



## **Rapid Ecological Assessment for the Wildlife, Fishery, and State Natural Areas of the Northern Kettle Moraine Region**

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### **A Rapid Ecological Assessment Focusing on Rare Plants, Selected Rare Animals, and High-quality Natural Communities**

#### **Properties included in this report are:**

- Allenton Wildlife Area
- Cedarburg Bog State Natural Area
- Jackson Marsh State Natural Area
- Jackson Marsh Wildlife Area
- Kiel Marsh Wildlife Area
- LaBudde Creek Fishery Area
- Mullet Creek Wildlife Area
- Nichols Creek Wildlife Area
- Onion River Stream Bank Protection Area
- Theresa Marsh Wildlife Area

Wisconsin's Natural Heritage Inventory Program  
Bureau of Endangered Resources  
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**Cover Photo:** Aerial photo of Long Lake and surrounding habitat matrix at Cedarburg Bog State Natural Area. Photo by: William A. Smith

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## The Northern Kettle Moraine Region At a Glance

### Exceptional Characteristics of the Study Area

- **Rare Animals and Plants.** The diverse habitats of the NKMR support numerous rare species. Forty-two rare animal species are known from the NKMR, including six State Endangered, seven State Threatened, and 29 Special Concern species. Thirty-four rare plant species are known from the NKMR, including three State Endangered, seven State Threatened, and 24 Special Concern species. One species is Federally Endangered, one Federally Threatened, and one is a candidate for Federal listing.
- **Migratory Bird Stopover Habitat.** The NKMR provides stopover habitat to shorebirds, waterbirds, waterfowl, and landbirds. Large numbers of individuals from many species accumulate here during migration because these areas offer the most important resources to migrating birds which are food, water, and shelter.
- **Rare Invertebrates.** The Federally Endangered Hine's emerald dragonfly and the State Endangered swamp metalmark butterfly are both located on the NKMR. The swamp metalmark butterfly occurrence located during this study was the first time in 18 years that a new population has been found and one of only three current populations in the state.
- **Aquatic Resources.** Unique aquatic resources are present in the NKMR and include seeps, Springs, Spring Ponds, Spring Runs, and headwater streams. Rare fish, birds, and plants are known to utilize these high quality habitats.

### Site Specific Opportunities for Biodiversity Conservation

Seven ecologically important sites were identified on the NKMR. These "Primary Sites" were delineated because they generally encompass the best examples of 1) rare and representative natural communities, 2) documented occurrences of rare species populations, and/or 3) opportunities for ecological restoration or connections. These sites warrant high protection and/or restoration consideration during the development of the property master plan.

- **Kiel Marsh Breeding and Migratory Bird Area.** This Primary Site has a very high potential for migratory waterfowl and landbirds and supports numerous uncommon birds during the breeding season.
- **Mullet Creek Forested Wetland.** Several rare forest interior birds were found on or adjacent to this Primary Site. Two Special Concern plants are also known from the site.
- **Kamrath Creek Forest and Fen.** This Primary Site supports numerous high-quality natural communities of regional importance and important populations of rare species.
- **Nichols Creek Cedar Swamp and Springs.** A complex of high-quality natural communities, including a Northern Wet-mesic Forest laced with Springs and Spring Runs and containing a Calcareous Fen, is present at this Primary Site. Rare species are present and the potential for more is high.
- **Cedarburg Bog State Natural Area.** This Primary Site is a well-studied area that contains numerous State Threatened and Endangered animals and plants and high-quality natural communities.
- **Jackson Marsh Cedar Swamp.** This Primary Site is part of a regionally important forested area that supports a large population of a rare species and is part of Jackson Marsh State Natural Area.
- **Jackson Marsh Southern Hardwood Swamp.** This Primary Site, along with the Jackson Marsh Cedar Swamp Primary Site, is part of Jackson Marsh State Natural Area and is part of an extensive forested area within an otherwise agricultural landscape.

# Introduction

## Purpose and Objectives

This report is intended to be used as a source of information for developing a new master plan for the Wildlife, Fishery, and State Natural Areas (SNA) of the Northern Kettle Moraine Region Planning Group (NKMR; Figure 1). The regional ecological context for the NKMR is also provided to assist in developing the Regional and Property Analysis that is part of the master plan. Properties included in this assessment are:

- Allenton Wildlife Area
- Cedarburg Bog State Natural Area
- Jackson Marsh
- Jackson Marsh Wildlife Area
- Kiel Marsh Wildlife Area
- LaBudde Creek Fishery Area
- Mullet Creek Wildlife Area
- Nichols Creek Wildlife Area
- Onion River Stream Bank Protection Area
- Theresa Marsh Wildlife Area

The primary objectives of this project were to collect biological inventory information relevant to the development of a master plan for the NKMR and to analyze, synthesize and interpret this information for use by the master planning team. This effort focused on assessing areas of documented or potential habitat for rare species and identifying natural community management opportunities.

Survey efforts for the NKMR were limited to a “rapid ecological assessment” for 1) identifying and evaluating ecologically important areas, 2) documenting rare species occurrences, and 3) documenting occurrences of high quality natural communities. This report can serve as the “Biotic Inventory” document used for master planning, although inventory efforts were reduced compared to similar projects conducted on much larger properties such as state forests. This report provides much of the same information as in “Biotic Inventory” reports, although, the inventory was limited to a “rapid ecological assessment.” There will, undoubtedly be gaps in our knowledge of the biota of this property, especially for certain taxa groups; these groups have been identified as representing either opportunities or needs for future work.

## Overview of Methods

The Wisconsin Natural Heritage Inventory (NHI) program is part of the Wisconsin DNR’s Bureau of Endangered Resources and a member of an international network of natural heritage programs representing all 50 states, as well as portions of Canada, Latin America, and the Caribbean. These programs share certain standardized methods for collecting, processing, and managing data for rare species and natural communities. NatureServe, an international non-profit organization (see [www.NatureServe.org](http://www.NatureServe.org) for more information), coordinates the network.

Natural heritage programs track certain *elements* of biological diversity: rare plants, rare animals, high-quality examples of natural communities, and other selected natural features. The NHI Working List contains the elements tracked in Wisconsin; they include endangered, threatened, and special concern plants and animals, as well as the natural community types recognized by NHI. The NHI Working List is periodically updated to reflect new information about the rarity and distribution of the state’s plants, animals, and natural communities. The most recent Working List is available from the Wisconsin DNR Web site (*Wisconsin Natural Heritage Working List*).

The Wisconsin NHI program uses standard methods for biotic inventory to support master planning (Appendix A). Our general approach involves collecting relevant background information, planning and conducting surveys, compiling and analyzing data, mapping rare species and high quality natural community locations into the NHI database, identifying ecologically important areas, and providing interpretation of the findings through reports and other means.

