

Assessment of Sleeping Bear Dunes National Lakeshore: Backcountry Visitor Usage and Campground Suitability

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Abstract

Sleeping Bear Dunes National Lakeshore is a national park located near Traverse City, Michigan, that was established as a national lakeshore in 1970. The park provides opportunities for recreation year round, and serves thousands of visitors each year. Sleeping Bear Dunes National Lakeshore is experiencing increased usage by visitors and increased use of its recreational facilities. In order to assist the park service in future management of the backcountry areas of the park, this project looks to identify the most frequently visited areas of North and South Manitou islands, and also to identify new possible backcountry camping areas to meet park needs. Suitability for camping on the North and South Manitou Islands was evaluated on the basis of three key components: suitable camping areas, marginally suitable camping areas, and areas not suitable for camping. Primary variables defining these components are soil drainage, slope, vegetation, and park restrictions. The assessment demonstrates that based on the analysis of the four variables in the study there are park regions suitable for additional campgrounds on both North Manitou Island and South Manitou Island.

Introduction

Sleeping Bear Dunes National Lakeshore is a national park located near Traverse City,

Michigan, along the shoreline of Lake Michigan.

Sleeping Bear Dunes was established as a national lakeshore in 1970, and has since served many purposes for citizens for both private and public use. The park provides opportunities for recreation year round, and serves thousands of visitors each year. Individuals from across the country visit the park to enjoy the aesthetic qualities of the dunes, to camp, hike, swim, and to learn about the cultural history of the area. The park itself consists of a mainland, which is a short drive from Traverse City, and two offshore islands accessible by boat or ferry, North Manitou and South Manitou islands (Figure 1). The entire park encompasses a 60km stretch of Lake Michigan's eastern coastline and was established



Figure 1. General location of Sleeping Bear Dunes National Lakeshore in relation to the state of Michigan.

primarily for its outstanding natural features, including forests, beaches, dune formations, and ancient glacial phenomena. The Lakeshore also contains many cultural features including an 1871 lighthouse, three former Life-Saving Service/Coast Guard stations and an extensive rural historic farm district (www.nps.gov). According to [A Nationalized Lakeshore: The Creation and Administration of Sleeping Bear Dunes National Lakeshore](#), “This rich mixture of historic and natural assets, together with the lakeshore’s location amid rapidly developing resort communities, makes Sleeping Bear Dunes an immensely complex park unit to administer” (Karamanski, 2000).

As with many other areas of the state and country, development outside of the park’s borders is rapidly increasing. As a result, Sleeping Bear Dunes National Lakeshore is experiencing increased usage by visitors and increased use of its recreational facilities. In order to assist the park service in future management of the backcountry areas of the park, this project looks to identify the most frequently visited areas, and to identify new possible backcountry camping areas to meet park needs.

North Manitou Island

The area dunes, rich in Native American culture, were named from the Native American “Legend of Sleeping Bear”, a tale of a mother bear and her two cubs. The story describes a mother bear and two cubs that were driven from Wisconsin by a forest fire. The bears jumped into Lake Michigan to escape, and swam towards the Michigan shoreline. Eventually, the mother bear swam to shore, but the smaller cubs tired and drowned. The mother bear climbed atop the bluffs to wait for her cubs and witnessed their death. The “Great Spirit Manitou” created two islands: the North and South Manitou islands, to mark the spot of the cubs’ death, and a single dune on the Michigan mainland which was created to represent the ever faithful mother bear (www.nps.gov).

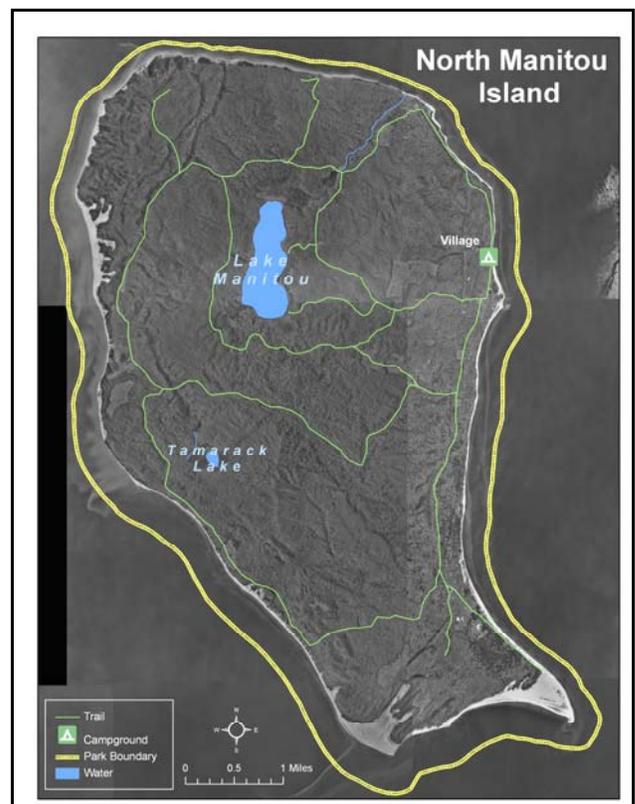


Figure 2. North Manitou Island

North Manitou Island (Figure 2) is a 15,000-acre island managed as a wilderness area for backpacking and camping. The Village Campground, located on the eastern shore of the island, is the only area that has designated campsites, fire rings, and other limited facilities. Travel outside of the village is by foot only, via the island's trail system. According to the National Park Service, "Visiting the island is a primitive experience emphasizing solitude, a feeling of self-reliance, and a sense of exploration."

The topography of the island varies considerably. Two lakes can be found in low-lying areas of the island, Lake Manitou and Tamarack Lake. The highest point on the island is in the northwest corner, 1,001 feet (305 m) above sea level or 421 feet (128 m) above Lake Michigan. Sandy dune country occurs on the southeast side and grades into high sand hills and blowout dunes on the southwest side of the island. In certain areas of the island, there are old buildings and other remnants from when the island was occupied by residents or used for summer homes or lodges. (www.nps.gov).

South Manitou

South Manitou Island is also a popular island for visitors, but does not offer backcountry camping as the North Manitou Island currently allows. Camping on South Manitou Island is restricted to the following designated camping areas: Weather Station, Bay, and Popple. Topography of the South Manitou Island consists of high, sandy bluffs and dunes on the western side of the island, and forested area towards the eastern side of the island. There is one lake, Florence Lake, located on the southern half of the island. During the late 1800's, a small number of farmers used the island to grow crops and sell surplus to passing ships and the

mainland. Remnants of this land use can be seen today in items that remain on the island such as abandoned machinery, old farm buildings, a schoolhouse, and an old cemetery (www.nps.gov).

Park Usage

Permit data was obtained from the National Park Service outlining the number of backcountry camping permits issued during the years of 2001 and 2005 (Appendix A-B). North Manitou Island

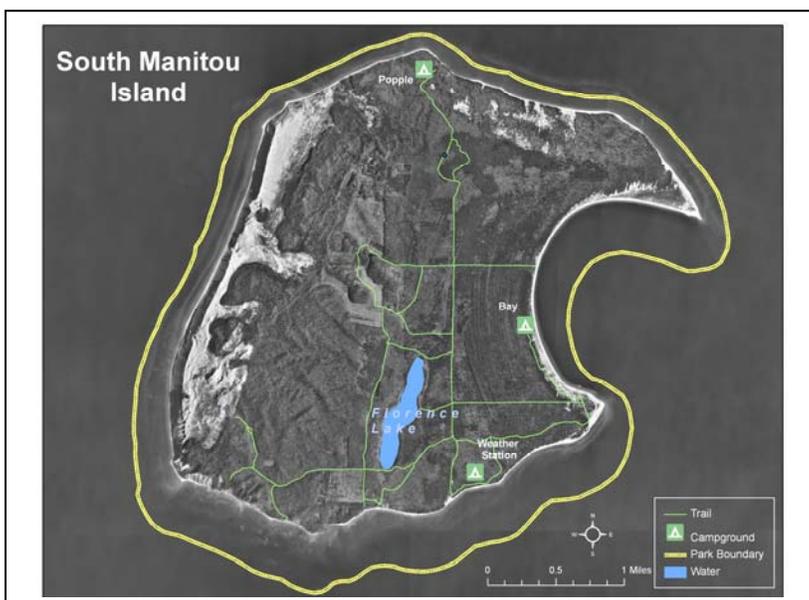


Figure 3. South Manitou Island

does not have designated camping areas other than the Village Campground. Therefore, permits are issued for backcountry camping by the island region. The island regions, associated numbers of visits, and change in visits are outlined in Table 1. Backcountry camping permit data was not available for South Manitou Island, as backcountry camping is not permitted on South Manitou Island.

