

Natural Community Surveys of Known Element Occurrences on State Park and Recreation Area Lands



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Cover photos: top left, Lake Gogebic mesic northern forest from Lake Gogebic State Park; top right, Bauer Road Fen prairie fen from Brighton State Recreation Area; lower left, Crooked Lake Shrub Swamp inundated shrub swamp from Pinckney State Recreation Area; and lower right, Proud Lake Barrens oak barrens from Proud Lake State Recreation Area. Photos by Joshua G. Cohen.

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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, and Harbors. 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 Biodiversity Conservation Planning Process (BCPP) 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 BCPP 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, or threat assessments. To inform the PRD management planning process, the DNR BCPP, 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 has initiated a multi-year survey and assessment on State Park and Recreation Area lands of known natural community element occurrences.

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). During the summer of 2011, MNFI scientists conducted surveys of 67 high-quality natural communities previously identified on State Park and Recreation Area lands. According to MNFI's natural community classification, there are 76 natural community types in Michigan (Kost et al. 2007). Nineteen different natural community types are represented in the 67 element occurrences surveyed (Table 1). Surveys assessed the current 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 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 BCPP. This report summarizes the findings of MNFI's third year of ecological surveys.

METHODS

Field Preparation

Prioritization of sites to visit during the third survey year was determined in consultation with PRD staff. This process resulted in the selection of 67 sites within 15 different State Parks or Recreation Areas (Table 1) including the following: Bald Mountain State Recreation Area (10 sites), Brighton State Recreation Area (5 sites), Holly State Recreation Area (7 sites), Island Lake State Recreation Area (4 sites), Lake Gogebic State Park (1 site), Laughing Whitefish Falls State Park (1 site), Negwegon State Park (2 sites), Ortonville State Recreation Area (1 site), Pinckney State Recreation Area (8 sites), Pontiac Lake State Recreation Area (2

sites), Proud Lake State Recreation Area (5 sites), Seven Lakes State Park (2 sites), Waterloo State Recreation Area (13 sites), Wells State Park (1 site), and Yankee Springs State Recreation Area (5 sites).

These sites were made a priority for the 2011 field season for one or more of the following reasons: PRD is in the process of writing and updating management plans; restoration work is in progress and needs evaluation; surveys have not been conducted within these areas for many years; and/or limited information has been recorded about the site. Two sites within the Waterloo State Recreation Area were identified as priorities for surveys (Prairie Fen 8490 and Rich Tamarack Swamp 7962) but aerial photographic interpretation and ground-truthing indicated that the natural community types of interest do not occur on state land but on nearby private land.

Site preparation involved the creation by MNFI and PRD staff of Arcview GIS projects utilizing several layers, including the intersection of the natural community boundaries in MNFI's Biotics database (MNFI 2012) with PRD lands, topographic maps, 1998 digital orthographic photos, 2005 color aerial imagery, MNFI's circa 1800 vegetation map (Comer et al. 1995), and Rockford PLAT maps. For each of the 67 occurrences, a site package was printed that included the polygon of the natural community overlaying the aforementioned data layers and a copy of the existing Element Occurrence Record. In addition to printed site packages, digital site packages were created for use with handheld Global Positioning System (GPS) units and ArcPad. The element occurrence polygons, PRD boundary maps, topographic maps, PLAT maps, and aerial imagery were saved to one- and four-GB storage cards compatible with HP iPAQ units, which were paired with Bluetooth GPS receivers.

In preparation for field surveys for this project, the Ecological Community Field Survey Form was revised and converted to a writable portable document format (pdf) to facilitate electronic archiving of the collected data (see Appendix 1). In addition, MNFI staff worked with PRD staff to develop a Threat Assessment Form to allow for the scoring of each observed threat in terms of severity, scope, and reversibility (see Appendix 2). 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.

Field Surveys

Natural Heritage and MNFI methodology 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 conducted during the growing season (from June 5, 2011 through September 29, 2011) to evaluate the condition and classification of the sites. 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 public portions of the occurrences. For each site visited, an Ecological Community Field Survey Form (Appendix 1) and a Threat Assessment Form (Appendix 2) were completed. The surveys 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 (both Garmin and HP iPAQ 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) 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 the element occurrence records in MNFI's statewide biodiversity conservation database (MNFI 2012). When necessary, natural community boundaries were re-mapped. Information from the 2011 field surveys and from surveys conducted prior to this project was used to produce threat assessments and management recommendations for each natural community occurrence, which appear within the following Results section.

RESULTS

Sixty-seven occurrences of high-quality natural communities were surveyed during the 2011 field season. As noted above, the 67 sites surveyed were within 15 different State Parks or Recreation Areas (see above and Table 1). A total of 19 different natural communities were visited including bog (3 element occurrences or EOs), dry southern forest (1 EO), dry-mesic southern forest, (10 EOs), emergent marsh (1 EO), floodplain forest (1 EO), Great Lakes marsh (1 EO), inundated shrub swamp (1 EO), mesic northern forest (3 EOs), mesic southern forest (2 EOs), oak barrens (3 EOs), poor conifer swamp (1 EO), prairie fen (26 EOs), rich conifer swamp (1 EO), rich tamarack swamp (4 EOs), southern hardwood swamp (1 EO), southern shrub-carr (2 EOs), southern wet meadow (3 EOs), submergent marsh (2 EOs), and wooded dune and swale complex (1 EO). Table 1 lists the visited sites, their previous element occurrence ranks, and their current element occurrence ranks. Thirty percent of the sites (20 of the 67 sites) maintained their prior element occurrence ranking, 15% of the sites (10 of 67 sites) had an improved ranking, and 55% of the sites (37 of 67 sites) received lower element occurrence ranks compared to their prior ranking (Table 1). Of the 67 sites surveyed, all were re-mapped but the Gorman Lake submergent marsh (EO ID 13458), which was re-mapped recently (January 8, 2009).

The following site summaries contain a detailed discussion for each of these 67 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	PRIOR EO RANK	CURRENT EO RANK	Surveyor
Bog	13370	Washtenaw	Cassidy Road Bog	Waterloo State Recreation Area	C	BC	J. Cohen
Bog	13366	Washtenaw	Joslin Road Bog	Pinckney State Recreation Area	BC	C	J. Cohen
Bog	8326	Jackson	Race Road Bog	Waterloo State Recreation Area	BC	BC	J. Cohen
Dry Southern Forest	10880	Jackson & Washtenaw	Crooked Lake Forest	Waterloo State Recreation Area	A	C	J. Cohen
Dry-Mesic Southern Forest	10872	Oakland	Chamberlain Lakes	Bald Mountain State Recreation Area	C	CD	B. Slaughter
Dry-Mesic Southern Forest	12628	Oakland	Graham Lakes	Bald Mountain State Recreation Area	C	CD	B. Slaughter
Dry-Mesic Southern Forest	13353	Barry	Hall Lake	Yankee Springs State Recreation Area	AB	C	B. Slaughter
Dry-Mesic Southern Forest	6146	Oakland	Mt. Holly Forest	Holly State Recreation Area	C	CD	J. Cohen
Dry-Mesic Southern Forest	13348	Barry	Norris Road Woods	Yankee Springs State Recreation Area	BC	BC	B. Slaughter
Dry-Mesic Southern Forest	9296	Washtenaw	Pickereil Lake Complex	Pinckney State Recreation Area	B	BC	J. Cohen
Dry-Mesic Southern Forest*	2647	Oakland	Pontiac Woods	Pontiac Lake State Recreation Area	BC	C	B. Slaughter
Dry-Mesic Southern Forest	2388	Oakland	Seven Lakes Woods	Seven Lakes State Park	C	BC	B. Slaughter
Dry-Mesic Southern Forest	10627	Oakland	Trout Lake	Bald Mountain State Recreation Area	BC	CD	B. Slaughter
Dry-Mesic Southern Forest	16037	Washtenaw	Walsh Lake	Waterloo State Recreation Area	C	C	J. Cohen
Emergent Marsh	6744	Oakland	Moss Lake	Proud Lake State Recreation Area	C	B	J. Cohen
Floodplain Forest	11353	Livingston	Archery Range Floodplain Forest	Island Lake State Recreation Area	BC	C	J. Cohen
Great Lakes Marsh	5459	Alpena	Negwegon Marsh	Negwegon State Park	B	B	B. Slaughter
Inundated Shrub Swamp	16880	Washtenaw	Crooked Lake Shrub Swamp	Pinckney State Recreation Area	B	AB	J. Cohen
Mesic Northern Forest	8276	Gogebic	Lake Gogebic	Lake Gogebic State Park	A	AB	J. Cohen
Mesic Northern Forest	7919	Alger	Laughing Whitefish Falls	Laughing Whitefish Falls State Park	AB	B	J. Cohen
Mesic Northern Forest	9618	Menominee	Wells Mesic Northern Forest	Wells State Park	BC	BC	J. Cohen
Mesic Southern Forest	12888	Oakland	Moss Lake Forest	Proud Lake State Recreation Area	B	C	J. Cohen
Mesic Southern Forest	11418	Oakland	Teggerdine Road Mesic Forest	Pontiac Lake State Recreation Area	C	C	B. Slaughter
Oak Barrens	1344	Livingston	Huron River Barrens	Island Lake State Recreation Area	C	CD	M. Kost
Oak Barrens	548	Oakland	Proud Lake Barrens	Proud Lake State Recreation Area	CD	D	J. Cohen
Oak Barrens	3617	Livingston	Teahen Road Oak Barrens	Brighton State Recreation Area	C	D	J. Cohen & M. Penskar
Poor Conifer Swamp	16762	Jackson	Waterloo Black Spruce Bog	Waterloo State Recreation Area	C	C	J. Cohen
Prairie Fen	12367	Lapeer	Algoe Lake Prairie Fen	Ortonville State Recreation Area	B	BC	M. Kost
Prairie Fen	10244	Livingston	Bauer Road Fen	Brighton State Recreation Area	B	BC	J. Cohen & M. Penskar
Prairie Fen	8730	Oakland	Brandt Road Fen	Holly State Recreation Area	B	BC	M. Kost & J. Fody
Prairie Fen	11045	Oakland	Burns Lake	Holly State Recreation Area	C	CD	M. Kost
Prairie Fen	6741	Livingston	Caroga Lake Prairie Fen	Brighton State Recreation Area	C	CD	J. Cohen
Prairie Fen	16698	Livingston	Chenango Lake - Camp Talahi	Brighton State Recreation Area	BC	BC	J. Cohen & M. Penskar
Prairie Fen	9954	Jackson	Glenn Road Prairie Fen	Waterloo State Recreation Area	C	CD	J. Cohen & M. Penskar

Table 1. Summary of 2011 Surveys (* indicates element occurrence natural community type was re-classified).

Community Type	EO ID	County	Survey Site	Management Area	PRIOR EO RANK	CURRENT EO RANK	Surveyor
Prairie Fen	15918	Barry	Hall Lake Fen	Yankee Springs State Recreation Area	C	C	B. Slaughter
Prairie Fen	1556	Oakland	Halstead Lake	Holly State Recreation Area	B	C	M. Kost & J. Fody
Prairie Fen	2830	Washtenaw	Hankard Lake Fen	Waterloo State Recreation Area	C	C	J. Cohen & M. Penskar
Prairie Fen	4177	Oakland	Hartwig Fen	Holly State Recreation Area	C	D	M. Kost
Prairie Fen	9836	Oakland	Headquarters Fen	Holly State Recreation Area	C	D	M. Kost
Prairie Fen	4907	Oakland	Kern Road Fen	Bald Mountain State Recreation Area	BC	D	B. Slaughter
Prairie Fen	222	Livingston	Little Appleton Lake	Brighton State Recreation Area	BC	CD	J. Cohen & M. Penskar
Prairie Fen**	8490	Jackson	Locker Lake Fen	Waterloo State Recreation Area	C?	NA	J. Cohen & M. Penskar
Prairie Fen	15855	Washtenaw	McLaughlin Fen	Waterloo State Recreation Area	BC	B	J. Cohen & M. Penskar
Prairie Fen	7086	Jackson	Mt. Hope Road Fen	Waterloo State Recreation Area	BC	B	J. Cohen & M. Penskar
Prairie Fen	327	Washtenaw	Park Lyndon Fen	Pinckney State Recreation Area	B	B	B. Slaughter
Prairie Fen	16131	Jackson	Portage Lake	Waterloo State Recreation Area	C	CD	J. Cohen & M. Penskar
Prairie Fen	12600	Oakland	Seven Lakes Fen	Seven Lakes State Park	C	CD	B. Slaughter
Prairie Fen	2182	Livingston	Spring Mill Creek Fen	Island Lake State Recreation Area	B	C	M. Kost
Prairie Fen	16877	Washtenaw	Sullivan Lakes, Hadley Road	Pinckney State Recreation Area	BC	BC	J. Cohen & M. Penskar
Prairie Fen	2260	Livingston	Tiplady Fen	Pinckney State Recreation Area	C	BC	J. Cohen & M. Penskar
Prairie Fen	6249	Oakland	Trout Lake	Bald Mountain State Recreation Area	C?	C	B. Slaughter
Prairie Fen	15859	Washtenaw	Waterloo Long Lake Fen	Waterloo State Recreation Area	BC	BC	J. Cohen & M. Penskar
Prairie Fen	16636	Jackson	Willis Road	Waterloo State Recreation Area	C	CD	J. Cohen & M. Penskar
Prairie Fen	13087	Barry	Yankee Springs Fen	Yankee Springs State Recreation Area	BC	C	B. Slaughter
Rich Conifer Swamp*	6310	Oakland	Trout Lake	Bald Mountain State Recreation Area	C	C	B. Slaughter
Rich Tamarack Swamp	9826	Oakland	Chamberlain Lakes	Bald Mountain State Recreation Area	C?	CD	B. Slaughter
Rich Tamarack Swamp*	13568	Washtenaw	Embury Road Swamp	Pinckney State Recreation Area	BC	B	B. Slaughter
Rich Tamarack Swamp	7676	Livingston	Huron River Wetland	Island Lake State Recreation Area	C	C	J. Cohen
Rich Tamarack Swamp**	7962	Jackson & Washtenaw	M52 Tamarack Swamp	Waterloo State Recreation Area	AB	AB	M. Kost
Rich Tamarack Swamp*	18597	Oakland	Trout Lake	Bald Mountain State Recreation Area	C	CD	B. Slaughter
Southern Hardwood Swamp	12460	Oakland	Holdridge Lakes	Holly State Recreation Area	BC	BC	M. Kost
Southern Shrub-Carr*	1208	Oakland	Chamberlain Lakes	Bald Mountain State Recreation Area	C	CD	B. Slaughter
Southern Shrub-Carr	13342	Barry	Williams Lake	Yankee Springs State Recreation Area	CD	BC	B. Slaughter
Southern Wet Meadow*	8240	Oakland	Graham Lakes	Bald Mountain State Recreation Area	BC	BC	B. Slaughter
Southern Wet Meadow	4345	Oakland	Moss Lake Wet Meadow	Proud Lake State Recreation Area	B	BC	J. Cohen
Southern Wet Meadow	13389	Jackson	Seymour Rd. Swamp	Waterloo State Recreation Area	BC	C	J. Cohen
Submergent Marsh	13458	Washtenaw	Gorman Lake	Pinckney State Recreation Area	C	B	M. Kost & J. Fody
Submergent Marsh	2993	Oakland	Moss Lake	Proud Lake State Recreation Area	B	B	J. Cohen
Wooded Dune & Swale Complex	409	Alcona & Alpena	Negwegon Dune and Swale	Negwegon State Park	C	B	B. Slaughter

Table 1 (continued). Summary of 2011 Surveys (* indicates element occurrence natural community type was re-classified and ** indicates that element occurrence was not surveyed because high-quality natural community type of interest does not occur on state lands).

SITE SUMMARIES

BOG

Overview: 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).

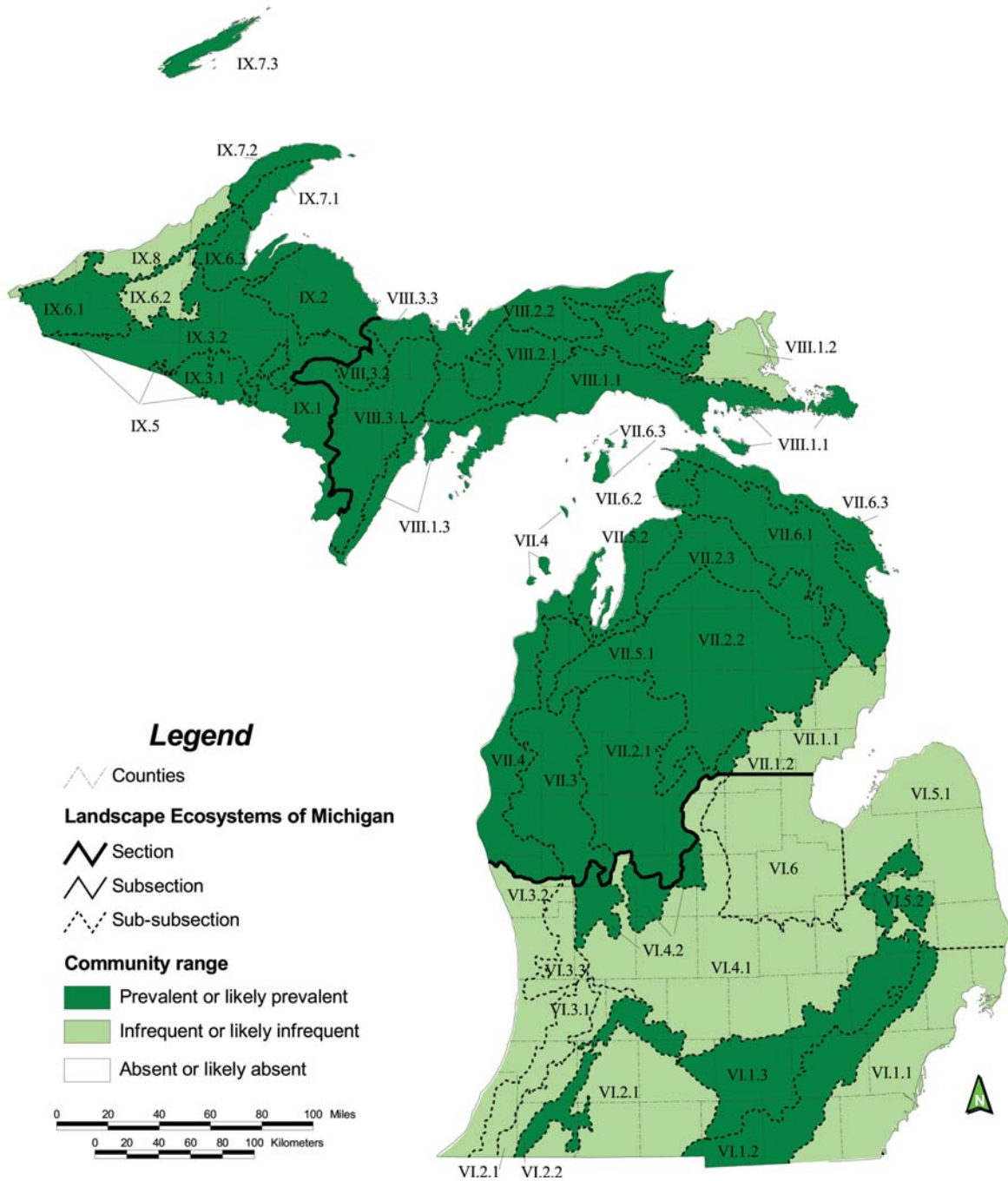


Figure 1. Distribution of bog in Michigan.

1. Cassidy Road Bog

Natural Community Type: Bog

Rank: G3G5 S4, vulnerable to secure globally and secure within the state

Element Occurrence Rank: BC

Size: 20 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 13370

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. Cassidy Road Bog. Photo by Joshua G. Cohen.

2. Joslin Road Bog

Natural Community Type: Bog

Rank: G3G5 S4, vulnerable to secure globally and secure within the state

Element Occurrence Rank: C

Size: 17 acres

Location: Pinckney State Recreation Area

Element Occurrence Identification Number: 13366

Threats: The majority of the bog's species composition and structure are influenced by natural processes. However, there is one localized patch of narrow-leaved cat-tail (*Typha angustifolia*) in the western portion of the depression associated with a sedge mat. Joslin Road may influence localized areas of the bog. Fire suppression in the general landscape is likely impacting the fire regime of the bog. Purple loosestrife (*Lythrum salicaria*) was noted during a 2003 survey along the edges of the wetland but was not observed during the 2011 survey.

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



Photo 2. Joslin Road Bog. Photo by Joshua G. Cohen.

3. Race Road Bog

Natural Community Type: Bog

Rank: G3G5 S4, vulnerable to secure globally and secure within the state

Element Occurrence Rank: BC

Size: 31 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 8326

Threats: The bog is bordered to the east by Race Road, which has likely locally altered the hydrology of the kettle depression. In addition, fire suppression throughout the general landscape may have altered the fire regime of the bog. The overwhelming dominance of leatherleaf (*Chamaedaphne calyculata*), may be an indication that this bog is fire suppressed. Scattered white pine (*Pinus strobus*) saplings occur infrequently within the bog and may have seeded in from the nearby pine plantation to the south 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. Race Road Bog. Photo by Joshua G. Cohen.

DRY SOUTHERN FOREST

Overview: Dry southern forest is a fire-dependent, oak-dominated forest type on dry sites lying mostly south of the climatic tension zone in southern Lower Michigan. Frequent fires maintain semi-open conditions, promoting oak regeneration and ground and shrub layer diversity. The community occurs principally on glacial outwash, and less frequently on sand dunes, sandy glacial lakeplains, and coarse-textured moraines. Dry southern forest typically occurs in conjunction with other fire-dependent upland and wetland communities such as dry-mesic southern forest, oak barrens, dry sand prairie, coastal plain marsh, southern wet meadow, and prairie fen. The soils of dry southern forest are infertile, well-drained sand, loamy sand, or sandy loam with medium to strongly acid pH and low water-retaining capacity (Kost et al. 2007).

