Lakeplain Prairie Surveys and Management Recommendations for St. John's Marsh State Wildlife Area

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Cover Photo: Remnant lakeplain wet prairie and lakeplain wet-mesic prairie within St. John's Marsh State Wildlife Area. Photo by Joshua G. Cohen.

ACKNOWLEDGMENTS

MNFI ecologists Jesse Lincoln and Joshua Cohen with DNR wildlife biologist Terrence McFadden.

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INTRODUCTION

St. John's Marsh State Wildlife Area (SWA) is a large block of contiguous land in southeast Lower Michigan consisting of 3,060 acres of St. Clair County. St. John's Marsh and the adjacent St. Clair Flats SWA are important ecologically because they provide critical habitat for a myriad of game and non-game species that depend on coastal wetlands. Within St. Clair County, natural cover constitutes 58% of the county. In comparison, natural cover constitutes approximately 97% of St. John's Marsh SWA (NOAA 2016).

In the 2016 field season, the Wildlife Division of the Michigan Department of Natural Resources (DNR) commissioned Michigan Natural Features Inventory (MNFI) to conduct Michigan Forest Inventory (MiFi) Stage 1 inventory and surveys for high-quality lakeplain prairie in St. John's Marsh SWA as part of the ongoing Integrated Inventory Project. This project is part of a long-term effort by the Wildlife Division to document and sustainably manage areas of high conservation significance on state lands. This preliminary report provides an overview of the landscape and historical context of St. John's Marsh SWA, summarizes the findings of MNFI's surveys of high-quality lakeplain prairie ecosystems, and discusses stewardship needs, opportunities, and priorities within the wildlife area. This report will be amended following future surveys of St. John's Marsh SWA for rare species, which are slated to be conducted over the course of the 2017 field season. The focus of this project and this report is on native biodiversity with an emphasis on high-quality ecosystems. Biodiversity stewardship considerations are included in the report and we acknowledge that the DNR manages for multiple values including wildlife management, hunting and other wildlife related recreation, as well as biodiversity, and that this report does not necessarily reflect the planned management actions of the DNR.

Ecoregions and Subsections

The regional landscape ecosystems of Michigan have been classified and mapped based on an integration of climate, physiography, soils, and natural vegetation (Albert 1995) (Figure 1). This classification system can be useful for conservation planning and integrated resource management because it provides a framework for understanding the distribution patterns of species, natural communities, anthropogenic activities, and natural disturbance regimes. The classification is hierarchically structured with three levels in a nested series, from broad landscape regions called sections, down to smaller subsections and sub-subsections. St. John's Marsh SWA occurs within the Southern Lower Michigan section (Section VI) and lies within the Washtenaw subsection (Subsection VI.1) and the Maumee Lake Plain sub-subsection (Sub-Subsection VI.1.1).

Washtenaw

The Washtenaw subsection is located in southeastern Lower Michigan and is characterized by glacial lakeplain, ground moraine, end moraine, and outwash plain. This subsection is characterized by the longest growing season in the state. The growing season ranges from approximately 130 days inland to 180 days along Lake Erie and Lake St. Clair in the east (Eichenlaub et al. 1990). Total annual precipitation averages between 28 and 36 inches, and total snowfall averages 30 to 50 inches. Surface glacial deposits, which are as thick as 300 feet near the inland margin of the subsection and locally less than 5 feet near the Lake Erie shoreline, are underlain by Pennsylvanian, Mississippian, Devonian, and Silurian marine and nearshore bedrock, including sandstone, shale, coal, marine limestone and dolomite, and gypsum and other evaporites (Dorr and Eschman 1984, Milstein 1987). Prevalent soils include sands, sandy loams, and loamy sands. Loams with clayey soils occur locally in areas of lakeplain. Prevalent vegetation types within this region historically included beech-sugar maple forest, oak savanna, swamp forest, wet prairie, and coastal marshes. The subsection has some of the most intensive urban, industrial, and agricultural land use in the state and much of the prairie, savanna, and coastal marshes have been eliminated or degraded. Remaining natural cover within this subsection is primarily fire suppressed oak-dominated forest (Albert 1995).

Maumee Lake Plain

The Maumee Lake Plain (VI.1.1) is a flat, clay lakeplain dissected by broad glacial drainageways of sandy soil (Figure 2). The southern two-thirds of the sub-subsection is clay lakeplain, with several broad channels of lacustrine sand. The northern third, where St. John's Marsh SWA occurs, is primarily lakeplain with clay soils. Beach ridges and small sand dunes are common on the sand channels. Lakeplain throughout this area is broad and flat (Figure 1). Wet loamy and clayey soils are prevalent with sandy soils localized. Soil permeability is generally low and soils are calcareous at shallow depth.