Island Region	Visits 2001	Visits 2005	Change 2001-2005
North	302	257	-45
Northwest Side	236	147	-89
North Middle	621	357	-264
Frank	107	93	-14
Northwest Middle	638	109	-529
Middle East	320	317	-3
South Middle	245	630	+ 385
South	326	237	-89
Village	252	326	-74

Table 1. North Manitou Island Backcountry Camping Visits

Table 1 illustrates that the number of visits decreased from 2001 to 2005 in all regions except for the South Middle region, which had a considerable increase in number of visitors.

Although the reasons for this change are unknown and beyond the scope of this study, this information is helpful in determining which regions of the island are most frequently used.

Conceptualization

For this analysis, suitability for camping on the North and South Manitou Islands was evaluated on the basis of three key components:

1. Suitable camping areas
2. Marginally suitable camping areas
3. Areas not suitable for camping

Each of the key components is comprised of multiple variables. Primary variables defining these components are soil drainage, slope, vegetation, and park management restrictions. To

identify suitable camping areas, soil drainage was first examined, and then slope, vegetation, and restricted areas were incorporated into the analysis.

Areas Suitable for Camping

Many different areas could be suitable for camping depending on different characteristics of the camping party such as: the number of campers, the age and experience of the campers, the type of experience desired, and the type of camping equipment used.

Soil Drainage

For this study, suitable soils for camping areas were considered to be dry or well drained (Appendix C). Thus, visitors should avoid low laying or poorly drained areas where soil and vegetation could easily be disturbed. Areas with hard ground or sandy soils should be more stable and comfortable. Soils with poor drainage would likely be too wet for comfortable camping after periods of rain, or could be expected to occur in a bog or wetland area, which is not preferable for overnight stay.

Slope

Relatively flat slopes are considered to fall between 0 and 12 percent (Appendix D). In addition, suitable slopes should be less than 12 percent because most individuals would not be comfortable sleeping on steep inclines, or areas that would be difficult to set up camping equipment. Slopes greater than 18 percent are high erosion or slope failure areas, and would therefore not be considered suitable for this study.



Figure 4. North Manitou Hiking Trail (Courtesy of National Park Service, Kerry Kelly 2005)

Vegetation

Vegetation type was also considered for park management purposes and the construction aspect of additional campgrounds. Suitability of vegetation was classified based on the amount of effort needed by the park service to convert an area to a campground (Appendix E-F). The suitability classes for vegetation are outlined in Table 2.

Park Restrictions

Visitors have been prohibited from backcountry camping in certain areas of North Manitou (Appendix G). If camping were to be allowed island-wide on South Manitou Island, it is assumed the same prohibitions would be enforced. Therefore, all park restrictions were considered as areas not suitable for camping.

A suitable combination of all three of the above variables that are absent of areas restricted by park rules would indicate areas possessing the most desirable conditions for camping on North and South Manitou Islands.

Marginal/Medium Suitable Areas for Camping

Areas that are not classified as suitable areas, but also are not prohibited by regulations or slope could be used for camping, but may not be the most desirable due to soil conditions or other characteristics. The potential for these marginal areas could be increased based on the amount of visitors in that particular region, or demand for camping in the area.

Areas Not Suitable for Camping

Any area in which camping is prohibited by the park, has a slope greater than 18 percent, has poor soil drainage, or a vegetation type classified as not suitable would be considered an area not suitable for camping.

Implementation

Each data layer was converted to raster and scored according to the following values:

Score	0	1	2
Slope	Not Suitable	Marginal	Suitable
Soils	Not Suitable	Marginal	Suitable
Vegetation	Not Suitable	Marginal	Suitable
Park Regulations	Not Suitable		

Table 2. Analysis variables and assigned suitability

The three raster layers were summed to determine a total value, ranging from 3 to 6, with 3 representing marginally suitable areas, and 6 representing the most suitable areas (Appendix H-J).

Soils

Soils were classified using data from the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) Soil Survey Geographic Database (SSURGO) obtained from the National Park Service for the Sleeping Bear Dunes National Lakeshore. Soil drainage was determined by referencing the USDA-NRCS Official Soils Series Descriptions based on the series' "Drainage and Saturated Hydraulic Conductivity". Soil drainage types that ranged from excessively drained to well drained were considered suitable. Soil types described as moderately well drained or somewhat excessively drained were considered marginal. Soil types described as poor or very poorly drained were considered to be not suitable. Soil type suitability is displayed in Table 3.

Soil Type	Suitability	Soil Type	Suitability
Adrian-Houghton Mucks	Not Suitable	Kalkaska-East Lake Loamy Sands	Suitable
Alpena Gravelly Sand Loam	Suitable	Lake Beaches	Not Suitable
Au-Gras Kalkaska Sands	Marginal	Lake Bluffs	Not Suitable
Au-Gres Roscommon Complex	Not Suitable	Leelanau-East Lake Loamy Sands	Suitable
Croswell Sand	Marginal	Lupton-Markey Mucks	Not Suitable
Deer Park Sand	Suitable	Mancelona Sandy Loam	Suitable
Deer Park-Wurtsmith-Roscommon Complex	Marginal	Mancelona-East Lake Loamy Sands	Suitable
Duneland-Quartzipsamments	Marginal	Mancelona-Richter Gravelly Sandy Loams	Suitable
East Lake Loamy Sand	Suitable	Nester Silt Loam	Marginal
Eastport Sand	Suitable	Quartzipsamments	Marginal
Emmet-Leelanau Complex	Marginal	Rocommon Sand-Markey Muck	Not Suitable
Emmet-Mancelona Gravelly Sandy Loams	Marginal	Sanilac Silt Loam	Not Suitable
Emmet-Omena Sandy Loams	Marginal	Tonkey-Munuscong-Iosco Sandy Loams	Not Suitable
Emmet-Ommena Sandy Loams	Marginal	Wallace Kalkaska Sands	Suitable
Gladwin Variant-Epoufette Complex	Not Suitable	Water	Not Suitable
Hettinger-Muck Complex	Not Suitable	Wind Eroded Land	Not Suitable
Kalkaska Sand	Suitable	Wurtsmith-Au Gres Complex	Suitable

Table 3. Soil type and assigned suitability.

Slope

Slope suitability was also determined using the SSURGO soil data layer. Soils with slope categories below 12 percent were considered suitable. Slope categories ranging between 6 percent and 12 percent were considered marginal, and any slope categories above 18 percent were considered not suitable. Slopes and corresponding suitability is shown in Table 4.

Slope	Suitability	Slope	Suitability
0-3	Suitable	6-18	Marginal
0-4%	Suitable	12-18	Marginal
0-6	Suitable	18-25	Not Suitable
0-12	Suitable	18-35	Not Suitable
2-6	Suitable	18-45	Not Suitable
2-12	Suitable	25-45	Not Suitable
6-12	Suitable	25-50	Not Suitable

Table 4. Slope categories and assigned suitability.

Vegetation

Vegetation categories were determined based on practicality for development of new campgrounds. Areas that could be easily converted, such as fields, were considered suitable. Areas that would require more intensive management, such as wooded or forested areas were considered marginal. Areas that would clearly not be suitable for a campground, such as wetlands or swamp, were considered not suitable. The vegetation types and corresponding suitability is outlined in Table 5.

Vegetation Category	Suitability	Vegetation Category	Suitability
Birch-Aspen	Marginal	Lake Plain Woods	Marginal
Black Ash Swamps	Not Suitable	Northern Conifers	Marginal
Bluffs	Not Suitable	Northern Hardwoods	Marginal
Coastal Forest	Marginal	Oak-Aspen	Marginal
Conifer Plantation	Marginal	Open Water	Not Suitable
Dunes	Not Suitable	South Manitou Village	Not Suitable
Dunes and Shores	Not Suitable	Unknown	Not Suitable
Fields	Suitable	Valley of the Giants*	Not Suitable
Jack Pine	Marginal	Water	Not Suitable
Lake	Not Suitable	Wetlands	Not Suitable

Table 5. Vegetation categories and assigned suitability. The area designated as Valley of the Giants is considered not suitable because it is one of the few stands of virgin timber left in all of Michigan and would likely not be converted to a campground.