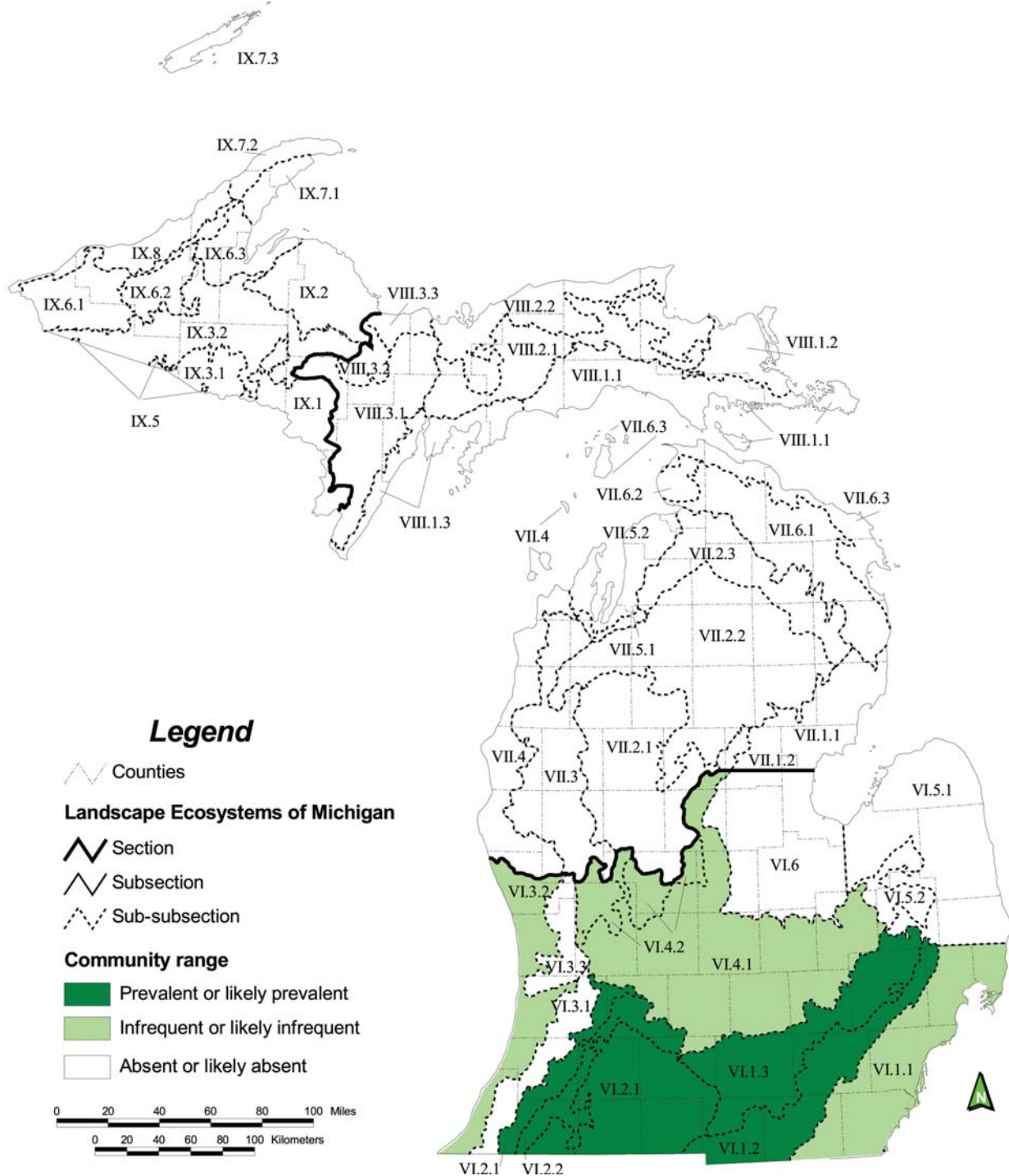


Figure 2. Distribution of dry southern forest in Michigan.

4. Crooked Lake Forest

Natural Community Type: Dry Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: C

Size: 191 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 10880

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by fire suppression, invasive species, and deer herbivory. Oak regeneration is sparse to absent, likely due to fire suppression and mesophytic invasion, competition from invasives, and deer browse pressure. McClure road bisects the forest and numerous hiking and horse trails pass through the forest. These linear anthropogenic disturbances are correlated with invasive species cover. In addition, the two polygons of forest have been fragmented by the sand and gravel mining operation. Invasives are locally abundant in the understory and ground cover and include autumn olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), honeysuckles (*Lonicera* spp.), common privet (*Ligustrum vulgare*), Oriental bittersweet (*Celastrus orbiculatus*), and garlic mustard (*Alliaria petiolata*).

Management Recommendations: The primary management need is the reintroduction of fire as a prevalent disturbance factor. Subcanopy and understory red maple (*Acer rubrum*) could be mechanically controlled if repeated fires do not control this mesophytic invader. In addition, chemical and mechanical control of invasive shrubs will also complement the use of fire. Garlic mustard should be controlled. Control of invasive plant populations will require a major, long-term effort. Deer browse pressure can be lowered by reducing local deer densities. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 4. Crooked Lake Forest dry southern 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).

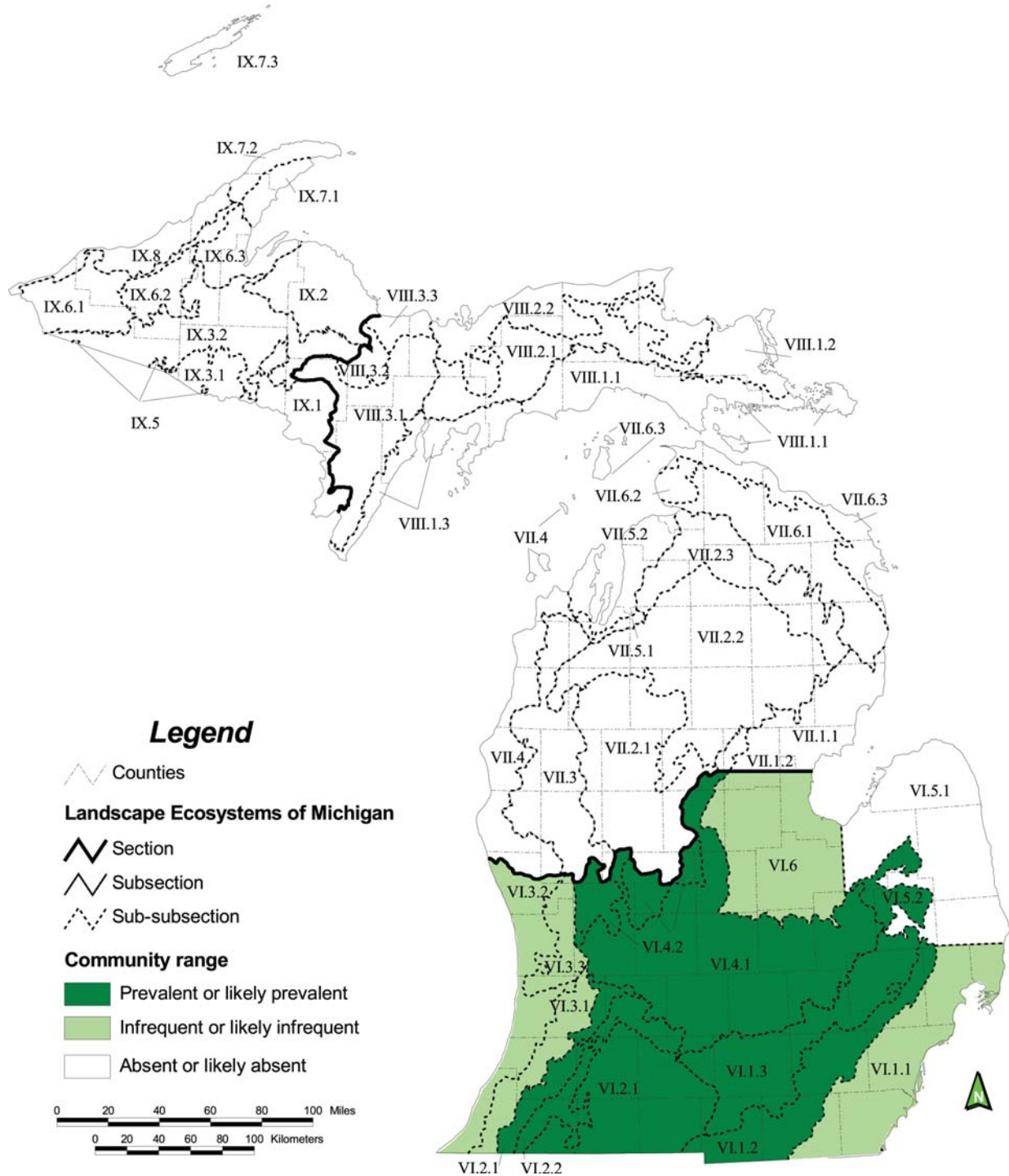


Figure 3. Distribution of dry-mesic southern forest in Michigan.

5. Chamberlain Lakes

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: CD

Size: 90 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 10872

Threats: Historic logging, grazing, fire suppression, and high deer densities have led to considerable degradation of this occurrence. Long-term fire suppression has resulted in significant mesophytic invasion and decrease in oak recruitment. Red maple (*Acer rubrum*) is dominant in the subcanopy, especially on heavier soils. Deer browse has eliminated woody regeneration (including oak regeneration) and almost eliminated populations of preferred forbs in much of the occurrence. The emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.) throughout the area. Well-used trails contribute to the spread of invasive plant species. Invasive species are locally dominant, and are common throughout the occurrence. Oriental bittersweet (*Celastrus orbiculatus*) is the dominant low shrub/woody vine in a significant portion of the forest, particularly under dense canopy and subcanopy cover on heavier soils and in blowdowns. Japanese barberry (*Berberis thunbergii*) is also common to locally abundant, particularly in the same areas as the Oriental bittersweet. Common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*R. frangula*), and multiflora rose (*Rosa multiflora*) are occasional to locally common.

Management Recommendations: Management should focus on reducing or eliminating infestations of invasive species in areas of the forest that are not yet severely impacted (particularly isolated hills within wetland areas) through mechanical treatments, herbicide, and prescribed fire. Deer browse pressure can be lowered by reducing local deer densities (i.e., encouraging increased hunting) and/or by protecting plant regeneration from deer (e.g., targeted seedling/sapling caging). Reintroduction of fire as a prevalent disturbance factor is also recommended. Subcanopy and understory red maple could be mechanically controlled if repeated fires do not provide adequate control. Monitoring should be implemented to evaluate efforts to control non-native plant populations, gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 5. Chamberlain Lakes dry-mesic southern forest. Photo by Bradford S. Slaughter.

6. Graham Lakes

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: CD

Size: 117 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 12628

Threats: Historic logging, grazing, fire suppression, and high deer densities have led to considerable degradation of this occurrence. Long-term fire suppression has resulted in significant mesophytic invasion and a decrease in oak recruitment. Red maple (*Acer rubrum*) is dominant in the subcanopy, especially on heavier soils. Deer browse has eliminated woody regeneration (including oak regeneration) and almost eliminated populations of preferred forbs in much of the occurrence. Well-used trails contribute to the spread of invasive plant species. Invasive species are locally dominant, and are common throughout the occurrence. Oriental bittersweet (*Celastrus orbiculatus*) is the primary threat and is widespread and locally abundant within the forest. Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*) are concentrated on disturbed soils on run-off slopes. Autumn olive (*Elaeagnus umbellata*), smooth arrow-wood (*Viburnum dentatum*) (this population of smooth arrow-wood derives from an escaped cultivar), and Morrow's honeysuckle (*Lonicera morrowii*) are occasional to locally common, often occurring at the bases of large canopy oaks in gaps. The emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.) throughout the area.

Management Recommendations: Management should focus on reducing or eliminating infestations of invasive species through mechanical treatments, herbicide, and prescribed fire. Deer browse pressure can be lowered by reducing local deer densities (i.e., encouraging increased hunting) and/or by protecting plant regeneration from deer (e.g., targeted seedling/sapling caging). Reintroduction of fire as a prevalent disturbance factor is also recommended. Subcanopy and understory red maple could be mechanically controlled if repeated fires do not provide adequate control. Monitoring should be implemented to evaluate efforts to control non-native plant populations, gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 6. Graham Lakes dry-mesic southern forest. Photo by Bradford S. Slaughter.

7. Hall Lake

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: C

Size: 77 acres

Location: Yankee Springs State Recreation Area

Element Occurrence Identification Number: 13353

Threats: The closed-canopy forest suffers from long-term fire suppression, excessive deer browse, invasive species infestations, and disturbances associated with trails and hunting activities. The forest may have been grazed historically. Long-term fire suppression has resulted in significant mesophytic invasion and, in conjunction with high deer densities, a lack of woody regeneration, particularly of fire-adapted species such as oaks. Invasive plant species are abundant and dominate portions of the shrub and ground layers. Of particular note are autumn olive (*Elaeagnus umbellata*) and tree-of-heaven (*Ailanthus altissima*), which are common especially in canopy gaps, and garlic mustard (*Alliaria petiolata*), which is widespread in very large, dense colonies throughout the tract. Amur honeysuckle (*Lonicera maackii*), multiflora rose (*Rosa multiflora*), and Japanese hedge parsley (*Torilis japonica*) are also common, often infesting the same areas. Invasive species have outcompeted native species throughout much of the tract, and alter community composition and the successional trajectory of the forest. The emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.) throughout the area.

Management Recommendations: The site needs considerable stewardship to restore ecological functions and diversity. Management should focus on reducing or eliminating infestations of invasive species through mechanical treatments, herbicide, and prescribed fire. Efforts to control invasive species should focus on tree-of-heaven, autumn olive, and garlic mustard. Deer browse pressure can be lowered by reducing local deer densities. Reintroduction of fire as a prevalent disturbance factor is also recommended. Subcanopy and understory red maple could be mechanically controlled if repeated fires do not provide adequate control. Monitoring should be implemented to evaluate efforts to control non-native plant populations, gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 7. Hall Lake dry-mesic southern forest. Photo by Bradford S. Slaughter.

8. Mt. Holly Forest

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: CD

Size: 81 acres

Location: Holly State Recreation Area

Element Occurrence Identification Number: 6146

Threats: Species composition, vegetative structure, and successional trajectory are strongly influenced by gap dynamics, past logging and grazing history, fire suppression, invasive species, and deer herbivory. Signs of old anthropogenic disturbance were noted throughout the forest including scattered cut stumps, an old fence, and rock piles. Oak regeneration is sparse to absent, likely due to fire suppression and mesophytic invasion, competition from invasives, and deer browse pressure (deer browse was observed on common buckthorn). The prevalence of understory and subcanopy red maple (*Acer rubrum*) and black cherry (*Prunus serotina*) and understory white ash (*Fraxinus americana*) indicate that the forest is fire suppressed. Hiking and biking trails pass through the forest. These linear anthropogenic disturbances are correlated with invasive species cover. Invasives are scattered in the understory and ground cover and include multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), and garlic mustard (*Alliaria petiolata*). Overstory ash have been killed by the emerald ash borer (*Agrilus planipennis*).

Management Recommendations: The primary management need is the reintroduction of fire as a prevalent disturbance factor. Subcanopy and understory red maple could be mechanically controlled if repeated fires do not control this mesophytic invader. In addition, chemical and mechanical control of invasive shrubs will also complement the use of fire to control invasive shrubs. Garlic mustard should be controlled. Control of invasive plant populations will require a major, long-term effort. Deer browse pressure can be lowered by reducing local deer densities. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 8. Mt. Holly Forest dry-mesic southern forest. Photo by Joshua G. Cohen.

9. Norris Road Woods

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: BC

Size: 127 acres

Location: Yankee Springs State Recreation Area

Element Occurrence Identification Number: 13348

Threats: The tract was historically logged and is disturbed by trails that pass through much of the occurrence. The Devil's Soup Bowl area, in particular, is heavily impacted by foot traffic and erosion on trails across the slopes of the bowl. The historic fire regime is suppressed, resulting in increased mesophytic species (i.e., red maple). Deer browse has reduced woody regeneration and reduced and locally eliminated populations of favored forbs. The emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.) throughout the area. Invasive plant species are prevalent and alter community composition, structure, and succession. Of particular note are autumn olive (*Elaeagnus umbellata*) and tree-of-heaven (*Ailanthus altissima*), which are common especially in canopy gaps, and garlic mustard (*Alliaria petiolata*), which is locally abundant in large, dense colonies concentrated in the southern portion of the tract. Multiflora rose (*Rosa multiflora*) and Japanese hedge parsley (*Torilis japonica*) are also common, often infesting the same areas.

Management Recommendations: Management should focus on reducing or eliminating infestations of invasive species through mechanical treatments, herbicide, and prescribed fire. Efforts to control invasive species should focus on tree-of-heaven, autumn olive, and garlic mustard. Deer browse pressure can be lowered by reducing local deer densities. Reintroduction of fire as a prevalent disturbance factor is also recommended. Subcanopy and understory red maple (*Acer rubrum*) could be mechanically controlled if repeated fires do not provide adequate control. Monitoring should be implemented to evaluate efforts to control non-native plant populations, gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 9. Norris Road Woods dry-mesic southern forest. Photo by Bradford S. Slaughter.

10. Pickerel Lake Complex

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: BC

Size: 87 acres

Location: Pinckney State Recreation Area

Element Occurrence Identification Number: 9296

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by gap dynamics, past logging and grazing history, fire suppression, invasive species, and deer herbivory. Oak regeneration is sparse to absent, likely due to fire suppression and mesophytic invasion, competition from invasives, and deer browse pressure. Deer browse was noted throughout and was locally severe. The prevalence of understory and subcanopy red maple (*Acer rubrum*) and black cherry (*Prunus serotina*) and understory gray dogwood (*Cornus foemina*) indicate that the forest is fire suppressed. Hiking and biking trails pass through the forest and have caused severe erosion in places. These linear anthropogenic disturbances are correlated with invasive species cover. Invasives are scattered in the understory and ground cover and include autumn olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), Tartarian honeysuckle (*Lonicera tatarica*), spindle tree (*Euonymus europaea*), Oriental bittersweet (*Celastrus orbiculatus*), and garlic mustard (*Alliaria petiolata*). Fence lines and possible old logging roads were observed, suggesting that portions of the forest were historically grazed and selectively logged.

Management Recommendations: The primary management need is the reintroduction of fire as a prevalent disturbance factor. Subcanopy and understory red maple could be mechanically controlled if repeated fires do not control this mesophytic invader. In addition, chemical and mechanical control of invasive shrubs will also complement the use of fire to control invasives. Garlic mustard should be controlled. Control of invasive plant populations will require a major, long-term effort. Deer browse pressure can be lowered by reducing local deer densities. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 10. Pickerel Lake Complex dry-mesic southern forest. Photo by Joshua G. Cohen.

11. Pontiac 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: 42 acres

Location: Pontiac Lake State Recreation Area

Element Occurrence Identification Number: 2647

Threats: Species composition, vegetative structure, and successional trajectories are strongly influenced by gap dynamics, past logging, fire suppression, invasive species, and deer herbivory. The mapped area was selectively logged but supports mostly mature second-growth forest. The emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.) throughout the area. High deer densities have led to severe browse, reducing and locally eliminating favored herbs and reducing or eliminating (native) woody regeneration throughout the tract. The interaction of fire suppression, high deer densities, and human disturbances have favored a significant increase in red maple (*Acer rubrum*), resulting in dense shading and the elimination of light-dependent ground layer species. Numerous trails pass through the forest, leading to local soil compaction and serving as conduits for the spread of invasive plant species. Several aggressive invasive plant species have colonized this site. Oriental bittersweet (*Celastrus orbiculatus*) is widespread and locally abundant, altering forest structure and composition, particularly in light gaps. Garlic mustard (*Alliaria petiolata*) was noted in several areas and likely impacts ground layer composition. Numerous invasive shrubs also occur, including common buckthorn (*Rhamnus cathartica*), multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and honeysuckles (*Lonicera* spp.). These species alter community structure and soil properties. Several small infestations of black swallow-wort (*Vincetoxicum nigrum*) were noted in the western portion of the occurrence.

Management Recommendations: Management should focus on reducing or eliminating infestations of invasive species through mechanical treatments, herbicide, and prescribed fire. Efforts to control invasive species should focus on black swallow-wort and garlic mustard. Deer browse pressure can be lowered by reducing local deer densities. Reintroduction of fire as a prevalent disturbance factor is also recommended. Subcanopy and understory red maple could be mechanically controlled if repeated fires do not provide adequate control. Monitoring should be implemented to evaluate efforts to control non-native plant populations, gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 11. Pontiac Woods dry-mesic southern forest. Photo by Bradford S. Slaughter.

12. Seven Lakes Woods

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: BC

Size: 102 acres

Location: Seven Lakes State Park

Element Occurrence Identification Number: 2388

Threats: The site has been impacted by historic selective cutting, fire suppression, trail infrastructure, and invasive species. Historic selective cutting affected canopy composition and woody regeneration. Long-term fire suppression affects the broader landscape, including this site, which has been impacted by mesophytic invasion. Red maple (*Acer rubrum*) is locally dominant in the subcanopy, where it is dense enough in places to prevent significant light from reaching the forest floor. Trails provide conduits for invasive plant species and fragment the forest. Emerald ash borer (*Agrilus planipennis*) and invasive plant species have affected forest composition and structure (the latter to a lesser degree). The most commonly noted invasive plants were multiflora rose (*Rosa multiflora*) and autumn olive (*Elaeagnus umbellata*), which were occasional throughout the site and currently pose a modest threat to forest integrity. Edges of trails supported dense but generally narrow infestations of Canada bluegrass (*Poa compressa*). Orchard grass (*Dactylis glomerata*) was commonly present in tight colonies. The emerald ash borer has killed canopy ash (*Fraxinus* spp.) throughout the area.