Historically, extensive Great Lakes marsh occurred along the entire coast of Lakes Erie and St. Clair. The marshes, which extended into water four to five feet deep, were one to two miles wide in places and extended for miles up major rivers. Upland of the marshes there was typically a broad zone of swamp forest but locally along Lake St. Clair and Lake Erie, one- to three-mile wide expanses of wet prairie occurred. Extensive coastal complexes of Great Lakes marsh, lakeplain prairie, and lakeplain oak openings occurred within the St. Clair River Delta. The upland vegetation varied depending on soil composition with areas of sandy lakeplain supporting lakeplain oak openings
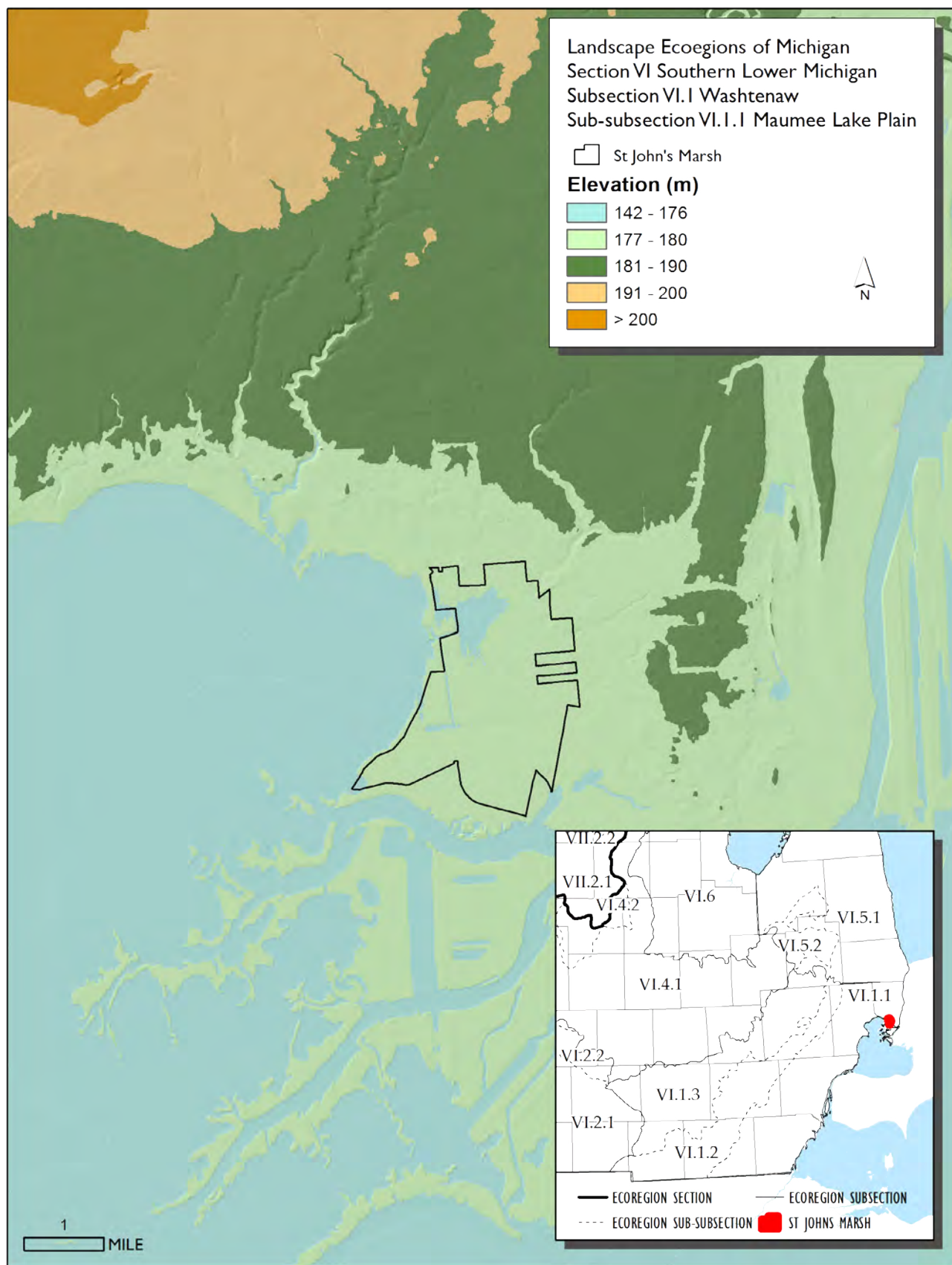
Figure 1. Ecoregions of St. John's Marsh State Wildlife Area (Albert 1995)
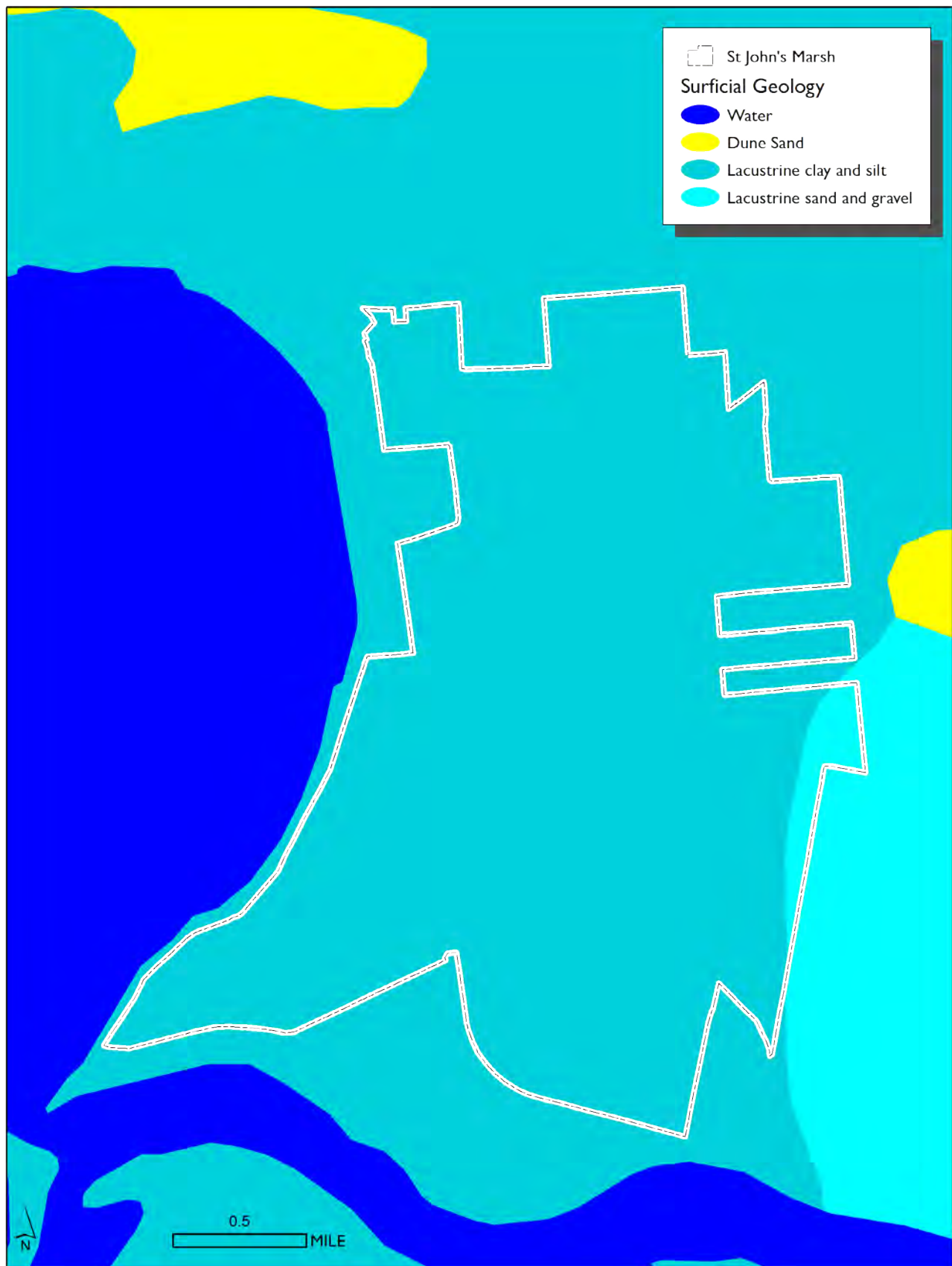
Figure 2. Surficial geology and relief of St. John's Marsh State Wildlife Area (Farrand and Bell 1982, USGS 2009).

and areas of clay lakeplain supporting beech-sugar maple forest in well drained areas and wet-mesic flatwoods in moderately drained areas. Areas of poorly drained clay lakeplain supported deciduous swamp forest.

Within the Maumee Lake Plain there is a long history of land use by humans, beginning with Native American farming and likely use of fire to maintain open conditions in the prairies and savannas. The clay soils of the sub-subsection were among the first areas in Michigan farmed by European settlers. The lake-moderated climate and productive soils resulted in early and intensive agricultural development. Much of the lakeplain has been ditched and tiled for agricultural usage. As a result, many of the coastal ecosystems within this region have been eliminated or degraded (Albert 1995).

Circa 1800s Vegetation

Interpretations of the General Land Office (GLO) surveyor notes by MNFI ecologists indicated that the St. John's Marsh SWA and surrounding area were dominated by lakeplain prairie ecosystems (Comer et al. 1995) (Figure 3). Surveyors recorded information on the vegetative cover, tree species composition, tree size, and general condition of the lands within and surrounding the St. John's Marsh SWA. Circa 1800, the game area was predominantly "Wet Prairie", with 72% of the area supporting this vegetation type. Within this landscape, "Wet Prairie" likely included lakeplain wet prairie, lakeplain wet-mesic prairie, and wet meadow zones of Great Lakes marsh. A significant portion of the wildlife area (18% of the area) supported "Beech-Sugar Maple Forest". This type likely included mesic uplands dominated by beech and sugar maple but also likely included wet-mesic flatwoods, which have a more diverse canopy with both upland and lowland trees due to seasonal inundation caused by clay lenses in the soil profile. A moderate proportion of the wildlife area (10%) was classified as "Shrub Swamp/Emergent Marsh". Compared to the surrounding area, St. John's Marsh SWA historically supported a high proportion of lakeplain prairie. Within St. Clair County the most common covertypes were "Beech-Sugar Maple Forest" (66% of the county), "Mixed Hardwood Swamp" (16% of the county), "Mixed Conifer Swamp" (6% of the county), and "Wet Prairie" (3% of the county compared to 72% of the wildlife area). Within the Maumee Lake Plain (Sub-Subsection VI.1.1) the most common covertypes were "Beech-Sugar Maple Forest" (51% of the area), "Mixed Hardwood Swamp" (24% of the area), "Wet Prairie" (8% of the area compared to 77% of the wildlife area), and "Mixed Oak Savanna" (5% of the area).

Current Land Cover

The land cover within the St. John's Marsh SWA (Figure 4) has changed significantly since 1800 due to agriculture, hydrologic alteration, fire suppression, and invasive species encroachment. The mosaic of aerial photographs from 1938 (Figure 5) shows how the expansion of agriculture heavily impacted the St. John's Marsh SWA and the surrounding area. In addition, a golf course was established in the center of the area sometime in the 1930s. However, compared to the surrounding fragmented landscape, St. John's Marsh SWA is characterized by a significant portion of natural cover. As noted above, 97% of the game area is natural cover. In comparison, only 22% of the Maumee Lake Plain is natural cover (NOAA 2016). Current land cover in St. John's Marsh SWA is dominated by non-forested wetlands (55%) and forested wetlands (30%) (Figure 4). The non-forested wetlands are primarily composed of emergent wetlands (35%) and lowland shrub (20%). The majority of these wetlands are either degraded Great Lakes marsh dominated by reed (*Phragmites australis* subsp. *australis*) or degraded lakeplain prairie dominated by reed and/or glossy buckthorn (*Frangula alnus*). Surveys for high-quality lakeplain prairie identified 77 acres of remnant lakeplain wet prairie and 25 acres of remnant lakeplain wet-mesic prairie constituting just 2.5% and 0.8% of St. John's Marsh SWA respectively. Forested wetlands remain an important component of the game area with lowland hardwoods accounting for 17% of the area. A majority of these lowland hardwoods are early-successional (< 80 years of age) and most of these forests are wet-mesic flatwoods, a natural community type that is not an available cover type in the current MiFi system. Additional covertypes within St. John's Marsh SWA identified during MiFi Stage 1 inventory include herbaceous openland (6%), open water (4%), cultivated crops (2%), upland shrub (<1%), and upland oak (<1%).