Park Regulations-Areas Prohibited to Campers:

According to federal law, certain areas of the National Lakeshore are prohibited from being used for camping. According to the 2005 Listing of Special Regulations for Sleeping Bear Dunes National Lakeshore,

“Under the provisions of Title 16, United States Code (U.S.C.), Section 3, and Title 36, Code of Federal Regulation (CFR), Chapter 1, Parts 1-7, the following Superintendent’s Orders (Compendium) are established for the proper management, protection, and public use of Sleeping Bear Dunes National Lakeshore.”

- *In the 27 acre (11 hectare) village*
- *Within 300 feet (90 meters) of Lake Michigan high water mark, other campsites, and buildings, including historic farm structures*
- *On any trail*

For this reason, the Village campground area of North Manitou Island was considered not suitable. A 300-foot buffer was created from the high water mark, campsites, historic buildings, and surface water features for both islands based on available data layers obtained from the park service. A 5-meter buffer was created to surround all trails on both islands, as it is unlikely a campground would be developed directly adjacent to a trail. These areas were all categorized as unsuitable.

Analysis

The marginal and suitable areas for soil, slope, and vegetation were selected out from each corresponding layer, removing unsuitable areas for each variable. These layers were then overlaid and the resulting intersection indicates the most suitable areas for campground development. The most suitable areas for new campgrounds are considered to be camper-friendly and would not require intensive development efforts for park staff and resources. The less suitable, or lower scoring areas could also be considered as potential campground areas, but should be further investigated by park staff to determine if the selected locations are indeed appropriate. The areas prohibited from camping by park regulations were overlaid with the potential camping areas derived from the spatial analysis to exclude prohibited areas from consideration. When these areas are compared with the most frequently visited regions, it can

suggest future areas that the park service should consider if they were to create a camping site for visitors on North Manitou Island. Additionally, if wilderness camping were to be allowed on South Manitou Island, the suitability maps could serve as a guide for hikers who may want to hike to areas that have the most suitable conditions for wilderness camping, but where formal campgrounds may not currently be established.

Results and Discussion

The areas of the islands with the highest suitability can be seen in appendices H-J. The dark blue areas are the most suitable and can be seen in the following regions of North Manitou Island: Northwest Side, Northwest Middle, North Middle, Frank, and South. The most suitable areas on South Manitou Island can be found generally on the eastern half of the island, particularly in the north central area of the island. 2001 visitor permit data suggests that the areas of North Manitou Island where campgrounds may be needed are in the Northwest Middle and North Middle regions; however the analysis does not show many highly suitable areas in these regions. The 2005 permit data suggests additional camping areas could be needed in the South Middle region, which does contain areas scoring as 5, a relatively high suitability. The north central region of South Manitou Island, which scores at 6, is within close proximity to multiple trails, and falls between the existing campgrounds, appears to be the best area for potential campgrounds based on location and score from the analysis.

Potential Uncertainties

Some potential for uncertainty in the analysis does exist. Data from the different data layers was collected at different time periods, so the analysis can not really be considered a “snapshot” in time. However, this impact from this could be considered minimal because the features in the analysis, such as soils, remain fairly constant over time.

SSURGO soil data collected from soil surveys does not have pinpoint accuracy, and may have some variation within smaller areas. Another potential source of miscalculation in the analysis could be from the interpretation of suitability categories. Some assignment of suitability categories could be considered subjective, and there could be other options for the breakdown of categories that were not used in this analysis. Changes in the structure of the categories and the assignment of suitability could have a significant effect on the outcome of the analysis.

Limited available data could also have influenced the identification of areas popular to visitors. Because permit data was available only for the years of 2001 and 2005 for one island, some assumptions had to be made. A broader range of data would help determine trends more

accurately, since circumstances such as weather, the economy, etc, could influence the number of visitors that the island experiences which may vary from year to year. Additionally, structures may exist that are not present on GIS layers provided by the park service that have not been geolocated. Other historic features or buildings may exist that could exclude some potential areas from consideration. These features would need to be surveyed or groundtruthed to ensure that all were accounted for. Due to time constraints of the project and the location of the study area in relation to the site of the GIS analysis, groundtruthing was beyond the scope of this project.

Conclusions

This assessment demonstrates that based on the analysis of the four variables in this study; there are additional regions in both islands that could be suitable for additional park campgrounds. Specifically, analysis of soil, slope, and vegetation show that additional areas could be developed if need for space at the current campgrounds and visitor demand increases. My recommendations to the park service based on the results of the analysis are to focus first on regions that are most popular based on permit data and to then consider smaller areas within the region based on the score of the suitability analysis.

By focusing efforts to the areas identified by the analysis, strain on budget, staff, and time could be minimized. Further surveys should be conducted to confirm potentially suitable areas, and perhaps survey visitors to South Manitou Island as to where their preferred areas would be since permit information is not available for the areas on the island other than the existing campground. This will help identify popular areas on the south island that were not identified in this analysis.

The overall goal of this analysis was to aid the National Park Service in identification of suitable backcountry camping areas in hopes of aiding an increasing number of visitors to the park. The primary benefits of this analysis are identification of trends regarding park usage, and identification of suitable camping areas. My hope is that the park service will take the information from this analysis into consideration if they choose to perform any campground related management activities on North or South Manitou Islands, and that backcountry visitors will continue to enjoy the Sleeping Bear Dunes National Lakeshore and the many unique aspects this park has to offer. The mission of the National Park Service (NPS) is, “to preserve unimpaired the natural and cultural resources and values of the park system for the enjoyment,

education, and inspiration of this and future generations”. I feel this project fits in well with the mission of the National Park Service, because wise management of the park’s resources will benefit future generations by providing additional recreational opportunities, while simultaneously preserving the unique resources, history, and character of the Sleeping Bear Dunes National Lakeshore.