Management Recommendations: The primary management needs include the continued use of prescribed fire, an assessment of deer densities and browse impacts on woody regeneration and favored herbaceous species, and control and monitoring of invasive plant species. Orchard grass should be reduced and monitored, as it appears to respond positively to prescribed fire.



Photo 12. Seven Lakes Woods dry-mesic southern forest. Photo by Bradford S. Slaughter.

13. Trout Lake

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: CD

Size: 116 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 10627

Threats: Historic logging, grazing, fire suppression, and high deer densities have led to considerable degradation of this occurrence. Long-term fire suppression has resulted in significant mesophytic invasion and, in conjunction with high deer densities, a lack of woody regeneration, particularly of fire-adapted species such as oaks (*Quercus* spp.). Red maple (*Acer rubrum*) is dominant in the subcanopy, especially on heavier soils. In addition, deer browse has almost eliminated populations of preferred forbs in much of the occurrence. The emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.) throughout the area. Well-used trails contribute to the spread of invasive plant species. Invasive species are widespread and abundant and have altered the community structure and successional trajectory of this site. Of particular concern are invasive shrubs, especially Oriental bittersweet (*Celastrus orbiculatus*), smooth arrow-wood (*Viburnum dentatum*) (this population of smooth arrow-wood derives from an escaped cultivar), honeysuckles (*Lonicera* spp.), common buckthorn (*Rhamnus cathartica*), and glossy buckthorn (*R. frangula*). Invasive woody species dominate the shrub and ground layer where deer browse and other factors have eliminated native cover. Isolated canopy gaps are often infested with invasive species (especially Oriental bittersweet). Inclusions of successional forest and old pockets of apple orchard are infested with and co-dominated by the above-listed invasive species.

Management Recommendations: Management should focus on reducing or eliminating infestations of invasive species through mechanical treatments, herbicide, and prescribed fire. Deer browse pressure can be lowered by reducing local deer densities (i.e., encouraging increased hunting) and/or by protecting plant regeneration from deer (e.g., targeted seedling/sapling caging). Reintroduction of fire as a prevalent disturbance factor is also recommended. Subcanopy and understory red maple could be mechanically controlled if repeated fires do not provide adequate control. Monitoring should be implemented to evaluate efforts to control non-native plant populations, gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 13. Trout Lake dry-mesic southern forest. Photo by Bradford S. Slaughter.

14. Walsh Lake

Natural Community Type: Dry-Mesic Southern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: C

Size: 75 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 16037

Threats: Species composition, vegetative structure, and successional trajectory are strongly influenced by gap dynamics, fire suppression, invasive species, and deer herbivory. Oak regeneration is sparse to absent, likely due to fire suppression and mesophytic invasion, competition from invasives, and deer browse pressure. The prevalence of understory and subcanopy red maple (*Acer rubrum*) and black cherry (*Prunus serotina*) and understory gray dogwood (*Cornus foemina*) indicate that the forest is fire suppressed. Hiking trails pass through the forest. These linear anthropogenic disturbances are correlated with invasive species cover. Invasives are scattered in the understory and ground cover and include autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*).

Management Recommendations: The primary management need is the reintroduction of fire as a prevalent disturbance factor. Subcanopy and understory red maple could be mechanically controlled if repeated fires do not control this mesophytic invader. In addition, chemical and mechanical control of invasive shrubs will also complement the use of fire to control invasives. Garlic mustard should be controlled. Control of invasive plant populations will require a major, long-term effort. Deer browse pressure can be lowered by reducing local deer densities. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 14. Walsh Lake dry-mesic southern forest. Photo by Joshua G. Cohen.

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 plantain (*Alisma plantago-aquatica*), 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 4. Distribution of emergent marsh in Michigan.

15. Moss Lake

Natural Community Type: Emergent Marsh

Rank: GU S4, globally unrankable and secure within the state

Element Occurrence Rank: B

Size: 3.4 acres

Location: Proud Lake State Recreation Area

Element Occurrence Identification Number: 6744

Threats: Species composition, vegetative structure, and successional trajectory are influenced by natural process. The dam downstream of Proud Lake has impacted the wetland hydrology. In addition, boat traffic may be impacting emergent marsh vegetation. The invasives reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), narrow-leaved cat-tail (*Typha angustifolia*), and hybrid cat-tail (*Typha xglauca*) may pose a threat to shallow water and nearshore areas of emergent marsh, especially during low water periods.

Management Recommendations: The primary management needs are to maintain a buffer of natural communities surrounding the marsh to preserve the wetland hydrology and control populations of invasive species along the shoreline, especially reed, purple loosestrife, invasive cat-tails, and reed canary grass. Efforts to control invasive species should be monitored.



Photo 15. Moss Lake emergent marsh. Photo by Joshua G. Cohen.

FLOODPLAIN FOREST

Overview: Floodplain forest is a bottomland, deciduous or deciduous-conifer forest community occupying low-lying areas adjacent to streams and rivers of third order or greater, and subject to periodic over-the-bank flooding and cycles of erosion and deposition. Species composition and community structure vary regionally and are influenced by flooding frequency and duration. Silver maple (*Acer saccharinum*) and green ash (*Fraxinus pennsylvanica*) are typically major overstory dominants. Floodplain forests occur along major rivers throughout the state, but are most extensive in the Lower Peninsula. Species richness is greatest in the southern Lower Peninsula, where many floodplain species reach the northern extent of their range (Kost et al. 2007).

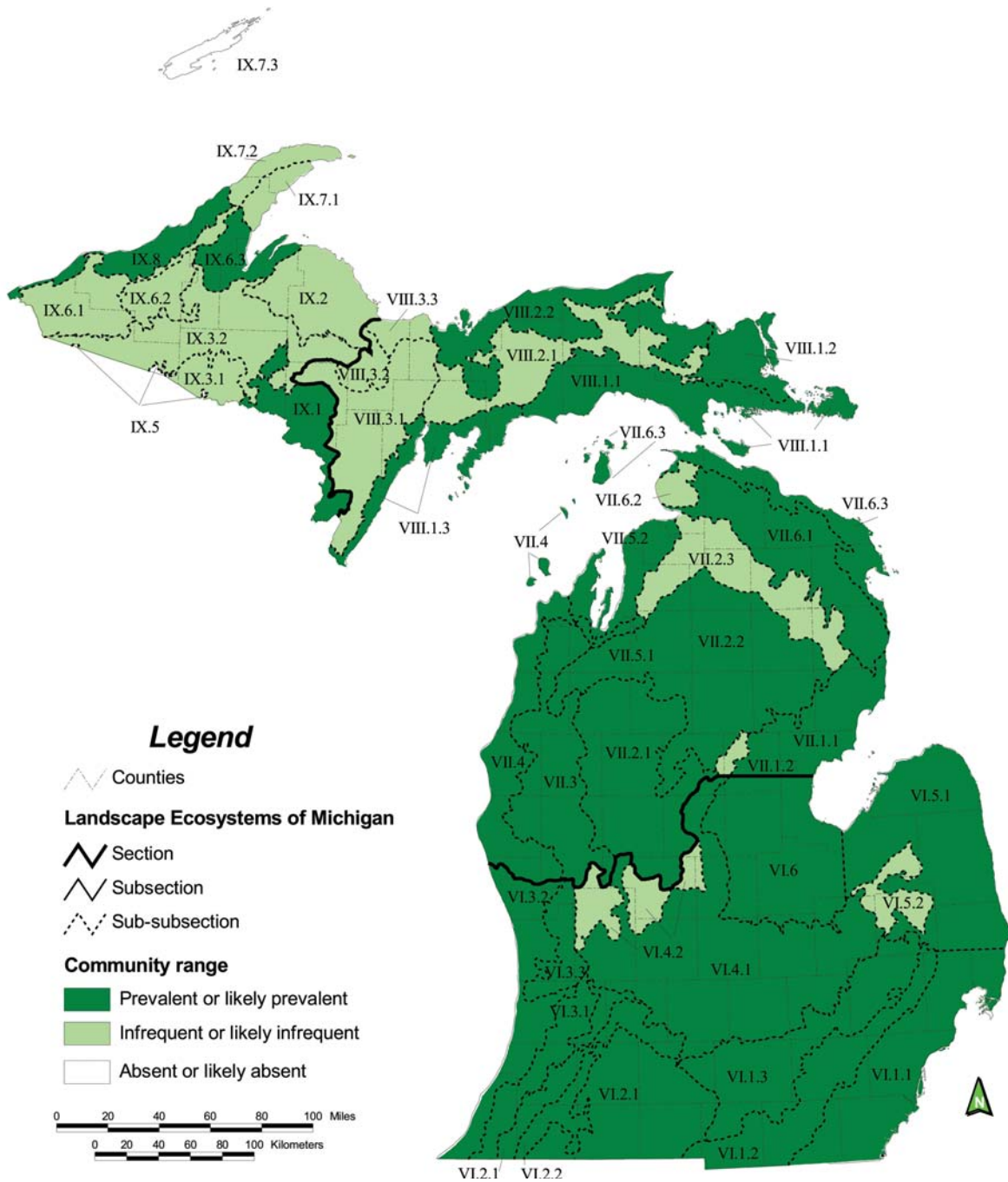


Figure 5. Distribution of floodplain forest in Michigan.

16. Archery Range Floodplain Forest

Natural Community Type: Floodplain Forest

Rank: G3? S3, vulnerable throughout range

Element Occurrence Rank: C

Size: 81 acres

Location: Island Lake State Recreation Area

Element Occurrence Identification Number: 11353

Threats: Species composition, vegetative structure, and successional trajectory are strongly influenced by gap dynamics and over-the-bank-flooding but they are also impacted by invasive species. Emerald ash borer (*Agilus planipennis*) has killed the canopy ash (*Fraxinus* spp.) within this floodplain forest generating numerous snags, light gaps, and ash coarse woody debris. Invasive species (i.e., reed canary grass, garlic mustard, privet, Japanese barberry, autumn olive, glossy buckthorn, multiflora rose, Tartarian honeysuckle, and woodland forget-me-not) are locally common and compete with native understory species. A canoe camp site, trails, and scattered cut stumps occur within the floodplain forest.

Management Recommendations: The primary management recommendations are to allow natural processes (i.e., flooding and windthrow) to operate unhindered (e.g., prohibit salvage logging and avoid altering the hydrology of the Huron River), control invasives, monitor for invasives and deer browse, and retain an intact buffer of natural communities surrounding the floodplain forest.



Photo 16. Archery Range Floodplain Forest. 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).

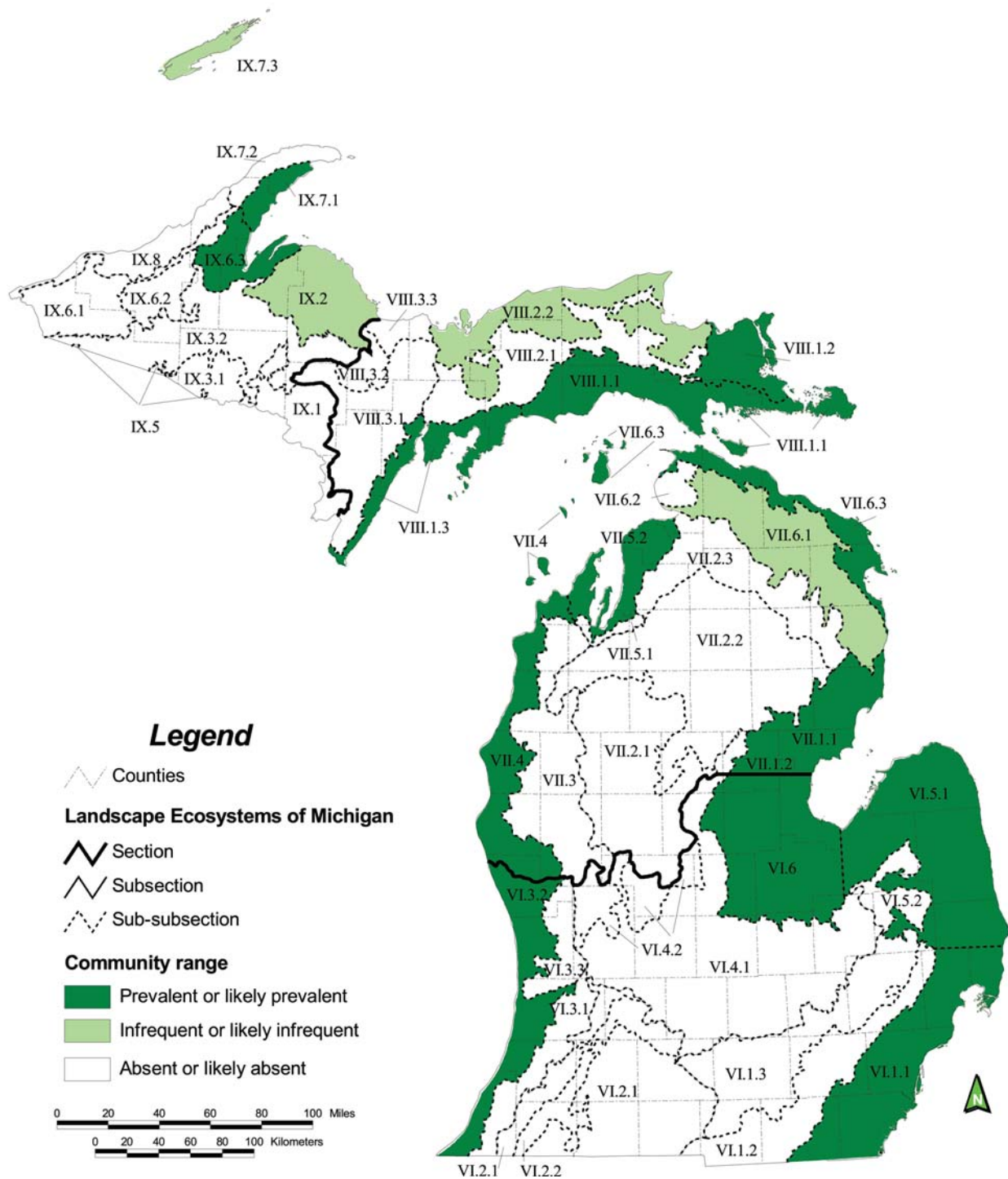


Figure 6. Distribution of Great Lakes marsh in Michigan.

17. Negwegon Marsh

Natural Community Type: Great Lakes Marsh

Rank: G2 S3, globally imperiled and vulnerable within the state

Element Occurrence Rank: B

Size: 573 acres

Location: Negwegon State Park

Element Occurrence Identification Number: 5459

Threats: Several invasive plant species that are local or occasional within the wetland have the potential to increase, particularly reed (*Phragmites australis*), hybrid cat-tail (*Typha x glauca*), and glossy buckthorn (*Rhamnus frangula*). Infestations of these plants are still localized and treatable, but will become less easily treatable without timely implementation of a control strategy.

Management Recommendations: The primary management recommendations are to control populations of reed and hybrid cat-tail, monitor for invasive species, and restrict off-road vehicle access along the shoreline.



Photo 17. Negwegon Marsh Great Lakes marsh. Photo by Bradford S. Slaughter.

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).

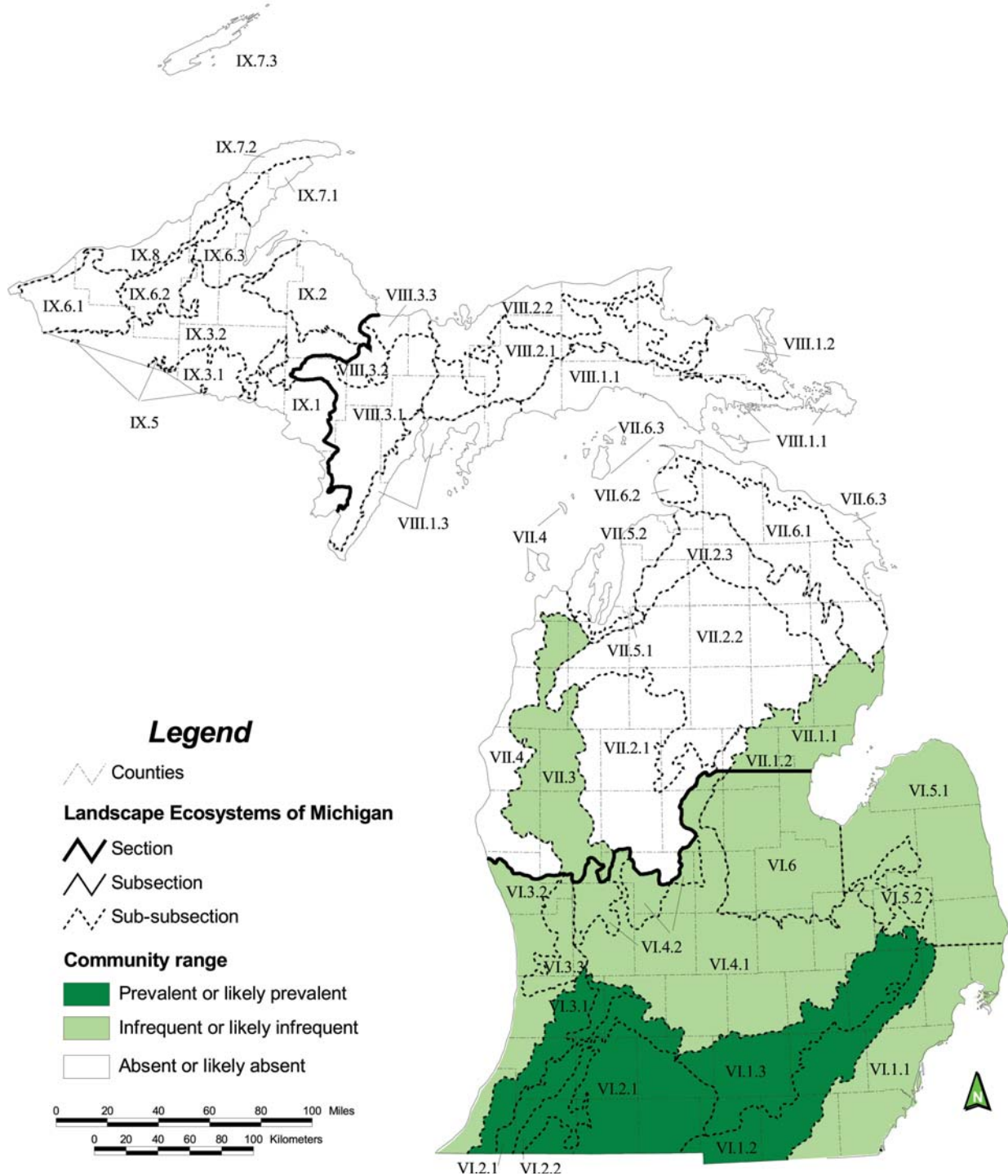


Figure 7. Distribution of inundated shrub swamp in Michigan.
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18. Crooked Lake Shrub Swamp

Natural Community Type: Inundated Shrub Swamp

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: AB

Size: 12 acres

Location: Pinckney State Recreation Area

Element Occurrence Identification Number: 16880

Threats: Species composition, vegetative structure, and successional trajectory are influenced by natural process. Bittersweet nightshade (*Solanum dulcamara*) is locally common within the shrub swamp but does not appear to currently threaten native species composition and floristic structure. Invasives noted in adjacent uplands include glossy buckthorn (*Rhamnus frangula*), multiflora rose (*Rosa multiflora*), and Tartarian honeysuckle (*Lonicera tatarica*).

Management Recommendations: The primary management recommendations are to maintain a forested buffer around the inundated shrub swamp and allow the swamp to burn when surrounding uplands are burned. Efforts to control and monitor bittersweet nightshade and invasive shrubs in the surrounding uplands should be implemented.



Photo 18. Crooked Lake Shrub Swamp inundated shrub swamp. 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).

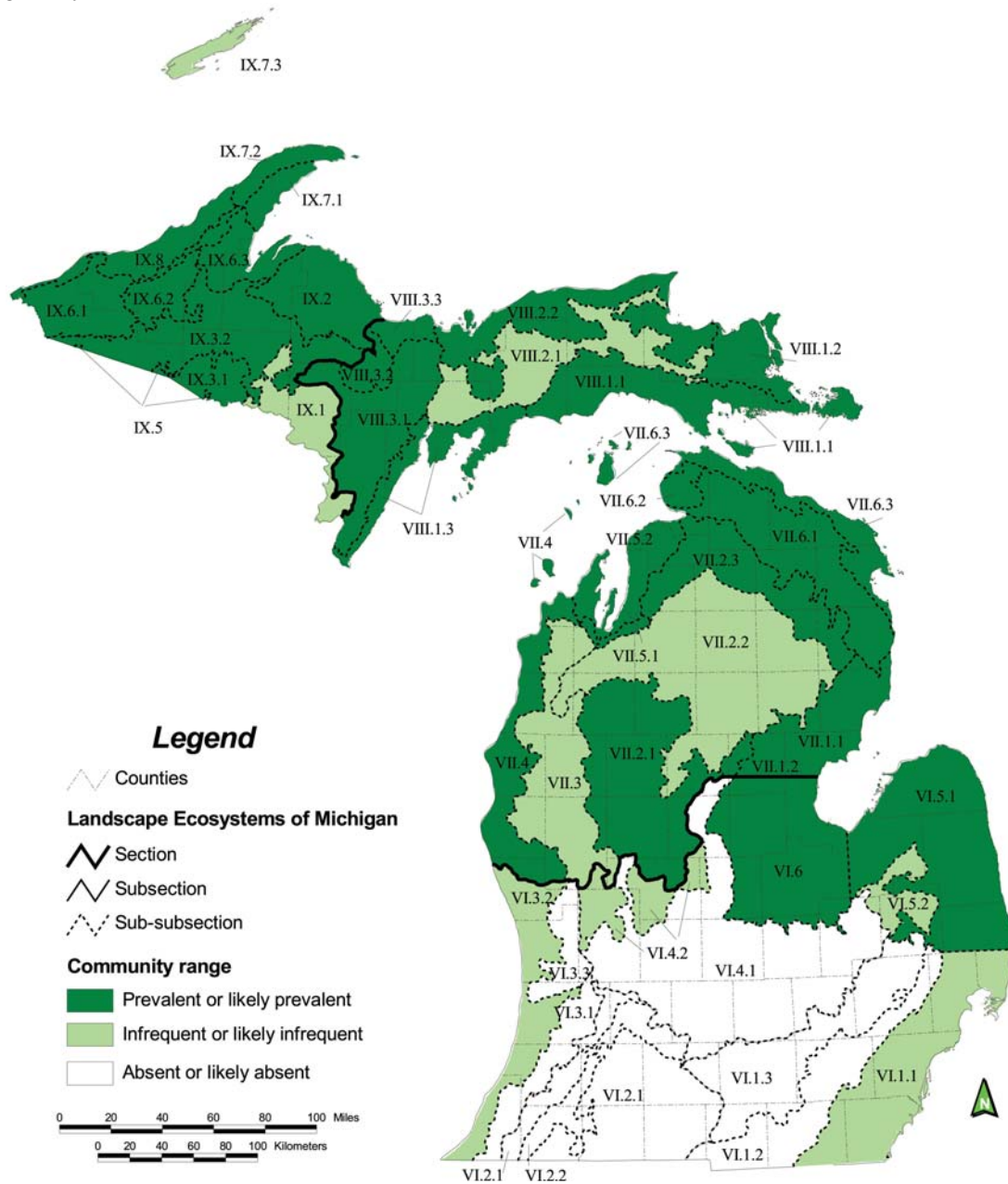


Figure 8. Distribution of mesic northern forest in Michigan.