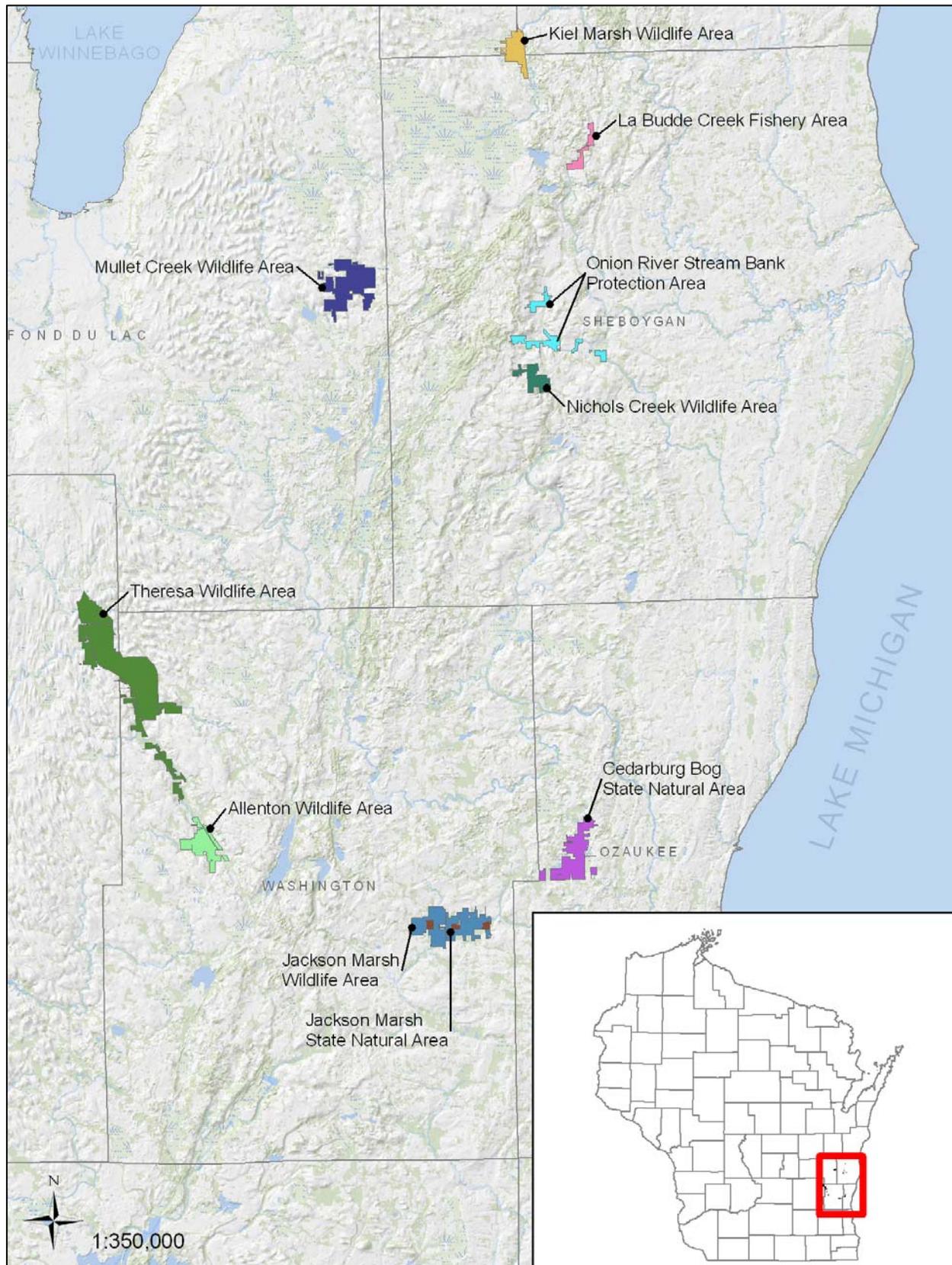
Existing NHI data are often the starting point for conducting a biotic inventory to support master planning. Prior to this project, NHI data for the NKMR were limited to: 1) the Statewide Natural Area Inventory, a county-by-county effort conducted by WDNR's Bureaus of Research and Endangered Resources between 1969 and 1984 that focused on natural communities but include some surveys for rare plants and animals, 2) breeding bird surveys on State Natural Areas, 3) surveys conducted for the *Biodiversity in Selected Natural Communities Related to Global Climate Change* (aka Peatlands Project; Anderson et al. 2008), 4) surveys conducted for *A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin* (SEWRPC 1997), and 5) taxa specific surveys.

The most recent taxa-specific field surveys for the study area were conducted during 2008 and 2010. Surveys were limited in scope and focused on documenting high quality natural communities, rare plants, breeding birds, and, for some properties, the swamp metalmark butterfly (*Calephelis muticum*). The collective results from all of these surveys were used, along with other information, to identify ecologically important areas (Primary Sites) on the NKMR.

Survey locations were identified or guided by using recent aerial photos, USGS 7.5' topographic maps, various Geographic Information System (GIS) sources, information from past survey efforts, discussions with property managers, and the expertise of several biologists familiar with the properties or with similar habitats in the region. Based on the location and ecological setting of properties within the NKMR, key inventory considerations included the identification of high quality Northern Wet-mesic Forest types and other wetland communities, including ecologically significant stands of hardwood swamp, sedge meadows, Emergent Marsh, and the location of habitats that had the potential to support rare species. Private lands surrounding the NKMR were not surveyed.

Scientific names for all species mentioned in the text are included in a list on page 41.

**Figure 1:** Location of Properties in the Northern Kettle Moraine Region Planning Group



## Background on Past Efforts

Various large-scale research and planning efforts have identified a number of locations within the NKMR as being ecologically significant. The following are examples of such projects and the significant features identified.

The **Land Legacy Report** (WDNR 2006a) which was designed to identify Wisconsin's most important conservation and recreation needs for the next 50 years. The report identifies this region as particularly important for nesting and migrating waterfowl because the large marshes and shallow lakes that occur throughout the area provide critical feeding, nesting, and resting habitat for ducks, geese, and other marsh-dwelling birds (WDNR 2006a). Cedarburg Bog, was assigned a score of five points on their five-point scale, meaning it possesses "outstanding ecological qualities, is of adequate size to meet the needs of the critical components, and/or harbors natural communities or species of global or continental significance." Other areas identified in the report include the Cedar Creek (area), which flows through the Jackson Marsh Wildlife Area and has been designated as a Stream Bank Protection Area (WDNR 2006a). The Sheboygan River Marshes which include diverse wetland habitats for waterfowl, cranes, colonial water birds like herons, terns, and egrets, and marsh birds like rails and bitterns includes the Kiel Marsh Wildlife Area.

