trees within the next five years.

A fungus called *Ceratocystis fagacearum* is responsible for oak wilt, a potentially deadly disease that affects oak trees. This fungus, which is believed to be native to the United States, plugs the trees' water-conducting vessels, reducing water movement and causing the leaves to wilt and drop. It spreads both above and below ground, which makes it difficult to stop, and it has been identified just 15 miles from the park. By prohibiting visitors from bringing firewood into the park, staff hope to prevent the fungus from entering Sleeping Bear Dunes. This tactic also helps guard against the spread of emerald ash borers.

Park staff have taken action against non-native gypsy moths (*Lymantria dispar*), whose

larvae seriously defoliate trees. In 2004, park staff sprayed *Bacillus thuringiensis*, a bacterium that kills moth larvae, and Gypchek, a gypsy moth-specific virus that is the most environmentally friendly substance used to eliminate gypsy moths. It is believed that nucleopolyhedrosis (NPV), a virus that is a natural disease of gypsy moth larvae, is present in the area and also helps keep gypsy moth populations in check.

Hemlock woolly adelgids (*Adelges tsugae*), aphid-like insects native to Japan, feed on hemlock trees, often killing them. Hemlocks are important forest components at Sleeping Bear Dunes, providing wildlife food and habitat and shade over streams. The adelgids are found only about 60 miles from the park, so staff must be prepared to protect the hemlocks against a potential invasion. Funds and plans are needed to address these and all other forest pests.

WATER QUALITY—STAFF NEEDED TO MONITOR PARK WATERS

Sleeping Bear Dunes lies along the shore of Lake Michigan, and is home to more than 500 acres of wetlands such as bogs and marshes, 26 lakes and ponds, four rivers and creeks, and about 13,000 acres of Lake Michigan. The lakeshore boundary extends one-quarter mile offshore for its entire 65 miles of length, yet the park does not have a full-time staff member devoted to water resource management as a result of funding shortfalls. Instead, a seasonal biologist collects water quality data from May through September, with assistance from volunteers and interns when available. Additional direction for this program is provided to park employees by Park Service Midwest Regional Office staff and Park Service Great Lakes Inventory and Monitoring staff stationed at Ashland, Wisconsin.

In 2000, the park implemented a more comprehensive sampling plan to determine overall water quality, but a lack of consistent staff dedicated to water quality monitoring continues to make it difficult for resource

managers to gain a full understanding of park needs. Sleeping Bear Dunes recently received funds to hire a water quality staff person to fill a three-year term appointment, which should help contribute to knowledge of park-wide water quality issues.

Certain water resources within the boundaries of Sleeping Bear Dunes National Lakeshore are considered high-quality waters that are designated as Outstanding State Resource Waters by the state of Michigan, which means that the level of water quality necessary to protect existing uses shall be maintained and protected. Furthermore, where designated uses of a water body are not attained, there can be no lowering of the water quality with respect to the pollutant or pollutants that are causing the non-attainment.

Water quality data collected from streams and lakes within the park show minimal impairments; however, a trend illustrated by changes in water quality from 1992 to 1997 reveals that lakes within Sleeping Bear Dunes are becoming increasingly eutrophic—high in nutrients that promote algal growth, which can lead to oxygen depletion. Levels of both phosphorous and chlorophyll appear to be increasing, and comparisons of water quality data from 1992 and 1997 also indicate a greater occurrence of algal blooms.

More recent freshwater sampling indicates that water quality is fairly consistent throughout the park, though Otter and North Bar Lakes have slightly higher nitrate concentrations than other park waters. A qualitative biological survey conducted as part of the Michigan Water Quality Division's Watershed Surveillance Program rated park waters as acceptable according to state standards, with macro-invertebrate habitat rated as either good or slightly impaired. In contrast, Glen Lake has been included on Michigan's 303(d) list—a list of water bodies that do not meet water quality standards because of pollutant levels—because of polychlorinated biphenyl (PCB),

chlordan, and mercury levels. The remaining lakes within Sleeping Bear Dunes are also included in the 303(d) list because of statewide fish consumption restrictions related to dangerous mercury levels.

Overall, Lake Michigan water quality has improved over the last three decades, though the ecology of the lake is in dire condition because of invasive species. According to the Michigan Department of Environmental Quality, the open waters of Lake Michigan have generally good water quality except for some nearshore waters influenced by large, densely populated, and heavily industrialized urban areas. All Michigan waters of the Great Lakes fully support secondary contact (i.e., non-swimming) recreational, agricultural, industrial, and navigational uses, but the aquatic life use, based on fish consumption advisories, is not being met in Lake Michigan. As a result, no Michigan waters of Lake Michigan are considered to be fully supporting designated uses. A type E botulism outbreak in 2006 was responsible for killing nearly 3,000 waterfowl on certain Lake Michigan beaches within the park. About 180 of these waterfowl were common loons (*Gavia immer*, a state-listed threatened species). It is believed that the botulism episode resulted from a combination of invasive aquatic species working together. Lake Michigan ecology appears to be rapidly changing because of invasive species.

Increased enforcement of laws requiring the reduction of phosphorous in soaps and detergents and improvements in sewage treatment has resulted in decreased phosphorous and chloride concentrations in Lake Michigan compared to historic measurements. Still, recent preliminary sampling results indicate that phosphorus and chloride levels in the open waters of the lake may be rising. The primary source of chloride is likely municipal wastewater discharges and salt from road deicing.



CULTURAL RESOURCES

HISTORY—MORE RESEARCH WOULD FURTHER GUIDE MANAGEMENT AND BOLSTER INTERPRETATION

Sleeping Bear Dunes National Lakeshore is rich with history related to navigation, trade, and transportation of goods on Lake Michigan, logging to fuel the steamers that plied the lake's waters, commercial fishing, and agriculture. Glen Haven, established in the 1860s as a harbor, lumber town, and fuel stop for ships traveling to and from Chicago, is a favorite destination for visitors who want to explore the village's store, inn, cannery, and

blacksmith shop. Port Oneida, established in 1852, was once a flourishing agricultural area. Interpretation of the farms and cultural landscapes there teaches visitors about agricultural life in the mid- to late 19th century, and for two days each summer, the Port Oneida Rural Art and Culture Fair showcases crafts, skills, and arts from this period.

On North Manitou Island, a national historic landmark (the U.S. Life-Saving Station Complex), home sites, orchards, and the ruins of schools, docks, and farms give insight into the lives of the people who once lived on the island. South Manitou Island has similar features, including several farms, a lighthouse, a

Dozens of shipwrecks inhabit park waters. The wreck of the *Francisco Morazon*, which ran aground off South Manitou Island in 1960, can be seen from shore.



Glen Haven was established in the 1860s as a harbor, lumber town, and fuel stop for ships traveling to and from Chicago. Today visitors can explore historic buildings such as the village's store.

lifesaving station, and other historic ruins. Dozens of shipwrecks inhabit park waters, particularly the Manitou Passage between the mainland and South Manitou Island.

Research into the park's history has included several studies. A historic resource study completed in 1984 explored such topics as prehistoric peoples and American Indians; settlement by French, British, and Americans; navigation of the treacherous Manitou Passage; logging for steamboats and the timber industry; commercial fishing and agriculture; and tourism. Historical context studies have covered aspects of the park's agricultural heritage. An administrative history, *A Nationalized Lakeshore: The Creation and Administration of Sleeping Bear Dunes National Lakeshore*, was completed in 2000. These studies have helped paint a picture of the region's history and the park's history, and they have contributed to interpretation.

Park staff have recognized the need for additional studies to help guide resource management and further inform interpretation. Several

projects have been entered into the Project Management Information System, a Park Service database used to manage information about project funding requests. These projects include an updated historic resource study to better integrate new historical research into park management; an American Indian traditional use study to include traditionally associated peoples and their culture in the interpretation and preservation of the park; a comprehensive interpretation plan to better inform and direct interpretive efforts and dominant themes; and an oral history project. The oral history project is particularly time-sensitive because stories and memories must be gathered from long-time local residents before the opportunities are lost.

Sleeping Bear Dunes does not have a historian on staff, which makes it difficult to accomplish historical research. The park has limited access to a regional historian, but this person must also serve many other parks in the Midwest. Hiring a staff historian would allow Sleeping Bear Dunes to update its interpretive messages, start gathering oral histories, and create a bibliography of historic research, which would help park staff be more aware of the historical research available for creating interpretive programs. Currently no funds are available to hire a historian or begin work on additional historical research projects.