19. Lake Gogebic

Natural Community Type: Mesic Northern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: AB

Size: 184 acres

Location: Lake Gogebic State Park

Element Occurrence Identification Number: 8276

Threats: Species composition and structure are patterned by gap-phase dynamics. Dutch elm disease has eliminated American elm (*Ulmus americana*) as a canopy component. American elm was noted as a canopy associate during the 1981 survey. Hiking trails occur throughout the forest. No invasive species were noted within the forest. The proximity of the state park campground to the east results in the perennial threat of the introduction of the emerald ash borer (*Agrilus planipennis*) if campers bring firewood from affected areas to the site. Deer browse was noted throughout the forest (evidence of browse was noted on sugar maple and jewelweed). Scattered cut stumps occur along the margins of the forest.

Management Recommendations: Management recommendations include allowing natural processes (i.e., fire and windthrow) to operate unhindered (e.g., prohibit salvage logging), and monitoring for invasives and deer browse. As noted above, the proximity of the campground to the east results in the perennial threat of the introduction of the emerald ash borer if campers bring firewood from affected areas to the site. Monitoring of firewood entering the campground and prohibiting the use of non-local firewood would help limit the possibility of introduction of emerald ash borer to this area.



Photo 19. Lake Gogebic mesic northern forest. Photo by Joshua G. Cohen.

20. Laughing Whitefish Falls

Natural Community Type: Mesic Northern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: B

Size: 243 acres

Location: Laughing Whitefish Falls State Park

Element Occurrence Identification Number: 7919

Threats: Species composition and structure are patterned by gap-phase dynamics. Hiking trails occur throughout the forest and include areas of boardwalk and stairs. No major invasive species were noted. Non-native weeds observed include helleborine (*Epipactis helleborine*), common dandelion (*Taraxacum officinale*), and common hemp nettle (*Galeopsis tetrahit*), which were primarily noted along the trail margins. Deer browse was noted but does not appear to be limiting species composition and floristic structure. Scattered cut stumps occur along the margins of the forest.

Management Recommendations: The primary management recommendations are to allow natural processes (i.e., fire and windthrow) to operate unhindered (e.g., prohibit salvage logging), monitor for invasives and deer browse, and to retain an intact buffer of natural communities surrounding the forest.



Photo 20. Laughing Whitefish Falls mesic northern forest. Photo by Joshua G. Cohen.

21. Wells Mesic Northern Forest

Natural Community Type: Mesic Northern Forest

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: BC

Size: 122 acres

Location: Wells State Park

Element Occurrence Identification Number: 9618

Threats: Hiking and skiing trails occur throughout the forest. In addition, the forest is intersected by gravel roads and Highway 35. A lone autumn olive (*Elaeagnus umbellata*) was documented within the forest. Both glossy buckthorn (*Rhamnus frangula*) and Japanese barberry (*Berberis thunbergii*) were noted in boreal forest to the northeast. Non-native weeds are common within the recent windthrow gaps and along the trails (i.e., burdock, lawn prunella, and Canada bluegrass). Deer browse was noted throughout the forest and may be impacting species composition and floristic structure. Scattered cut stumps occur along the margins of the forest. Along the trails, coarse woody debris has been cut and moved, and near the rustic cabin there has been some cutting for firewood.

Management Recommendations: Management recommendations include allowing natural processes (i.e., windthrow and fire) to operate unhindered (e.g., prohibit salvage logging and moving and removal of coarse woody debris), controlling non-native species in the forest and in the surrounding area, reducing local deer densities, and monitoring for invasives and deer browse.



Photo 21. Wells Mesic Northern Forest. Photo by Joshua G. Cohen.

MESIC SOUTHERN FOREST

Overview: Mesic southern forest is an American beech– and sugar maple–dominated forest distributed south of the climatic tension zone and found on flat to rolling topography with predominantly loam soils. Mesic southern forest is found principally on medium- or fine-textured ground moraine, medium- or fine-textured end moraine, and on silty/clayey glacial lakeplains. Sand dunes and sandy lakeplains can support these systems where proximity to the Great Lakes modifies the local climate. The community can also occur on ice-contact topography and coarse-textured end moraines, as well as floodplain terraces in a diversity of landforms. Prevalent topographic positions of this community are gentle to moderate slopes and low, level areas with moderate to good drainage. The community occurs on a variety of soil types, but loam is the predominant texture. Soils supporting mesic southern forest include sand, sandy loam, loamy sand, loam, silt loam, silty clay loam, clay loam, and clay. Soils are typically well-drained with high water-holding capacity and high nutrient and soil organism content. The natural disturbance regime is characterized by gap-phase dynamics; frequent, small windthrow gaps allow for the regeneration of shade-tolerant, canopy species. Historically, mesic southern forest occurred as a matrix system, dominating vast areas of rolling to level, loamy uplands of the Great Lakes region. These forests were multi-generational, with old-growth conditions lasting many centuries (Kost et al. 2007).

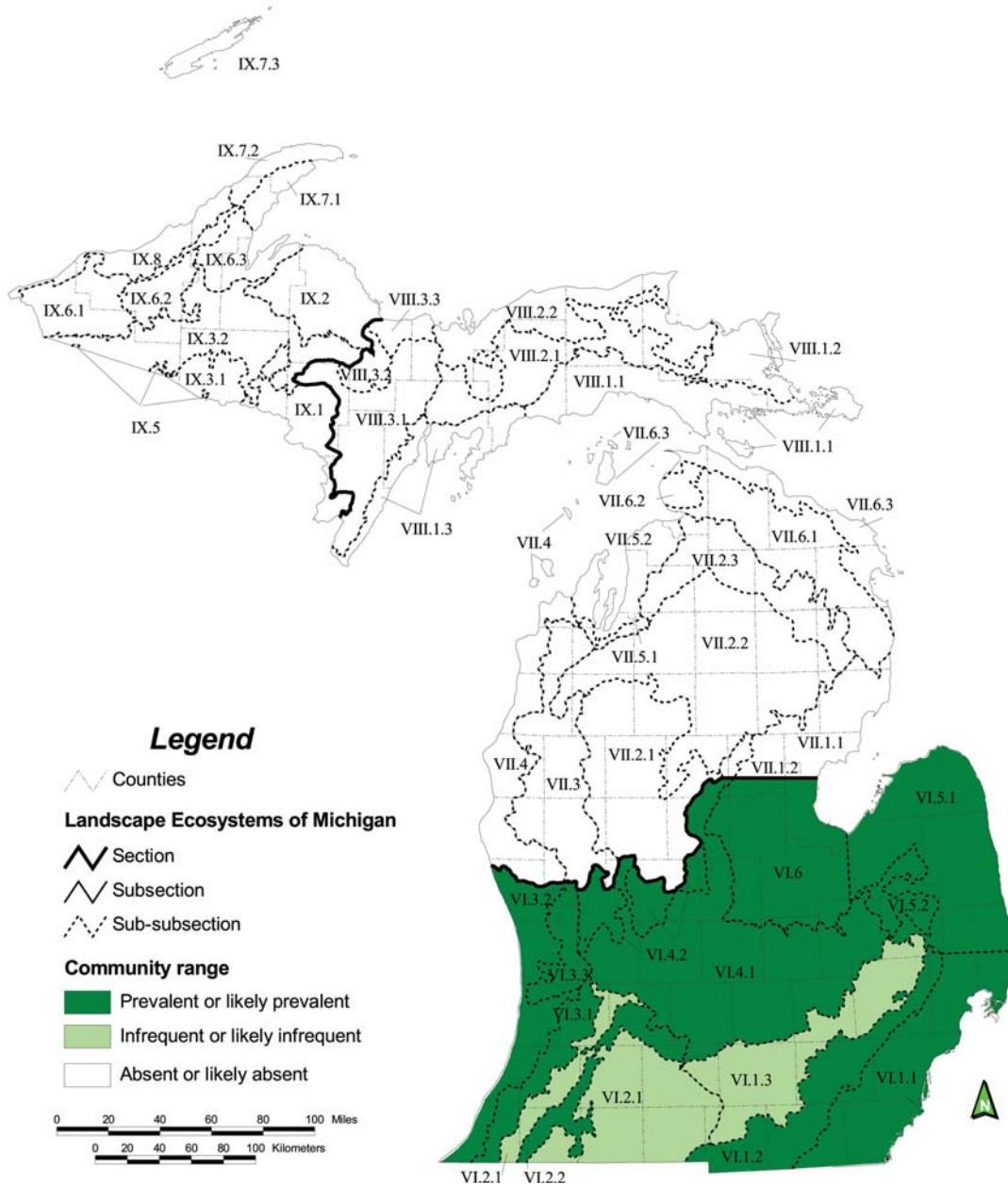


Figure 9. Distribution of mesic southern forest in Michigan.

22. Moss Lake Forest

Natural Community Type: Mesic Southern Forest

Rank: G2G3 S3, imperiled to vulnerable globally and vulnerable within the state

Element Occurrence Rank: C

Size: 89 acres

Location: Proud Lake State Recreation Area

Element Occurrence Identification Number: 12888

Threats: Species composition, vegetative structure, and successional trajectory are strongly influenced by gap dynamics, past logging and grazing history, invasive species, and deer herbivory. Scattered windthrow has generated small canopy gaps and a moderate volume of coarse woody debris. Emerald ash borer (*Agilus planipennis*) has killed the canopy ash (*Fraxinus americana*) within this forest. Invasive shrubs (i.e., Japanese barberry, autumn olive, and multiflora rose) are locally common and compete with the native understory species. Deer browse was noted throughout and deer herbivory has likely impacted species composition and structure. Numerous hiking trails occur throughout the forest. In addition, a power line and a road intersect the forest complex. Invasives are concentrated near trails and roads. Fire suppression in the overall landscape may result in decreased fire frequency in the forest complex.

Management Recommendations: The primary management need is to control the invasive species. Control of invasive plant populations will require a major, long-term effort. Deer browse pressure can be lowered by reducing local deer densities. Monitoring should be implemented for efforts to control non-native plant populations, to gauge the impact of deer herbivory, and evaluate regeneration.



Photo 22. Moss Lake Forest mesic southern forest. Photo by Joshua G. Cohen.

23. Teggerdine Road Mesic Forest

Natural Community Type: Mesic Southern Forest

Rank: G2G3 S3, imperiled to vulnerable globally and vulnerable within the state

Element Occurrence Rank: C

Size: 8.4 acres

Location: Pontiac Lake State Recreation Area

Element Occurrence Identification Number: 11418

Threats: The main disturbance to the forest is severe deer browse, which has restricted woody regeneration and reduced populations of deer-preferred ground layer species. No invasive plants were noted within the mapped occurrence. Emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus americana*).

Management Recommendations: The primary management needs are to reduce deer densities (i.e., encouraging increased hunting) and browse pressure (i.e., targeted seedling/sapling protection) and to monitor for invasive species.



Photo 23. Teggerdine Road Mesic Forest mesic southern forest. Photo by Bradford S. Slaughter.

OAK BARRENS

Overview: Oak barrens is a fire-dependent savanna type dominated by oaks, having between 5 and 60% canopy, with or without a shrub layer. Black oak (*Quercus velutina*) and white oak (*Q. alba*) typically dominate the scattered overstory. The predominantly graminoid ground layer is composed of species associated with both prairie and forest communities. Oak barrens are found on droughty soils and occur typically on nearly level to slightly undulating glacial outwash in southern Lower Michigan (Kost et al. 2007).

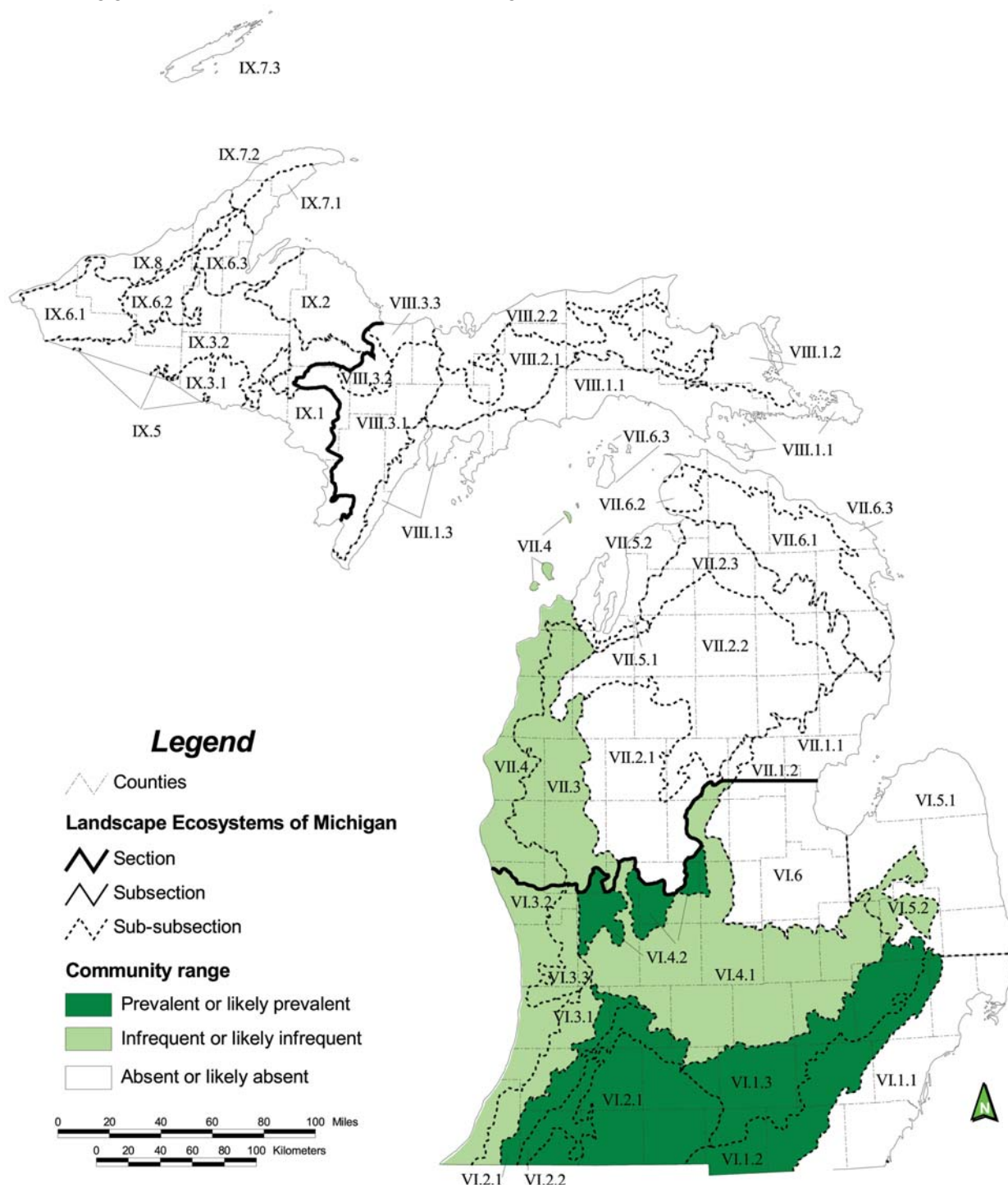


Figure 10. Distribution of oak barrens in Michigan.

24. Huron River Barrens

Natural Community Type: Oak Barrens

Rank: G2? S1, globally imperiled and critically imperiled in the state

Element Occurrence Rank: CD

Size: 421 acres

Location: Island Lake State Recreation Area

Element Occurrence Identification Number: 1344

Threats: Long-term fire suppression has resulted in the invasion of mesophytic and/or fire-intolerant species into the canopy, sub-canopy, and understory as well as the widespread establishment and infestation of invasive species. Woody encroachment has generated a shift in structure from barrens to predominantly woodland with scattered open pockets. Invasives have also been widely planted within the surrounding landscape. Past farming practices, the establishment of pine plantations, and fragmentation have further degraded this oak barrens. A railroad bed and roads fragment the barrens. Widespread and/or commonly dominant invasives include: quack grass (*Agropyron repens*), false indigo (*Amorpha fruticosa*), Japanese barberry (*Berberis thunbergii*), smooth brome (*Bromus inermis*), musk thistle (*Carduus nutans*), Oriental bittersweet (*Celastrus orbiculata*), spotted knapweed (*Centaurea maculosa*), autumn olive (*Elaeagnus umbellata*), silky bush clover (*Lespedeza cuneata*), butter and eggs (*Linaria vulgaris*), Amur honeysuckle (*Lonicera maackii*), Timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), lawn prunella (*Prunella vulgaris*), common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*R. frangula*), black locust (*Robinia pseudoacacia*), multiflora rose (*Rosa multiflora*), sheep sorrel (*Rumex acetosella*), bouncing bet (*Saponaria officinalis*), common mullein (*Verbascum thapsus*), and hairy vetch (*Vicia villosa*). In addition to invasive plants, high deer densities are likely impacting the species composition and floristic structure of the barrens.

Management Recommendations: The primary management need is the continued use of fire as a prevalent disturbance factor. Establishment of very large burn units is recommended. Subcanopy and understory mesophytic species could be mechanically controlled if repeated fires do not control them. Pine plantations and naturalized pine could be burnt or mechanically removed. In addition, chemical and mechanical control of invasive shrubs and woody vines will also complement the use of fire to control invasive shrubs. 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. In addition, native prairie seed could be collected and sowed to expand the barrens remnants. Deer browse pressure could be reduced by decreasing local deer populations (i.e., encouraging increased hunting). Monitoring should be implemented to assess the effectiveness of efforts to control non-native plant populations, gauge the impact of deer herbivory, and evaluate fire management.



Photo 24. Huron River Barrens oak barrens. Photo by Michael A. Kost.

25. Proud Lake Barrens

Natural Community Type: Oak Barrens

Rank: G2? S1, globally imperiled and critically imperiled in the state

Element Occurrence Rank: D

Size: 21 acres

Location: Proud Lake State Recreation Area

Element Occurrence Identification Number: 548

Threats: Decades of fire suppression have resulted in the invasion of mesophytic and/or fire-intolerant species into the canopy, sub-canopy, and understory including maples (*Acer* spp.), sassafras (*Sassafras albidum*), red cedar (*Juniperus virginiana*), black cherry (*Prunus serotina*), aspens (*Populus* spp.), gray dogwood (*Cornus foemina*), and invasive shrubs. Woody encroachment has generated a shift in structure from barrens to predominantly woodland. Invasive shrubs prevalent within the degraded barrens include autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and common buckthorn (*Rhamnus cathartica*). The site was likely logged, grazed, and/or farmed in the past. Absence of canopy oaks in portions of the complex suggests that the site was selectively logged. Hiking, biking, and horse trails occur throughout the barrens. Numerous non-native weeds are prevalent in the ground cover and especially along the trails including spotted knapweed (*Centaurea maculosa*), St. John's-wort (*Hypericum perforatum*), wild carrot (*Daucus carota*), white sweet-clover (*Melilotus alba*), smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), asparagus (*Asparagus officinalis*), and common mullein (*Verbascum thapsus*).

Management Recommendations: The primary management need is the reintroduction of fire as a prevalent disturbance factor. Subcanopy and understory mesophytic species could be mechanically controlled if repeated fires don't control them. In addition, chemical and mechanical control of invasive shrubs will also complement the use of fire to control invasive shrubs. 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, to gauge the impact of deer herbivory, and evaluate oak regeneration.



Photo 25. Proud Lake Barrens oak barrens. Photo by Joshua G. Cohen.