References

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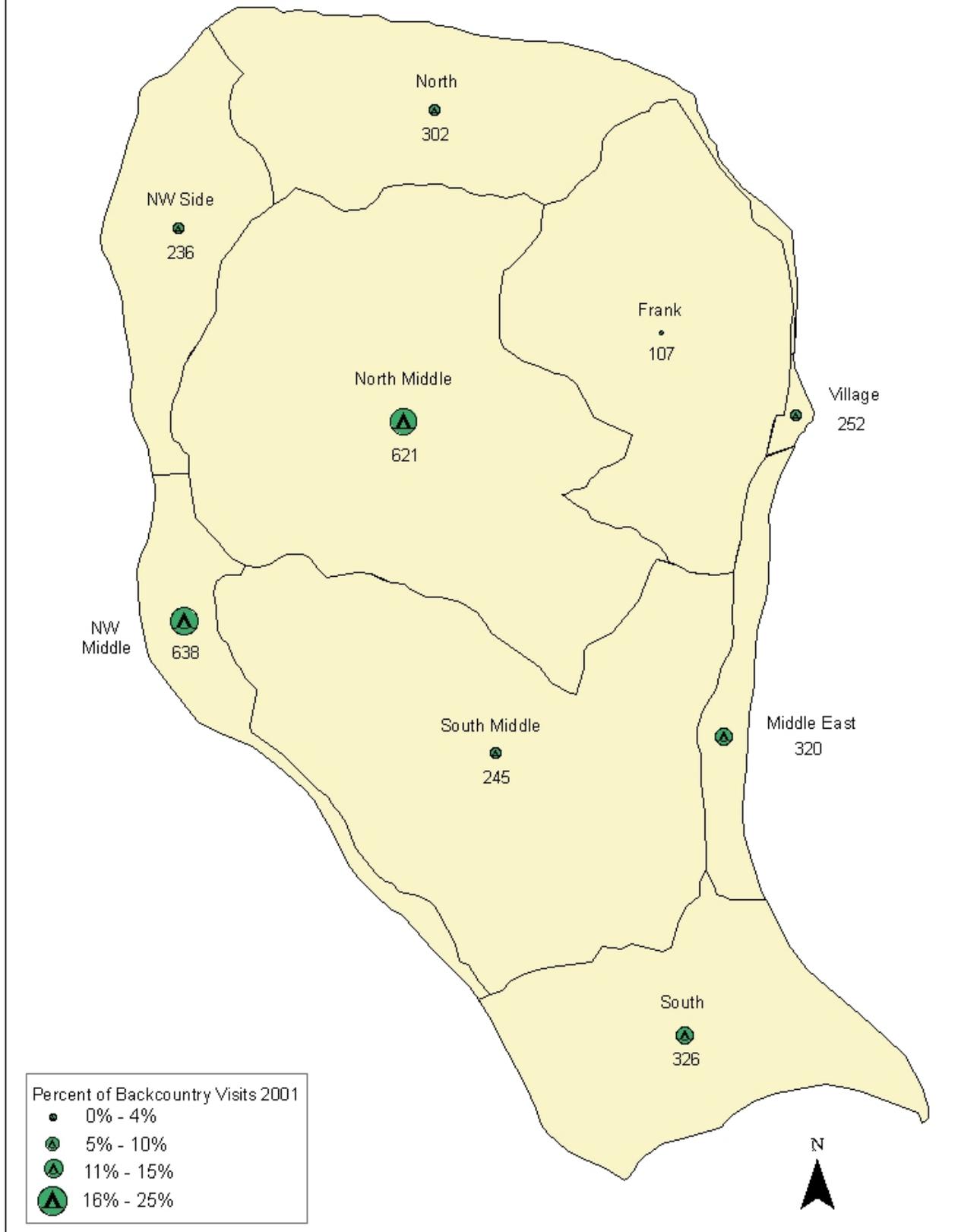
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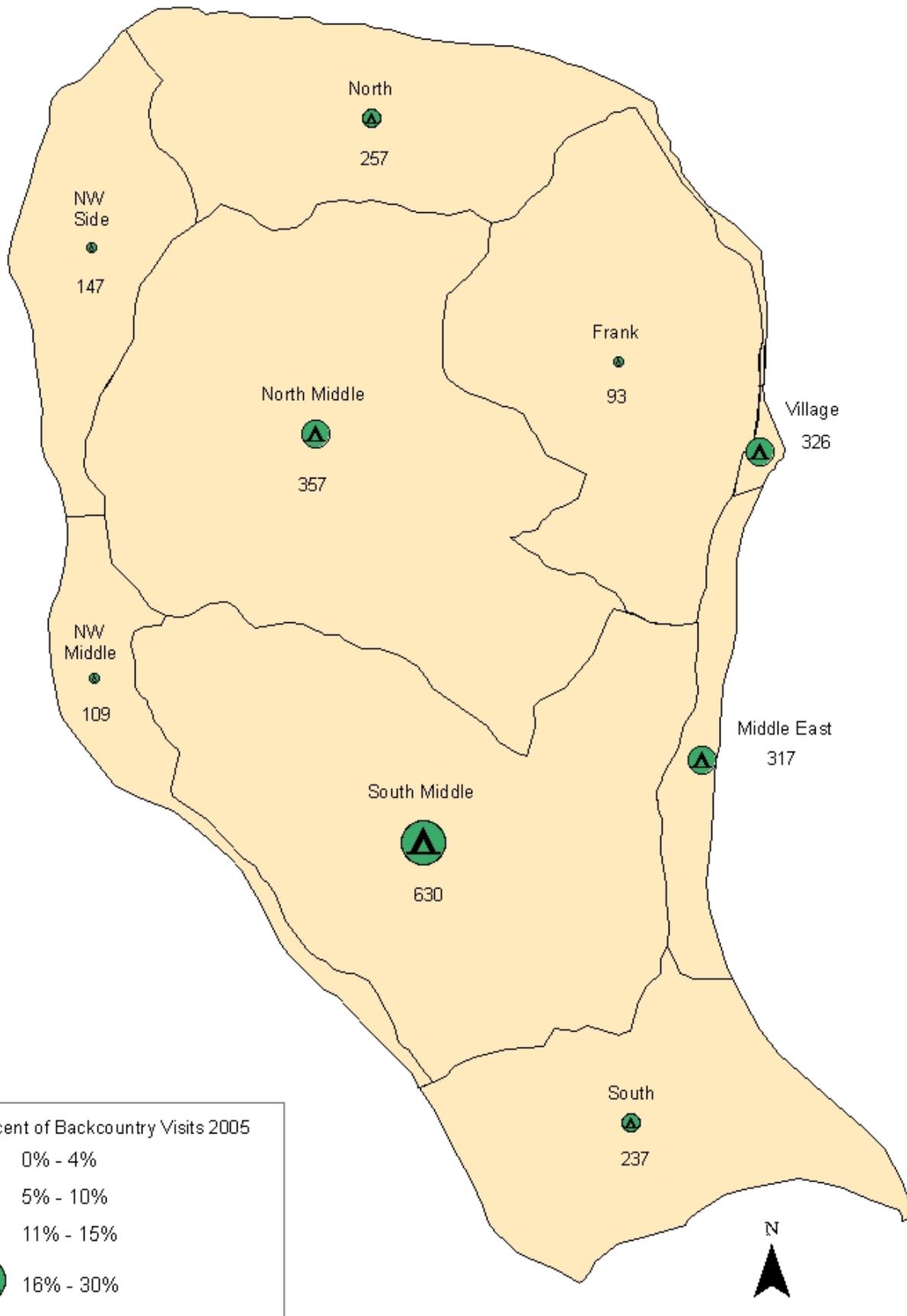
APPENDICES

North Manitou Island Backcountry Visits 2001



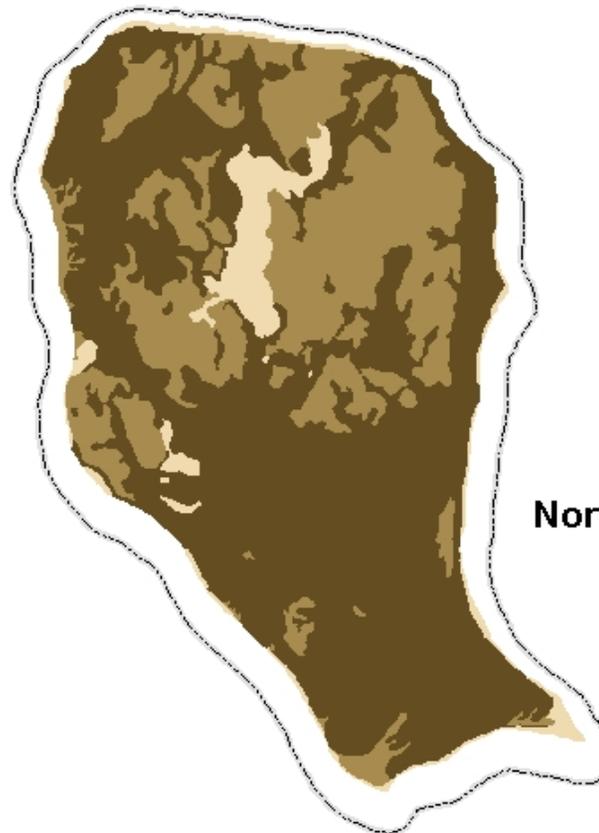
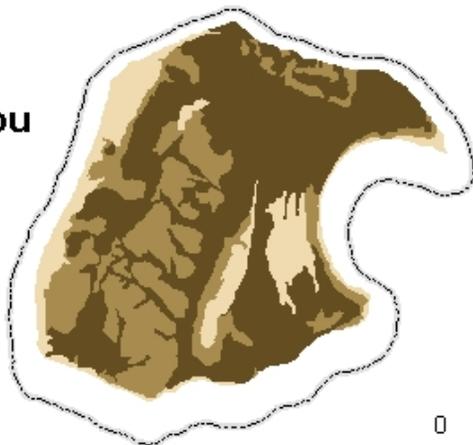
Appendix A. North Manitou Island backcountry visits in 2001 from National Park Service permit data.