ARCHAEOLOGY—OVERVIEW AND ASSESSMENT UNDER WAY

Prehistoric and historic archaeological sites promise to provide much insight into the lives of the people who inhabited the Sleeping Bear Dunes region during the past hundreds and even thousands of years. Pottery shards and stone tools are evidence from the Middle and Late Woodland Periods (300 B.C. to A.D. 500 and A.D. 500 to 1000, respectively), while building foundations tell of more recent times within the small, logging town of Aral. In sum, the park has 152 identified and recorded archaeological sites; 115 are in good condition.

One threat to the park's archaeological resources comes from wind and water erosion that is part of weathering processes on the dunes. Sites can become exposed and vulnerable to dispersal and theft. Ensuring the safety of archaeological deposits within the dunes requires ongoing monitoring.

About 2 percent of the park has been intensively inventoried for archaeological resources; about 69 percent has been inventoried less rigorously. An archaeological overview and assessment is currently under way, however, that will help park managers identify all archeological resources in the park, prioritize their preservation, and interpret both historic and prehistoric archaeology for visitors.

Other archaeological work park staff would like to accomplish includes an inventory of specific topographic settings on South Manitou Island, mapping and evaluation of the former town site of Aral, an inventory of specific settings on North Manitou Island, and an inventory of sites related to early settlement history. Sleeping Bear Dunes does not have archaeologists on staff; instead, the park relies on assistance from the Midwest Archeological Center in Lincoln, Nebraska, which also serves all parks in the Midwest Region of the National Park System.

Sleeping Bear Dunes currently has one archaeological site listed on the National Register of Historic Places. The site, located along the Platte River, provided important resources for both prehistoric and historic peoples. Additional evaluations are needed to see if other archaeological sites might be eligible for the register, but they are not being done because of a lack of staff and project funds.

CULTURAL LANDSCAPES—ADDITIONAL WORK NEEDED

Among the scenic dunes, lakes, and forests where today's visitors gather to recreate, is evidence of the people who once made these places home. Cultural landscapes illustrate how

people shaped their natural environments to suit their needs. Farms, lifesaving stations, and villages are parts of Sleeping Bear Dunes' cultural landscapes. Park Service staff have evaluated the landscapes of the South Manitou Island Light Station, Glen Haven, and the Port Oneida Rural Historic District; after a comprehensive cultural landscape inventory is completed, Sleeping Bear Dunes may possess as many as 30 landscapes. So far, just one has been listed on the National Register of Historic Places—Port Oneida Rural Historic District. Parts of other cultural landscapes are also listed on the National Register, but nominations need to be updated to include all aspects of the landscapes.

The South Manitou Island Lighthouse Complex has been the focus of a cultural landscape report, the primary guide for treatment and use of a landscape. No other landscapes have cultural landscape reports, but the park has requested funding to produce others. Other completed cultural landscape research includes four context studies that focus on the agricultural history of Port Oneida, North and South Manitou Islands, and the Sleeping Bear Dunes National Lakeshore area.

Because the park's history includes widespread settlement, there is a great need for addi-

Cultural landscapes at Sleeping Bear Dunes illustrate how people have used the land and include features such as this barn at Port Oneida.



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Visitors can climb to the top of the historic South Manitou Island Lighthouse.

tional cultural landscape work. Although the park has some limited access to a historic landscape architect at the regional level, resources would benefit from the addition of a staff cultural landscape specialist to conduct research, evaluate landscapes, create a historic landscape plan, and nominate eligible landscapes to the National Register. Additional cultural landscape preservation training would help park staff better protect resources, but there are no funds to support such training.

In the face of limited funds for training, research, and restoration, park staff have created some novel programs to restore cultural landscapes. Apple orchards are part of several of the park's cultural landscapes; without regular maintenance, they no longer resemble their historic appearance. Through partnerships with the Leelanau Conservation District, Michigan State University Northwest Michigan Horticultural Station, and the County Extension Master Gardener Program, the park sponsors pruning workshops at Port Oneida. Park staff and public participants learn how to prune apple trees, and park resources benefit as the orchards are restored to their historic appearance, which also helps the trees stay healthy.

HISTORIC STRUCTURES—PARTNERS AND VOLUNTEERS HELP PRESERVE PIECES OF HISTORY

A rich combination of maritime, agricultural, and commercial history means that Sleeping Bear Dunes National Lakeshore is home to hundreds of historic structures that range from lighthouses to outhouses. All 366 of these properties are eligible for the National Register of Historic Places, and 209 have been listed. Funding shortfalls prevent park staff from evaluating and nominating the remaining structures.

About two-thirds of the park's historic structures are related to maritime history. Lake Michigan was an important transportation corridor for goods going to and from Chicago. The waters of Manitou Passage, which lay between South Manitou Island and the mainland, proved perilous for many ships. At least 42 ships wrecked while trying to navigate this passage. In 1839, a lighthouse was built on South Manitou to help guide ships. In 1858, a second lighthouse was built to take its place, and this one was modified in 1871 to include a taller tower and a lens upgrade from 4th order to 3rd order. The current lighthouse has withstood the test of time and still stands as a reminder of the busy shipping industry that moved goods to and from Chicago during 19th century.

A lifesaving station built on North Manitou Island in 1854 is the only remaining station in the country from the 1850s, and is listed on the National Register of Historic Places as a National Historic Landmark. It continued to serve troubled vessels until 1939. In 1871, the federal government established the U.S. Life-Saving Service, precursor to the U.S. Coast Guard, to provide assistance to vessels in trouble along the seacoasts and within the Great Lakes. On South Manitou Island, a lifesaving station was built in 1901 near the existing lighthouse. It provided assistance to vessels until its closure in 1958. In 1983, the site was listed on the National Register of Historic Places as the South Manitou Island Lighthouse Complex and Life-Saving Station.

The Sleeping Bear Point Life-Saving Station was built in 1902 near the village of Glen Haven. Today it serves as a museum where park visitors can learn about maritime history and the U.S. Coast Guard. The station was added to the National Register in 1979. Several other historic buildings are still standing within Glen Haven, which was placed on the National Register in 1983. They include the Sleeping Bear Inn, a cannery, a blacksmith shop, and the general store. The general store has been restored to its early-20th century appearance, and is operated as an interpretive site by the park's cooperating association, Eastern National. Friends of the Sleeping Bear Dunes assisted with the funding for the restoration. A portion of the store has been adapted for use as a ranger station.

More than 120 historic structures are found throughout the Port Oneida Rural Historical District, which was added to the National Register in 1997. The 3,400-acre historic landscape is composed of 18 farms separated by rolling, sandy hills covered with hardwood forests. Port Oneida, which was established in 1852 and farmed for more than 100 years, includes houses, barns, corncribs, and other agricultural buildings.

Park staff, volunteers, and partners work together to protect historic structures. Sleeping Bear Dunes employs a full-time historic architect that conducts research aimed at protecting the structures, and a historical landscape architect employed through the regional office is consulted on about 80 percent of the projects that relate to cultural landscapes. Interpreters use buildings for programs and are quick to notice and report any problems. Volunteers and park partners such as the Friends of Sleeping Bear Dunes, Manitou Islands Memorial Society, and Preserve Historic Sleeping Bear use or occupy several historic structures and assist with maintenance work.

Another creative way the park has found to accomplish restoration is through a partnership

with the Michigan Barn Preservation Network. This decade-old program offers training to the public and to park staff and volunteers about historic structure preservation in the context of barn restoration. Program participants have helped restore barns at Port Oneida and South Manitou Island.

Even with assistance from volunteers and partners, the park still has a difficult time keeping up with maintenance needs. Wind, sun, and precipitation constantly weather historic structures, many of which are made of wood. Condition surveys indicate that 214 of the park's 366 historic structures are in good condition; just 31 are rated as being in poor condition. Even so, deferred maintenance costs at Sleeping Bear Dunes are about \$11.2 million, while the cost of needed rehabilitation tops \$8.8 million.

MUSEUM COLLECTION AND ARCHIVES—FULL-TIME STAFFER NEEDED TO PROVIDE CARE

The museum collection at Sleeping Bear Dunes is home to items both large and small, from fishing vessels to shell buttons. The Fredrickson Great Lakes Maritime Collection is the park's signature holding, and it includes the world's largest collection of name boards from Great Lakes vessels. In sum, the park's

Several historic buildings are still standing in Glen Haven, including the Sleeping Bear Inn.



museum collection includes more than 75,000 objects and archives.