Oblique image of St. John's Marsh State Wildlife Area. Photo by Joshua G. Cohen
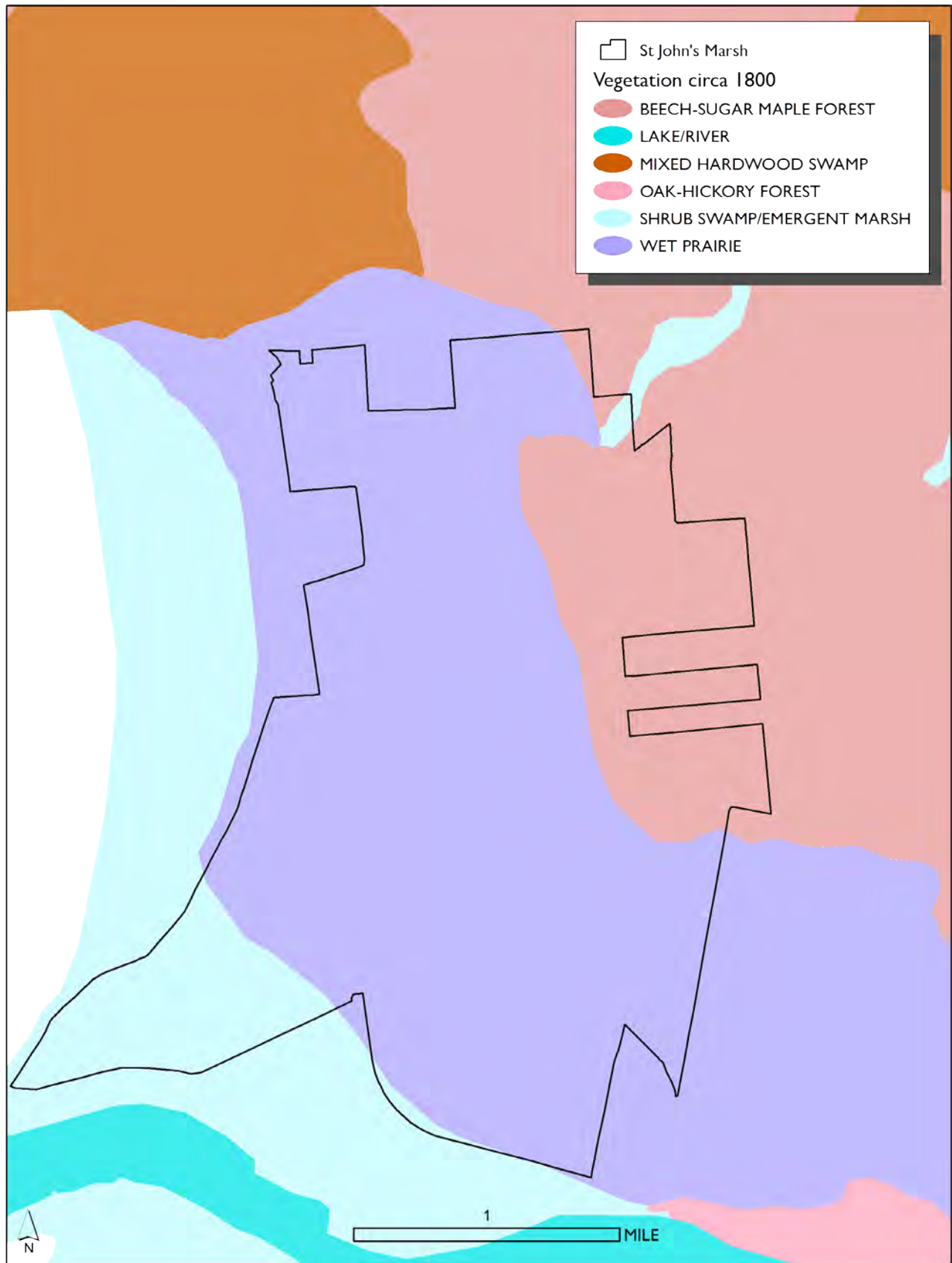
Figure 3. Circa 1800 vegetation of St. John's Marsh State Wildlife Area (Comer et al. 1995).
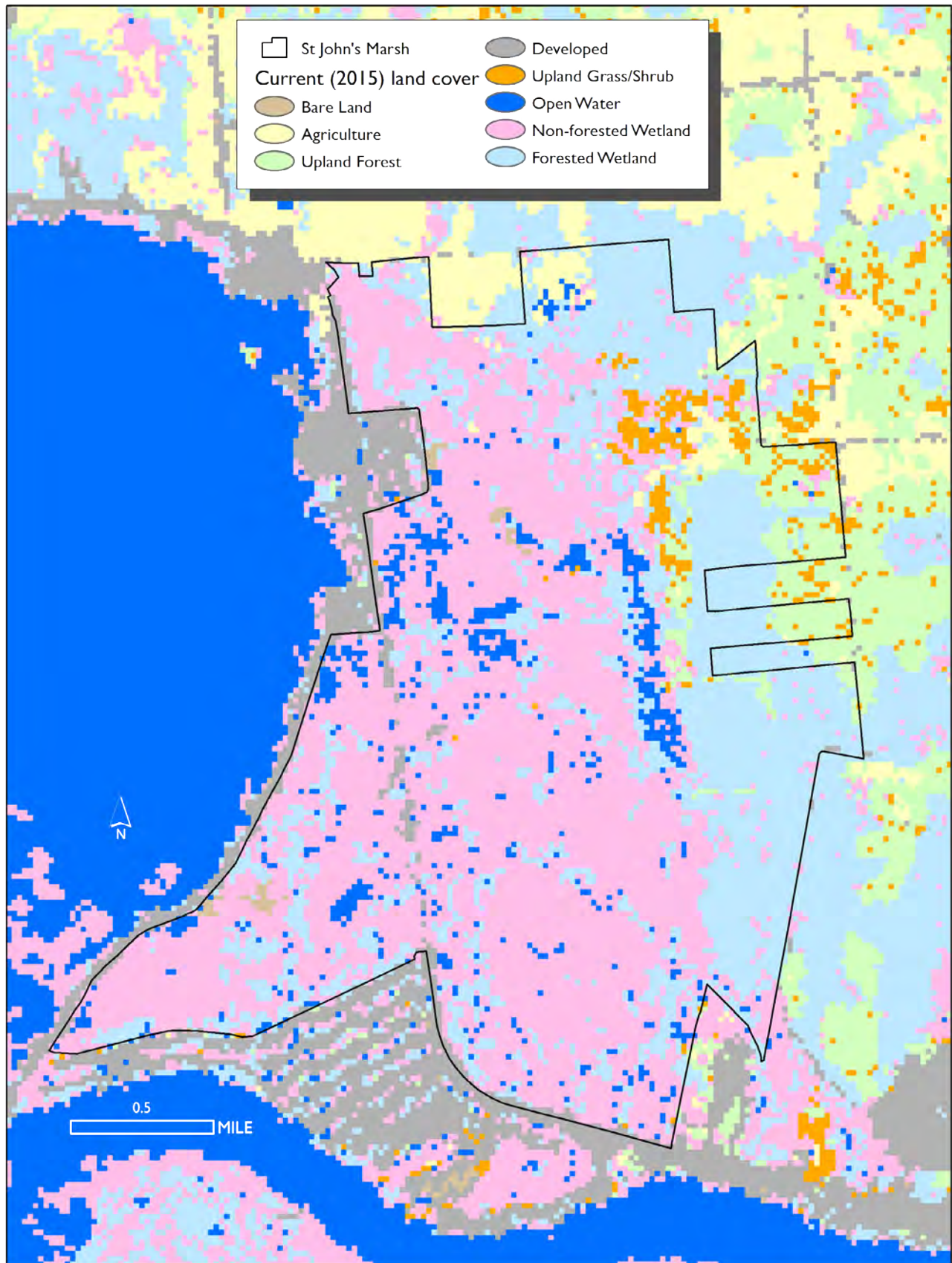
Figure 4. Current land cover of St. John's Marsh State Wildlife Area.