North Manitou Island Backcountry Visits 2005



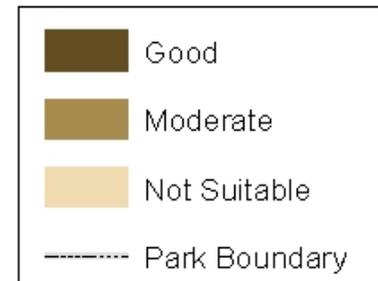
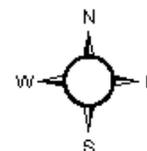
Soil Suitability for Backcountry Camping

South Manitou
Island

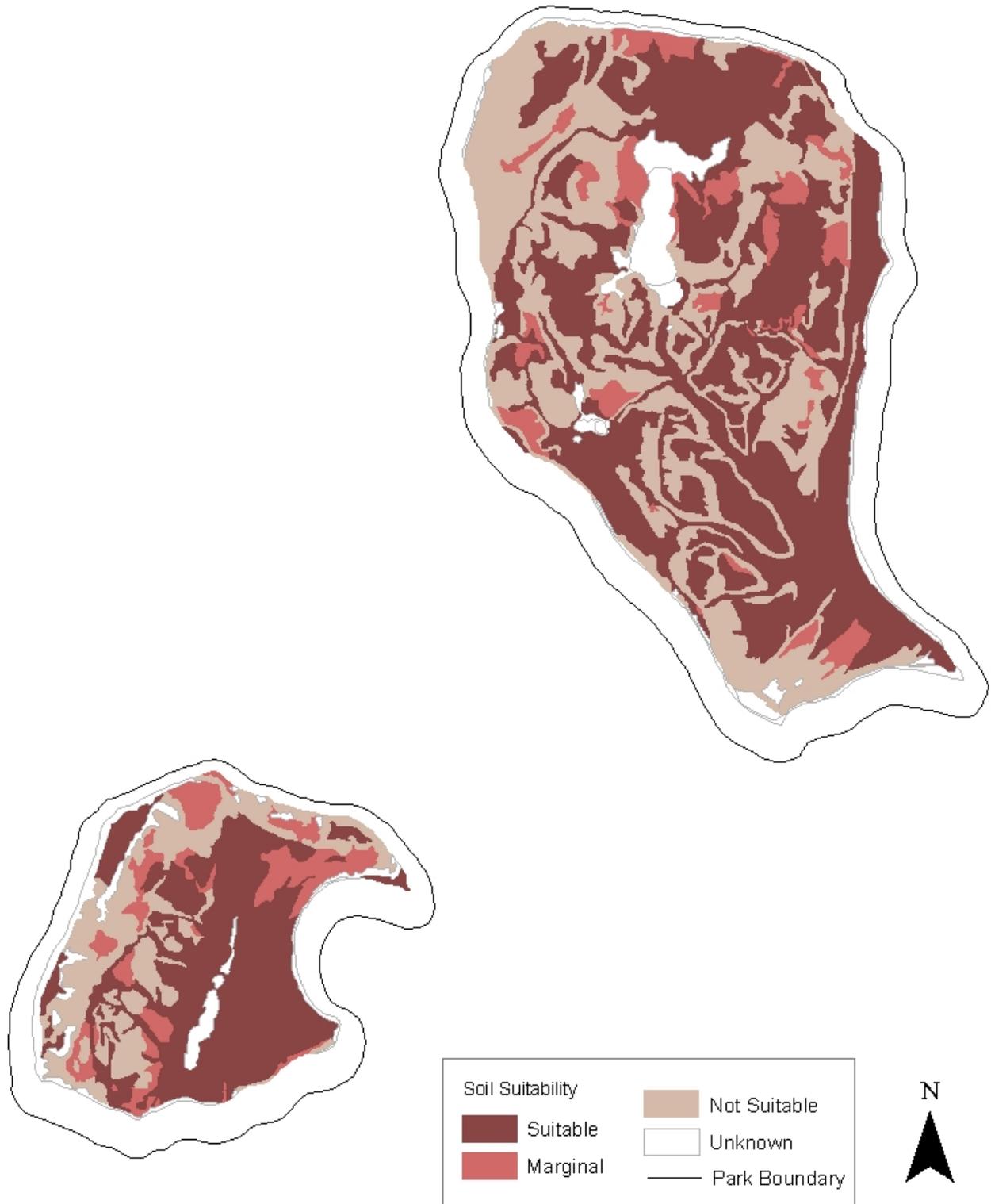


North Manitou
Island

0 1 2 Miles

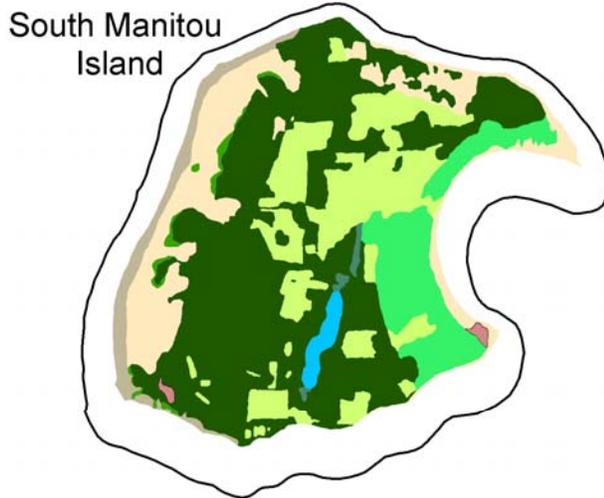
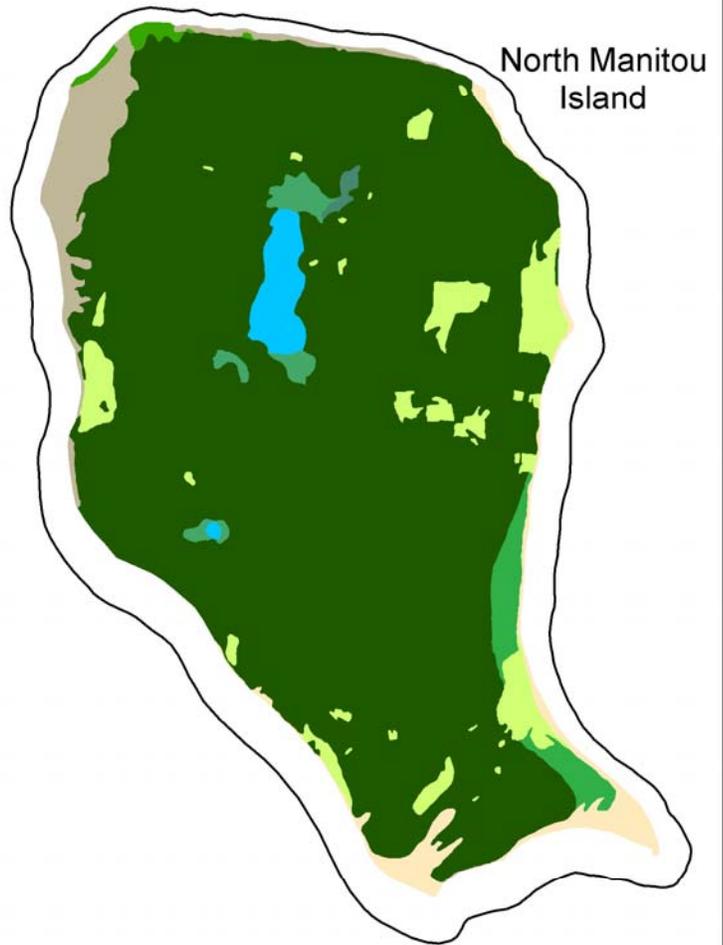


Backcountry Camping Slope Suitability



Appendix D. Slope suitability for North and South Manitou Islands.