The **NHI Peatlands project** (Anderson et al. 2008) was a five-year statewide study conducted by the Bureau of Endangered Resources. The primary goals of the project were 1) to obtain baseline data on the presence/absence, abundance, and distribution of species in multiple taxon groups associated with peatland communities in Wisconsin, and 2) to document selected biotic and abiotic variables that could potentially influence the organisms being studied. The surveys were designed to be replicated in 5-10 years and used to detect changes in biota related to climate change. The project included sites at four of the Wildlife Areas (Jackson Marsh, Theresa, Nichols Creek, and Mullet Creek) within the NKMR. All sites were evaluated in the field for inclusion to the Peatlands project, but none of four potential sites contained within this study area met the criteria for the project, meaning they were either too small or consisted of muck soils rather than peat. Cedarburg Bog was used as a peatlands project "Intensive" site.

**Important Bird Areas** (IBA) are critical sites for the conservation and management of Wisconsin's birds. Cedarburg Bog was recognized as an IBA (WDNR 2007) because it contains important habitats for both breeding and migrating birds. There is a unique assemblage of southern breeding birds found here near their northern range limit and more northern birds breeding here at their southern limits. Additionally, thousands of migrants have been recorded using the varied habitats in both fall and spring making it is an important area for migratory birds.

The Wisconsin Wildlife Action Plan (WAP) recognized two **Conservation Opportunity Areas** (COA) within the NKMR: Cedarburg Bog COA and Milwaukee River COA (see Appendix B). Conservation Opportunity Areas are places in Wisconsin that contain ecological features, natural communities, or Species of Greatest Conservation Need (SGCN) habitat for which Wisconsin has a unique responsibility for protection when viewed from the global, continental, upper Midwest, or state perspective (WDNR 2006b)

- Cedarburg Bog COA was recognized as it includes large examples of Wet-mesic Prairie, Calcareous Fen, large Sedge Meadow, Tamarack Swamp, and associated wetlands.
- Milwaukee River COA was recognized because it affords excellent opportunities to protect large warmwater river systems along with their associated Floodplain Forest, Northern Sedge Meadow, and Emergent Marsh communities.

The Nature Conservancy's (TNC) **Prairie-Forest Border Ecoregion Conservation Plan** (TNC 2001) recognized Jackson Marsh and Cedarburg Bog as "Functional Sites." Functional Sites are defined as sites

that contain one or more small-patch or large-patch plant communities and may or may not include rare species targets (TNC 2001). Cedarburg Bog was recognized for having noteworthy community types that include a northern patterned rich fen, black spruce swamp, black ash swamp, a good-quality maple-beech forest, and several undeveloped lakes. In addition, it supports numerous rare plants and animals, some of which are globally rare. Jackson Marsh occupies a large depression created by a now extinct glacial lake and constitutes the most extensive patch of natural vegetation remaining in southern Washington County. The site is located very near the climatic transition area known as the “tension zone” (Curtis 1959) and consists of remnant community types reflecting this transition. There is a large forested wetland of black spruce and northern white-cedar with northern outlier plants and animals near their southernmost locations in the state, along with other portions of the site composed of swamp hardwoods more characteristic of southern Wisconsin.

**Forest Certification** is established on all DNR-managed lands, including state parks, wildlife and fishery areas, and natural areas. Certified forests are recognized by the Forest Stewardship Council and the Sustainable Forestry Initiative as being responsibly managed (WDNR 2009). This certification emphasizes the state’s commitment to responsibly managing and conserving forestlands, supporting economic activities, protecting wildlife habitat, and providing recreational opportunities.

## Special Management Designations

**State Natural Areas** are places on the landscape that protect outstanding examples of native natural communities, significant geological formations, and archaeological sites. They harbor natural features essentially unaltered by human-caused disturbances or that have substantially recovered from disturbance over time. Designation confers a significant level of land protection through state statutes, administrative rules, and guidelines. State Natural Areas within the NKMR include Cedarburg Bog State Natural Area and Jackson Marsh State Natural Area.

A **National Natural Landmark** has been officially recognized at Cedarburg Bog SNA. The National Natural Landmarks Program is administered by the National Park Service and recognizes outstanding examples of biological and geological features throughout the country.

**Critical Habitat for Hine’s emerald dragonfly** (*Somatochlora hineana*) has been designated at Cedarburg Bog SNA. The Hine’s emerald dragonfly is a federal and state endangered dragonfly that has been found in small, cool, calcareous marshy streams. Critical Habitat is a tool within the Endangered Species Act that identifies areas that are important to the conservation and recovery of a listed species. Critical Habitat is defined by the US Fish and Wildlife Service as a specific geographic area(s) that contains features essential for the conservation of a threatened and endangered species and that may require special management and protection. The *Federal Register* has published a final boundary detailing this Critical Habitat area (Federal Register 2007). Federal agencies are required to consult with the US Fish and Wildlife Service on actions they carry out, fund, or authorize to ensure that their actions will not destroy or adversely modify critical habitat for Hine’s Emerald Dragonfly.

**Outstanding Resource Waters** are officially designated (NR 102.11) waters that provide outstanding recreational opportunities, support fish and wildlife habitat, have good water quality, and are not significantly impacted by human activities. The North Branch Milwaukee River is a designated Outstanding Resource Water. Outstanding Resource Waters typically do not have any point sources discharging pollutants directly to the water (for instance, no industrial sources or municipal sewage treatment plants) and no increases of pollutant levels are allowed. Less than 8% of the rivers and streams in Wisconsin have been designated Outstanding Resource Waters.

# Regional Ecological Context

## Southeast Glacial Plains Ecological Landscape

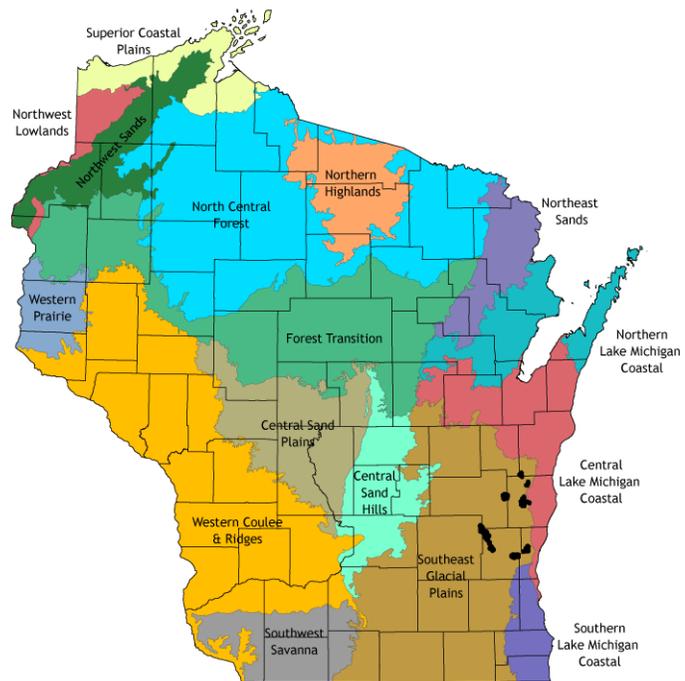
This section is largely reproduced from the Ecological Landscapes of Wisconsin Handbook (WDNR In Prep.). This Handbook was developed by the WDNR Ecosystem Management Planning Team (EMPT) and identifies the best areas of the state to manage for natural communities, key habitats, aquatic features, native plants, and native animals from an ecological perspective.