26. Teahen Road Oak Barrens

Natural Community Type: Oak Barrens

Rank: G2? S1, globally imperiled and critically imperiled in the state

Element Occurrence Rank: D

Size: 2.3 acres

Location: Brighton State Recreation Area

Element Occurrence Identification Number: 3617

Threats: Decades of fire suppression have resulted in the invasion of mesophytic and/or fire-intolerant species into the canopy, sub-canopy, and understory including red maple (*Acer rubrum*), sassafras (*Sassafras albidum*), black cherry (*Prunus serotina*), red cedar (*Juniperus virginiana*), gray dogwood (*Cornus foemina*), choke cherry (*Prunus virginiana*), and invasive shrubs. Woody encroachment has generated a shift in structure from barrens to predominantly woodland. Woody invasive prevalent within the degraded barrens include autumn olive (*Elaeagnus umbellata*), glossy buckthorn (*Rhamnus frangula*), honeysuckles (*Lonicera* spp.), and Oriental bittersweet (*Celastrus orbiculatus*). A trail passes through the barrens. Numerous non-native weeds are prevalent in the ground cover and especially along the trail including spotted knapweed (*Centaurea maculosa*), St. John's-wort (*Hypericum perforatum*), wild carrot (*Daucus carota*), smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), ox-eye daisy (*Chrysanthemum leucanthemum*), Canada bluegrass (*Poa compressa*), lawn prunella (*Prunella vulgaris*), red clover (*Trifolium pratense*), sheep sorrel (*Rumex acetosella*), and common mullein (*Verbascum thapsus*).

Management Recommendations: The primary management need is the increased use of fire as a prevalent disturbance factor. Subcanopy and understory mesophytic species could be mechanically controlled if repeated fires don't control them. In addition, chemical and mechanical control of invasive shrubs will also complement the use of fire to control invasive shrubs. 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, to gauge the impact of deer herbivory, and evaluate the floristic response to fire.



Photo 26. Teahen Road Oak Barrens. 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 coniferous trees, sphagnum mosses, and ericaceous shrubs. This system is found predominantly north of the climatic tension zone, and much less frequently in southern Lower Michigan. The community occurs in depressions in glacial outwash and sandy glacial lakeplains and in kettles on pitted outwash and depressions on moraines. Fire occurs naturally during drought periods and creates even-aged, often monospecific, stands of black spruce (*Picea mariana*). Windthrow, beaver flooding, and insect defoliation are also important disturbance factors influencing species composition and structure (Kost et al. 2007).

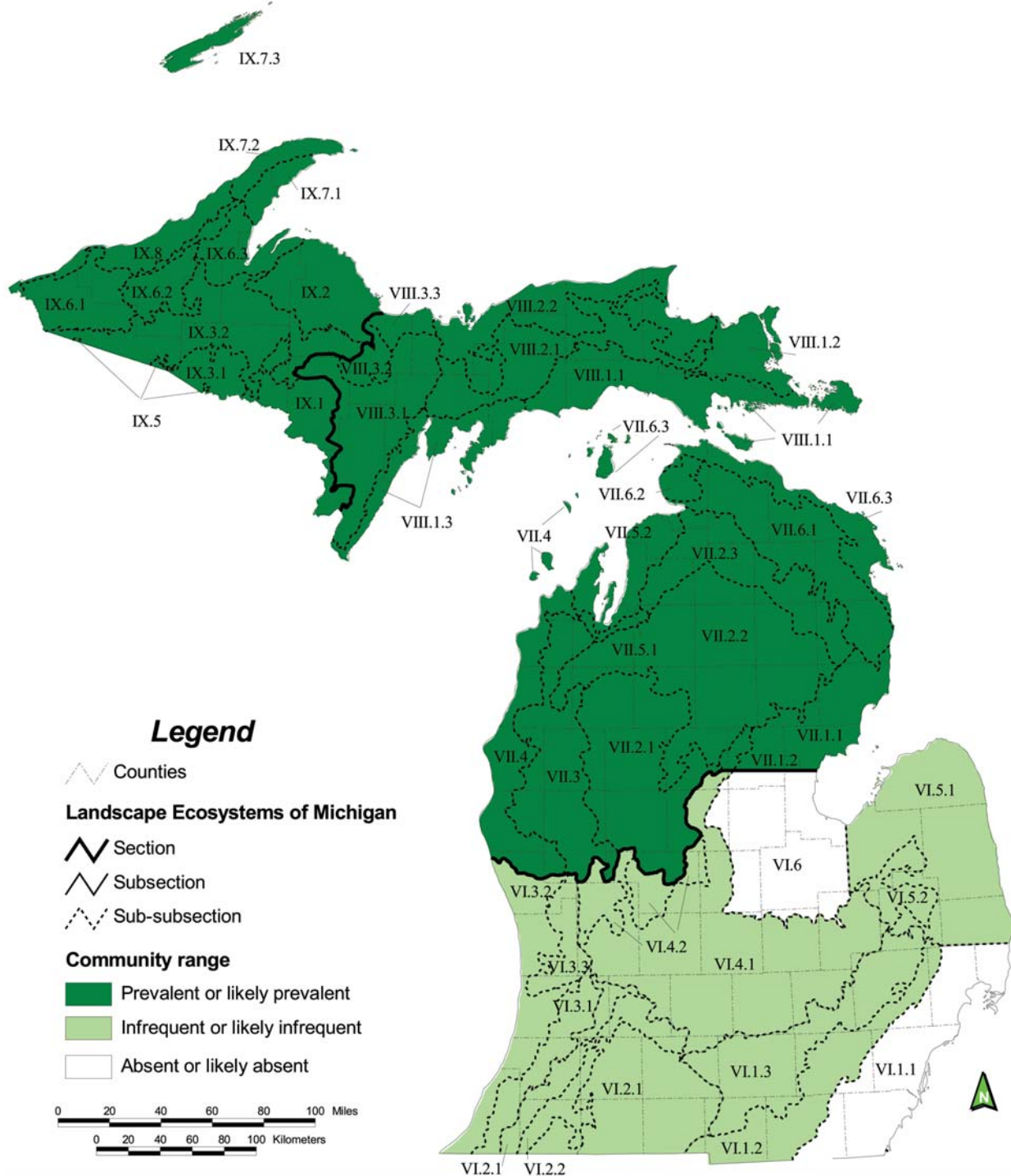


Figure 11. Distribution of poor conifer swamp in Michigan.

27. Waterloo Black Spruce Bog

Natural Community Type: Poor Conifer Swamp

Rank: G4 S4, apparently secure globally and within the state

Element Occurrence Rank: C

Size: 15 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 16762

Threats: The species composition, vegetative structure, and successional trajectory of the poor conifer swamp have been impacted by competition from the invasive shrub glossy buckthorn (*Rhamnus frangula*), which is locally abundant in the understory and low shrub layers. The hydrology of the peatland may have been altered by drainage for agriculture. It is possible that drier conditions of the peat have made the swamp more susceptible to invasion by glossy buckthorn. Fire suppression throughout the general landscape may have altered the fire regime of the poor conifer swamp. Hunting paths have been cut through the 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.



Photo 27. Waterloo Black Spruce Bog poor conifer swamp. 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).

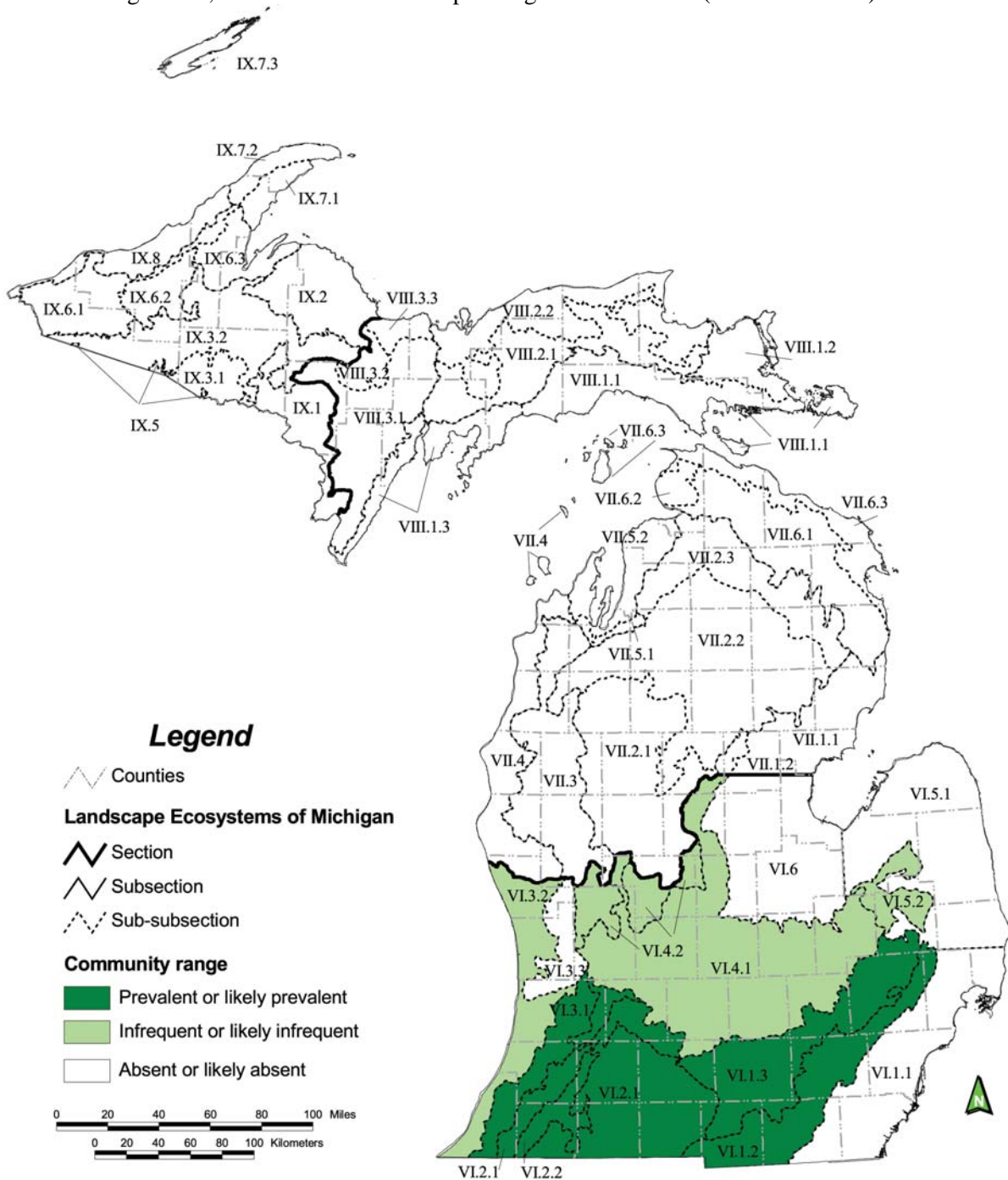


Figure 12. Distribution of prairie fen in Michigan.

28. Algae Lake Prairie Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: BC

Size: 5.0 acres

Location: Ortonville State Recreation Area

Element Occurrence Identification Number: 12367

Threats: A very small, abandoned gravel mine borders the northwest portion of the fen. A low earthen dam serves as the western border of the fen and separates the fen from the remainder of the wetland. A culvert under the earthen dam creates a stream channel within the fen where soil erosion and soil sloughing occur. Garbage is common along the shoreline. Fire suppression has allowed for increases in woody vegetation. High deer densities may be detrimentally impacting the fen's flora. Localized infestations of invasive plants also threaten to alter the fen's species composition and vegetative structure. Invasives and their abundances are as follows: red top (*Agrostis gigantea*) (uncommon); asparagus (*Asparagus officinalis*) (rare); wild carrot (*Daucus carota*) (occasional); autumn olive (*Elaeagnus umbellata*) (occasional); white sweet clover (*Melilotus alba*) (rare); Colorado blue spruce (*Picea pungens*) (rare); scotch pine (*Pinus sylvestris*) (rare); glossy buckthorn (*Rhamnus frangula*) (occasional); bittersweet nightshade (*Solanum dulcamara*) (uncommon); narrow-leaved cat-tail (*Typha angustifolia*) (locally dominant); and hybrid cattail (*Typha xglauca*) (locally dominant).

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen, remove the earthen dam, pick up the trash, lower deer browse pressure by reducing deer densities, and burn the fen periodically once the invasive cat-tails have been controlled. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate deer browse pressure and the success of fire management.



Photo 28. Algae Lake Prairie Fen. Photo by Michael A. Kost.

29. Bauer Road Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: BC

Size: 35 acres

Location: Brighton State Recreation Area

Element Occurrence Identification Number: 10244

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment. Invasives are localized but increasing in dominance and include narrow-leaved cat-tail (*Typha angustifolia*) (concentrated in marl flats) and glossy buckthorn (*Rhamnus frangula*) (infringing from the upper margin and locally dominant). In addition, purple loosestrife (*Lythrum salicaria*) occurs occasionally in the marl flats near the lake margin. A boardwalk occurs along the southeastern shore of Murray Lake and evidence of off-road vehicle activity was noted within the wetland.

Management Recommendations: Prescribed fire should continue to be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should be controlled. Continued chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology. Restriction of off-road vehicle activity should be enforced.



Photo 29. Bauer Road Fen prairie fen. Photo by Joshua G. Cohen.

30. Brandt Road Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: BC

Size: 27 acres

Location: Holly State Recreation Area

Element Occurrence Identification Number: 8730

Threats: Perryville Road occurs along the south edge of the fen and bisects this wetland and disrupts its hydrology. Runoff from Perryville Road and salt spray from nearby paved roads likely enter the fen and provides favorable conditions for cat-tails (*Typha* spp.). Fire suppression in the past allowed for increases in woody vegetation. High deer densities may be detrimentally impacting the fen's flora. Localized infestations of invasive plants also threaten to alter the fen's species composition and vegetative structure. Invasives and their abundances are as follows: redtop (*Agrostis gigantea*) (rare); autumn olive (*Elaeagnus umbellata*) (rare within fen but dense in forest to west along Brandt Road); purple loosestrife (*Lythrum salicaria*) (rare in fen but dense along Perryville Road); watercress (*Nasturtium officinale*) (locally abundant in the stream); glossy buckthorn (*Rhamnus frangula*) (uncommon within fen but locally dominant along the edges of the fen); multiflora rose (*Rosa multiflora*) (rare within fen but dense in forest to west along Brandt Road); bittersweet nightshade (*Solanum dulcamara*) (rare); perennial sow thistle (*Sonchus arvensis*) (rare); narrow-leaved cat-tail (*Typha angustifolia*) (sparse in fen but dense along Perryville Road and within wet meadow to the east); and hybrid cat-tail (*Typha xglauca*) (dense along Perryville Road and in wet meadow to the east).

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen and in the surrounding forest and open wetlands, lower deer browse pressure by reducing deer densities, and continue to burn the fen periodically. Fire should be restricted from areas where invasive cat-tails are prevalent to prevent their spread. Invasive cat-tails should be controlled. Chemical and mechanical control of glossy buckthorn along the fen margin are warranted. The population of purple loosestrife within the wetland complex should also be controlled. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate deer browse pressure, the success of fire management, and the condition of rare plant and animal populations.



Photo 30. Brandt Road Fen prairie fen. Photo by Michael A. Kost.

31. Burns Lake

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: CD

Size: 15 acres

Location: Holly State Recreation Area

Element Occurrence Identification Number: 11045

Threats: The prairie fen borders a busy two-lane highway (Grange Hall Road) and is located about a quarter mile west of the I-75 expressway. The fen is likely heavily impacted by salt spray and possibly road runoff. These roads may also be impacting the fen's hydrology. The fen and the surrounding landscape are fire suppressed. High deer densities may be detrimentally impacting the fen's flora. Localized infestations of invasive plants also threaten to alter the fen's species composition and vegetative structure. Invasives and their abundances are as follows: autumn olive (*Elaeagnus umbellata*) (locally common); purple loosestrife (*Lythrum salicaria*) (locally abundant); reed (*Phragmites australis*) (locally dominant along the northern side of Burns Lake); glossy buckthorn (*Rhamnus frangula*) (locally abundant); multiflora rose (*Rosa multiflora*) (occasional); narrow-leaved cat-tail (*Typha angustifolia*) (locally dominant); and hybrid cat-tail (*Typha xglauca*) (locally dominant).

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen, lower deer browse pressure by reducing deer densities, and burn the fen periodically. 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. Chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate deer browse pressure and the success of fire management.



Photo 31. Burns Lake prairie fen. Photo by Michael A. Kost.

32. Caroga Lake Prairie Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: CD

Size: 3.2 acres

Location: Brighton State Recreation Area

Element Occurrence Identification Number: 6741

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment. Invasives are localized and include narrow-leaved cat-tail (*Typha angustifolia*) and glossy buckthorn (*Rhamnus frangula*). Glossy buckthorn is dominant within the adjacent degraded southern shrub-carr. In addition, purple loosestrife (*Lythrum salicaria*) and bittersweet nightshade (*Solanum dulcamara*) are occasional within the fen.

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should be controlled. Chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.



Photo 32. Caroga Lake Prairie Fen. Photo by Joshua G. Cohen.

33. Chenango Lake – Camp Talahi

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: BC

Size: 8.5 acres

Location: Brighton State Recreation Area

Element Occurrence Identification Number: 16698

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage and fire suppression. Fire suppression is beginning to lead to woody encroachment. Invasives are occasional to patchy and include glossy buckthorn (*Rhamnus frangula*) (occasional), purple loosestrife (*Lythrum salicaria*) (locally common), and bittersweet nightshade (*Solanum dulcamara*) (common).

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen 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 33. Chenango Lake – Camp Talahi prairie fen. Photo by Joshua G. Cohen.

34. Glenn Road Prairie Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: CD

Size: 3.6 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 9954

Threats: Species composition, vegetative structure, and successional trajectory 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 (*Rhamnus frangula*) (infringing from the upper margin and along the stream margin), multiflora rose (*Rosa multiflora*), and Tartarian honeysuckle (*Lonicera tatarica*). In addition, purple loosestrife (*Lythrum salicaria*) and bittersweet nightshade (*Solanum dulcamara*) are occasional within the fen. Deer browse was noted on red-osier dogwood (*Cornus stolonifera*).

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Chemical and mechanical control of glossy buckthorn, multiflora rose, and Tartarian honeysuckle are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen 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 34. Glenn Road Prairie Fen. Photo by Joshua G. Cohen.

35. Hall Lake Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: C

Size: 9.6 acres

Location: Yankee Springs State Recreation Area

Element Occurrence Identification Number: 15918

Threats: The main disturbance to the prairie fen is the channelized drainage of Hall Lake that passes through the center of the fen pocket. Near the stream, lower water tables have permitted an increase in density and vigor of low and tall shrubs. In addition, increased flow velocity within the channel has eroded peat soils. A water-control structure at Gun Lake causes backups and ponding of surface water along the channel; these areas support disturbance-tolerant, weedy wetland species. Landscape-scale fire suppression has likely increased woody stem density within the wetland complex. Along the drainage near Gun Lake Road, broad-leaved cat-tails (*Typha latifolia*) occur and may increase in response to nutrient and salt run-off from the road. In addition, purple loosestrife (*Lythrum salicaria*) was noted in a small patch west of the drainage. Shrub and tree zones of the wetland were invaded by multiflora rose (*Rosa multiflora*) and autumn olive (*Elaeagnus umbellata*), which threaten to alter community structure and composition.

Management Recommendations: The primary management recommendations are to control and monitor invasive plant species, conduct prescribed fire to reduce the density and cover of woody species, and monitor deer browse.



Photo 35. Hall Lake Fen prairie Fen. Photo by Bradford S. Slaughter.

36. Halstead Lake

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: C

Size: 18 acres

Location: Holly State Recreation Area

Element Occurrence Identification Number: 1556

Threats: Warden Road to the west of the fen disrupts the hydrology by separating this site from adjacent wetlands (formerly a contiguous wetland). In addition, the proximity of the I-75 expressway may impact the fen's hydrology and influence nutrient levels through salt spray. Fire suppression has allowed for increases in woody vegetation and invasive species. High deer densities may be detrimentally impacting the fen's flora. Localized infestations of invasive plants also threaten to alter the fen's species composition and vegetative structure. Invasives and their abundances are as follows: autumn olive (*Elaeagnus umbellata*) (rare within fen but common along forest edges); reed (*Phragmites australis*) (locally dominant along I-75); glossy buckthorn (*Rhamnus frangula*) (occasional to sparse within fen but abundant along forest edges and I-75); bittersweet nightshade (*Solanum dulcamara*) (uncommon); perennial sow thistle (*Sonchus arvensis*) (uncommon); narrow-leaved cat-tail (*Typha angustifolia*) (locally dominant in low areas and along portions of the lakeshore); and hybrid cat-tail (*Typha xglauca*) (locally dominant in low areas and along portions of the lakeshore).

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen, lower deer browse pressure by reducing deer densities, and burn the fen periodically. 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. Chemical and mechanical control of glossy buckthorn are warranted. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate deer browse pressure, the success of fire management, and the condition of rare plant and animal populations.



Photo 36. Halstead Lake prairie fen. Photo by Michael A. Kost.

37. Hankard Lake

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: C

Size: 2.0 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 2830

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment and a thick litter layer. Fire has occurred recently within portions of the fen as manifest by charred snags along the wetland margin. Invasives are localized within the wetland complex and include patches of reed (*Phragmites australis*) and narrow-leaved cat-tail (*Typha angustifolia*) near the lake margin in areas of southern wet meadow. Within the prairie fen, multiflora rose (*Rosa multiflora*) and autumn olive (*Elaeagnus umbellata*) were noted along the upper margin of the fen and purple loosestrife (*Lythrum salicaria*) was scattered within the fen.

Management Recommendations: Employ prescribed fire to control shrub encroachment and reduce invasive species. Fire management within the wetland complex will likely lead to the decrease in southern shrub-carr and rich tamarack swamp and the increase in prairie fen. Fire should be restricted from areas where narrow-leaved cat-tail and reed are prevalent to prevent their spread. These invasives should first be controlled using other techniques. Chemical and mechanical control of multiflora rose and autumn olive are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.



Photo 37. Hankard Lake prairie fen. Photo by Joshua G. Cohen.