Figure 5. Mosaic of 1938 aerial photographs of St. John's Marsh State Wildlife Area (MNFI 2014).

METHODS

During the 2016 field season, the Wildlife Division commissioned MNFI to conduct natural community surveys for high-quality lakeplain prairie ecosystems within the St. John's Marsh SWA. Prior to the surveys, a known element occurrence lakeplain wet prairie was known from St. John's Marsh SWA. Throughout this report, all high-quality natural communities are referred to as elements and their documented occurrences at specific locations are referred to as element occurrences or "EOs." 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 (Cohen et al. 2014). 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). According to MNFI's natural community classification, there are 77 natural community types in Michigan (Kost et al. 2007, Cohen et al. 2014). 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 EO. 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.

Field Surveys

Each natural community was evaluated employing Natural Heritage and MNFI methodology, which considers three factors to assess a natural community's ecological integrity or quality: size, landscape context, and condition (Faber-Langendoen et al. 2008, Faber-Langendoen et al. 2015). 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 from May 2016 to August 2016 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.

The ecological field 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
d) analyzing soils and hydrology
e) noting current and historical anthropogenic disturbances
f) evaluating potential threats
g) ground-truthing aerial photographic interpretation using GPS (Garmin units were utilized)
h) taking digital photos and GPS points at significant locations
i) surveying adjacent lands to assess landscape context
j) evaluating the natural community classification and mapped ecological boundaries
k) assigning or updating element occurrence ranks
l) noting management needs and restoration opportunities or evaluating past and current restoration activities and noting additional management needs and restoration opportunities

Data Analysis

Following completion of the field surveys, the collected data were analyzed and transcribed to update and create new EO records in MNFI's statewide biodiversity conservation database (MNFI 2016). Natural community boundaries were mapped or re-mapped. Information from these surveys was used to produce site descriptions, threat assessments, and management recommendations for each natural community occurrence, which appear within the following **Results** section.

Floristic data collected during the surveys was entered into the Universal Floristic Quality Assessment (FQA) Calculator (Freyman et al. 2016) with species lists stratified by prairie type (lakeplain wet prairie and lakeplain wet-mesic prairie). Nomenclature for the FQAs follows Reznicek et al. (2014). The FQA is derived from two values, a mean coefficient of conservatism (C) and the floristic quality index (FQI) (Herman et al. 2001). Each native taxon is assigned a C value on a scale of 0-10 based on the probability of its occurrence in a natural versus degraded habitat. In this manner, a taxon that is restricted to a specialized habitat, such as the federally threatened Pitcher's thistle (*Cirsium pitcheri*) that occurs on active sand

dunes, is assigned a value of 10, implying that the taxon has extremely strong fidelity to a particular habitat. Native taxa that are not particular to or indicative of natural conditions, such as common milkweed (*Asclepias syriaca*), are assigned low values (in this instance, *C*= 1) (Herman et al. 2001). Non-native species are not assigned *C* values because they are not indicative of native habitats. From the total list of vascular plant taxa for an area, a mean *C* value is calculated (= $\Sigma C/n$), and that value is multiplied by the square root of the total number of plants ($\sqrt{n}$) to calculate the *FQI* ($FQI = \sqrt{n}$) (Herman et al. 2001). Herman et al. (2001) suggest that Michigan sites with an FQI of 35 or greater "possess sufficient conservatism and richness that they are floristically important from a statewide perspective". Mean *C* values and *FQI* values were calculated for the lakeplain wet prairie and lakeplain wet-mesic prairie element occurrences and these values are presented in the following Results section.

Lakeplain wet-mesic prairie, St. John's Marsh State Wildlife Area. Photo by Joshua G. Cohen

Lakeplain wet prairie, St. John's Marsh State Wildlife Area. Photo by Joshua G. Cohen

RESULTS

During the first year of the Integrated Inventory Project at St. John's Marsh SWA, MNFI ecologists documented one new lakeplain wet-mesic prairie and updated a known element occurrence of lakeplain wet prairie. Data compiled on these EOs was entered into MNFI's Biotics database (MNFI 2016). The locations in St. John's Marsh SWA of these natural community occurrences are illustrated in Figure 6.

MNFI ecologists and botanists conducted field surveys over the course of nine days (May 12, May 13, May 19, May 20, May 24, May 25, June 3, July 28, and August 3 2016). These natural community surveys consisted of classifying wetland habitat, evaluating soils and hydrology, cataloging floristic composition, describing vegetative and community structure, and documenting threats. The surveys focused on lakeplain wet prairie element occurrence 8228 and potential lakeplain prairie habitat to the north of this element occurrence within a proposed DNR project area. Prior to the surveys this lakeplain prairie element occurrence consisted of one large polygon of 265 acres and had an element occurrence rank of BC. Following the ecological surveys we have significantly modified the lakeplain wet prairie element occurrence, which now consists of 12 distinct polygons constituting 77 acres. In addition, the element occurrence has been downgraded to a C rank. This reduction of size and quality ranking is due in part to the encroachment of reed (*Phragmites australis* subsp. *australis*) and shrubs, including the invasive glossy buckthorn (*Frangula alnus*). In addition, we identified sufficient lakeplain wet-mesic prairie to add a distinct occurrence of this natural community type. This lakeplain wet-mesic prairie (Element Occurrence 20638) is 24 acres, is composed of six distinct polygons, and was assigned a C rank. Prior to this effort, pockets of lakeplain wet-mesic prairie within this game area were lumped in with the original lakeplain wet prairie as inclusions. This lakeplain wet-mesic prairie faces the same threats from invasive species (i.e., reed and glossy buckthorn) and shrub encroachment. Both lakeplain wet prairie and lakeplain wet-mesic prairie were identified within the proposed project area. Within this project area, two polygons of lakeplain wet-mesic prairie constituting approximately 1.2 acres were identified and three polygons of lakeplain wet prairie constituting approximately 4.7 acres were identified.

The subsequent **Site Summaries** section provides in depth description of each natural community EO as well as site-specific threat assessments and management recommendations. The following site summaries contain a detailed discussion for both of the natural communities organized alphabetically by community type. 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, Cohen et al. 2014). 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) state and global rank (see Appendix 1 for ranking criteria)
d) current element occurrence rank
e) size
f) locational information
g) digital photographs
h) detailed description
i) Floristic Quality Index and Mean coefficient of conservatism
j) threat assessment
k) management recommendations