The WDNR has mapped the state into areas of similar ecological potential and geography called Ecological Landscapes. The Ecological Landscapes are based on aggregations of smaller ecoregional units (Subsections) from a national system of delineated ecoregions known as the National Hierarchical Framework of Ecological Units (NHFEU) (Cleland et al. 1997). These ecoregional classification systems delineate landscapes of similar ecological pattern and potential for use by resource administrators, planners, and managers.

The NKMR properties are located in the Southeast Glacial Plains Ecological Landscape (WDNR In Prep.) (Figure 2). The Southeast Glacial Plains Ecological Landscape borders the Illinois border and covers a large area of southeastern Wisconsin. This ecological landscape is home to some of the world's best examples of continental glacial activity. Drumlins, eskers, kettle lakes, kames, ground and end moraines, and other glacial features are evident throughout the entire area (WDNR 2006a). Most of this Ecological Landscape is composed of glacial materials deposited during the Wisconsin Ice Age (WDNR In Prep.). One area of interest is the interlobate moraine, a long "ridge" that formed between the Green Bay and Lake Michigan lobes during the Wisconsin Glaciation (WDNR 2006a). Other portions of this region offer very moderate relief, with glacial deposits forming the greatest irregularities (Martin 1965). Soils in this landscape vary from poorly drained clayey to well drained loamy soils with a silt loam surface over calcareous loam till.

Historically, vegetation in the Southeast Glacial Plains Ecological Landscape consisted of a mix of prairie, oak forests and savanna, and maple-basswood forests. Wet-mesic Prairies, Southern Sedge Meadows, Emergent Marshes, Calcareous Fens, and tamarack swamps were found in poorly drained, wetter portions of the Landscape. End moraines and drumlins supported savannas and forests.

Agricultural and urban land use practices have drastically changed the land cover of the Landscape since Euro-American settlement. The current vegetation is primarily agricultural cropland. Remaining forests occupy only about 10% of the land area and dominant covertypes include oak, maple-basswood, and lowland hardwoods. No large areas of



**Figure 2:** Ecological Landscapes of Wisconsin and the Study Area (in black)

contiguous forest exist today except within the Kettle Moraine State Forest on the Kettle Interlobate Moraine, which has relatively rugged topography that is often ill-suited for row-crop agriculture.

## Regional Biodiversity Needs and Opportunities

Opportunities for sustaining natural communities in the Southeast Glacial Plains Ecological Landscape were developed by the Ecosystem Management Planning Team (EMPT 2007) and later presented in the Wisconsin Wildlife Action Plan (WDNR 2006b). The goal of sustaining natural communities is to manage for natural community types that historically occurred in a given landscape and have a high potential to maintain its characteristic composition, structure, and ecological function over a long period of time (e.g., 100 years). This list can help guide land and water management activities so that they are compatible with the local ecology of the Ecological Landscape while maintaining important components of ecological diversity and function. These are the most appropriate community types that could be considered for management activities within the Southeast Glacial Plains Ecological Landscape.

There are management opportunities for 38 natural communities in the Southeast Glacial Plains Ecological Landscape. Of these, 21 are considered “major” opportunities (Table 1). A “major” opportunity indicates that the natural communities can be sustained in the Ecological Landscape, either because many significant occurrences of the natural community have been recorded in the landscape or major restoration activities are likely to be successful in maintaining the community’s composition, structure, and ecological function over a longer period of time. An additional 13 natural communities are considered “important” in this landscape. An “important” opportunity indicates that although the natural community does not occur extensively or commonly in the Ecological Landscape, one to several occurrences do occur and are important in sustaining the community in the state. In some cases, important opportunities may exist because the natural community may be restricted to just one or a few Ecological Landscapes within the state and there may be a lack of opportunities elsewhere.

**Table 1.** Major Natural Communities Management Opportunities in the Southeast Glacial Plains Ecological Landscape (EMPT 2007 and WDNR 2006b)

Bog Relict	Emergent Marsh	Oak Opening	Southern Sedge Meadow
Calcareous Fen	Floodplain Forest	Oak Woodland	Southern Tamarack Swamp (rich)
	Impoundments/Reservoirs		
Dry Cliff	*	Shrub Carr	Surrogate Grasslands
Dry Prairie	Inland lakes*	Southern Dry Forest	Warmwater rivers*
Dry-mesic Prairie	Mesic Prairie	Southern Dry-mesic Forest	Warmwater streams*
			Wet-mesic Prairie

\*Natural Communities that were listed in the Wisconsin Wildlife Action Plan only.

## Rare Species of the Southeast Glacial Plains Ecological Landscape

Numerous rare species are known from the Southeast Glacial Plains Ecological Landscape. “Rare” species include all of those species that appear on the WDNR’s NHI Working List (*Wisconsin Natural Heritage Working List*) classified as “Endangered,” “Threatened,” or “Special Concern.” Table 2 lists the number of species known to occur in the Southeast Glacial Plains Ecological Landscape based on information stored in the NHI database as of November 2009 (WDNR In Prep).

**Table 2.** Listing Status for rare species in the Southeast Glacial Plains Ecological Landscape as of November 2009 (WDNR In Prep.)

<b>Listing Status</b>	<b>Birds</b>	<b>Fishes</b>	<b>Herptiles</b>	<b>Invertebrate s</b>	<b>Mammal s</b>	<b>Plant s</b>	<b>Total Faun a</b>	<b>Total Flor a</b>	<b>Total Rare</b>
WI Endangered	8	4	7	11		10	30	10	40
WI Special Concern	19	10	6	61	5	71	101	71	172
WI Threatened	10	6	3	5		28	24	28	52
U.S. Candidate			1				1	0	1
U.S. Endangered				2			2	0	2
U.S. Threatened						2	0	2	2

The Wisconsin Wildlife Action Plan denoted Species of Greatest Conservation Need (SGCN). Species of Greatest Conservation Need are animals that have low and/or declining populations that are in need of conservation action. They include various birds, fish, mammals, reptiles, amphibians, and invertebrates (e.g. dragonflies, butterflies, and freshwater mussels) that are:

- Already listed as threatened or endangered;
- At risk because of threats to their life history needs or their habitats;
- Stable in number in Wisconsin, but declining in adjacent states or nationally.
- Of unknown status in Wisconsin and suspected to be vulnerable.

There are 62 vertebrate SGCN significantly associated with the Southeast Glacial Plains Ecological Landscape (See Appendix E). This means that the species is (and/or historically was) significantly associated with the Ecological Landscape, and restoration of natural communities this species is associated with in the Ecological Landscape would significantly improve conditions for the species.