38. Hartwig Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: D

Size: 2.9 acres

Location: Holly State Recreation Area

Element Occurrence Identification Number: 4177

Threats: The fen's hydrology is disrupted by the channelization of the stream within the utility right-of-way and an artificial lake created by damming the stream that flows through the fen. Fire suppression has allowed for significant increases in woody vegetation. Much of the wetland (and former fen) is now dominated by trees and tall shrubs including abundant glossy buckthorn (*Rhamnus frangula*). High deer densities may be detrimentally impacting the fen's flora. Localized infestations of invasive plants also threaten to alter the fen's species composition and vegetative structure. Invasives and their abundances are as follows: reed canary grass (*Phalaris arundinacea*) (locally abundant); glossy buckthorn (locally abundant to locally dominant); and multiflora rose (*Rosa multiflora*) (occasional).

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen, lower deer browse pressure by reducing deer densities, burn the fen periodically, and assess the potential for improvement to the fen's hydrology and implement if feasible. Monitoring should be conducted to assess efforts to control non-native plant populations and evaluate deer browse pressure and the success of fire management.



Photo 38. Hartwig Fen prairie fen. Photo by John W. Fody.

39. Headquarters Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: D

Size: 3.9 acres

Location: Holly State Recreation Area

Element Occurrence Identification Number: 9836

Threats: The fen's hydrology is disrupted by McGinnis Road to the south, which blocks drainage. Fire suppression has allowed for significant increases in woody vegetation. High deer densities may be detrimentally impacting the fen's flora. Widespread infestation of invasive plants has significantly altered the fen's species composition and vegetative structure. Invasives and their abundances are as follows: glossy buckthorn (*Rhamnus frangula*) (locally dominant); multiflora rose (*Rosa multiflora*) (locally dominant); autumn olive (*Elaeagnus umbellata*) (locally abundant); narrow-leaved cat-tail (*Typha angustifolia*) (locally dominant); hybrid cat-tail (*Typha xglauca*) (locally dominant); purple loosestrife (*Lythrum salicaria*) (locally dominant), bittersweet nightshade (*Solanum dulcamara*) (occasional); and wild carrot (*Daucus carota*) (uncommon).

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen, lower deer browse pressure by reducing deer densities, burn the fen periodically to reduce shrub and tree encroachment and reduce invasive species, and maintain the flow through the culvert under McGinnis Road. Fire should be restricted from areas where invasive cat-tails are prevalent to prevent their spread. Invasive cat-tails should first be controlled using other techniques. Chemical and mechanical control of glossy buckthorn, multiflora rose, and autumn olive are warranted. The population of purple loosestrife should also be controlled. Monitoring should be conducted to assess efforts to control non-native plant populations and evaluate deer browse pressure and the success of fire management.



Photo 39. Headquarters Fen prairie fen. Photo by Michael A. Kost.

40. Kern Road Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: D

Size: 3.7 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 4907

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, altered hydrology, fire suppression, competition from invasive species, and road salt contamination. Kern Road passes through the wetland complex and has significantly disrupted hydrology and likely water quality within the fen. What was once a more open community is now densely infested with invasive shrubs and cat-tails (*Typha* spp.) closer to the road. Emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.) throughout the wetland. Fire suppression has likely led to an increase in shrub cover, including invasives, within the wetland and in the surrounding landscape. The fen is infested with invasive plant species. Glossy buckthorn (*Rhamnus frangula*) forms a dense thicket over much of the site, associated with native shrubs and other invasive shrubs (especially smooth arrow-wood and European highbush-cranberry). Narrow-leaved cat-tail (*Typha angustifolia*) and hybrid cat-tail (*Typha xglauca*) form dense stands along Kern Road that extend a significant distance away from the road. Cat-tails have smothered native vegetation and form a thick thatch layer in these areas. Reed (*Phragmites australis*) is also present, especially immediately along Kern Road. These invasive plants have severely degraded and altered the fen. Populations of fen species have likely been significantly reduced by this invasive encroachment.

Management Recommendations: The occurrence is close to being unrestorable. The primary management recommendations are to reintroduce fire as a fundamental disturbance factor maintaining open conditions and control invasive species populations. 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. Chemical and mechanical control of glossy buckthorn are warranted. Control of invasive plant populations will require a major, long-term effort. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management.



Photo 40. Kern Road Fen prairie fen. Photo by Bradford S. Slaughter.

41. Little Appleton Lake

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: CD

Size: 26 acres

Location: Brighton State Recreation Area

Element Occurrence Identification Number: 222

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment and the increase of the litter layer. Invasives include narrow-leaved cat-tail (*Typha angustifolia*) (concentrated in marl flats) and glossy buckthorn (*Rhamnus frangula*) (infringing from the upper margin and locally dominant especially along the upper margin and along the streams). Where glossy buckthorn is a dominant, it is impacting species composition and floristic structure, reducing both the floristic and structural diversity of the fen. In addition, purple loosestrife (*Lythrum salicaria*) and reed (*Phragmites australis*) occur locally in the marl flats near the lake margin and multiflora rose (*Rosa multiflora*) and bittersweet nightshade (*Solanum dulcamara*) are occasional within the fen meadow and shrub fen. A boat launch occurs along the eastern shore of Little Appleton Lake and areas of fen near the boat launch have been impacted by trampling from foot traffic. Deer browse was noted within the fen on dogwoods (*Cornus* spp.) and numerous deer trails occur throughout the wetland.

Management Recommendations: Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail and reed are prevalent to prevent their spread. These invasives should first be controlled using other techniques. Continued chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.



Photo 41. Little Appleton Lake prairie fen. Photo by Joshua G. Cohen.

42. Locker Lake Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: C?

Size: 14 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 8490

Aerial photographic interpretation and ground-truthing indicated that prairie fen does not occur on state land but on nearby private land. This element occurrence was re-mapped to reflect that prairie fen does not occur on state land.



Photo 42. Cat-tails dominate emergent marsh and southern wet meadow on state lands south of Locker Lake Fen prairie fen. Photo by Joshua G. Cohen.

43. McLaughlin Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: B

Size: 55 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 15855

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment and build-up of leaf litter. Invasives are localized but increasing in dominance and include narrow-leaved cat-tail (*Typha angustifolia*), purple loosestrife (*Lythrum salicaria*) (locally common in fen meadow), reed (*Phragmites australis*) (locally dominant along the drain), reed canary grass (*Phalaris arundinacea*) (locally common in wet meadow zones), and glossy buckthorn (*Rhamnus frangula*) (infringing from the upper margin). A drain intersects the wetland complex and has locally impacted the wetland's hydrology. Deer browse was noted throughout the fen, especially on dogwoods (*Cornus* spp.). Canopy tamarack (*Larix laricina*) within the wetland complex have been impacted by larch sawfly (*Pristiphora erichsonii*). Evidence of off-road vehicle activity was noted within localized portions of the wetland.

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail and reed are prevalent to prevent their spread. These invasives should first be controlled using other techniques. Chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology. Restriction of off-road vehicle activity should be enforced. Finally, pursuit of acquisition of adjacent private lands or discussion of compatible management with private landowners is recommended.



Photos 43 and 44. McLaughlin Fen prairie fen. Photos by Joshua G. Cohen.



44. Mt. Hope Road Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: B

Size: 34 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 7086

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment and build-up of leaf litter. Invasives are localized and include narrow-leaved cat-tail (*Typha angustifolia*) (concentrated near the road), purple loosestrife (*Lythrum salicaria*) (uncommon), and glossy buckthorn (*Rhamnus frangula*) and autumn olive (*Elaeagnus umbellata*) (infringing from the upper margin). Deer browse was noted throughout the fen especially on dogwood (*Cornus* spp.).

Management Recommendations: Continue prescribed fire to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should first be controlled using other techniques. Continued chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.



Photo 45. Mt. Hope Road Fen prairie fen. Photo by Joshua G. Cohen.

45. Park Lyndon Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: B

Size: 66 acres

Location: Pinckney State Recreation Area

Element Occurrence Identification Number: 327

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Ditches and channelized streams associated with lake drainages impact the hydrology of the fen and support local infestations of invasive plant species, primarily cat-tails. Despite these disturbances, hydrologic integrity appears to be quite good over most of the occurrence. Historically, fires originating in adjacent oak savanna likely spread into the fen wetlands. Fire suppression has eliminated this process and likely led to an increase in woody vegetation within the fen, in conjunction with disturbed hydrology. Portions of the wetland were likely grazed historically. Cat-tail swarms (primarily hybrid cat-tail and broad-leaved cat-tail) are concentrated in wet areas affected by surface water along drainages, and dominate the extensive wetlands around Snyder Lake and the small unnamed ponds north of the fen area. Purple loosestrife (*Lythrum salicaria*) is also common in these wet meadow/emergent marsh zones. Narrow-leaved cat-tail (*Typha angustifolia*) is invading fen domes, including areas being managed with prescribed fire. The southern shrub-carr and rich tamarack swamp at the margins of the fen contain infestations of autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), honeysuckles (*Lonicera* spp., but primarily Morrow's honeysuckle) and European highbush-cranberry (*Viburnum opulus*).

Management Recommendations: The primary management recommendation is to use fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where invasive cat-tails are prevalent to prevent their spread. Invasive cat-tails should first be controlled using other techniques. Chemical and mechanical control of invasive shrubs along the fen margin and in adjacent wetlands are warranted. The population of purple loosestrife within the wetland should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations, evaluate deer herbivory and feral hog impacts (potential wallows were observed during the survey), and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology. Pursuit of acquisition of adjacent private lands or discussion of compatible management with private and local government landowners is recommended.



Photo 46. Park Lyndon Fen prairie fen. Photo by Bradford S. Slaughter.

46. Portage Lake

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: CD

Size: 2.3 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 16131

Threats: Species composition, vegetative structure, and successional trajectory 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 (*Rhamnus frangula*) (infringing from the upper margin), narrow-leaved cat-tail (*Typha angustifolia*) (locally dominant in southern portion of fen), and purple loosestrife (*Lythrum salicaria*) (occasional).

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Chemical and mechanical control of glossy buckthorn are warranted. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should first be controlled using other techniques. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.



Photo 47. Portage Lake prairie fen. Photo by Joshua G. Cohen.

47. Seven Lakes

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: CD

Size: 3.6 acres

Location: Seven Lakes State Park

Element Occurrence Identification Number: 12600

Threats: Historically, the primary disturbance to the fen was the impoundment of the Seven Lakes drainage, which reduced the size of the fen. Surface water fluctuations continue to degrade shoreline portions of the fen. The fen is also threatened by infestations of cat-tails (*Typha* spp.) along drainages and invasive shrubs (especially glossy buckthorn) along the shrub margin of the wetland. The very small size of this fen makes it particularly susceptible to complete eradication by invasive plants. The primary invasive threats are narrow-leaf cat-tail (*Typha angustifolia*) and hybrid cat-tail (*Typha xglauca*), which have both infested the lake margin and a drainage between two fen lobes, and glossy buckthorn (*Rhamnus frangula*), which is abundant throughout the area in degraded wetlands.

Management Recommendations: A combination of prescribed fire and invasive species treatment will likely be required on a frequent basis to maintain the remaining fen pockets. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where invasive cat-tails are prevalent to prevent their spread. These invasives should first be controlled using other techniques. Chemical and mechanical control of glossy buckthorn along the fen margin and in adjacent wetlands are warranted. Monitoring should be implemented to assess efforts to control non-native plant populations, evaluate deer herbivory, and evaluate the success of fire management.



Photo 48. Seven Lakes prairie fen. Photo by Bradford S. Slaughter.

48. Spring Mill Creek Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: C

Size: 72 acres

Location: Island Lake State Recreation Area

Element Occurrence Identification Number: 2182

Threats: The fen's hydrology is disrupted by two road crossings and a nearby, former gravel mine. The fen is further impacted by road runoff and salt spray. Fire suppression has allowed for increases in woody vegetation. High deer densities may be detrimentally impacting the fen's flora. Localized infestations of invasive plants also threaten to alter the fen's species composition and vegetative structure. Invasives that are locally dominant or abundant include purple loosestrife (*Lythrum salicaria*) (locally abundant), reed canary grass (*Phalaris arundinacea*) (locally dominant), reed (*Phragmites australis*) (locally abundant), glossy buckthorn (*Rhamnus frangula*) (locally common, especially under tamaracks and along the fen/forest margin), narrow-leaved cat-tail (*Typha angustifolia*) (locally dominant), and hybrid cat-tail (*Typha xglauca*) (locally dominant). Less common invasive plants include multiflora rose (*Rosa multiflora*) (occasional) and bittersweet nightshade (*Solanum dulcamara*) (rare).

Management Recommendations: The primary management recommendations are to control the invasive plants within the fen as well as in adjacent open wetlands and surrounding forests, lower deer browse pressure by reducing deer densities, burn the fen periodically to reduce shrub and tree encroachment and reduce invasive species, and assess the hydrologic impacts and remedy where feasible. 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. Chemical and mechanical control of glossy buckthorn and multiflora rose are warranted. The population of purple loosestrife should also be controlled. Monitoring should be conducted to assess efforts to control non-native plant populations and evaluate deer browse pressure and the success of fire management.



Photo 49. Spring Mill Creek Fen prairie fen. Photo by Michael A. Kost.

49. Sullivan Lakes, Hadley Road

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: BC

Size: 14 acres

Location: Pinckney State Recreation Area

Element Occurrence Identification Number: 16877

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage and fire suppression. Fire suppression has led to woody encroachment. Invasives are localized and include narrow-leaved cat-tail (*Typha angustifolia*) (locally common in the southern polygon) and purple loosestrife (*Lythrum salicaria*) (occasional in the southern polygon). Deer browse was noted in the northern polygon. A boardwalk passes through the northeastern portion of northern fen.

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should be controlled using other techniques. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology.



Photo 50. Sullivan Lakes, Hadley Road prairie fen. Photo by Joshua G. Cohen.

50. Tiplady Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: BC

Size: 18 acres

Location: Pinckney State Recreation Area

Element Occurrence Identification Number: 2260

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage and fire suppression. Fire suppression has led to woody encroachment and the build-up of sedge litter. Invasives are localized but increasing in dominance and include narrow-leaved cat-tail (*Typha angustifolia*) (locally dominant), glossy buckthorn (*Rhamnus frangula*) (uncommon along the upper fen margin), and purple loosestrife (*Lythrum salicaria*) (uncommon in areas of fen meadow and shrub fen). Deer browse was noted on dogwood (*Cornus* spp.). The southern portion of the fen has been impacted by foot traffic. This site has been used by the University of Michigan botany classes and has been locally impacted by trampling.

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should first be controlled using other techniques. Chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. In addition, maintaining natural communities surrounding the prairie fen 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 51. Tiplady Fen prairie fen. Photo by Joshua G. Cohen.

51. Trout Lake

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: C

Size: 2.5 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 6249

Threats: The fen openings are locally invaded by aggressive non-native plants. Glossy buckthorn (*Rhamnus frangula*) occurs at the northern margin of the northernmost opening, where there is evidence that the shrub is being cleared. Otherwise, glossy buckthorn is restricted to the margins of the swamp forest. A small patch of the non-native variety of reed (*Phragmites australis*) was noted at the margin of the western fen opening. In addition, the fen likely suffers from high deer browse pressure.

Management Recommendations: The primary management recommendation is to control the invasive species found within the fen and the surrounding wetland complex. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate whether deer herbivory is impacting species composition and vegetative structure of the fen.



Photo 52. Trout Lake prairie fen. Photo by Bradford S. Slaughter.

52. Waterloo Long Lake Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: BC

Size: 36 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 15859

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment and build-up of leaf litter. Invasives are localized but increasing in dominance and include narrow-leaved cat-tail (*Typha angustifolia*) (concentrated in marl flats), purple loosestrife (*Lythrum salicaria*) (locally common in fen meadow), and glossy buckthorn (*Rhamnus frangula*) (infringing from the upper margin and locally common in areas of shrub fen). A boardwalk occurs along the northeastern portion of the wetland on private land. In addition, off-road vehicle activity has created ruts in the peat and marl and locally altered the wetland hydrology with this portion of the fen. Deer browse was noted throughout the fen.

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should continue to be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should first be controlled using other techniques. Chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. Maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology. Restriction of off-road vehicle activity should be enforced. In addition, pursuit of acquisition of adjacent private lands or discussion of compatible management with private landowners is recommended.



Photo 53. Waterloo Long Lake Fen prairie fen. Photo by Joshua G. Cohen.

53. Willis Road

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: CD

Size: 1.6 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 16636

Threats: Species composition, vegetative structure, and successional trajectory are influenced by groundwater seepage, fire suppression, and competition from invasive species. Fire suppression has led to woody encroachment. Invasives are localized and include narrow-leaved cat-tail (*Typha angustifolia*) (concentrated along the stream margin) and glossy buckthorn (*Rhamnus frangula*) (infringing from the upper margin). In addition, purple loosestrife (*Lythrum salicaria*) and bittersweet nightshade (*Solanum dulcamara*) are occasional within the fen.

Management Recommendations: The primary management recommendation is to reintroduce fire as a fundamental disturbance factor maintaining open conditions. Prescribed fire should be employed to control shrub encroachment and reduce invasive species. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should first be controlled using other techniques. Chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Monitoring should be implemented to assess efforts to control non-native plant populations and evaluate the success of fire management. Maintaining natural communities surrounding the prairie fen will buffer the wetland and help preserve its hydrology. In addition, pursuit of acquisition of adjacent private lands or discussion of compatible management with private landowners is recommended.



Photo 54. Willis Road prairie fen. Photo by Joshua G. Cohen.

54. Yankee Springs Fen

Natural Community Type: Prairie Fen

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: C

Size: 34 acres

Location: Yankee Springs State Recreation Area

Element Occurrence Identification Number: 13087

Threats: The primary disturbance to the fen was the deepening and straightening of the drainage south of Deep Lake. Water collects near drainages and supports dense infestations of broad-leaved cat-tail (*Typha latifolia*) that are spreading into other areas of the fen. Landscape-scale fire suppression has increased woody stem density within the surrounding uplands and possibly in drier portions of the wetland complex. The primary invasive species noted was native but aggressive broad-leaved cat-tail in drainage areas, particularly along the straightened drainage channel and around the pond in the eastern portion of the wetlands. Cat-tails are also patchy to dense under open tamarack canopy in the center of the wetland. Autumn olive (*Elaeagnus umbellata*) is locally common in areas of rich tamarack swamp and multiflora rose (*Rosa multiflora*) is less common.

Management Recommendations: The primary management recommendations are to control and monitor invasive plant species, conduct prescribed fire to reduce the density and cover of woody species, and monitor deer browse.



Photo 55. Yankee Springs Fen prairie fen. Photo by Bradford S. Slaughter.

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).

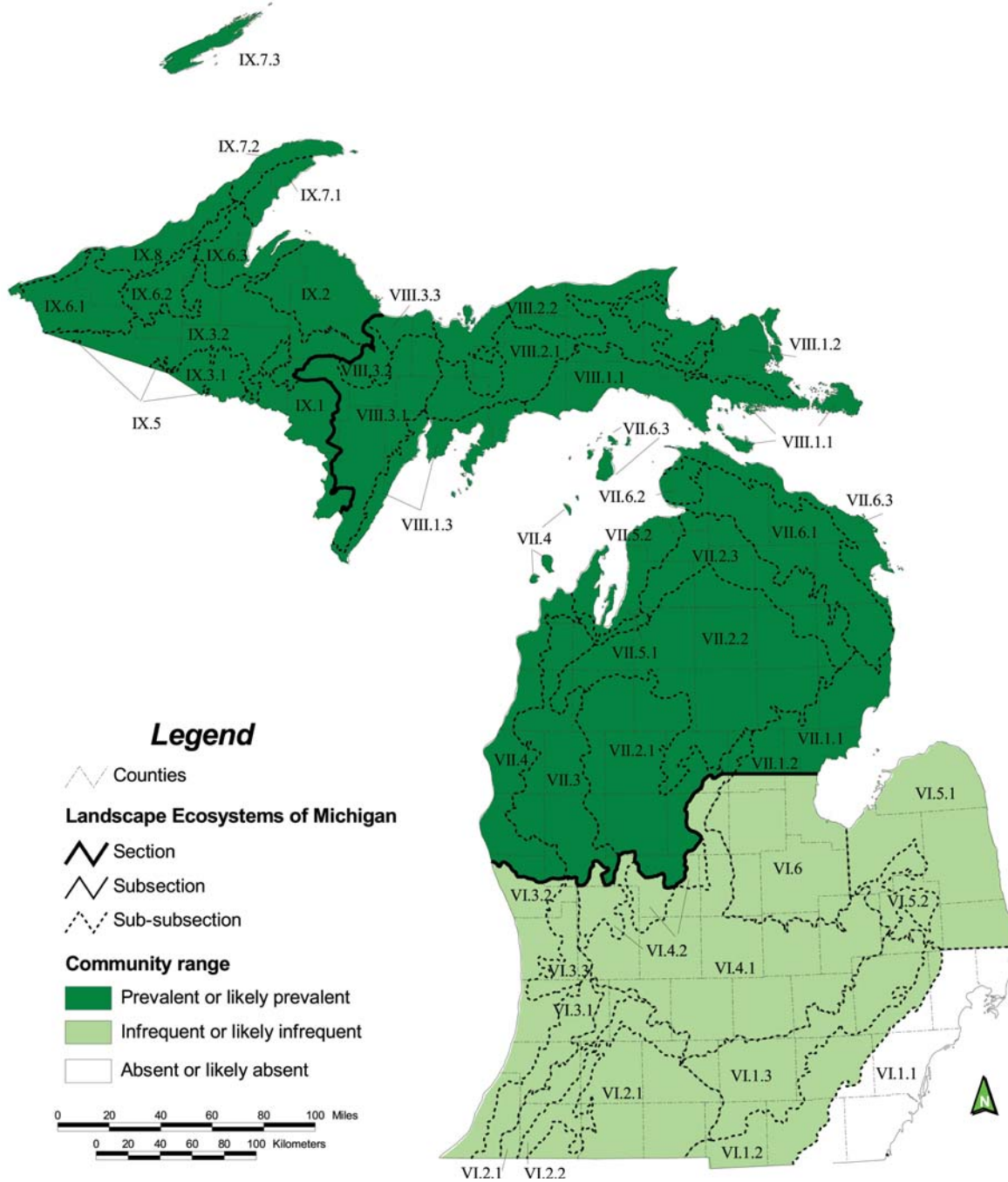


Figure 13. Distribution of rich conifer swamp in Michigan.

