Summary of Natural Community Surveys of State Park and Recreation Area Lands




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Cover photos: top left, Pesheke Bog and Van Riper Glade granite bedrock glade from Van Riper State Park; top right, Stevenson's Fen northern fen from Rockport State Recreation Area; lower left, Porcupine Shore sandstone bedrock lakeshore from Porcupine Mountains Wilderness State Park; and lower right, Carp River East northern shrub thicket and Carp River and Lake of the Clouds northern wet meadow nested within Porcupine Mountains mesic northern forest from Porcupine Mountains Wilderness State Park. Photos by Joshua G. Cohen.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE

ACKNOWLEDGMENTS

We thank the Michigan Department of Natural Resources (DNR) Parks and Recreation Division (PRD) for funding this effort to synthesize survey data of high-quality natural communities in Michigan's State Parks and Recreation Areas. Special thanks are due to PRD's Ray Fahlsing and Glenn Palmgren for overseeing this project. Glenn was instrumental in the development of the workplan and the Threat Assessment Form. This report relies heavily on data collected by many present and former Michigan Natural Features Inventory (MNFI) field scientists, especially: Joshua Cohen, Bradford Slaughter, Steve Thomas, Mike Penskar, Michael Kost, Tyler Bassett, John Fody, Alan Tepley, Dennis Albert, Patrick Comer, Rebecca Schillo, Aimee Kay, and Mark Tomboulian. Editorial support and insightful comments were provided by Martha Gove. Finally, we thank the following MNFI colleagues: Kraig Korroch and Rebecca Rogers assisted with database management; Helen Enander offered technological support; and Sue Ridge, Nancy Toben, Yu Man Lee, and Brian Klatt provided administrative support.

INTRODUCTION

The Michigan Department of Natural Resources (DNR), Parks and Recreation Division (PRD) is responsible for managing Michigan's State Parks, Recreation Areas, Boating Access Sites, Harbors, Scenic Sites, State Forest Campgrounds, and Pathways. Part of PRD's stated mission is to "acquire, protect, and preserve the natural, historic, and cultural features of Michigan's unique resources." Within the division, the Stewardship Unit is charged with preserving, protecting, and restoring the natural and cultural features. Preservation and restoration of the natural communities within State Parks and Recreation Areas, along with their constituent plants and animals, are core parts of the mission. The PRD is in the process of writing and updating management plans for State Parks and Recreation Areas. In these plans, the land is zoned for various levels of protection and use based on the location and type of its natural and cultural features. In addition, the DNR's Living Legacies initiative (formerly Biodiversity Conservation Planning Process) is identifying Biodiversity Stewardship Areas (BSAs), many of which will include portions of State Parks and Recreation Areas. Within the BSAs, biodiversity conservation will be a primary management priority. The goal of the Living Legacies initiative is to establish a network of representative natural communities that contribute to functioning landscape ecosystems across the state.

A baseline inventory of rare natural communities was conducted by Michigan Natural Features Inventory (MNFI) in State Parks and Recreation Areas in the late 1990s to early 2000s. However, this initial inventory effort did not include comprehensive boundary mapping, detailed condition assessments, threat assessments, or surveys of common natural communities. To inform the PRD management planning process, the DNR Living Legacies Program initiatives, and the overall protection, preservation, and restoration of natural communities throughout Michigan's State Parks and Recreation Areas, up-to-date information is needed on the boundaries, condition, landscape context, and current threats to the ecological integrity of natural communities. Through work on this project, MNFI is synthesizing data from high-quality natural communities documented within State Park and Recreation Area lands. Funding for these surveys was provided by the Wildlife Division and the Forest Resource Division, primarily to inform the Living Legacies initiative (Cohen 2009, Cohen et al. 2009, Cohen 2010, Cohen 2011).

A natural community is defined as an assemblage of interacting plants, animals, and other organisms that repeatedly occurs under similar environmental conditions across the landscape and is predominantly structured by natural processes rather than modern anthropogenic disturbances. Protecting and managing representative natural communities is critical to biodiversity conservation, since native organisms are best adapted to environmental and biotic forces with which they have survived and evolved over the millennia (Kost et al. 2007).

From 2006 to 2012, MNFI scientists conducted surveys of 124 high-quality natural communities on State Park and Recreation Area lands. According to MNFI's natural community classification, there are 77 natural community types in Michigan (Kost et al. 2007). Forty-three different natural community types are represented in the 124 element occurrences surveyed (Table 1). Surveys assessed the element occurrence ranking, classification, and delineation of these occurrences and detailed the vegetative structure and composition, ecological boundaries, landscape and abiotic context, threats, management needs, and restoration opportunities. The primary goal of synthesizing this survey effort is to provide resource managers and planners with standardized, baseline information on each natural community element occurrence. This baseline information is critical for facilitating site-level decisions about biodiversity stewardship, prioritizing protection, management and restoration, monitoring the success of management and restoration, and informing landscape-level biodiversity planning efforts such as the Living Legacies initiative. This report summarizes the findings of MNFI's ecological surveys.

METHODS

Field Surveys

The 124 high-quality natural communities were documented in 22 different State Parks or Recreation Areas (Table 1) including the following: Agate Falls Scenic Site (1 site), Bald Mountain State Recreation Area (2 sites), Bond Falls Scenic Site (2 sites), Brighton State Recreation Area (1 site), Cheboygan State Park (2 sites), Fayette Historic State Park (1 site), Fisherman's Island State Park (1 site), Hartwick Pines State Park (6 sites), Laughing Whitefish Falls State Park (2 sites), Menominee River State Recreation Area (1 site), Muskegon State Park (1 site), Pinckney State Recreation Area (2 sites), Porcupine Mountains Wilderness State Park (22 sites), Proud Lake State Recreation Area (1 site), Rockport State Recreation Area (5 sites), Tahquamenon Falls State Park (19 sites), Thompson's Harbor State Park (4 sites), Van Riper State Park (5 sites), Waterloo State Recreation Area (25 sites), Wells State Park (2 sites), Wilderness State Park (13 sites), and Yankee Springs State Recreation Area (6 sites).

These sites were made a priority for survey for one or more of the following reasons: Phase 1 of the Living Legacies initiative or Biodiversity Planning Process identified these areas as potential Biodiversity Stewardship Areas; PRD was in the process of writing and updating management plans for these areas; surveys had not been conducted within these areas or surveys had not been conducted for many years; and/or limited information had been recorded about the sites or the natural community types within the sites. In addition, natural communities that were undersurveyed and/or underrepresented across the state and regionally were prioritized.

Each natural community was evaluated employing Natural Heritage and MNFI methodology, which considers three factors to assess a natural community's ecological integrity or quality: size, landscape context, and condition (Faber-Langendoen et al. 2008). If a site meets defined requirements for these three criteria (MNFI 1988) it is categorized as a high-quality example of that specific natural community type, entered into MNFI's database as an element occurrence, and given a rank based on the consideration of its size, landscape context, and condition. Ecological field surveys were typically conducted during the growing season to evaluate the condition and classification of the sites. Two sites were surveyed after the growing season (the Little Portage Lake Woods dry-mesic southern forest and the Waterloo-Munith Road Oak Swamp southern hardwood swamp). To assess natural community size and landscape context, a combination of field surveys, aerial photographic interpretation, and Geographic Information System (GIS) analysis was employed. Typically, a minimum of a half day was dedicated to each site, depending on the size and complexity of the site. For sites that occur on multiple ownerships, surveys were restricted to PRD portions of the occurrences unless permission was granted to access other ownerships.

For each site visited, an Ecological Community Field Survey Form (Appendix 1) and a Threat Assessment Form (Appendix 2) were completed. The Threat Assessment Form allows for the scoring of each observed threat in terms of severity, scope, and reversibility. For the purposes of this form, severity was defined as the level of damage to the site caused by the threat, scope was defined as the geographic extent of impact of the threat, and reversibility was defined as the probability of controlling the threat and reversing the damage.

The ecological field surveys typically involved:

a) compiling comprehensive plant species lists and noting dominant and representative species
b) describing site-specific structural attributes and ecological processes
c) measuring tree diameter at breast height (DBH) of representative canopy trees and aging canopy dominants (where appropriate)
d) analyzing soils and hydrology
e) noting current and historical anthropogenic disturbances
f) evaluating potential threats (using the Threat Assessment Form, each observed threat was ranked in terms of its severity, scope, and reversibility, and scores for these categories were summed to generate an overall threat score)

g) ground-truthing aerial photographic interpretation using GPS (Garmin, HP iPAQ, and Ashtech Mobile Mapper 10 units were utilized)
h) taking digital photos and GPS points at significant locations
i) surveying adjacent lands when possible to assess landscape context
j) evaluating the natural community classification and mapped ecological boundaries
k) assigning or updating element occurrence ranks
l) noting management needs and restoration opportunities or evaluating past and current restoration activities and noting additional management needs and restoration opportunities

Following completion of the field surveys, the collected data were analyzed and transcribed to update or create element occurrence records in MNFI's statewide biodiversity conservation database (MNFI 2012). Natural community boundaries were mapped or re-mapped. Information from these surveys and prior surveys, if available, was used to produce threat assessments and management recommendations for each natural community occurrence, which appear within the following Results section.

RESULTS

The 124 occurrences of high-quality natural communities were surveyed primarily during the 2009, 2010, and 2011 field seasons with three sites surveyed in the 2006 field season, one site surveyed in the 2007 field season, two sites surveyed in the 2008 field season, and one site surveyed in the 2012 field season. As noted above, the 124 sites surveyed were within 22 different State Parks or Recreation Areas (see above and Table 1). A total of thirty-nine different natural communities were visited including: bog (6 element occurrences or EOs), boreal forest (2 EOs), clay bluffs (1 EO), coastal fen (2 EOs), dry northern forest (2 EOs), dry sand prairie (1 EO), dry-mesic northern forest (4 EOs), dry-mesic southern forest (6 EOs), emergent marsh (4 EOs), granite bedrock glade (1 EO), Great Lakes barrens (1 EO), Great Lakes marsh (1 EO), hardwood-conifer swamp (5 EOs), interdunal wetland (1 EO), inundated shrub swamp (3 EOs), limestone bedrock lakeshore (1 EO), limestone cobble shore (3 EOs), limestone lakeshore cliff (1 EO), mesic northern forest (2 EOs), muskeg (3 EOs), northern fen (6 EOs), northern shrub thicket (10 EOs), northern wet meadow (6 EOs), open dunes (1 EO), patterned fen (1 EO), poor conifer swamp (5 EOs), poor fen (6 EOs), prairie fen (7 EOs), rich conifer swamp (3 EOs), rich tamarack swamp (5 EOs), sand and gravel beach (1 EO), sandstone bedrock lakeshore (1 EO), sandstone cliff (5 EOs), sandstone cobble shore (1 EO), sinkhole (1 EO), southern hardwood swamp (2 EOs), southern wet meadow (2 EOs), submergent marsh (1 EO), volcanic bedrock glade (4 EOs), volcanic bedrock lakeshore (1 EO), volcanic cliff (3 EOs), volcanic cobble shore (1 EO), and wet prairie (1 EO).

Table 1 lists the visited sites, their element occurrence ranks, and their previous element occurrence ranks if applicable.

The following site summaries contain a detailed discussion for each of these 124 natural communities organized alphabetically by community type and then by element occurrence. The beginning of each grouping of communities contains an overview of the natural community type, which was adapted from MNFI's natural community classification (Kost et al. 2007). In addition, an ecoregional distribution map is provided for each natural community type (Albert et al. 2008). For each site summary, the following information is provided:

a) site name
b) natural community type
c) global and state rank (see Appendix 3 for ranking criteria)
d) current element occurrence rank
e) size
f) locational information
g) digital photograph(s)
h) threat assessment
i) management recommendations

Community Type	EO ID	County	Survey Site	Management Area	EO RANK	Surveyor
Bog	18705	Washtenaw	Crooked Lake Bog	Pinckney State Recreation Area	BC	J. Cohen
Bog	15902	Barry	Horsetrail Bog	Yankee Spring State Recreation Area	BC (C)	T. Bassett and S. Thomas
Bog	18855	Washtenaw	McLaughlin Bog	Waterloo State Recreation Area	BC	J. Cohen and M. Penskar
Bog	17489	Jackson	Moeckel Road Tall Shrub Bog	Waterloo State Recreation Area	C	S. Thomas
Bog	17833	Marquette	Pesheke Bog	Van Riper State Park	B	J. Cohen
Bog	18701	Washtenaw	Rosewarne's Bog	Waterloo State Recreation Area	B	J. Cohen and M. Penskar
Boreal Forest	17838	Emmet	Big Stone Bay Boreal Forest	Wilderness State Park	AB	J. Cohen
Boreal Forest	18859	Menominee	Wells Boreal Forest	Wells State Park	BC	J. Cohen
Clay Bluffs	18009	Gogebic	Porcupine Mountains Clay Bluffs	Porcupine Mountains Wilderness State Park	A	J. Cohen
Coastal Fen	17529	Cheboygan	Cheboygan State Park	Cheboygan State Park	B	B. Slaughter
Coastal Fen	17336	Emmet	Waugoshance Point	Wilderness State Park	AB	J. Cohen
Dry Northern Forest	17913	Chippewa	Prison Camp Dry Northern Forest	Tahquamenon Falls State Park	AB	J. Cohen
Dry Northern Forest	17869	Chippewa	Tahquamenon River Mouth	Tahquamenon Falls State Park	AB	J. Cohen
Dry Sand Prairie	18856	Washtenaw	McLaughlin Prairie	Waterloo State Recreation Area	C	J. Cohen and M. Penskar
Dry-mesic Northern Forest	17325	Crawford	Dalibarda Pines	Hartwick Pines State Park	BC	J. Cohen
Dry-mesic Northern Forest	17835	Marquette	Pesheke Pines	Van Riper State Park	B	J. Cohen
Dry-mesic Northern Forest	18056	Ontonagon	Porcupine Oaks	Porcupine Mountains Wilderness State Park	AB	J. Cohen
Dry-mesic Northern Forest	17923	Luce	Prison Camp Pine Ridges	Tahquamenon Falls State Park	AB	J. Cohen
Dry-mesic Southern Forest	18973	Barry	Gun Lake Woods	Yankee Spring State Recreation Area	B	M. Kost
Dry-mesic Southern Forest*	17492	Jackson	Little Portage Lake Woods	Waterloo State Recreation Area	C	S. Thomas
Dry-mesic Southern Forest	17500	Jackson	Markla Lake Woods	Waterloo State Recreation Area	BC	S. Thomas
Dry-mesic Southern Forest*	17491	Jackson	Moeckel Road Woods	Waterloo State Recreation Area	BC	J. Fody
Dry-mesic Southern Forest*	17496	Jackson	Tophith Road Woods	Waterloo State Recreation Area	C	S. Thomas
Dry-mesic Southern Forest*	17497	Jackson	Waterloo North Woods	Waterloo State Recreation Area	BC	S. Thomas
Emergent Marsh	17998	Ontonagon	Lake of the Clouds	Porcupine Mountains Wilderness State Park	A	J. Cohen
Emergent Marsh	17549	Jackson	South Portage Marsh	Waterloo State Recreation Area	B	J. Fody
Emergent Marsh	17338	Presque Isle	Thompson's Harbor	Thompson's Harbor State Park	AB	J. Cohen
Emergent Marsh	17843	Emmet	Waugoshance Island	Wilderness State Park	AB	J. Cohen
Granite Bedrock Glade	17834	Marquette	Van Riper Glades	Van Riper State Park	AB	J. Cohen
Great Lakes Barrens	17844	Emmet	Waugoshance Point	Wilderness State Park	B	J. Cohen
Great Lakes Marsh	17340	Presque Isle	Thompson's Harbor	Thompson's Harbor State Park	B	J. Cohen
Hardwood-Conifer Swamp	17917	Luce	Anchard Creek Hemlocks	Tahquamenon Falls State Park	AB	J. Cohen
Hardwood-Conifer Swamp	18863	Ontonagon	Carp River Swamp	Porcupine Mountains Wilderness State Park	A	J. Cohen
Hardwood-Conifer Swamp	16865	Barry	Long Lake	Yankee Spring State Recreation Area	B	B. Slaughter
Hardwood-Conifer Swamp	16866	Barry	Payne Lake	Yankee Spring State Recreation Area	BC	B. Slaughter
Hardwood-Conifer Swamp	17919	Chippewa/Luce	Tahquamenon River	Tahquamenon Falls State Park	B	J. Cohen
Interdunal Wetland	18757	Presque Isle	Besser Natural Area	Rockport State Recreation Area	BC	J. Cohen
Inundated Shrub Swamp	18615	Oakland	Chamberlain Lakes	Bald Mountain State Recreation Area	C	B. Slaughter
Inundated Shrub Swamp	17494	Jackson	Tophith Road Buttonbush Swamps	Waterloo State Recreation Area	BC	S. Thomas
Inundated Shrub Swamp	18596	Oakland	Trout Lake	Bald Mountain State Recreation Area	C	B. Slaughter
Limestone Bedrock Lakeshore	17854	Charlevoix	Fisherman's Island	Fisherman's Island State Park	BC	J. Cohen
Limestone Cobble Shore	18759	Presque Isle	Besser Natural Area	Rockport State Recreation Area	AB	J. Cohen

Table 1. Summary of Natural Community Surveys (* indicates element occurrence natural community type was re-classified. Where applicable, old element occurrence rankings provided in parantheses).

Community Type	EO ID	County	Survey Site	Management Area	EO RANK	Surveyor
Limestone Cobble Shore	17845	Emmet	Temperance and Waugoshance Islands	Wilderness State Park	AB	J. Cohen
Limestone Cobble Shore	17337	Emmet	Waugoshance Point	Wilderness State Park	AB	J. Cohen
Limestone Lakeshore Cliff	9467	Delta	Burnt Bluff	Fayette Historic State Park	AB	J. Cohen
Mesic Northern Forest	17520	Muskegon	Muskegon State Park	Muskegon State Park	BC	B. Slaughter
Mesic Northern Forest	18862	Emmet	Wycamp Mesic Forest	Wilderness State Park	BC	J. Cohen
Muskeg	17839	Emmet	Nebo Muskeg	Wilderness State Park	BC	J. Cohen
Muskeg	17343	Chippewa	Tahquamenon Falls	Tahquamenon Falls State Park	B	J. Cohen
Muskeg	17868	Chippewa	Tahquamenon River Mouth Muskeg	Tahquamenon Falls State Park	B	J. Cohen
Northern Fen	17533	Cheboygan	Cheboygan State Park	Cheboygan State Park	B	B. Slaughter
Northern Fen	15803	Presque Isle	Stevenson's Fen	Rockport State Recreation Area	B	J. Cohen
Northern Fen	17841	Emmet	Sturgeon Bay	Wilderness State Park	B	J. Cohen and M. Penskar
Northern Fen	17341	Presque Isle	Thompson's Harbor	Thompson's Harbor State Park	AB	J. Cohen
Northern Fen	17842	Emmet	Waugoshance Fen	Wilderness State Park	B	J. Cohen and M. Penskar
Northern Fen	17334	Emmet	Wilderness State Park	Wilderness State Park	B	J. Cohen
Northern Shrub Thicket	17932	Ontonagon	Carp River East	Porcupine Mountains Wilderness State Park	A	J. Cohen
Northern Shrub Thicket	18006	Ontonagon	Carp River West	Porcupine Mountains Wilderness State Park	AB	J. Cohen
Northern Shrub Thicket	17324	Crawford	Hartwick Pines	Hartwick Pines State Park	B	J. Cohen
Northern Shrub Thicket	18703	Alger	Laughing Whitefish Falls	Laughing Whitefish Falls State Park	AB	J. Cohen
Northern Shrub Thicket	18782	Crawford	Lewiston Grade	Hartwick Pines State Park	BC	J. Cohen
Northern Shrub Thicket	17924	Luce	Little Two Hearted River	Tahquamenon Falls State Park	A	J. Cohen
Northern Shrub Thicket	17912	Chippewa	Prison Camp	Tahquamenon Falls State Park	AB	J. Cohen
Northern Shrub Thicket	17339	Presque Isle	Thompson's Harbor	Thompson's Harbor State Park	AB	J. Cohen
Northern Shrub Thicket	17837	Marquette	Van Riper	Van Riper State Park	B	J. Cohen
Northern Shrub Thicket	17335	Emmet	Wilderness State Park	Wilderness State Park	B	J. Cohen
Northern Wet Meadow	17999	Ontonagon	Carp River and Lake of the Clouds	Porcupine Mountains Wilderness State Park	A	J. Cohen
Northern Wet Meadow	18005	Ontonagon	Carp River West	Porcupine Mountains Wilderness State Park	AB	J. Cohen
Northern Wet Meadow	18001	Ontonagon	Miscowawbic Meadow	Porcupine Mountains Wilderness State Park	B	J. Cohen
Northern Wet Meadow	17836	Marquette	Pesheke Meadows	Van Riper State Park	B	J. Cohen
Northern Wet Meadow	17911	Chippewa	Prison Camp	Tahquamenon Falls State Park	AB	J. Cohen
Northern Wet Meadow	17920	Chippewa	Tahquamenon River	Tahquamenon Falls State Park	BC	J. Cohen
Open Dunes	18758	Presque Isle	Besser Natural Area	Rockport State Recreation Area	BC	J. Cohen
Patterned Fen	17921	Luce	Prison Camp Patterned Fen	Tahquamenon Falls State Park	B	J. Cohen
Poor Conifer Swamp	17925	Chippewa/Luce	Clark Lake Swamp	Tahquamenon Falls State Park	AB	J. Cohen
Poor Conifer Swamp	18780	Crawford	Lewiston Grade Swamp	Hartwick Pines State Park	BC	J. Cohen
Poor Conifer Swamp*	17490	Jackson	Moeckel Road Swamp	Waterloo State Recreation Area	BC	S. Thomas
Poor Conifer Swamp	17922	Luce	Prison Camp Swamp	Tahquamenon Falls State Park	A	J. Cohen
Poor Conifer Swamp	17872	Chippewa	Tahqua Trail Swamp	Tahquamenon Falls State Park	AB	J. Cohen
Poor Fen	18857	Washtenaw	Cassidy Road Poor Fen	Waterloo State Recreation Area	BC	J. Cohen
Poor Fen	18781	Crawford	Lewiston Grade Fen	Hartwick Pines State Park	B	J. Cohen
Poor Fen	17870	Chippewa	Park Poor Fen	Tahquamenon Falls State Park	B	J. Cohen
Poor Fen	17840	Emmet	Sturgeon Bay	Wilderness State Park	B	J. Cohen and M. Penskar
Poor Fen	17867	Chippewa	Tahquamenon River Mouth Fen	Tahquamenon Falls State Park	AB	J. Cohen

Table 1 (continued). Summary of Natural Community Surveys (* indicates element occurrence natural community type was re-classified. Where applicable, old element occurrence rankings provided in parantheses).

Community Type	EO ID	County	Survey Site	Management Area	EO RANK	Surveyor
Poor Fen	17871	Chippewa	Tahqua Trail Fen	Tahquamenon Falls State Park	B	J. Cohen
Prairie Fen	16876	Jackson	Little Portage Lake Fen	Waterloo State Recreation Area	BC	B. Slaughter, M. Penskar, & S. Thomas
Prairie Fen	15920	Barry	McDonald Lake Fen	Yankee Spring State Recreation Area	C (CD)	T. Bassett, S. Thomas, & A. Kay
Prairie Fen	15907	Barry	McKibben Fen	Yankee Spring State Recreation Area	C (CD)	T. Bassett, S. Thomas, & A. Kay
Prairie Fen	18877	Washtenaw	Pickerel Lake Fen	Pinckney State Recreation Area	BC	M. Kost
Prairie Fen	18702	Oakland	Proud Lake Fen	Proud Lake State Recreation Area	C	J. Cohen
Prairie Fen	17523	Jackson	Riethmiller South Fen	Waterloo State Recreation Area	C	J. Fody
Prairie Fen	17521	Jackson	Tophith Road Fen	Waterloo State Recreation Area	C	S. Thomas and M. Penskar
Rich Conifer Swamp	17931	Ontonagon	Carp River East	Porcupine Mountains Wilderness State Park	A	J. Cohen
Rich Conifer Swamp	18779	Crawford	Lewiston Grade Swamp	Hartwick Pines State Park	C	J. Cohen
Rich Conifer Swamp	18858	Menominee	Wells Swamp	Wells State Park	C	J. Cohen
Rich Tamarack Swamp	18704	Livingston	Chenango Lake- Camp Talahi	Brighton State Recreation Area	C	J. Cohen
Rich Tamarack Swamp	15947	Jackson	Leeke Lake Swamp	Waterloo State Recreation Area	B	M. Kost, S. Thomas, & A. Kay
Rich Tamarack Swamp	15946	Washtenaw	Little Portage Lake Swamp	Waterloo State Recreation Area	B	B. Saughter, M. Penskar, & S. Thomas
Rich Tamarack Swamp	7962	Jackson/Washtenaw	M52 Tamarack Swamp	Waterloo State Recreation Area	AB	M. Kost and S. Thomas
Rich Tamarack Swamp	17535	Jackson	Riethmiller Road Tamarack Swamp	Waterloo State Recreation Area	BC	S. Thomas and J. Fody
Sand and Gravel Beach	18010	Gogebic	Porcupine Beach	Porcupine Mountains Wilderness State Park	A	J. Cohen
Sandstone Bedrock Lakeshore	18014	Ontonagon	Porcupine Shore	Porcupine Mountains Wilderness State Park	A	J. Cohen
Sandstone Cliff	17320	Ontonagon	Agate Falls	Agate Falls Scenic Site	C	J. Cohen
Sandstone Cliff	18812	Alger	Laughing Whitefish Falls	Laughing Whitefish Falls State Park	B	J. Cohen
Sandstone Cliff	18008	Gogebic	Presque Isle River	Porcupine Mountains Wilderness State Park	B	J. Cohen
Sandstone Cliff	18028	Gogebic	Shining Cloud Falls	Porcupine Mountains Wilderness State Park	AB	J. Cohen
Sandstone Cliff	17918	Luce	Tahquamenon Falls	Tahquamenon Falls State Park	B	J. Cohen
Sandstone Cobble Shore	18012	Gogebic/Ontonagon	Porcupine Shore	Porcupine Mountains Wilderness State Park	A	J. Cohen
Sinkhole	8704	Presque Isle	Rockport Karst	Rockport State Recreation Area	AB	J. Cohen and B. Schillo
Southern Hardwood Swamp	17498	Jackson	Tophith Road Oak Swamp	Waterloo State Recreation Area	BC	S. Thomas
Southern Hardwood Swamp	17522	Jackson	Waterloo-Munith Road Oak Swamp	Waterloo State Recreation Area	BC	S. Thomas, M. Kost, and M. Penskar
Southern Wet Meadow	17525	Jackson	North Waterloo Wet Meadow	Waterloo State Recreation Area	BC	S. Thomas
Southern Wet Meadow	17534	Jackson	Riethmiller Road Wet Meadow	Waterloo State Recreation Area	BC	S. Thomas and J. Fody
Submergent Marsh	17934	Ontonagon	Carp River and Lake of the Clouds	Porcupine Mountains Wilderness State Park	A	J. Cohen
Volcanic Bedrock Glade	17318	Ontonagon	Bond Falls	Bond Falls Scenic Site	C	J. Cohen
Volcanic Bedrock Glade	18003	Ontonagon	Green Mountain Glade	Porcupine Mountains Wilderness State Park	AB	J. Cohen
Volcanic Bedrock Glade	18004	Ontonagon	Porcupine Mountains Glades	Porcupine Mountains Wilderness State Park	B	J. Cohen
Volcanic Bedrock Glade	12704	Dickinson	Sand Portage Falls	Menominee River State Recreation Area	B	J. Cohen
Volcanic Bedrock Lakeshore	18013	Gogebic/Ontonagon	Porcupine Shore	Porcupine Mountains Wilderness State Park	A	J. Cohen
Volcanic Cliff	17319	Ontonagon	Bond Falls	Bond Falls Scenic Site	BC	J. Cohen
Volcanic Cliff	18000	Ontonagon	Escarpment Trail Cliffs	Porcupine Mountains Wilderness State Park	A	J. Cohen
Volcanic Cliff	18002	Ontonagon	Green Mountain Cliffs	Porcupine Mountains Wilderness State Park	AB	J. Cohen
Volcanic Cobble Shore	18011	Gogebic	Porcupine Shore	Porcupine Mountains Wilderness State Park	AB	J. Cohen
Wet Prairie	17493	Jackson	Waterloo Wet Prairie	Waterloo State Recreation Area	CD	S. Thomas

Table 1(continued). Summary of Natural Community Surveys (* indicates element occurrence natural community type was re-classified. Where applicable, old element occurrence rankings provided in parantheses).

SITE SUMMARIES

BOG

Bog is a nutrient-poor peatland characterized by acidic, saturated peat and the prevalence of sphagnum mosses and ericaceous shrubs. Located in depressions in glacial outwash and sandy glacial lakeplains and in kettles on pitted outwash and moraines, bogs frequently occur as a floating mat on the margins of lakes and ponds. Fire occurs naturally during drought periods and can alter the hydrology, mat surface, and flora. Beaver-induced flooding also influences bogs (Kost et al. 2007).

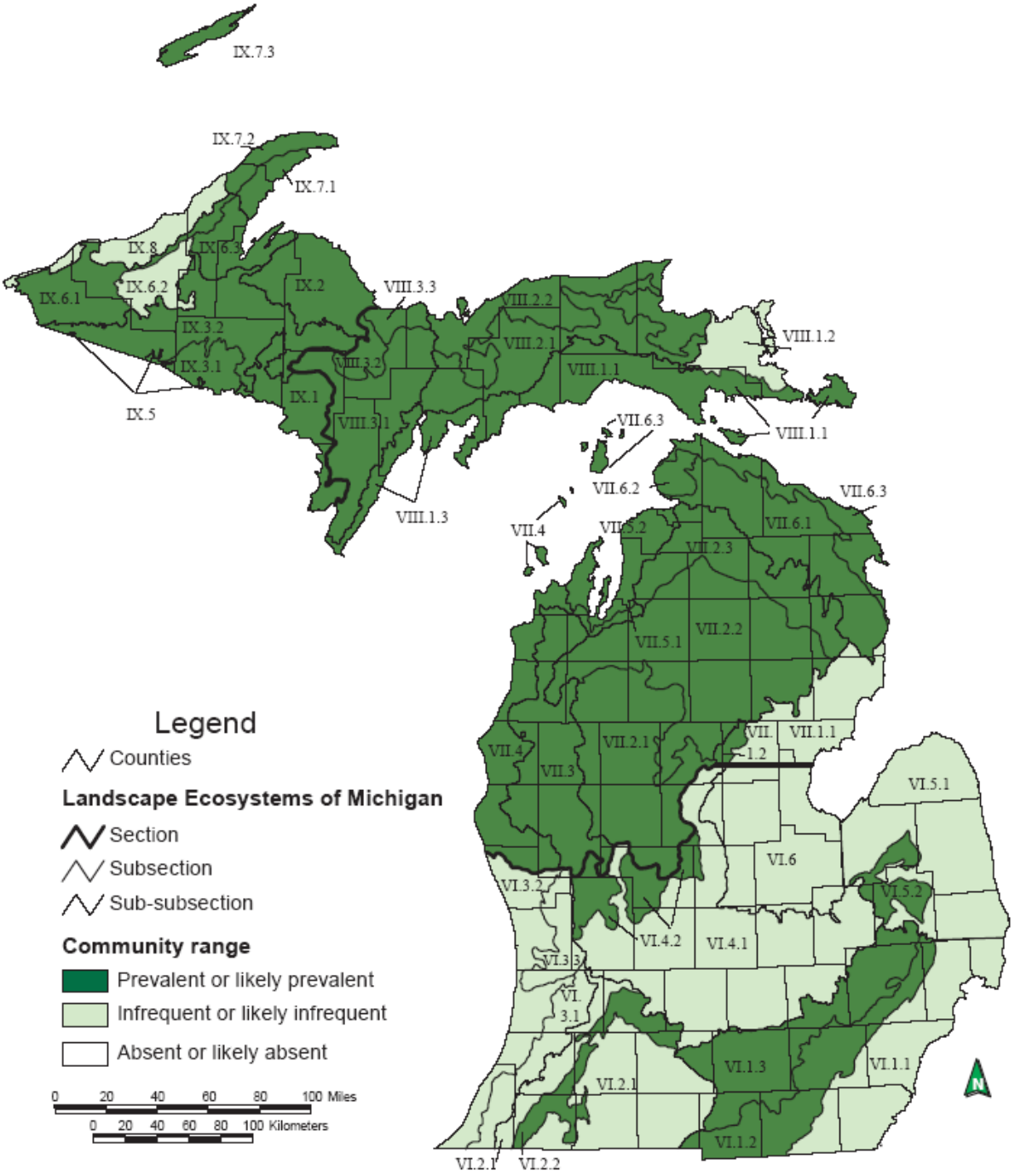

Figure 1. Distribution of bogs in Michigan.

1. Crooked Lake Bog
Natural Community Type: Bog
Rank: G3G5 S4, vulnerable to secure globally and secure within the state
Element Occurrence Rank: BC
Size: 5.1 acres
Location: Pinckney State Recreation Area
Element Occurrence Identification Number: 18705

Threats: Fire suppression throughout the general landscape may have altered the fire regime of the bog.

Management Recommendations: The main management recommendations are to maintain a forested buffer to preserve the hydrology, consider burning the bog with the surrounding uplands, and monitor for invasive species and following prescribed fire.

Photo 1. Crooked Lake Bog. Photo by Joshua G. Cohen.

2. Horsetrail Bog
Natural Community Type: Bog
Rank: G3G5 S4, vulnerable to secure globally and secure within the state
Element Occurrence Rank: BC
Size: 19 acres
Location: Yankee Springs State Recreation Area
Element Occurrence Identification Number: 15902

Threats: Fire suppression throughout the general landscape may have altered the fire regime of the bog.

Management Recommendations: The main management recommendations are to maintain a forested buffer to preserve the hydrology, consider burning the bog with the surrounding uplands, and monitor for invasive species and following prescribed fire.

Photo 2. Horsetrail Bog. Photo by Steve A. Thomas.

3. McLaughlin Bog
Natural Community Type: Bog
Rank: G3G5 S4, vulnerable to secure globally and secure within the state
Element Occurrence Rank: BC
Size: 4.7 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 18855

Threats: Fire suppression throughout the general landscape may have altered the fire regime of the bog.

Management Recommendations: The main management recommendations are to maintain a forested buffer to preserve the hydrology, consider burning the bog with the surrounding uplands, and monitor for invasive species and following prescribed fire.

Photo 3. McLaughlin Bog. Photo by Joshua G. Cohen.

4. Moeckel Road Tall Shrub Bog
Natural Community Type: Bog
Rank: G3G5 S4, vulnerable to secure globally and secure within the state
Element Occurrence Rank: C
Size: 13 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17489

Threats: Fire suppression throughout the general landscape may have altered the fire regime of the bog. Invasives noted within the bog include glossy buckthorn (*Frangula alnus*) and reed canary grass (*Phalaris arundinacea*).

Management Recommendations: The main management recommendations are to maintain a forested buffer to preserve the hydrology, consider burning the bog with the surrounding uplands, control invasive species, and monitor for invasive species and following prescribed fire. In addition, the artificial drainage ditch along the south side of the bog should be evaluated and possibly filled if the ditch is impacting the hydrology of the bog.

Photo 4. Moeckel Road Tall Shrub Bog. Photo by Steve A. Thomas.

5. Pesheke Bog
Natural Community Type: Bog
Rank: G3G5 S4, vulnerable to secure globally and secure within the state
Element Occurrence Rank: B
Size: 4.1 acres
Location: Van Riper State Park
Element Occurrence Identification Number: 17833

Threats: No threats were identified during the survey. Logging of the adjacent forest and granite bedrock glade could impact the hydrology of the bog by increasing sedimentation and surface water input.

Management Recommendations: The main management recommendation is to maintain an undisturbed buffer adjacent to the bog to minimize the threat of hydrological alteration.

Photo 5. Pesheke Bog. Photo by Joshua G. Cohen.

6. Rosewarne's Bog
Natural Community Type: Bog
Rank: G3G5 S4, vulnerable to secure globally and secure within the state
Element Occurrence Rank: B
Size: 30 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 18701

Threats: Fire suppression throughout the general landscape may have altered the fire regime of the bog.

Management Recommendations: The main management recommendations are to maintain a forested buffer to preserve the hydrology, consider burning the bog with the surrounding uplands, and monitor for invasive species and following prescribed fire.

Photo 6. Rosewarne's Bog. Photo by Joshua G. Cohen.

BOREAL FOREST

Overview: Boreal forest is a conifer or conifer-hardwood forest type occurring on moist to dry sites characterized by species dominant in the Canadian boreal forest. It typically occupies upland sites along shores of the Great Lakes, on islands in the Great Lakes, and locally inland. The community occurs north of the climatic tension zone primarily on sand dunes, glacial lakeplains, and thin soil over bedrock or cobble. Soils of sand and sandy loam are typically moderately acid to neutral, but heavier soils and more acid conditions are common. Proximity to the Great Lakes results in high levels of windthrow and climatic conditions characterized by low summer temperatures and high levels of humidity, snowfall, and summer fog and mist. Additional important forms of natural disturbance include fire and insect epidemics (Kost et al. 2007).

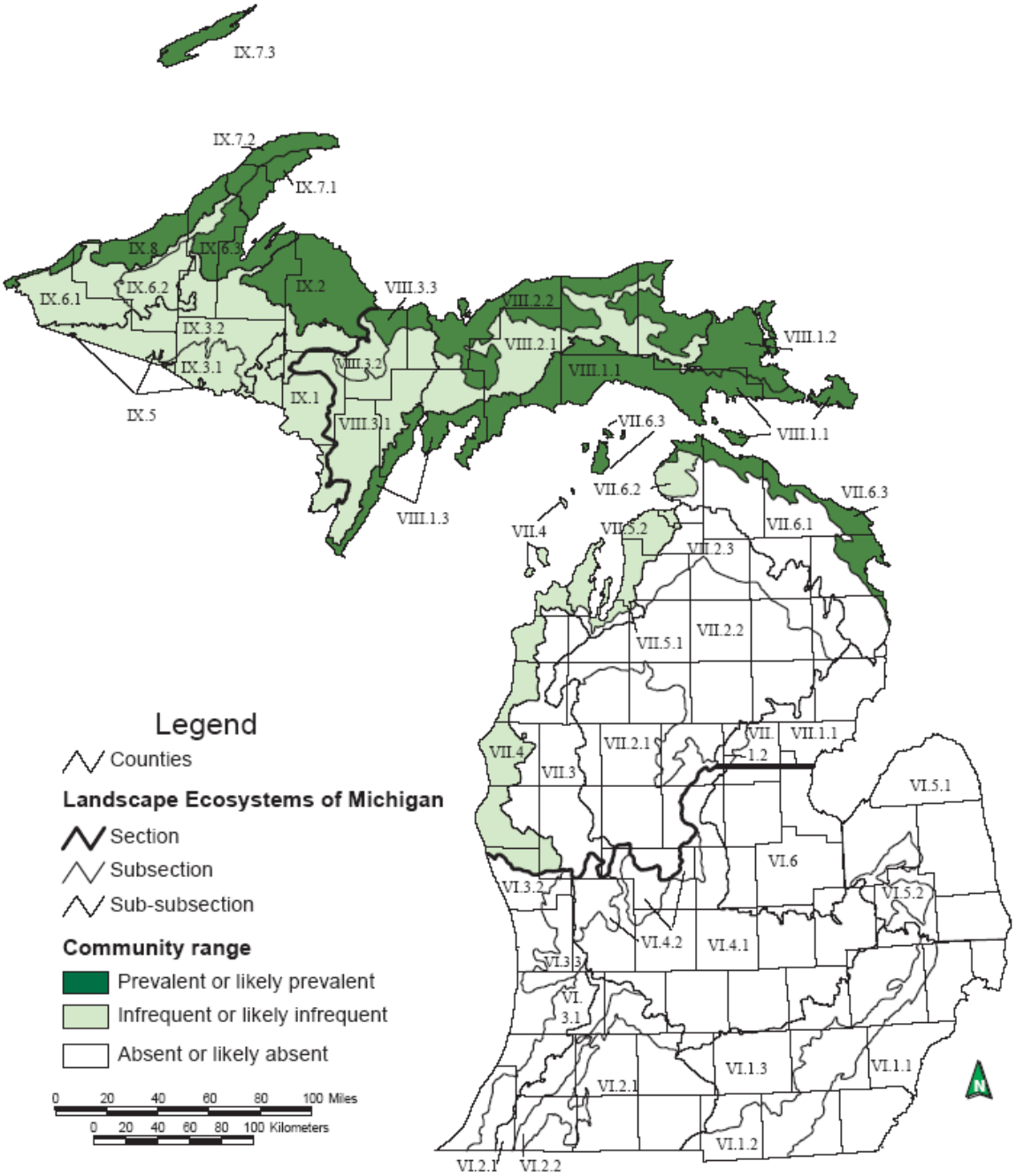

Figure 2. Distribution of boreal forest in Michigan.

7. Big Stone Bay Boreal Forest
Natural Community Type: Boreal Forest
Rank: GU S3, globally unrankable and vulnerable within the state
Element Occurrence Rank: AB
Size: 132 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17838

Threats: No major threats were noted. Currently observed non-natives [common mullein (*Verbascum thapsus*) and helleborine (*Epipactis helleborine*)] appear to be mainly weedy opportunists and not invasive. Deer browse could limit the regeneration capacity of the overstory conifers.

Management Recommendations: The primary management recommendations are to allow natural processes to operate unhindered and to monitor for invasive species and deer herbivory.

Photo 7. Big Stone Bay Boreal Forest. Photo by Joshua G. Cohen.

8. Wells Boreal Forest
Natural Community Type: Boreal Forest
Rank: GU S3, globally unrankable and vulnerable within the state
Element Occurrence Rank: BC
Size: 20 acres
Location: Wells State Park
Element Occurrence Identification Number: 18859

Threats: The species composition and structure of this boreal forest is influenced by natural processes but also by deer herbivory. Deer browse could limit the regeneration capacity of the overstory conifers. Scattered invasive species were noted and include glossy buckthorn (*Frangula alnus*) and Japanese barberry (*Berberis thunbergii*). Numerous linear anthropogenic disturbances (i.e., trails) occur within the forest and provide conduits for weeds and deer.

Management Recommendations: The primary management recommendations are to allow natural processes to operate unhindered, to control glossy buckthorn and Japanese barberry, and to monitor for invasive species and deer herbivory. Reducing local deer densities is also recommended.

Photo 8. Wells Boreal Forest. Photo by Joshua G. Cohen.