# Description of the Study Area

## Location and Size

The NKMR is a cluster of Wildlife Areas, Fishery Areas, and State Natural Areas located in Calumet, Dodge, Fond du Lac, Manitowoc, Ozaukee, Sheboygan, and Washington counties (Figure 1). Comprising ca. 15,980 acres, the properties occur along several regionally significant waterways including the North Branch Milwaukee River (classified as an outstanding resource waterway), LaBudde Creek (classified as an exceptional resource waterway), Onion River (classified as an exceptional resource waterway), Nichols Creek (a Class 1 trout stream), and the Mullet River (a Class 2 trout stream). One site, Cedarburg Bog State Natural Area, is one of the largest, least disturbed peatland complexes in southeast Wisconsin (SEWRPC 1997). It contains an extensive conifer swamp forest and a patterned peatland (characterized by noticeable ridges and swales running perpendicular to water flow). This is the southernmost example of a patterned peatland in North America (SEWRPC 1997) and one of only four known in Wisconsin.

Properties included in the NKMR are:

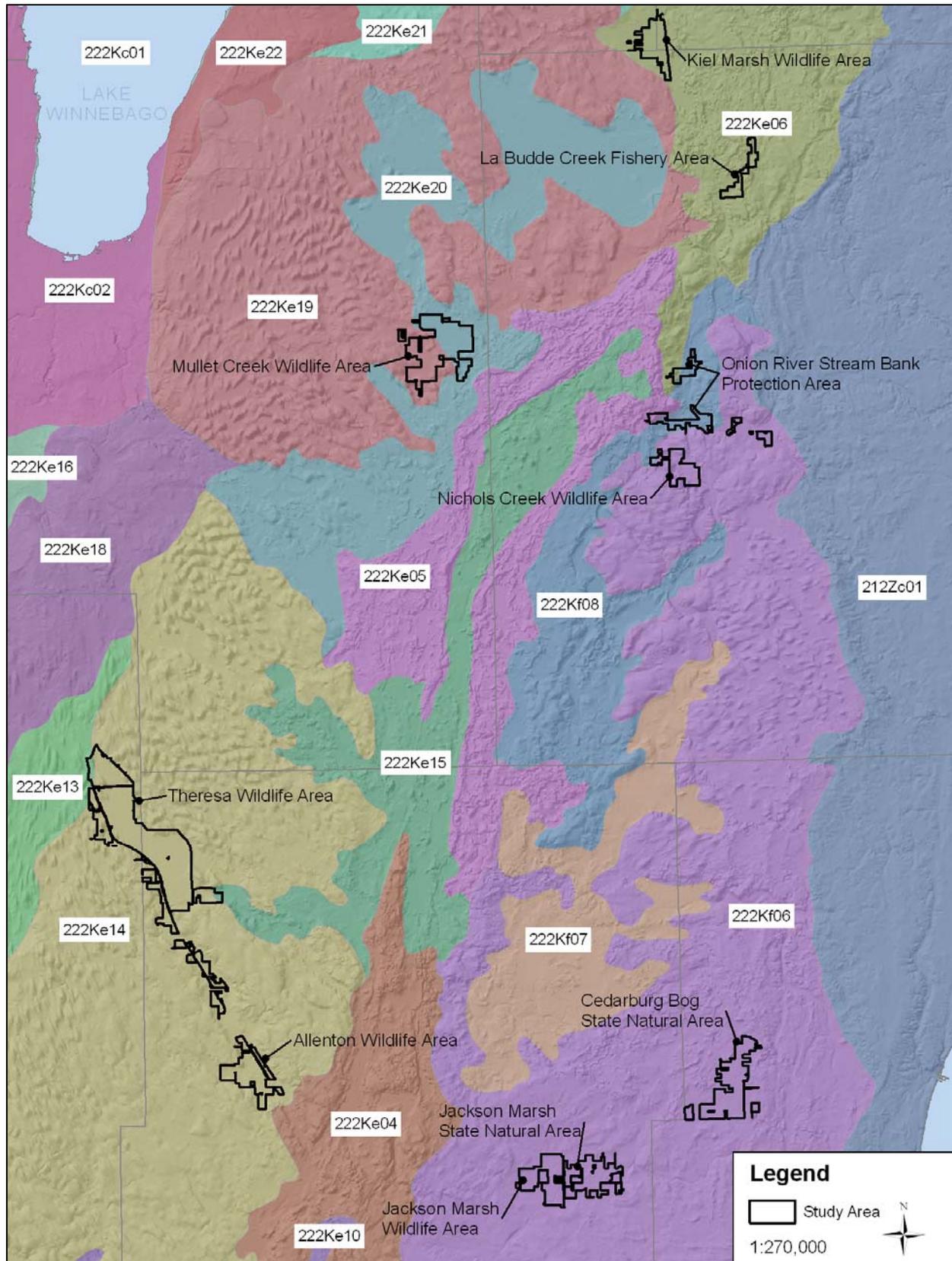
- **Allenton Wildlife Area** (1,160 acres) is located in west-central Washington County at the headwaters of the East Branch Rock River, about 6 miles west of the city of West Bend along USH 41.
- **Cedarburg Bog State Natural Area** (1,650 acres) is located in west central Ozaukee County, about 2 miles west of the city of Saukville, just south of STH 33.
- **Jackson Marsh Wildlife Area and State Natural Area** (2,312 acres) is located in southeast Washington County adjacent to the town of Jackson and bordering both sides of Cedar Creek, a tributary to the Milwaukee River.
- **Kiel Marsh Wildlife Area** (833 acres) is located on the border of Calumet, Manitowoc, and Sheboygan counties, along the Sheboygan River and directly south of the city of Kiel.
- **LaBudde Creek Fishery Area** (426 acres) is located in west-central Sheboygan County along LaBudde Creek, a class 1 trout stream, about 1 mile east of the village of Elkhart Lake.
- **Mullet Creek Wildlife Area** (2,217 acres) is located in east-central Fond du Lac County at the headwaters of the Mullet River about 10 miles west of Plymouth.
- **Nichols Creek Wildlife Area** (651 acres) is located in central Sheboygan County about 4 miles southwest of the city of Plymouth at the headwaters of the North Branch Milwaukee River.
- **Onion River Stream Bank Protection (SBP) Area** (934 acres) is located in west central Sheboygan County along Ben Nutt Creek and Mill Creek, both major tributaries to the Onion River and class 2 trout streams, and Kamrath Creek, about 1.5 miles southwest of the city of Plymouth.
- **Theresa Marsh Wildlife Area** (5,797 acres) is located on the border of Dodge and Washington counties, just east of the village of Theresa and encompassing a large stretch of the East Branch Rock River. Theresa Marsh Wildlife Area is separated from Allenton Wildlife Area by approximately 0.5 miles.