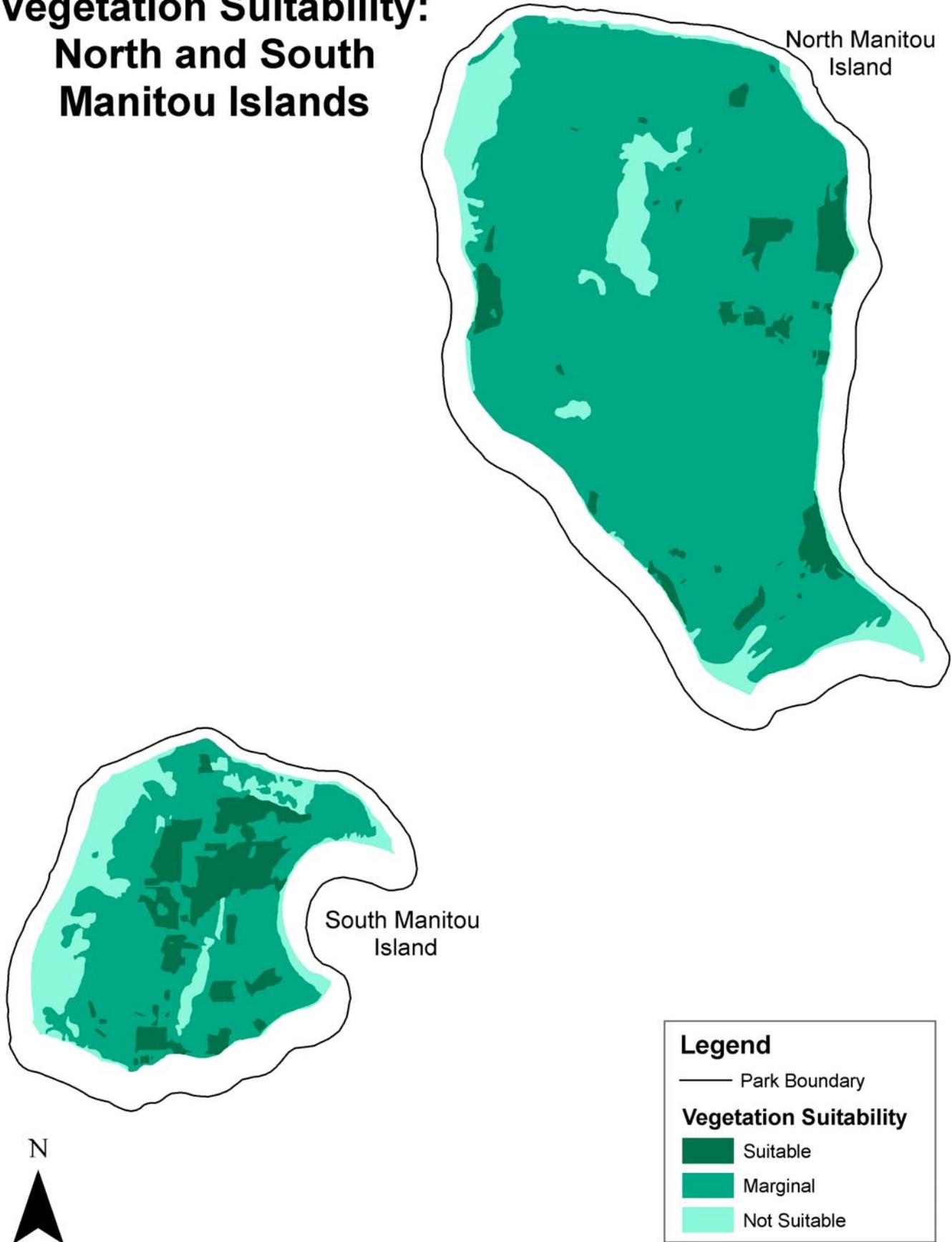
Vegetation Classes: North and South Manitou Islands



Vegetation Category

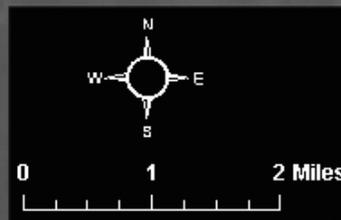
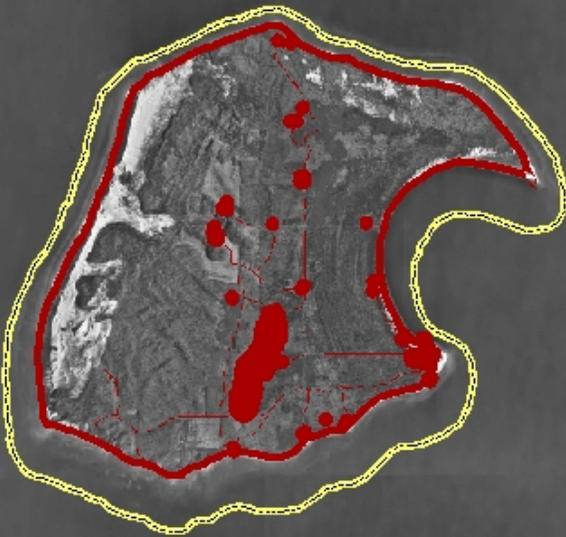
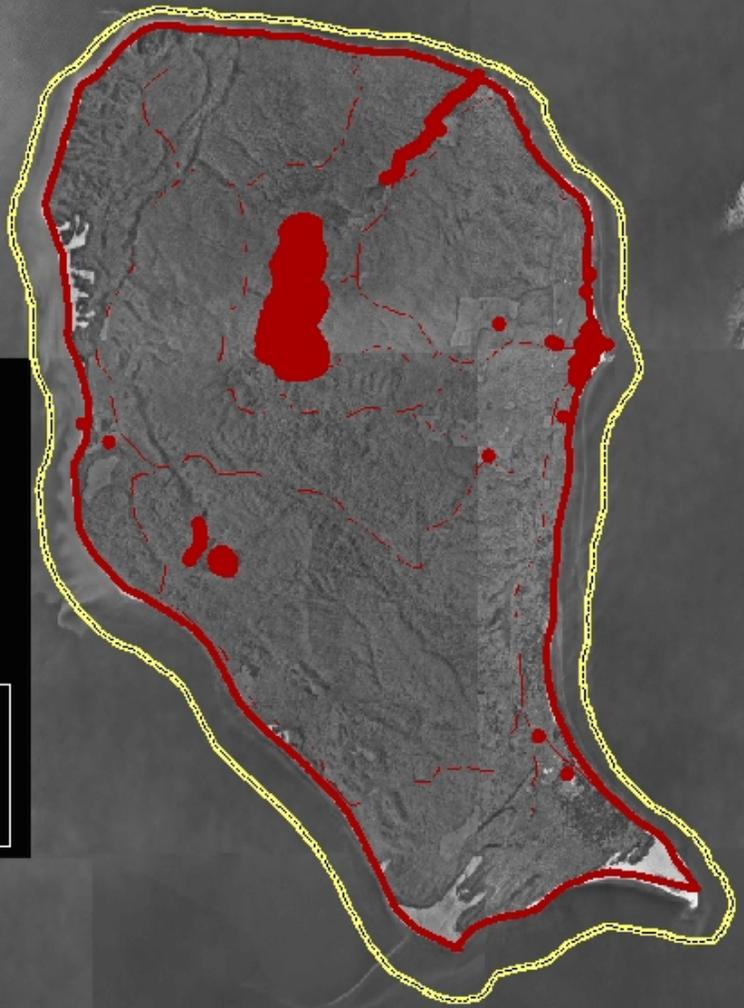
Northern Hardwoods	Jack Pine	Fields	Open Water
Oak-Aspen	Wetlands	Island	Valley of the Giants
Birch-Aspen	Black Ash Swamps	Bluffs	South Manitou Village
Northern Conifers	Lake Plain Woods	Dunes and Shores	Park Boundary
Conifer Plantation	Coastal Forest	Unknown	N

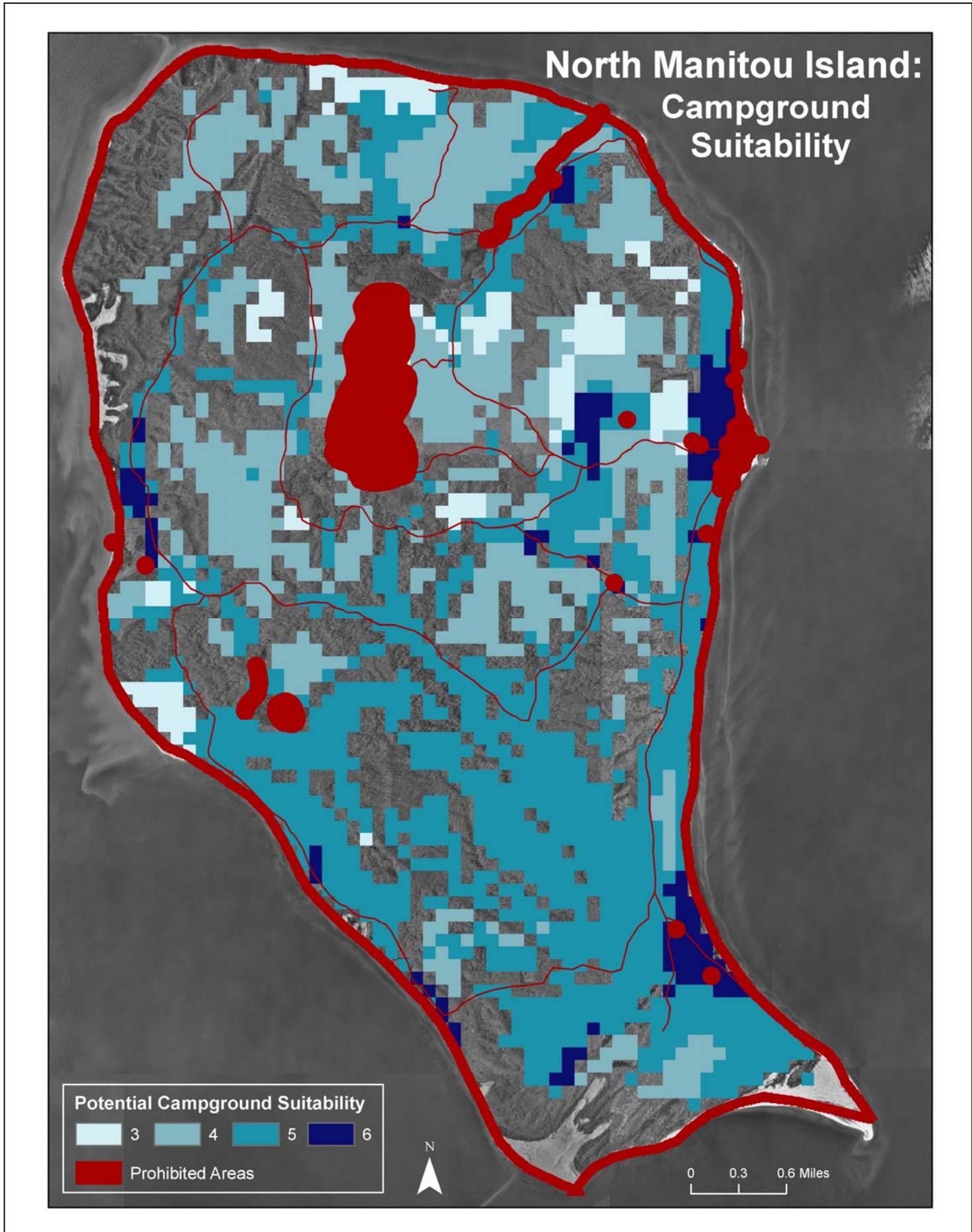
Vegetation Suitability: North and South Manitou Islands