CLAY BLUFFS

Overview: Clay bluffs is a forb-, graminoid-, and shrub-dominated and erosion-dependent community that occurs infrequently on steep to near-vertical slopes along the shorelines of Lake Michigan and Lake Superior. Clay bluffs is less commonly found localized along eroding banks of rivers and streams that form ravines through clay soils and drain into these Great Lakes. Clay bluffs range from three to 30 meters (10 to 100 feet) tall. Clay bluffs are dynamic systems with active sloughing occurring following frost heave and spring thaw and vegetation varying from year to year. Clay bluffs occurs on alkaline clays that are locally exposed following these landslide events. Species composition and vegetative structure of clay bluffs is patterned by sloughing of clay slopes due to ground-water seepage. Clay bluffs is characterized by sparse forb, graminoid, and low shrub cover, dense patches of tall shrubs, and scattered and stunted overstory trees.

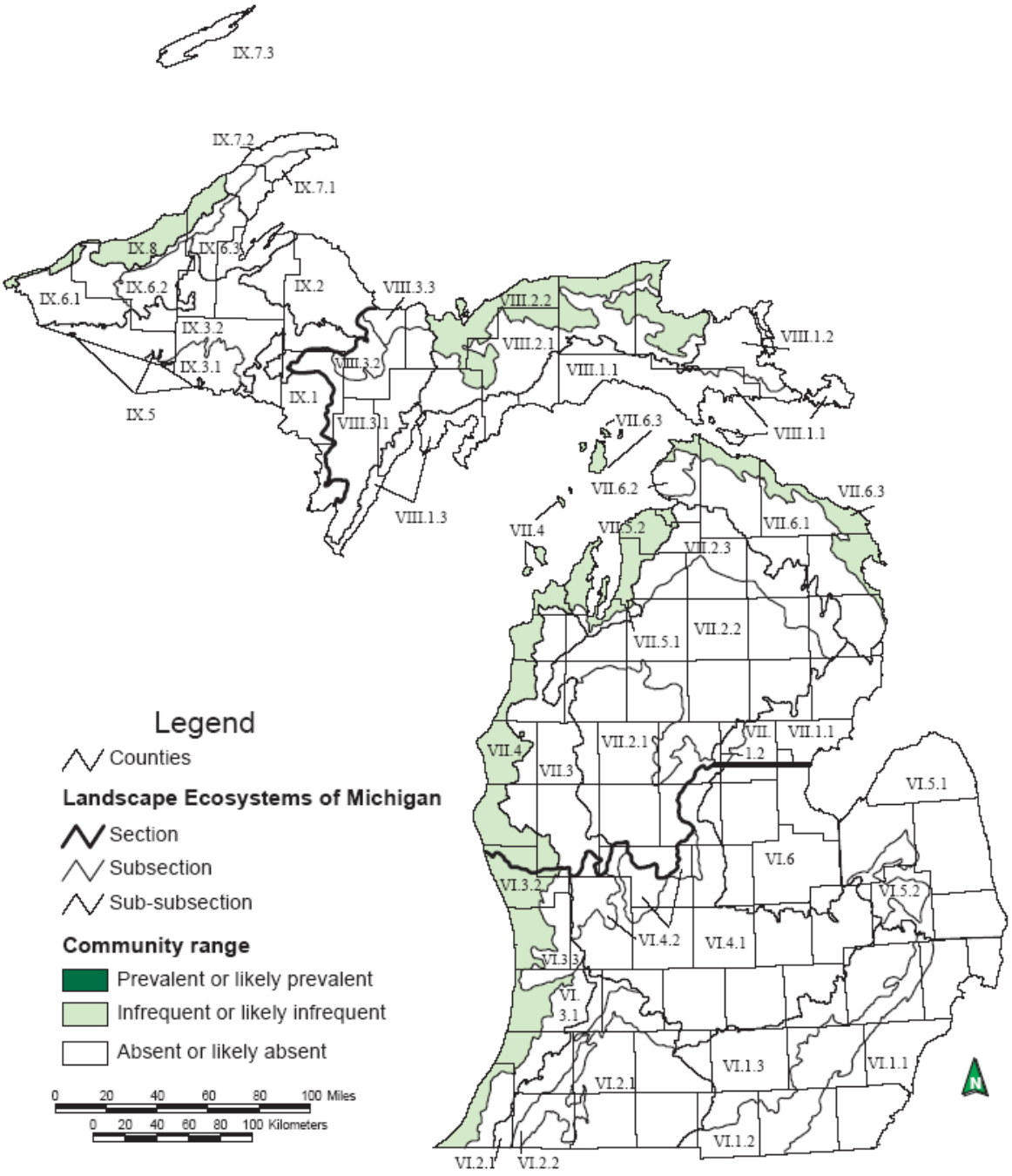

Figure 3. Distribution of clay bluffs in Michigan.

9. Porcupine Mountains Clay Bluffs
Natural Community Type: Clay Bluffs
Rank: GNR S2, not ranked globally and imperiled within the state
Element Occurrence Rank: A
Size: 16 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18009

Threats: No threats were observed during the course of the survey.

Management Recommendations: The primary management recommendation is to maintain a buffer of natural communities to reduce the risk of altering the site's hydrology and introducing non-native species.

Photo 9. Porcupine Mountains Clay Bluffs. Photo by Joshua G. Cohen.

COASTAL FEN

Overview: Coastal fen is a sedge- and rush-dominated wetland that occurs on calcareous substrates along Lake Huron and Lake Michigan north of the climatic tension zone. The community occurs where marl and organic soils accumulate in protected coves and abandoned coastal embayments and grade to moderately alkaline glacial tills and lacustrine sediments lakeward. Sediments along the lakeshore are typically fine-textured and rich in calcium and magnesium carbonates. Vegetation is comprised primarily of calcicolous species capable of growing on wet alkaline substrates (Kost et al. 2007).

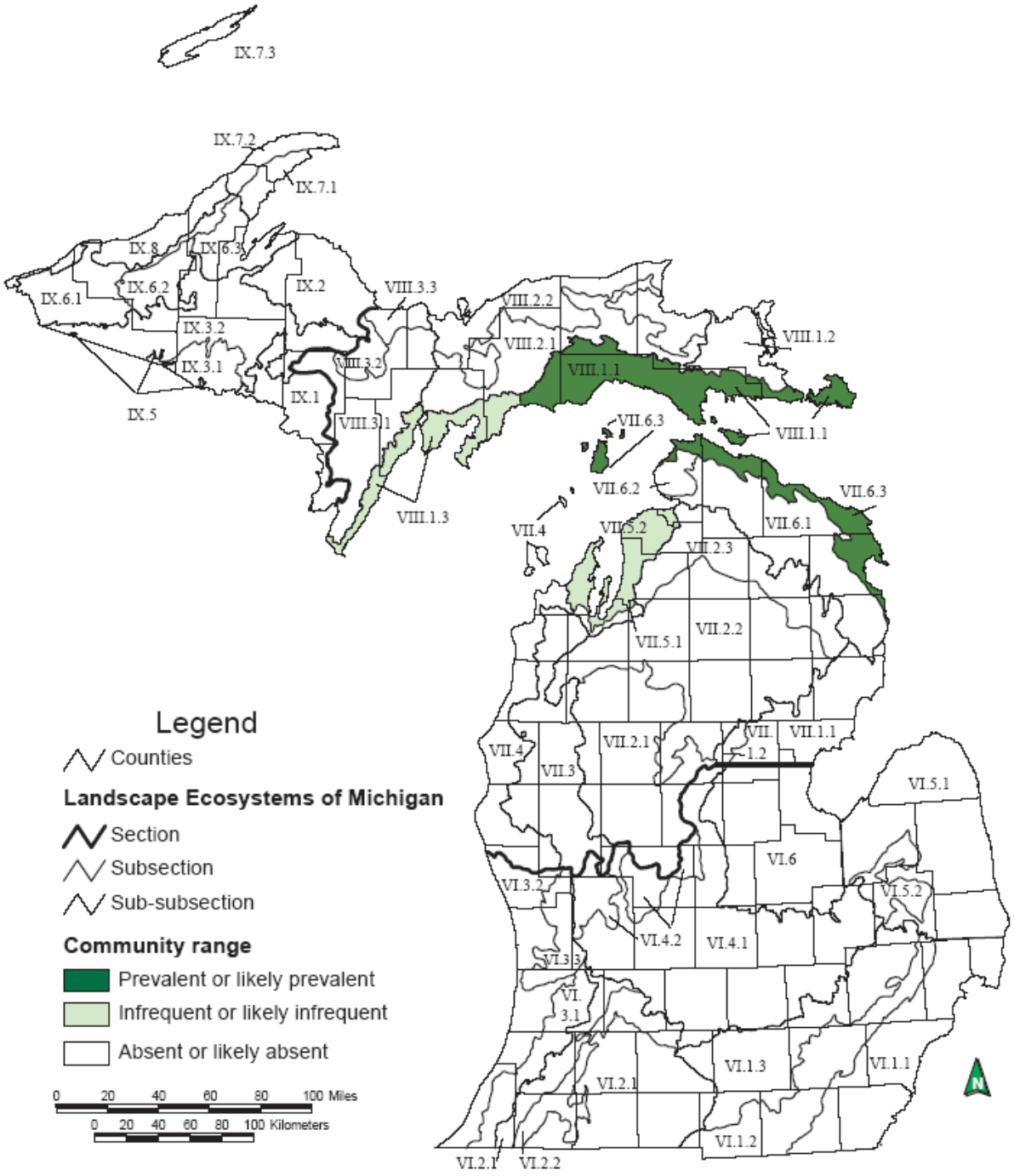

Figure 4. Distribution of coastal fen in Michigan.

10. Cheboygan State Park
Natural Community Type: Coastal Fen
Rank: G1G2 S2, globally critically imperiled to imperiled and imperiled within the state
Element Occurrence Rank: B
Size: 45 acres
Location: Cheboygan State Park
Element Occurrence Identification Number: 17529

Threats: The coastal fen openings are relatively undisturbed. The fen in the southern embayment has been impacted by road construction on the adjacent upland ridge and by the placement of a powerline cut that crosses the open flats. No invasive species were noted in the coastal fen. Narrow-leaved cat-tail (*Typha angustifolia*) is the primary threat to the adjacent Great Lakes marsh, and may establish in the coastal fen.

Management Recommendations: The primary stewardship needs are to control the populations of narrow-leaved cat-tail in adjacent areas of Great Lakes marsh, monitor control efforts and the coastal fen for invasive species, and restrict off-road vehicle access along the shoreline.

Photo 10. Cheboygan State Park coastal fen. Photo by Bradford S. Slaughter.

11. Waugoshance Point
Natural Community Type: Coastal Fen
Rank: G1G2 S2, globally critically imperiled to imperiled and imperiled within the state
Element Occurrence Rank: AB
Size: 634 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17336

Threats: No invasive species were noted during the course of the survey, although spotted knapweed (*Centaurea stoebe*) was noted in the adjacent open dunes. The coastal fen is mildly impacted by diffuse foot traffic. Several trails and one old road were noted within the wetland.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., Great Lakes water level fluctuations) to operate unhindered, to maintain canopy closure of the surrounding uplands to minimize surface water flow into the fen and to maintain groundwater seepage, and to monitor for invasive plant populations and deer browse.

Photo 11. Waugoshance Point coastal fen. Photo by Joshua G. Cohen.

DRY NORTHERN FOREST

Overview: Dry northern forest is a pine- or pine-hardwood-dominated forest type that occurs on dry sandy sites lying mostly north of the climatic tension zone. Dry northern forest occurs principally on sandy glacial outwash and sandy glacial lakeplains, and also commonly on sand ridges within peatlands on glacial outwash or glacial lakeplains. Soils are coarse-textured, well-sorted, excessively drained dry sands with low amounts of organic matter and low water-holding capacity. The droughty soils are extremely acid to very strongly acid with low nutrient content and high frost proclivity. Two distinct variants are included within this community type, one dominated by jack pine (*Pinus banksiana*) or jack pine and hardwoods, and the other dominated by red pine (*P. resinosa*). Prior to European settlement, dry northern forest typically originated in the wake of catastrophic fire. Frequent, low-intensity ground fires maintained red pine systems (Kost et al. 2007).

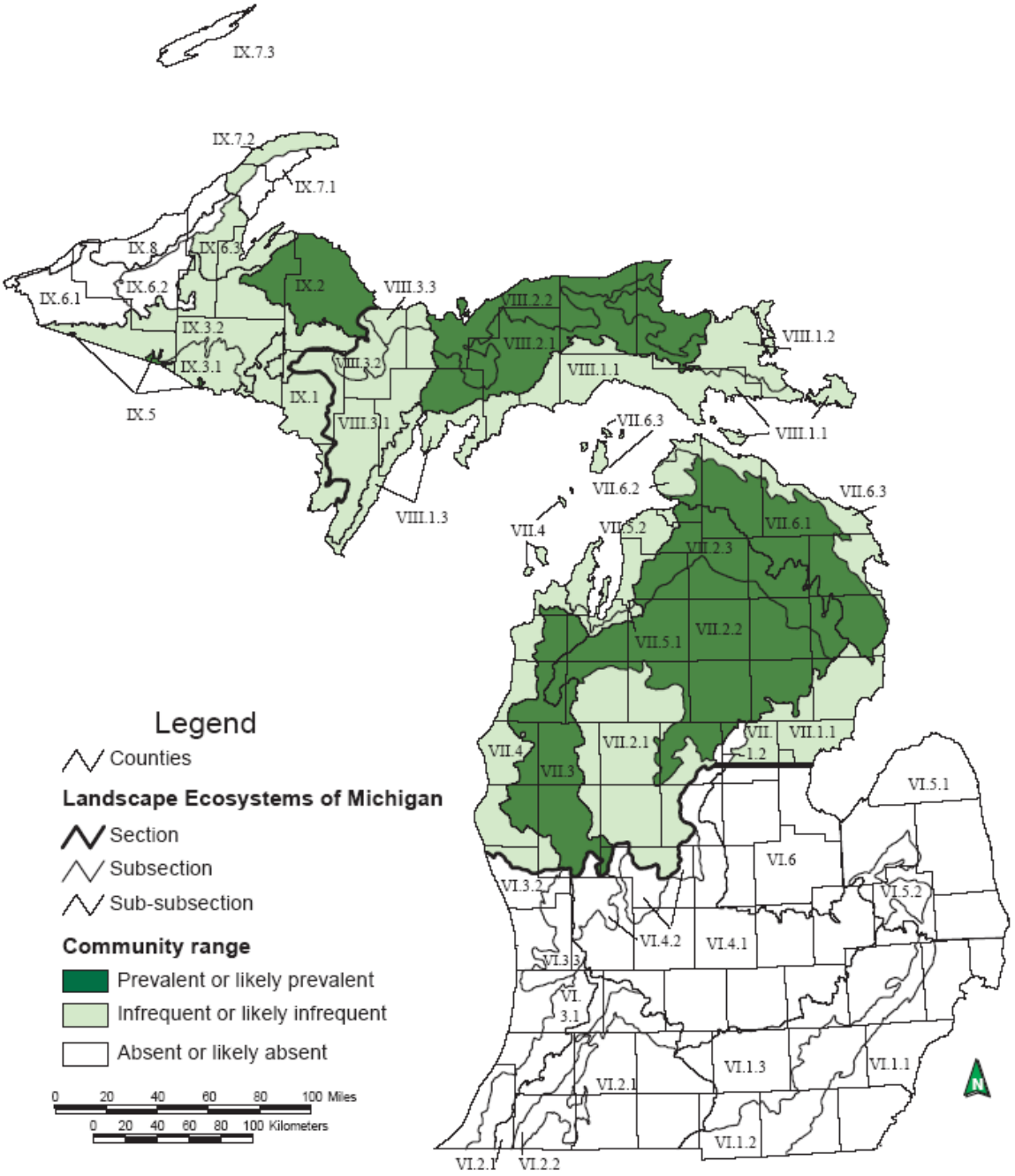

Figure 5. Distribution of dry northern forest in Michigan.

12. Prison Camp Dry Northern Forest
Natural Community Type: Dry Northern Forest
Rank: G3? S3, vulnerable throughout range
Element Occurrence Rank: AB
Size: 67 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17913

Threats: The primary threat to the site is fire suppression. No non-native species were documented during the course of the survey

Management Recommendations: The primary management recommendation is to allow natural processes to operate unhindered (i.e., allow wildfires to burn). If fire suppression prevents wildfires within the next four decades, prescribed fire could be considered to promote pine regeneration. In the event of a wildfire or if prescribed fire is implemented, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for non-native species encroachment.

Photo 12. Prison Camp Dry Northern Forest. Photo by Joshua G. Cohen.

13. Tahquamenon River Mouth
Natural Community Type: Dry Northern Forest
Rank: G3? S3, vulnerable throughout range
Element Occurrence Rank: AB
Size: 164 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17869

Threats: The primary threat to the site is fire suppression. No non-native species were documented during the course of the survey

Management Recommendations: The primary management recommendation is to allow natural processes to operate unhindered (i.e., allow wildfires to burn). If fire suppression prevents wildfires within the next four decades, prescribed fire could be considered to promote pine regeneration. In the event of a wildfire or if prescribed fire is implemented, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for non-native species encroachment.

Photo 13. Tahquamenon River Mouth dry northern forest. Photo by Joshua G. Cohen.

DRY SAND PRAIRIE

Overview: Dry sand prairie is a native grassland community dominated by little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), and Pennsylvania sedge (*Carex pensylvanica*). Vegetation is patchy and short in comparison to other prairie communities. The community occurs on loamy sands on well-drained to excessively well-drained, sandy glacial outwash plains and lakebeds both north and south of the climatic tension zone but is most common in northern Lower Michigan (Kost et al. 2007).

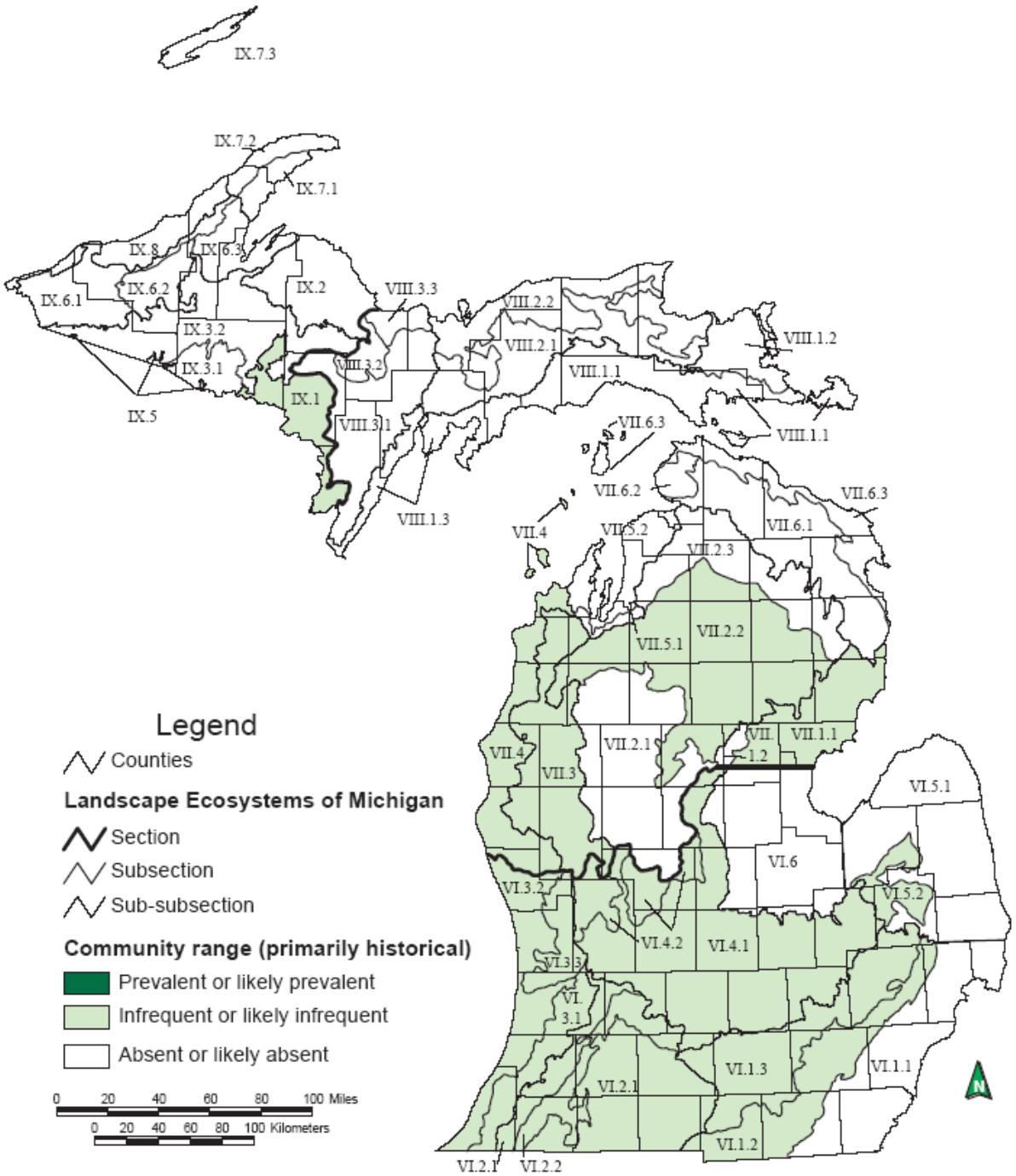

Figure 6. Distribution of dry sand prairie in Michigan.

14. McLaughlin Prairie
Natural Community Type: Dry Sand Prairie
Rank: G3 S2, globally vulnerable and imperiled within the state
Element Occurrence Rank: C
Size: 1.7 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 18856

Threats: Decades of fire suppression have resulted in the invasion of mesophytic and/or fire-intolerant species including black cherry (*Prunus serotina*), gray dogwood (*Cornus foemina*), and woody invasives. Woody invasives prevalent within the dry sand prairie include glossy buckthorn (*Frangula alnus*), common buckthorn (*Rhamnus cathartica*), multiflora rose (*Rosa multiflora*), autumn olive (*Elaeagnus umbellata*), and Siberian elm (*Ulmus pumila*). Numerous non-native weeds are prevalent in the ground cover including spotted knapweed (*Centaurea stoebe*), Canada bluegrass (*Poa compressa*), and smooth brome (*Bromus inermis*).

Management Recommendations: The primary management need is the reintroduction of fire as a prevalent disturbance factor. The extent of dry sand prairie could be expanded by removing native and non-native shrubs through integrated management (i.e., prescribed fire, mechanical measures, and herbicide). Control of invasive plant populations will require a major, long-term effort. Reduction of invasive species throughout the entire recreation area will reduce the local seed source of non-native species. Monitoring should be implemented for efforts to control non-native plant populations and evaluate the floristic response of the dry sand prairie to fire.

Photo 14. McLaughlin Prairie dry sand prairie. Photo by Joshua G. Cohen.

DRY-MESIC NORTHERN FOREST

Overview: Dry-mesic northern forest is a pine or pine-hardwood forest type of generally dry-mesic sites located mostly north of the transition zone. Dry-mesic northern forest is characterized by acidic, coarse- to medium-textured sand or loamy sand and occurs principally on sandy glacial outwash, sandy glacial lakeplains, and less often on inland dune ridges, coarse-textured moraines, and thin glacial drift over bedrock. The community historically originated in the wake of catastrophic fire and was maintained by frequent, low-intensity ground fires (Kost et al. 2007).

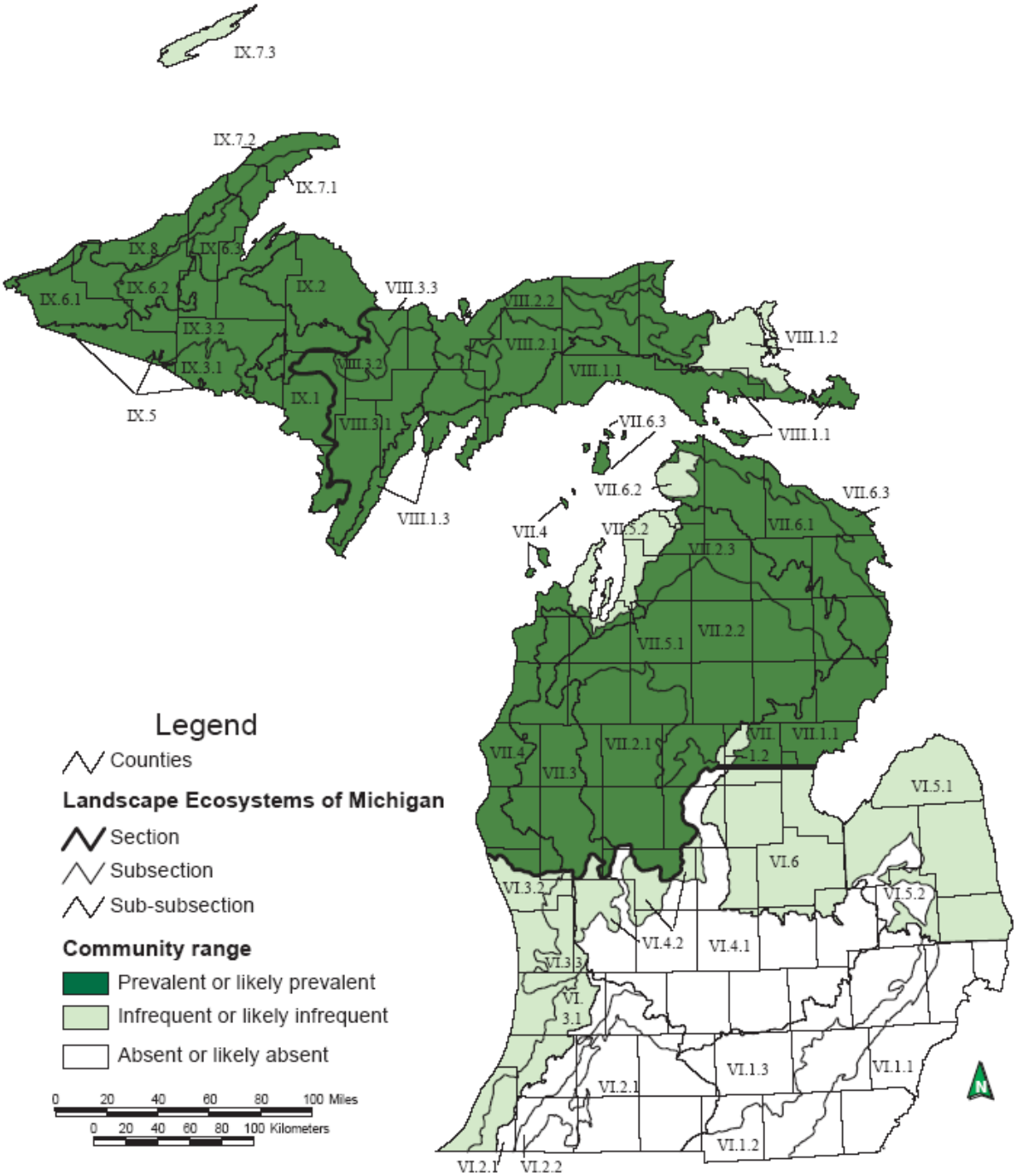

Figure 7. Distribution of dry-mesic northern forest in Michigan.

15. Dalibarda Pines
Natural Community Type: Dry-mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 77 acres
Location: Hartwick Pines State Park
Element Occurrence Identification Number: 17325

Threats: Fire suppression is the primary threat to the site. Non-native species and invasive plants are restricted to the road corridor. St. John's-wort (*Hypericum perforatum*), spotted knapweed (*Centaurea stoebe*), and timothy (*Phleum pratense*) were noted to be locally common along the road margin. No invasive species were documented within the interior of the site.

Management Recommendations: The primary management recommendation is to allow natural processes to operate unhindered (i.e., permit wildfires to burn through this site and the surrounding wetlands). The site should be monitored to ascertain if pine is recruiting and whether or not surface fires are occurring. If no fire occurs in 10 to 30 years, then pine regeneration should be assessed, and, if lacking, prescribed fire should be considered as a management option. In the event of a wildfire or if prescribed fire is implemented, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. Existing red maple (*Acer rubrum*) could be controlled through girdling, herbicide, and or mechanical felling. Invasives occurring along the road margin should be controlled.

Photo 15. Dalibarda Pines dry-mesic northren forest. Photo by Joshua G. Cohen.

16. Pesheke Pines
Natural Community Type: Dry-mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 13 acres
Location: Van Riper State Park
Element Occurrence Identification Number: 17835

Threats: No threats noted during survey. Fire suppression and increased deer herbivory could result in the failure of pine to regenerate.

Management Recommendations: The primary management recommendation is to allow natural processes to operate unhindered (i.e., permit wildfires to burn through this site and the surrounding landscape). The site should be monitored to ascertain if pine is recruiting and whether or not surface fires are occurring. If no fire occurs in 20 to 40 years, then pine regeneration should be assessed, and, if lacking, prescribed fire should be considered as a management option. In the event of a wildfire or if prescribed fire is implemented, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used.

Photo 16. Pesheke Pines dry-mesic northern forest. Photo by Joshua G. Cohen.

17. Porcupine Oaks
Natural Community Type: Dry-mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 94 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18056

Threats: Hiking trails pass through the dry-mesic northern forest and non-native weeds [i.e., timothy (*Phleum pratense*) and Canada bluegrass (*Poa compressa*)] occur along the margins of these trails**.**

Management Recommendations: The primary management recommendation is to allow natural processes to operate unhindered (i.e., permit wildfires to burn through this site and the surrounding volcanic bedrock glade and northern bald). The site should be monitored to ascertain if oak is recruiting and whether or not surface fires are occurring. If no fire occurs in 20 to 40 years, then oak regeneration should be assessed, and, if lacking, prescribed fire should be considered as a management option. In the event of a wildfire or if prescribed fire is implemented, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. In addition, monitoring and controlling non-native species is recommended.

Photo 17. Porcupine Oaks dry-mesic northern forest. Photo by Joshua G. Cohen.

18. Prison Camp Pine Ridges
Natural Community Type: Dry-mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 225 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17923

Threats: Some old off-road vehicle trails occur along some of the dune ridges. Portions of the forest burned in the spring of 2010. Some of the dune ridges that burned were impacted by fire suppression activity. Recent off-road vehicle trails occur on recently burned ridges and many scorched canopy trees were felled, likely as a safety precaution

Management Recommendations: The primary management recommendation is to allow natural processes to operate unhindered (i.e., permit wildfires to burn through this site and the surrounding wetlands). In the event of future wildfire or if prescribed fire is implemented, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used.

Photo 18. Prison Camp Pine Ridges dry-mesic northern forest. Photo by Joshua G. Cohen.

DRY-MESIC SOUTHERN FOREST

Overview: Dry-mesic southern forest is a fire-dependent, oak or oak-hickory forest type on generally dry-mesic sites found south of the climatic tension zone in southern Lower Michigan. This natural community occurs principally on glacial outwash, coarse-textured moraines, sandy glacial lakeplains, kettle-kame topography, and sand dunes. Soils are typically sandy loam or loam and slightly acid to neutral in pH. Frequent fires maintain semi-open conditions, promoting oak regeneration and ground and shrub layer diversity (Kost et al. 2007).

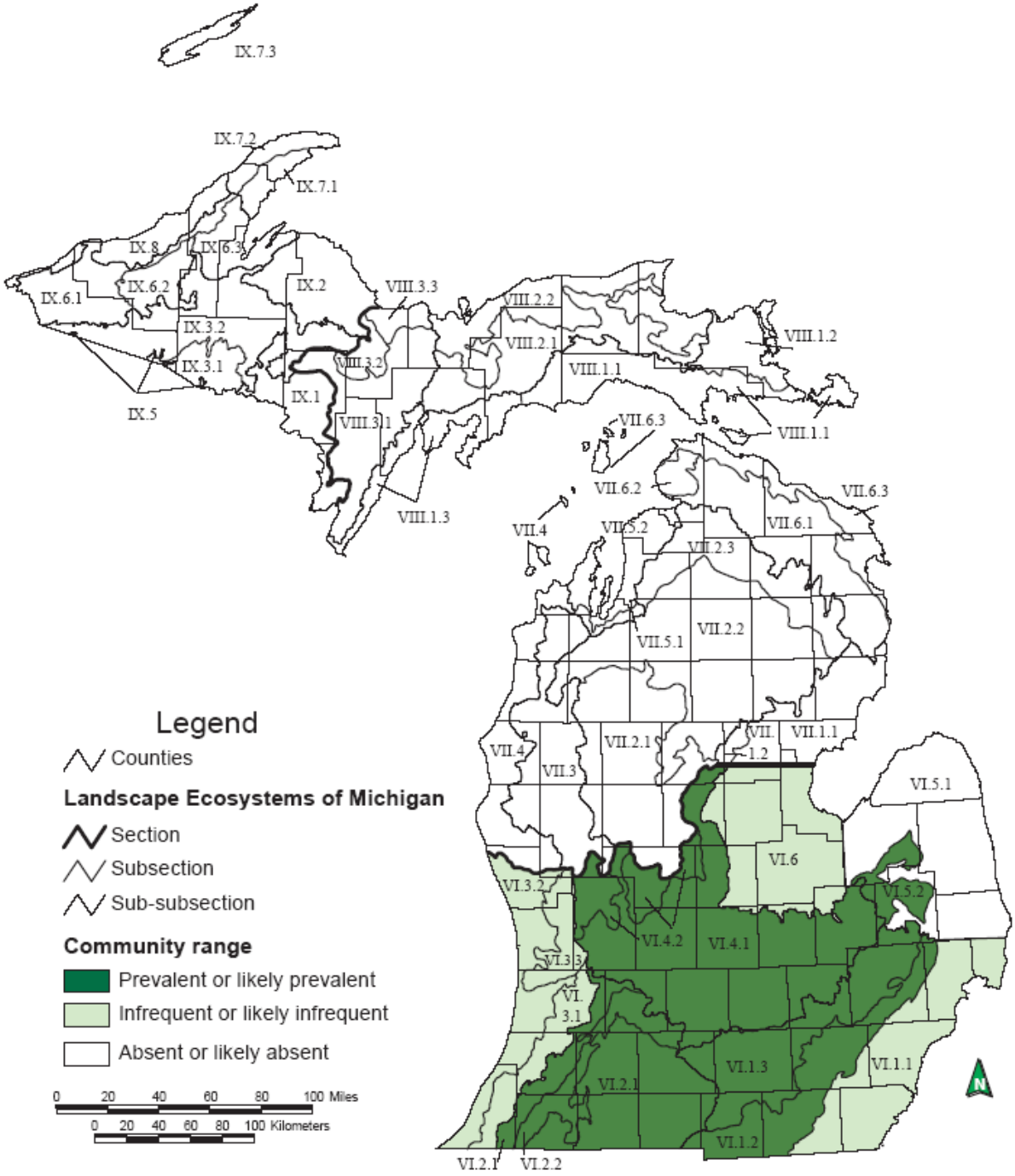

Figure 8. Distribution of dry-mesic southern forest in Michigan.

19. Gun Lake Woods
Natural Community Type: Dry-Mesic Southern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 119 acres
Location: Yankee Springs State Recreation Area and Barry State Game Area
Element Occurrence Identification Number: 18973

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by gap dynamics, fire suppression, invasive species, and likely deer herbivory. The prevalence of red maple (*Acer rubrum*), black cherry (*Prunus serotina*), and sassafras (*Sassafras albidum*) indicate that the forest is fire suppressed. Invasives are scattered in the understory and ground cover and include autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*). Additional non-natives documented include spotted knapweed (*Centaurea stoebe*), timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), hedge parsley (*Torilis japonica*), and lawn prunella (*Prunella vulgaris*).

Management Recommendations: Management should focus on reducing infestations of invasive species through mechanical treatments, herbicide, and/or prescribed fire. Reintroduction of fire as a prevalent disturbance factor is also recommended. Implementation of prescribed fire is best done in the context of landscape-scale fire. Subcanopy and understory red maple, black cherry, and sassafras could be girdled if repeated fires do not control these mesophytic invaders. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration and response of the forest to fire.

Photo 19. Gun Lake Woods dry-mesic southern forest. Photo by Michael A. Kost.

20. Little Portage Lake Woods
Natural Community Type: Dry-Mesic Southern Forest (re-classified from Dry Southern Forest)
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 4.5 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17492

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by gap dynamics, fire suppression, invasive species, and likely deer herbivory. Invasive species noted in 2010 include autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and hedge parsley (*Torilis japonica*).

Management Recommendations: Management should focus on reducing infestations of invasive species through mechanical treatments, herbicide, and/or prescribed fire. Reintroduction of fire as a prevalent disturbance factor is also recommended. Implementation of prescribed fire is best done in the context of landscape-scale fire. Subcanopy and understory red maple and black cherry (*Prunus serotina*) could be girdled if repeated fires do not control these mesophytic invaders. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration and response of the forest to fire.

Photo 20. Little Portage Lake Woods dry-mesic southern forest. Photo by Steve A. Thomas.

21. Markla Lake Woods
Natural Community Type: Dry-Mesic Southern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 51 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17500

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by gap dynamics, fire suppression, and likely invasive species and deer herbivory. Invasive species were not noted within the site description but likely occur within woods given landscape context and similar occurrences in vicinity.

Management Recommendations: Reintroduction of fire as a prevalent disturbance factor is recommended. Implementation of prescribed fire is best done in the context of landscape-scale fire. Subcanopy and understory mesophytic invaders (i.e., red maple) could be girdled if repeated fires do not control them. Monitoring should be implemented to assess non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration and the forest's response to fire.

Photo 21. Markla Lake Woods dry-mesic southern forest. Photo by Steve A. Thomas.

22. Moeckel Road Woods
Natural Community Type: Dry-Mesic Southern Forest (re-classified from Dry Southern Forest)
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 58 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17491

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by gap dynamics, fire suppression, invasive species, and likely deer herbivory. The prevalence of red maple (*Acer rubrum*), black cherry (*Prunus serotina*), and sassafras (*Sassafras albidum*) indicate that the forest is fire suppressed. Invasives are scattered in the understory and ground cover and include autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*). Additional non-natives documented include spotted knapweed (*Centaurea stoebe*), timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), hedge parsley (*Torilis japonica*), and lawn prunella (*Prunella vulgaris*).

Management Recommendations: Management should focus on reducing infestations of invasive species through mechanical treatments, herbicide, and/or prescribed fire. Reintroduction of fire as a prevalent disturbance factor is also recommended. Implementation of prescribed fire is best done in the context of landscape-scale fire. Subcanopy and understory red maple, black cherry, and sassafras could be girdled if repeated fires do not control these mesophytic invaders. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration and response of the forest to fire.

Photo 22. Moeckel Road Woods dry-mesic southern forest. Photo by Steve A. Thomas.

23. Tophith Road Woods
Natural Community Type: Dry-Mesic Southern Forest (re-classified from Dry Southern Forest)
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 9.4 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17496

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by gap dynamics, fire suppression, invasive species, and likely deer herbivory and past logging history. Invasive species noted in 2010 include hedge parsley (*Torilis japonica*), glossy buckthorn (*Frangula alnus*), multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*), and autumn olive (*Elaeagnus umbellata*).

Management Recommendations: Management should focus on reducing infestations of invasive species through mechanical treatments, herbicide, and/or prescribed fire. Reintroduction of fire as a prevalent disturbance factor is also recommended. Implementation of prescribed fire is best done in the context of landscape-scale fire. Subcanopy red maple could be girdled if repeated fires do not control this mesophytic invader. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration and response of the forest to fire.

Photo 23. Tophith Road Woods dry-mesic southern forest. Photo by Steve A. Thomas.

24. Waterloo North Woods
Natural Community Type: Dry-Mesic Southern Forest (re-classified from Dry Southern Forest)
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 56 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17497

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by gap dynamics, fire suppression, invasive species, and likely deer herbivory. Invasive species occur scattered within the woods but have not yet caused serious degradation. Invasive species noted in 2010 include multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*), hedge parsley (*Torilis japonica*), and autumn olive (*Elaeagnus umbellata*).

Management Recommendations: Management should focus on reducing infestations of invasive species through mechanical treatments, herbicide, and/or prescribed fire. Reintroduction of fire as a prevalent disturbance factor is also recommended. Implementation of prescribed fire is best done in the context of landscape-scale fire. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration and response of the forest to fire.

Photo 24. Waterloo North Woods dry-mesic southern forest. Photo by Steve A. Thomas.

EMERGENT MARSH

Overview: Emergent marsh is a shallow-water wetland along the shores of lakes and streams characterized by emergent narrow- and broad-leaved herbs and grass-like plants as well as floating-leaved herbs. Common plants include water plantains (*Alisma* spp.), sedges (*Carex* spp.), spike-rushes (*Eleocharis* spp.), pond-lilies (*Nuphar* spp.), pickerel weed (*Pontederia cordata*), arrowheads (*Sagittaria* spp.), bulrushes (*Schoenoplectus* spp.), and cat-tails (*Typha* spp.). The community occurs on both mineral and organic soils (Kost et al. 2007).