Glossy buckthorn invading lakeplain wet-mesic prairie. Photo by Joshua G. Cohen

Reed invading lakeplain wet prairie. Photo by Joshua G. Cohen
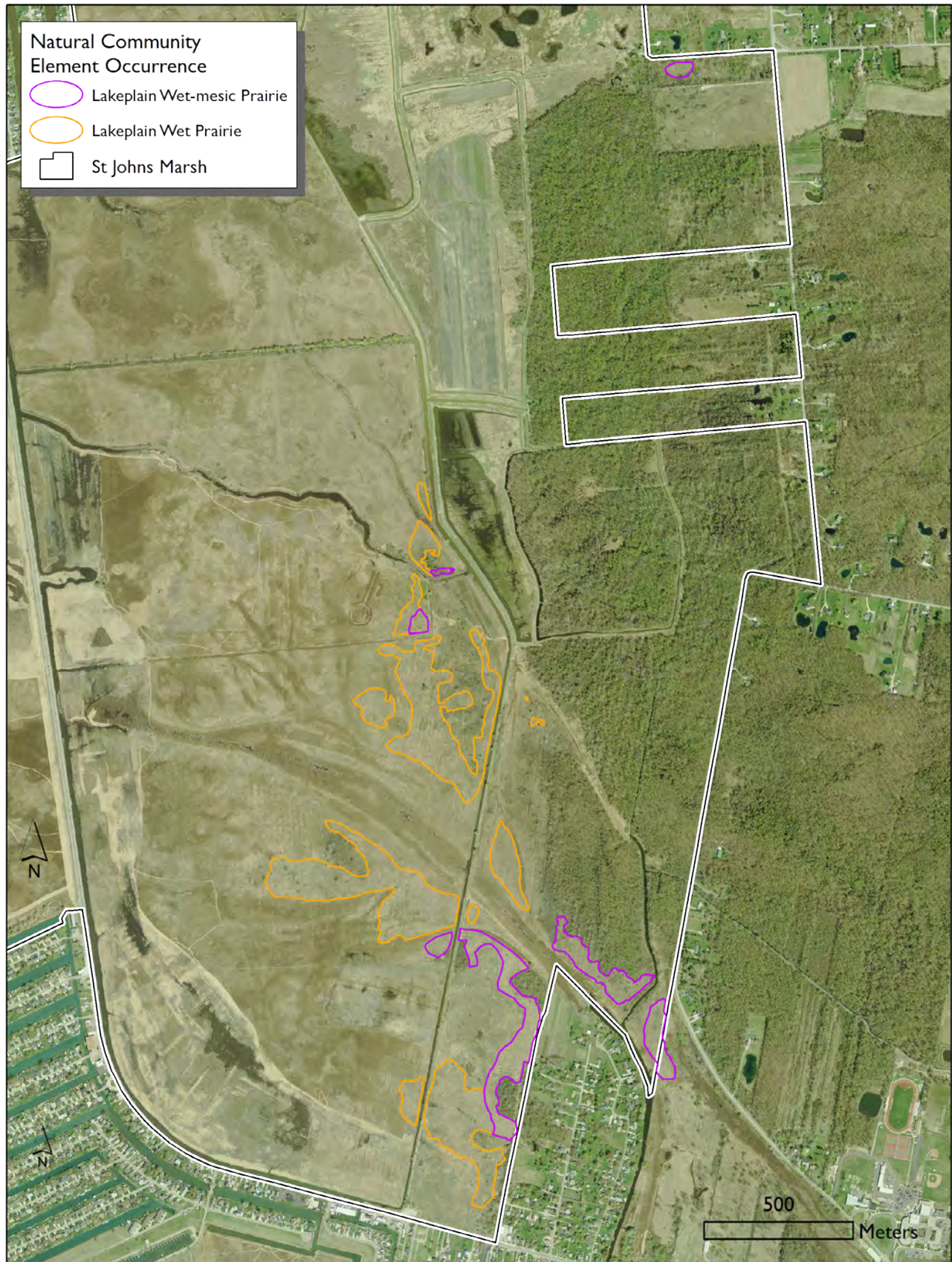
Figure 6. Natural community element occurrences in St. John's Marsh State Wildlife Area.

SITE SUMMARIES

LAKEPLAIN WET PRAIRIE

Overview: Lakeplain wet prairie is a native lowland grassland that occurs on level, seasonally inundated glacial lakeplains in the southern Lower Peninsula. Lakeplain wet prairie is found along and near the shoreline of Lake Huron in Saginaw Bay, within the St. Clair River Delta, and near Lake Erie. The community develops on slightly acidic to moderately alkaline sands, sandy loams, or silty clays. Natural processes that influence species composition and community structure include seasonal flooding, cyclic changes in Great Lakes water levels, flooding by beaver, and fire. Lakeplain wet prairie is dominated by grasses, sedges, rushes, and a diversity of forbs. Dominant grasses, sedges, and rushes typically include blue-joint (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), sedges (*Carex aquatilis*, *C. pellita*, *C. stricta*, *C. prairea*, *C. buxbaumii*, and *C. tetanica*), Baltic rush (*Juncus balticus*), twig-rush (*Cladium mariscoides*), and switch grass (*Panicum virgatum*). Today, lakeplain wet prairie is nearly extirpated from Michigan due to changes in land use, colonization by shrubs and trees, and competition from invasive plants. Lakeplain wet prairie is globally imperiled and critically imperiled in Michigan. Less than 1% of the original natural community remains in Michigan (Albert and Kost 1998a, Kost et al. 2007, Cohen et al. 2014).
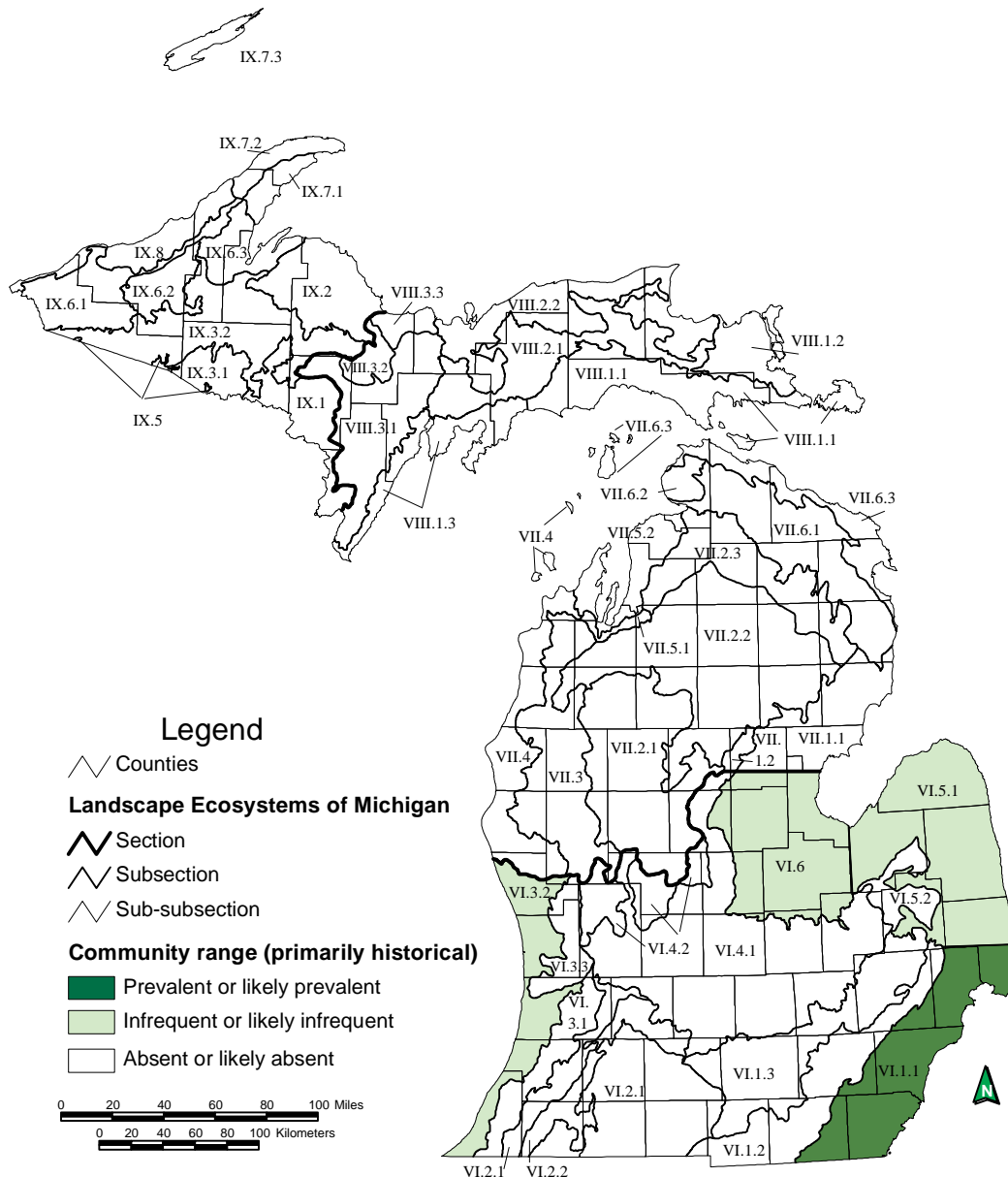
Map 1. Distribution of lakeplain wet prairie in Michigan (Albert et al. 2008).