## Ecoregion

From the NHFEU, the units most relevant to this study are two Subsections: the Southern Green Bay Lobe and the Geneva-Darien Moraines and Till Plains and seven Landtype Associations (LTA; Figure 3). Landtype Associations represent an area of 10,000 – 300,000 acres and contain similarities of landform, soil, and vegetation. The following Landtype Associations are within the study area:

- Millhome Moraines LTA (222Ke06). The characteristic landform pattern is rolling hummocky moraine. Soils are predominantly well drained loam over calcareous sandy loam till, gravelly sandy outwash, or loamy lacustrine.
- Mt. Calvary Moraine (222Ke19). The characteristic landform pattern is rolling till plain with drumlins. Soils are predominantly well drained silt and loam over calcareous loam till.
- Armstrong Plains (222Ke20). The characteristic landform pattern is nearly level outwash plain and marsh complex. Soils are predominantly well drained silt and loam over calcareous gravelly sandy outwash and muck.
- Allenton Drumlins LTA(222Ke14). The characteristic landform pattern is rolling till plain with drumlins, kame terraces, and muck areas common. Soils are predominantly well drained silt over calcareous sandy loam till.
- Waubeka Moraines LTA (222Kf06) Landform pattern is rolling till plain intermixed with lake, outwash plains, and swamps. Soils are predominantly moderately well drained loam over calcareous sandy loam till, loamy lacustrine, or gravelly sandy outwash.
- Beechwood Plains LTA (222Kf08). The characteristic landform pattern is undulating outwash plain with remnant moraines, scattered lake plains, and swamps. Soils are predominantly loam over calcareous gravelly sandy outwash and sandy loam till.
- North Kettle Moraines LTA (222Ke05). The characteristic landform pattern is hilly kame moraine with eskers. Soils are predominantly well drained loam and sand over calcareous gravelly sandy drift or outwash.

**Figure 3: Landtype Associations of the Study Area**



# Physical Environment

## Geology and Geography

The NKMR is underlain by Silurian dolomite of the Niagara Formation (WDNR In Prep.). Bedrock depth is highly variable in this area where erosion and abrasion during glaciation has highly altered the landscape. The NKMR is located on both sides of the interlobate region of the Green Bay and Lake Michigan lobes of the Laurentide ice sheet of the Wisconsin glaciation. This area is characterized by pitted outwash plains, remnants of small glacial lakes, and till-covered dolomite uplands (Dott and Attig 1994).

## Soils

(From the Ecological Landscapes of Wisconsin Handbook [WDNR In Prep.]) The **Southern Green Bay Lobe (Subsection 222Ke)** was formed by the Green Bay Lobe of the Wisconsin glacier. The dominant soils are calcareous loamy tills; there are also areas of outwash sands and gravel, and silty lacustrine materials. Soils on the moraine uplands and drumlins are formed in brown calcareous sandy loam to loam till. They range from well-drained to somewhat poorly drained and generally have silt loam surface textures, moderate to very slow permeability, and moderate to high available water capacity.

The outwash plains have upland soils with loamy alluvium or loess surfaces over calcareous outwash sands and gravel. They range from well-drained to somewhat poorly drained and generally have silt loam to loam surface textures, moderately rapid to moderate permeability, and moderate available water capacity.

Most lowland soils are very poorly drained non-acid muck, but may also be silty and clayey lacustrine, or loamy till. The major river valleys have soils formed in loamy to silty alluvium or non-acid muck; they range from moderately well-drained to very poorly drained, and have areas subject to periodic flooding.

Soils in the **Geneva/Darien Moraines and Till Plains (Subsection 222Kf)**, where the landscape was formed by the Lake Michigan Lobe, can be calcareous loamy till, outwash, or loamy lacustrine material. This area was glaciated at about the same time as the Southern Green Bay Lobe Subsection, and landforms are similar but the soils are slightly sandier. Moraine uplands have soils formed in brown calcareous sandy loam to loam till. They range from well drained to somewhat poorly drained and generally have silt loam surface textures, moderate to slow permeability, and moderate to high available water capacity.

The outwash plains have upland soils formed in loamy alluvium or loess surfaces over calcareous outwash sand and gravel. They range from well drained to somewhat poorly drained and generally have silt loam to loam surface textures, moderately rapid to moderate permeability, and moderate available water capacity.

The lake plains have soils formed in calcareous loamy to silty lacustrine. They range from well drained to somewhat poorly drained and generally have silty loam surface textures, moderate to slow permeability, and moderate to very high available water capacity. Most lowland soils are very poorly drained non-acid muck, but include silty and clayey lacustrine and loamy till.

## Hydrology

All of the NKMR, except Allenton and Theresa Wildlife Areas, are within the Lake Michigan basin. Allenton and Theresa Wildlife Areas are within the Mississippi River Basin. The NKMR is drained by a large number of streams and rivers. Numerous springs are also present on the NKMR, but generally

uncommon in the surrounding landscape and serve as cold water sources for coldwater streams, many of which are designated trout streams.

The Sheboygan River, which flows through Kiel Marsh Wildlife Area, and its tributary network form the major drainage system in Sheboygan County (Weber et. al 1968) and the northern part of the NKMR. The Mullet River, a major tributary to the Sheboygan River, flows through Mullet Creek Wildlife Area. The Mullet River is fed by LaBudde Creek which drains the LaBudde Creek Fishery Area. Also feeding into the Sheboygan River is the Onion River, which is fed by Ben Nutt Creek and Mill Creek, both Class 2 designated trout streams that drain the Onion River SBP Area and Kamrath Creek.

The East Branch Rock River is a major stream in northwestern Washington County (Weber et. al 1968) and flows through the wetland valley of Allenton and Theresa Wildlife Areas. Feeder streams on the properties include: Allenton Creek (a Class 2 designated trout stream), Limestone Creek, No Name Creek, Kohlsville River, Lomira Creek, and Kiefer Creek.

The Milwaukee River, the major waterway of Ozaukee County (Weber et. al 1968) is fed by the North Branch Milwaukee River, a Class 1 designated trout stream, which originates in Nichols Creek Wildlife Area. Cedar Creek is a major tributary to the Milwaukee River and, along with Evergreen Creek, drains Jackson Marsh Wildlife Area.