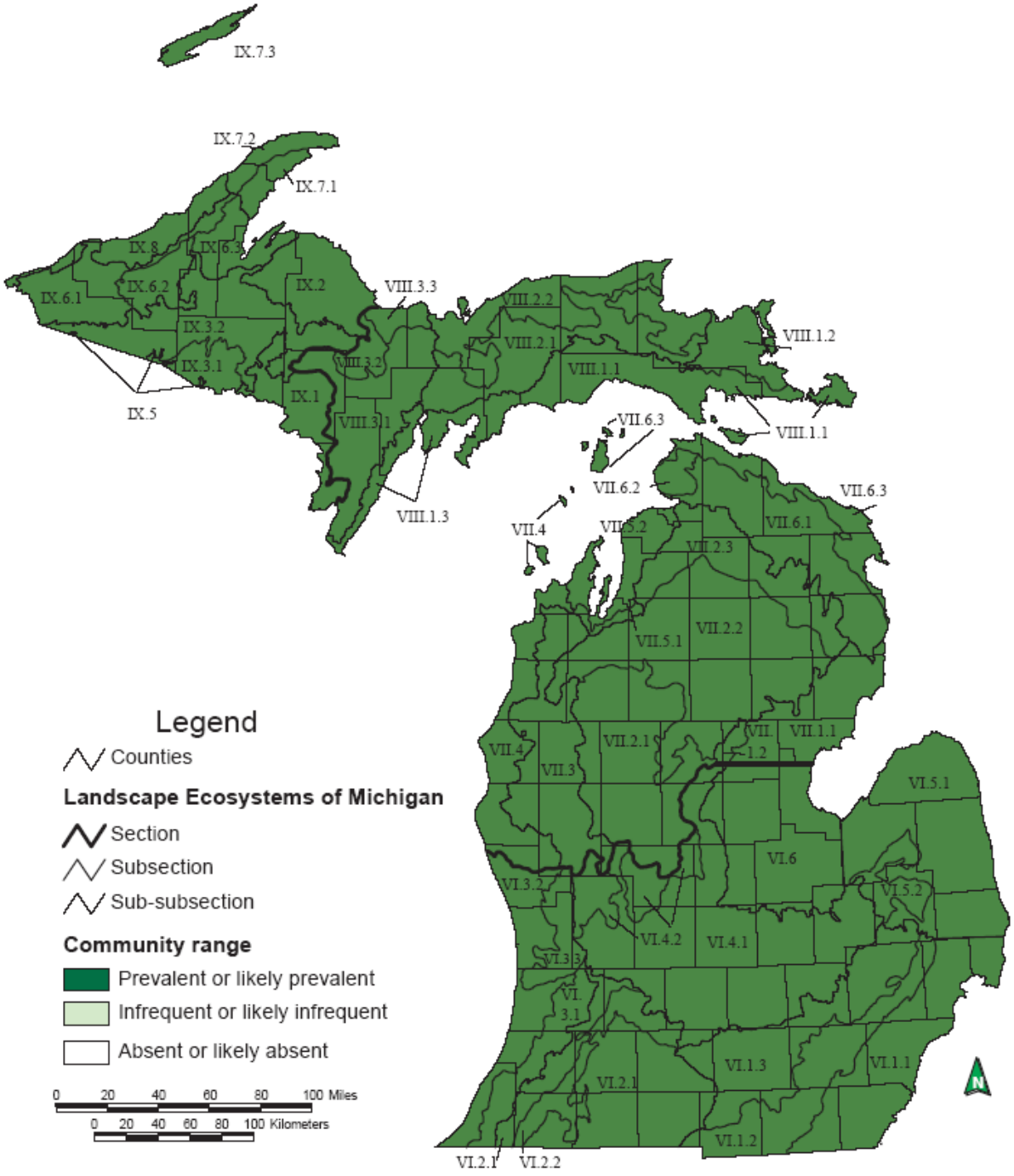

Figure 9. Distribution of emergent marsh in Michigan.

25. Lake of the Clouds
Natural Community Type: Emergent Marsh
Rank: GU S4, globally unrankable and secure within the state
Element Occurrence Rank: A
Size: 24 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 17988

Threats: No threats were noted during the course of the survey.

Management Recommendations: The primary management recommendation is to allow natural processes to operate unhindered and to maintain a forested buffer surrounding the wetlands associated with the Lake of the Clouds and the Carp River to protect the hydrologic regime.

Photo 25. Lake of the Clouds emergent marsh. Photo by Joshua G. Cohen.

26. South Portage Marsh
Natural Community Type: Emergent Marsh
Rank: GU S4, globally unrankable and secure within the state
Element Occurrence Rank: B
Size: 681 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17549

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by high water table and also influenced by fire suppression and invasive species. Invasive species observed in 2010 include purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis*), glossy buckthorn (*Frangula alnus*), bittersweet nightshade (*Solanum dulcamara*), narrow-leaved cattail (*Typha angustifolia*), and hybrid cattail (*Typha* x*glauca*).

Management Recommendations: The main management recommendations are to maintain a natural community buffer to preserve the hydrology of the marsh, consider burning the marsh with the surrounding uplands, control invasive species, and monitor for invasive species and following prescribed fire.

Photo 26. South Portage Marsh emergent marsh. Photo by John Fody.

27. Thompson's Harbor
Natural Community Type: Emergent Marsh
Rank: GU S4, globally unrankable and secure within the state
Element Occurrence Rank: AB
Size: 22 acres
Location: Thompson's Harbor State Park
Element Occurrence Identification Number: 17338

Threats: No threats were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and maintain a forested buffer surrounding the wetlands to protect the hydrologic regime. Invasive species in adjacent areas should be controlled and control efforts should be monitored.

Photo 27. Thompson's Harbor emergent marsh. Photo by Joshua G. Cohen.

28. Waugoshance Island
Natural Community Type: Emergent Marsh
Rank: GU S4, globally unrankable and secure within the state
Element Occurrence Rank: AB
Size: 9.6 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17843

Threats: No anthropogenic disturbance or non-native species were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., windthrow and flooding) to operate unhindered, maintain canopy closure of the surrounding forest, and monitor for invasive plant populations.

Photo 28. Waugoshance Island emergent marsh. Photo by Joshua G. Cohen.

GRANITE BEDROCK GLADE

Overview: Granite bedrock glade consists of an open forested or savanna community found where knobs of granitic bedrock types are exposed at the surface. The sparse vegetation consists of scattered open-grown trees, scattered shrubs or shrub thickets, and a partial turf of herbs, grasses, sedges, mosses, and lichens. Granite bedrock glades typically occupy areas of steep to stair-stepped slopes, with short cliffs, and exposed knobs of bedrock. The community occurs in the western Upper Peninsula with primary concentrations in Marquette, Baraga, and Dickinson Counties (Kost et al. 2007).

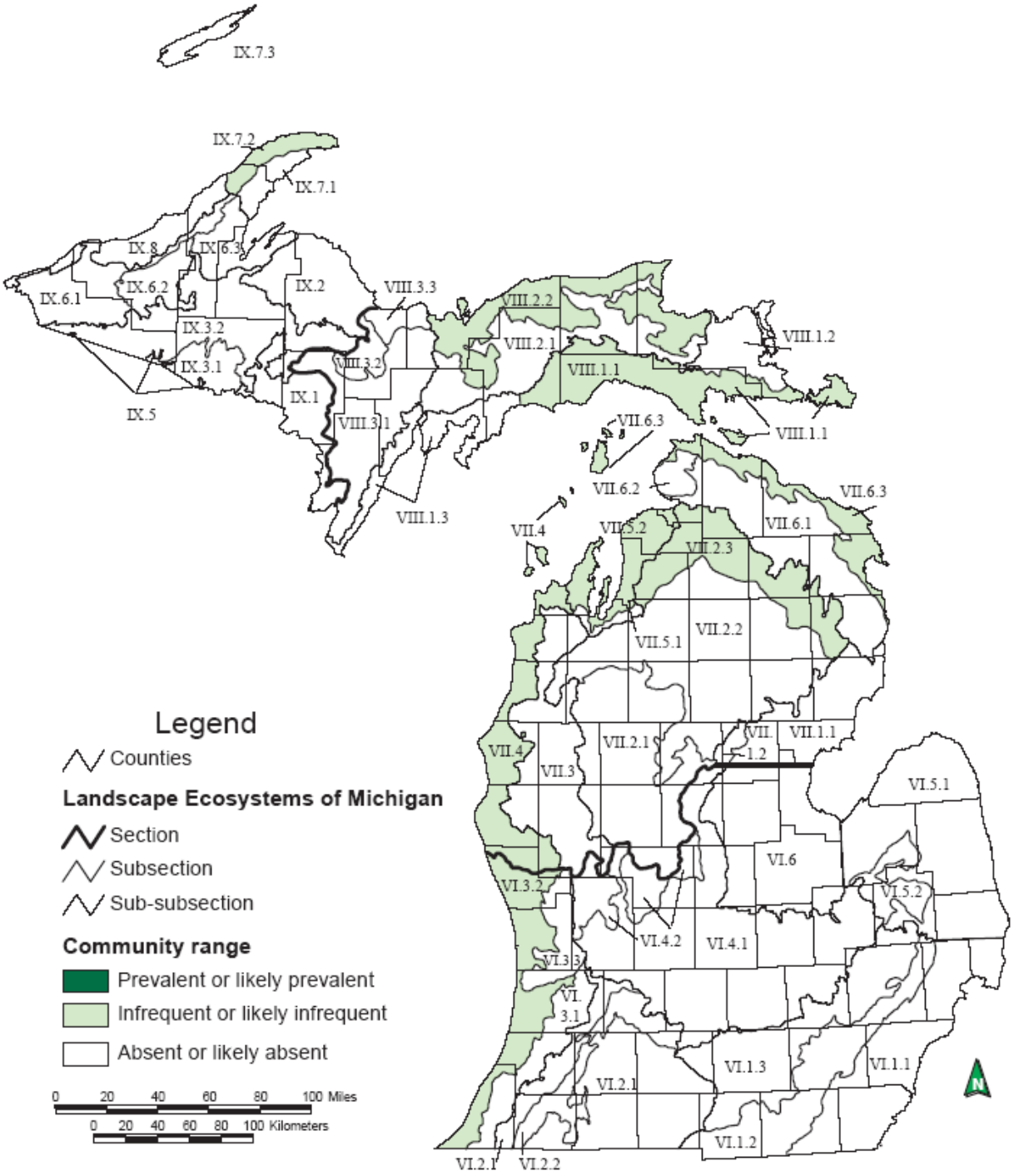

Figure 10. Distribution of granite bedrock glade in Michigan.

29. Van Riper Glades
Natural Community Type: Granite Bedrock Glade
Rank: GU S4, globally unrankable and secure within the state
Element Occurrence Rank: AB
Size: 26 acres
Location: Van Riper State Park
Element Occurrence Identification Number: 17834

Threats: Species composition, vegetative structure, and successional trajectory are influenced by natural processes. However, there are moderate to low levels of non-native species located within the glade including spotted knapweed (*Centaurea stoebe*), hawkweeds (*Hieracium* spp.), and sheep sorrel (*Rumex acetosella*). Logging in forested areas adjacent to the glade has likely led to the increase of the seed source of non-native species in the surrounding landscape.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn) and to maintain a natural buffer surrounding the glades to prevent the increase of a weedy seed source. Monitoring should be implemented for non-native plant populations.

Photo 29. Van Riper Glades. Photo by Joshua G. Cohen.

GREAT LAKES BARRENS

Overview: Great Lakes barrens is a coniferous savanna community of scattered and clumped trees, and an often dense, low or creeping shrub layer. The community occurs along the shores of the Great Lakes where it is often associated with interdunal wetlands and open dunes (Kost et al. 2007).

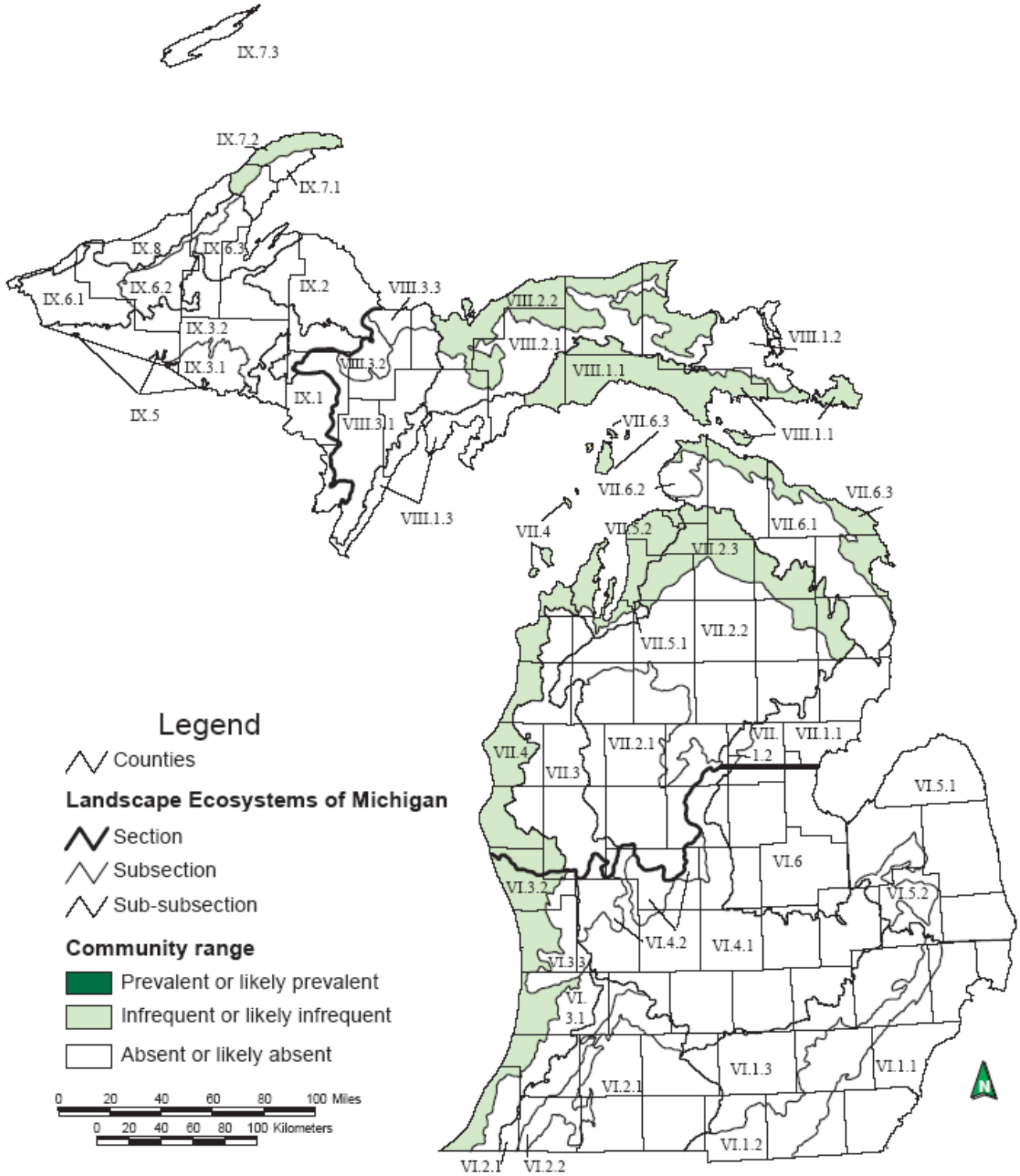

Figure 11. Distribution of Great Lakes barrens in Michigan.

30. Waugoshance Point
Natural Community Type: Great Lakes Barrens
Rank: G3 S2, vulnerable globally and imperiled within the state
Element Occurrence Rank: B
Size: 8.1 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17844

Threats: Threats include off-road vehicle activity, deer browsing, erosion from foot traffic, and invasive plants. Spotted knapweed (*Centaurea stoebe*), white sweet-clover (*Melilotus alba*), common mullein (*Verbascum thapsus*), and wild parsnip (*Pastinaca sativa*) were noted as locally common within the adjacent open dunes with spotted knapweed occurring as a dominant in stretches. Reed (*Phragmites australis*) occurs within nearshore areas and interdunal wetlands. Off-road vehicle activity can degraded nearshore areas and may facilitate non-native plant invasion.

Management Recommendations: The primary management recommendations are to allow natural processes to operate unhindered, eliminate illegal off-road vehicle activity, increase educational efforts to encourage visitors to stay on trails, control clusters of non-native plants (especially spotted knapweed and white sweet-clover within the nearby open dunes), and monitor efforts to control invasive species. Spotted knapweed has been treated in large areas of the nearby open dunes.

Photo 30. Waugoshance Point Great Lakes barrens. Photo by Joshua G. Cohen.

GREAT LAKES MARSH

Overview: Great Lakes marsh is an herbaceous wetland community occurring statewide along the shoreline of the Great Lakes and their major connecting rivers. Vegetational patterns are strongly influenced by water level fluctuations and type of coastal feature, but generally include the following: a deep marsh with submerged plants; an emergent marsh of mostly narrow-leaved species; and a sedge-dominated wet meadow that is inundated by storms. Great Lakes marsh provides important habitat for migrating and breeding waterfowl, shore-birds, spawning fish, and medium-sized mammals (Kost et al. 2007).

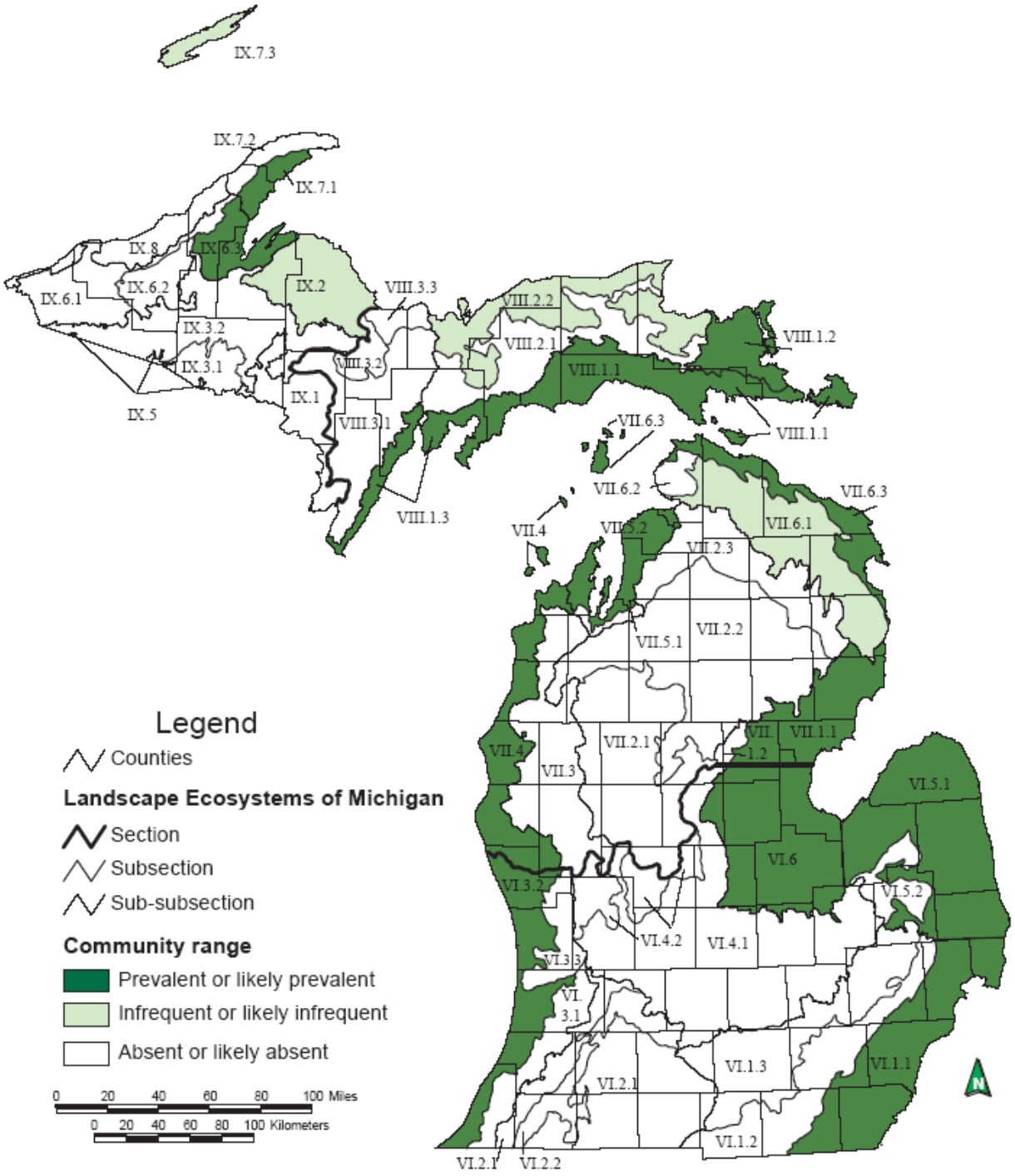

Figure 12. Distribution of Great Lakes marsh in Michigan.

31. Thompson's Harbor
Natural Community Type: Great Lakes Marsh
Rank: G2 S3, globally imperiled and vulnerable within the state
Element Occurrence Rank: B
Size: 32 acres
Location: Thompson's Harbor State Park
Element Occurrence Identification Number: 17340

Threats: No threats were noted during the course of the survey.

Management Recommendations: The main management recommendations are to maintain a natural community buffer adjacent to the marsh to help preserve the wetland's hydrology and monitor for invasive species.

Photo 31. Thompson's Harbor Great Lakes marsh. Photo by Joshua G. Cohen.

HARDWOOD-CONIFER SWAMP

Overview: Hardwood-conifer swamp is a minerotrophic forested wetland dominated by a mixture of lowland hardwoods and conifers, occurring on organic (i.e., peat) and poorly drained mineral soils throughout Michigan. The community occurs on a variety of landforms, often associated with headwater streams and areas of groundwater discharge. Species composition and dominance patterns can vary regionally. Windthrow and fluctuating water levels are the primary natural disturbances that structure hardwood-conifer swamp (Kost et al. 2007).

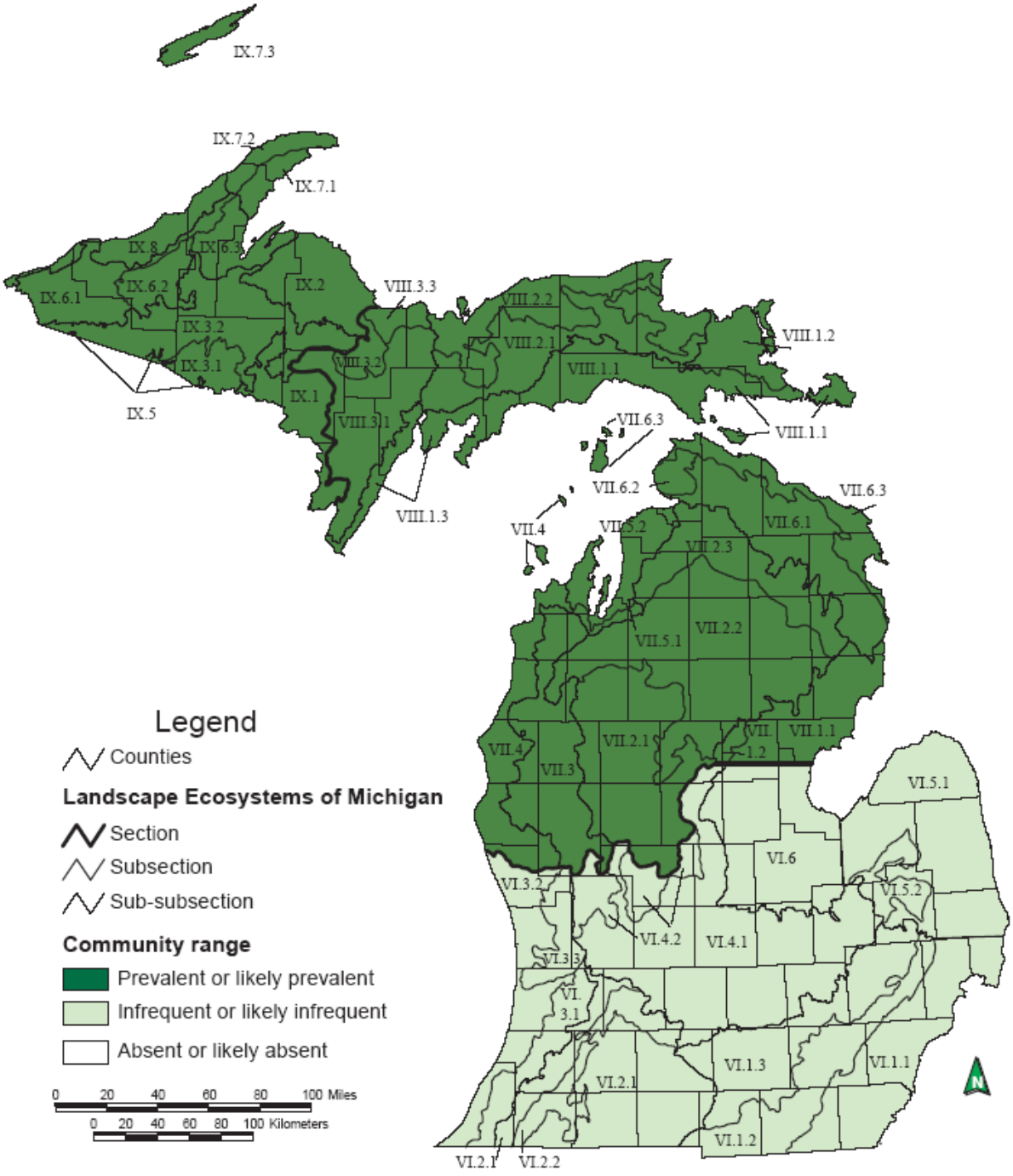

Figure 13. Distribution of hardwood-conifer swamp in Michigan.

32. Anchard Creek Hemlocks
Natural Community Type: Hardwood-Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 26 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17917

Threats: There is a sharp contrast in the management of the adjacent private lands and the management of the state park. Private lands adjacent to the western polygon have been managed intensively for deer. A blind and plowed food plot occur on the private land immediately adjacent to the state land. Deer herbivory was noted within the hardwood-conifer swamp [jewelweed (*Impatiens capensis*) has been heavily browsed]. Some scattered cut stumps occur within the swamp. The diameter of the cut stumps is comparable to the diameter of living trees.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, monitor for invasives and deer browse, and to retain an intact buffer of natural communities surrounding the wetland. In addition, pursuit of acquisition of adjacent private lands or discussion of compatible management with private landowners is recommended.

Photo 32. Anchard Creek Hemlocks hardwood-conifer swamp. Photo by Joshua G. Cohen.

33. Carp River Swamp
Natural Community Type: Hardwood-Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: A
Size: 51 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18863

Threats: No anthropogenic disturbances or non-native species were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland.

Photo 33. Carp River Swamp hardwood-conifer swamp. Photo by Joshua G. Cohen.

34. Long Lake
Natural Community Type: Hardwood-Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 53 acres
Location: Yankee Springs Recreation Area
Element Occurrence Identification Number: 16865

Threats: Both multiflora rose (*Rosa multiflora*) and bittersweet nightshade (*Solanum dulcamara*) were localized within the swamp. In addition, the non-native halotype of reed (*Phragmites australis*) occurs on a floating sedge mat along the shore of Long Lake. Deer browse was noted to be moderate to locally heavy.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, to control invasive species (including the reed along the adjacent lake margin), monitor for invasives and deer browse, and to retain an intact buffer of natural communities surrounding the wetland to maintain the swamp's hydrology.

Photo 34. Long Lake hardwood-conifer swamp. Photo by Bradford S. Slaughter.

35. Payne Lake
Natural Community Type: Hardwood-Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 32 acres
Location: Yankee Springs Recreation Area
Element Occurrence Identification Number: 16866

Threats: Invasive species were uncommon and of minimal impact in the swamp forest. Both multiflora rose (*Rosa multiflora*) and bittersweet nightshade (*Solanum dulcamara*) were localized within the swamp. Deer browse was noted to be moderate to locally heavy.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, to control invasive species, monitor for invasives and deer browse, and to retain an intact buffer of natural communities surrounding the wetland to maintain the swamp's hydrology.

Photo 35. Payne Lake hardwood-conifer swamp. Photo by Bradford S. Slaughter.

36. Tahquamenon River
Natural Community Type: Hardwood-Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 20 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17919

Threats: A northward shift in deer wintering range with less severe winters could result in overbrowsing of hemlock (*Tsuga canadensis*) and northern white-cedar (*Thuja occidentalis*) regeneration.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, monitor for invasives and deer browse, and to retain an intact buffer of natural communities surrounding the wetland.

Photo 36. Tahquamenon River hardwood-conifer swamp. Photo by Joshua G. Cohen.

INTERDUNAL WETLAND

Overview: Interdunal wetland is a rush-, sedge-, and shrub-dominated wetland situated in depressions within open dunes or between beach ridges along the Great Lakes, experiencing a fluctuating water table seasonally and yearly in synchrony with lake level changes (Kost et al. 2007).

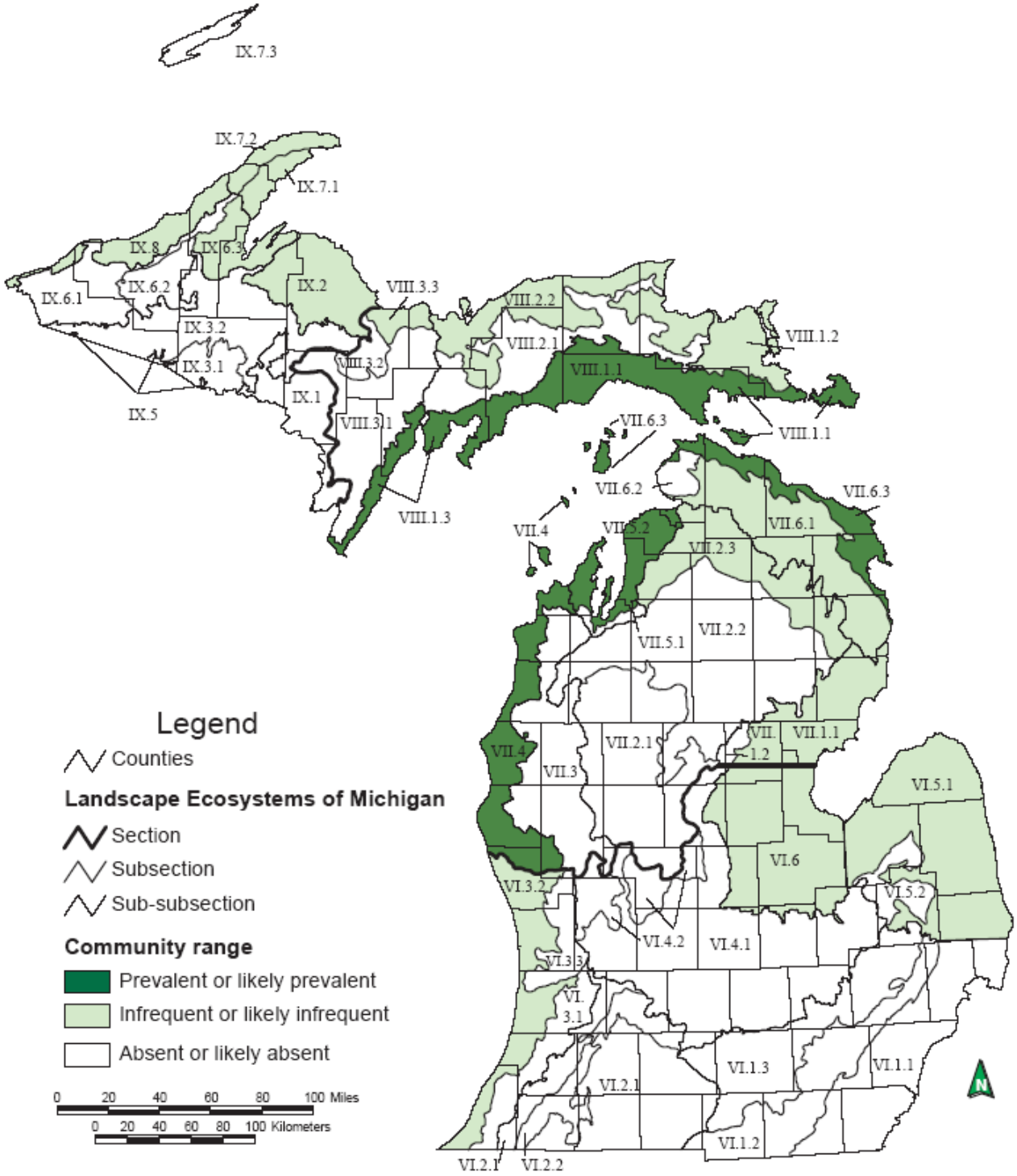

Figure 14. Distribution of interdunal wetland in Michigan.

37. Besser Natural Area
Natural Community Type: Interdunal Wetland
Rank: G2? S2, imperiled throughout range
Element Occurrence Rank: BC
Size: 6.6 acres
Location: Rockport State Recreation Area
Element Occurrence Identification Number: 18757

Threats: Threats include illegal off-road vehicle activity and invasive plants. Spotted knapweed (*Centaurea stoebe*) was documented in the adjacent open dunes and off-road vehicle tracks were noted within portions of the interdunal wetland.

Management Recommendations: The primary management recommendations are to allow natural processes to operate unhindered, eliminate illegal off-road vehicle, and control and monitor non-native plants along the shoreline (i.e., spotted knapweed).

Photo 37. Besser Natural Area interdunal wetland. Photo by Joshua G. Cohen.

INUNDATED SHRUB SWAMP

Overview: Inundated shrub swamp is a shrub-dominated wetland occurring in small kettle depressions on ice-contact features, ground moraines, end moraines, outwash plains, and glacial lakeplains. Soils are saturated or inundated mucks of variable depth over silty or sandy clay. Substrate pH ranges from strongly acid to circumneutral. Water depth varies seasonally and from site to site. The community is dominated by buttonbush (*Cephalanthus occidentalis*) and is often surrounded by a shallow moat of open water ringed by a thin band of wetland trees. Herbaceous cover, which is sparse and includes numerous aquatic and semi-aquatic species, varies with degree of inundation. The community is also referred to as a buttonbush depression (Kost et al. 2007).

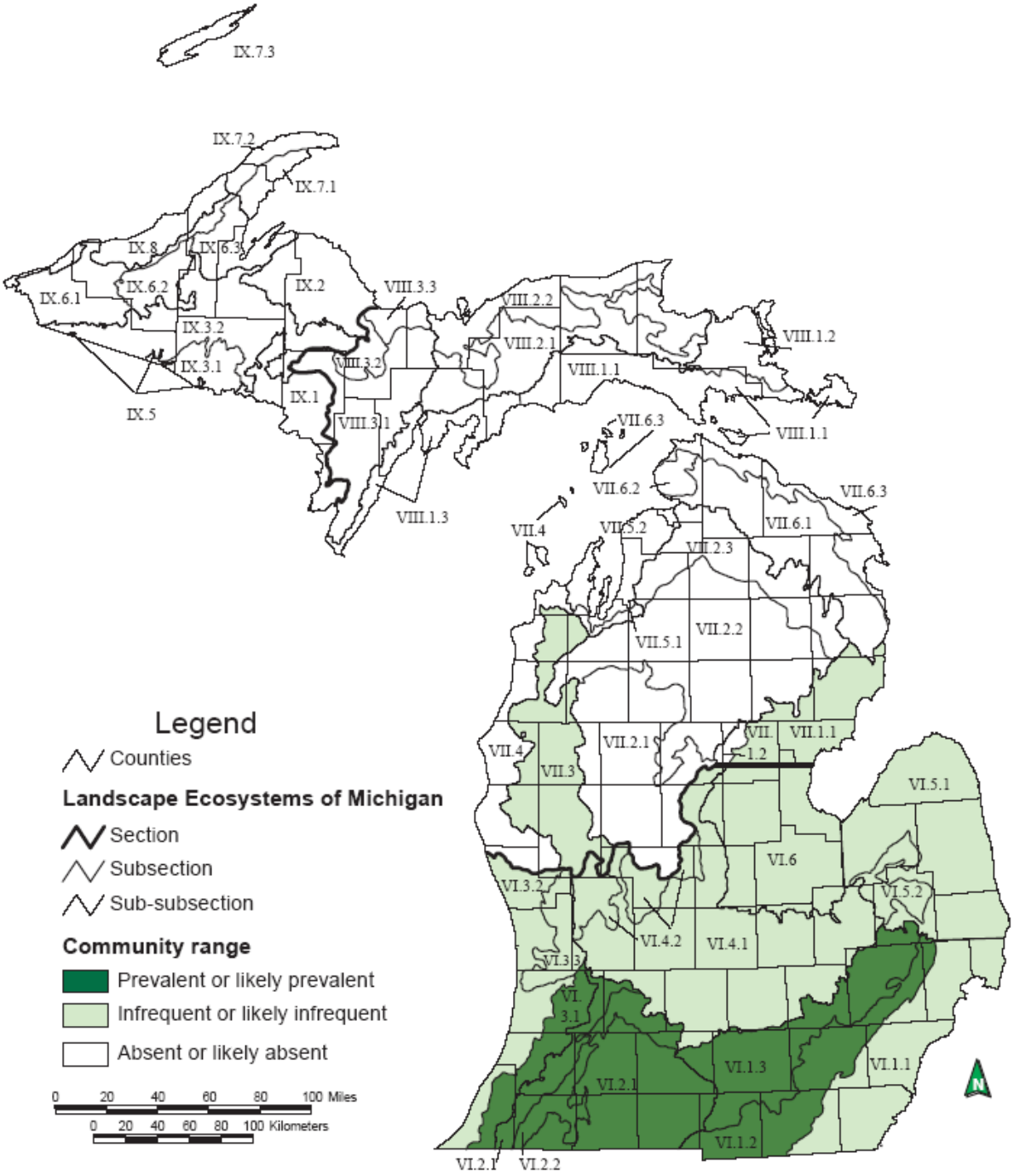

Figure 15. Distribution of inundated shrub swamp in Michigan.

38. Chamberlain Lakes
Natural Community Type: Inundated Shrub Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 3.6 acres
Location: Bald Mountain State Recreation Area
Element Occurrence Identification Number: 18615

Threats: Trails pass by these kettle depressions and may modify surface water flow into the ponds. Otherwise, natural processes appear intact. Glossy buckthorn (*Frangula alnus*) is occasional, hybrid cattail (*Typha* x*glauca*) is locally common, and reed canary
grass (*Phalaris arundinacea*) is present at the margin of at least one kettle. All of these non-native species will likely increase, although deeper ponds restrict encroachment of all three species.

Management Recommendations: The primary management recommendations are to maintain a forested buffer around the inundated shrub swamp and control and monitor the invasive species.

Photo 38. Chamberlain Lakes inundated shrub swamp. Photo by Bradford S. Slaughter.

39. Tophith Road Buttonbush Swamps
Natural Community Type: Inundated Shrub Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 4.9 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17494

Threats: Species composition, vegetative structure, and successional trajectory are influenced by natural processes. Glossy buckthorn (*Frangula alnus*), reed canary grass (*Phalaris arundinacea*), garlic mustard (*Alliaria petiolata*), and Morrow honeysuckle (*Lonicera morrowii*) occur in small amounts within the wetland complex. Runoff from nearby roads may be impacting the depressions.

Management Recommendations: The primary management recommendations are to maintain a forested buffer around the inundated shrub swamp to preserve the wetland's hydrology, control and monitor the invasive species, and allow the swamp to burn when the surrounding uplands burn. Monitoring of the inundated shrub swamp following fire is also recommended.

Photo 39. Tophith Road Buttonbush Swamps inundated shrub swamp. Photo by Steve A. Thomas.

40. Trout Lake
Natural Community Type: Inundated Shrub Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 4.2 acres
Location: Bald Mountain State Recreation Area
Element Occurrence Identification Number: 18596

Threats: Trails pass by these kettle depressions and may modify surface water flow into the ponds. Otherwise, natural processes appear intact. Glossy buckthorn (*Frangula alnus*) is occasional and is the primary threat. In addition, bittersweet nightshade (*Solanum dulcamara*) is also present within the inundated shrub swamp.

Management Recommendations: The primary management recommendations are to maintain a forested buffer around the inundated shrub swamp and control and monitor the invasive species. If the invasive species are treated, care should be taken to minimize disturbance to the wetland soils and vegetation.

Photo 40. Trout Lake inundated shrub swamp. Photo by Bradford S. Slaughter.

LIMESTONE BEDROCK LAKESHORE

Overview: Limestone bedrock lakeshore is a sparsely vegetated natural community dominated by lichens, mosses, and herbaceous vegetation. This community, which is also referred to as alvar pavement and limestone pavement lakeshore, occurs along the shorelines of northern Lake Michigan and Lake Huron on broad, flat, horizontally bedded expanses of limestone or dolomite bedrock. On the Lake Michigan shoreline, limestone bedrock lakeshore is concentrated along the Garden Peninsula and the southern part of Schoolcraft County. Along Lake Huron, it is located east of the Les Cheneaux Islands, on Drummond Island, and on Thunder Bay Island (Kost et al. 2007).

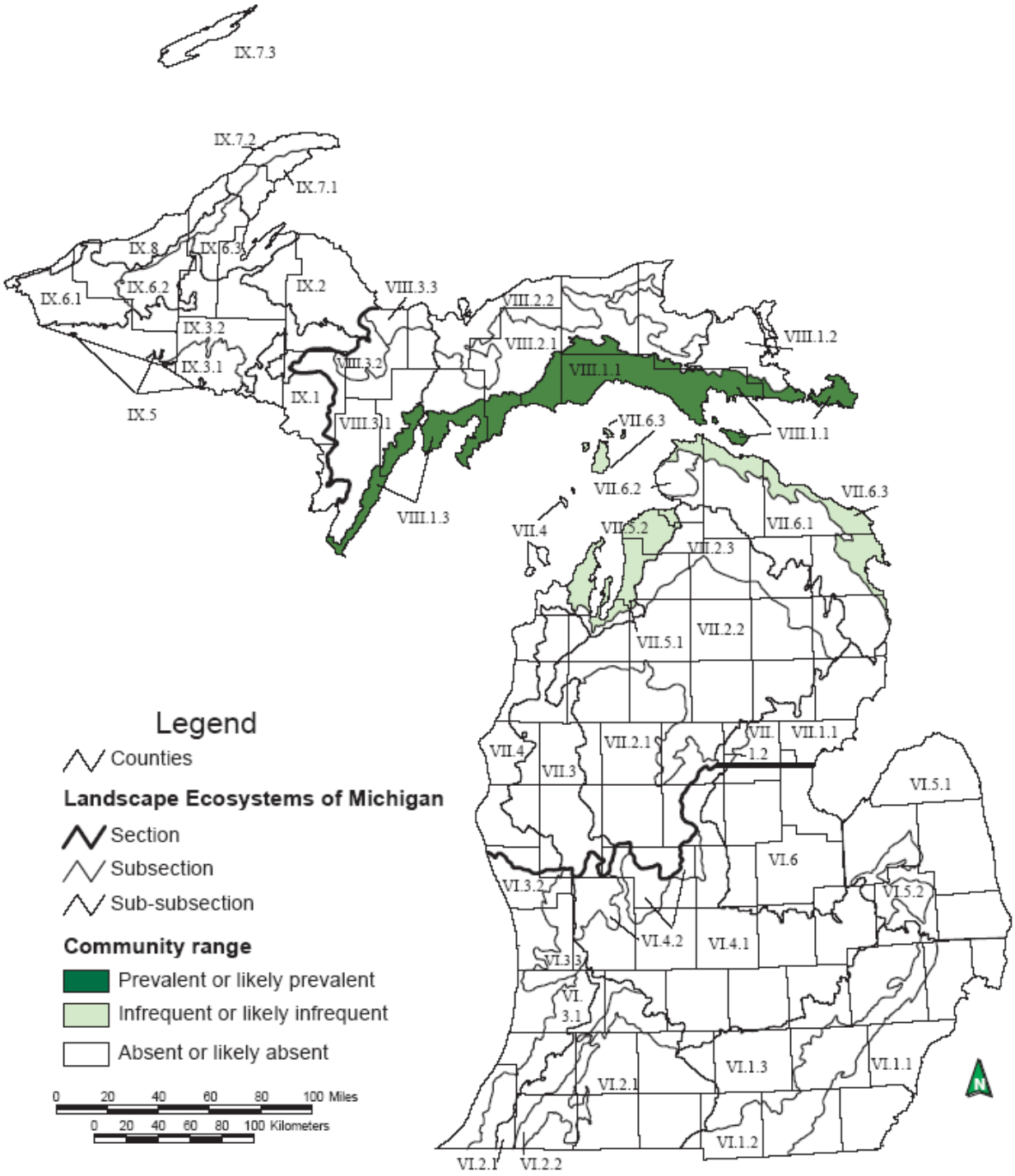

Figure 16. Distribution of limestone bedrock lakeshore in Michigan.