One temporary staff person who works just one day each week is responsible for caring for the park's collection. To better manage, preserve, and make accessible the museum collections and update the scope of collections statement and collection management plan, a full-time position is needed.

Many items within the extensive collection are so large in size that they must be stored and displayed at various buildings throughout the park. For example, the cannery at Glen Haven houses historic vessels such as a fish tug and several lifesaving watercraft, while agricultural equipment such as hay loaders and wagons are kept in the many historic barns and other historic structures in the park. The Sleeping Bear Point Life-Saving Station—now used as a maritime museum—houses some of the ship name boards, as well as ship models, boat objects, and historical furnishings used by the U.S. Life-Saving Service. The Hart Visitor Center, located in Empire, includes natural, geological, and maritime history displays. It is the only exhibit area that is open year-round.

Structures used to store collections and exhibits do not adequately preserve them. For

example, rodents have access to the Sleeping Bear Point Life-Saving Station Boathouse and threaten the artifacts displayed. In addition, collections storage facilities need upgraded heating, ventilating, and air-conditioning (HVAC) and fire suppression systems.

ETHNOGRAPHY—AMERICAN INDIAN CONNECTIONS NEED STUDY

American Indians lived in the Sleeping Bear Dunes region from the end of the glacial era until modern times, yet their story is seldom told at Sleeping Bear Dunes. The park's ethnography program is in its infancy; an ethnographic overview and assessment that formally identifies groups of people with traditional associations to parklands and waters is needed to get the program off the ground.

Although no groups have been formally identified yet, the park has begun to consult with some American Indian tribes to try to start putting together the historical pieces. Those groups include the Bay Mills Indian Community, Grand Traverse Band of Ottawa and Chippewa Indians, Little River Band of Odatta Indians, Little Traverse Bay Bands of Odawa Indians, and the Sault Ste. Marie Tribe of Chippewa (Ojibwa) Indians.

Forging relationships with traditionally associated groups leads to richer interpretive programs and a better understanding of how these groups used resources in the past. The Park Service is also mandated to build such relationships and ensure traditionally associated people are considered when park management decisions are made that could affect ethnographic resources.

Park staff have prepared project requests for an American Indian traditional use study and an oral history study. Collecting oral histories is particularly time sensitive; waiting too long could mean losing important opportunities to record the memories and knowledge of tribal elders.

The museum collection at Sleeping Bear Dunes is home to items both large and small, from fishing vessels and lifesaving watercraft to shell buttons.



NATIONAL PARK SERVICE



STEWARDSHIP CAPACITY

FUNDING AND STAFFING—SHORTFALLS COMPROMISE RESOURCE PRESERVATION AND PROTECTION

Sleeping Bear Dunes National Lakeshore has received modest increases to its annual operating budget over the last five years (\$3,004,000 in 2001 to \$3,519,000 in 2006). In spite of these increases, the park suffers from funding and associated staffing shortfalls that translate to difficulties protecting and preserving park resources. The park's inflation-adjusted appropriated base budget has remained relatively flat over the past 20 years. During the same period,

the cost of operating the park has risen. Staff salary and benefit expenditures have historically comprised the largest amount of the lakeshore's operational costs. Legislated mandates have increased law enforcement, resource management, interpretive ranger, and administrative staff salaries. The cost of employee benefits has increased due to a government-wide change in the retirement system. Other increases are the result of cultural resource mandates, planning requirements, accessibility standards, information technology upgrades, and a maintenance backlog. Mandated salary increases and increased operational costs have come without adequate budget increases.

Park staff strive to provide quality educational programs to park visitors and organized school and civic groups. Current staffing levels, however, do not consistently allow for adequate educational programming to be offered to school groups, on- or off-site.

In recent years with the advent of the Recreational Fee Demonstration Program/Federal Lands Recreation Enhancement Act, the park has been able to augment basic funding with revenues from entrance and other user fees. But this additional income is not enough, and Sleeping Bear Dunes suffers from funding and staffing shortfalls. One example of these shortfalls: Although the park is home to more than 366 historic structures, there is just one staff person dedicated to cultural resources. In addition, staff shortages prevent the park from completing and implementing needed resource management plans.

Top priority needs for Sleeping Bear Dunes include improving natural resources management and scientific research, enhancing park-wide planning efforts, strengthening partnerships, restoring and operating the Glen Haven Historic District, preserving the Port Oneida Rural Historic District, and restoring the South Manitou Island Lighthouse. The park has requested increases to its base operational budget to support these and other efforts, but funding has not been received.

PARK PLANS—STAFF SHORTAGES PREVENT PARK PLANNING

Sleeping Bear Dunes National Lakeshore is currently in the process of updating its general management plan (GMP) to include a wilderness study. The existing GMP was developed in 1979, and since then, a number of issues and conditions have changed. Through the wilderness study, a fresh look at the wilderness potential in the park is under way. Sleeping Bear Dunes currently manages 31,000 acres as wilderness in accordance with the 1981 Wilderness Recommendation and 1982 amendments to the park's legislation. The GMP and wilderness study are expected to be completed by the end of 2008.

Other plans and research have gone undone because of funding and staffing shortfalls; most notable is the need for numerous natural and

cultural resource management plans, updates to National Register of Historic Places nominations, and a comprehensive interpretive plan. Establishing an education program and preparing a comprehensive interpretive plan will enable visitors to better understand, appreciate, and ultimately protect resources at Sleeping Bear Dunes. Historic structure reports and cultural landscape reports are needed for most of the park's historic structures and landscapes. Monitoring plans are also needed, but these are low priorities because the park does not have the staff needed to write and implement such plans.

RESOURCE EDUCATION—NOT ENOUGH STAFF TO SERVE VISITORS

Park staff at Sleeping Bear Dunes strive to provide quality educational programs to park visitors and organized school and civic groups. Current staffing levels, however, do not consistently allow for adequate educational programming to be offered to school groups, on- or off-site. Park managers would like to develop a comprehensive interpretive program that includes curriculum-based components, educational outreach, and teaching support materials for educators. These resources could help to compensate for a shortage of ranger-led programs.

EXTERNAL SUPPORT—OUTSIDE GROUPS AID PARK

Sleeping Bear Dunes National Lakeshore benefits from a wide variety of local partnerships, which help to both support park management actions and foster good relations with stakeholder groups. Organizations actively involved with the lakeshore include Eastern National, Friends of Sleeping Bear Dunes, Preserve Historic Sleeping Bear, Glen Arbor Art Association, Glen Lake School, Manitou Islands Memorial Society, and the Benzie Conservation District (watershed issues).