Park Regulations: Prohibited Camping Areas

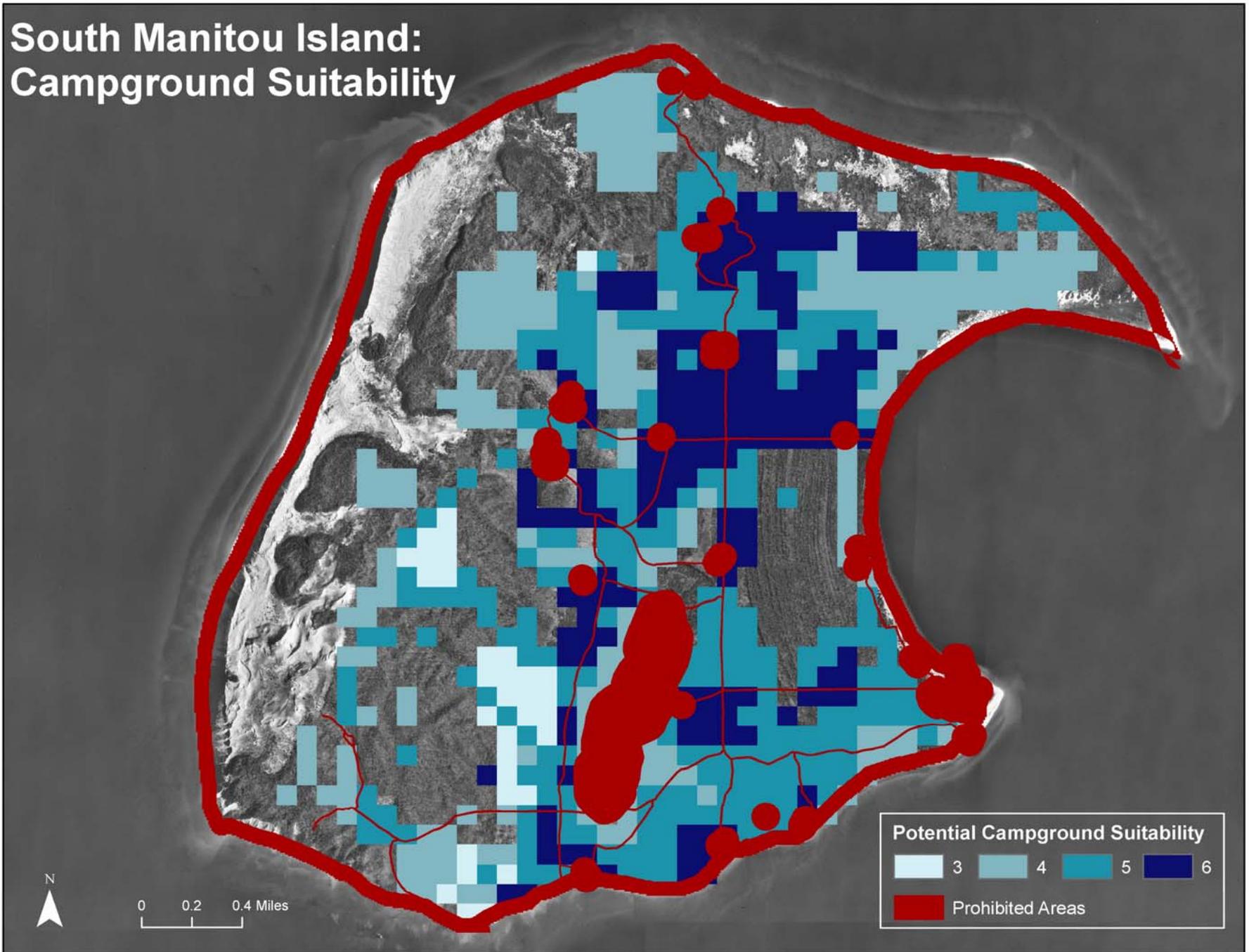
 Prohibited Camping Areas
 Park Boundary





Appendix H. Campground area suitability on North Manitou Island.

South Manitou Island: Campground Suitability

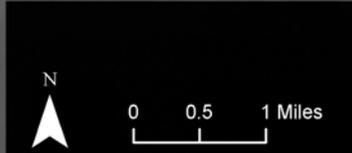
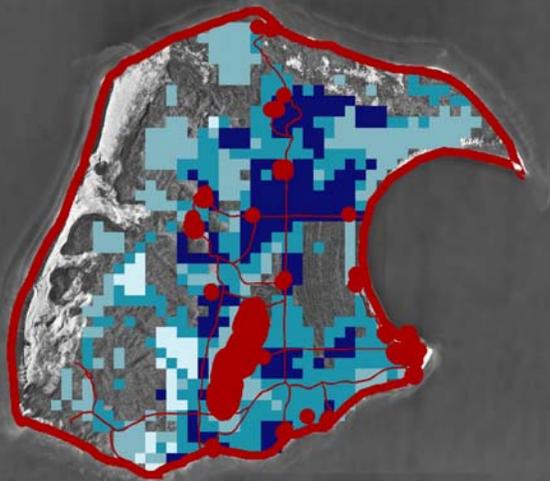
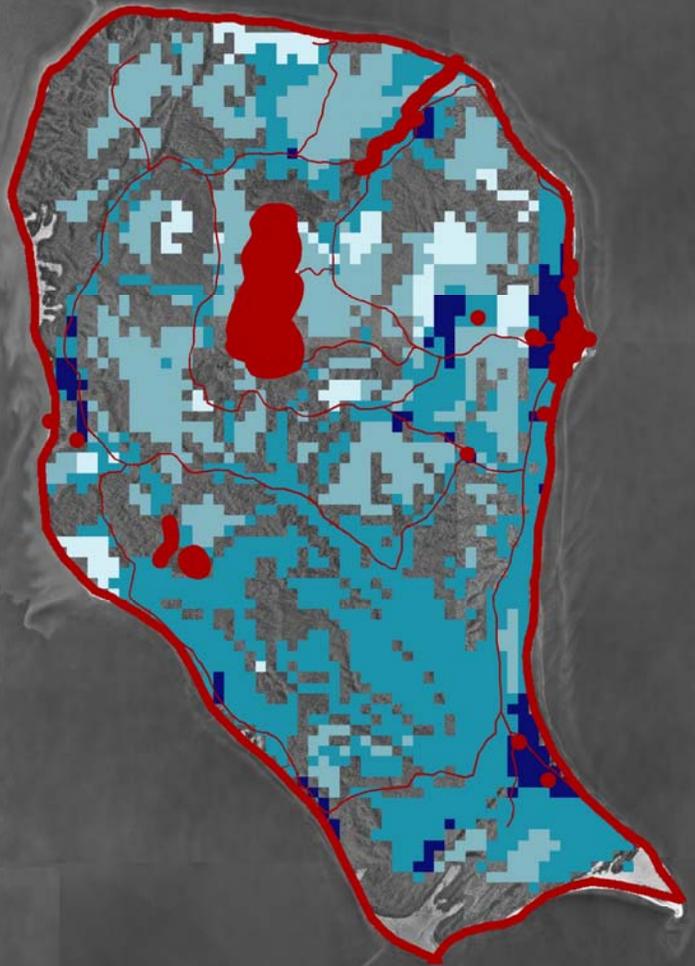


Appendix I. Campground suitability on South Manitou Island.