41. Fisherman's Island
Natural Community Type: Limestone Bedrock Lakeshore
Rank: G3 S2, globally vulnerable and imperiled within the state
Element Occurrence Rank: BC
Size: 0.9 acres
Location: Fisherman's Island State Park
Element Occurrence Identification Number: 17854

Threats: Non-native reed (*Phragmites australis*) was documented locally.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, to control populations of non-native species, and to maintain a natural community buffer surrounding the shoreline to prevent the increase of the weedy seed source. Monitoring should be implemented for non-native plant populations.

Photo 41. Fisherman's Island limestone bedrock lakeshore. Photo by Joshua G. Cohen.

LIMESTONE COBBLE SHORE

Overview: Limestone cobble shore occurs along gently sloping shorelines of Lake Michigan and Lake Huron. The community is studded with cobbles and boulders and is frequently inundated by storms and periods of high water. Limestone cobble shore is typically sparsely vegetated, because cobbles cover most of the surface and storm waves prevent the development of a diverse, persistent plant community. Soils are neutral to slightly alkaline mucks and sands that accumulate between cobbles and boulders (Kost et al. 2007).

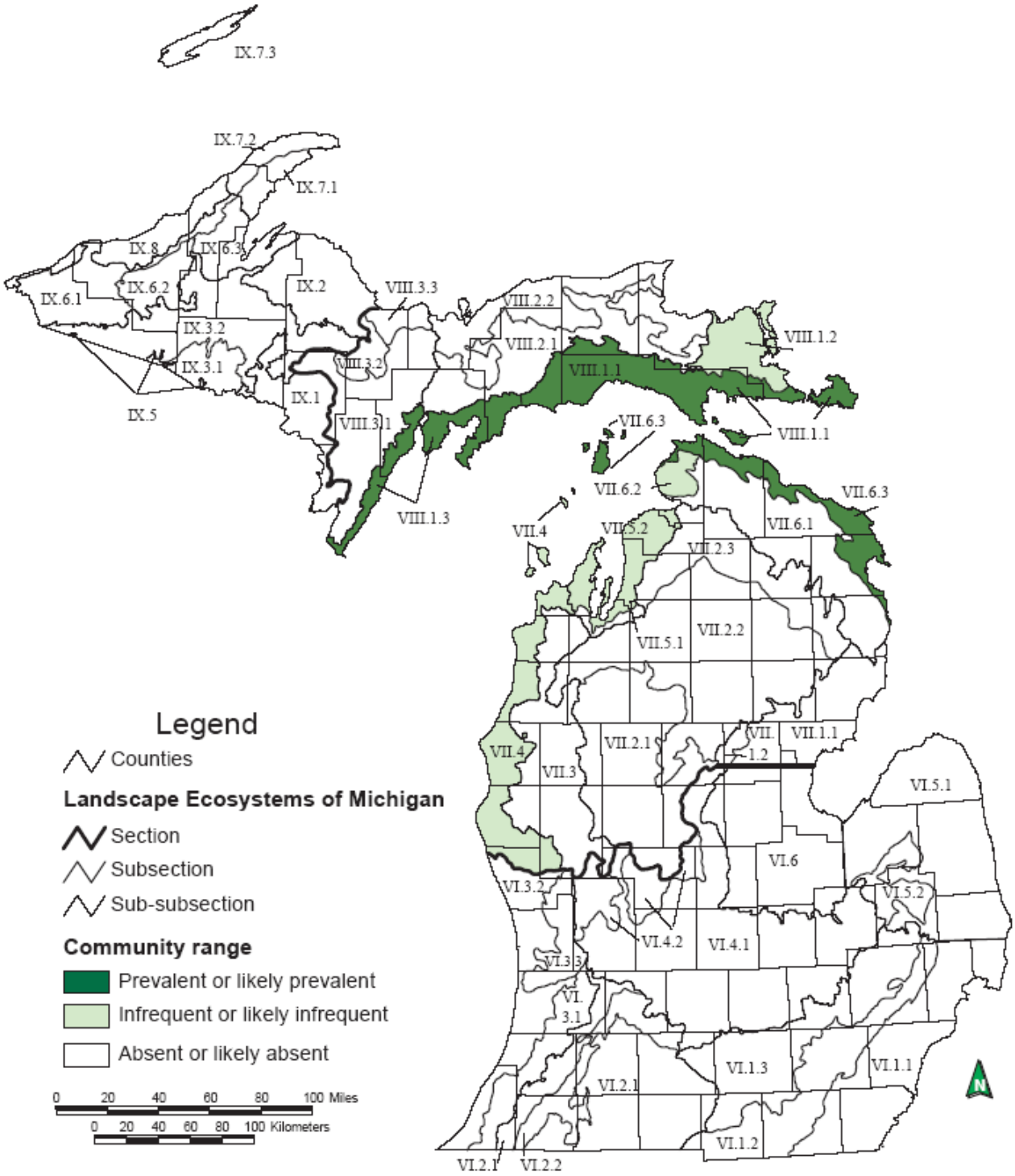

Figure 17. Distribution of limestone cobble shore in Michigan.

42. Besser Natural Area
Natural Community Type: Limestone Cobble Shore
Rank: G2G3 S3, imperiled to vulnerable globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 17 acres
Location: Rockport State Recreation Area
Element Occurrence Identification Number: 18759

Threats: The species composition and zonation of the limestone cobble shore are patterned by natural processes. Spotted knapweed (*Centaurea stoebe*) occurs scattered along the shoreline and illegal off-road vehicle activity was noted nearby in areas of interdunal wetland.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., Great Lakes water level fluctuations) to operate unhindered, control populations of non-native species, maintain a natural community buffer surrounding the shoreline to prevent the increase of the weedy seed source, and monitor for invasive plant populations.

Photo 42. Besser Natural Area limestone cobble shore. Photo by Joshua G. Cohen.

43. Temperance and Waugoshance Islands
Natural Community Type: Limestone Cobble Shore
Rank: G2G3 S3, imperiled to vulnerable globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 249 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17845

Threats: The species composition and zonation of the limestone cobble shore are patterned by natural processes. No invasive species were noted during the course of the survey, although spotted knapweed (*Centaurea stoebe*) and common mullein (*Verbascum thapsus*) were noted in the nearby open dunes and narrow-leaved cat-tail (*Typha angustifolia*) is locally common in the adjacent Great Lakes marsh.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., Great Lakes water level fluctuations) to operate unhindered, maintain canopy closure of the surrounding boreal forest, and monitor for invasive plant populations.

Photo 43. Temperance and Waugoshance Islands limestone cobble shore. Photo by Joshua G. Cohen.

44. Waugoshance Point
Natural Community Type: Limestone Cobble Shore
Rank: G2G3 S3, imperiled to vulnerable globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 622 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17337

Threats: No invasive species were noted during the course of the survey, although spotted knapweed (*Centaurea stoebe*) was noted in the adjacent open dunes. The limestone cobble shore is mildly impacted by diffuse foot traffic. Several trails and one old road were noted within the coastal complex. In addition, piles of zebra mussel shells occur along the shore.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., Great Lakes water level fluctuations) to operate unhindered, to maintain canopy closure of the surrounding uplands, and to monitor for invasive plant populations.

Photo 44. Waugoshance Point limestone cobble shore. Photo by Joshua G. Cohen.

LIMESTONE LAKESHORE CLIFF

Overview: Limestone lakeshore cliff consists of vertical or near-vertical exposures of bedrock, which typically support less than 25% vascular plant coverage, although some rock surfaces can be densely covered with lichens, mosses, and liverworts. The community occurs in the Upper Peninsula along the shorelines of Lake Michigan and Lake Huron. Like all of Michigan's lakeshore cliffs, vegetation cover is sparse but abundant cracks and crevices combined with calcareous conditions result in greater plant diversity and coverage than on most other cliff types. Limestone lakeshore cliffs are characterized by high site moisture due to the proximity to the Great Lakes and a stressed and unstable environment because of severe waves, wind, and winter ice (Kost et al. 2007).

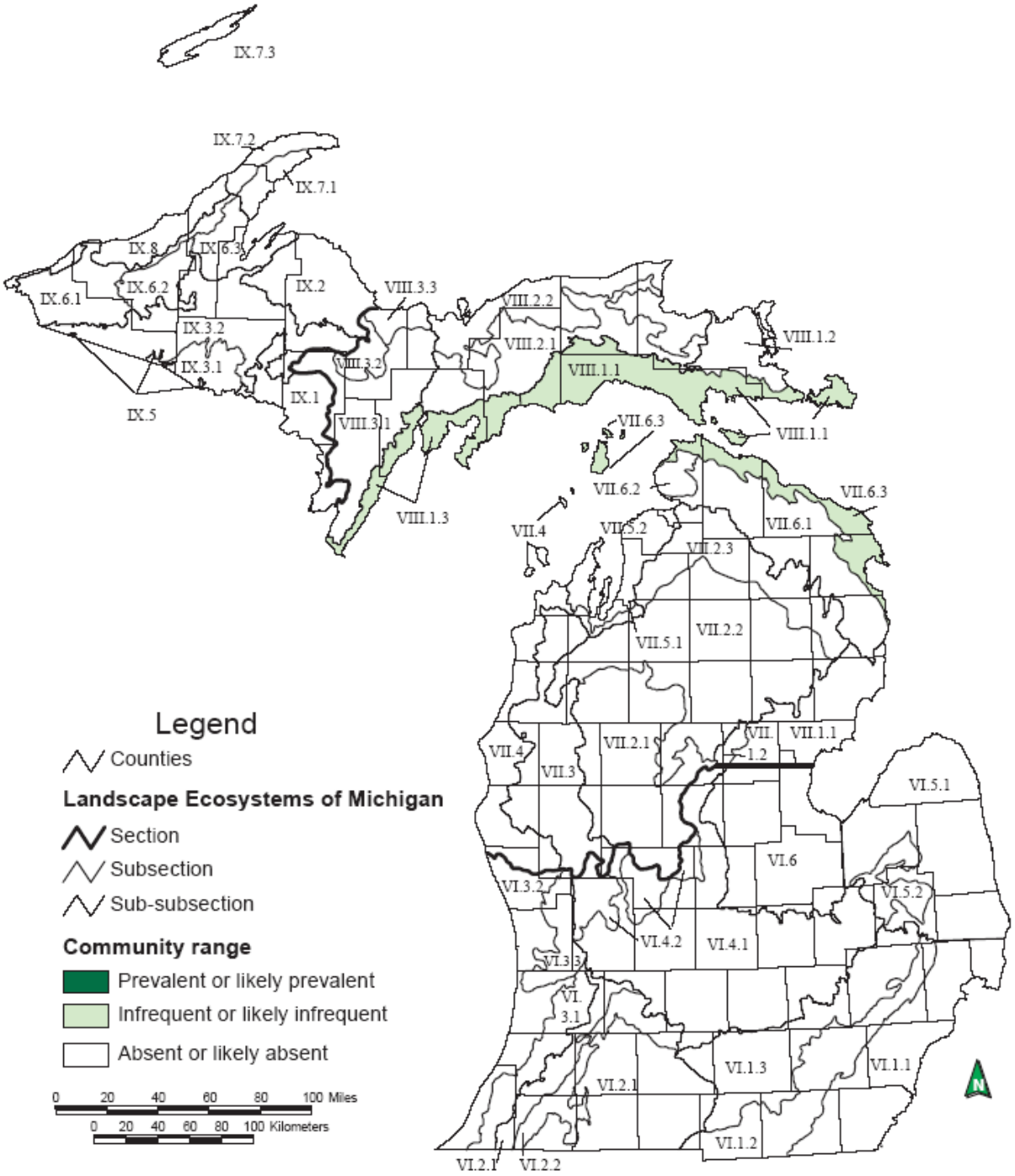

Figure 18. Distribution of limestone lakeshore cliff in Michigan.

45. Burnt Bluff
Natural Community Type: Limestone Lakeshore Cliff
Rank: G4G5 S1, apparently secure globally and critically imperiled within the state
Element Occurrence Rank: AB
Size: 51 acres
Location: Fayette Historic State Park
Element Occurrence Identification Number: 9467

Threats: No major threats were identified during the survey. Logging of the surrounding forest on private and state land could potentially increase the seed source for weedy species that might invade portions of the site.

Management Recommendations: The main management recommendations are to maintain the forested buffer surrounding the cliffs to minimize the threat of invasion by non-native species and to allow natural processes (i.e., wildfire and windthrow) to operate unhindered. Pursuing acquisition of private parcels or establishing conservation easements would allow for the establishment of forested buffers. Based on aerial photographic interpretation, surveys for additional high-quality limestone lakeshore cliff to the north are merited.

Photo 45. Burnt Bluff limestone lakeshore cliff. Photo by Joshua G. Cohen.

MESIC NORTHERN FOREST

Overview: Mesic northern forest is a forest type of moist to dry-mesic sites lying mostly north of the climatic tension zone, characterized by the dominance of northern hardwoods, particularly sugar maple (*Acer saccharum*) and American beech (*Fagus grandifolia*). Conifers such as hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) are frequently important canopy associates. This community type breaks into two broad classes: northern hardwood forest and hemlock-hardwood forest. It is primarily found on coarse-textured ground and end moraines, and soils are typically loamy sand to sandy loam. The natural disturbance regime is characterized by gap-phase dynamics; frequent, small windthrow gaps allow for the regeneration of the shade-tolerant canopy species. Catastrophic windthrow occurred infrequently with several generations of trees passing between large-scale, severe disturbance events. Historically, mesic northern forest occurred as a matrix system, dominating vast areas of mesic uplands in the Great Lakes region. These forests were multi-generational, with old-growth conditions lasting many centuries (Kost et al. 2007).

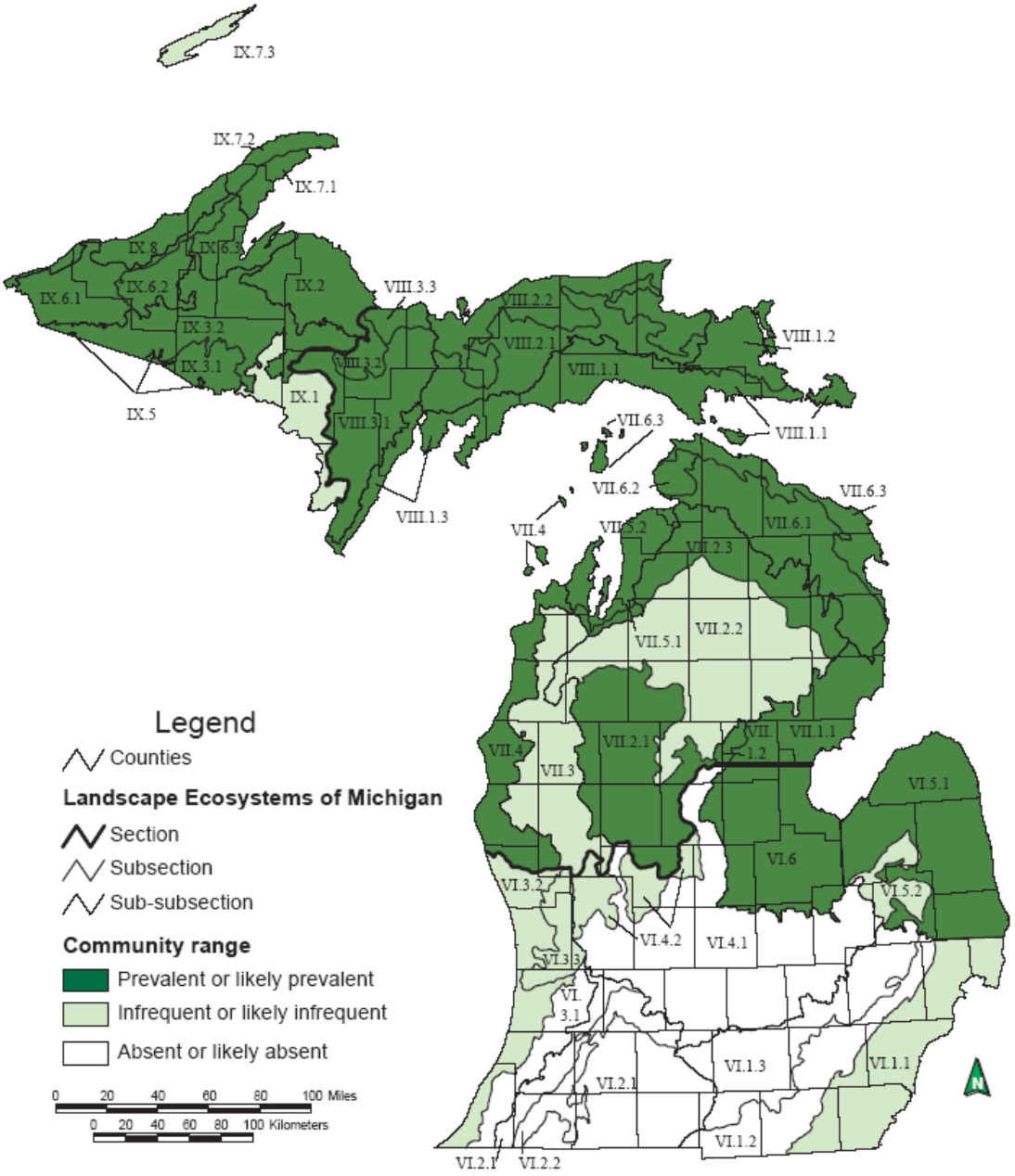

Figure 19. Distribution of mesic northern forest in Michigan.

46. Muskegon State Park
Natural Community Type: Mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 193 acres
Location: Muskegon State Park
Element Occurrence Identification Number: 17520

Threats: The forest is severely impacted by excessive deer browse, which has eliminated the ground and shrub layers within the occurrence. Only the unpalatable glandular wood fern (*Dryopteris intermedia*) remains in significant numbers. Browse on woody species has primarily affected hardwoods, and there is conifer regeneration, especially in blowdowns. Canada bluegrass (*Poa compressa*) is locally common along trails and on dry ridgetops, but it likely has minor effects on native species. Japanese barberry (*Berberis thunbergii*) was noted along roads and trails and in blowdowns, but was nowhere particularly abundant. Garlic mustard (*Alliaria petiolata*) was not noted but may be locally present.

Management Recommendations: The primary need is a reduction of the deer population. Due to the significant degradation of the ground and shrub layers that has already occurred, target deer numbers should be below the "ecological carrying capacity" of the forest type. Invasive species should be controlled and monitored. Early season surveys for invasive species (i.e., garlic mustard) are recommended.

Photo 47. Muskegon State Park mesic northern forest. Photo by Bradford S. Slaughter.

47. Wycamp Mesic Forest
Natural Community Type: Mesic Northern Forest
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 39 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 18862

Threats: No threats were noted during the course of the survey.

Management Recommendations: The primary management recommendation is to allow natural processes (i.e., windthrow and fire) to operate unhindered (i.e., permit wildfires to burn through this site and the surrounding wetlands).

Photo 48. Wycamp Mesic Forest. Photo by Joshua G. Cohen.

MUSKEG

Overview: Muskeg is a nutrient-poor peatland characterized by acidic, saturated peat, and scattered or clumped, stunted conifer trees set in a matrix of sphagnum mosses and ericaceous shrubs. Black spruce (*Picea mariana*) and tamarack (*Larix laricina*) are typically the most prevalent tree species. The community primarily occurs in large depressions on glacial outwash and sandy glacial lakeplains. Fire occurs naturally during periods of drought and can alter the hydrology, mat surface, and floristic composition of muskegs. Windthrow, beaver flooding, and insect defoliation are also important disturbance factors that influence species composition and structure (Kost et al. 2007).

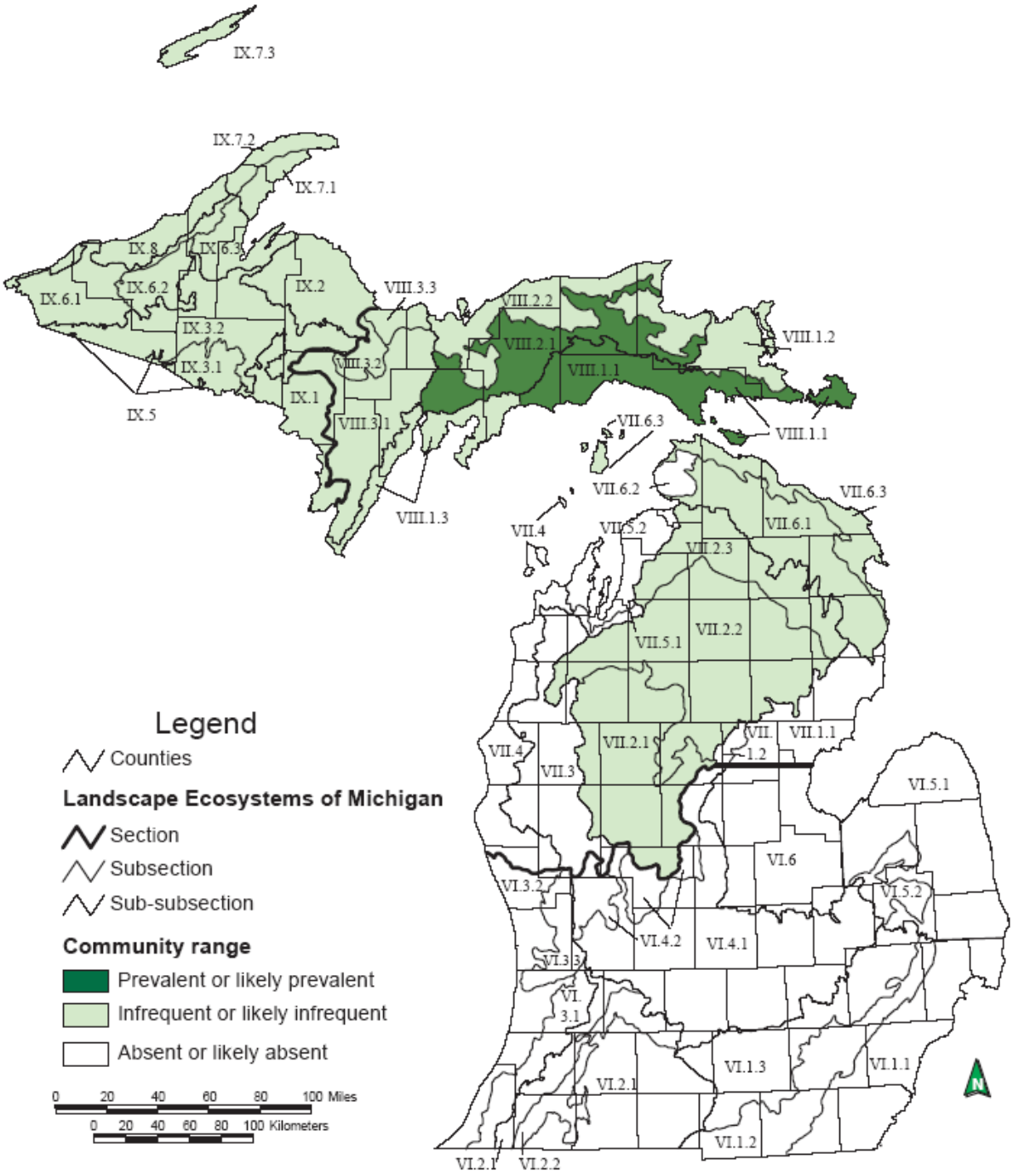

Figure 20. Distribution of muskeg in Michigan.

48. Nebo Muskeg
Natural Community Type: Muskeg
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 3.4 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17839

Threats: No threats were noted during the course of the survey.

Management Recommendations: The main management recommendation is to allow natural processes to operate unhindered. Wildfires should be allowed to burn the muskeg as well as the surrounding uplands. In the event of a wildfire, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for invasive species encroachment. Vehicular traffic should be avoided through this peatland. The forested mosaic (dry-mesic northern forest on dune ridges) surrounding the muskeg should be left uncut.

Photo 48. Nebo Muskeg. Photo by Joshua G. Cohen.

49. Tahquamenon Falls
Natural Community Type: Muskeg
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 611 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17343

Threats: No threats were noted during the course of the survey. Fire suppression in the overall landscape may reduce the fire frequency within the muskeg.

Management Recommendations: The main management recommendation is to allow natural processes to operate unhindered. Wildfires should be allowed to burn the muskeg as well as the surrounding landscape. In the event of a wildfire, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for invasive species encroachment. Vehicular traffic should be avoided through this peatland. The forested mosaic (dry-mesic northern forest on dune ridges) surrounding the muskeg should be left uncut.

Photo 49. Tahquamenon Falls muskeg. Photo by Joshua G. Cohen.

50. Tahquamenon River Mouth Muskeg
Natural Community Type: Muskeg
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 26 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17868

Threats: No threats were noted during the course of the survey. Fire suppression in the overall landscape may reduce the fire frequency within the muskeg.

Management Recommendations: The main management recommendation is to allow natural processes to operate unhindered. Wildfires should be allowed to burn the muskeg as well as the surrounding uplands and wetlands. In the event of a wildfire, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for invasive species encroachment. Vehicular traffic should be avoided through this peatland. Adjacent forest (dry-mesic northern forest and dry northern forest) should be left uncut.

Photo 50. Tahquamenon River Mouth Muskeg. Photo by Joshua G. Cohen.

NORTHERN FEN

Overview: Northern fen is a sedge- and rush-dominated wetland occurring on neutral to moderately alkaline saturated peat and/or marl influenced by groundwater rich in calcium and magnesium carbonates. The community occurs north of the climatic tension zone and is found primarily where calcareous bedrock underlies a thin mantle of glacial drift on flat areas or shallow depressions of glacial outwash and glacial lakeplains and also in kettle depressions on pitted outwash and moraines (Kost et al. 2007).

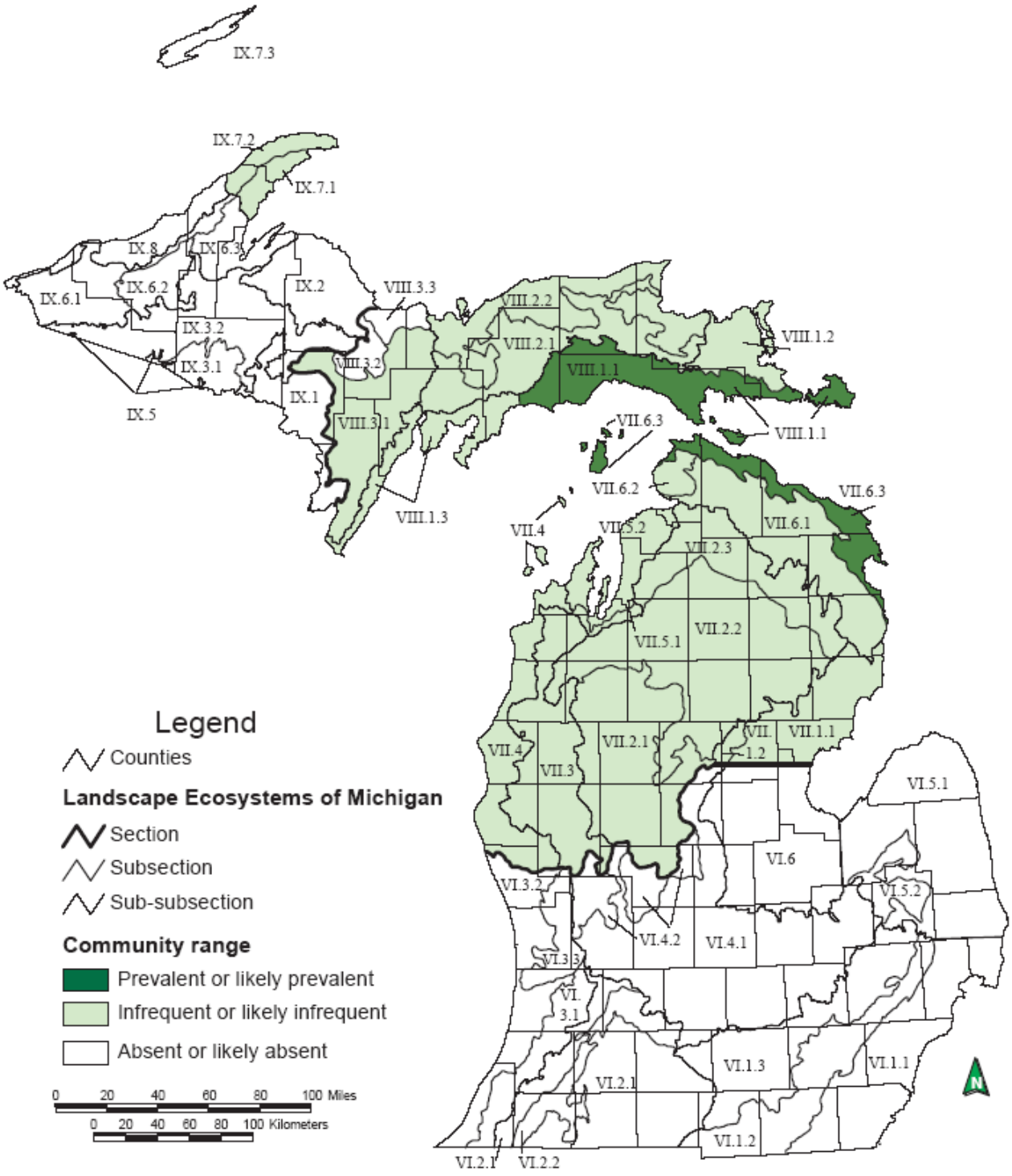

Figure 21. Distribution of northern fen in Michigan.

51. Cheboygan State Park
Natural Community Type: Northern Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 12 acres
Location: Cheboygan State Park
Element Occurrence Identification Number: 17533

Threats: The northern fen openings are mostly undisturbed; a powerline cut passes through the eastern margins of two of the larger fen pockets. No invasive species were noted in the northern fen. Invasive plants that occur in the nearby Great Lakes marsh, including narrow-leaved cat-tail (*Typha angustifolia*), may establish in the northern fen.

Management Recommendations: The main management recommendations are to maintain a natural community buffer adjacent to the fen to minimize disturbance to the wetland hydrology and the threat of invasion by non-native species. Control of the narrow-leaved cat-tail in the nearby Great Lakes marsh should be undertaken and followed by monitoring. Off-road vehicle access should be restricted.

Photo 51. Cheboygan State Park northern fen. Photo by Bradford S. Slaughter.

52. Stevenson's Fen
Natural Community Type: Northern Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 23 acres
Location: Rockport State Recreation Area
Element Occurrence Identification Number: 15803

Threats: An off-road vehicle trail passes through the fen and disrupts the local hydrology. Ruts create unnatural areas of pooling. In addition, the railroad grade to the east has also likely disrupted the natural hydrology. A small population of reed canary grass (*Phalaris arundinacea*) was noted during the surveys.

Management Recommendations: The main management recommendation is to allow natural processes to operate unhindered. Adjacent forest and swamp should be left uncut. Maintaining a forested buffer surrounding the northern fen will help ensure the stability of the fen's hydrologic regime. In addition, maintaining a forested buffer around the site and closing roads and trails within the surrounding forest would help reduce the illegal off-road vehicle traffic. The population of reed canary grass should be monitored and controlled if necessary.

Photo 52. Stevenson's Fen. Photo by Joshua G. Cohen.

53. Sturgeon Bay
Natural Community Type: Northern Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 2.9 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17841

Threats: No anthropogenic disturbance or non-native species were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., windthrow, flooding, and fire) to operate unhindered, to maintain canopy closure of the surrounding forest and swamp to minimize surface water flow into the fen and to maintain groundwater seepage, and to monitor for invasive plant populations.

Photo 53. Sturgeon Bay northern fen. Photo by Joshua G. Cohen.

54. Thompson's Harbor
Natural Community Type: Northern Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 89 acres
Location: Thompson's Harbor State Park
Element Occurrence Identification Number: 17341

Threats: Threats are limited to localized anthropogenic disturbance. No invasive plant species were noted during the course of the survey. Invasives may become established near the foot trail that passes by one of the fen polygons since there is localized anthropogenic disturbance emanating from the trail. A powerline intersects one of the fen polygons and a lone off-road vehicle track was observed coming off of the powerline into the fen. Deer browse may be impacting species composition and structure.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, eliminate illegal off-road vehicle activity, and to reduce deer densities in the surrounding landscape to dampen deer browse pressure. Deer densities could be reduced through direct measures and also by reducing early-successional habitat in the surrounding landscape. Monitoring deer densities and deer herbivory will allow for the assessment of whether deer herbivory impacts species composition and structure. Establishing no-cut buffers around the northern fen polygons can help protect the hydrologic regime. Invasive species occurring in adjacent areas should be controlled and these control efforts should be monitored.

Photo 54. Thompson's Harbor northern fen. Photo by Joshua G. Cohen.

55. Waugoshance Fen
Natural Community Type: Northern Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 23 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17842

Threats: No anthropogenic disturbance or non-native species were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., windthrow, flooding, and fire) to operate unhindered, to maintain canopy closure of the surrounding forest and swamp to minimize surface water flow into the fen and to maintain groundwater seepage, and to monitor for invasive plant populations.

Photo 55. Waugoshance Fen. Photo by Joshua G. Cohen.

56. Wilderness State Park
Natural Community Type: Northern Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 6.6 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17334

Threats: No anthropogenic disturbance or non-native species were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., windthrow, flooding, and fire) to operate unhindered, to maintain canopy closure of the surrounding forest and swamp to minimize surface water flow into the fen and to maintain groundwater seepage, and to monitor for invasive plant populations.

Photo 56. Wilderness State Park northern fen. Photo by Joshua G. Cohen.

NORTHERN SHRUB THICKET

Overview: Northern shrub thicket is a shrub-dominated wetland located north of the climatic tension zone, typically occurring along streams, but also adjacent to lakes and beaver floodings. The saturated, nutrient-rich, organic soils are composed of sapric peat or less frequently mineral soil, typically with medium acid to neutral pH. Succession to closed-canopy swamp forest is slowed by fluctuating water tables, beaver flooding, and windthrow. Northern shrub thickets are overwhelmingly dominated by tag alder (*Alnus incana*) (Kost et al. 2007).

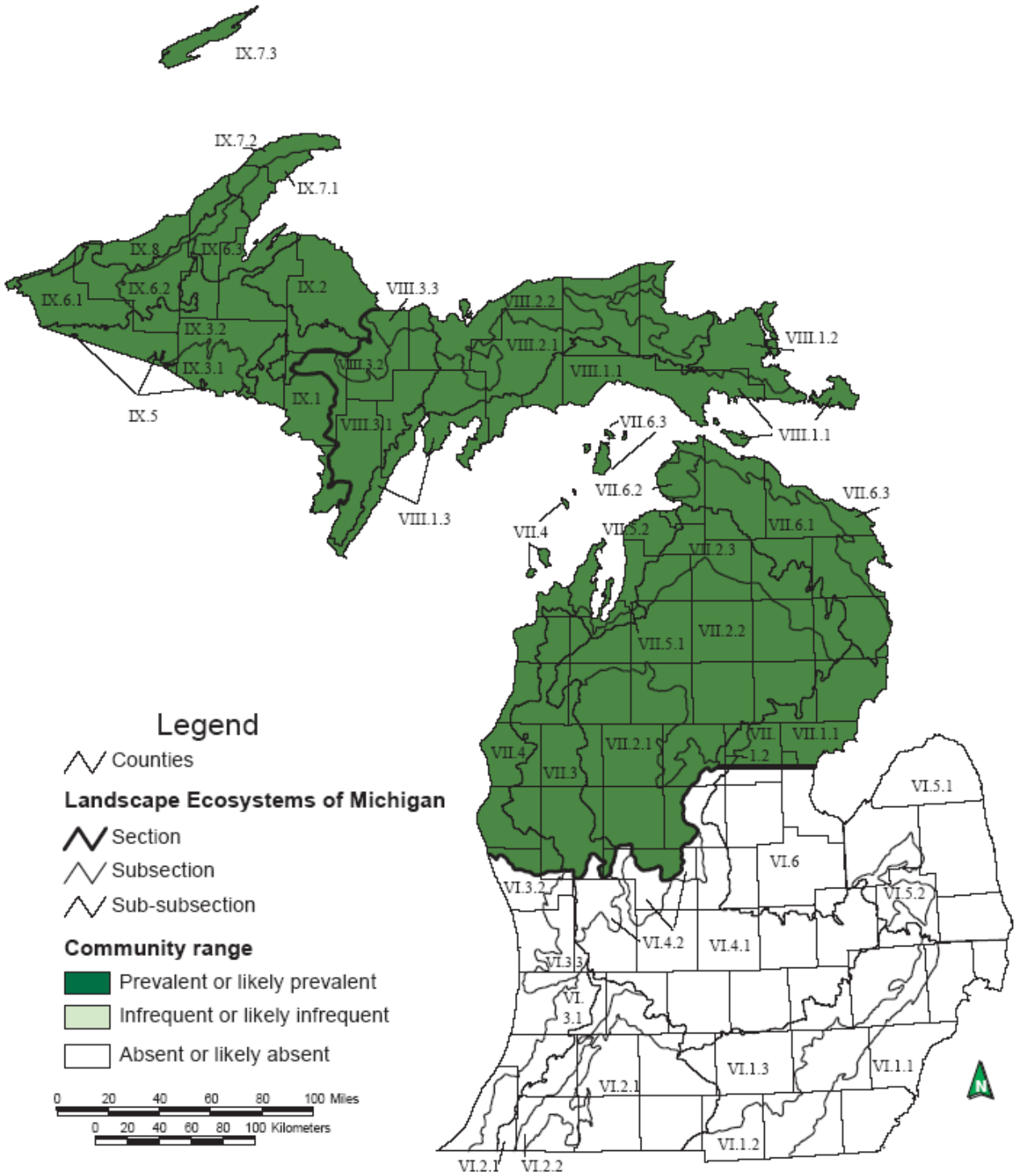

Figure 22. Distribution of northern shrub thicket in Michigan.

57. Carp River East
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: A
Size: 146 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 17932

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 57. Carp River East northern shrub thicket. Photo by Joshua G. Cohen.

58. Carp River West
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: AB
Size: 21 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18006

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 58. Carp River West northern shrub thicket. Photo by Joshua G. Cohen.

59. Hartwick Pines
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: B
Size: 53 acres
Location: Hartwick Pines State Park
Element Occurrence Identification Number: 17324

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Fire suppression may be impacting the northern shrub thicket and invasive species occur in the general area but are currently restricted to the road margins.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 59. Hartwick Pines northern shrub thicket. Photo by Joshua G. Cohen.

60. Laughing Whitefish Falls
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: AB
Size: 36 acres
Location: Laughing Whitefish Falls State Park
Element Occurrence Identification Number: 18703

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., beaver flooding and wildfire) and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 60. Laughing Whitefish Falls northern shrub thicket. Photo by Joshua G. Cohen.

61. Lewiston Grade
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: BC
Size: 104 acres
Location: Hartwick Pines State Park
Element Occurrence Identification Number: 18782

Threats: Lewiston Grade passes through the northern shrub thicket and locally alters the wetland's hydrology. Fire suppression may be impacting the northern shrub thicket and invasive species occur in the general area but are currently restricted to the road margins.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 61. Lewiston Grade northern shrub thicket. Photo by Joshua G. Cohen.

62. Little Two Hearted River
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: A
Size: 74 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17924

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 62. Little Two Hearted River northern shrub thicket. Photo by Joshua G. Cohen.

63. Prison Camp
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: AB
Size: 42 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17912

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 63. Prison Camp northern shrub thicket. Photo by Joshua G. Cohen.

64. Thompson's Harbor
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: AB
Size: 155 acres
Location: Thompson's Harbor State Park
Element Occurrence Identification Number: 17339

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex. Deer browse may be impacting species composition and vegetative structure.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., flooding and fire) to operate unhindered. Monitoring deer densities and deer herbivory will allow for the assessment of whether deer herbivory impacts species composition and structure. Retaining an intact buffer of natural communities surrounding the wetland can help protect the hydrologic regime.

Photo 64. Thompson's Harbor northern shrub thicket. Photo by Joshua G. Cohen.

65. Van Riper
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: B
Size: 4.5 acres
Location: Van Riper State Park
Element Occurrence Identification Number: 17837

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 65. Van Riper northern shrub thicket. Photo by Joshua G. Cohen.

66. Wilderness State Park
Natural Community Type: Northern Shrub Thicket
Rank: G4 S5, apparently secure globally and secure within the state
Element Occurrence Rank: B
Size: 16 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17335

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex. Deer browse pressure may be impacting species composition and vegetative structure.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., flooding and fire) to operate unhindered. Monitoring deer densities and deer herbivory will allow for the assessment of whether deer herbivory impacts species composition and structure. Retaining an intact buffer of natural communities surrounding the wetland can help protect the hydrologic regime.

Photo 66. Wilderness State Park northern shrub thicket. Photo by Joshua G. Cohen.

NORTHERN WET MEADOW

Overview: Northern wet meadow is an open, groundwater-influenced, sedge- and grass-dominated wetland that occurs in the northern Lower and Upper Peninsulas and typically borders streams but is also found on pond and lake margins and above beaver dams. Soils are nearly always sapric peat and range from strongly acid to neutral in pH. Open conditions are maintained by seasonal flooding, beaver-induced flooding, and fire (Kost et al. 2007).