55. Trout Lake

Natural Community Type: Rich Conifer Swamp (re-classified from Hardwood-Conifer Swamp)

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: C

Size: 43 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 6310

Threats: The swamp is second-growth; evidence of historic logging is found throughout the tract. Relative hydrologic isolation has limited the impacts of surrounding development. Currently, high deer densities and invasive plant species are the primary impacts. Deer have locally eliminated woody regeneration and have likely altered species composition and structure over much of the occurrence. Deer may have also eliminated preferred browse species (e.g., Canadian yew) or significantly reduced populations of favored ground layer species (e.g., trillium, several orchids). Glossy buckthorns (*Rhamnus frangula*) are common to locally abundant, particularly as seedlings and suppressed saplings in the ground layer. Any canopy-opening disturbances have the potential to release these seedlings and saplings to the tall shrub layer, as has occurred in open-canopy tamarack and hardwood swamps in the surrounding landscape. Reed (*Phragmites australis*) was noted at the margins of one of the adjacent fen openings. Cat-tails (*Typha* spp.) occur along the drainage and have the potential to spread into open canopy areas of the swamp. Numerous other invasive plants, mostly of lesser concern, occur within the complex (i.e., Japanese barberry). Emerald ash borer (*Agrilus planipennis*) has killed scattered canopy ash within the wetland complex.

Management Recommendations: The main management recommendations are to allow natural processes to operate unhindered, control invasives species, reduce deer browse pressure, monitor for invasives, and retain an intact buffer of natural communities surrounding the swamp. Deer browse pressure could be reduced by decreasing local deer populations (i.e., encouraging increased hunting). Prompt control of glossy buckthorn is critical since it is abundant in the landscape and locally within the occurrence but has not yet achieved dominance in the shrub or ground layers. It is also recommended that populations of reed and invasive cat-tails be controlled and monitored within adjacent wetlands to reduce the risk of infestation into open canopy areas of the swamp.



Photo 56. Trout Lake rich conifer swamp. Photo by Bradford S. Slaughter.

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. This natural community type was known as relict conifer swamp in previous versions of the natural community classification (Kost et al. 2007).

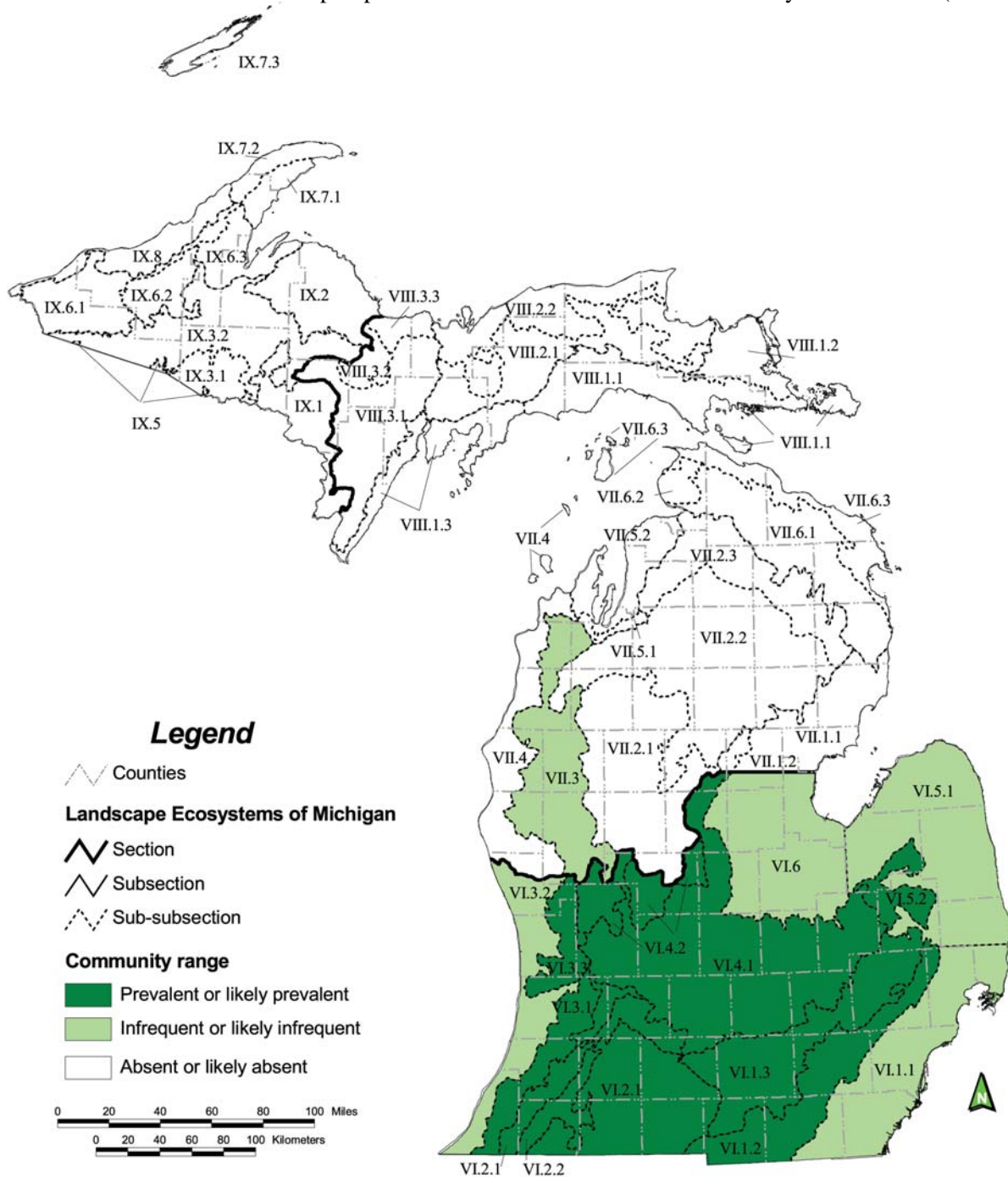


Figure 14. Distribution of rich tamarack swamp in Michigan.

56. Chamberlain Lakes

Natural Community Type: Rich Tamarack Swamp

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: CD

Size: 29 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 9826

Threats: The rich tamarack swamp has been impacted by a variety of stressors. The spread of invasive plant and animal species, in particular, has altered the structure and composition of much of the swamp. Senescence of tamarack and the spread of emerald ash borer (*Agilus planipennis*) and subsequent death of canopy ash (*Fraxinus* spp.) have opened the canopy, providing light gaps that are being rapidly colonized by invasive shrubs, especially glossy buckthorn (*Rhamnus frangula*). In addition, ash-kill has led to locally higher water tables. Songbirds, including starlings and robins, have spread the seeds of glossy buckthorn and other shrubs through the use of perch trees. Multiflora rose (*Rosa multiflora*) and Japanese barberry (*Berberis thunbergii*) are also abundant. Larger gaps and lakeshore areas are locally infested by reed (*Phragmites australis*) and cat-tails (*Typha* spp.). Surface water fluctuations and nutrient inputs along lakeshores have further degraded portions of the occurrence. Areas along streams and lakes have been impacted by run-off and hydrologic disruption associated with road culverts. Suppression of fire at the landscape scale has allowed a significant increase in red maple (*Acer rubrum*) throughout the landscape. Deer browse has reduced woody regeneration in places. In addition, deer avoid the aforementioned invasive species, allowing them to dominate large areas of the swamp. Continued senescence of tamarack and increases in invasive species are likely to convert portions of the occurrence to severely degraded southern shrub-carr in the next couple decades.

Management Recommendations: Portions of this site may be degraded beyond rehabilitation. Infestations of glossy buckthorn and other invasive plants may be too dense and widespread to be adequately treated in the most degraded portions of the swamp. However, monitoring and control of invasive plants in less impacted areas (e.g., the isolated kettle depressions away from surface water-impacted lakeshores) is recommended. Control of invasive plant populations will require a major long-term effort to reduce reed, cat-tails, and glossy buckthorn. Reducing local deer densities will help decrease browse pressure.



Photo 57. Chamberlain Lakes rich tamarack swamp. Photo by Bradford S. Slaughter.

57. Embury Road Swamp

Natural Community Type: Rich Tamarack Swamp (re-classified from Southern Hardwood Swamp)

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: B

Size: 79 acres

Location: Pinckney State Recreation Area

Element Occurrence Identification Number: 13568

Threats: Embury Road appears to have disrupted the hydrology of the wetland complex and may have initiated or hastened development of tamarack swamp in former wet meadow or fen. Alternatively, the area may be reforesting following historic logging or grazing. Emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.) throughout the area. High deer densities and associated browse may be impacting ground layer species and woody regeneration. Fire suppression has occurred at the landscape scale, and has primarily affected adjacent upland oak savanna and oak-hickory forest. Autumn olive (*Elaeagnus umbellata*) was noted within the swamp, where it was occasional.

Management Recommendations: The swamp forest should be monitored for deer browse and invasion of especially aggressive species present in the region, including glossy buckthorn (*Rhamnus frangula*), reed (*Phragmites australis*), narrow-leaved cat-tail (*Typha angustifolia*), and hybrid cat-tail (*Typha xglauca*). Autumn olive should be controlled.



Photo 58. Embury Road Swamp rich tamarack swamp. Photo by Bradford S. Slaughter.

58. Huron River Wetland

Natural Community Type: Rich Tamarack Swamp

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: C

Size: 33 acres

Location: Island Lake State Recreation Area

Element Occurrence Identification Number: 7676

Threats: The species composition, vegetative structure, and successional trajectory of the rich tamarack swamp have been impacted by competition from the invasive shrub glossy buckthorn (*Rhamnus frangula*), which is locally abundant in the understory and low shrub layers. In addition, multiflora rose (*Rosa multiflora*) and autumn olive (*Elaeagnus umbellata*) occur in the understory and purple loosestrife (*Lythrum salicaria*) and bittersweet nightshade (*Solanum dulcamara*) occur in the ground cover. Fire suppression throughout the general landscape may have altered the fire regime of the rich tamarack swamp. Deer browse was noted on jewelweed (*Impatiens capensis*) and red-osier dogwood (*Cornus stolonifera*).

Management Recommendations: The primary management recommendation is to control invasive species, especially glossy buckthorn. Chemical and mechanical control of glossy buckthorn, multiflora rose, and autumn olive are warranted. The population of purple loosestrife should also be controlled. Control of invasive plant populations will require a major, long-term effort. Reducing invasive species throughout the surrounding area is recommended in order to reduce the local seed source. Prescribed fire in surrounding uplands should be allowed to spread into the rich tamarack swamp and associated wetlands. Reducing local deer densities will help decrease browse pressure. Monitoring should be implemented for efforts to control non-native plant populations and to gauge the impact of deer herbivory. Maintaining natural communities surrounding the rich tamarack swamp will buffer the wetland and help preserve its hydrology.



Photo 59. Huron River Wetland rich tamarack swamp. Photo by Joshua G. Cohen.

59. 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: 268 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 7962

Aerial photographic interpretation and ground-truthing indicated that high-quality rich tamarack swamp does not occur on state land but on nearby private land. This element occurrence was re-mapped to reflect that high-quality rich tamarack swamp does not occur on state land.



Photo 60. Southern shrub-carr on state land south of M52 Tamarack Swamp. Photo by Steve A. Thomas.

60. Trout Lake

Natural Community Type: Rich Tamarack Swamp (re-classified from Hardwood-Conifer Swamp)

Rank: G4 S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: CD

Size: 28 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 18597

Threats: Kern Road bisects the wetland and disrupts the hydrology. Modifications to Clear Creek cause backups at the road and these flood events contribute to the spread of invasive cat-tails (*Typha* spp.) and reed (*Phragmites australis*) within the wetland complex. High deer densities are eliminating woody regeneration and reducing or eliminating populations of sensitive ground layer species. The emerald ash borer (*Agrilus planipennis*) has killed canopy ash (*Fraxinus* spp.), opening the canopy and contributing to the spread of invasive plants. Tamarack snags may represent trees killed by native insects or by the introduced larch casebearer (*Coleophora laricella*). Fire suppression at the landscape scale has permitted an increase in the density of woody species, particularly in oak-dominated uplands. These disturbances, in concert with invasive plants, have seriously degraded this site over the past several decades. Glossy buckthorn (*Rhamnus frangula*) is abundant. Narrow-leaved cat-tail (*Typha angustifolia*), hybrid cat-tail (*Typha xglauca*), and reed are locally abundant to dominant near Kern Road and are spreading away from the road. Smooth arrow-wood (*Viburnum dentatum*) (this population of smooth arrow-wood derives from an escaped cultivar) and European highbush-cranberry (*Viburnum opulus*) are also locally important, the former especially in the understory on root islands. Several other invasive plant species were noted throughout the wetland (i.e., Japanese barberry and common buckthorn). The invasives within the swamp have combined to significantly degrade the site and threaten to irreversibly alter community structure and succession.

Management Recommendations: The main management recommendations are to control invasive species, reduce deer browse pressure by lowering local deer densities, and monitor efforts to control invasives and reduce deer browse pressure.



Photo 61. Trout Lake rich tamarack swamp. Photo by Bradford S. Slaughter.

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 (*Fraxinus nigra*) (Kost et al. 2007).

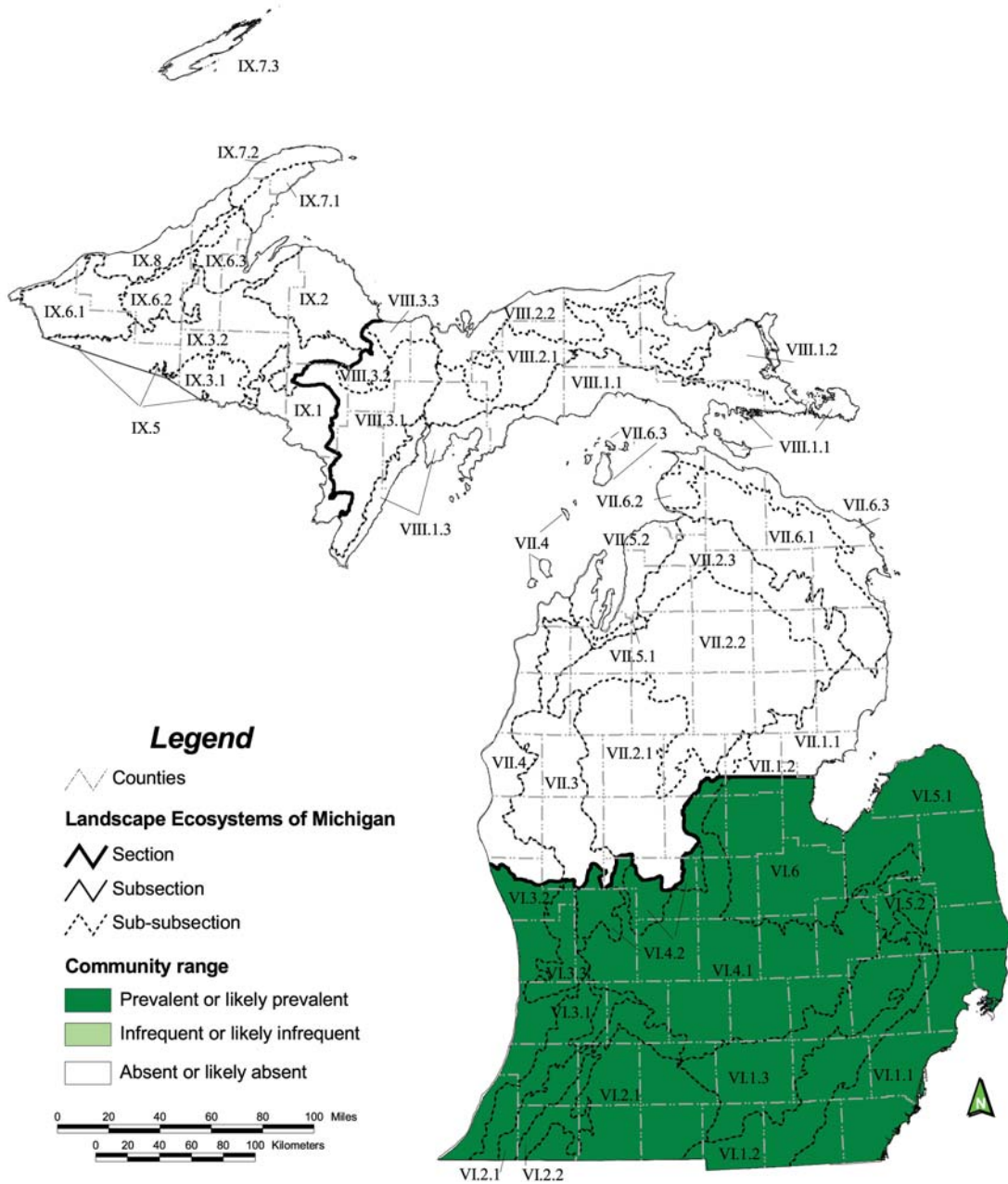


Figure 15. Distribution of southern hardwood swamp in Michigan.

61. Holdridge Lakes

Natural Community Type: Southern Hardwood Swamp

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: BC

Size: 101 acres

Location: Holly State Recreation Area

Element Occurrence Identification Number: 12460

Threats: The hydrology of the swamp has been altered by the I-75 expressway to the east; the highway bisects the broader wetland that contains this swamp. Dutch elm disease and emerald ash borer (*Agrilus planipennis*) have caused the death of canopy American elm (*Ulmus americana*) and green ash (*Fraxinus pennsylvanica*), respectively. The site is characterized by many large-diameter, dead, standing ash and the absence of canopy elm. Invasive species noted within the swamp include: glossy buckthorn (*Rhamnus frangula*) (uncommon); common buckthorn (*R. cathartica*) (uncommon); multiflora rose (*Rosa multiflora*) (occasional); autumn olive (*Elaeagnus umbellata*) (uncommon); bittersweet nightshade (*Solanum dulcamara*) (uncommon); and reed canary grass (*Phalaris arundinacea*) (rare). High levels of deer densities may have resulted in high deer browse pressure on the understory and ground cover species. Fire suppression in the surrounding landscape may have altered species composition in this swamp.

Management Recommendations: The main management recommendations are to control invasives species and reduce deer browse pressure by lowering local deer densities. Monitoring should be implemented to assess the effectiveness of efforts to control non-native plant populations, gauge the impact of deer herbivory, and evaluate hydrologic impacts.



Photo 62. Holdridge Lakes southern hardwood swamp. Photo by Michael A. Kost.

62. Chamberlain Lakes

Natural Community Type: Southern Shrub-Carr (re-classified from Prairie Fen)

Rank: GU S5, globally unrankable and secure within the state

Element Occurrence Rank: CD

Size: 22 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 1208

Threats: Hydrologic disruption, fire-suppression, invasive species, and emerald ash borer (*Agrilus planipennis*) have significantly degraded the occurrence. The eastern-most pockets of shrub-carr are impacted by Harmon Road and associated culverts and hydrologic disruption and pollution (i.e., input of nutrients). Beaver activity temporarily raised water levels in both Heart and Shoe Lakes, leading to inundation of adjacent wetland communities. A narrow band of shore fen that occurred at the margins of Heart Lake has apparently been eliminated by flooding and replaced with cat-tails (*Typha* spp.) and reed (*Phragmites australis*). The western-most lakes may have also been impacted by beaver activity and are locally impacted by culverts under the trails. Landscape-scale fire suppression has likely led to an increase in woody vegetation within the lakeshore wetlands. Invasive plant and animal species (i.e., emerald ash borer) have significantly altered vegetative structure and likely composition. Glossy buckthorn (*Rhamnus frangula*) is widespread and common in shrub-carr and forested pockets, and likely increasing. Oriental bittersweet (*Celastrus orbiculatus*) is common on shrubs and scattered trees throughout the area. Cat-tails (particularly hybrid cat-tail) and reed infest large areas of open wetlands, particularly along lakeshores and along drainages. These species have replaced fen and wet meadow species following beaver flooding. Purple loosestrife (*Lythrum salicaria*) is common throughout the area. Emerald ash borer has killed ash (*Fraxinus* spp.) throughout the region. Gaps created by ash-kill are largely filled by invasive species.

Management Recommendations: The main management recommendations are to control invasive species, eliminate or reduce road salt application along the stretch of Harmon Road that passes through the wetland complex, consider use of prescribed fire within areas of wet meadow, and monitor efforts to control invasives, deer browse pressure, and the function of culverts.



Photo 63. Chamberlain Lakes southern shrub-carr. Photo by Bradford S. Slaughter.

63. Williams Lake

Natural Community Type: Southern Shrub-Carr

Rank: GU S5, globally unrankable and secure within the state

Element Occurrence Rank: BC

Size: 5.8 acres

Location: Yankee Springs State Recreation Area

Element Occurrence Identification Number: 13342

Threats: The wetlands are essentially undisturbed, except for impacts of surface water in Williams Lake, which contains nutrients and presumably road salt from adjacent road crossings. Glossy buckthorn (*Rhamnus frangula*) seedlings were local on hummocks under shrubs and trees. Lakeshore areas are affected by infestations of the native broad-leaved cat-tails (*Typha latifolia*) and invasive hybrid cat-tail (*Typha xglauca*). Invasive species have not yet significantly impacted the shrub-carr.

Management Recommendations: The main management recommendation is to control and monitor glossy buckthorn and other invasive native and non-native plant species. Control efforts should be concentrated on source populations. Unstable, quaking soils and thick vegetation within much of the shrub-carr will make control of invasive species particularly difficult.