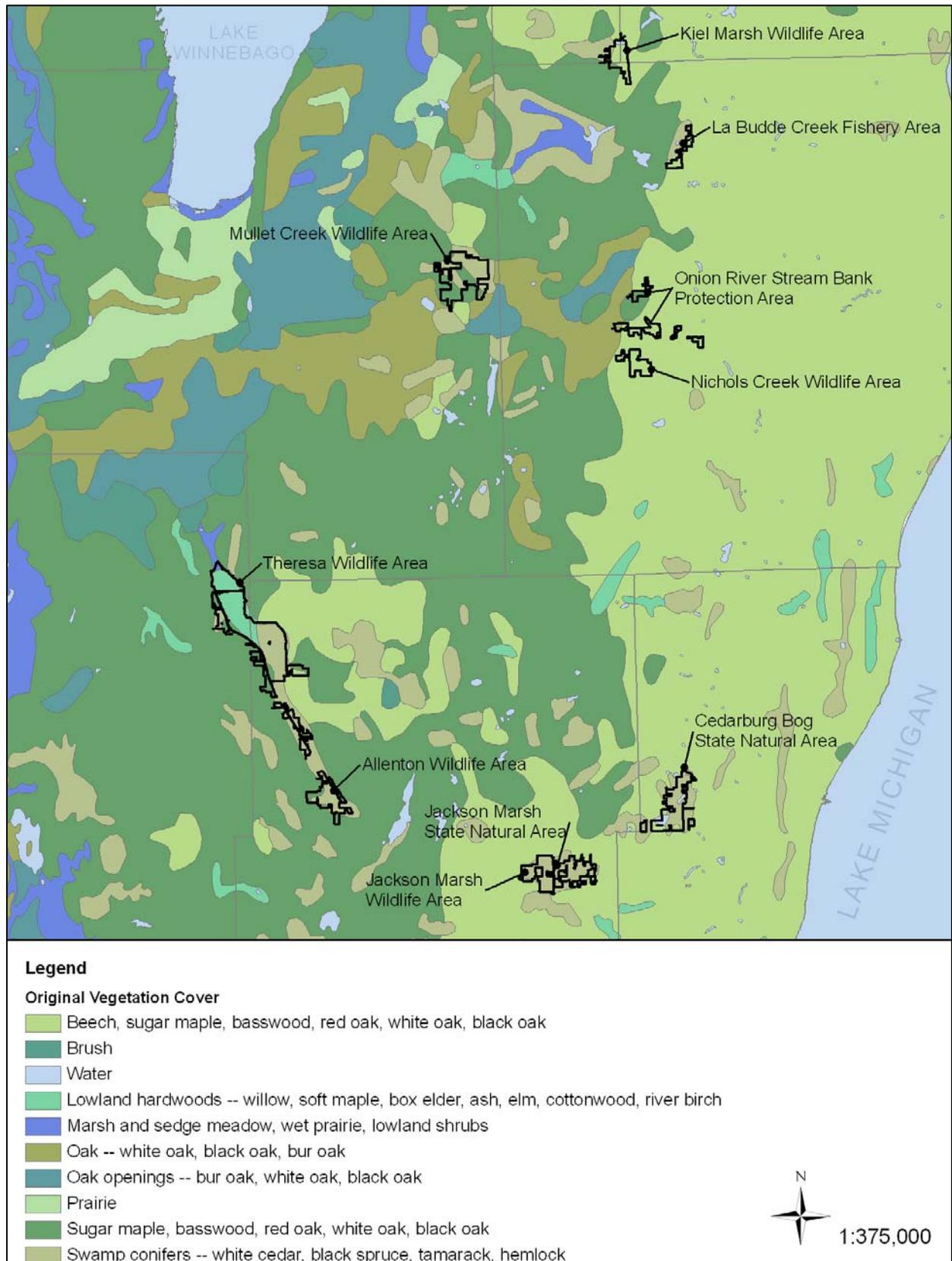
Lakes are not as common as rivers and streams on the NKMR. Two small un-named lakes are in the northern unit of the Onion River SBP Area, and Cedarburg Bog SNA has six lakes. Impoundments are located on a few properties, creating open water habitat used by some species.

## **Vegetation**

### **Historic Vegetation**

Data from Wisconsin's original Public Land Surveys are often used to infer vegetation cover types prior to Euro-American Settlement. Public Land Surveys for the NKMR were completed between 1832 and 1840. Finley's (1976) Pre-settlement Vegetation map (Figure 4) identifies the study areas as being dominated by forests of sugar maple, basswood, red oak, and white oak, along with areas of American beech and conifer swamps of northern white-cedar, black spruce, and tamarack.

**Figure 4:** Vegetation for the study area prior to Euro-American settlement. Data are from Finley (1976).



## Current Vegetation

The NKMR properties are embedded in a largely agricultural landscape with low density development, although development is denser near Jackson Marsh, Cedarburg Bog, and Onion River SBP Area (Figure 5). The NKMR are in the top twenty counties for population size in Wisconsin (US Census 2000).

Currently most of the properties are comprised of wetlands including Emergent and Submergent Marsh, Southern Sedge Meadow, Southern Hardwood Swamp, Northern Wet-mesic Forest, Southern Tamarack Swamp (rich), Floodplain Forest, and Shrub-carr. Several small Calcareous Fens add to the overall diversity of the wetlands. The uplands are comprised of forests (Southern Dry-mesic and Southern Mesic), old fields, pine and spruce plantations, and farmland. The conifer forest types present here are near the southern extent of their range in the state.

Current vegetation for all properties except Cedarburg Bog SNA is described by community type. Due to the uniqueness of the vegetation at Cedarburg Bog SNA, it is described separately.

### Calcareous Fen

Calcareous Fens, an unusual natural community found in southern Wisconsin, often underlain by a calcareous substrate, through which carbonate-rich groundwater infiltrates (Epstein et al. 2002), have been found at Allenton, Theresa Marsh, and Nichols Creek Wildlife Areas and Onion River SBP Area. The best quality example is at Allenton Wildlife Area and occurs in the headwaters area of Limestone Creek, which is a tributary of the Rock River. Dominant plant species are fen star (*Carex sterilis*) and tussock sedges, red-osier dogwood (*Cornus stolonifera*), and Canada bluejoint (*Calamagrostis canadensis*). Characteristic fen indicators include grass-of-Parnassus (*Parnassia glauca*), swamp-lousewort (*Pedicularis lanceolata*), marsh muhly (*Muhlenbergia glomerata*), and Kalm's lobelia (*Lobelia kalmii*). Glossy buckthorn is abundant. The Calcareous Fen is isolated from other natural vegetation remnants by encroachment of invasive plants and brush. At the headwaters of Kamrath Creek, in the Onion River SBP Area, a small, high quality Calcareous Fen is present. Calciphile are common and springs bubbling from the slightly sloping fen continue downslope into a Forested Seep. The Calcareous Fen at Theresa Marsh Wildlife Area is small, isolated, and lower quality. The Calcareous Fen at Nichols Creek Wildlife Area is also small but is embedded within a spring and Northern Wet-mesic Forest. It supports an unusual assemblage of herbs, many of them associated with alkaline groundwater including the species listed for Allenton.