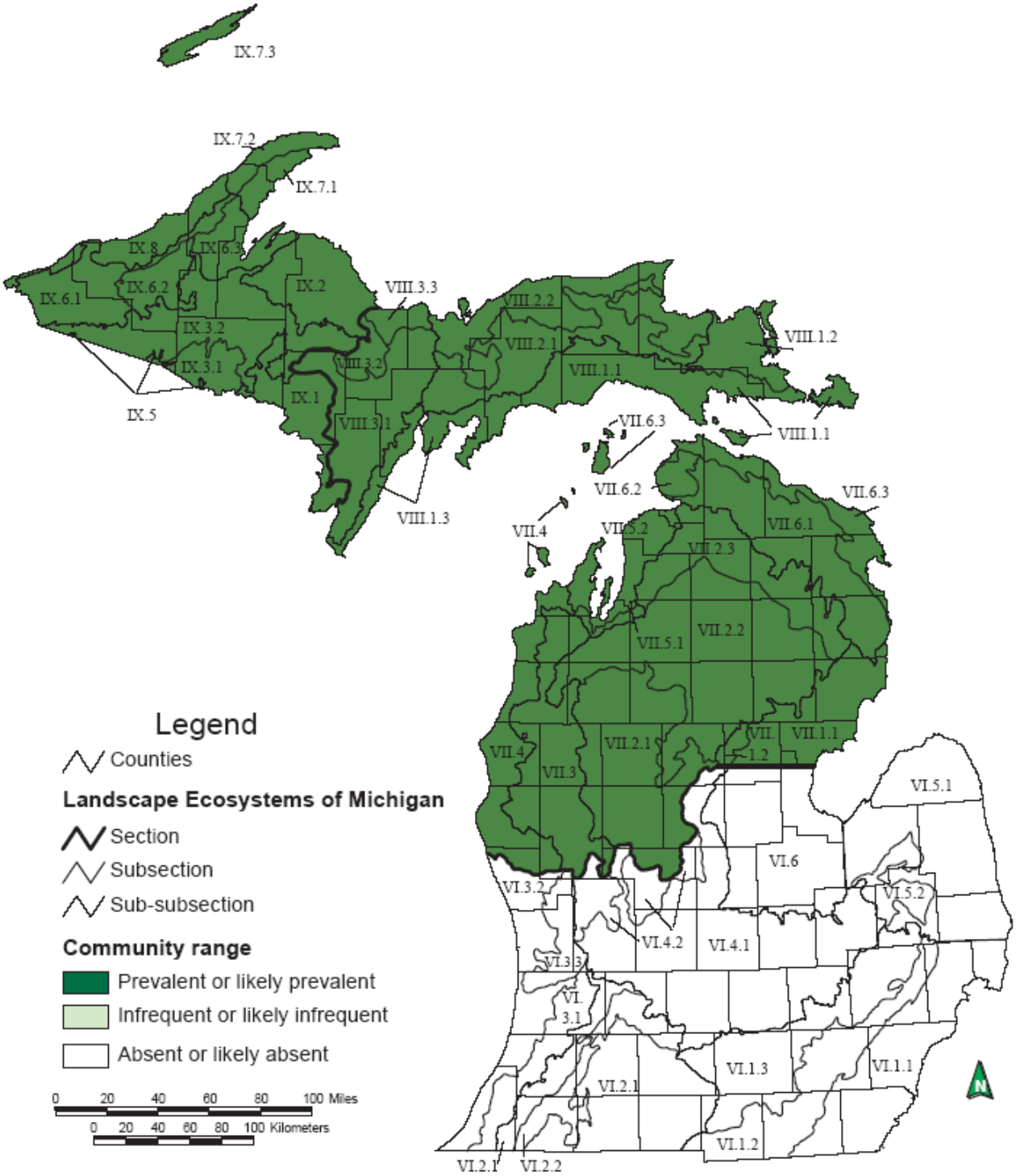

Figure 23. Distribution of northern wet meadow in Michigan.

67. Carp River and Lake of the Clouds
Natural Community Type: Northern Wet Meadow
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: A
Size: 20 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 17999

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 67. Carp River and Lake of the Clouds northern wet meadow. Photo by Joshua G. Cohen.

68. Carp River West
Natural Community Type: Northern Wet Meadow
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 4.5 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18005

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 68. Carp River West northern wet meadow. Photo by Joshua G. Cohen.

69. Miscowawbic Meadow
Natural Community Type: Northern Wet Meadow
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 1.1 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18001

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 69. Miscowawbic Meadow. Photo by Joshua G. Cohen.

70. Pesheke Meadows
Natural Community Type: Northern Wet Meadow
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 1.0 acres
Location: Van Riper State Park
Element Occurrence Identification Number: 17836

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 70. Pesheke Meadows. Photo by Joshua G. Cohen.

71. Prison Camp
Natural Community Type: Northern Wet Meadow
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 6.2 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17911

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 71. Prison Camp northern wet meadow. Photo by Joshua G. Cohen.

72. Tahquamenon River
Natural Community Type: Northern Wet Meadow
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 2.6 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17920

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., flooding) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 72. Tahquamenon River northern wet meadow. Photo by Joshua G. Cohen.

OPEN DUNES

Overview: Open dunes is a grass- and shrub-dominated multi-seral community located on wind-deposited sand formations near the shorelines of the Great Lakes. Dune formation and the patterning of vegetation are strongly affected by lake-driven winds. The greatest concentration of open dunes occurs along the eastern and northern shorelines of Lake Michigan, with the largest dunes occurring along the eastern shoreline due to the prevailing southwest winds (Kost et al. 2007).

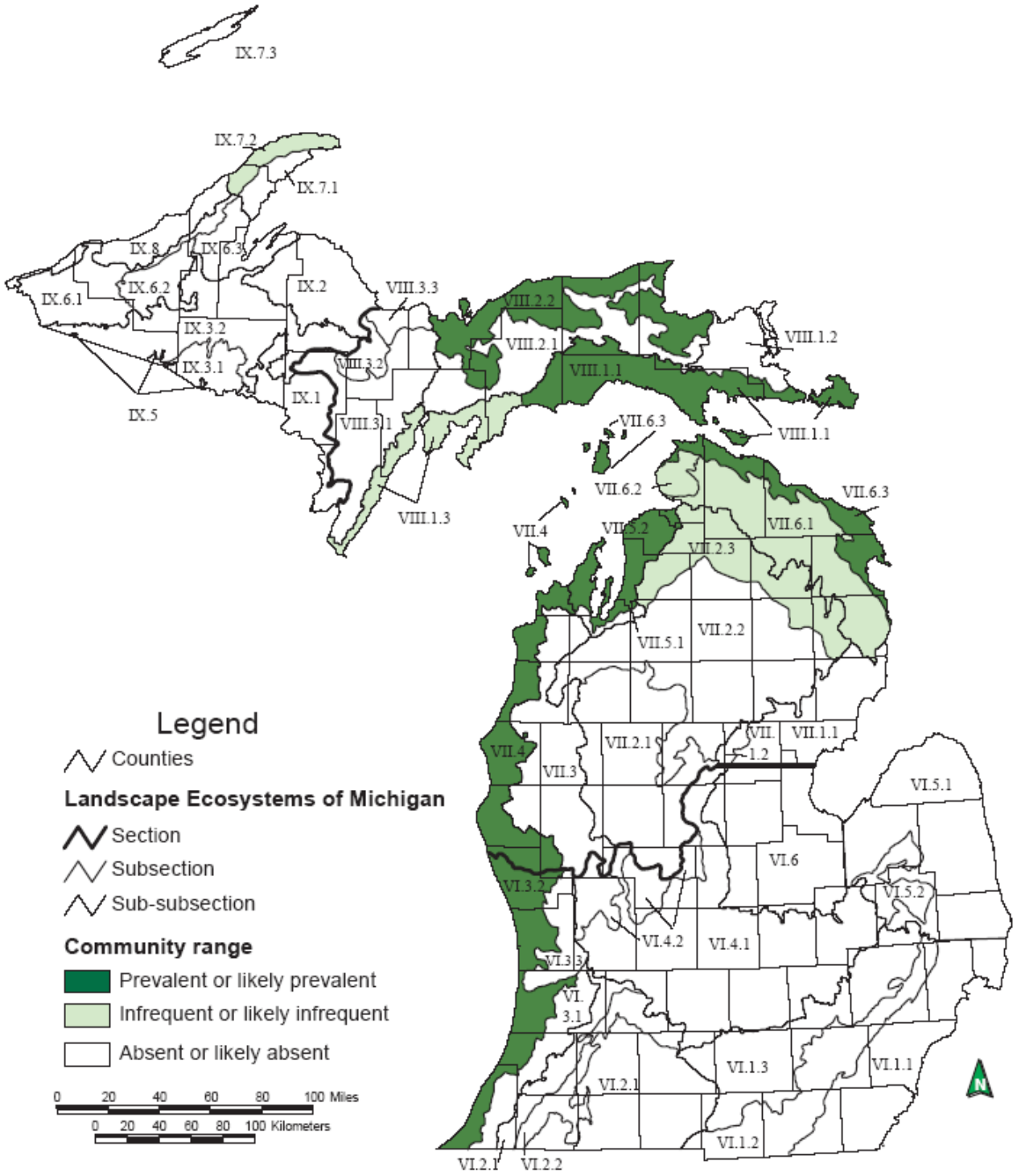

Figure 24. Distribution of open dunes in Michigan.

73. Besser Natural Area
Natural Community Type: Open Dunes
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: BC
Size: 5.6 acres
Location: Rockport State Recreation Area
Element Occurrence Identification Number: 18758

Threats: Threats include illegal off-road vehicle activity, erosion from foot traffic, and invasive plants. Spotted knapweed (*Centaurea stoebe*) was documented within the open dunes and off-road vehicle activity was noted along nearshore areas and in the adjacent interdunal wetlands.

Management Recommendations: The primary management recommendations are to allow natural processes to operate unhindered, control clusters of non-native plants (i.e., spotted knapweed), eliminate off-road vehicle activity, and increase educational efforts to encourage visitors to stay on trails. Monitoring for invasive species should be implemented following control efforts.

Photo 73. Besser Natural Area open dunes. Photo by Joshua G. Cohen.

PATTERNED FEN

Overview: Patterned fen is a minerotrophic shrub- and herb-dominated peatland mosaic characterized by a series of peat ridges (strings) and hollows (flarks) oriented parallel to the slope of the landform and perpendicular to the flow of groundwater. The strings vary in height, width, and spacing, but are generally less than one meter tall, resulting in a faint wave-like pattern that may be discernable only from aerial photographs. The flarks are saturated to inundated open lawns of sphagnum mosses, sedges, and rushes, while the strings are dominated by sedges, shrubs, and scattered, stunted trees. Patterned fens occur primarily in the eastern Upper Peninsula, with the highest concentration found in Schoolcraft County. Patterned fens are also referred to as patterned bogs, patterned peatlands, strangmoor, aapamires, and string bogs (Kost et al. 2007).

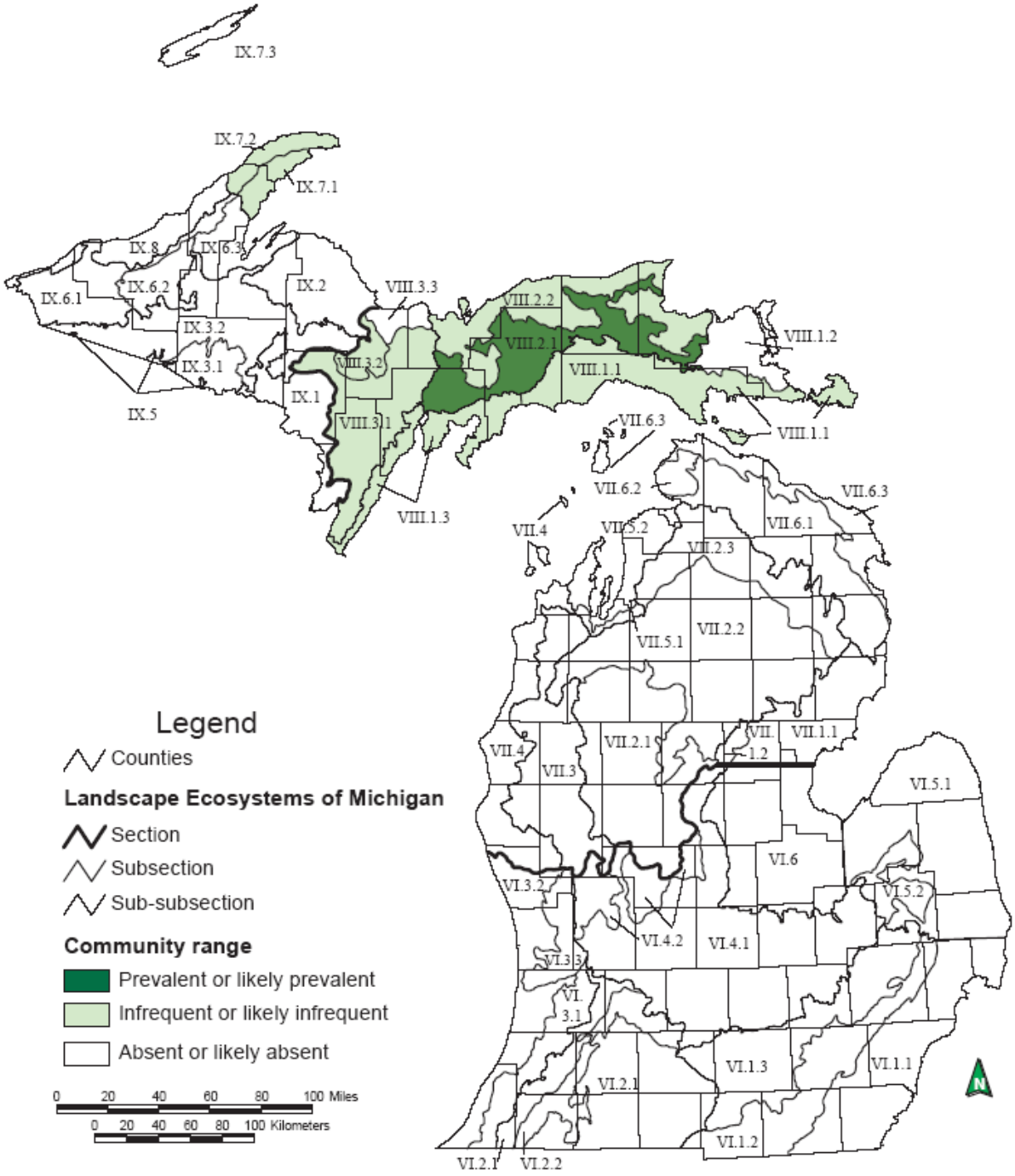

Figure 25. Distribution of patterned fen in Michigan.

74. Prison Camp Patterned Fen
Natural Community Type: Patterned Fen
Rank: GU S2, globally unrankable and imperiled within the state
Element Occurrence Rank: B
Size: 12 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17921

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could alter the local hydrology of the peatland.

Management Recommendations: The main management recommendation is to allow natural processes to operate unhindered. Wildfires should be allowed to burn the peatland as well as the surrounding uplands. In the event of a wildfire, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for invasive species encroachment. Vehicular traffic should be avoided through this peatland. Forest surrounding the patterned fen and muskeg should be left uncut to protect the hydrologic regime.

Photo 74. Prison Camp Patterned Fen. Photo by Joshua G. Cohen.

POOR CONIFER SWAMP

Overview: Poor conifer swamp is a nutrient-poor, forested peatland characterized by acidic, saturated peat, and the prevalence of conifer trees, *Sphagnum* mosses, and ericaceous shrubs. The community is located in depressions in glacial outwash and sandy glacial lakeplains and in kettles on pitted outwash and depressions on moraines. Poor conifer swamp occasionally occurs on floating mats on the margins of lakes and ponds. Fire occurs naturally during drought periods and creates even-aged, often monospecific, stands of *Picea mariana* (black spruce). Windthrow, beaver flooding, and insect defoliation are also important disturbance factors influencing species composition and structure (Kost et al. 2007).

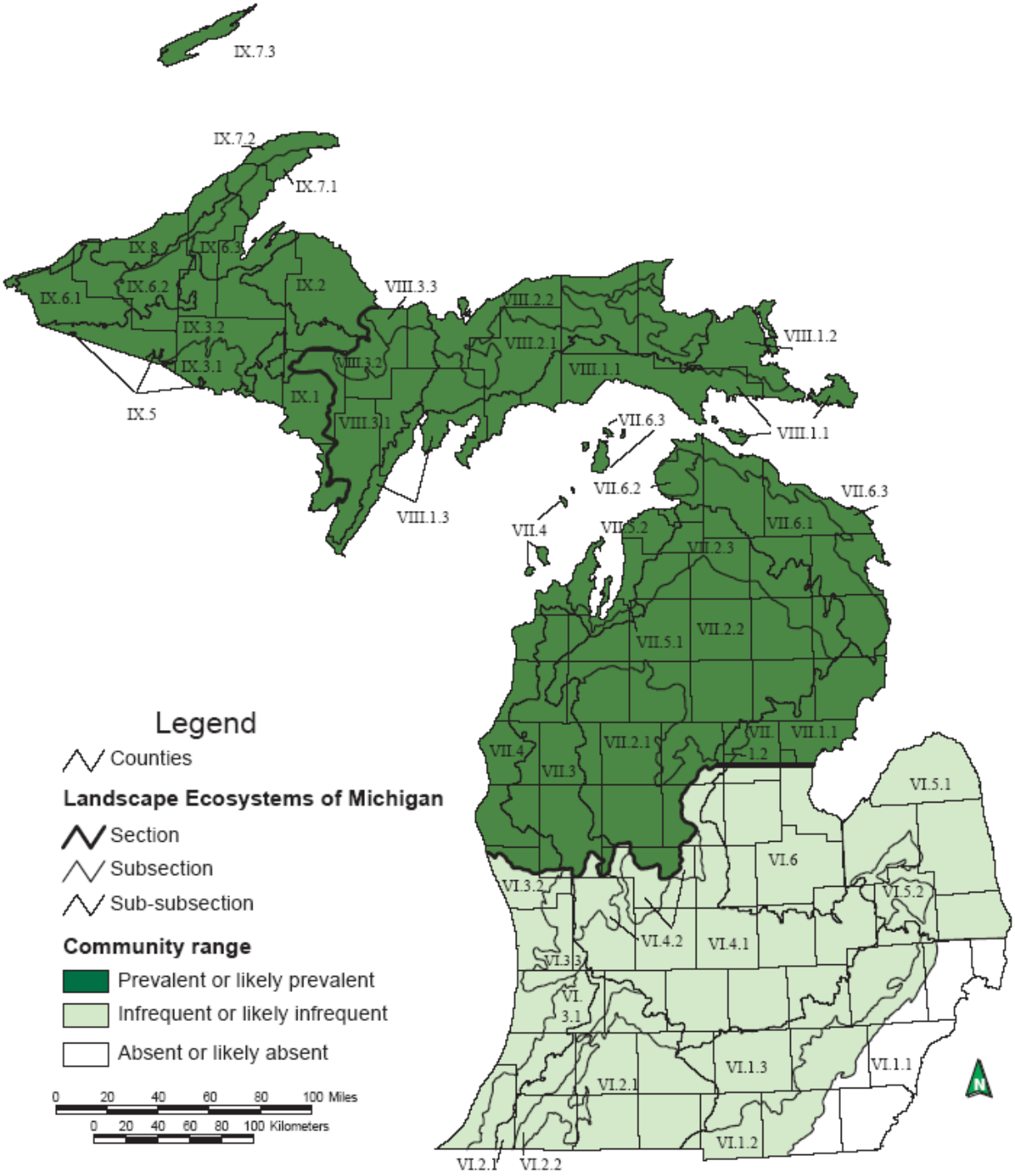

Figure 26. Distribution of poor conifer swamp in Michigan.

75. Clark Lake Swamp
Natural Community Type: Poor Conifer Swamp
Rank: G4 S4, apparently secure globally and within the state
Element Occurrence Rank: AB
Size: 36 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17925

Threats: The species composition and vegetative structure of the poor conifer swamp are influenced by natural processes. A hiking trail passes through a portion of poor conifer swamp.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., windthrow and fire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

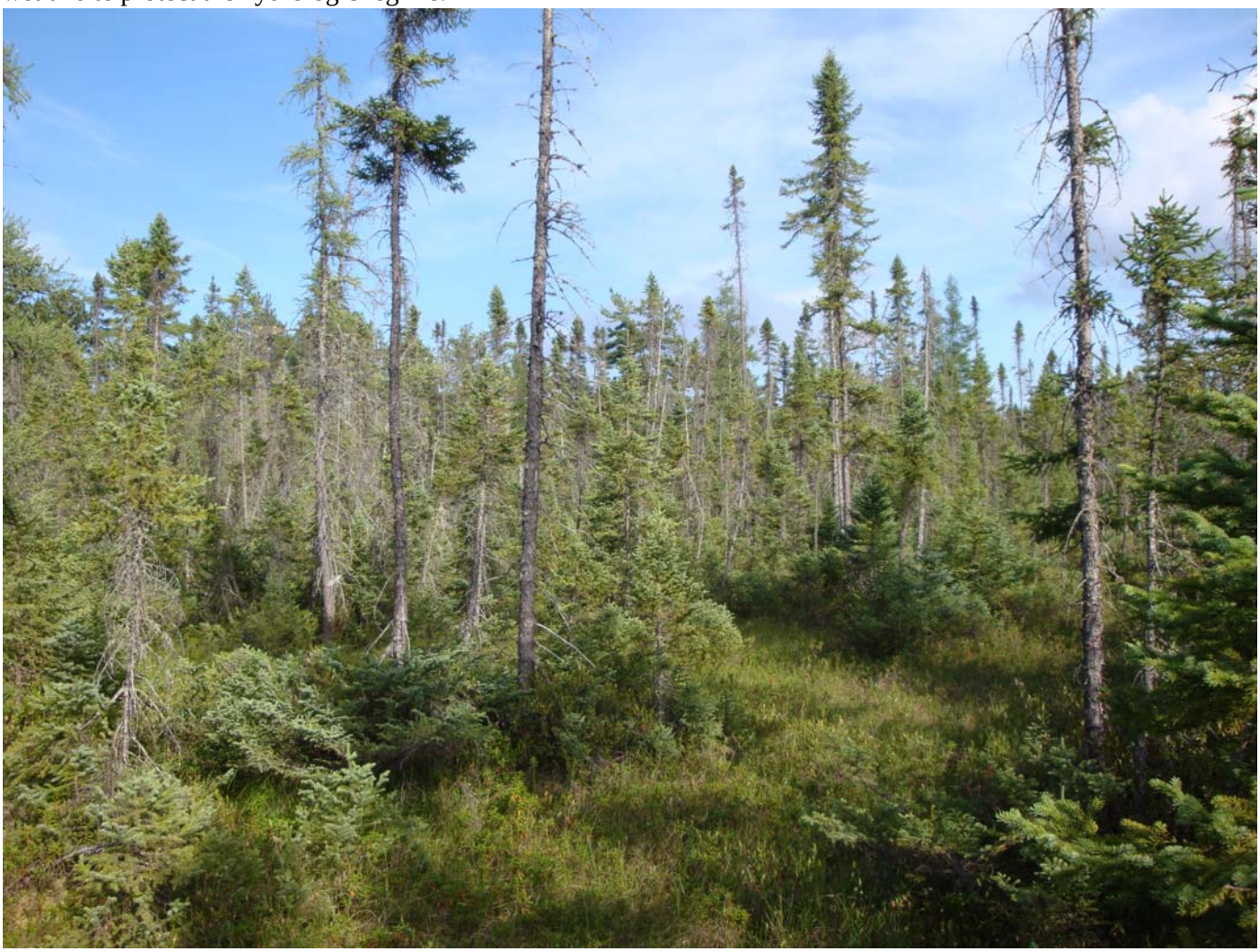

Photo 75. Clark Lake Swamp poor conifer swamp. Photo by Joshua G. Cohen.

76. Lewiston Grade Swamp
Natural Community Type: Poor Conifer Swamp
Rank: G4 S4, apparently secure globally and within the state
Element Occurrence Rank: BC
Size: 24 acres
Location: Hartwick Pines State Park
Element Occurrence Identification Number: 18780

Threats: The species composition and vegetative structure of the poor conifer swamp are influenced by natural processes. No anthropogenic threats or non-native species were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., windthrow and fire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 76. Lewiston Grade Swamp poor conifer swamp. Photo by Joshua G. Cohen.

77. Moeckel Road Swamp
Natural Community Type: Poor Conifer Swamp (re-classified from Bog)
Rank: G4 S4, apparently secure globally and within the state
Element Occurrence Rank: BC
Size: 60 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17490

Threats: The species composition and vegetative structure of the poor conifer swamp have been impacted by competition from the invasive shrub glossy buckthorn (*Frangula alnus*). Fire suppression throughout the general landscape may have altered the fire regime of the poor conifer swamp.

Management Recommendations: The main management recommendations are to control glossy buckthorn, monitor the control efforts, and maintain a forested buffer to protect the swamp's hydrology. The site should be allowed to burn when surrounding uplands are burned.

Photo 77. Moeckel Road Swamp poor conifer swamp. Photo by Steve A. Thomas.

78. Prison Camp Swamp
Natural Community Type: Poor Conifer Swamp
Rank: G4 S4, apparently secure globally and within the state
Element Occurrence Rank: A
Size: 537 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17922

Threats: The species composition and vegetative structure of the poor conifer swamp are influenced by natural processes. No anthropogenic disturbances or non-native species were noted during the course of the survey.

Management Recommendations: The primary management recommendations are to allow natural processes to operate unhindered (i.e., windthrow and permit wildfires to burn through this site and the surrounding uplands) and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime. In the event of future wildfire or if prescribed fire is implemented, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used.

Photo 78. Prison Camp Swamp poor conifer swamp. Photo by Joshua G. Cohen.

79. Tahqua Trail Swamp
Natural Community Type: Poor Conifer Swamp
Rank: G4 S4, apparently secure globally and within the state
Element Occurrence Rank: AB
Size: 103 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17872

Threats: The species composition and vegetative structure of the poor conifer swamp are influenced by natural processes. No anthropogenic disturbances or non-native species were noted during the course of the survey.

Management Recommendations: The primary management recommendations are to allow natural processes (i.e., windthrow and fire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 79. Tahqua Trail Swamp poor conifer swamp. Photo by Joshua G. Cohen.

POOR FEN

Overview: Poor fen is a sedge-dominated wetland found on very strongly to strongly acid, saturated peat that is moderately influenced by groundwater. The community occurs primarily north of the climatic tension zone in kettle depressions and in flat areas or mild depressions on glacial outwash and glacial lakeplain (Kost et al. 2007).

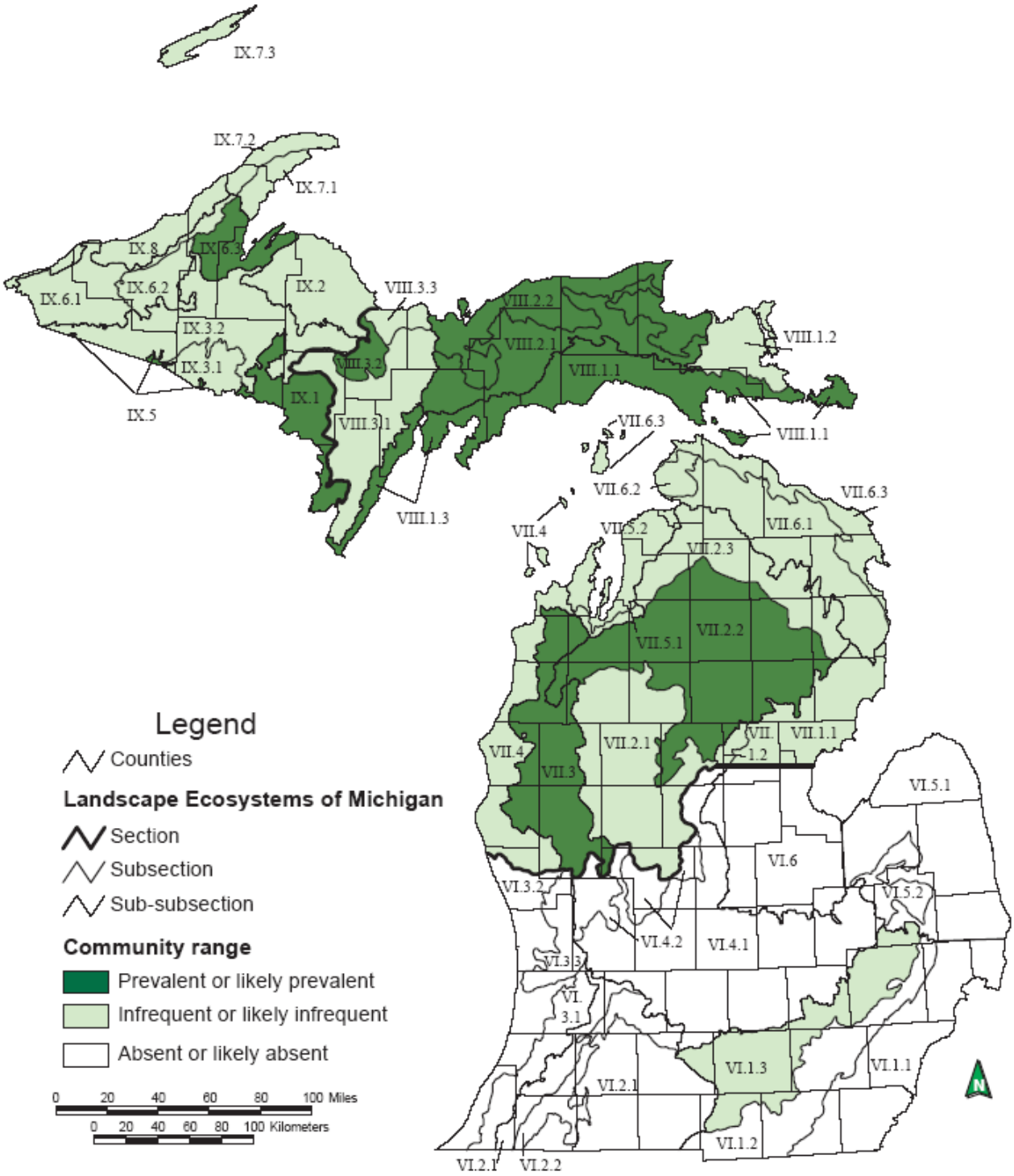

Figure 27. Distribution of poor fen in Michigan.

80. Cassidy Road Poor Fen
Natural Community Type: Poor Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 31 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 18857

Threats: Non-native species are locally common and include purple loosestrife (*Lythrum salicaria*) and narrow-leaved cat-tail (*Typha angustifolia*).

Management Recommendations: The main management recommendations are to maintain an undisturbed natural community buffer adjacent to the poor fen to minimize the threat of hydrological alteration and to control and monitor invasive species.

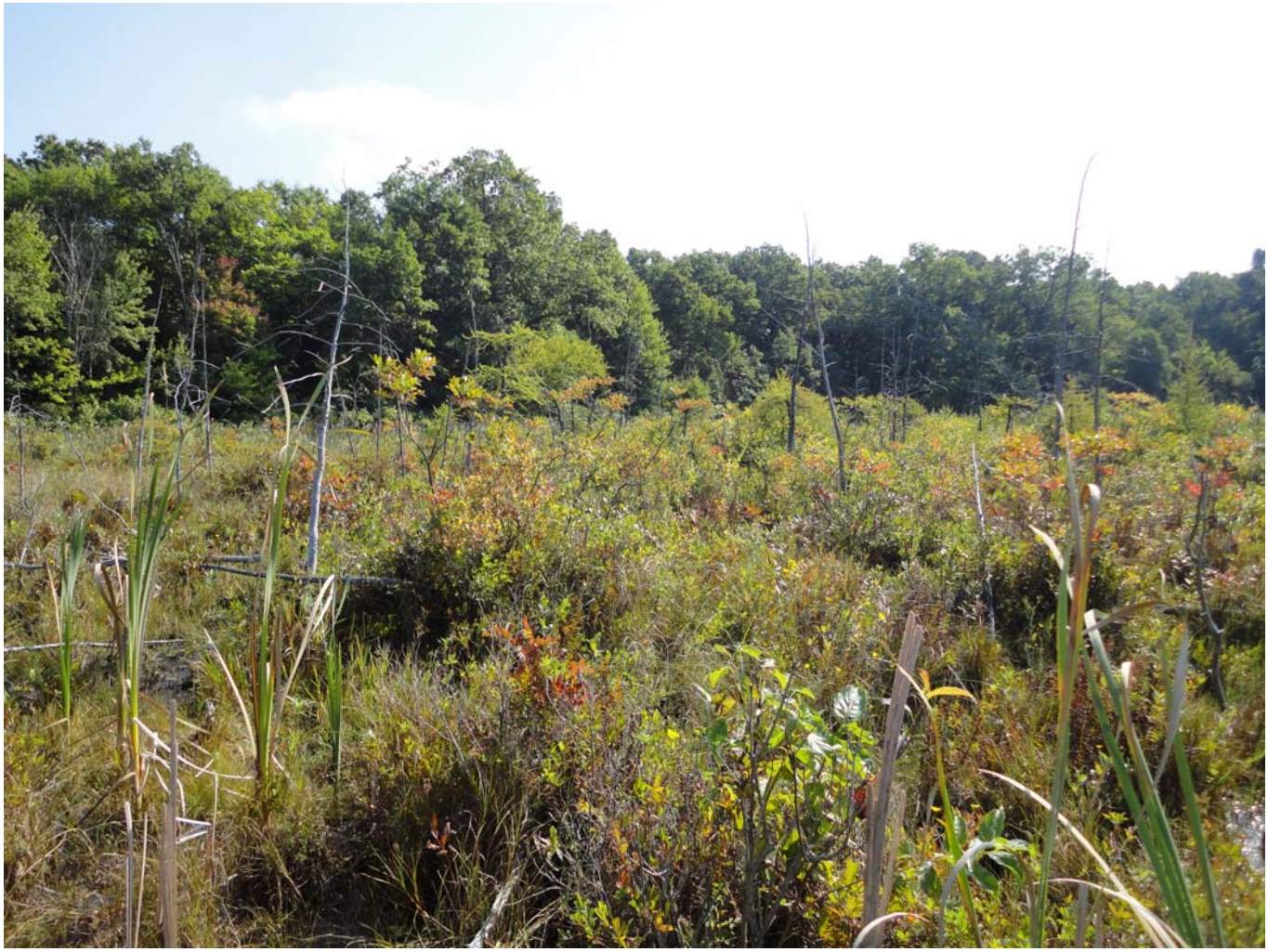

Photo 80. Cassidy Road Poor Fen. Photo by Joshua G. Cohen.

81. Lewiston Grade Fen
Natural Community Type: Poor Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 8.2 acres
Location: Hartwick Pines State Park
Element Occurrence Identification Number: 18781

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to minimize the threat of hydrological alteration.

Photo 81. Lewiston Grade Fen poor fen. Photo by Joshua G. Cohen.

82. Park Poor Fen
Natural Community Type: Poor Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 312 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17870

Threats: A powerline passes through the southern portion of the fen and off-road vehicle tracks were noted under the powerline. Fire suppression in the overall landscape may reduce the fire frequency within the poor fen.

Management Recommendations: The main management recommendation is to allow natural processes (i.e., fire) to operate unhindered. Wildfires should be allowed to burn the poor fen as well as the surrounding uplands and wetlands. In the event of a wildfire, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for invasive species encroachment. Vehicular traffic should be avoided throughout this peatland. Adjacent forest (dry-mesic northern forest and dry northern forest) should be left uncut; an intact buffer of natural communities surrounding the wetland will reduce the threat of hydrological alteration.

Photo 82. Park Poor Fen. Photo by Joshua G. Cohen.

83. Sturgeon Bay
Natural Community Type: Poor Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 4.8 acres
Location: Wilderness State Park
Element Occurrence Identification Number: 17840

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., windthrow, flooding, and fire) to operate unhindered, to maintain canopy closure of the surrounding forest and swamp to minimize surface water flow into the fen and to maintain groundwater seepage, and to monitor for invasive plant populations.

Photo 83. Sturgeon Bay poor fen. Photo by Joshua G. Cohen.

84. Tahquamenon River Mouth Fen
Natural Community Type: Poor Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 493 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17867

Threats: Fire suppression in the overall landscape may reduce the fire frequency within the poor fen.

Management Recommendations: The main management recommendation is to allow natural processes (i.e., fire) to operate unhindered. Wildfires should be allowed to burn the poor fen as well as the surrounding uplands and wetlands. In the event of a wildfire, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for invasive species encroachment. Vehicular traffic should be avoided throughout this peatland. Adjacent forest (dry-mesic northern forest and dry northern forest) should be left uncut; an intact buffer of natural communities surrounding the wetland will reduce the threat of hydrological alteration.

Photo 84. Tahquamenon River Mouth Fen poor fen. Photo by Joshua G. Cohen.

85. Tahqua Trail Fen
Natural Community Type: Poor Fen
Rank: G3G5 S3, vulnerable to secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 26 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17871

Threats: Fire suppression in the overall landscape may reduce the fire frequency within the poor fen.

Management Recommendations: The main management recommendation is to allow natural processes (i.e., fire) to operate unhindered. Wildfires should be allowed to burn the poor fen as well as the surrounding uplands and wetlands. In the event of a wildfire, establishment of new fire lines should be avoided and existing fire breaks (i.e., roads and wetlands) should be used. New fire breaks could allow for invasive species encroachment. Vehicular traffic should be avoided throughout this peatland. Adjacent forest (dry-mesic northern forest and dry northern forest) should be left uncut; an intact buffer of natural communities surrounding the wetland will reduce the threat of hydrological alteration.

Photo 85. Tahqua Trail Fen poor fen. Photo by Joshua G. Cohen.

PRAIRIE FEN

Overview: Prairie fen is a wetland community dominated by sedges, grasses, and other graminoids that occurs on moderately alkaline organic soil and marl south of the climatic tension zone in southern Lower Michigan. Prairie fens occur predominantly within poorly drained outwash channels and outwash plains in the interlobate regions of southern Lower Michigan. This area is comprised of coarse-textured end moraines and ice-contact features (eskers and kames) that are bordered by glacial outwash. Prairie fen occurs on saturated organic soil and marl. Prairie fens occur where cold, calcareous, groundwater-fed springs reach the surface. The flow rate and volume of groundwater through a fen strongly influence vegetation patterning; thus, the community typically contains multiple, distinct zones of vegetation, some of which contain prairie grasses and forbs (Kost et al. 2007).

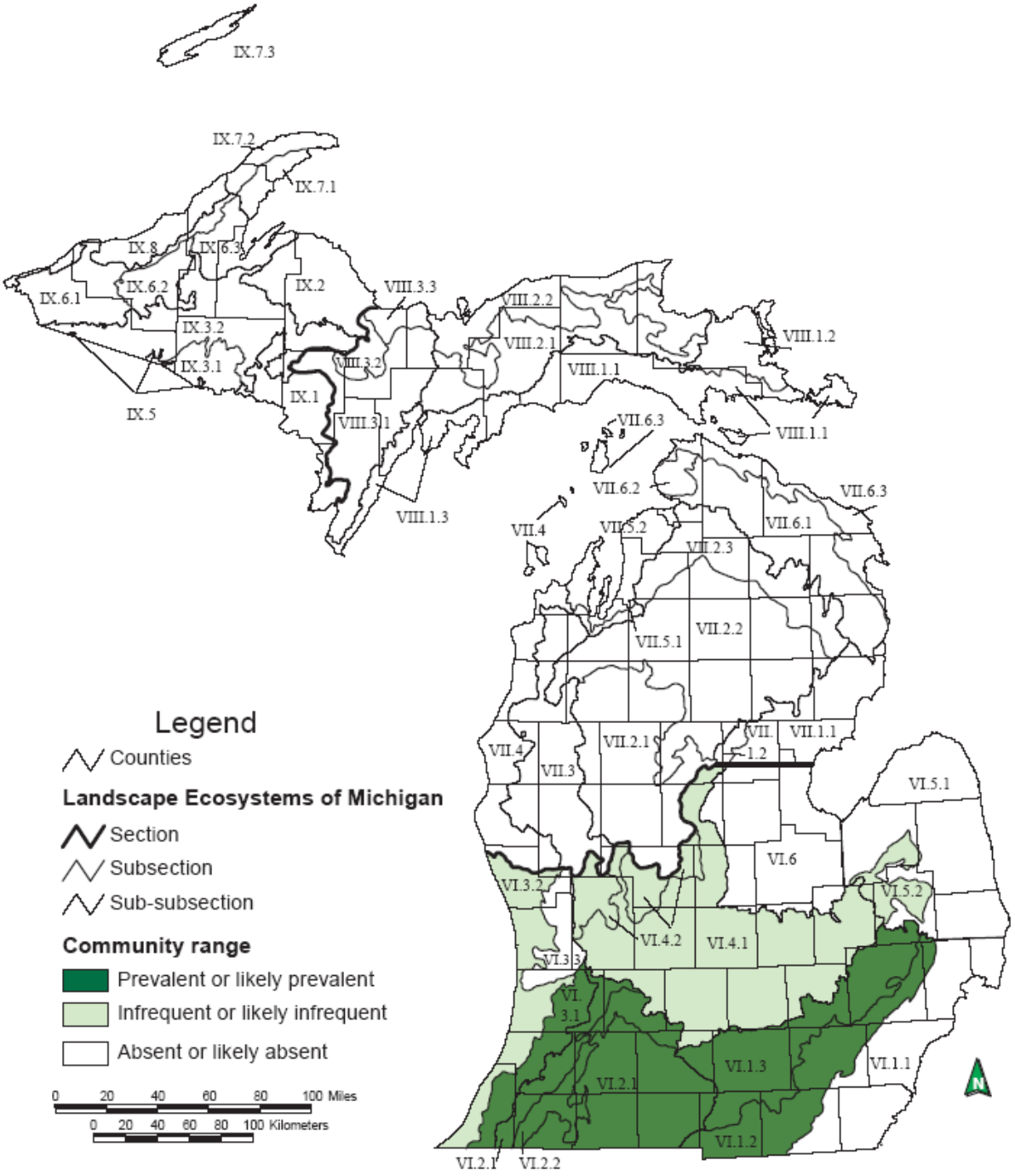

Figure 28. Distribution of prairie fen in Michigan.

86. Little Portage Lake Fen
Natural Community Type: Prairie Fen
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: BC
Size: 69 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 16876

Threats: The species composition and vegetative structure of the prairie fen are influenced by hydrologic fluctuation, groundwater discharge, invasive species, and fire suppression. Purple loosestrife (*Lythrum salicaria*) is occasional, especially near the lake and the drainage between the northern and southern portions of the lake. Glossy buckthorn (*Frangula alnus*) is locally common at the upland margin, and seedlings are occasional in the open wetland.

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen, burn the fen periodically, and retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime. The prairie fen should be burned in concert with the surrounding uplands and wetlands. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management.

Photo 86. Little Portage Lake Fen prairie fen. Photo by Steve A. Thomas.

87. McDonald Lake Fen
Natural Community Type: Prairie Fen
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: C
Size: 1.6 acres
Location: Yankee Springs State Recreation Area
Element Occurrence Identification Number: 15920

Threats: The species composition and vegetative structure of the prairie fen are influenced by groundwater discharge, invasive species, and fire suppression. Invasives are localized in the fen and include multiflora rose (*Rosa multiflora*), narrow-leaved cat-tail (*Typha angustifolia*), autumn olive (*Elaeagnus umbellata*), and purple loosestrife (*Lythrum salicaria*). In addition, erosion from foot traffic was observed along the trail and near the dock.