INDIANA DUNES NATIONAL LAKESHORE



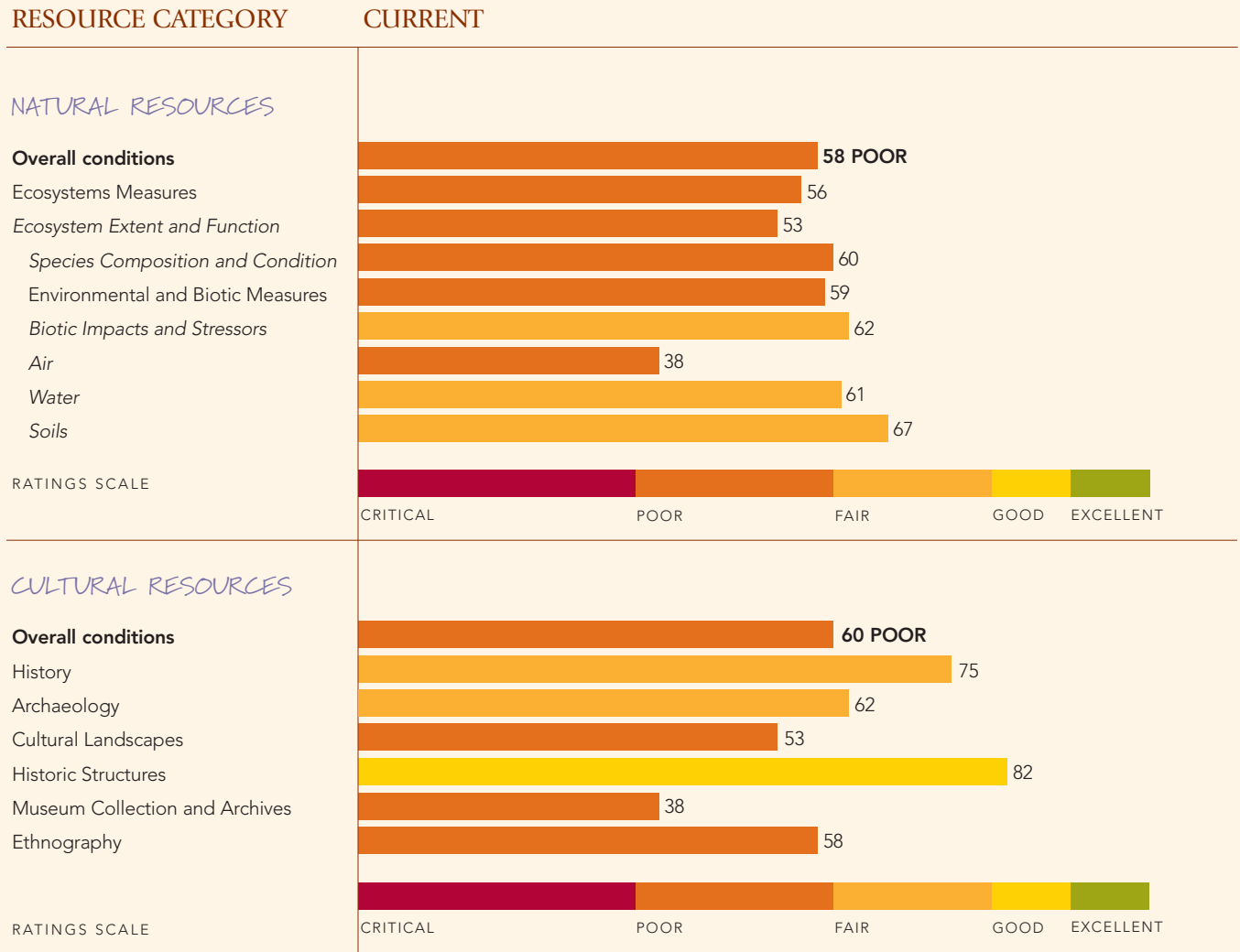
Pleasant summer temperatures and abundant fish and wildlife made the southern shores of Lake Michigan an attractive place for early American Indians. The Miami, Ottawa, and Potawatomi tribes lived in the area when French fur traders and missionaries traveled through the Calumet region of present-day Indiana and Illinois in 1675.

Initially, the swamps and dunes of the Calumet region were barriers to early Euro-

American settlement. In 1822, Joseph Bailly and his son-in-law, Joel Wicker, became two of the first documented settlers in the dunes. Bailly built a trading post and then a tavern on the Little Calumet River. After his death, his family began a sawmill business to supply the area's building boom. The land surrounding the dunes was logged in the 1860s, then converted to farms by Swedish and German immigrants. Extensive areas of uplands and wetlands were

Abundant resources and beautiful scenery have long attracted people to the Indiana Dunes region.

Note: When interpreting the scores for natural resource conditions, recognize that critical information upon which the ratings are based is not always available. This limits data interpretation to some extent. For Indiana Dunes National Lakeshore, 80 percent of the information required by the methodology was available.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases pre-dating a park's creation. The intent of the Center for State of the Parks is to document the present status of park resources and determine which actions can be taken to protect them in the future.

cleared between the 1830s and the 1930s for row crop agriculture and pasture.

As the 19th century drew to a close, ecologist Henry Chandler Cowles published an article titled "Ecological Relations of the Vegetation on Sand Dunes of Lake Michigan." His research on plant succession and the physiographic ecology of the dunes provided the foundation for additional dune research in the first half of the 20th century, and is still highly regarded in the field of ecology. Cowles was also a strong early advocate of protecting the dunes and establishing a national park.

As the 20th century progressed, industrial, commercial, and residential development took root in the Indiana Dunes region. Such development involved ditching and draining wetlands, fire suppression, and building roads and railroads, which fragmented and degraded the landscape. Once the largest sand dune on the Indiana shore, the Hoosier Slide was mined and removed for use in making glass jars and plate glass. Development escalated in the 1950s and 1960s with the post-war economic boom.

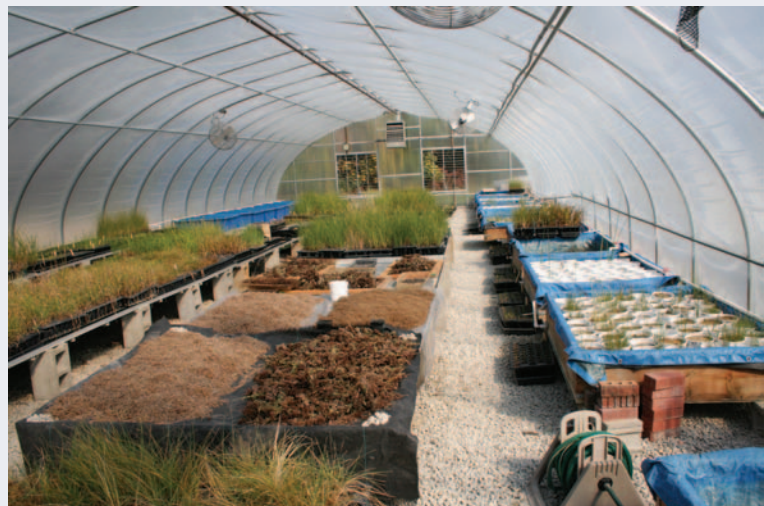
During this time, the Northern Indiana Public Service Company unveiled plans for a new power plant on 300 acres within the dunes, while Bethlehem Steel wanted to build a new mill to the east of existing industrial development. Furthermore, Bethlehem sought federal funding for construction of new harbor facilities to facilitate shipping raw materials and product. Significant opposition from many who wished to preserve the Indiana Dunes resulted in a political compromise: Bethlehem received federal funding for its harbor project while dune conservationists convinced Congress to establish a 8,100-acre national lakeshore in 1966. Subsequent expansions increased the park to 15,067 acres.

Nestled between Gary and Michigan City, Indiana Dunes National Lakeshore includes 15 miles of Lake Michigan shoreline within its designated boundaries and is composed of two large parcels (East Unit and West Unit)

RESOURCE MANAGEMENT HIGHLIGHTS

- Park staff rehabilitate old home sites and agricultural fields by removing non-native species and replacing them with native plants from local sources. Habitat recovery can be very good at the sites where native species dominate adjacent areas and natural disturbances such as fire are allowed to occur.
- The park is home to five houses originally built for the 1933 World's Fair in Chicago. Architects employed innovative construction methods and experimental building materials in efforts to envision homes of the future. Real estate developer Robert Bartlett moved the houses to Indiana Dunes in 1935. They later became part of the national lakeshore, and now the Park Service is using an innovative leasing plan to ensure the homes are preserved for the future. Participants receive use of the homes for 30 years in exchange for funding rehabilitation of the structures.
- On November 29, 2006, Indiana Dunes National Lakeshore and Porter County Convention, Recreation, and Visitor Commission opened the Dorothy Buell Memorial Visitor Center to the public. It is the park's only visitor center. Exhibits will be planned, designed, and built to fill the facility's 1,400-square-foot exhibit hall once \$1.2 million is secured. Until then, the park's interpretive staff offer informal interpretive activities and programs to increase visitor understanding of the park's natural and cultural resources.

Park staff rehabilitate agricultural fields by removing non-native species and replacing them with native plants grown in the park's greenhouse.



NATIONAL PARK SERVICE

KEY FINDINGS

- The park's dunes, which are home to unique vegetation communities, suffer from the effects of adjacent shoreline development. Natural dune construction processes have been halted, while the pace of erosion has increased, imperiling the park's namesake features.
- Indiana Dunes encompasses 15 miles of Lake Michigan shoreline within its designated boundaries, two named inland lakes, 17 streams, and acres of bogs, wetlands, and lagoons. Ditching, draining, diverting, and dredging have seriously affected these aquatic resources. Riparian buffers and habitat were reduced, and the wetlands' natural filtering abilities were compromised. Contamination from aerial deposition, runoff, industrial pollution, and sewage system inputs from adjacent lands continues to affect park waters and wetlands.
- Industrial, commercial, and residential development surrounding the park negatively affect air quality. Nitrogen deposition is high, which is of particular concern in

Industrial, commercial, and residential development surround Indiana Dunes.

NATIONAL PARK SERVICE



the park's nitrogen-limited systems. Additionally, Indiana Dunes experiences pollution from ozone, sulfur dioxide, sulfate, and mercury. Particulates are also at critically high levels.