Photo 64. Williams Lake southern shrub-carr. Photo by Bradford S. Slaughter.

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).

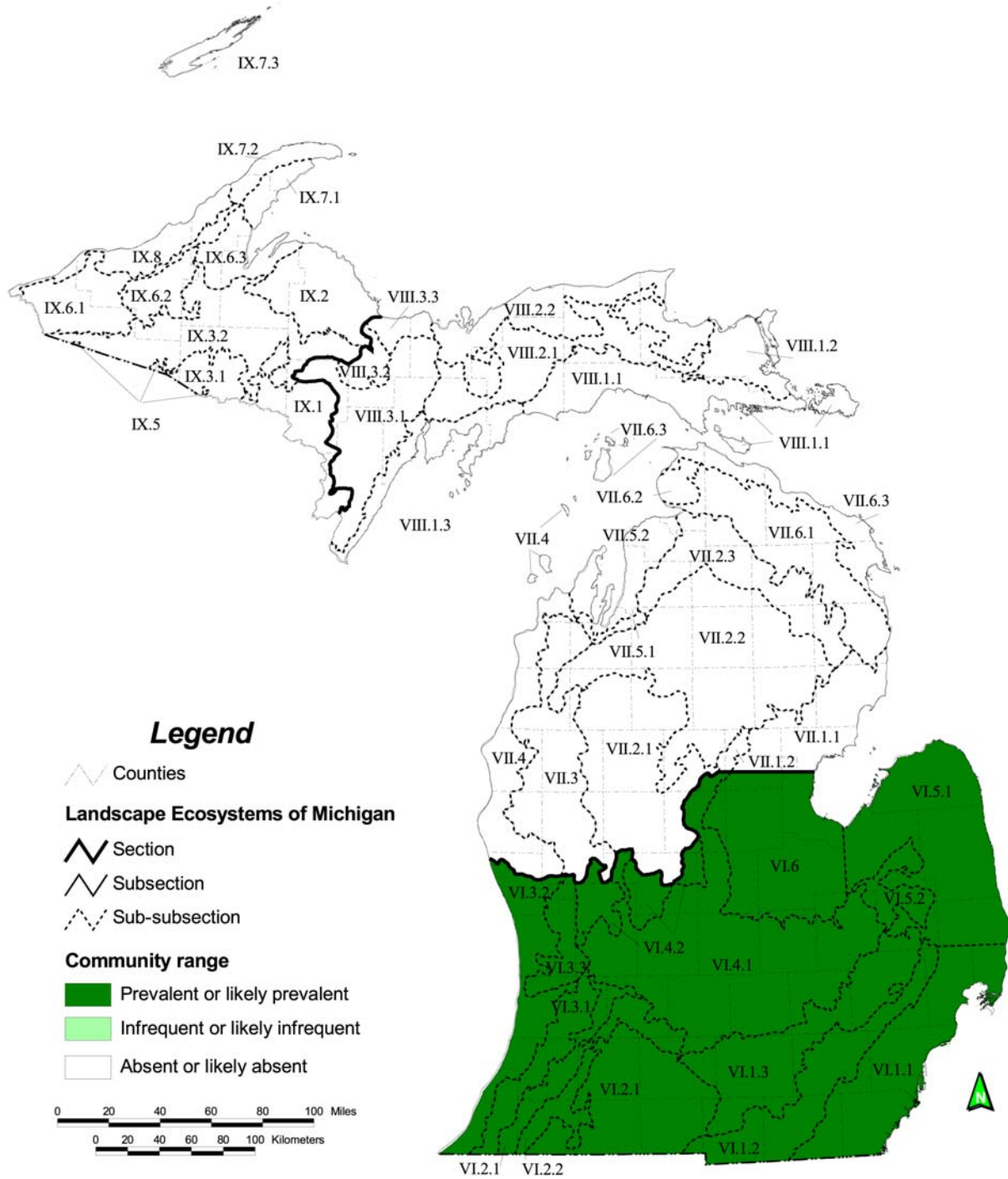


Figure 17. Distribution of southern wet meadow in Michigan.

64. Graham Lakes

Natural Community Type: Southern Wet Meadow (re-classified from Prairie Fen)

Rank: G4? S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: BC

Size: 39 acres

Location: Bald Mountain State Recreation Area

Element Occurrence Identification Number: 8240

Threats: Historically, at least a portion of the occurrence was likely hayed and used for other agricultural purposes (possibly grazing). The area north of the lake is apparently ditched and has converted from hay field to shrub-carr and early seral swamp forest and has been removed from the occurrence. The hydrology in this wetland is relatively intact although the drainage between Graham Lakes and Shoe Lake is impacted by a road crossing. Landscape-scale fire suppression has permitted an increase in woody vegetation throughout the area; historic wildfires likely helped maintain open conditions within the wet meadow. Narrow-leaved cat-tail (*Typha angustifolia*) and hybrid cat-tail (*Typha xglauca*) are locally abundant and threaten to increase, replacing native wet meadow and fen species. Non-native reed (*Phragmites australis*) was noted along the weedy drainage in the western portion of the occurrence. Glossy buckthorn (*Rhamnus frangula*) is occasional to common within the wet meadow and locally abundant on mineral soil rises within the wetland and has altered vegetative structure and composition in these areas. Purple loosestrife (*Lythrum salicaria*) is relatively common but rarely dense.

Management Recommendations: The primary management recommendation is continue to use prescribed fire and mechanical treatment to reduce woody encroachment. In addition, it is recommended that application of these management tools be considered for north of the lake, where formerly open meadow has succeeded to shrub-carr and early seral swamp forest. Areas with invasive cat-tails and reed should not be burned since these species can spread dramatically following fire. Instead, the patches of invasive cat-tails and reed should first be controlled using other techniques. Chemical and mechanical control of glossy buckthorn are warranted. Populations of purple loosestrife could also be controlled. Efforts to control invasive species should be monitored.



Photo 65. Graham Lakes southern wet meadow. Photo by Bradford S. Slaughter.

65. Moss Lake Wet Meadow

Natural Community Type: Southern Wet Meadow

Rank: G4? S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: BC

Size: 11 acres

Location: Proud Lake State Recreation Area

Element Occurrence Identification Number: 4345

Threats: Species composition, vegetative structure, and successional trajectory are influenced by season water level fluctuation, fire suppression, and competition from invasive species. Fire suppression has lead to woody encroachment within the southern wet meadow and prairie fen. In addition, the hydrology of the wetland complex has been impacted by the dam that occurs downstream of Proud Lake along the Huron River. Invasives are common to locally abundant and include reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and narrow-leaved cat-tail (*Typha angustifolia*). In addition, glossy buckthorn (*Rhamnus frangula*) occurs in adjacent areas of southern shrub-carr and infrequently within the southern wet meadow.

Management Recommendations: The primary management needs are to maintain a buffer of natural communities surrounding the wetland to preserve the hydrology, utilize prescribed fire to control shrub encroachment, and control populations of invasive species along the shoreline, especially reed, purple loosestrife, and narrow-leaved cat-tail. 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. Chemical and mechanical control of glossy buckthorn are warranted. The population of purple loosestrife should also be controlled. Efforts to control invasive species should be monitored.



Photo 66. Moss Lake Wet Meadow southern wet meadow. Photo by Joshua G. Cohen.

66. Seymour Rd. Swamp

Natural Community Type: Southern Wet Meadow

Rank: G4? S3, apparently secure globally and vulnerable within the state

Element Occurrence Rank: C

Size: 33 acres

Location: Waterloo State Recreation Area

Element Occurrence Identification Number: 13389

Threats: Species composition, vegetative structure, and successional trajectory are influenced by season water level fluctuation, fire suppression, and competition from invasive species. Fire suppression has lead to woody encroachment and the development of a deep litter layer within the southern wet meadow. Invasives are localized and include narrow-leaved cat-tail (*Typha angustifolia*) (concentrated along pond margins), reed canary grass (*Phalaris arundinacea*), bittersweet nightshade (*Solanum dulcamara*), and purple loosestrife (*Lythrum salicaria*), and multiflora rose (*Rosa multiflora*), Tartarian honeysuckle (*Lonicera tatarica*), and glossy buckthorn (*Rhamnus frangula*) in areas of southern shrub-carr. In addition garlic mustard (*Alliaria petiolata*) was noted along the stream margin. The invasive species are localized along the stream margins, near the ponds, and in the inclusions of southern shrub-carr. Deer browse was noted on dogwoods (*Cornus* spp.). The hydrology of the wetland complex has likely been altered by past attempts to drain the wetland or portions of the wetland for agricultural.

Management Recommendations: The primary management needs are to maintain a buffer of natural communities surrounding the wetland to preserve the hydrology, utilize prescribed fire to control shrub encroachment, and control populations of invasive species. Fire should be restricted from areas where narrow-leaved cat-tail is prevalent to prevent its spread. Narrow-leaved cat-tail should first be controlled using other techniques. Chemical and mechanical control of glossy buckthorn, multiflora rose, and Tartarian honeysuckle are warranted. The population of purple loosestrife should also be controlled. Efforts to control invasive species should be monitored.



Photo 67. Seymour Rd Swamp southern wet meadow. Photo by Joshua G. Cohen.

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 18. Distribution of submergent marsh in Michigan.

67. Gorman Lake

Natural Community Type: Submergent Marsh

Rank: GU S4, globally unrankable and secure within the state

Element Occurrence Rank: B

Size: 67 acres

Location: Pinckney State Recreation Area

Element Occurrence Identification Number: 13458

Threats: In the far northern portion of the element occurrence, purple loosestrife (*Lythrum salicaria*) is occasional and has colonized many of the floating peat mats and narrow-leaved cat-tail (*Typha angustifolia*) is locally dominant. In addition, glossy buckthorn (*Rhamnus frangula*) was occasionally noted.

Management Recommendations: The main management need is control and monitoring of invasive species. The upland adjacent to the west portion of the lake is infested with invasive species, some of which threaten the wetland (e.g., glossy buckthorn). Control of invasive plant populations in the surrounding landscape will require a major, long-term effort.



Photo 68. Gorman Lake submergent marsh. Photo by Michael A. Kost.

68. Moss Lake

Natural Community Type: Submergent Marsh

Rank: GU S4, globally unrankable and secure within the state

Element Occurrence Rank: B

Size: 8.8 acres

Location: Proud Lake State Recreation Area

Element Occurrence Identification Number: 2993

Threats: Species composition, vegetative structure, and successional trajectory are influenced by natural process. The dam downstream of Proud Lake has impacted the wetland hydrology. In addition, boat traffic has impacted the submergent vegetation, reducing the extent of submergent marsh. The invasives reed (*Phragmites australis*), narrow-leaved cat-tail (*Typha angustifolia*), and hybrid cat-tail (*Typha xglauca*) may pose a threat to shallow water and near shore areas of submergent marsh, especially during low water periods.

Management Recommendations: The primary management needs are to maintain a buffer of natural communities surrounding the marsh to preserve the wetland hydrology and control populations of invasive species along the shoreline, especially reed and invasive cat-tails. Efforts to control invasive species should be monitored.



Photo 69. Moss Lake submergent marsh. Photo by Joshua G. Cohen.

WOODED DUNE AND SWALE COMPLEX

Overview: Wooded dune and swale complex is a large complex of parallel wetland swales and upland beach ridges (dunes) found in coastal embayments and on large sand spits along the shorelines of the Great Lakes. The upland dune ridges are typically forested, while the low swales support a variety of herbaceous or forested wetland types, with open wetlands more common near the shoreline and forested wetlands more prevalent further from the lake. Wooded dune and swale complexes occur primarily in the northern Lower and Upper Peninsulas and Thumb region (Kost et al. 2007).

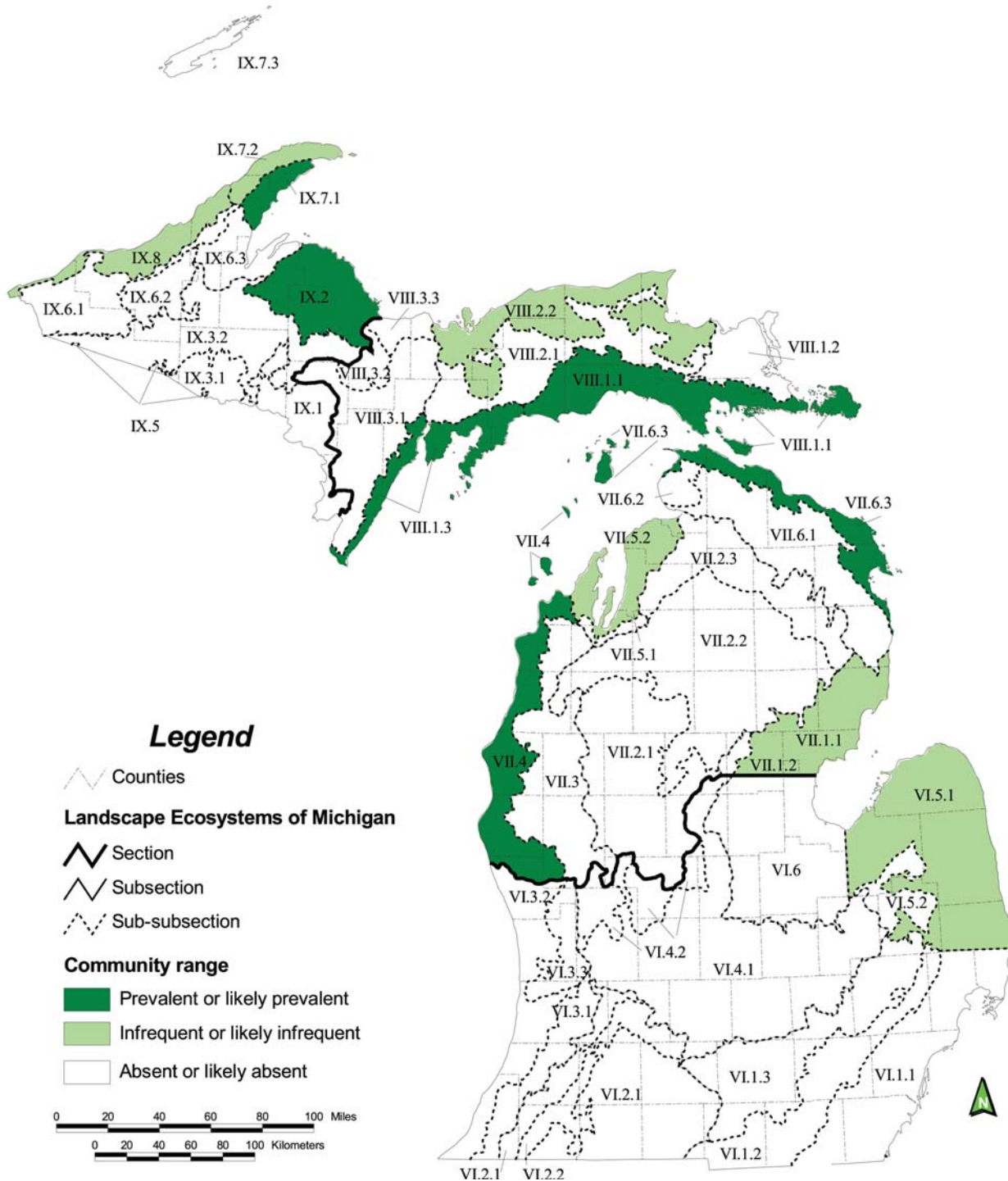


Figure 19. Distribution of wooded dune and swale complex in Michigan.

69. Negwegon Dune and Swale

Natural Community Type: Wooded Dune and Swale Complex

Rank: G3 S3, vulnerable throughout range

Element Occurrence Rank: B

Size: 1400 acres

Location: Negwegon State Park

Element Occurrence Identification Number: 409

Threats: Historically, forested portions of the occurrence were apparently dominated by northern white-cedar (*Thuja occidentalis*) and other conifers. The region was heavily logged in the late 1800s and was impacted by subsequent slash fires; evidence of fires was noted on charred cut stumps within the occurrence. Current cover is dominated by early-successional hardwoods (aspen and birch), with conifers concentrated on beach ridges near Lake Huron. White pine (*Pinus strobus*) and balsam fir (*Abies balsamea*) regeneration is patchy. Deer browse appears to be reducing and locally eliminating woody regeneration on beach ridges, resulting in a patchy, occasionally open canopy with a patchy to absent shrub layer. The construction of the railbed and roads through the occurrence have locally disrupted hydrology. Several invasive plants of concern were noted in generally low levels. Glossy buckthorn (*Rhamnus frangula*) was occasional, mostly as seedlings or small saplings, in wetland areas. Although it has not yet had an appreciable negative impact on the site, it will be difficult to control due to its widespread distribution in relatively inaccessible areas. Hybrid cat-tail (*Typha xglauca*) occurred in patches along the railroad. Reed canary grass (*Phalaris arundinacea*) was noted in a beaver-flooded swale and at the margins of several other swales. The open dunes are infested with spotted knapweed (*Centaurea maculosa*).

Management Recommendations: Management recommendations for this site include allowing natural processes to operate unhindered by avoiding salvage logging in areas of windthrow and allowing wildfires to burn, control of invasive species, reducing local deer densities, and monitoring of invasive species and deer browse pressure. In addition, pursuit of acquisition of adjacent private lands or discussion of compatible management with private landowners is recommended.



Photo 70. Negwegon Dune and Swale wooded dune and swale complex. Photo by Bradford S Slaughter.

DISCUSSION

This report provides site-based assessments of 67 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. Over the next year, MNFI will continue to survey the remaining natural community element occurrences within the State Parks and Recreation Areas. 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 71. Moss Lake submergent marsh. Photo by Joshua G. Cohen.

REFERENCES

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- Michigan Natural Features Inventory (MNFI). 1988. Draft criteria for determining natural quality and condition grades, element occurrence size-classes and significance levels for palustrine and terrestrial natural communities in Michigan. Michigan Natural Features Inventory, Lansing, MI. 39 pp.
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Photo 72. Mt. Hope Road Fen prairie fen. Photo by Joshua G. Cohen.

Appendix 1. Ecology Community Field Survey Form



Ecological Community Field Survey Form



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

- | | | |
|---|---|--|
| <input type="checkbox"/> Logging | <input type="checkbox"/> Plant disease: _____ | <input type="checkbox"/> Wild fire |
| <input type="checkbox"/> Grazing/browsing | <input type="checkbox"/> Insect damage: _____ | <input type="checkbox"/> Prescribed fire |
| <input type="checkbox"/> Agriculture | <input type="checkbox"/> Exotic animal activity: _____ | <input type="checkbox"/> Windthrow |
| <input type="checkbox"/> Soil erosion | <input type="checkbox"/> Herbivore impact (e.g., deer): _____ | <input type="checkbox"/> Ice storm |
| <input type="checkbox"/> Mining | <input type="checkbox"/> Invasive plants: _____ | <input type="checkbox"/> Ice scour |
| <input type="checkbox"/> Dumping | | <input type="checkbox"/> Desiccation |
| <input type="checkbox"/> Trails/roads | | <input type="checkbox"/> Flooding |
| <input type="checkbox"/> ORV/vehicular disturbance | | <input type="checkbox"/> Beaver flooding |
| <input type="checkbox"/> Hydrologic alteration
(drainage, ditches, blocked culverts, etc.) | | <input type="checkbox"/> Beaver chewed trees |
| <input type="checkbox"/> Fire suppression | | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> 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
<input type="checkbox"/> Fibirc Peat:	_____	_____
<input type="checkbox"/> Hemic Peat:	_____	_____
<input type="checkbox"/> Sapric Peat (muck):	_____	_____
<input type="checkbox"/> Marl (depth):	_____	_____
<input type="checkbox"/> Other (describe):	_____	_____

Comments:

Core Two: GPS Point

	Depth	pH
<input type="checkbox"/> Fibirc Peat:	_____	_____
<input type="checkbox"/> Hemic Peat:	_____	_____
<input type="checkbox"/> Sapric Peat (muck):	_____	_____
<input type="checkbox"/> Marl (depth):	_____	_____
<input type="checkbox"/> Other (describe):	_____	_____

Comments:

Core Three: GPS Point

	Depth	pH
<input type="checkbox"/> Fibirc Peat:	_____	_____
<input type="checkbox"/> Hemic Peat:	_____	_____
<input type="checkbox"/> Sapric Peat (muck):	_____	_____
<input type="checkbox"/> Marl (depth):	_____	_____
<input type="checkbox"/> 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:

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%

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)

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°

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

Topographic position:

- Ridge, summit, or crest
- High slope (upper slope, convex slope)
- Midslope (middle slope)
- Low slope (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 at that location. Factors to consider include evidence of stability/presence of old growth, richness/distribution 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)

- | | | |
|---|---|--|
| <input type="checkbox"/> Logging | <input type="checkbox"/> Plant disease: _____ | <input type="checkbox"/> Wild fire |
| <input type="checkbox"/> Grazing/browsing | <input type="checkbox"/> Insect damage: _____ | <input type="checkbox"/> Prescribed fire |
| <input type="checkbox"/> Agriculture | <input type="checkbox"/> Exotic animal activity: _____ | <input type="checkbox"/> Windthrow |
| <input type="checkbox"/> Soil erosion | <input type="checkbox"/> Herbivore impact (e.g., deer): _____ | <input type="checkbox"/> Ice storm |
| <input type="checkbox"/> Mining | <input type="checkbox"/> Invasive plants: _____ | <input type="checkbox"/> Ice scour |
| <input type="checkbox"/> Dumping | | <input type="checkbox"/> Desiccation |
| <input type="checkbox"/> Trails/roads | | <input type="checkbox"/> Flooding |
| <input type="checkbox"/> ORV/vehicular disturbance | | <input type="checkbox"/> Beaver flooding |
| <input type="checkbox"/> Hydrologic alteration
(drainage, ditches, blocked culverts, etc.) | | <input type="checkbox"/> Beaver chewed trees |
| <input type="checkbox"/> Fire suppression | | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> 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.

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.