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen, burn the fen periodically, and retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime. The prairie fen should be burned in concert with the surrounding uplands and wetlands. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. Signage should be considered to help reduce excessive foot traffic off of the trail.

Photo 87. McDonald Lake Fen prairie fen. Photo by Steve A. Thomas.

88. McKibben Fen
Natural Community Type: Prairie Fen
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: C
Size: 1.9
Location: Yankee Springs State Recreation Area
Element Occurrence Identification Number: 15907

Threats: Species composition and vegetative structure of the prairie fen are influenced by groundwater discharge, invasive species, and fire suppression. Invasives documented in the fen include Morrow honeysuckle (*Lonicera morrowii*), multiflora rose (*Rosa multiflora*), and autumn olive (*Elaeagnus umbellata*).

Management Recommendations: The primary management recommendations are to continue controlling invasive plants within the fen and burning the fen periodically. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management and impacts of prescribed fire on rare species.

Photo 88. McKibben Fen prairie fen. Photo by Steve A. Thomas.

89. Pickerel Lake Fen
Natural Community Type: Prairie Fen
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: BC
Size: 13 acres
Location: Pinckney State Recreation Area
Element Occurrence Identification Number: 18877

Threats: The species composition and vegetative structure of the prairie fen are influenced by groundwater discharge, invasive species, and fire suppression. Invasives documented in the fen include purple loosestrife (*Lythrum salicaria*), multiflora rose (*Rosa multiflora*), and autumn olive (*Elaeagnus umbellata*).

Management Recommendations: The primary management recommendations are to control invasive plants within the fen, burn the fen periodically, and retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime. The prairie fen should be burned in concert with the surrounding uplands and wetlands. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management.

Photo 89. Pickerel Lake Fen prairie fen. Photo by Michael A. Kost.

90. Proud Lake Fen
Natural Community Type: Prairie Fen
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: C
Size: 46 acres
Location: Proud Lake Recreation Area
Element Occurrence Identification Number: 18702

Threats: The species composition, vegetative structure, and successional trajectory of the prairie fen are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has lead to woody encroachment. Invasives are localized and include narrow-leaved cat-tail (*Typha angustifolia*), reed (*Phragmites australis*) (concentrated along the lake margin), and glossy buckthorn (*Frangula alnus*) (infringing from the upper margin). In addition, purple loosestrife (*Lythrum salicaria*) is locally common within the fen and southern wet meadow. Localized clumps of hybrid cat-tail (*Typha xglauca*), narrow-leaved cat-tail, and reed occur in close proximity to the prairie fen along the shore of Proud Lake. In addition, the dam downstream of Proud Lake has impacted the hydrology of the wetland.

Management Recommendations: Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where invasive cat-tails and reed are prevalent to prevent their spread. These invasives should first be controlled using other techniques. Cutting and herbiciding of glossy buckthorn could also be considered to complement the use of prescribed fire. In addition, use of biocontrol could be considered to control the population of purple loosestrife. Monitoring should be employed to allow for assessment of whether management is reducing invasive species populations. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.

Photo 90. Proud Lake Fen prairie fen. Photo by Joshua G. Cohen.

91. Riethmiller South Fen
Natural Community Type: Prairie Fen
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: C
Size: 3.4 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17523

Threats: The species composition, vegetative structure, and successional trajectory of the prairie fen are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment. Invasives are localized and include multiflora rose (*Rosa multiflora*) and autumn olive (*Elaeagnus umbellata*). In addition, nearby wetlands contain purple loosestrife (*Lythrum salicaria*) and glossy buckthorn (*Frangula alnus*).

Management Recommendations: Prescribed fire should be employed to control shrub encroachment and reduce invasive species. In addition, invasives from nearby wetlands could also be controlled. Monitoring should be employed to allow for assessment of whether management is reducing invasive species populations. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.

Photo 91. Riethmiller South Fen prairie fen. Photo by John Fody.

92. Tophith Road Fen
Natural Community Type: Prairie Fen
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: C
Size: 8.9 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17521

Threats: The species composition, vegetative structure, and successional trajectory of the prairie fen are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment. Invasives are localized and include glossy buckthorn (*Frangula alnus*) and reed canary grass (*Phalaris arundinacea*).

Management Recommendations: Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Cutting and herbiciding of glossy buckthorn could also be considered to complement the use of prescribed fire. Monitoring should be employed to allow for assessment of whether management is reducing invasive species populations. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.

Photo 92. Tophith Road Fen prairie fen. Photo by Mike R. Penskar.

RICH CONIFER SWAMP

Overview: Rich conifer swamp is a groundwater-influenced, minerotrophic, forested wetland dominated by northern white-cedar (*Thuja occidentalis*) that occurs on organic soils (i.e., peat) primarily north of the climatic tension zone in the northern Lower and Upper Peninsulas. Rich conifer swamp occurs in outwash channels, outwash plains, glacial lakeplains, and in depressions on coarse- to medium-textured ground moraines. It is common in outwash channels of drumlin fields and where groundwater seeps occur at the bases of moraines. Rich conifer swamp typically occurs in association with lakes and cold, groundwater-fed streams. It also occurs along the Great Lakes shoreline in old abandoned embayments and in swales between former beach ridges where it may be part of a wooded dune and swale complex. Windthrow is common, especially on broad, poorly drained sites. Fire was historically infrequent. Rich conifer swamp is characterized by diverse microtopography and ground cover. The community is also referred to as cedar swamp (Kost et al. 2007).

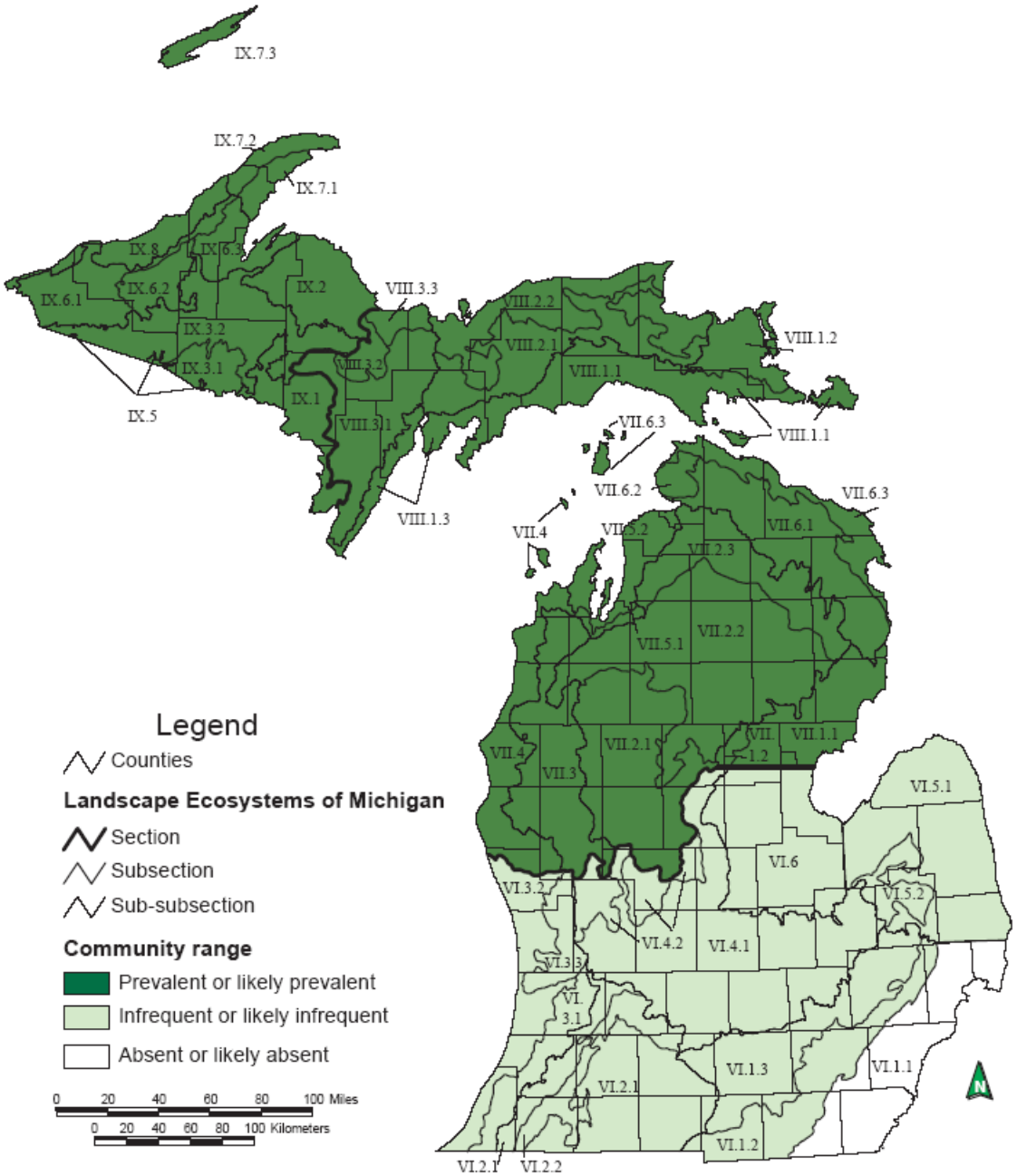

Figure 29. Distribution of rich conifer swamp in Michigan.

93. Carp River East
Natural Community Type: Rich Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: A
Size: 2.4 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 17931

Threats: No anthropogenic disturbances or non-native plants were noted during the course of the survey. Logging in the surrounding forest could locally alter the hydrology of the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., beaver flooding and wildfire) to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime.

Photo 93. Carp River East rich conifer swamp. Photo by Joshua G. Cohen.

94. Lewiston Grade Swamp
Natural Community Type: Rich Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 193 acres
Location: Hartwick State Park
Element Occurrence Identification Number: 18779

Threats: Deer browse pressure is high and has limited cedar regeneration. Deer browse was noted on marsh marigold (*Caltha palustris*). Cut stumps occur throughout the swamp; however, the diameter of the cut stumps is equivalent to the size of the canopy trees.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the wetland to minimize the threat of hydrological alteration. Reducing local deer densities is also recommended.

Photo 94. Lewiston Grade Swamp rich conifer swamp. Photo by Joshua G. Cohen.

95. Wells Swamp
Natural Community Type: Rich Conifer Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 51 acres
Location: Wells State Park
Element Occurrence Identification Number: 18858

Threats: Deer browse pressure is high and likely limiting species composition and the swamp's vegetative structure. Numerous linear anthropogenic disturbances occur throughout the state park and swamp and provide conduits for weeds and deer. Glossy buckthorn (*Frangula alnus*) was noted within the rich conifer swamp.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to retain an intact buffer of natural communities surrounding the swamp to protect the hydrologic regime. Reducing local deer densities is also recommended. Control and monitoring of invasive species (i.e., glossy buckthorn) is recommended.

Photo 95. Wells Swamp rich conifer swamp. Photo by Joshua G. Cohen.

RICH TAMARACK SWAMP

Overview: Rich tamarack swamp is a groundwater-influenced, minerotrophic, forested wetland dominated by tamarack (*Larix laricina*) that occurs on deep organic soils predominantly south of the climatic tension zone in southern Lower Michigan. Rich tamarack swamp occurs in outwash channels, outwash plains, and kettle depressions. Rich tamarack swamp typically occurs in association with headwater streams and adjacent to inland lakes. The organic soils underlying rich tamarack swamp are typically comprised of deep peat containing large amounts of woody debris and occasionally layers of sedge-dominated peat. Windthrow, insect outbreak, beaver flooding, and fire are all important forms of natural disturbance for rich tamarack swamp (Kost et al. 2007).

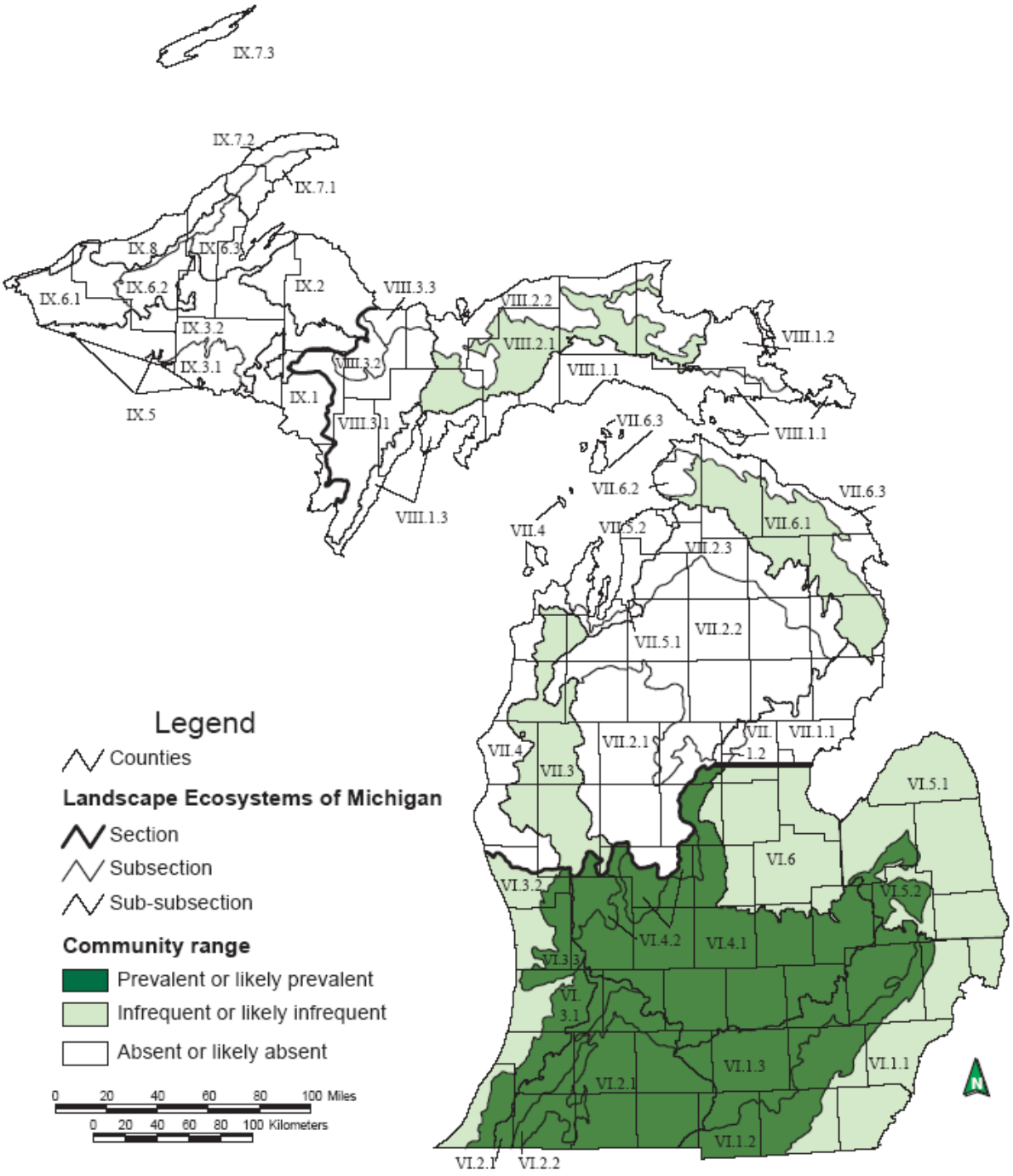

Figure 30. Distribution of rich tamarack swamp in Michigan.

96. Chenango Lake – Camp Talahi
Natural Community Type: Rich Tamarack Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 4.2 acres
Location: Brighton State Recreation Area
Element Occurrence Identification Number: 18704

Threats: The species composition, vegetative structure, and successional trajectory of the rich tamarack swamp are influenced by groundwater seepage, fire suppression, and invasive species. Fire suppression is beginning to lead to woody encroachment. Invasives are occasional to patchy and include glossy buckthorn (*Frangula alnus*), purple loosestrife (*Lythrum salicaria*), and bittersweet nightshade (*Solanum dulcamara*).

Management Recommendations: The primary management recommendation is to control invasive species and monitor the control efforts. Landscape fires should be allowed to burn the rich tamarack swamp and adjacent prairie fen. In addition, maintaining natural communities surrounding the rich tamarack swamp will buffer the wetland and help preserve its hydrology. Finally, pursuit of acquisition of adjacent private lands or discussion of compatible management with private landowners is recommended.

Photo 96. Chenango Lake – Camp Talahi rich tamarack swamp. Photo by Joshua G. Cohen.

97. Leeke Lake Swamp
Natural Community Type: Rich Tamarack Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 78 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 15947

Threats: Species composition, vegetative structure, and successional trajectory are influenced by fire suppression and invasive species. Fire suppression may be leading to woody encroachment and the increase in importance of red maple (*Acer rubrum*). Invasives documented in the rich tamarack swamp include glossy buckthorn (*Frangula alnus*), purple loosestrife (*Lythrum salicaria*), and Morrow honeysuckle (*Lonicera morrowii*).

Management Recommendations: The primary management recommendation is to control invasive species and monitor the control efforts. Landscape fires should be allowed to burn the rich tamarack swamp. In addition, maintaining natural communities surrounding the rich tamarack swamp will buffer the wetland and help preserve its hydrology.

Photo 97. Leeke Lake Swamp rich tamarack swamp. Photo by Steve A. Thomas.

98. Little Portage Lake Swamp
Natural Community Type: Rich Tamarack Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: B
Size: 57 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 15946

Threats: Species composition, vegetative structure, and successional trajectory are influenced by fire suppression and invasive species. Fire suppression may be leading to woody encroachment and the increase in importance of red maple (*Acer rubrum*). Invasives documented in the rich tamarack swamp include glossy buckthorn (*Frangula alnus*), reed (*Phragmites australis*), and reed canary grass (*Phalaris arundinacea*).

Management Recommendations: The primary management recommendation is to control invasive species and monitor the control efforts. Landscape fires should be allowed to burn the rich tamarack swamp. If red maple is limiting tamarack regeneration through shading, red maple could be cut or girdled. In addition, maintaining natural communities surrounding the rich tamarack swamp will buffer the wetland and help preserve its hydrology.

Photo 98. Little Portage Lake Swamp rich tamarack swamp. Photo by Steve A. Thomas.

99. M52 Tamarack Swamp
Natural Community Type: Rich Tamarack Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 156 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 7962

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater influence, fire suppression, and invasive species. Fire suppression may be leading to woody encroachment. Invasives documented in the rich tamarack swamp include reed canary grass (*Phalaris arundinacea*) and reed (*Phragmites australis*).

Management Recommendations: The primary management recommendation is to control invasive species and monitor the control efforts. Landscape fires should be allowed to burn the rich tamarack swamp. In addition, maintaining natural communities surrounding the rich tamarack swamp will buffer the wetland and help preserve its hydrology.

Photo 99. M52 Tamarack Swamp. Photo by Steve A. Thomas.

100. Riethmiller Road Tamarack Swamp
Natural Community Type: Rich Tamarack Swamp
Rank: G4 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 27 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17335

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage and fire suppression. No invasive species were noted during a brief survey.

Management Recommendations: Landscape fires should be allowed to burn the rich tamarack swamp. Monitoring should be implemented for invasive species, and, if found, invasive species should be controlled. In addition, maintaining natural communities surrounding the rich tamarack swamp will buffer the wetland and help preserve its hydrology.

Photo 100. Riethmiller Road Tamarack Swamp. Photo by John Fody.

SAND AND GRAVEL BEACH

Overview: Sand and gravel beaches occur along the shorelines of the Great Lakes and on some of Michigan's larger freshwater lakes, where wind, waves, and winter ice cause the shoreline to be too unstable to support aquatic vegetation. Because of the high levels of disturbance, these beaches are typically quite open, with sand and gravel sediments and little or no vegetation (Kost et al. 2007).

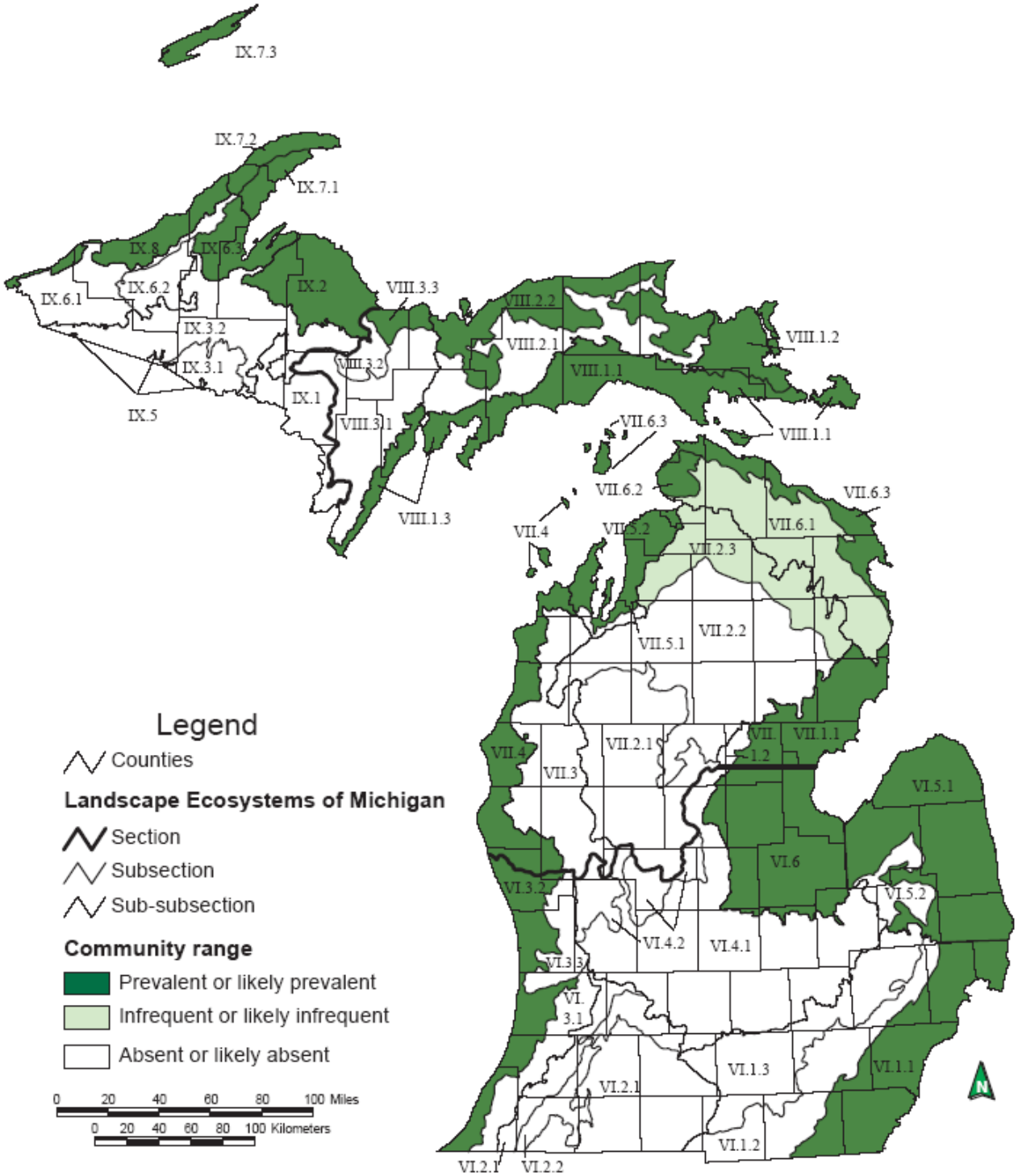

Figure 31. Distribution of sand and gravel beach in Michigan.

101. Porcupine Beach
Natural Community Type: Sand and Gravel Beach
Rank: G3? S3, vulnerable throughout range
Element Occurrence Rank: A
Size: 4.7 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18010

Threats: No anthropogenic disturbance or non-native species were noted during the course of the survey. Logging of the surrounding forests could increase the seed source for weedy species, which could be windblown or bird-dispersed onto the lakeshore.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a forested buffer surrounding the lakeshore to prevent the increase of a weedy seed source. Monitoring efforts to detect invasive species should be implemented. Preventing illegal off-road vehicle activity is a primary means of protecting the ecological integrity of sand and gravel beaches.

Photo 101. Porcupine Beach sand and gravel beach. Photo by Joshua G. Cohen.

SANDSTONE BEDROCK LAKESHORE

Overview: Sandstone bedrock lakeshore is a sparsely vegetated community that occurs along the Lake Superior shoreline in the central and western Upper Peninsula. Exposed sandstone bedrock is prominent, with lichens and mosses locally dominant, and scattered sedges, grasses, forbs, shrubs, and occasionally trees restricted to cracks, joints, and depressions in the bedrock (Kost et al. 2007).

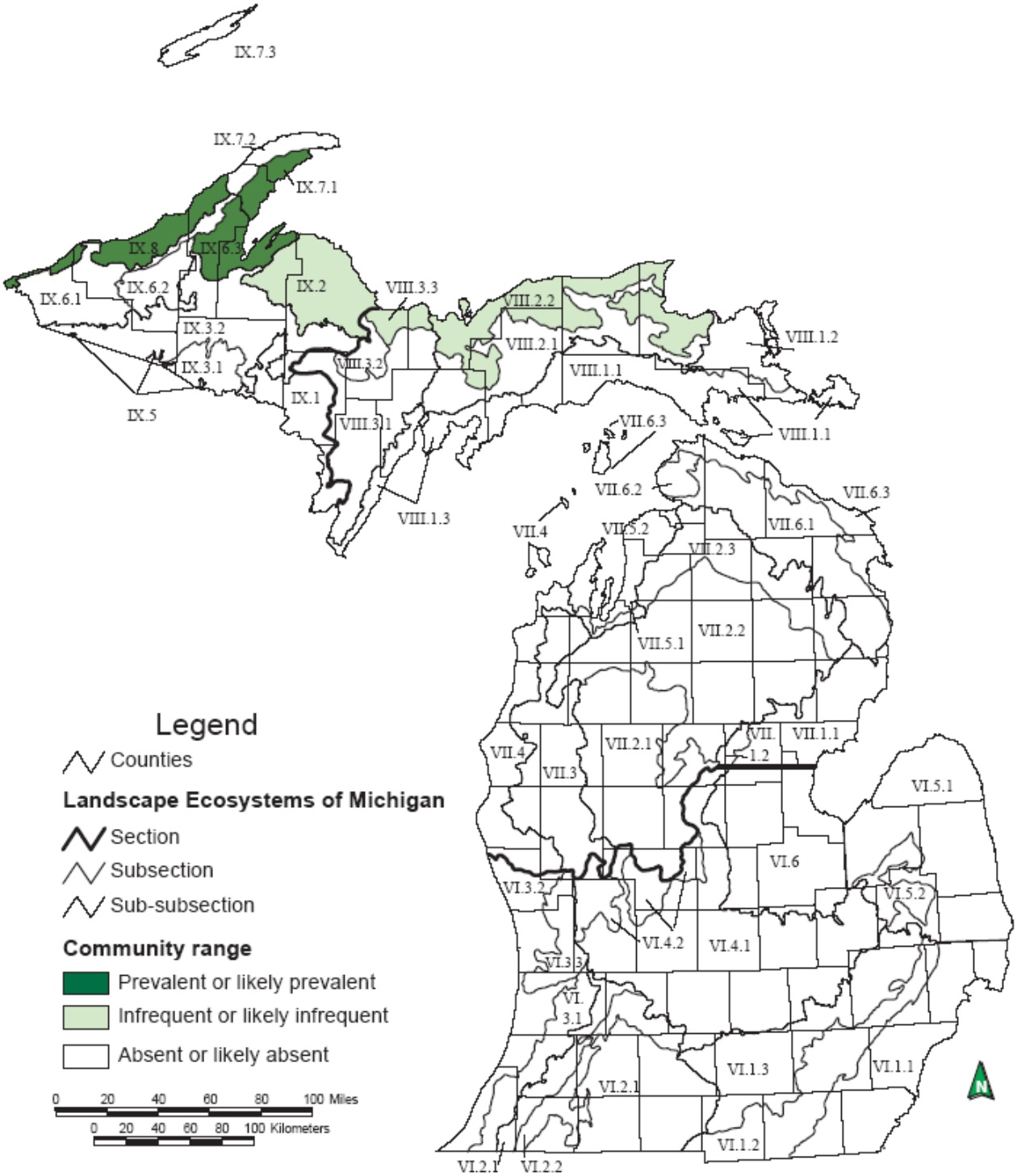

Figure 32. Distribution of sandstone bedrock lakeshore in Michigan.

102. Porcupine Shore
Natural Community Type: Sandstone Bedrock Lakeshore
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: A
Size: 179 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18014

Threats: Disperse foot traffic occurs along the shore, but is concentrated near campsites and where the hiking trails parallel the shoreline. No invasive species were noted during the surveys. Several weedy species occur in nearby areas of shoreline including St. John's-wort (*Hypericum perforatum*), ox-eye daisy (*Leucanthemum vulgare*), and lawn prunella (*Prunella vulgaris*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a forested buffer surrounding the lakeshore to prevent the increase of a weedy seed source. Current populations of non-native species in areas of nearby shoreline should be removed. Monitoring efforts to detect invasive species and evaluate control efforts should be implemented.

Photo 102. Porcupine Shore sandstone bedrock lakeshore. Photo by Joshua G. Cohen.

SANDSTONE CLIFF

Overview: Sandstone cliff consists of vertical or near-vertical exposures of bedrock with sparse coverage of vascular plants, lichens, mosses, and liverworts. The community occurs in the central and western Upper Peninsula, and locally in Eaton County in the southern Lower Peninsula (Kost et al. 2007).

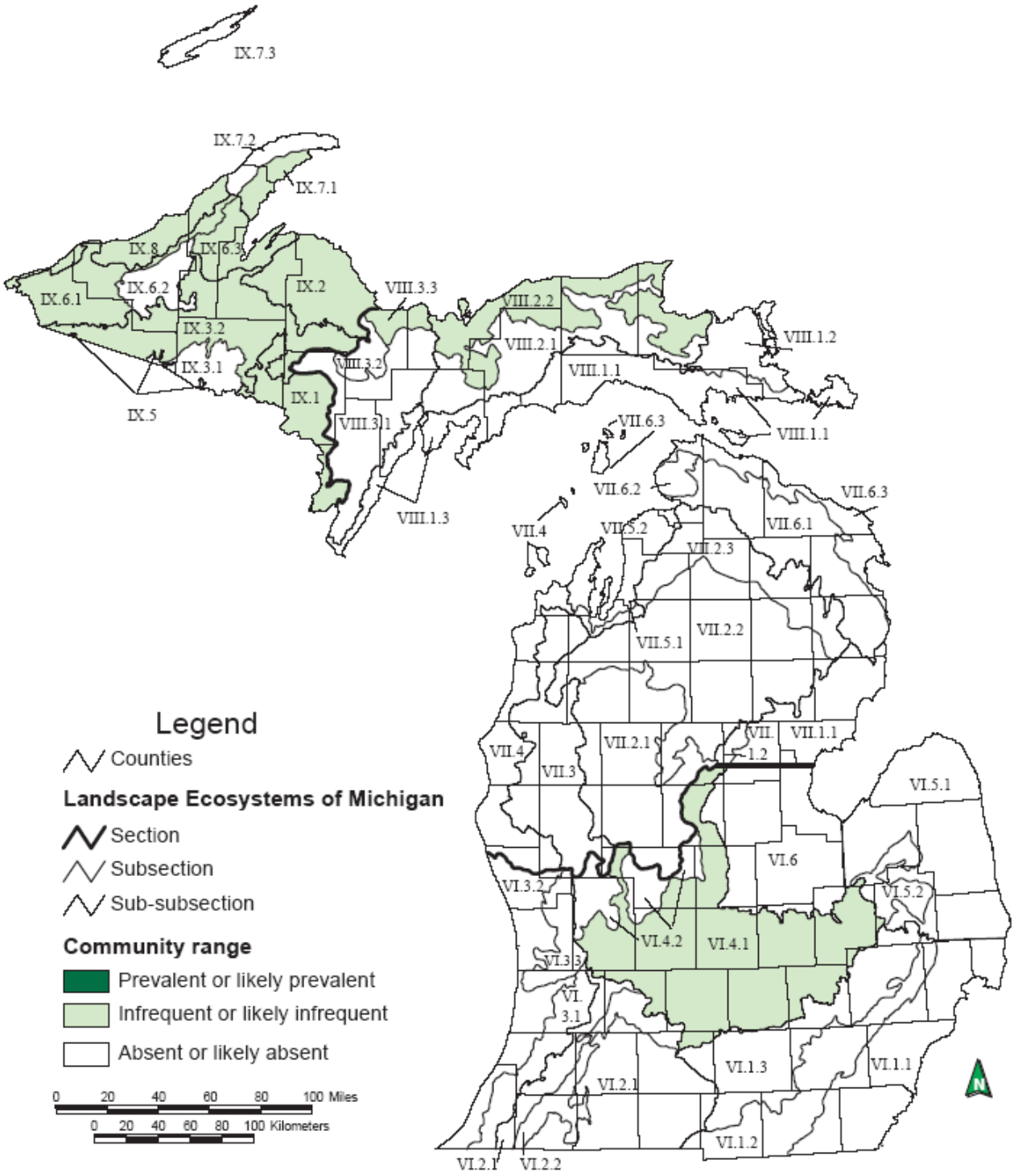

Figure 33. Distribution of sandstone cliff in Michigan.

103. Agate Falls
Natural Community Type: Sandstone Cliff
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: C
Size: 1.0 acres
Location: Agate Falls Scenic Site
Element Occurrence Identification Number: 17320

Threats: Disperse foot traffic associated with waterfall viewers has caused some erosion.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., erosion) to operate unhindered, monitor for non-native invasive species, maintain a forested buffer surrounding the site to limit the seed source for weedy species, and maintain signs to limit erosion from foot traffic.

Photo 103. Agate Falls sandstone cliff. Photo by Joshua G. Cohen.

104. Laughing Whitefish Falls
Natural Community Type: Sandstone Cliff
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: B
Size: 6.5 acres
Location: Laughing Whitefish Falls State Park
Element Occurrence Identification Number: 18812

Threats: The frequent disturbance of river flow creates a very weedy flora. No invasive species were documented during the course of the survey. Hiking trails occur along the river and occasional foot traffic impacts the bedrock along the river.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., erosion) to operate unhindered, maintain a forested buffer surrounding the cliff, and control and monitor invasives throughout the surrounding forest.

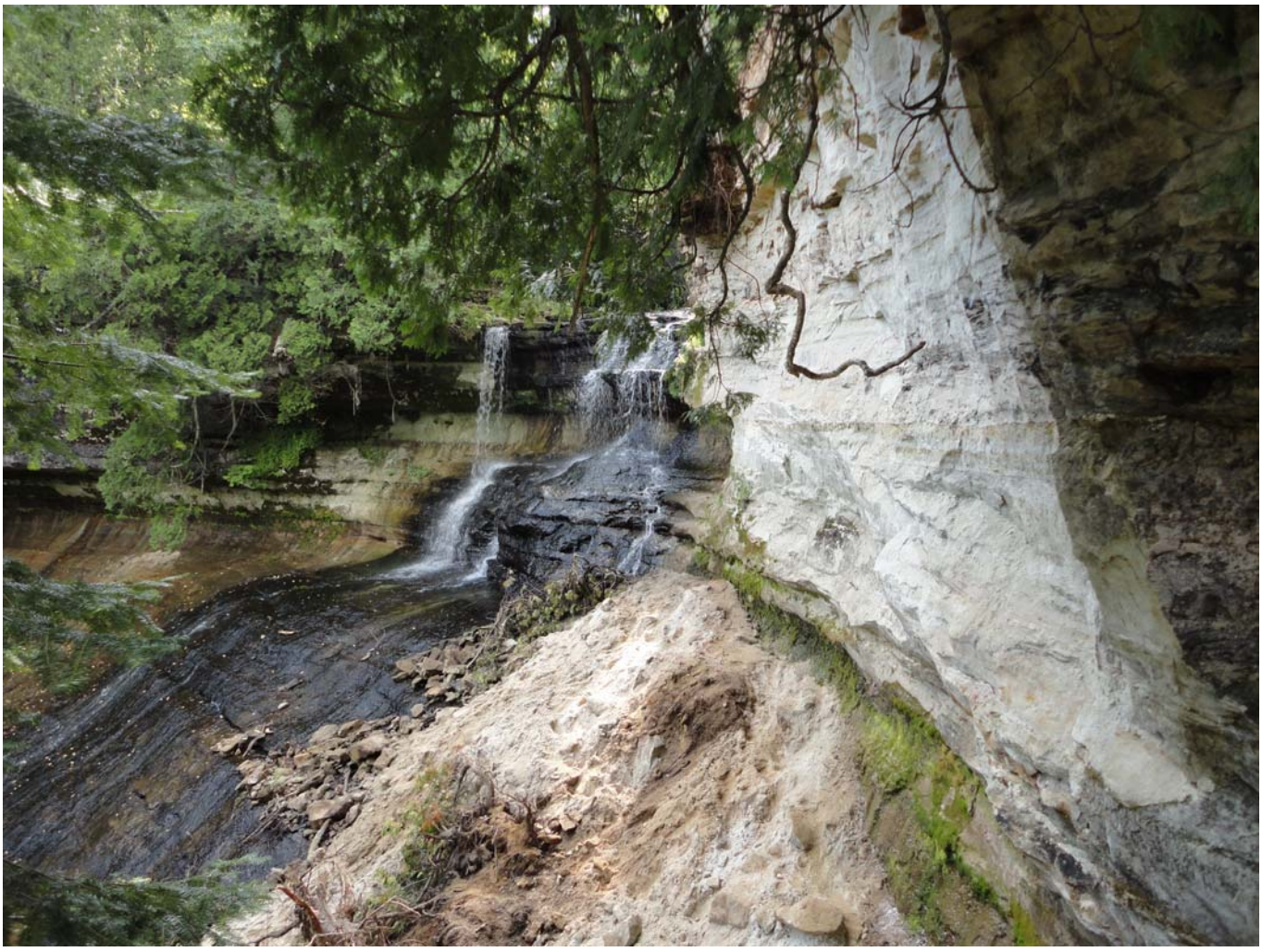

Photo 104. Laughing Whitefish Falls sandstone cliff. Photo by Joshua G. Cohen.

105. Presque Isle River
Natural Community Type: Sandstone Cliff
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: B
Size: 4.1 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18008

Threats: The frequent disturbance of river flow creates a very weedy flora. No invasive species were documented during the course of the survey. Hiking trails occur along the river and occasional foot traffic impacts the bedrock along the river.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., erosion) to operate unhindered, monitor for and control invasive non-native species, and maintain a forested buffer surrounding the site to limit the seed source for weedy species.

Photo 105. Presque Isle River sandstone cliff. Photo by Joshua G. Cohen.

106. Shining Cloud Falls
Natural Community Type: Sandstone Cliff
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 2.2 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18028

Threats: The frequent disturbance of river flow creates a very weedy flora. No invasive species were documented during the course of the survey. Hiking trails occur along the river and occasional foot traffic impacts the bedrock along the river.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., erosion) to operate unhindered, monitor for and control invasive non-native species, and maintain a forested buffer surrounding the site to limit the seed source for weedy species.

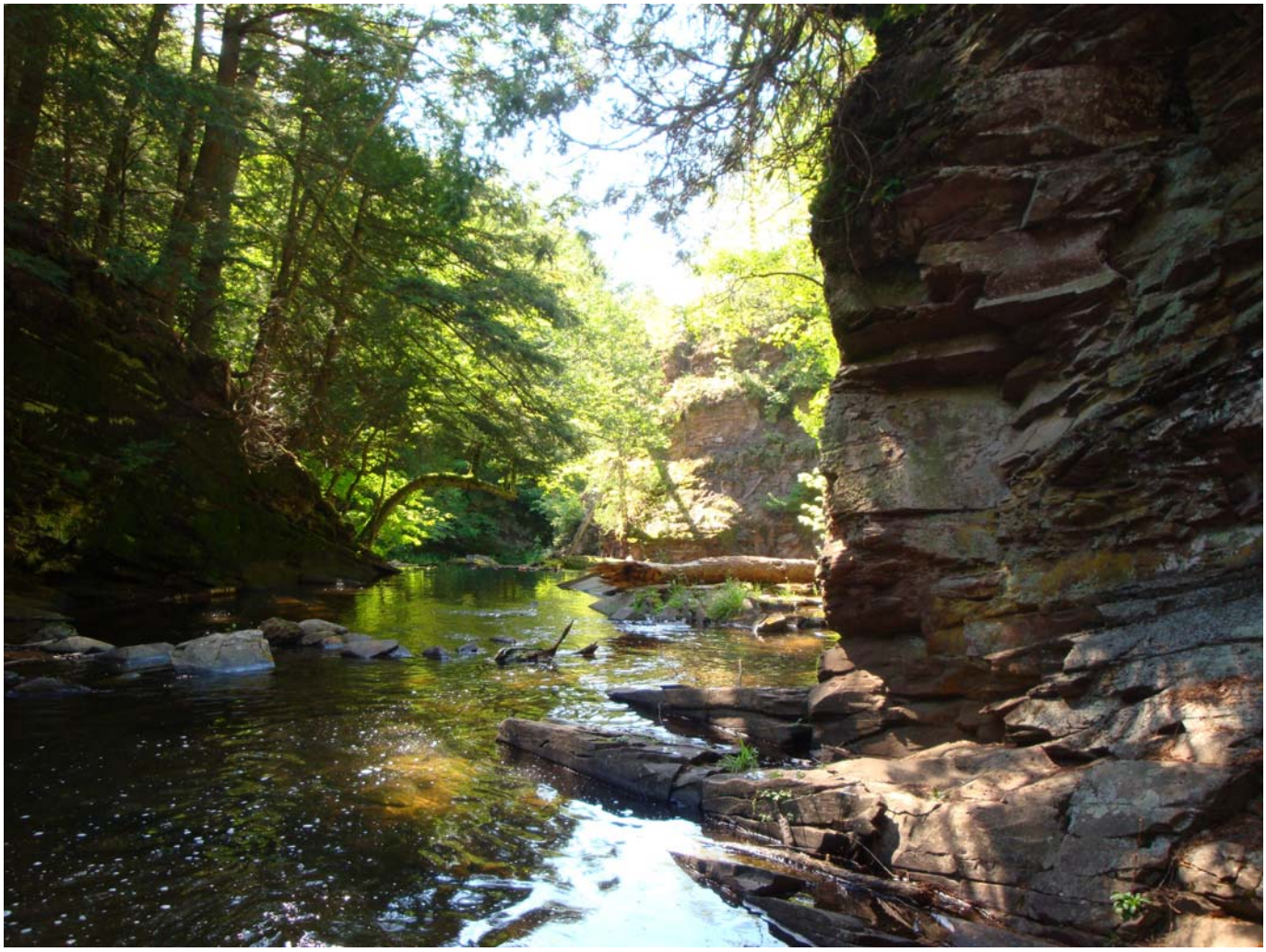

Photo 106. Shining Cloud Falls sandstone cliff. Photo by Joshua G. Cohen.