- Further documentation of resources through historic structure reports, cultural landscape reports, a traditional use study, a cultural affiliation study, and an updated historic resource study are needed in order to determine the extent of cultural resources at Indiana Dunes and provide for their proper care and interpretation. Park staff have requested funding for several of these projects.
- Additional training opportunities are needed to supplement park staff knowledge about cultural landscapes, collections management, and ethnography. A well-trained staff can better guide resource protection and maintenance, and can better interpret resources for visitors.
- The park's museum storage facilities are not adequate to house collections, and some items are at risk of being damaged or destroyed because there are no funds to install fire suppression and climate control systems. The park does not have a curator or museum technician on staff. As a result, about 40 percent of the museum collection and archives has not been cataloged, and providing routine care to the collection is a challenge.
- Since 2000, the park has lost 20 staff positions from its resource management, resource and visitor protection, maintenance, interpretation, management, and administrative divisions because there are no longer funds to support these positions.



In 1822, Joseph Bailly and his family became some of the first documented settlers in the dunes, building this home as well as a trading post and a tavern.

that are separated by a large industrial complex and smaller noncontiguous satellite areas (Pinhook Bog, Hobart Prairie Grove, Calumet Prairie, Hoosier Prairie, and the Heron Rookery). The park also includes 596 acres of Lake Michigan waters.

Indiana Dunes' impressive biological diversity and historical significance have garnered much attention. Biological diversity is among the highest per area compared to all national parks, and more than 1,100 native species of flowering plants and ferns have been documented at the park. Indiana Dunes is home to four national natural landmarks, lands that have been federally designated for their premier biological and geological features. These include Hoosier Prairie State Nature Preserve, Cowles Bog, Pinhook Bog, and the Dunes Nature Preserve.

The Bailly Homestead, former home of some

of the area's first Euro-American settlers, is a national historic landmark, the highest honor awarded to a cultural site. Century of Progress houses originally built for the 1933 Chicago World's Fair are also listed on the National Register of Historic Places.

Center for the State of the Parks researchers' assessment of natural resource conditions at Indiana Dunes rated overall conditions as "poor," with a score of 58 out of 100. The park is located in the midst of industrial and residential development that fragments habitat, contributes to air, water, and noise pollution, and disrupts scenic viewsheds.

Cultural resource conditions also rated "poor," overall, with a score of 60 out of 100. Additional studies are needed to better document the park's cultural resources, and more training opportunities would enable staff to provide even better care for resources.



Indiana Dunes National Lakeshore is renowned for its birdlife. One area, the Heron Rookery, has been set aside especially for nesting great blue herons.

NATURAL RESOURCES

NATIVE SPECIES AND HABITATS—DUNES, BOGS, FORESTS, AND PRAIRIES ARE HOME TO MANY PLANTS AND ANIMALS

The high biological diversity within Indiana Dunes National Lakeshore is due, in part, to the variability of its habitats and the intersection of three biomes—the temperate deciduous forest, tallgrass prairie, and boreal forest. Across the park's landscape there are unvegetated beaches, grass-covered dune ridges, blowouts, dunes dominated by woody shrubs, jack pine-forested dunes, oak-forested dunes, oak savannas, and prairies.

Hoosier Prairie State Nature Preserve and Hobart Prairie Grove contain some of the last vestiges of tallgrass prairie in the region, while Great Marsh in the East Unit features remnant sedge meadows surrounded by cattail marsh and ponds. Cowles Bog is home to species such as northern white cedar (*Thuja occidentalis*) and yellow birch (*Betula alleghaniensis*), while Pinhook Bog is filled with sphagnum moss, leatherleaf (*Chamaedaphne calyculata*), highbush blueberry (*Vaccinium corymbosum*), lady's-slipper orchid (*Cypripedium acaule*), deciduous evergreens such as tamarack (*Larix laricina*), and carnivorous plants such as pitcherplant (*Sarracenia purpurea*).

The park's dunelands and wetlands were the settings for renowned ecologist Dr. Henry Cowles' pioneering studies of plant ecology and succession more than 100 years ago. The unique plant communities of the area have been the basis for a considerable body of ecological research that continues today.

In sum, Indiana Dunes hosts 1,445 plant species, of which 1,135 are native, including Pitcher's thistle (*Cirsium pitcheri*), which is listed as threatened under the Endangered Species Act. About 30 percent of Indiana's state-listed rare, threatened, endangered, and special concern plant species also occur in the park.

The wide variety of aquatic and terrestrial habitats within the park also supports hundreds of wildlife species. The park is renowned for its birdlife—more than 350 species have been observed there. One area, the Heron Rookery, has been set aside especially for nesting great blue herons (*Ardea herodias*). Visitors are not permitted in this area. Indiana Dunes is also an important stop for feeding and resting migratory birds.

Mammals include the gray fox (*Urocyon cinereoargenteus*) and red fox (*Vulpes vulpes*), coyote (*Canis latrans*), various rodents and mustelids, and a number of bats. The extirpation of all large mammalian predators, including the gray wolf (*Canis lupus*) and mountain lion (*Puma concolor*), in and around the park has likely allowed numbers of several prey species to increase. For example, before Euro-Americans settled in the region and predators were extirpated, there were about eight to 11 white-tailed deer (*Odocoileus virginianus*) per square mile; today there are about 98 deer per square mile. At this density, these grazers threaten certain plant species and the stability of habitats. About 77 of 119 state and federally listed plant species at the park are known to be palatable to deer. In the Cowles Bog area, one large area enclosure protects the roughly two acres that support the only white cedar popu-

lation in Indiana, in addition to other sensitive plant species.

Fish communities in the southern Lake Michigan basin are typically low in species richness, and native species richness has declined by 22 percent since European settlement of the region. But natural fish communities with a relatively diverse assemblage of species remain primarily in the ponds of Miller Woods, the Grand Calumet Lagoons, and the Little Calumet River.

DUNES—THREATENED BY SHORELINE DEVELOPMENT

Wind, water, and waves continually erode the dunes and beaches at Indiana Dunes National Lakeshore, but sands transported to the park

Indiana Dunes provides habitat for Pitcher's thistle, a plant listed as threatened under the Endangered Species Act.



NATIONAL PARK SERVICE

USACE has brought more than 1 million cubic yards of sand to Mt. Baldy—the park's largest active dune and a favorite hiking destination for visitors—to help counteract extensive erosion.



NATIONAL PARK SERVICE

traditionally brought fresh building supplies. One of the most serious long-term issues that faces Indiana Dunes is the lack of sediment transport, a key component of dune construction. Because the Indiana shoreline is now fragmented into individual cells between human-made structures, sediment transport that historically provided sand to the beaches no longer occurs naturally.

Urban shoreline developments interrupt the natural sediment transport along the shoreline. Sediment is transported from east to west down the Lake Michigan coast, but updrift of shoreline structures there is accretion (beaches are expanding), and down-drift of the structures there is erosion. As a result, dune construction has stopped in some areas, erosion continues at an accelerated rate, and the long-term health of this ecosystem is in serious jeopardy.

To mitigate this situation, the U.S. Army Corps of Engineers (USACE) initiated a beach nourishment program to supply sand to build up the beaches and protect Mt. Baldy—the park's largest active dune and a favorite hiking destination for visitors—from extensive erosion. As of January 1, 2007, USACE had brought about 697,273 cubic yards of sand to Mt. Baldy beach from an inland source of sand and 357,261 cubic yards of clean sand dredged from Michigan City Harbor.

ADJACENT LAND USE—PARK LOCATED AMID MUCH DEVELOPMENT

Indiana Dunes is surrounded by a highly industrialized landscape, and roads, railroad grades, power line rights-of-way, and inholdings fragment habitat. Steel mills, two fossil-fueled power plants, and other significant industry border and are between park units.

These developments are major contributors to air, water, and noise pollution, and they also degrade scenic and historic viewsheds.

Within Indiana Dunes National Lakeshore, there are more than 50 improved residential properties that cover about 1,500 acres of authorized parkland that have not been purchased by the Park Service; most are primary residences, while some are summer homes or rental properties. The park also contains 87 tracts where private individuals maintain reserved use rights, some of which continue until 2020.

Residential development in the area has exploded over the last decade, partly because of the proximity to the desirable lakeshore park. Rising property values have made it increasingly more expensive and difficult for the park to acquire parcels within its authorized boundary. Increased residential development directly adjacent to the park's boundary interferes with viewsheds, and local commercial tourist operators are increasingly bringing greater numbers of people to the park, which can lead to visitor impacts such as vegetation trampling and dune erosion, which is an issue at popular sites such as Mt. Baldy.