Sleeping Bear Dunes National Lakeshore

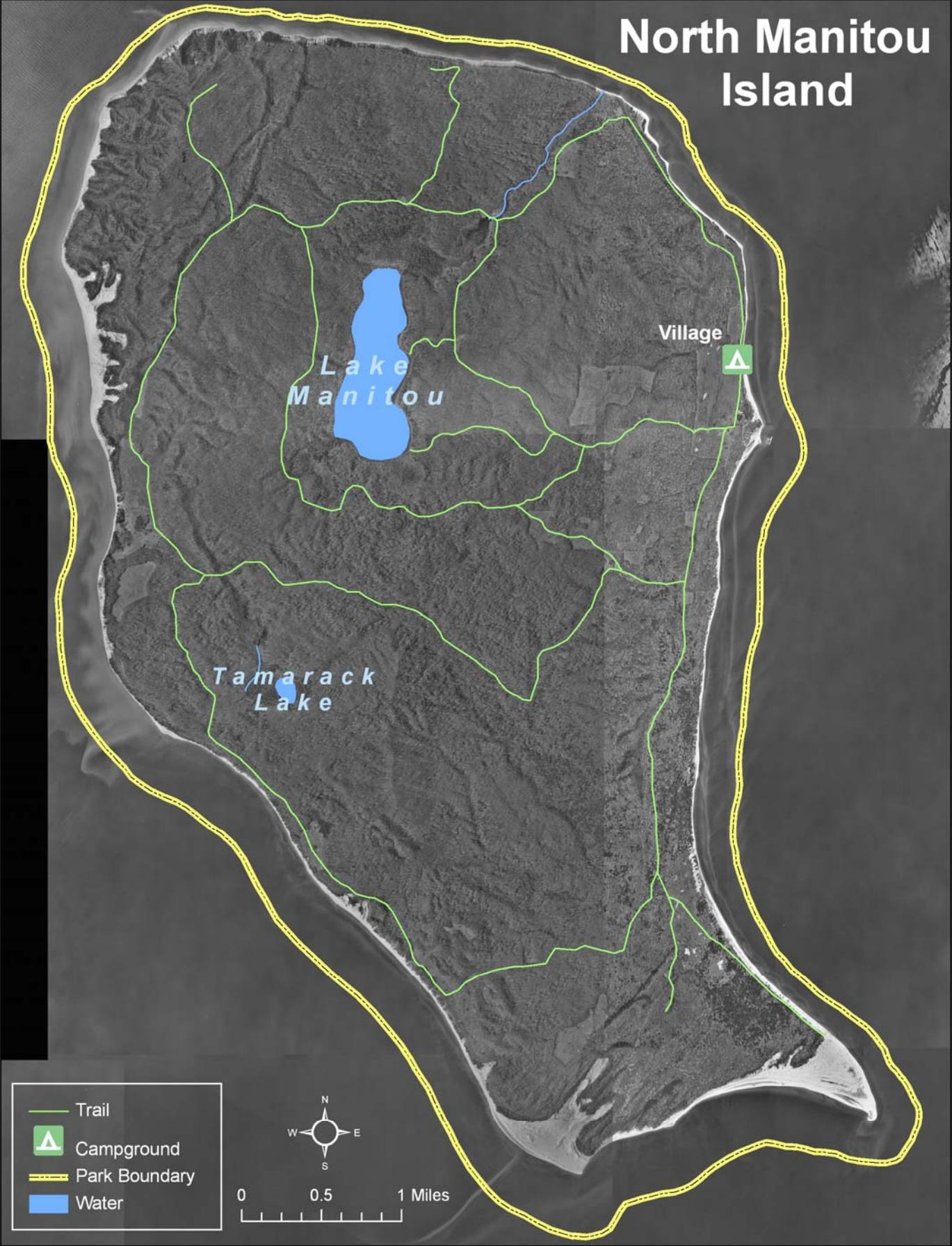
North Manitou Island and South Manitou Island

Campground Suitability



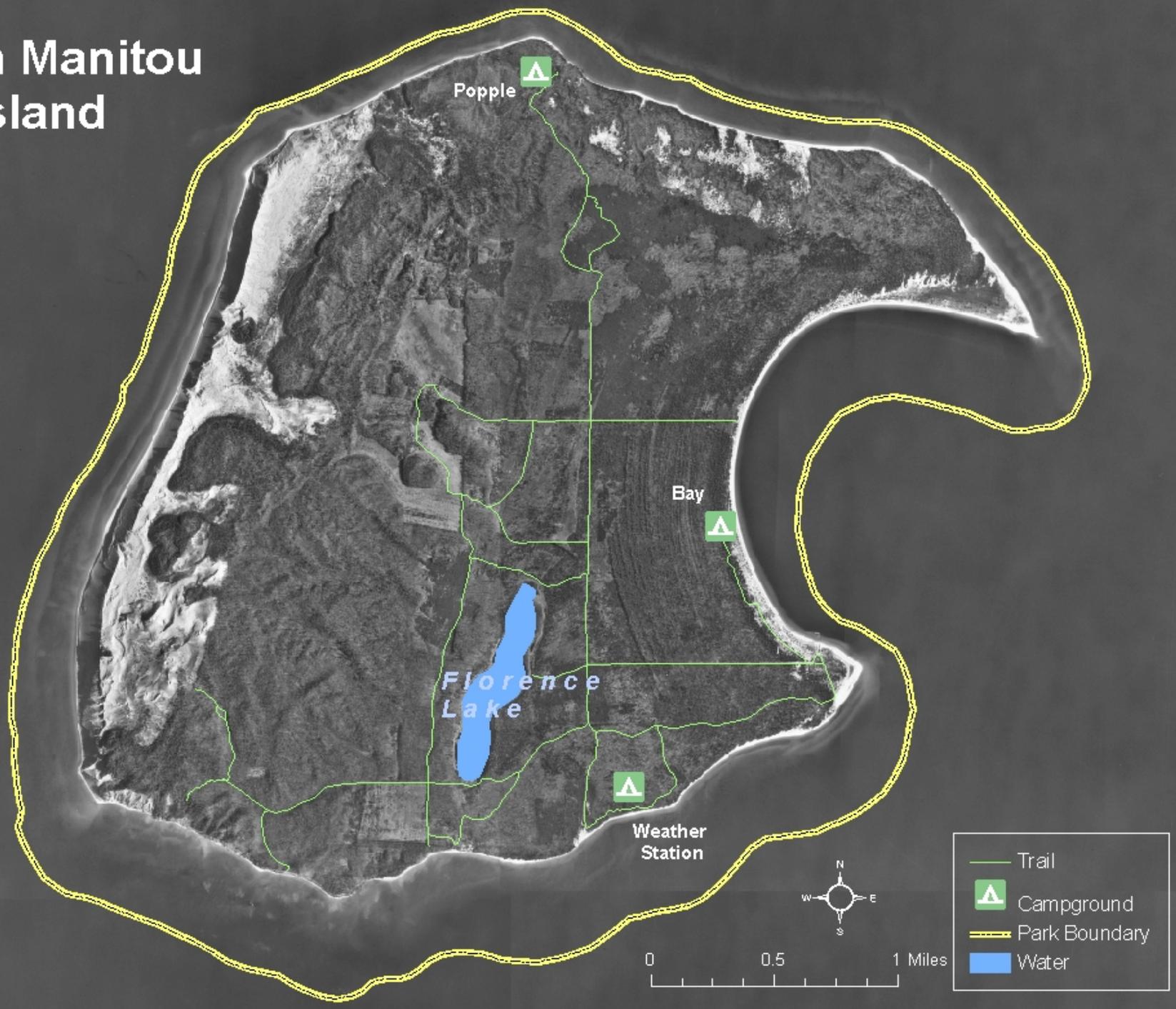
Appendix J. Campground suitability for North and South Manitou islands.

North Manitou Island



Appendix K. North Manitou Island trails and campground

South Manitou Island



Appendix L. South Manitou Island trails and campgrounds.