107. Tahquamenon Falls
Natural Community Type: Sandstone Cliff
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: B
Size: 1.6 acres
Location: Tahquamenon Falls State Park
Element Occurrence Identification Number: 17918

Threats: Paved trails and wooden viewing platforms occur above the cliffs along the north side of the river. A less frequented hiking trail occurs on the south side of the river. Hikers have pulled mosses and liverworts off of portions of the cliffs. Disperse foot traffic associated with waterfall viewers has caused some erosion.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., erosion) to operate unhindered, monitor for non-native invasive species, maintain a forested buffer surrounding the site to limit the seed source for weedy species, and maintain signs to limit erosion from foot traffic and educate hikers about the fragile nature of theses cliffs and their vegetation.

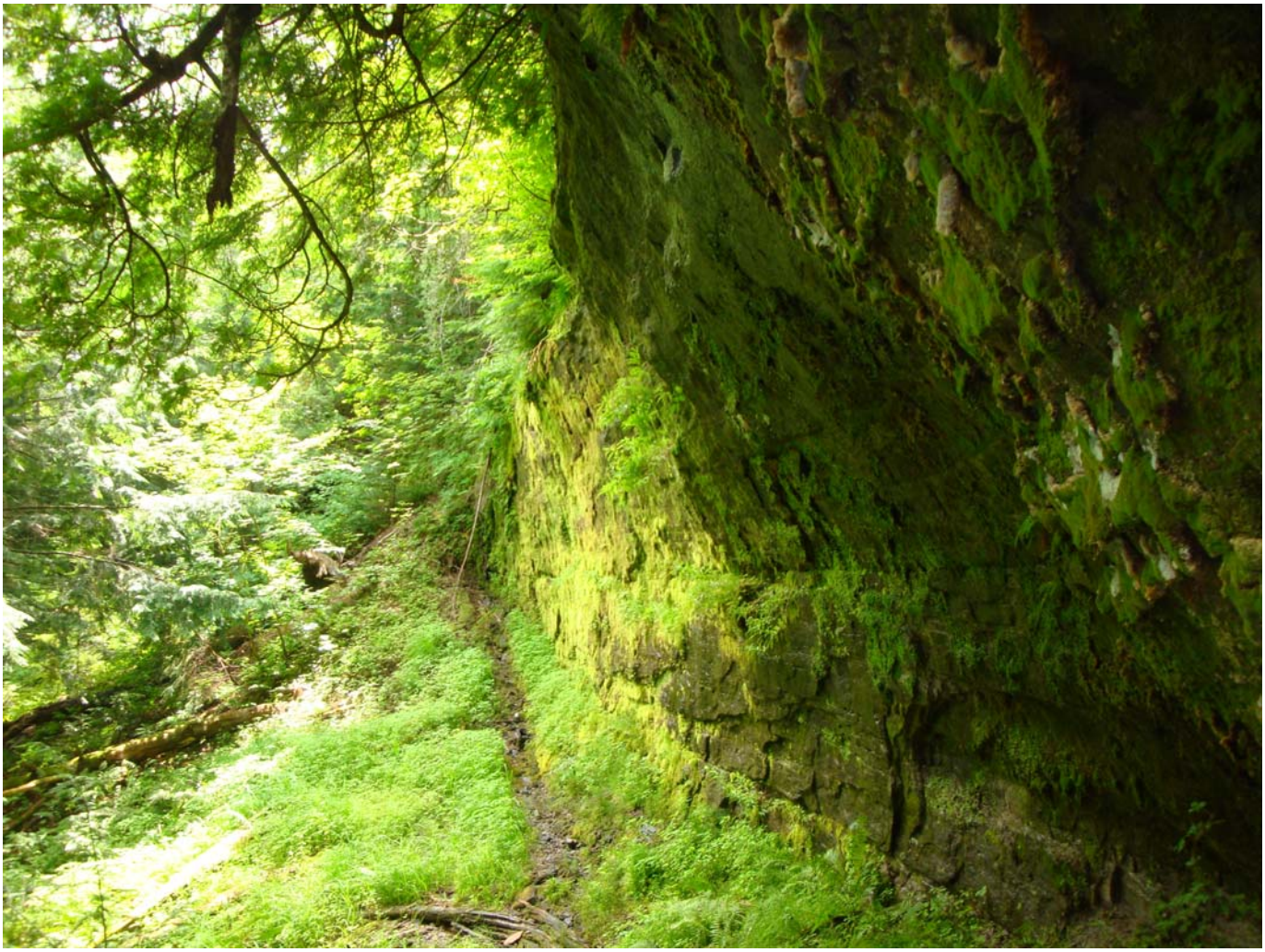

Photo 107. Tahquamenon Falls sandstone cliff. Photo by Joshua G. Cohen.

SANDSTONE COBBLE SHORE

Overview: Sandstone cobble shore is a sparsely vegetated community that occupies the edges of Lake Superior, predominantly occurring in coves and gently curving bays in association with bedrock cliff, bedrock outcrop, sandstone bedrock lakeshore, and sand and gravel beach. These cobble shores may be nearly level and support a diversity of herbaceous plants where they border sand and gravel beach or relatively steep and terraced in coves between bedrock outcrops, with vegetation mostly limited to the highest cobble beach ridge, where scattered trees and shrubs are dominant. Sandstone cobble shore is dominated by flat, round-sided sandstones that move readily when subject to intense wave action, limiting soil development and vegetation establishment (Kost et al. 2007).

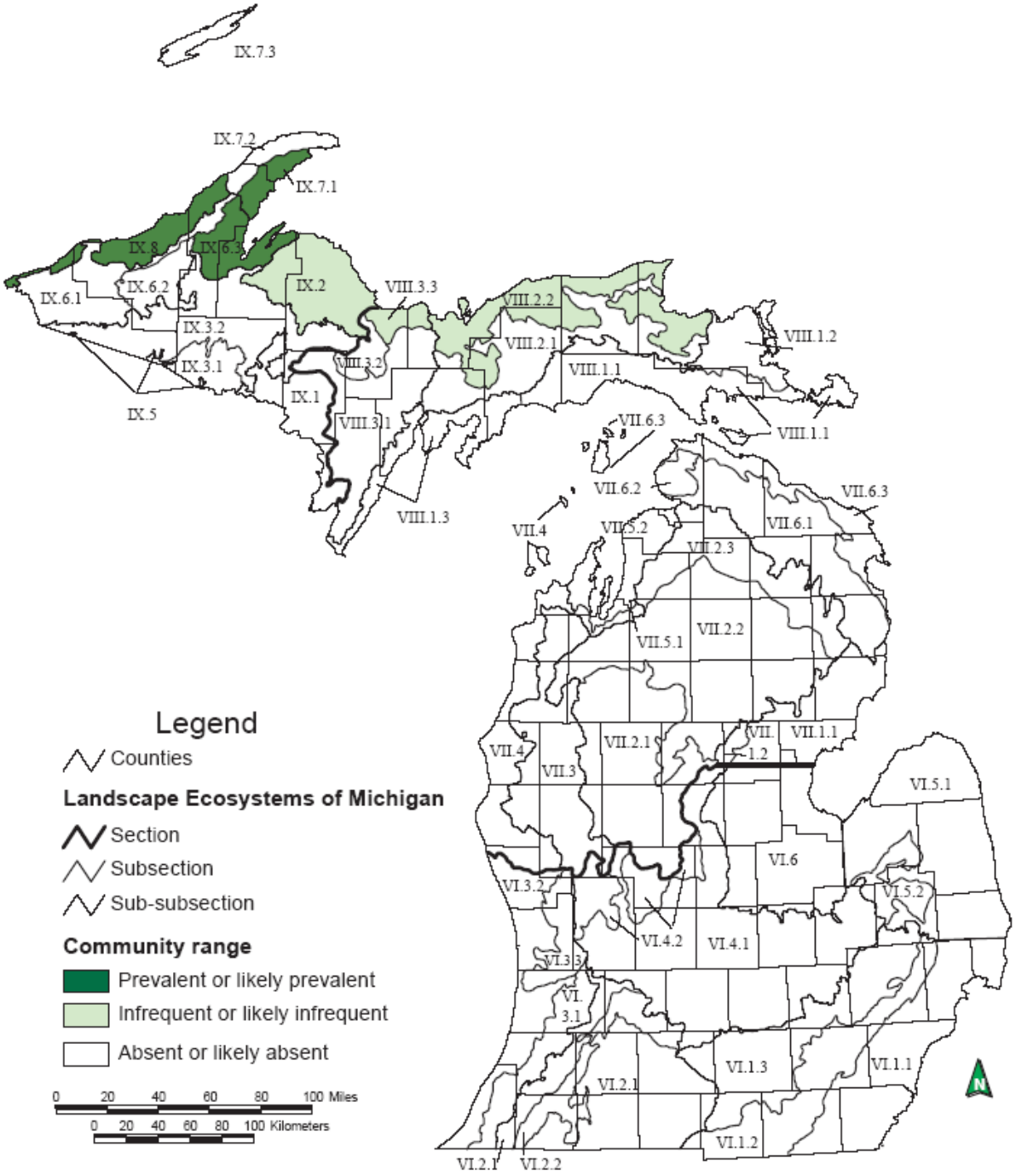

Figure 34. Distribution of sandstone cobble shore in Michigan.

108. Porcupine Shore
Natural Community Type: Sandstone Cobble Shore
Rank: G2G3 S3, imperiled to vulnerable globally and vulnerable within the state
Element Occurrence Rank: A
Size: 112 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18012

Threats: Disperse foot traffic occurs along the shore, but is concentrated near campsites and where the hiking trails parallel the shoreline. No invasive species were noted during the surveys. Several weedy species occur in nearby areas of shoreline including St. John's-wort (*Hypericum perforatum*), ox-eye daisy (*Leucanthemum vulgare*), lawn prunella (*Prunella vulgaris*), and bittersweet nightshade (*Solanum dulcamara*) (uncommon).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a forested buffer surrounding the lakeshore to prevent the increase of a weedy seed source. Current populations of non-native species in areas of nearby shoreline should be removed. Monitoring efforts to detect invasive species and evaluate control efforts should be implemented.

Photo 108. Porcupine Shore sandstone cobble shore. Photo by Joshua G. Cohen.

SINKHOLE

Overview: Sinkholes are depressions in the landscape caused by the dissolution and collapse of subsurface limestone, dolomite, or gypsum. The term *karst*, first applied to a plateau region of the Dinaric Alps in Yugoslavia, is now used to describe regions throughout the world that have features formed largely by underground drainage. Karst terrains are characterized by caves, steep valleys, sinkholes, and a general lack of surface streams. Sinkholes are found predominantly in the northeastern Lower Peninsula and eastern Upper Peninsula.

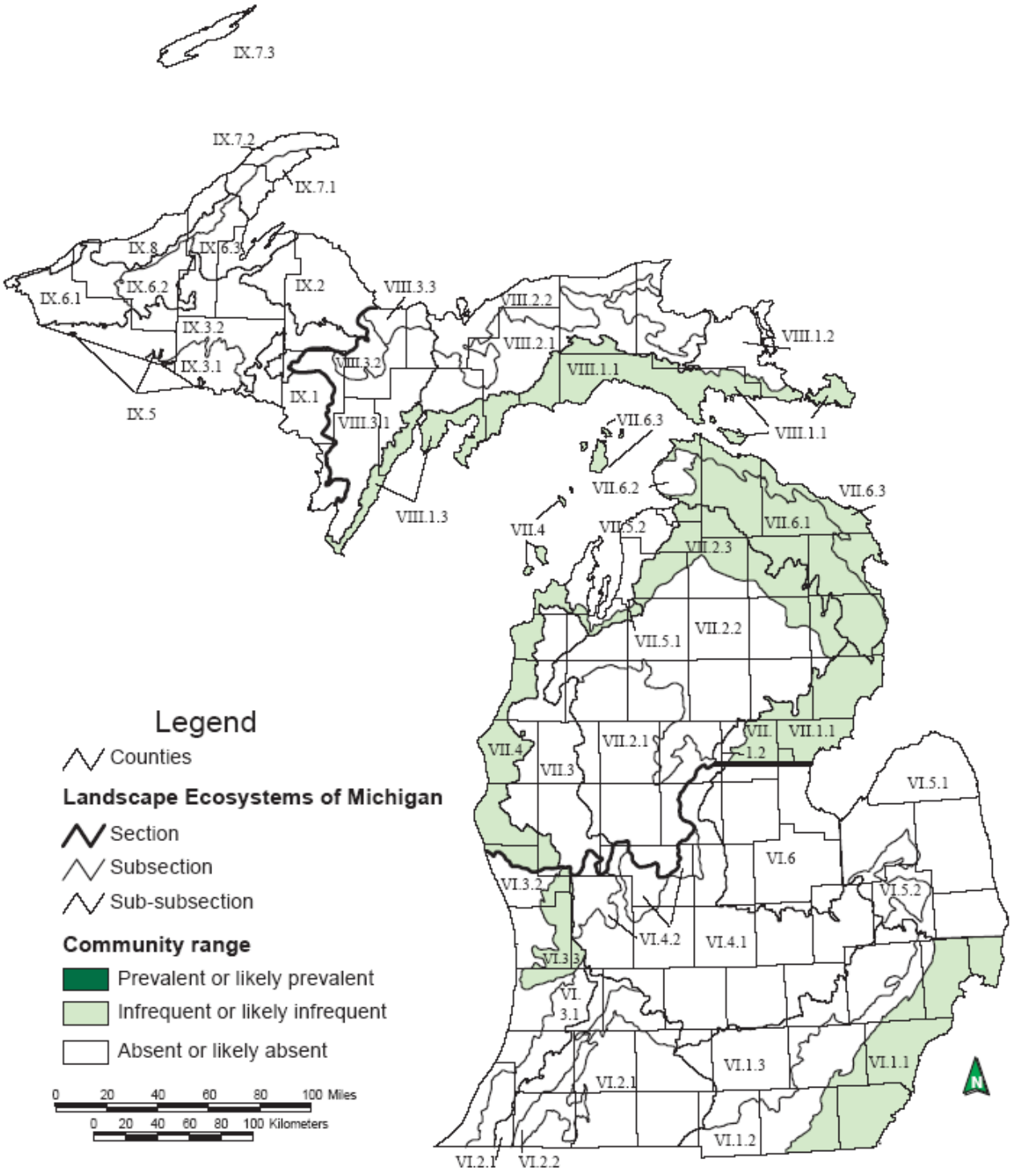

Figure 35. Distribution of sinkhole in Michigan.

109. Rockport Karst
Natural Community Type: Sinkhole
Rank: G3G5 S2, vulnerable to secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 46 acres
Location: Rockport State Recreation Area
Element Occurrence Identification Number: 8704

Threats: Timber management in the surrounding forests could alter the groundwater hydrology and coarse woody debris inputs to the sinkholes. Introduction of roads in the adjacent forests could increase the probability of non-native species spread to the sinkhole margins. Stocking of fish to the sinkholes could alter the aquatic composition.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., windthrow) to operate unhindered and to maintain a forested buffer surrounding the sinkholes to protect the groundwater quality, minimize surface water input and sedimentation, and prevent the increase of a non-native species in the surrounding landscape. Stocking the sinkholes with fish should be avoided.

Photo 109. Rockport Karst sinkhole. Photo by Joshua G. Cohen.

SOUTHERN HARDWOOD SWAMP

Overview: Southern hardwood swamp is a minerotrophic forested wetland occurring in southern Lower Michigan on mineral or occasionally organic soils dominated by a mixture of lowland hardwoods. Conifers are absent or local. The community occupies shallow depressions and high-order stream drainages on a variety of landforms. Southern hardwood swamp occurs in poorly drained depressions on glacial lakeplain, outwash plains and channels, end moraines, till plains, and perched dunes. Soils are typically loam or silt loam, sometimes sandy loam or clay loam, of neutral to mildly alkaline pH (sandy substrates are more acidic), and sometimes covered by a thin layer of muck. An underlying impermeable clay lens is often present and allows for prolonged pooling of water. Water levels fluctuate seasonally, with standing water typically occurring throughout winter and spring. Due to anaerobic conditions associated with prolonged inundation and a high water table, trees are shallowly rooted and prone to frequent blowdown. The canopy is typically dominated by silver maple (*Acer saccharinum*), red maple (*A. rubrum*), green ash (*Fraxinus pennsylvanica*), and black ash (*F. nigra*) (Kost et al. 2007).

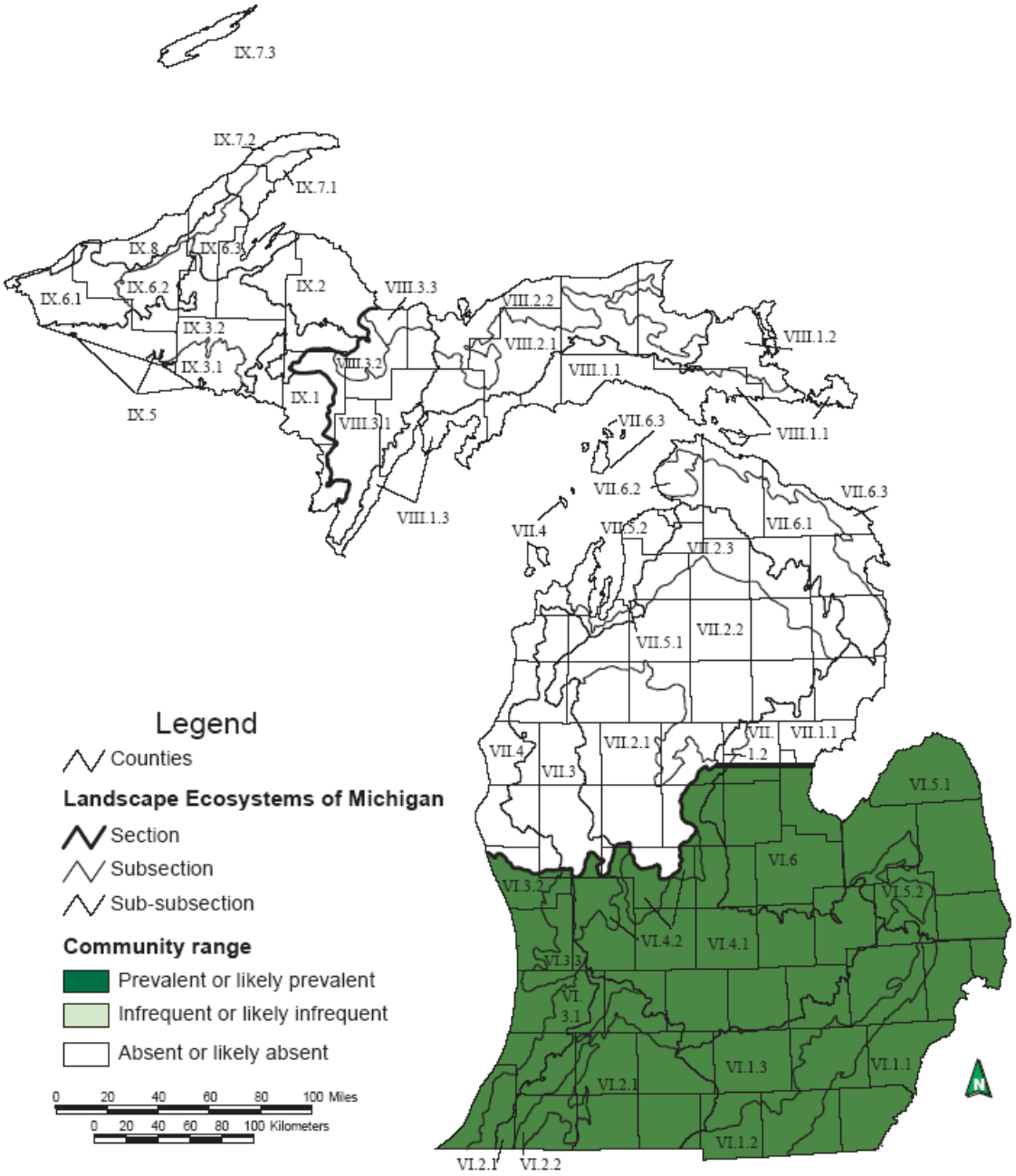

Figure 36. Distribution of southern hardwood swamp in Michigan.

110. Tophith Road Oak Swamp
Natural Community Type: Southern Hardwood Swamp
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: BC
Size: 20 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17498

Threats: Invasive species have impacted the species composition and vegetative structure of the swamp. Emerald ash borer (*Agrilus planipennis*) has caused the death of canopy green ash (*Fraxinus pennsylvanica*). Invasive plant species noted within the swamp include reed canary grass (*Phalaris arundinacea*), reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and Morrow honeysuckle (*Lonicera morrowii*). Fire suppression may have altered species composition in the swamp.

Management Recommendations: The main management recommendation is to control invasive species. Landscape fires should be allowed to burn the southern hardwood swamp and adjacent wetlands and uplands. Monitoring should be implemented to evaluate efforts to control non-native plant populations and the impacts of prescribed fire.

Photo 110. Tophith Road Oak Swamp southern hardwood swamp. Photo by Steve A. Thomas.

111. Waterloo-Munith Road Oak Swamp
Natural Community Type: Southern Hardwood Swamp
Rank: G3 S3, vulnerable throughout range
Element Occurrence Rank: BC
Size: 8.3 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17522

Threats: Invasive species have impacted the species composition and vegetative structure of the swamp. Invasive species noted within the swamp include reed canary grass (*Phalaris arundinacea*), barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), bittersweet nightshade (*Solanum dulcamara*), hybrid cattail (*Typha* x*glauca*), and common buckthorn (*Rhamnus cathartica*). Fire suppression may have altered species composition in the swamp.

Management Recommendations: The main management recommendation is to control invasive species. Landscape fires should be allowed to burn the southern hardwood swamp and adjacent wetlands and uplands. Monitoring should be implemented to evaluate efforts to control non-native plant populations and the impacts of prescribed fire.

Photo 111. Waterloo-Munith Road Oak Swamp southern hardwood swamp. Photo by Steve A. Thomas.

SOUTHERN WET MEADOW

Overview: Southern wet meadow is an open, groundwater-influenced (minerotrophic), sedge-dominated wetland that occurs in central and southern Lower Michigan. Southern wet meadow occurs on glacial lakebeds, lakeplains, and in depressions on glacial outwash and moraines. The community frequently occurs along the margins of lakes and streams, where seasonal flooding or beaver-induced flooding is common. Soils are typically neutral to strongly alkaline organic soils (i.e., sapric to hemic peat), but saturated mineral soil may also support the community. Open conditions are maintained by seasonal flooding, beaver-induced flooding, and fire. Sedges in the genus *Carex*, in particular tussock sedge (*Carex stricta*), dominate the community (Kost et al. 2007).

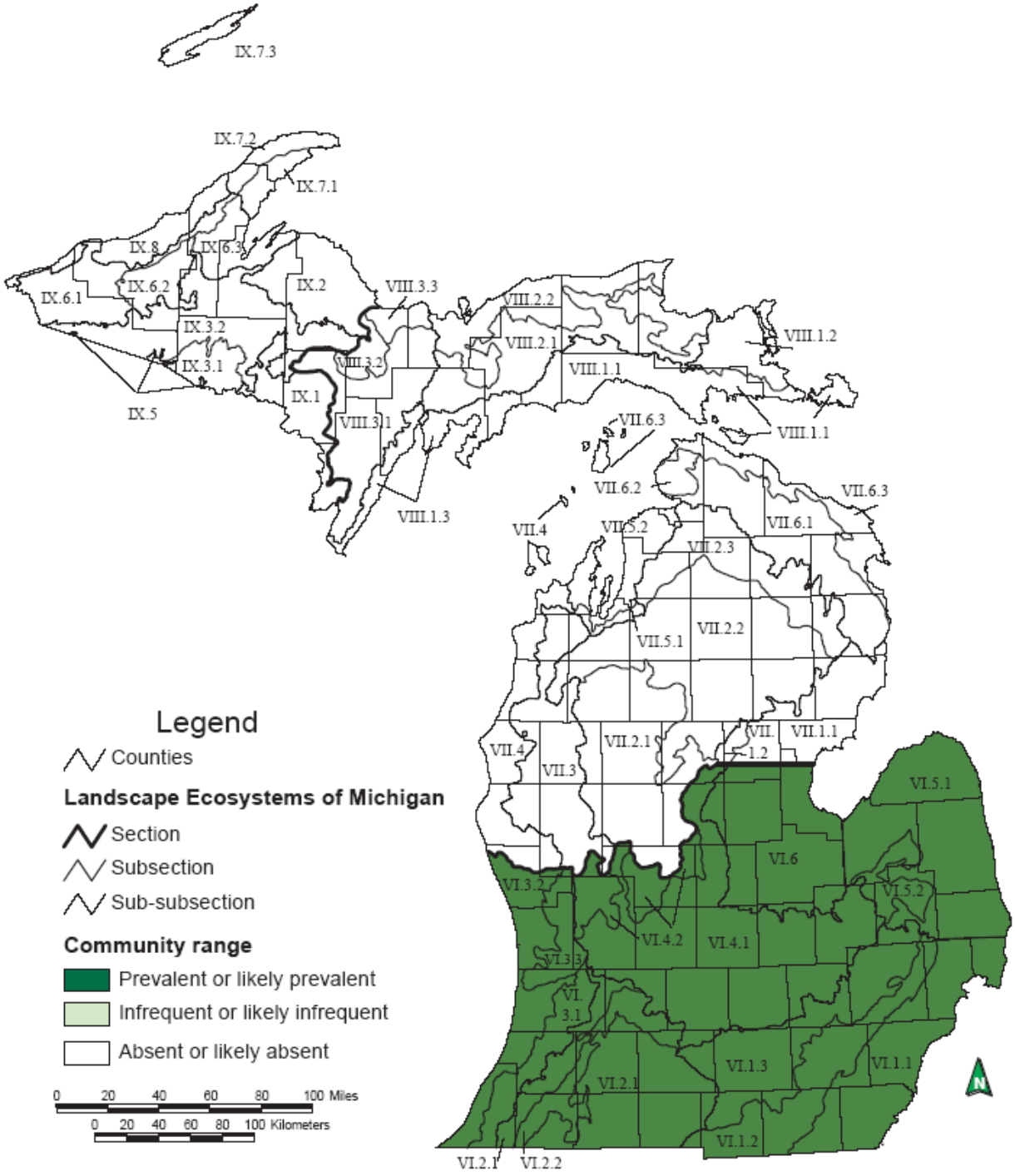

Figure 37. Distribution of southern wet meadow in Michigan.

112. North Waterloo Wet Meadow
Natural Community Type: Southern Wet Meadow
Rank: G4? S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 39 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17525

Threats: Species composition, vegetative structure, and successional trajectory are influenced by hydrologic fluctuation, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment. Invasive species are currently very sparse and include glossy buckthorn (*Frangula alnus*) and reed canary grass (*Phalaris arundinacea*)

Management Recommendations: Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Landscape fires should be allowed to burn the southern wet meadow and adjacent wetlands and uplands. Cutting and herbiciding of glossy buckthorn could also be considered to complement the use of prescribed fire. Monitoring should be employed to allow for assessment of whether management is reducing invasive species populations. In addition, maintaining natural communities surrounding the southern wet meadow will buffer the wetland and help preserve its hydrology.

Photo 112. North Waterloo Wet Meadow. Photo by Steve A. Thomas.

113. Riethmiller Road Wet Meadow
Natural Community Type: Southern Wet Meadow
Rank: G4? S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: BC
Size: 82 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17534

Threats: Species composition, vegetative structure, and successional trajectory are influenced by hydrologic fluctuation, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment. Purple loosestrife (*Lythrum salicaria*) was observed in the meadow but is not currently dense.

Management Recommendations: Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Landscape fires should be allowed to burn the southern wet meadow and adjacent wetlands and uplands. Monitoring should be employed to allow for assessment of whether management is reducing invasive species populations. In addition, maintaining natural communities surrounding the southern wet meadow will buffer the wetland and help preserve its hydrology.

Photo 113. Riethmiller Road Wet Meadow. Photo by John Fody.

SUBMERGENT MARSH

Overview: Submergent marsh is an herbaceous plant community that occurs in deep to sometimes shallow water in lakes and streams throughout Michigan. Soils are characterized by loosely consolidated organics of variable depth that range from acid to alkaline and accumulate over all types of mineral soil, even bedrock. Submergent vegetation is composed of both rooted and non-rooted submergent plants, rooted floating-leaved plants, and non-rooted floating plants. Common submergent plants include common waterweed (*Elodea canadensis*), water star-grass (*Heteranthera dubia*), milfoils (*Myriophyllum* spp.), naiads (*Najas* spp.), pondweeds (*Potamogeton* spp.), stoneworts (*Chara* spp. and *Nitella* spp.), coontail (*Ceratophyllum demersum*), bladderworts (*Utricularia* spp.), and water-celery (*Vallisneria americana*) (Kost et al. 2007).

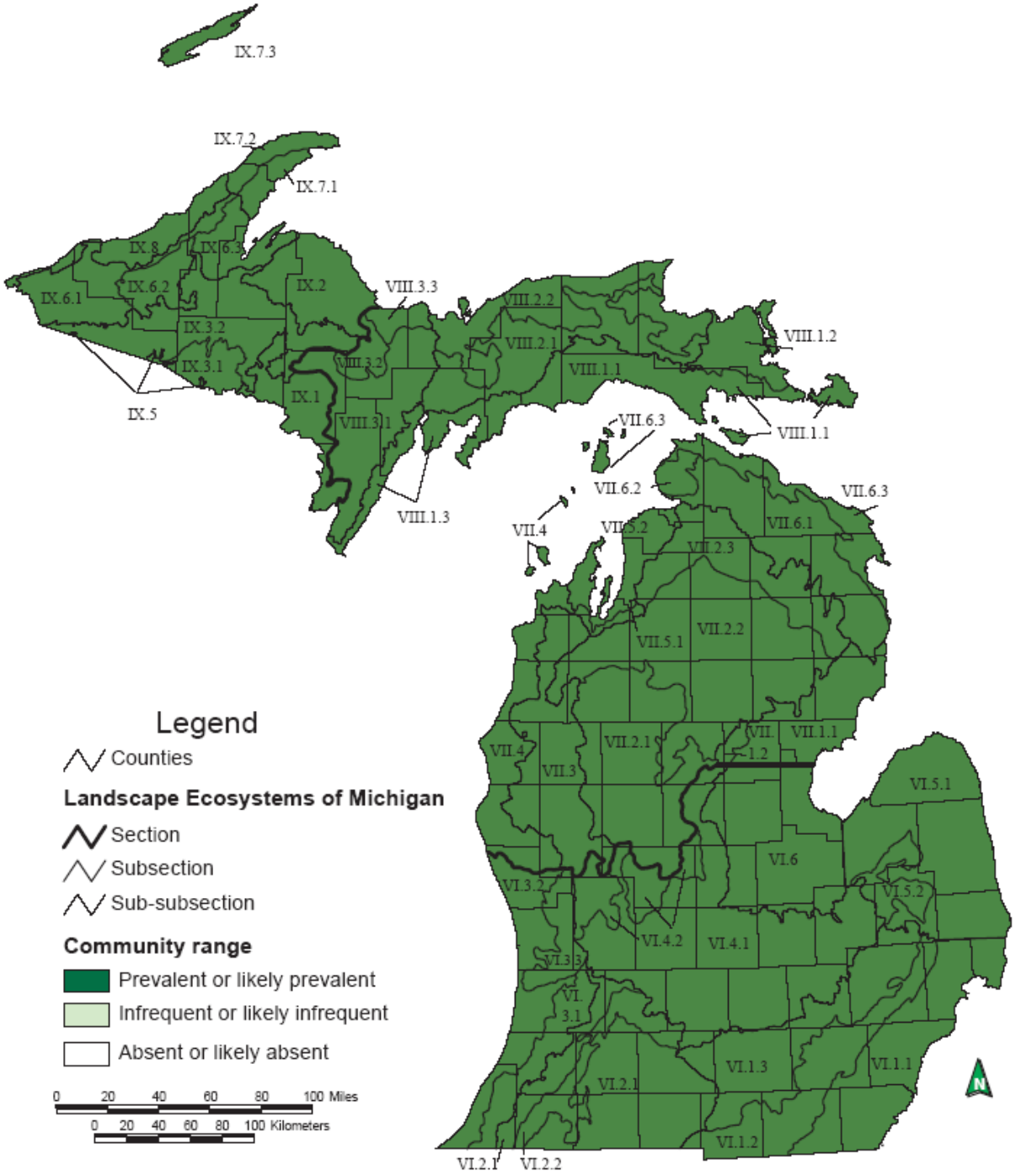

Figure 38. Distribution of submergent marsh in Michigan.

114. Carp River and Lake of the Clouds
Natural Community Type: Submergent Marsh
Rank: GU S4, globally unrankable and secure within the state
Element Occurrence Rank: A
Size: 26 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 17934

Threats: No threats were noted during the course of the survey.

Management Recommendations: The primary management recommendation is to allow natural processes to operate unhindered and to maintain a forested buffer surrounding the wetlands associated with the Lake of the Clouds and the Carp River to protect the hydrologic regime.

Photo 114. Carp River and Lake of the Clouds submergent marsh. Photo by Joshua G. Cohen.

VOLCANIC BEDROCK GLADE

Overview: Volcanic bedrock glade consists of an open forested or savanna community found where basaltic bedrock and conglomerates are exposed. The sparse vegetation consists of scattered open-grown trees, scattered shrubs or shrub thickets, and a partial turf of herbs, grasses, sedges, mosses, and lichens. The community occurs in the western Upper Peninsula on Isle Royale and the Keweenaw Peninsula, extending southwest into Houghton, Ontonagon, and Gogebic Counties (Kost et al. 2007).

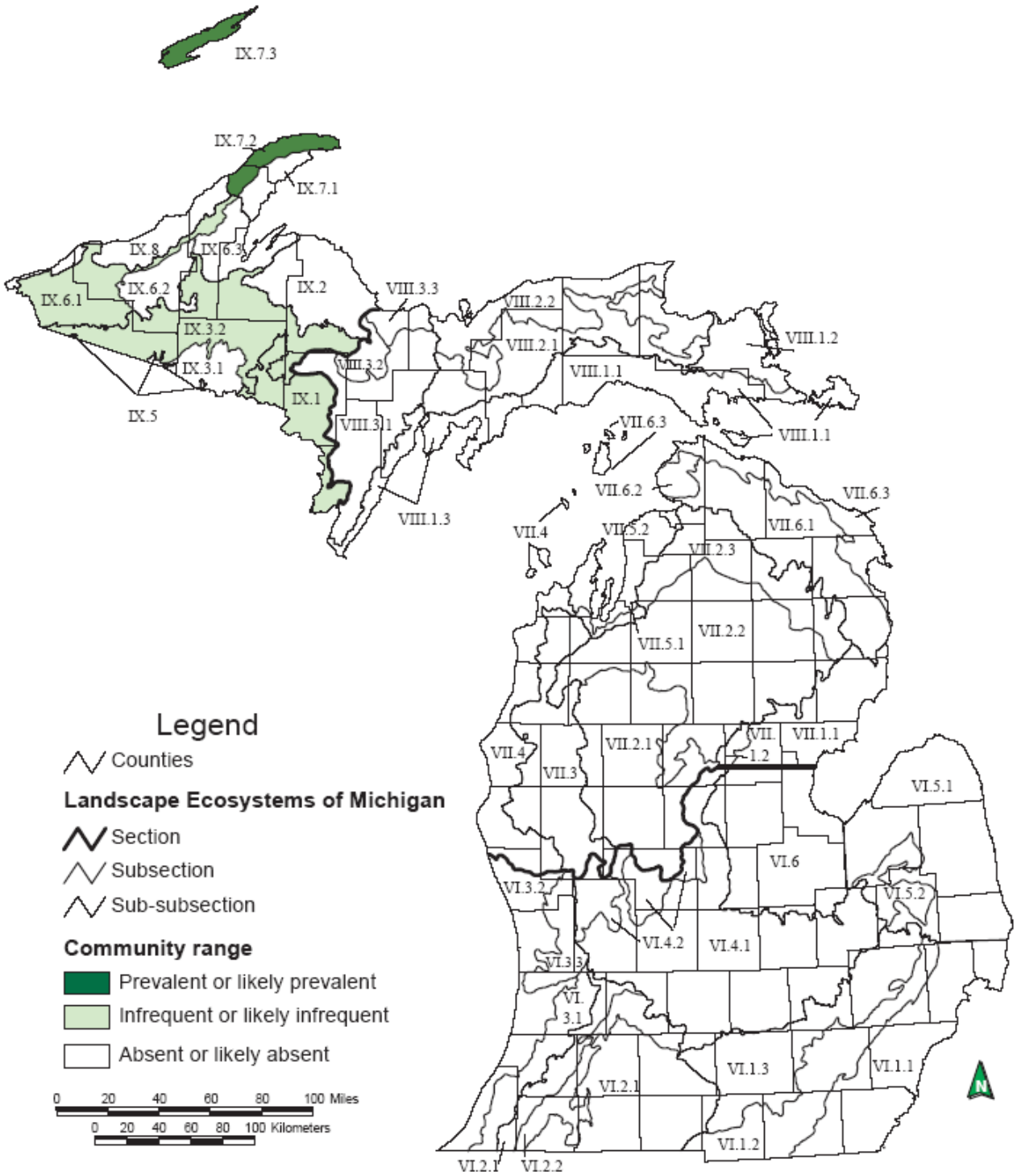

Figure 39. Distribution of volcanic bedrock glade in Michigan.

115. Bond Falls
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S3, globally unrankable and vulnerable within the state
Element Occurrence Rank: C
Size: 0.4 acres
Location: Bond Falls Scenic Site
Element Occurrence Identification Number: 17318

Threats: Numerous non-native species were noted within the glade including hawkweeds (*Hieracium* spp.), St. John's-wort (*Hypericum perforatum*), timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), and hemp nettle (*Galeopsis tetrahit*). Logging of the surrounding forests could increase the seed source for weedy species, which could be windblown or bird-dispersed onto the glades.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn), to control non-native species and monitor control efforts, and to maintain a forested buffer surrounding the glade to prevent the increase of a weedy seed source.

Photo 115. Bond Falls volcanic bedrock glade. Photo by Joshua G. Cohen.

116. Green Mountain Glade
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S3, globally unrankable and vulnerable within the state
Element Occurrence Rank: AB
Size: 2.9 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18003

Threats: Ox-eye daisy (*Leucanthemum vulgare*) was noted within this glade. Logging of the surrounding forests could increase the seed source for weedy species, which could be windblown or bird-dispersed onto the glades. Deer pellets were noted throughout the glade. Deer browsing could impact species composition and structure.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn), to control non-native plants, and to maintain a forested buffer surrounding the glade to prevent the increase of a weedy seed source. In addition, monitoring could be implemented to evaluate the impacts of deer browsing on vegetative composition and structure.

Photo 116. Green Mountain Glade. Photo by Joshua G. Cohen

117. Porcupine Mountains Glades
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S3, globally unrankable and vulnerable within the state
Element Occurrence Rank: B
Size: 193 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18004

Threats: Numerous non-native species were noted within the glade including timothy (*Phleum pratense*), lawn prunella (*Prunella vulgaris*), wild carrot (*Daucus carota*), and common mullein (*Verbascum thapsus*). Logging of the surrounding forests could increase the seed source for weedy species, which could be windblown or bird-dispersed onto the glades. Deer browsed woody stems are common within some of the glade openings. In addition, scattered cut stumps occur in several of the glade polygons.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn), to control non-native plants, and to maintain a forested buffer surrounding the glade to prevent the increase of a weedy seed source. In addition, monitoring could be implemented to evaluate the impacts of deer browsing on vegetative composition and structure.

Photo 117. Porcupine Mountains Glades. Photo by Joshua G. Cohen

118. Sand Portage Falls
Natural Community Type: Volcanic Bedrock Glade
Rank: GU S3, globally unrankable and vulnerable within the state
Element Occurrence Rank: B
Size: 29 acres
Location: Menominee River State Recreation Area
Element Occurrence Identification Number: 12704

Threats: Numerous non-native species were noted within the glade including spotted knapweed (*Centaurea stoebe*), hawkweeds (*Hieracium* spp.), St. John's-wort (*Hypericum perforatum*), Tartarian honeysuckle (*Lonicera tatarica*), and reed canary grass (*Phalaris arundinacea*). Overall the site is very weedy, likely due to the frequent disturbance from river water and foot traffic. Logging of the surrounding forests could increase the seed source for weedy species, which could be windblown or bird-dispersed onto the glades. Large numbers of deer utilize this area during the winter months and deer browse of understory and ground cover species is likely prevalent.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn), control non-native plants and monitor control efforts, consider reducing local deer densities, and maintain a buffer of natural communities surrounding the glade to prevent the increase of a weedy seed source. In addition, monitoring could be implemented to evaluate the impacts of deer browsing on vegetative composition and structure.

Photo 118. Sand Portage Falls volcanic bedrock glade. Photo by Joshua G. Cohen

VOLCANIC BEDROCK LAKESHORE

Overview: Volcanic bedrock lakeshore is a sparsely vegetated community dominated by mosses and lichens, with a scattered coverage of vascular plants. The community is located primarily along the Lake Superior shoreline on the Keweenaw Peninsula and Isle Royale. This Great Lakes coastal community includes all types of volcanic bedrock, including basalt, conglomerate composed of volcanic rock, and rhyolite (Kost et al. 2007).