WATER RESOURCES—COMPROMISED BY CONTAMINANTS

Aquatic resources are key components of Indiana Dunes National Lakeshore. The park includes 596 acres of Lake Michigan and 15 miles of coastline; 1,247 acres of emergent wetlands, forested wetlands, and bogs; the Grand Calumet Lagoons (remnants of the former delta of the Grand Calumet River); two named lakes (Lake George and Long Lake totaling 80 acres); and 17 perennial and intermittent streams with a total length of 11 miles. Additionally, there are 12 miles of ditched streams that serve as a reminder of the habitat alteration that occurred in the early 20th century to accommodate agriculture, urbanization, and industrialization.

Ditching, draining, diverting, and dredging have seriously affected aquatic resources at Indiana Dunes National Lakeshore. Riparian buffers and habitat were reduced, and the wetlands' natural filtering abilities were compromised. Contamination from aerial deposition, runoff, industrial pollution, and sewage system inputs from adjacent lands continue to degrade park waters.

Indiana Dunes is surrounded by a highly industrialized landscape, which fragments habitat, significantly contributes to air, water, and noise pollution, and degrades scenic and historic viewsheds.



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PARK HARBORS THE ENDANGERED KARNER BLUE BUTTERFLY

Indiana Dunes is home to the Karner blue butterfly (*Lycaeides melissa samuelis*), a small butterfly with beautiful, intricate markings that is federally listed as endangered. This native of the Great Lakes region is at risk because of land development and habitat loss from altered disturbance regimes. Poaching by butterfly collectors is also a potential threat to this endangered species.

The caterpillars of the Karner blue butterfly feed solely on the leaves of wild lupines (*Lupinus* spp.), plants that grow in the open savannas of Indiana Dunes. As fires are suppressed, woody species encroach on savannas and lupines are excluded.

Staff at Indiana Dunes are working hard to ensure the park continues to provide good habitat for the butterflies. Carefully planned prescribed burns are key tools in savanna habitat restoration. In addition, staff use hand tools to restore and improve oak savanna habitat by creating or enlarging canopy openings and reducing woody undergrowth. The park hopes to create habitat corridors to connect isolated populations of Karner blue butterflies. The park is also working with The Nature Conservancy in butterfly restoration efforts.

Spotted knapweed (*Centaurea maculosa*), an invasive plant common along the railroad corridors that run throughout the park, is of great concern because it has spread into the west end of the park near a high-quality savanna/woodland complex, which could devastate the habitat for the Karner blue butterfly. Efforts are under way to control this highly invasive plant species.

Indiana Dunes is home to the endangered Karner blue butterfly. Staff work to restore and improve butterfly habitat.





Researchers sample sediments in the Grand Calumet Lagoons, waters at the west end of the park that are polluted by industrial waste.

An industrial landfill that contains millions of tons of steel slag and other industrial waste pollutes the Grand Calumet Lagoons in the west end of park. Prior to the passage of the Clean Water Act in 1977, the waters of the Grand Calumet River served as a dumping site for industrial and municipal wastes. Chemicals that were used in industrial applications were transported into the park. Contaminants such as polychlorinated naphthalenes (PCNs) have been found in phytoplankton, algae, amphipods, and smallmouth bass (*Micropterus dolomieu*), as well as non-native zebra mussels (*Dreissena polymorpha*) and round gobies (*Neogobius melanostomus*).

Certain organic contaminants bioaccumulate in fish, resulting in mortality or reduced reproductive success, leading to fish consumption advisories in the region. Researchers have documented the presence of contaminants such

as heavy metals, polychlorinated biphenyls (PCBs), organic pesticides, and nutrients in sediments and biota. Sediments also still have high levels of pollutants such as bacteria, nutrients, cyanide, lead, arsenic, cadmium, phenols, oils, and grease. Runoff from the Indiana Toll Road and an adjacent salt storage pile increased the salinity of Pinhook Bog, killing some native vegetation and promoting the growth of invasive species such as hybrid cattail (*Typha* spp.) and common reed (*Phragmites australis*). The salt dome has been removed and the site is no longer used, but the legacy of the impact has not been recently investigated.

HABITAT RESTORATION—PARK STAFF TARGET INVASIVE PLANTS

Severe fires and logging in the 19th century, along with a more recent history of fire suppression, atmospheric inputs of nitrogen, and inva-

sive species, have resulted in reduced tallgrass prairies and oak savannas and increased closed-canopy forests. The prairie and savanna that were most common in pre-settlement northwest Indiana are rarest today. Woody species are encroaching on the prairies, and the rapid spread of invasive, non-native black locusts (*Robinia pseudoacacia* L.), nitrogen-fixing trees, has greatly diminished native black oak savannas. Where black locust has invaded, community diversity has decreased and downy brome or cheatgrass (*Bromus tectorum*) has increased. This non-native grass can out-compete native plants when additional nitrogen—which is provided by the black locusts—is available.

To restore prairies and savannas, staff at Indiana Dunes use a combination of prescribed burns and other techniques to control invasive plants. Old home sites and agricultural fields support many of the invasive plant species found in the park. Park staff rehabilitate these sites by removing the non-native species and

replacing them with native plants from local sources. Habitat recovery can be very good at the sites where native species still dominate adjacent areas and natural disturbances such as fire occur. This restoration program is one of the park's longest running efforts, but still today presents some of the greatest restoration challenges.

Significant efforts are also being directed at controlling and removing non-native plants such as purple loosestrife (*Lythrum salicaria*), garlic mustard (*Alliaria petiolata*), and hybrid cattail. Wetland mitigation and conservation efforts that plug ditches, restore natural hydrology, remove invasive plants, and plant native species are restoring diverse wetland ecosystems. Additionally, park staff are removing many buildings—most of which were private residences—that were present when the park was created in order to restore natural landscapes. Only those buildings that are historically important or are used to further the mission of the park will remain.

Park staff use prescribed burns as tools in habitat restoration.





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CULTURAL RESOURCES

HISTORY—RESOURCES TELL MANY STORIES

Cultural resources at Indiana Dunes National Lakeshore tell the stories of American Indians who established trade routes through the region, Euro-American colonists and Swedish and German immigrants who built farms and carved livings from the land, architects who created futuristic homes for exhibit at the 1933 World's Fair, and steel companies that brought heavy industry to the region. Artifacts in the park's museum collection are evidence of American Indian habitation and fur trading,

the Chellberg Farm illustrates 19th century farm life, houses from the fair's Century of Progress exhibit are still displayed, and buildings remain from the Good Fellow Club Youth Camp, which was built in 1941 by U.S. Steel for workers' children.

To manage and plan for these and other historic resources, the park prepared a historic resource study in 1979, which provided a historical overview of the park for resource managers and interpreters. This study served the park well for several years, but an update is overdue to better support park planning, resource management, and interpretation. The park has set a goal of September 30, 2008, for

The Chellberg Farm illustrates 19th century farm life in the Midwest.

completed updates to the historic resource study and the administrative history, which was written in 1988.

ARCHAEOLOGY—OVERVIEW AND ASSESSMENT UNDER WAY

Archaeological sites and artifacts within Indiana Dunes National Lakeshore are evidence of both prehistoric and historic use. The park has 183 identified archaeological sites, while the museum collection includes arrow points, scrapers, pottery shards, and other artifacts. About 60 percent of the 88,000 items in the park's museum collection are archaeological artifacts, which are stored at The Midwest Archeological Center in Lincoln, Nebraska.

Archaeological overviews and assessments describe and evaluate known resources and determine what additional research is needed. The Midwest Archeological Center recently completed an archaeological overview and assessment for Indiana Dunes.

Several of the park's archaeological sites have been evaluated for the National Register of Historic Places, but none have been listed.

The Chellberg Farm includes structures such as a house, chicken coop, corncrib, and barn.



NATIONAL PARK SERVICE

Existing National Register nominations should be expanded and new nominations should be created to include archaeological resources.

Although the park does not have a full-time archaeologist on staff and must rely on archaeological expertise from the Midwest Archeological Center, existing park staff go to great lengths to protect archaeological resources. Staff recently rerouted a trail to avoid disturbing archaeological resources, and fire crews were not allowed to dig fire lines in a prescribed burn area for fear of disturbing buried archaeological resources. In addition, park staff take great pains to preserve archaeological sites when removing non-historic structures from parklands.