1. **St. John's Prairie**
Natural Community Type: Lakeplain Wet Prairie
Rank: G2 S1, imperiled globally and critically imperiled within the state
Element Occurrence Rank: C
Size: 77 acres
Location: St. John's Marsh SWA, Compartment 1, Stands 4, 50, 71, 76, 85, 91, 92, 94, 98, 105, and 111
Element Occurrence Identification Number: 8228 (EO Update)

Site Description: Lakeplain wet prairie and lakeplain wet-mesic prairie remnants occur on flat lakeplain within the Saint Clair River Delta along the shore of Lake St. Clair and just north of the North Channel. A total of twelve distinct polygons of lakeplain wet prairie were identified and mapped as part of this element occurrence. Historically, frequent fires and a seasonally fluctuating water table maintained the open prairie conditions. The soils of the lakeplain wet prairie are characterized by sandy loam and sandy clay loam (pH 7.3-7.8) of variable depth (2-30 cm but typically 5-20 cm) over sandy clay and sandy clay loam (pH 7.0-8.0). Clay lenses underlying the sandy loams allow for the seasonal fluctuation of the water table, which contributes to the open prairie conditions by preventing or limiting shrub and tree encroachment. Lakeplain wet-mesic prairie and lakeplain wet prairie intergrade within this complex with ecosystem patterning determined by very subtle differences in the depth to the clay layer and the resulting hydrologic regime. Shallower depth to the clay lens in lakeplain wet prairie compared to lakeplain wet-mesic prairie results in more prolonged inundated soils conditions in lakeplain wet prairie. As a result the lakeplain wet prairie is characterized by more wetland species and a simpler floristic composition and the lakeplain wet-mesic prairie is characterized by a diverse flora with both wetland, woodland, and prairie species. Scattered ant mounds, sedge tussocks, and animal trails contribute to the micro heterogeneity of the lakeplain prairie complex. Ants mix and aerate the soil and their mounds provide unique establishment sites for plants. Crayfish mounds were also observed throughout the lakeplain wet prairie.

The lakeplain wet prairie is dominated by graminoids with blue-joint (*Calamagrostis canadensis*) and tussock sedge (*Carex stricta*) dominant throughout and prairie cordgrass (*Spartina pectinata*) locally dominant. Common forbs within the lakeplain wet prairie include Canada anemone (*Anemone canadensis*), common mountain mint (*Pycnanthemum virginianum*), swamp thistle (*Cirsium muticum*), swamp milkweed (*Asclepias incarnata*), marsh bellflower (*Campanula aparinoides*), boneset (*Eupatorium perfoliatum*), grass-leaved goldenrod (*Euthamia graminifolia*), southern blue flag (*Iris virginica*), golden ragwort (*Packera aurea*), silverweed (*Potentilla anserina*), Canada goldenrod (*Solidago canadensis*), Ohio goldenrod (*Solidago ohioensis*), marsh pea (*Lathyrus palustris*), culvers-root (*Veronicastrum virginicum*), and sneezeweed (*Helenium autumnale*). Marsh fern (*Thelypteris palustris*) is common throughout. Additional common graminoids include golden-seeded spike rush (*Eleocharis elliptica*) and rush (*Juncus balticus*). Prairie grasses, including big bluestem (*Andropogon gerardii*) and switch grass (*Panicum virgatum*), occur locally within the lakeplain wet prairie on scattered ant mounds. Reed (*Phragmites australis* subsp. *australis*) is locally common within the lakeplain wet prairie and is an overwhelming dominant in adjacent degraded lakeplain wet prairie and Great Lakes marsh. In addition, purple loosestrife (*Lythrum salicaria*) occurs locally within the lakeplain wet prairie.

Scattered trees and shrubs include pin oak (*Quercus palustris*), quaking aspen (*Populus tremuloides*), cottonwood (*Populus deltoides*), red-osier dogwood (*Cornus sericea*), gray dogwood (*C. foemina*), silky dogwood (*C. amomum*), cockspur thorn (*Crataegus crus-galli*), slender willow (*Salix petiolaris*), prickly-ash (*Zanthoxylum americanum*), and glossy buckthorn (*Frangula alnus*). Shrubs occur as scattered individuals and also in scattered clumps. Areas along the margin of the lakeplain wet prairie and lakeplain wet-mesic prairie have a higher density of shrubs. Low shrubs include meadowsweet (*Spiraea alba*), Kalm's St. Johns-wort (*Hypericum kalmianum*), and swamp rose (*Rosa palustris*). Compared to the adjacent lakeplain wet-mesic prairie, shrubs are less prevalent in the lakeplain wet prairie remnants. In addition, the lakeplain wet prairie is not as floristically diverse as the lakeplain wet-mesic prairie.

MNFI ecologists and botanists visited this site nine times over the 2016 field season. The floristic data was compiled into the Michigan Floristic Quality Assessment (Reznicek et al. 2014). A total of 103 plant species were documented with 93 native species and 10 non-native species. The mean coefficient of conservatism (*C*) for this lakeplain wet prairie is 3.8 and the total floristic quality index (*FQI*) is 38.6.

Lakeplain wet prairie, St. John's Marsh State Wildlife Area. Photos by Joshua G. Cohen.

2010 aerial photograph of St. John's Marsh lakeplain wet prairie.

Threats: The lakeplain wet prairie has been impacted by altered hydrology, fire suppression, and invasive species encroachment. The construction of roads, the railroad grade, dikes, and ditches within and around the wildlife area have altered the hydrology of the coastal ecosystems within St. John's Marsh SWA. Altered hydrology and fire suppression have likely led to the establishment and spread of invasive species. Reed is locally dominant within the area and within the lakeplain wet prairie EO, reed is scattered to locally common. Significant portions of the wildlife area that are inundated to seasonally inundated are completely dominated by dense thickets of >12 foot tall reed. Glossy buckthorn is also locally dominant within the area and is concentrated along the upland margin and where there are saturated soils. Glossy buckthorn is locally common to scattered within the lakeplain wet-mesic prairie and occurs infrequently within the lakeplain wet prairie. Within St. John's Marsh SWA, many acres of lakeplain wet prairie have been degraded by reed invasion and many acres of lakeplain wet-mesic prairie have been lost to shrub encroachment with glossy buckthorn as one of the most prevalent shrub invaders. When these invasive species become established and dominate a system, in addition to outcompeting native vegetation, they also locally alter the hydrology and soil properties. Additional invasives found within the lakeplain wet prairie include purple loosestrife and reed canary grass, which occur locally within the element occurrence.

Management Recommendations: The main management recommendations are to reintroduce fire as a critical disturbance factor and control invasive species within the lakeplain prairie remnants and in the surrounding landscape through fire, mechanical removal, and herbicide application. Portions of the St. John's Marsh SWA have been burned in the past to maintain the open conditions of the prairie and control invasive species. In addition, portions of the area have been treated with herbicide in order to control reed. A sustained and concentrated effort to implement fire and control invasive species in the highest quality prairie remnants is recommended. We encourage the use of targeted herbicide treatment of reed, particularly in patches within the lakeplain wet prairie and along the perimeter of the lakeplain wet prairie. We discourage the use of broadcast spraying within the lakeplain wet prairie because of the collateral damage broadcast spraying can cause to floristic diversity. Mechanical control of glossy buckthorn and other woody shrubs should be followed by herbicide application to the cut stumps (e.g., glyphosate at 35%) from June through February. In addition, we recommend varying the seasonality of the prescribed fire in order to knock back the woody encroachment of glossy buckthorn as well as native shrubs that are increasing due to fire suppression. Conducting burns in late spring after leafout or during the growing season is recommended in areas with heavy shrub encroachment. During the late spring and throughout the growing season energy reserves of shrub species are already partially depleted or depleted, and resprouting vigor is low, particularly for clonal species. Late season fires should be used cautiously in areas with rare plant species and impacts of these burns should be monitored. The DNR WLD is considering treating the invasive reed within this wildlife area by flooding areas dominated by the reed. Significant portions of the area are being evaluated for this kind of treatment. If flooding is implemented within this area, resource managers should design the proposed hydrologic alteration so that the hydrology of the lakeplain prairies is not impacted by the flooding and to make sure that remnants of high-quality lakeplain wet prairie and lakeplain wet-mesic prairie are not permanently inundated.

Control of invasive reed and glossy buckthorn is a critical stewardship need for the lakeplain wet prairie. Photos by Joshua G. Cohen.