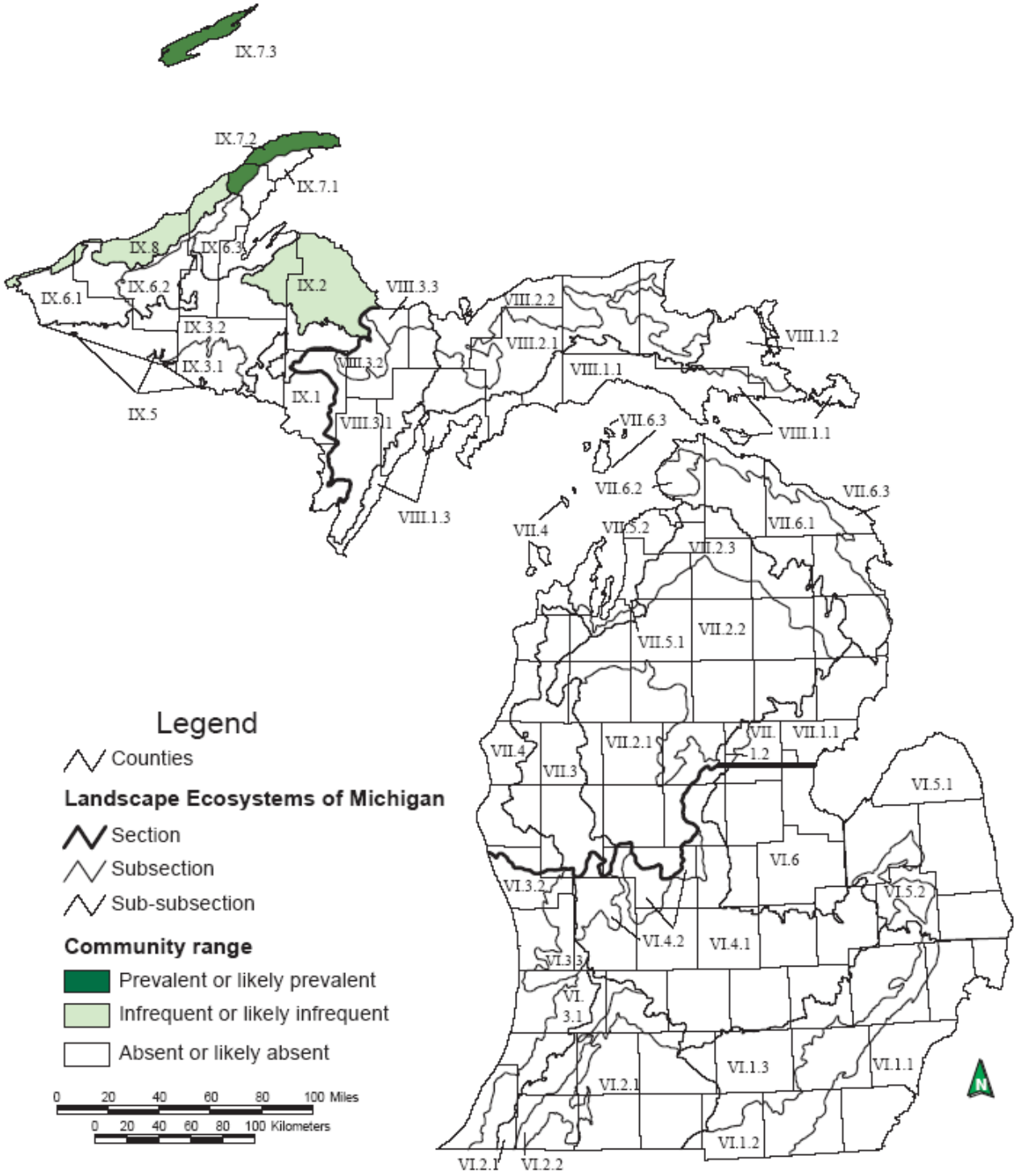

Figure 40. Distribution of volcanic bedrock lakeshore in Michigan.

119. Porcupine Shore
Natural Community Type: Volcanic Bedrock Lakeshore
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: A
Size: 56 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18013

Threats: The species composition and vegetative structure of the volcanic bedrock lakeshore are determined by natural processes. Disperse foot traffic occurs along the shore, but is concentrated near campsites and where the hiking trails run parallel to the shoreline. No invasive species were noted during the surveys but several weedy species occur in nearby areas of shoreline including St. John's-wort (*Hypericum perforatum*), ox-eye daisy (*Leucanthemum vulgare*), and lawn prunella (*Prunella vulgaris*).

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a forested buffer surrounding the lakeshore to prevent the increase of a weedy seed source. Current populations of non-native species in areas of nearby shoreline should be removed. Monitoring efforts to detect invasive species and evaluate control efforts should be implemented.

Photo 119. Porcupine Shore volcanic bedrock lakeshore. Photo by Joshua G. Cohen.

VOLCANIC CLIFF

Overview: Volcanic cliffs consist of vertical or near-vertical exposures of bedrock, which support less than 25% vascular plant coverage, although lichens, mosses, and liverworts are abundant on some rock surfaces. The cliffs can be as high as 80 m (260 ft) and occur on inland exposures of the resistant Middle Keweenawan volcanic rock, which runs from the north tip of the Keweenaw Peninsula south into Wisconsin and also along the entire length of Isle Royale (Kost et al. 2007).

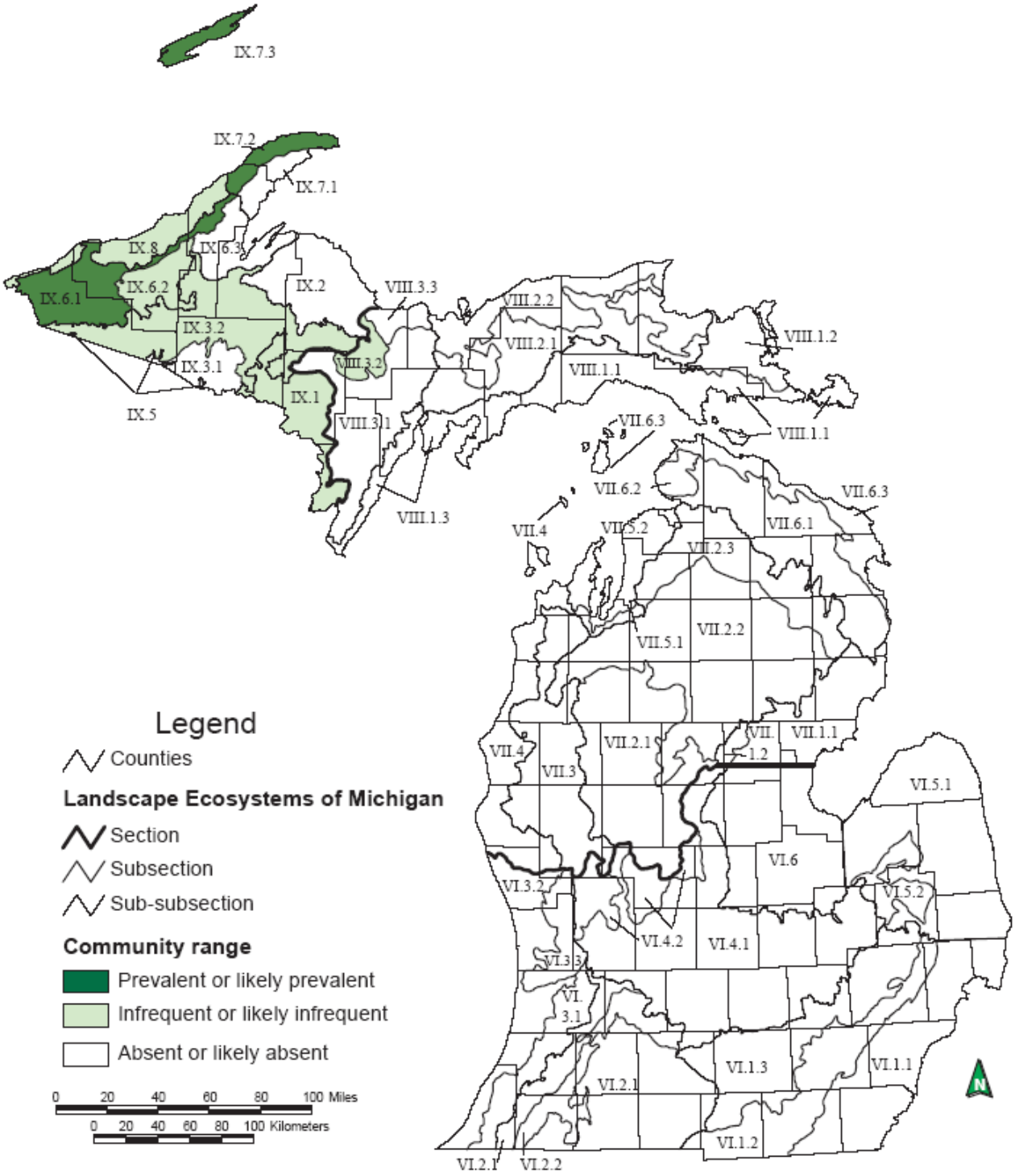

Figure 41. Distribution of volcanic cliff in Michigan.

120. Bond Falls
Natural Community Type: Volcanic Cliff
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: BC
Size: 0.6 acres
Location: Bond Falls Scenic Site
Element Occurrence Identification Number: 17319

Threats: Disperse foot traffic associated with waterfall viewers has caused some erosion.

Management Recommendations: The main management recommendations are to allow natural processes (i.e., erosion) to operate unhindered, to monitor for non-native invasive species, and to maintain a forested buffer surrounding the site to limit the seed source for weedy species.

Photo 120. Bond Falls volcanic cliff. Photo by Joshua G. Cohen.

121. Escarpment Trail Cliffs
Natural Community Type: Volcanic Cliff
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: A
Size: 92 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18000

Threats: A popular hiking trail (Escarpment Trail) passes along the escarpment and through significant portions of northern bald on top of the volcanic cliff causing localized erosion especially near overlooks above the volcanic cliff. Invasive species are locally common along the hiking trail and on unsanctioned feeder trails, as well as occurring sporadically throughout the northern bald and surrounding volcanic bedrock glade. In addition to spreading along the hiking trail, many of these species have spread throughout the bald and surrounding volcanic bedrock glade through bird dispersal. Invasives common along the northern bald include common mullein (*Verbascum thapsus*), timothy (*Phleum pratense*), lawn prunella (*Prunella vulgaris*), St. John's-wort (*Hypericum perforatum*), spotted knapweed (*Centaurea stoebe*), and Canada bluegrass (*Poa compressa*). Common mullein was noted along the base of the cliffs. Cut stumps are scattered along the margin of the northern bald, having been cut to enhance the view.

Management Recommendations: The main management recommendations are to limit foot traffic to the established trails, increase educational efforts to encourage visitors to stay on trails, control and monitor invasive species along the Escarpment Trail, maintain a natural community buffer adjacent to the escarpment to minimize the threat of invasion by additional non-native species, and allow natural processes (i.e., erosion and windthrow) to operate unhindered.

Photo 121. Escarpment Trail Cliffs. Photo by Joshua G. Cohen.

122. Green Mountain Cliffs
Natural Community Type: Volcanic Cliff
Rank: G4G5 S2, apparently secure globally and imperiled within the state
Element Occurrence Rank: AB
Size: 1.3 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18002

Threats: No anthropogenic disturbances or non-native species were noted during the course of the survey of this remote location. Ox-eye daisy (*Leucanthemum vulgare*) was documented in a nearby volcanic bedrock glade.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered (i.e., let wildfires burn), to monitor for non-native plants, and to maintain a forested buffer surrounding the cliff to prevent the increase of a weedy seed source.

Photo 122. Green Mountain Cliffs. Photo by Joshua G. Cohen.

VOLCANIC COBBLE SHORE

Overview: Volcanic cobble shore occurs along Lake Superior, predominantly in coves and gently curving bays between rocky points. These mostly unvegetated shores are often terraced, with the highest cobble beach ridge typically supporting a shrub zone several meters above Lake Superior (Kost et al. 2007).

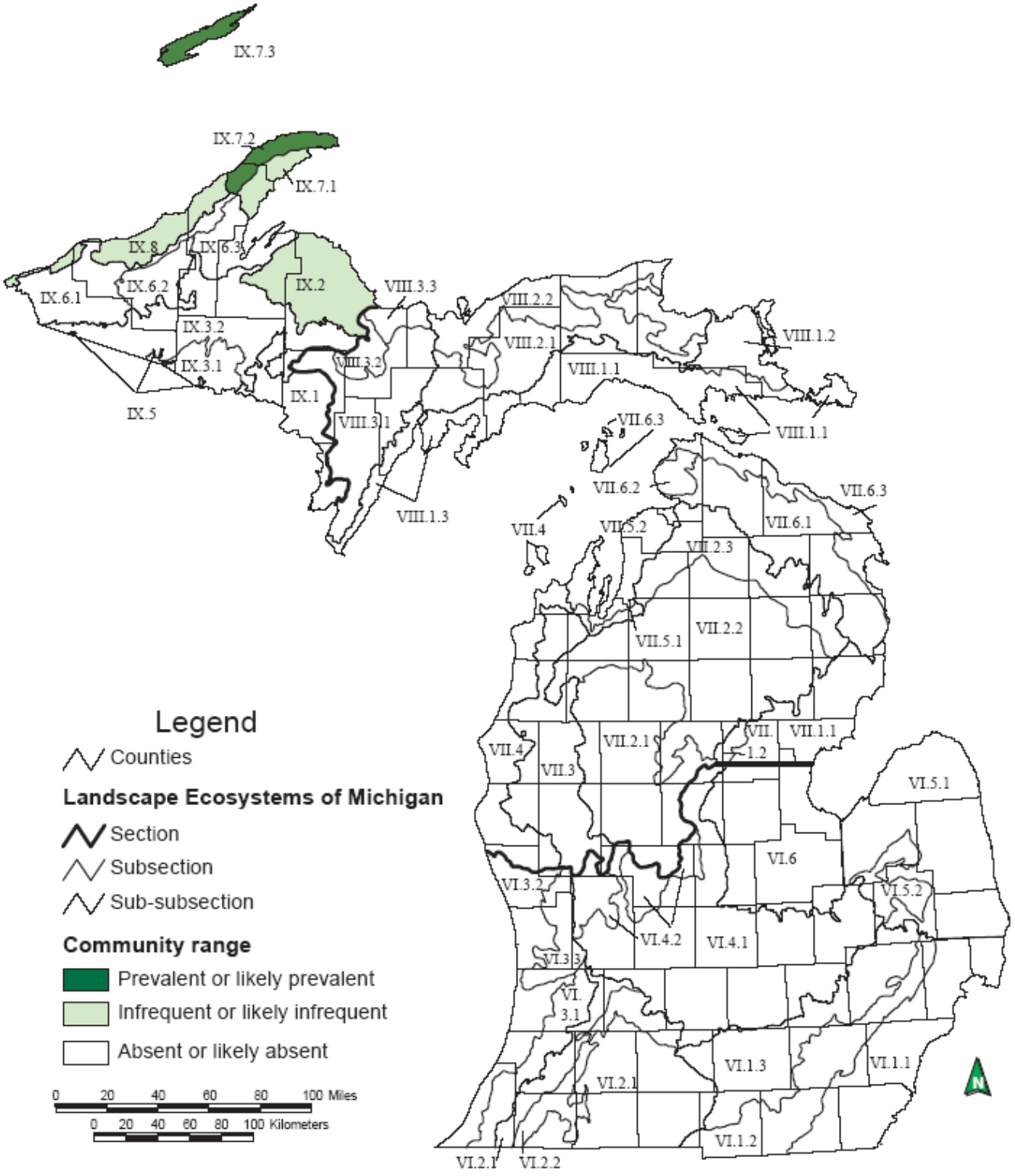

Figure 42. Distribution of volcanic cobble shore in Michigan.

123. Porcupine Shore
Natural Community Type: Volcanic Cobble Shore
Rank: G4G5 S3, apparently secure globally and vulnerable within the state
Element Occurrence Rank: AB
Size: 4.0 acres
Location: Porcupine Mountains Wilderness State Park
Element Occurrence Identification Number: 18011

Threats: Species composition and vegetative structure are determined by natural processes. Disperse foot traffic occurs along the shore, but is concentrated near campsites and where the hiking trails run parallel to the shoreline. No invasive species were noted during the surveys but several weedy species occur in nearby areas of shoreline including St. John's-wort (*Hypericum perforatum*), ox-eye daisy (*Leucanthemum vulgare*), and lawn prunella (*Prunella vulgaris*). Logging of the surrounding forests could increase the seed source for weedy species, which could be windblown or bird-dispersed onto the lakeshore.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered and to maintain a forested buffer surrounding the lakeshore to prevent the increase of a weedy seed source. Current populations of non-native species in areas of nearby shoreline should be removed. Monitoring efforts to detect invasive species and evaluate control efforts should be implemented.

Photo 123. Porcupine Shore volcanic cobble shore. Photo by Joshua G. Cohen.

WET PRAIRIE

Overview: Wet prairie is a native lowland grassland occurring on level, saturated and/or seasonally inundated stream and river floodplains, lake margins, and isolated depressions in southern Lower Michigan. It is typically found on outwash plains and channels near moraines. Soils are primarily loam or silt loam of neutral pH and have high organic content. Dominant species include bluejoint grass (*Calamagrostis canadensis*) and cordgrass (*Spartina pectinata*), with sedges (*Carex* spp.) often important subdominants (Kost et al. 2007).

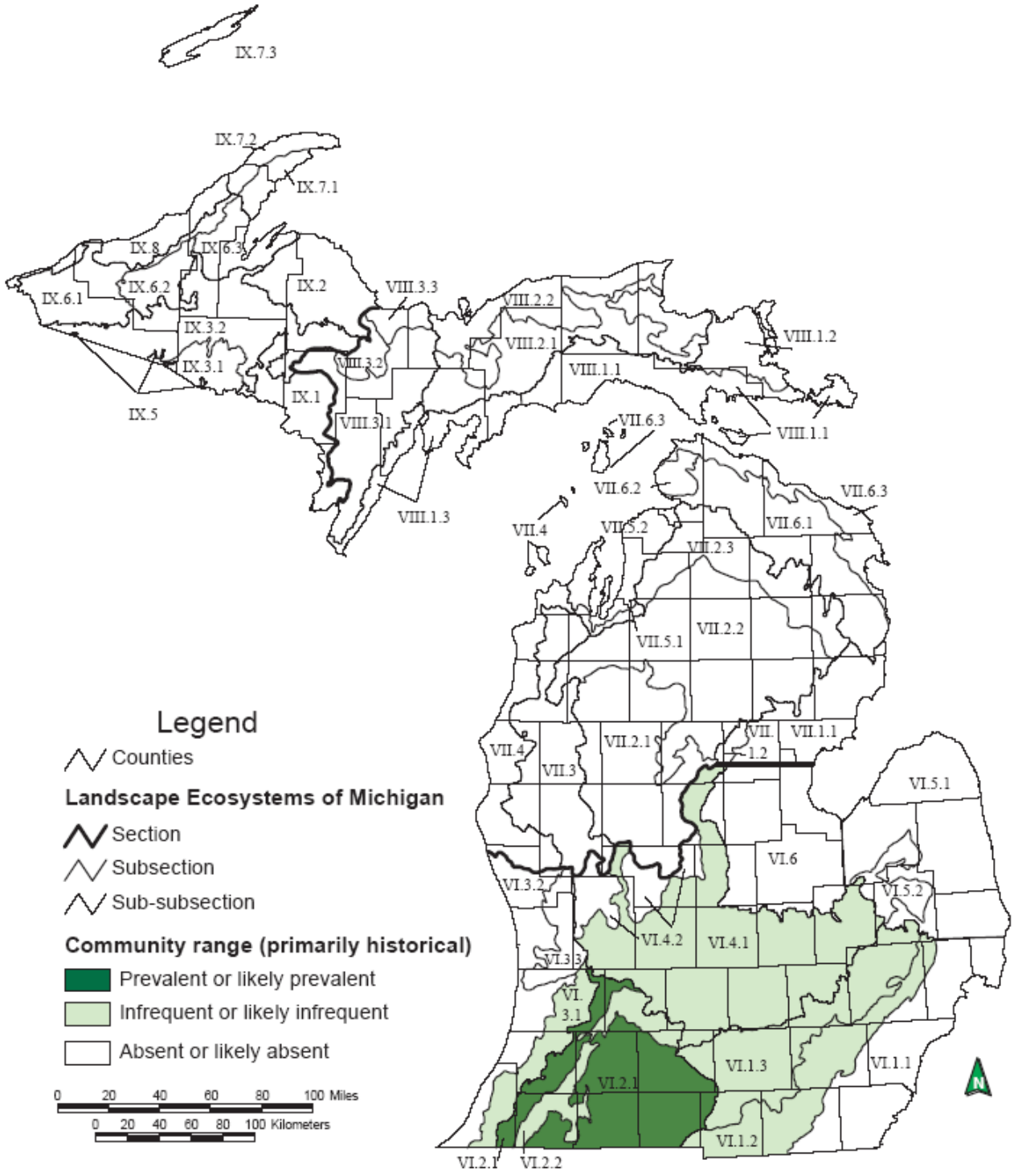

Figure 43. Distribution of wet prairie in Michigan.

124. Waterloo Wet Prairie
Natural Community Type: Wet Prairie
Rank: G3 S2, globally vulnerable and imperiled within the state
Element Occurrence Rank: CD
Size: 1.8 acres
Location: Waterloo State Recreation Area
Element Occurrence Identification Number: 17493

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by high water table, underlying clay soils, fire suppression, and invasive species. Invasive species observed in the wet prairie include Morrow honeysuckle (*Lonicera morrowii*) and reed canary grass (*Phalaris arundinacea*). Shrub encroachment due to fire suppression is severe.

Management Recommendations: The primary management recommendations are to control the invasive plants within the wet prairie, burn the wet prairie periodically to reduce shrub encroachment and invasives, and retain an intact buffer of natural communities surrounding the wetland to protect the hydrologic regime. The wet prairie should be burned in concert with the surrounding uplands and wetlands. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management.

Photo 124. Waterloo Wet Prairie. Photo by Steve A. Thomas.

DISCUSSION

This report provides site-based assessments of 124 natural community element occurrences on PRD lands. Threats, management needs, and restoration opportunities specific to each individual site have been discussed. The baseline information presented in the current report provides resource managers with an ecological foundation for prescribing site-level biodiversity stewardship, monitoring these management activities, and implementing landscape-level biodiversity planning to prioritize management efforts. In addition, over the next year, MNFI will survey for new natural community element occurrences within State Parks and Recreation Areas that have yet to be surveyed or were not thoroughly surveyed during past efforts. In addition to this continued survey effort, a much needed future step is the development of a framework for prioritizing stewardship efforts across these sites. This process should involve assessing the conservation significance of each site from both an ecoregional and statewide perspective and evaluating the severity of threats across sites. This analysis should be conducted using an ecological hierarchical framework, such as Albert's (1995) Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin. Understanding how each site relates to other examples of the same natural community and how rare that community is within an ecological region will help facilitate difficult decisions regarding the distribution of finite stewardship resources.

Photo 125. Lake of the Clouds emergent marsh, Porcupine Mountains Wilderness State Park. Photo by Joshua G. Cohen.

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Photo 126. Prison Camp Patterned fFen, Tahquamenon Falls State Park. Photo by Joshua G. Cohen.

Photo 127. Porcupine Mountain Glades volcanic bedrok glade, Porcupine Mountains Wilderness State Park. Photo by Joshua G. Cohen.

Photo 128. Tahquamenon River Mouth Fen poor fen, Tahquamenon Falls State Park. Photo by Joshua G. Cohen.

Appendix 1. Ecology Community Field Survey Form

Michigan Natural Features Inventory

Ecological Community Field Survey Form

MICHIGAN STATE UNIVERSITY EXTENSION

SURVEY INFORMATION

Survey date: _____ Time: from _____ AM PM to _____ AM PM Sourcecode: _____

Surveyors (principal surveyor first, include first & last name):

_____

Weather conditions: _____

Revisit needed? ☐ Yes ☐ No Why? ☐ Complete community survey ☐ Rare species survey ☐ Invasive plant survey ☐ Monitoring

FILING

Survey site: _____ Site name: _____

IDENTIFICATION (Identify community if known positively, or provide closest alliance/association if not known)

Community Name: _____ Overall Rank: _____ EOID: _____ EO #: _____

If classification problems, explain:

Photo/slide taken? ☐ Yes ☐ No Where has photo been deposited? _____

If associated plot, list project name, and reference #:

_____

LOCATIONAL INFORMATION

Township/Range/Section: _____ County: _____

DIRECTIONS: Provide detailed directions to the observation (rather than the survey site). Include landmarks, roads, towns, distances, compass directions.

Landowner type: ☐ Public ☐ Private ☐ Other: _____

Landowner Contact Information: _____

Notes: _____

Was a GPS used? ☐ Yes ☐ No Type of unit: _____ Unit number: _____

Waypoint name/#: _____ File name: _____

Latitude: _____ Longitude: _____

Feature Information (mandatory): _____ Source feature: ☐ Single Source EO ☐ Multiple Source EO

SIZE - Measure of the area of the Element at the observed location.

Observed area (unit): ☐ Acres ☐ Hectares Type of measurement: ☐ Precise ☐ Estimate

Basis for estimate: _____

SIZE RANK (comments): _____

CONFIDENCE EXTENT

Indicate whether there is confidence that the observed area represents the full extent of the community element at that location.
(Y = confidence that the full extent is known; N = confidence that the full extent is not known; ? = uncertainty whether full extent is known)

☐ Yes ☐ No ☐ ? _____

Appendix 1, continued. Ecology Community Field Survey Form.

LANDSCAPE CONTEXT - An integrated measure of the quality of biotic and abiotic factors, structures and processes surrounding the observed area, and the degree to which they may affect the continued existence of the Element at that location. Component of landscape context for communities are: 1) landscape structure and extent, 2) condition of the surrounding landscape (i.e., community development/maturity, species composition and biological structure, ecological processes, and abiotic physical/chemical factors.) Factors to consider include integrity/fragmentation, stability/old growth, richness/distribution of species, presence of invasive species, presence of invasive species, degree of disturbance, changes to ecological processes, stability of substrate, and water quality.

SURROUNDING LAND USE AND LAND COVER:

Percent natural cover: ☐ >90% ☐ >75% ☐ >50% ☐ >25% ☐ <25% Road density: ☐ HIgh ☐ Medium ☐ Low

Check all that apply

Dominant land use:

- ☐ Natural cover
- ☐ Managed timber/forest
- ☐ Agriculture
- ☐ Mining
- ☐ Urban/suburban
- ☐ Other: _____

Dominant land cover:

- ☐ Upland forest
- ☐ Savanna/grassland
- ☐ Forested wetland
- ☐ Non-forested wetland
- ☐ Agriculture
- ☐ Urban
- ☐ Other: _____

1. Comment on the relative integrity/fragmentation of the surrounding landscape

2. List native plant communities in surrounding landscape

3. Comment on invasive plants present in surrounding area and describe resulting impacts

List disturbances (either natural or caused by humans) and ecological processes (e.g., hydrologic and fire regimes) in surrounding area

- ☐ Logging
- ☐ Grazing/browsing
- ☐ Agriculture
- ☐ Soil erosion
- ☐ Mining
- ☐ Dumping
- ☐ Trails/roads
- ☐ ORV/vehicular disturbance
- ☐ Hydrologic alteration (drainage, ditches, blocked culverts, etc.)
- ☐ Fire supression
- ☐ Other: _____

- ☐ Plant disease: _____
- ☐ Insect damage: _____
- ☐ Exotic animal activity: _____
- ☐ Herbivore impact (e.g., deer): _____
- ☐ Invasive plants: _____

- ☐ Wild fire
- ☐ Prescribed fire
- ☐ Windthrow
- ☐ Ice storm
- ☐ Ice scour
- ☐ Desiccation
- ☐ Flooding
- ☐ Beaver flooding
- ☐ Beaver chewed trees
- ☐ Other: _____

LANDSCAPE RANK (comments)**:**

Appendix 1, continued. Ecology Community Field Survey Form.

CONDITION: ABIOTIC DATA

Geology

Igneous Rocks

- ☐ Granitic (Granite, Schyolite, Syenite, Trachyte)
- ☐ Dioritic (Diorite, Dacite, Andesite)
- ☐ Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite, Diabase, Traprock)
- ☐ Rhyolite
- ☐ Other: _____

Metamorphic Rocks

- ☐ Felsic Gneiss and Schist (Granitic)
- ☐ Mafic Gneiss and Schist
- ☐ Slate
- ☐ Quartzite
- ☐ Other: _____

Sedimentary Rocks

- ☐ Volcanic Conglomerates
- ☐ Breccias
- ☐ Sandstone
- ☐ Siltstone (calcareous or noncalcareous)
- ☐ Limestone and Dolomite
- ☐ Gypsum
- ☐ Shale
- ☐ Other: _____

Landform

Glacial

- ☐ Lake plain
- ☐ End or lateral moraine
- ☐ Ground moraine (till plain)

Ice Contact Feature

- ☐ Drumlin
- ☐ Esker
- ☐ Kame
- ☐ Kettle
- ☐ Lake bed
- ☐ Outwash channel

Outwash

- ☐ Outwash channel
- ☐ Outwash plain
- ☐ Pitted outwash
- ☐ Other: _____

River/Lakeshore

- ☐ Shoreline
- ☐ Sand dune
- ☐ Barrier dune
- ☐ Spit
- ☐ Offshore bar
- ☐ Riverine estuary
- ☐ Delta
- ☐ Stream bed
- ☐ Stream terrace
- ☐ Alluvial fan
- ☐ Alluvial flat
- ☐ Alluvial terrace
- ☐ Dike
- ☐ Other: _____

Aeolian

- ☐ Dunes
- ☐ Aeolian sand flats
- ☐ Other: _____

Other

- ☐ Cliff
- ☐ Ledge
- ☐ Lakeshore bedrock outcrop
- ☐ Ridgetop bedrock outcrop
- ☐ Inland level-to-sloping bedrock outcrop
- ☐ Ravine
- ☐ Seep
- ☐ Slide
- ☐ Talus
- ☐ Other: _____

Organic Soil Deposits:

Core One: GPS Point _____

	Depth	pH
☐ Fibirc Peat:		
☐ Hemic Peat:		
☐ Sapric Peat (muck):		
☐ Marl (depth):		
☐ Other (describe):		

Comments:

Core Two: GPS Point _____

	Depth	pH
☐ Fibirc Peat:		
☐ Hemic Peat:		
☐ Sapric Peat (muck):		
☐ Marl (depth):		
☐ Other (describe):		

Comments:

Core Three: GPS Point _____

	Depth	pH
☐ Fibirc Peat:		
☐ Hemic Peat:		
☐ Sapric Peat (muck):		
☐ Marl (depth):		
☐ Other (describe):		

Comments:

Appendix 1, continued. Ecology Community Field Survey Form.

Mineral Soil Depth (average): _____

pH: _____

Surface Soil Texture (Upper 10 cm of soil profile)

- ☐ Sand
- ☐ Loamy sand
- ☐ Sandy loam
- ☐ Loam
- ☐ Silt loam
- ☐ Sandy Clay loam
- ☐ Clay loam
- ☐ Silty clay loam
- ☐ Sandy clay
- ☐ Clay
- ☐ Silty clay
- ☐ Other: _____

Soil Series: _____

Comments:

Wetland Mineral Soil Indicators:

- ☐ Gleyed soils (list soil texture and depth):

_____

- ☐ Iron mottling (list soil texture and depth):

_____

Depth to saturation: _____

Depth to water table: _____

Hydrologic Regime:

Wetlands:

- ☐ Intermittently flooded
- ☐ Permanently flooded
- ☐ Semipermanently flooded
- ☐ Temporarily flooded (e.g., floodplains)
- ☐ Seasonally flooded (e.g., seasonal ponds)
- ☐ Saturated (e.g., bogs, perennial seeps)
- ☐ Unknown

Non-Wetlands:

- ☐ Wet Mesic
- ☐ Mesic (moist)
- ☐ Dry-Mesic
- ☐ Xeric (dry)

Groundcover:
(with >5% cover, 20 m x 20 m area)

_____ % Bedrock
_____ % Wood (>1cm)
_____ % Litter, duff
_____ % Large rocks (cobbles, boulders >10 cm)
_____ % Small rocks (gravel, 0.2 - 10 cm)
_____ % Bare soil
_____ % Water
_____ % Other
100% (Total = 100%)

Light:

- ☐ Open
- ☐ Partial
- ☐ Filtered
- ☐ Shade

Cowardin System:

- ☐ Upland
- ☐ Riverine
- ☐ Lacustrine
- ☐ Palustrine

Slope:

Measured Slope: _____ ° _____ %

☐ Flat	0°	0%
☐ Gentle	0 - 5°	0 - 9%
☐ Moderate	6 - 14°	10 - 25%
☐ Somewhat steep	15 - 25°	26 - 49%
☐ Steep	26 - 45°	50 - 100%
☐ Very Steep	45 - 69°	101 - 275%
☐ Abrupt	70 - 100°	276 - 300%
☐ Overhanging/sheltered	> 100°	> 300%

Aspect (down slope):

Measured Aspect: _____ ° (N = 0°)

☐ Flat	
☐ Variable	
☐ N	338 - 22°
☐ NE	23 - 67°
☐ E	68 - 112°
☐ SE	113 - 157°
☐ S	158 - 202°
☐ SW	203 - 247°
☐ W	248 - 292°
☐ NW	293 - 337°

Topographic position:

- ☐ Ridge, summit, or crest
- ☐ High slope (upper slope, convex slope)
- ☐ Midslope (middle slope)
- ☐ Lowslope (lower slope, footslope)
- ☐ Toeslope (alluvial toeslope)
- ☐ Low level (terrace lakeplain, outwash plan, lake bed, etc)
- ☐ Channel
- ☐ Other: _____

Soil Type - Describe soil profile, pH, and method of assessment

CONDITION: VEGETATIVE FIELD DATA FOR THE ELEMENT

DBH (indicate cm or inches) of several dominant tree species, include age in years of cored trees:

Species	DBH(AGE)	DBH(AGE)	DBH(AGE)	DBH(AGE)	DBH(AGE)	DBH(AGE)

Density:

	Tree canopy	Shrub layer	Herb layer
Closed			
Open			
Patchy			
Sparse			
Absent			

Appendix 1, continued. Ecology Community Field Survey Form.

Complete one or more of the quantitative vegetation data boxes below. If completing only box indicate whether data represents a synthesis of overall community or community is relatively homogeneous throughout.

QUANTITATIVE VEGETATION DATA FOR THE ELEMENT

Method used (e.g., ocular estimation, quantitative transect, fixed plot, prism plot): _____

Sample Point 1: _____ GPS Point: _____

STRATA	COVER CLASS	DOMINANT SPECIES in order to relative importance (>> much greater than, > greater than, and =)
T2 - Tree Canopy		
T3 - Subcanopy		
S1 - Tall Shrub		
S2 - Low Shrub		
G - Ground cover		
N - Nonvascular		
V - Woody Vine		

Cover Class *

1	trace
2	0.1 - 1%
3	1 - 2%
4	2 - 5%
5	5 - 10%
6	10 - 25%
7	25 - 50%
8	50 - 75%
9	75 - 95%
10	> 95%

Sample Point 2: _____ GPS Point: _____

STRATA	COVER CLASS	DOMINANT SPECIES in order to relative importance (>> much greater than, > greater than, and =)
T2 - Tree Canopy		
T3 - Subcanopy		
S1 - Tall Shrub		
S2 - Low Shrub		
G - Ground cover		
N - Nonvascular		
V - Woody Vine		

Cover Class *

1	trace
2	0.1 - 1%
3	1 - 2%
4	2 - 5%
5	5 - 10%
6	10 - 25%
7	25 - 50%
8	50 - 75%
9	75 - 95%
10	> 95%

Sample Point 3: _____ GPS Point: _____

STRATA	COVER CLASS	DOMINANT SPECIES in order to relative importance (>> much greater than, > greater than, and =)
T2 - Tree Canopy		
T3 - Subcanopy		
S1 - Tall Shrub		
S2 - Low Shrub		
G - Ground cover		
N - Nonvascular		
V - Woody Vine		

Cover Class *

1	trace
2	0.1 - 1%
3	1 - 2%
4	2 - 5%
5	5 - 10%
6	10 - 25%
7	25 - 50%
8	50 - 75%
9	75 - 95%
10	> 95%

Sample Point 4: _____ GPS Point: _____

STRATA	COVER CLASS	DOMINANT SPECIES in order to relative importance (>> much greater than, > greater than, and =)
T2 - Tree Canopy		
T3 - Subcanopy		
S1 - Tall Shrub		
S2 - Low Shrub		
G - Ground cover		
N - Nonvascular		
V - Woody Vine		

Cover Class *

1	trace
2	0.1 - 1%
3	1 - 2%
4	2 - 5%
5	5 - 10%
6	10 - 25%
7	25 - 50%
8	50 - 75%
9	75 - 95%
10	> 95%

Appendix 1, continued. Ecology Community Field Survey Form.

CONDITION - An integrated measure of the quality of biotic and abiotic factors, structures and processes within the observed area, and the degree to which they may affect the continued existence of the Element a that location. Factors to consider include evidence of stability/presence of old growth, richness/distirbution of species, presence of invasive species, degree of disturbance, changes to ecological processes, stability of substrate and water quality.

1. Species composition:

2. Community structure:

3. Ecological processes:

Natural and Anthropogenic Disturbance: information on disturbances(s) (either natural or caused by humans)

- ☐ Logging
- ☐ Grazing/browsing
- ☐ Agriculture
- ☐ Soil erosion
- ☐ Mining
- ☐ Dumping
- ☐ Trails/roads
- ☐ ORV/vehicular disturbance
- ☐ Hydrologic alteration (drainage, ditches, blocked culverts, etc.)
- ☐ Fire supression
- ☐ Other: _____

- ☐ Plant disease: _____
- ☐ Insect damage: _____
- ☐ Exotic animal activity: _____
- ☐ Herbivore impact (e.g., deer): _____
- ☐ Invasive plants: _____

- ☐ Wild fire
- ☐ Prescribed fire
- ☐ Windthrow
- ☐ Ice storm
- ☐ Ice scour
- ☐ Desiccation
- ☐ Flooding
- ☐ Beaver flooding
- ☐ Beaver chewed trees
- ☐ Other: _____

Comment on disturbance(s) and changes to ecological processes (e.g., hydrologic and fire regimes) within in observed area:

Comment on invasives present within the observed area and describe resulting impacts:

CONDITION RANK (comments):

Appendix 1, continued. Ecology Community Field Survey Form.

MANAGEMENT CONSIDERATIONS

Threats (e.g., fire suppression, invasive species, ORVs, hydrologic alteration, logging, high deer densities etc.)

Management (stewardship and restoration), **Monitoring and Research Needs** for the Element at this location (e.g., burn periodically, open the canopy, control invasives, ban ORV's, remove drainage ditches, clear blocked culvert, break drain tile, reduce deer densities, study effects of herbivore impacts)

Protection Needs for the Element at this location (e.g., protect the entire marsh, the slope and crest of slope)

SUMMARY OF ELEMENT OCCURRENCE

General Description of the Element: Provide a brief "word picture" of the community focusing on abiotic and biotic factors. Describe the landforms, geological formations, soils/substrates, topography, slope, aspect, hydrology, aquatic features, vegetative layers, significant species etc.

Description of the Vegetation: Describe variation within the observed area in terms of vegetation structure and environment. Describe dominant and characteristic species and any inclusion communities. If a mosaic, describe spatial distribution and associated community types.

OVERALL RANK (comments):

Appendix 1, continued. Ecology Community Field Survey Form.

SPECIES LIST

Group and record species for each relevant strata (e.g., Overstory, Sub-canopy, Tall Shrub, Low Shrub, Ground Cover).
For each species, include abundance rank: **D = dominant A = abundant C = common O = occasional U = uncommon R = scarce L = local (modifier)**

Appendix 1, continued. Ecology Community Field Survey Form.

Sketch the most descriptive cross-section through the natural community, depicting the topography, vegetative structure and composition:

Appendix 1, continued. Ecology Community Field Survey Form.

GPS WAYPOINTS AND DESCRIPTIONS

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Appendix 2. Threat Assessment Form.

Threat	Severity	Scope	Reversibility	Threat Score	Comments
Invasive Species					
Fire Suppression					
Deer Herbivory					
ORV Activity					
Hydrologic Alteration					
Infrastructure/ Trail Development					
Water Quality/ Contamination					
Invasive Plant #1:					
Invasive Plant #2:					
Invasive Plant #3:					
Invasive Plant #4:					
Invasive Plant #5:					

Rank each observed threat in terms of **Severity**, **Scope**, and **Reversibility** on a scale of 1 to 5.
Severity is the level of damage to the site and a score of 1 means the site is slightly damaged and a score of 5 means the site has been extensively damaged.
Scope is the geographic extent of impact and a score of 1 means the threat occupies a trace area within the site and a score of 5 means the threat is ubiquitous.
Reversibility is the probability of controlling the threat and reversing the damage and a score of 1 means the threat can be easily controlled and a score of 5 means the threat is unlikely to be controlled.
Threat Score is a sum of the rankings for **Severity**, **Scope**, and **Reversibility**.

Appendix 2, continued. Threat Assessment Form.

Severity:

5: Without action, the community will likely be destroyed or eliminated (beyond restoration) within 10-15 years
4: Without action, the community will likely be seriously degraded (potentially lowered by 1 EO Rank) within 10-15 years
3: Without action, the community will likely be moderately degraded (potentially lowered by 1/2 EO Rank) within 10-15 years
2: Without action, the community will likely be slightly impaired by this threat within 10-15 years
1: Without action, the community may be slightly impaired by this threat within 15+ years
0: No threat

Scope:

5: Threat impacts the entire community EO (90%+)
4: Threat impacts large portions of the community EO (roughly 50-89%)
3: Threat impacts moderate portions of the community EO (roughly 15-49%)
2: Threat impacts localized portions of the community EO (roughly 5-14%, possibly in several scattered small patches)
1: Threat impacts only one small patch within or on the edge of the community EO, or is currently outside EO in the vicinity but likely to impact EO within the next 10 years
0: No threat

Reversibility:

5: Threat is not reversible (e.g., parking lot/paving)
4: Threat is reversible but not practically affordable without major investment of $ and time (potentially hundreds of thousands of dollars or full time staff effort)
3: Threat is reversible but moderately difficult and requires a fair investment of $ and/or time (potentially tens of thousands of dollars or 2+ weeks of staff time/year)
2: Threat is reversible at relatively low cost (potentially several days of staff time/year or up to a few thousand dollars)
1: Threat is easily reversible with only a few hours of effort (potentially annually) by a small group of people such as volunteers or state workers
0: No threat

Appendix 3. Global and State Element Ranking Criteria.

GLOBAL RANKS

G1 = critically imperiled: at very high risk of extinction due to extreme rarity (often 5 or fewer occurrences), very steep declines, or other factors.

G2 = imperiled: at high risk of extinction due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors.

G3 = vulnerable: at moderate risk of extinction due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors.

G4 = apparently secure: uncommon but not rare; some cause for long-term concern due to declines or other factors.

G5 = secure: common; widespread.

GU = currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

GX = eliminated: eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.

G? = incomplete data.

STATE RANKS

S1 = critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.

S2 = imperiled in the state because of rarity due to very restricted range, very few occurrences (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.

S3 = vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 = uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 = common and widespread in the state.

SX = community is presumed to be extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

S? = incomplete data.