CULTURAL LANDSCAPES—STAFF WORK TOGETHER TO PRESERVE HISTORIC CONTEXTS

Cultural landscapes at Indiana Dunes National Lakeshore illustrate how the people who lived there before the park was created used the lands and waters. The Chellberg Farm includes the remains of an orchard, ten acres of woodland, ten acres of unimproved lands, acres of tilled land, and structures such as a house, chicken coop, corncrib, and barn. Three generations of Chellbergs lived on the farm from 1869 until 1972. Good Fellow Club Youth Camp was a summer recreational outlet for the children of U.S. Steel workers from 1941 to 1975. Woodlands, open areas, buildings, and recreational facilities remain. In sum, the Park Service's regional office has identified 17 cultural landscapes within the boundaries of Indiana Dunes. Seven of the park's cultural landscapes have been determined eligible for the National Register, but nominations have not been completed.

Cultural landscape reports are the primary guides for treatment and use of cultural landscapes. The Chellberg Farm is the only cultural landscape at Indiana Dunes with a completed report, which includes site history, existing conditions, management issues, and implemen-



An innovative leasing program supports restoration of the park's Century of Progress homes. The Florida Tropical House, designed for tropical climates, has both indoor and outdoor living spaces.

tation guidelines, though a cultural landscape report for Good Fellow Club Youth Camp is nearly complete. Reports for several of the park's other cultural landscapes would help guide management and interpretation, but funding is needed before any additional work can be done.

Both cultural and natural resources staff work together to protect cultural landscapes at Indiana Dunes. At the Bailly Homestead, natural resources staff have proposed replacing invasive black locust trees with similar-looking native trees as the black locusts die.

HISTORIC STRUCTURES—STRATEGIES NEEDED TO ENSURE PRESERVATION

When Indiana Dunes was established, there were dozens of structures throughout the park, including many residences. Some were removed to restore natural landscapes, while others remain occupied under reservations of use.

Structures with significant historical value were identified, and park staff have been working to ensure their preservation. Indiana Dunes is fortunate to have a historical architect on staff to guide this work.

Some of the park's most significant historic structures include the Bailly Homestead, buildings on the Chellberg Farm, houses within the proposed Swedish Heritage District, and futuristic houses within the Century of Progress District. In sum, the park's list of classified structures currently includes 62 structures and landscape features. All but two of these have been determined eligible for the National Register of Historic Places, but just 12 of them are actually listed.

Most of the park's historic structures are still used by the Park Service and cooperating partners, which can help ensure that preservation needs are quickly identified and remedied. The

SCIENCE AND ENVIRONMENTAL LEARNING CENTERS CONTRIBUTE TO RESEARCH AND EDUCATION

Partnerships with other federal agencies, nonprofit organizations, and universities enable the park to accomplish important research and expand its educational capacity to reach more people. Indiana Dunes National Lakeshore is home to the Lake Michigan Ecological Research Station, the Great Lakes Research and Education Center (GLREC), the Paul H. Douglas Center for Environmental Education, and the Indiana Dunes Environmental Learning Center.

The ecological research station has funded and produced much research at the park, including studies on threatened and endangered plant and animal species; oak savanna habitat function and restoration; invasive plant and animal species presence and control measures; and air and water quality and contaminants. The GLREC is one of 17 research learning centers established throughout the park system to engage the scientific community and the public in park research, management, and education. Since its inception in 2002, the GLREC has facilitated research conducted in ten Great Lakes national parks; sponsored workshops and forums for educators, resource managers, researchers, and the public; written articles on research findings for newsletters, newspapers, and magazines; created activities designed to teach about research findings; and facilitated citizen science opportunities. The Paul H. Douglas Center for Environmental Education and the Indiana Dunes Environmental Learning Center offer environmental education programs for elementary, middle school, and high school students.

Century of Progress homes originally built for the 1933 World's Fair are preserved through a 30-year leasing program administered by the Historic Landmarks Foundation of Indiana. These agreements allow people to live in the houses in exchange for restoring and preserving them. This project is estimated to be a \$6 million value for the Park Service, which would otherwise be unable to fund the restoration.

Living history programs at the Chellberg Farm are great learning experiences for park visitors, but years of heavy use are taking a toll on the structures. Decking on the front porch has deteriorated, while interior painted surfaces and wood floors are worn from high visitor use. Visitors are not allowed in the Bailly Homestead because it has not been restored yet and there are some safety concerns. These sites are two of the most important in the park, but additional work is needed to guide use and preservation. For example, the Bailly Homestead, named a national historic landmark in 1966, needs an up-to-date professional historic structure report. Strategies are also needed to ensure the long-term preservation of the homestead and other historic structures.

Deferred maintenance costs for historic structures total about \$326,000, while the cost of rehabilitation and restoration is estimated at about \$5.2 million. The park has requested funds for preservation, rehabilitation, and restoration projects. It is important that these projects are funded before damage forces closure of important historic structures, or worse, before significant pieces of history are lost.

MUSEUM COLLECTION AND ARCHIVES—STORAGE AND DISPLAY IMPROVEMENTS NEEDED

Prehistoric tools, artifacts from fur-trading days, 19th century farm implements and household items, plant and insect specimens, and historic photographs are parts of the museum collection and archives at Indiana Dunes. In sum, the collections total more than 88,000 items; about



Historic structures suffer damage when regular maintenance must be deferred because of a lack of funds. Deferred maintenance costs for historic structures at Indiana Dunes currently total about \$326,000.

60 percent of the collection is stored at the Midwest Archeological Center under optimal conditions. Of the items stored at the park, only about 25 are on public display, partly because the park does not have much secure exhibit space that meets museum standards.

The Bailly and Chellberg homes would be ideal locations to display items that belonged to those families, but without adequate pest control and fire suppression and climate control systems, artifacts cannot safely be displayed there. Other storage spaces throughout the park face similar issues, and some objects are at risk of being damaged or destroyed. Park staff have identified these shortcomings and are seeking funds to remedy the situation. So far, however, no funds have been awarded to investigate pest problems or install fire suppression systems. Park staff hope to display more artifacts in the new visitor center

that opened in 2006, but proper security and environmental controls must be addressed first.

The museum collection and archives also suffer because Indiana Dunes does not have enough staff to catalog, monitor, and provide routine care for the resources. There is no curator or museum technician on staff; instead, the park's historian cares for the collection as a collateral duty. Neither permanent nor seasonal staff receive training in museum preservation techniques. The park has access to a regional curator who also serves 51 other parks, which means that little time is allocated to Indiana Dunes.

The collection has never been comprehensively surveyed, though park staff have requested funds to complete this project. Forty percent of the museum collection and archives has not been cataloged. In order to accomplish these projects and provide daily care to the collections, Indiana Dunes needs museum staff.

ETHNOGRAPHY—PARK EXPLORING
AMERICAN INDIAN CONNECTIONS

The Indiana Dunes region has a long history of human use that dates to prehistoric times. When French fur trappers visited in the 17th century, they met with American Indians who had been using the area for centuries. Eventually, Swedish and German immigrants moved in and began to build their pieces of the region's history. Cultivating relationships with groups of people who have traditional associations to park resources is an important aspect of park management, and it begins with first identifying these groups. Indiana Dunes has completed this initial step by producing an ethnographic overview and assessment, which named the Miami, Potawatomi, and Ottawa as the three primary associated groups, along with Euro-American settlers.

Although archaeological evidence indicates American Indians used resources at Indiana Dunes, these activities are not widely interpreted at the park, partly because not enough

research has been done to understand exactly how resources were used. Several tribes have shown interest in helping the park enhance this kind of interpretation, however, and the park has requested funds to complete cultural affiliation and traditional use studies, which will further understandings of ethnographic resources. In addition, an ethnobotanical study is under way to identify how traditionally associated groups used plants for food, medicine, and other purposes.

Stories of French and Swedish settlers are more widely told at Indiana Dunes, perhaps because they are some of the most recent occupants and many historic structures and cultural landscapes reflect their lives. Living history programs at the Chellberg Farm give visitors a glimpse of what life was like for this family. Descendants of some settlers still live in the area, and park staff are working with them to develop additional interpretive programs. Additional ethnographic training would help staff better develop the park's ethnography program.

This handmade ceramic tile was commissioned around 1900 by Frances Howe, granddaughter of Joseph Bailly. It is one of 64 tiles made to surround the fireplace of the Bailly home.



NATIONAL PARK SERVICE



STEWARDSHIP CAPACITY

FUNDING AND STAFFING—SHORTFALLS LEAD TO CUTS IN STAFF AND RESOURCE PROTECTION

Indiana Dunes has received modest budget increases since 1996, going from a total budget of about \$5.1 million to a total budget of about \$7.7 million in fiscal year 2007. In spite of these increases, the park still cannot afford to employ critical staff or pay for important resource protection programs. Since 2000, the park has lost 20 staff positions from its resource management, resource and visitor protection, maintenance, interpretation,

management, and administrative divisions because there are no longer funds to support these positions.