LAKEPLAIN WET-MESIC PRAIRIE

Overview: Lakeplain wet-mesic prairie is a native lowland grassland that occurs on moist, level, seasonally inundated glacial lakeplains in the southern Lower Peninsula. The community develops on slightly acidic to moderately alkaline sands, sandy loams, or silty clays. Natural processes that influence species composition and community structure include seasonal flooding, cyclic changes in Great Lakes water levels, flooding by beaver, and fire. Prairie grasses, sedges, and a diversity of forbs dominate the community. Dominant species typically include big bluestem (*Andropogon gerardii*), cordgrass (*Spartina pectinata*), switch grass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), common mountain mint (*Pycnanthemum virginianum*), tall coreopsis (*Coreopsis tripteris*), and marsh blazing star (*Liatris spicata*). Today, lakeplain wet-mesic prairie is nearly extirpated from Michigan due to changes in land use, colonization by shrubs and trees, and competition from invasive plants. Lakeplain wet-mesic prairie is globally imperiled and critically imperiled in Michigan. Less than 1% of the original natural community remains in Michigan (Albert and Kost 1998b, Kost et al. 2007, Cohen et al. 2014).
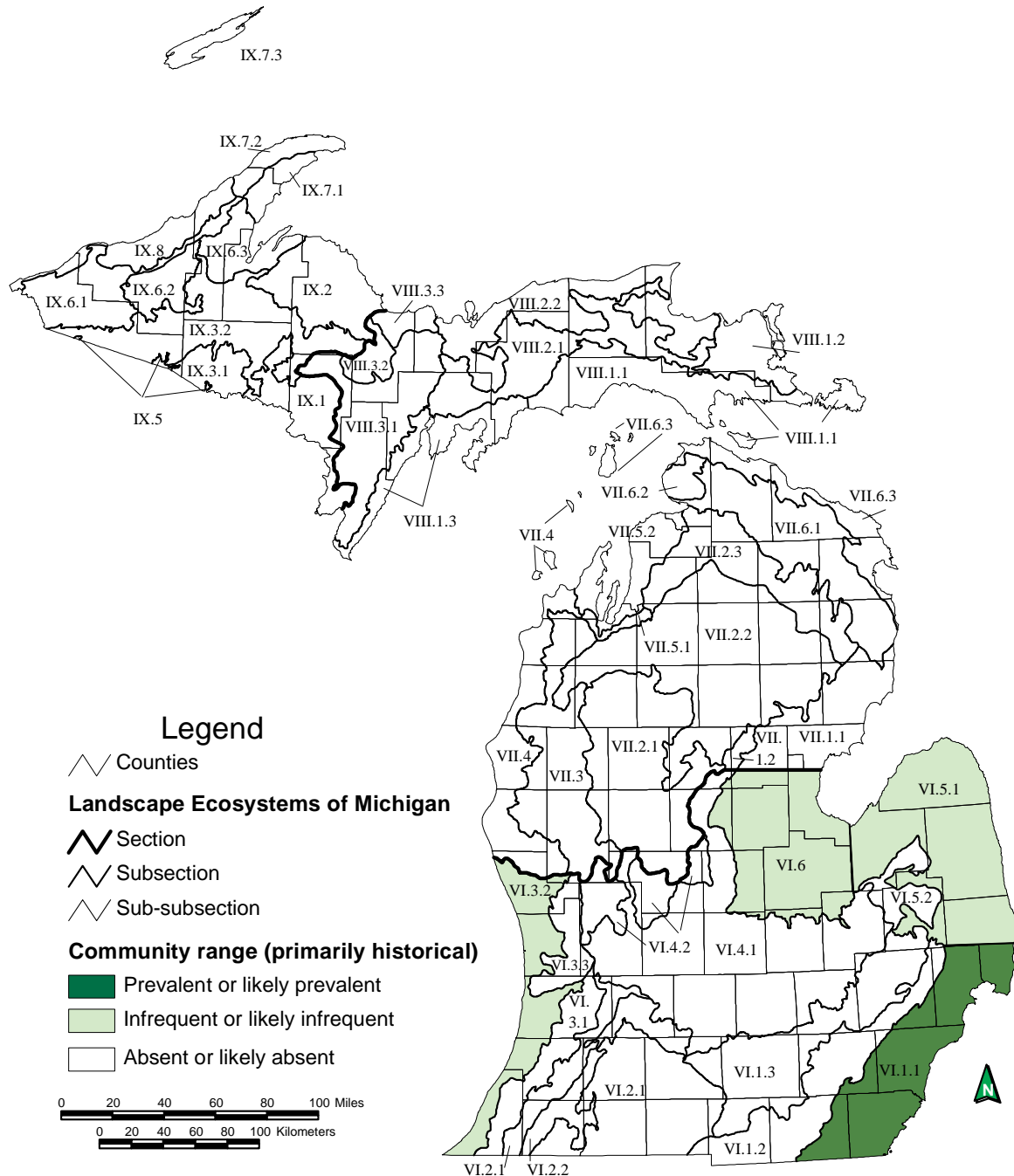
Map 2. Distribution of lakeplain wet-mesic prairie in Michigan (Albert et al. 2008).

2. St. John's Prairie
Natural Community Type: Lakeplain Wet-Mesic Prairie
Rank: G1? S1, Likely critically imperiled globally and critically imperiled within the state
Element Occurrence Rank: C
Size: 25 acres
Location: St. John's Marsh SWA, Compartment 1, Stands 4, 50, 76, 98, 107, 108, and 109
Element Occurrence Identification Number: 20638 (New EO)

Site Description: Lakeplain wet-mesic prairie and lakeplain wet prairie remnants occur on flat lakeplain within the Saint Clair River Delta along the shore of Lake St. Clair and just north of the North Channel. Historically, frequent fires and a seasonally fluctuating water table maintained the open prairie conditions. The soils are characterized by sandy loam and sandy clay loam (pH 7.3-8.0) of variable depth (10-40 cm but typically 30-40 cm) over sandy clay (pH 7.4-8.0 but typically pH 7.7-8.0). Clay lenses underlying the sandy loams allow for the seasonal fluctuation of the water table, which contributes to the open prairie conditions by preventing or limiting shrub and tree encroachment. Lakeplain wet-mesic prairie and lakeplain wet prairie intergrade within this complex with ecosystem patterning determined by very subtle differences in the depth to the clay layer and the resulting hydrologic regime. Greater depth to the clay lens in lakeplain wet-mesic prairie compared to lakeplain wet prairie results in less prolonged inundated soil conditions in lakeplain wet-mesic prairie. As a result, the lakeplain wet-mesic prairie is characterized by greater floristic diversity with a mixture of wetland, woodland, and prairie plants and the lakeplain wet prairie is characterized by more wetland species and a simpler floristic composition. Scattered ant mounds and animal trails contribute to the micro heterogeneity of the prairie. Ants mix and aerate the soil and their mounds provide unique establishment sites for plants. Crayfish mounds were also observed in wetter areas of the prairie.

The lakeplain wet-mesic prairie is dominated by graminoids and forbs with prevalent graminoids including big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), and switch grass (*Panicum virgatum*). Tall prairie grasses reach over two meters and many forbs are over one meter tall. Prevalent forbs include marsh blazing-star (*Liatris spicata*), common mountain mint (*Pycnanthemum virginianum*), tall coreopsis (*Coreopsis tripteris*), wild-bergamot (*Monarda fistulosa*), balsam ragwort (*Packera paupercula*), whorled loosestrife (*Lysimachia quadriflora*), Missouri ironweed (*Vernonia missurica*), culvers-root (*Veronicastrum virginicum*), northern bog violet (*Viola nephrophylla*), swamp-betony (*Pedicularis lanceolata*), swamp milkweed (*Asclepias incarnata*), common milkweed (*A. syriaca*), yarrow (*Achillea millefolium*), Canada anemone (*Anemone canadensis*), showy tick-trefoil (*Desmodium canadense*), star-grass (*Hypoxis hirsuta*), black-eyed Susan (*Rudbeckia hirta*), and golden alexanders (*Zizia aurea*). In addition, sedges (*Carex stricta*, *C. buxbaumii*, and *C. granularis*), goldenrods (*Solidago altissima*, *S. canadensis*, and *S. juncea*), marsh wild-timothy (*Muhlenbergia glomerata*), and golden-seeded spike rush (*Eleocharis elliptica*) are common throughout the prairie and prairie cordgrass (*Spartina pectinata*) is locally abundant. Reed (*Phragmites australis* subsp. *australis*) occurs scattered throughout the lakeplain wet-mesic prairie.