High priority projects such as threatened and endangered species protection, invasive plant control, historic structure and museum collection preservation, and dune protection remain unfunded. A plan is needed to guide wetland restoration at Indiana Dunes, but the park lacks the funds to gather baseline data and the staff needed to implement a plan.

Interpretive programs at Indiana Dunes include hikes through the park's dunes and bogs, opportunities to assist with native habitat restoration, farming demonstrations at Chellberg Farm, and programs about the lives of American Indians and the area's first Euro-American settlers.

Volunteers help make it possible for the park to provide everyday services, complete special projects, and present celebrations such as the annual Duneland Harvest Festival.



NATIONAL PARK SERVICE

RESOURCE EDUCATION—DIVERSE LEARNING OPPORTUNITIES HAVE DECLINED

Indiana Dunes provides an incredible variety of interpretive and educational programs to visitors and schoolchildren, both at the park and off-site. The majority of students and other park visitors are from the region—Indiana, Illinois, and Michigan. To maximize visitor contact per dollar spent, the interpretive division reorganized in 2005. In 2006, staff, volunteers, and interns more than doubled the number of visitors contacted—reaching 144,702 visitors through personal services; 9,799 visitors through nonpersonal services; and 7,568 students through outreach services.

Personal services included informal roving along the park's beaches and trails, the junior ranger program, hikes through the park's

dunes and bogs, opportunities to assist with native habitat restoration, maple sugaring demonstrations at Chellberg Farm, and programs about the lives of American Indians and the area's first Euro-American settlers. Traveling educational trunks contain lessons about Potawatomi lifestyles, culture, and the fur trade era, allowing teachers to bring park learning into the classroom. The park provides continuing education opportunities for teachers with workshops that cover various fields of study and hands-on activities.

Fourteen full-time interpretive staff and two subject-to-furlough employees are responsible for maintaining these interpretive and educational opportunities. Since 2000, three interpretive staff positions have been lost, and the number of interpretive programs has declined by about 21 percent. The park hopes to employ ten seasonal interpreters

through the Park Service's Centennial Challenge to reach a greater percentage of its 2 million annual visitors.

Wayside exhibits that teach visitors about the park's cultural and natural history have been updated within the last three years, and new exhibits will be developed for the new visitor center. The former visitor center is open by reservation only. As an interpretive center, it is a place where park interpreters present education programs for organized groups. Five new park brochures published in 2006 are now being distributed to park visitors.

EXTERNAL SUPPORT—VOLUNTEERS AND PARTNERS PROVIDE CRITICAL SUPPORT

Volunteers, the Friends of Indiana Dunes, the Historic Landmarks Foundation of Indiana, and a host of other private and nonprofit organizations make it possible for the park to provide everyday services and complete special projects. In 2006, volunteers spent 40,090 hours (up 50 percent from 2005) acting as campground hosts, assisting with interpretive programs, resource management and maintenance projects, and giving support to the park's annual Duneland Harvest Festival, an event that draws thousands of visitors who learn about the region's American Indian culture, fur-trading, and agricultural history. The festival is presented in partnership with the Friends of Indiana Dunes, a nonprofit organization dedicated to helping preserve the Indiana dunes.

The Boy Scouts of America provide trail maintenance, employees of Target stores in Indianapolis provide annual assistance with significant maintenance projects, students at Chesterton High School have helped restore Mnoké Prairie, the Save the Dunes Conservation Fund supports invasive plant control efforts, and The Nature Conservancy has supported restoration efforts for the Karner blue butterfly.

WHAT YOU CAN DO TO HELP

- **Support or become a member of groups helping to protect the parks:** National Parks of Lake Superior Foundation (www.nationalparksoflakesuperior.org), Isle Royale Natural History Association (www.irnha.org), Eastern National (www.easternnational.org), Friends of Sleeping Bear Dunes (www.friendsofsleepingbear.org), Preserve Historic Sleeping Bear (www.phsb.org), and Friends of Indiana Dunes (www.duneland.com/friends.htm).

- **Volunteer in the parks.** Many parks are looking for dedicated people who can lend a helping hand. To learn about opportunities, contact the parks:

Pictured Rocks National Lakeshore (906.387.2607)

Apostle Islands National Lakeshore (715.779.3397)

Isle Royale National Park (906.482.0984)

Keweenaw National Historical Park (906.337.3168)

Sleeping Bear Dunes National Lakeshore (231.326.5134)

Indiana Dunes National Lakeshore (219.926.7561 x225)

- **Become a National Parks Conservation Association (NPCA) activist** and learn about legislative initiatives affecting parks. When you join our activist network, you will receive *Park Lines*, a biweekly electronic newsletter with the latest park news and ways you can help. Join by visiting www.npca.org/takeaction.



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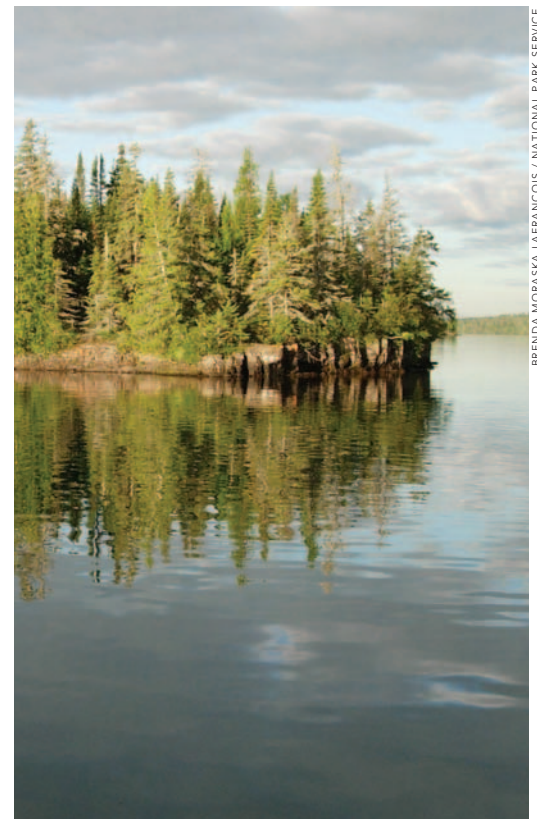
APPENDIX: METHODOLOGY

To determine the condition of known natural and cultural resources at the national parks of the Great Lakes and other national parks, the National Parks Conservation Association developed a resource assessment and ratings process. The assessment methodology can be found online at NPCA's Center for State of the Parks® website (www.npca.org/stateoftheparks/).

Researchers gather available information from a variety of research, monitoring, and background sources in a number of critical categories. The natural resources rating reflects assessment of more than 120 discrete elements associated with environmental quality, biotic health, and ecosystem integrity. Environmental quality and biotic health measures address air, water, soils, and climatic change conditions as well as their influences and human-related influences on plants and animals. Ecosystems measures address the extent, species composition, and interrelationships of organisms with each other and the physical environment for indicator, representative, or all terrestrial and freshwater communities.

The scores for cultural resources are determined based on the results of indicator questions that reflect the National Park Service's own Cultural Resource Management Guideline and other Park Service resource management policies.

Stewardship capacity refers to the Park Service's ability to protect park resources, and includes discussion of funding and staffing levels, park planning documents, resource education, and external support.



BRENDA MORASKA LAFRANCOIS / NATIONAL PARK SERVICE

For this report, researchers collected data and prepared a paper that summarized the results. The draft underwent peer review and was also reviewed by staff at Gateway National Recreation Area.

NPCA's Center for State of the Parks represents the first time that such assessments have been undertaken for units of the National Park System. Comments on the program's methods are welcome.

ACKNOWLEDGMENTS

For more information about the
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and this and other program reports, contact:

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National Historical Park (OR), Lewis and Clark National
Historic Trail (various), Little Bighorn Battlefield
National Monument (MT), Longfellow National Historic
Site (MA), Missouri National Recreational River (NE),
Mojave National Preserve (CA), Nez Perce National
Historical Park (WA, ID, MT, OR), Olympic National Park
(WA), Point Reyes National Seashore (CA), Rocky
Mountain National Park (CO), Shenandoah National
Park (VA), Saint-Gaudens National Historic Site (NH),
Waterton-Glacier International Peace Park (MT-Alberta),
Zion National Park (UT)

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