Scattered trees and shrubs include pin oak (*Quercus palustris*), quaking aspen (*Populus tremuloides*), cottonwood (*Populus deltoides*), gray dogwood (*Cornus foemina*), red-osier dogwood (*C. sericea*), willows (*Salix* spp.), prickly-ash (*Zanthoxylum americanum*), and glossy buckthorn (*Frangula alnus*). Shrubs occur as scattered individuals and also in scattered clumps. Glossy buckthorn occurs both scattered within the lakeplain wet-mesic prairie and as a dominant in localized shrub thickets. Areas along the margin of the prairie especially bordering the adjacent uplands have a higher density of shrubs. Low shrubs include meadowsweet (*Spiraea alba*), Kalm's St. Johns-wort (*Hypericum kalmianum*), and blackberry (*Rubus allegheniensis*). Additional invasive shrubs within the lakeplain wet-mesic prairie include autumn olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), and honeysuckles (*Lonicera* spp.). Compared to the adjacent lakeplain wet prairie, shrubs are more prevalent in the lakeplain wet-mesic prairie remnants.

MNFI ecologists and botanists visited this site nine times over the 2016 field season. The floristic data was compiled into the Michigan Floristic Quality Assessment (Reznicek et al. 2014). A total of 136 plant species were documented with 117 native species and 19 non-native species. The mean coefficient of conservatism (*C*) for this lakeplain wet prairie is 3.6 and the total floristic quality index (*FQI*) is 42.

Lakeplain wet-mesic prairie, St. John's Marsh State Wildlife Area. Photos by Joshua G. Cohen.

2010 aerial photograph of St. John's Marsh lakeplain wet-mesic prairie.

Threats: The lakeplain wet-mesic prairie has been impacted by altered hydrology, fire suppression, and invasive species encroachment. The construction of roads, the railroad grade, dikes, and ditches within and around the wildlife area have altered the hydrology of the coastal ecosystems within St. John's Marsh SWA. Altered hydrology and fire suppression have likely led to the establishment and spread of invasive species. Glossy buckthorn is locally dominant within the area and is concentrated along the upland margin and where there are saturated soils. Glossy buckthorn is locally common to scattered within the lakeplain wet-mesic prairie and occurs infrequently within the lakeplain wet prairie. Within St. John's Marsh SWA many acres of lakeplain wet-mesic prairie have been lost to shrub encroachment with glossy buckthorn as one of the most prevalent shrub invaders. Native shrubs including dogwoods are also locally common within the lakeplain wet-mesic prairie due to fire suppression. In addition, reed is locally dominant within St. John's Marsh SWA and within the lakeplain wet-mesic prairie EO, reed is scattered to locally common. When these invasive species become established and dominate a system, in addition to outcompeting native vegetation, they also locally alter the hydrology and soil properties. Additional invasives found within the lakeplain wet-mesic prairie include autumn olive, Japanese barberry, and honeysuckles, which occur locally within the element occurrence.

Management Recommendations: The main management recommendations are to reintroduce fire as a critical disturbance factor and control invasive species within the lakeplain prairie remnants and in the surrounding landscape through fire, mechanical removal, and herbicide application. Portions of the St. John's Marsh SWA have been burned in the past to maintain the open conditions of the prairie and control invasive species. In addition, portions of the area have been treated with herbicide in order to control reed. A sustained and concentrated effort to implement fire and control invasive species in the highest quality prairie remnants is recommended. We encourage the use of targeted herbicide treatment of reed, particularly in patches within the lakeplain wet-mesic prairie and along the perimeter of the lakeplain wet-mesic prairie. We discourage the use of broadcast spraying within the lakeplain wet-mesic prairie because of the collateral damage broadcast spraying can cause to floristic diversity. Mechanical control of glossy buckthorn and other woody shrubs should be followed by herbicide application to the cut stumps (e.g., glyphosate at 35%) from June through February. In addition, we recommend varying the seasonality of the prescribed fire in order to knock back the woody encroachment of glossy buckthorn as well as native shrubs that are increasing due to fire suppression. Conducting burns in late spring after leafout or during the growing season is recommended in areas with heavy shrub encroachment. During the late spring and throughout the growing season energy reserves of shrub species are already partially depleted or depleted, and resprouting vigor is low, particularly for clonal species. Late season fires should be used cautiously in areas with rare plant species and impacts of these burns should be monitored. Controlling shrub encroachment is the highest priority management objective within the lakeplain wet-mesic prairie. The DNR WLD is considering treating the invasive reed within this wildlife area by flooding areas dominated by the reed. Significant portions of the area are being evaluated for this kind of treatment. If flooding is implemented within this area, resource managers should design the proposed hydrologic alteration so that the hydrology of the lakeplain prairies is not impacted by the flooding and to make sure that remnants of high-quality lakeplain wet prairie and lakeplain wet-mesic prairie are not permanently inundated.

Lakeplain wet-mesic prairie is concentrated along the upland margin in the eastern portion of St. John's Marsh State Wildlife Area. Control of shrub encroachment along this upland margin is a critical stewardship need. Photo by Joshua G. Cohen.

DISCUSSION

Within Michigan, both lakeplain wet prairie and lakeplain wet-mesic prairie are classified as critically imperiled. Statewide there are only 15 documented occurrences of lakeplain wet prairie and 25 occurrences of lakeplain wet-mesic prairie. Globally, lakeplain wet prairie is imperiled and lakeplain wet-mesic prairie is likely critically imperiled. In addition, lakeplain prairie ecosystems provide habitat for both game and non-game species. Numerous rare species that depend on lakeplain ecosystems have been documented within the lakeplain prairie within St. John's Marsh SWA. Element occurrence records are known from within the wildlife area for the following rare species: blazing star borer (*Papaipema beeriana*, state special concern), eastern fox snake (*Pantherophis gloydi*, state threatened), red-legged spittlebug (*Prosapia ignipectus*, state special concern), American bittern (*Botaurus lentiginosus*, state special concern), leafhopper (*Flexamia reflexa*, state special concern), white lady slipper (*Cypripedium candidum*, state threatened), and Sullivant's milkweed (*Asclepias sullivantii*, state threatened). As noted above, rare species surveys within St. John's Marsh SWA are planned for the 2017 field season. In addition to harboring numerous rare species, lakeplain prairie ecosystems support high floristic diversity. The *FQI* for both lakeplain prairie element occurrences was over 35 (38.6 for the lakeplain wet prairie and 42 for the lakeplain wet-mesic prairie). Herman et al. (2001) suggest that Michigan sites with an *FQI* of 35 or greater "possess sufficient conservatism and richness that they are floristically important from a statewide perspective". In a report summarizing statewide biodiversity stewardship priorities along the coastal zone of Michigan, MNFI scientists determined that lakeplain prairie ecosystems were among the highest ranking stewardship priorities in the state (Cohen and Slaughter 2015).

Given the rarity of these ecosystems and the critical habitat they provide for both plants and animals, the stewardship of these occurrences of lakeplain wet prairie and lakeplain wet-mesic prairie is a biodiversity stewardship priority on a global basis. With the rapid spread of reed and glossy buckthorn, the pockets of remnant lakeplain wet prairie and lakeplain wet-mesic prairie are shrinking. A management priority for St. John's Marsh SWA is to control the spread of invasive species and eliminate clusters of invasive species from the highest quality lakeplain prairie remnants. We recommend using prescribed fire, mechanical removal, and herbicide application to achieve this outcome. As noted above, if the DNR floods portions of the wildlife area, they should design the proposed hydrologic alteration so that the hydrology of the lakeplain prairies is not negatively impacted by the flooding and to make sure that remnants of high-quality lakeplain prairie are not permanently inundated. Finally, monitoring of all management activities is recommended to facilitate adaptive management. Monitoring can help inform adaptive management by gauging the success of restoration at meeting the goals of reducing invasive species populations.

Michigan Natural Features Inventory is working with Michigan Aerospace to develop an autmotated monitoring protocol to monitor for invasive species within lakeplain ecosystems. Photo by Joshua G. Cohen.

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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.