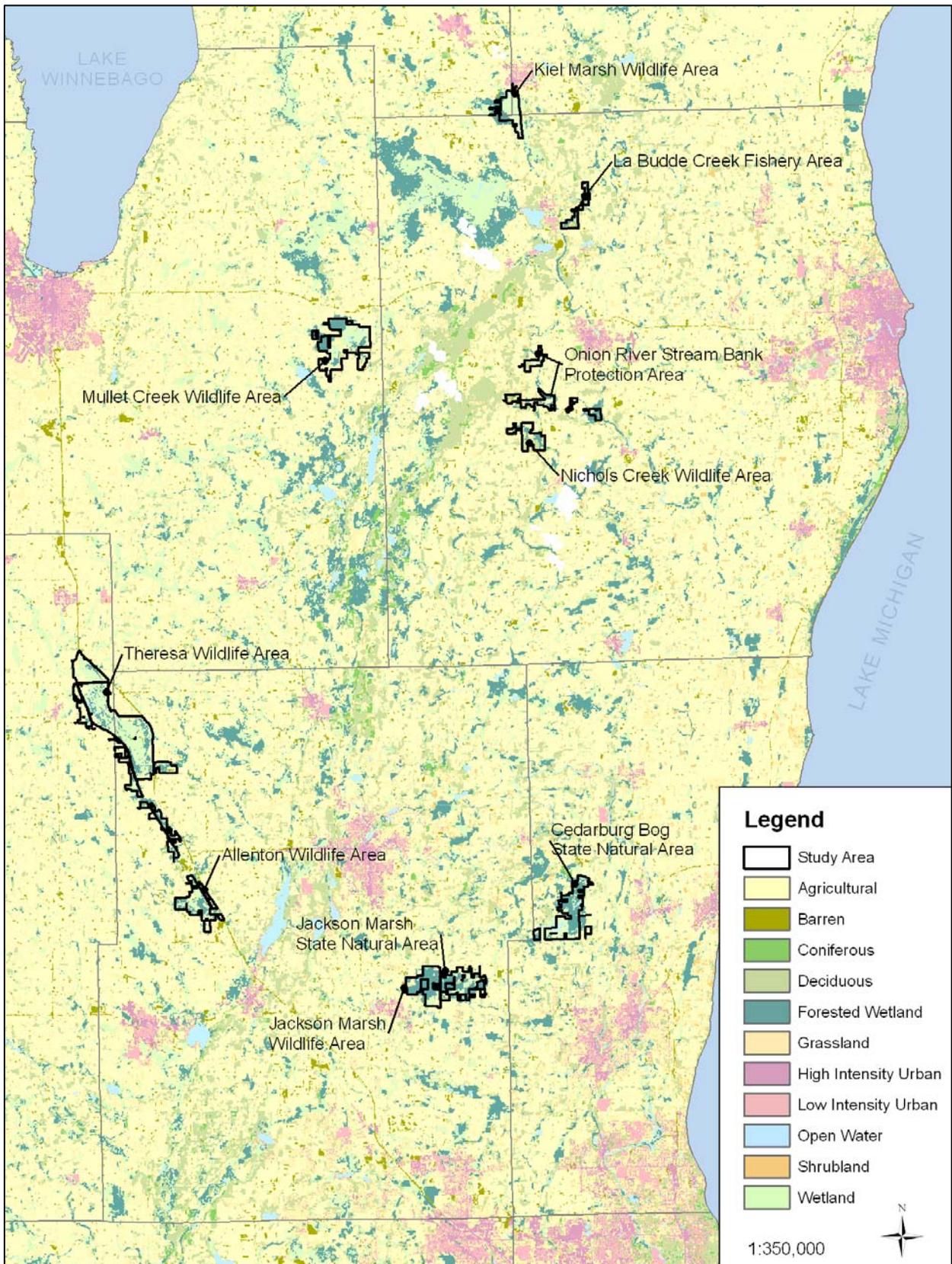
### Emergent Marsh

One of the more dominant natural communities on the NKMR is Emergent Marsh. Most are dominated by cattails (*Typha* spp.) with mixed broad-leaved sedges including lake sedge (*Carex lacustris*). Willows (*Salix* spp.) typically are scattered throughout the marshes. Reed canary grass (*Phalaris arundinacea*) is a common invasive species on several properties. Theresa Marsh and Mullet Creek Wildlife Areas have some of the most extensive Emergent Marshes inventoried, while Jackson Marsh and Kiel Marsh Wildlife Areas have smaller amounts. While these communities are low in plant diversity, they are still important for a number of animal species.

### Forested Seep

Forested Seeps are uncommon in Wisconsin with most occurrences in the Driftless Area or locally along major rivers flanked by steep bluffs. Within the NKMR, Forested Seeps are located at the Onion River SBP Area. Forested Seeps are distinguished from Northern Wet-mesic Forests by their prevalence of hardwood species and from Hardwood Swamps by the active spring discharges present. The springs in the Forested Seep at the Onion River SBP Area originate at the base an upland forest and travel through a moderately sloped semi-open Calcareous Fen. These springs continue further down slope where the

**Figure 5:** Landcover for the NKMR from the Wisconsin DNR Wisland GIS coverage (WDNR 1993).



forest canopy becomes more closed and they become Forested Seeps. The forest is dominated by sugar maple, yellow birch, and basswood with large areas of skunk cabbage, wild ginger, and other species of both rich mesic forests and wetlands.

### **Hardwood Swamp**

Hardwood swamps are common on the study area and consist of both the northern (classified in NHI as “Hardwood Swamp”) and southern (classified in NHI as “Southern Hardwood Swamp”) variants. The hardwood swamps are along the tension zone and impacted climatically from Lake Michigan resulting in a mixture of “northern” and “southern” species. Southern Hardwood Swamps are very rare in the state and examples tend to be degraded due to hydrological disturbance and invasive species. Many of the hardwood swamps in the study area have been temporarily classified at Southern Hardwood Swamps until more data can be collected to potentially develop a new natural community classification.

Southern Hardwood Swamps were documented at Jackson Marsh, Allenton, Kiel Marsh, Theresa Marsh, and Mullet Creek Wildlife Areas; LaBudde Creek Fishery Area; and Onion River SBP Area. Quality and extent varies greatly between the sites. The most extensive and best quality swamps are at Jackson Marsh Wildlife Area with a canopy dominated by silver maple (*Acer saccharum*) and yellow birch. There is also hackberry (*Celtis occidentalis*), green (*Fraxinus pennsylvanica*) and black ash, and American elm (*Ulmus americana*) in the canopy along with Northern white-cedar in seepage areas within the swamp. The canopy is moderately dense, and depending on the location within the Wildlife Area, the canopy trees average from about 8-10 inch dbh up to 20-30 inch dbh, and larger. The subcanopy is dense throughout and consists of canopy species. The ground flora includes stinging and false nettles (*Laportea* spp.), skunk cabbage, and fowl manna grass. Reed canary grass and garlic mustard (*Alliaria petiolata*) are present with the latter abundant along the floodplain corridor toward the southern end of the swamp. Both common and glossy buckthorns are present.

A fairly large Southern Hardwood Swamp occurs at Theresa Marsh Wildlife Area. It has a canopy of large silver maple and silver x red maple hybrid (up to 30-40inch dbh), black ash, green ash, American elm (saplings common, trees mostly dead), swamp white oak (*Quercus bicolor*), and red maple (*Acer rubrum*). Black ash saplings are common. Ground layer species include nettles, impatiens (*Impatiens capensis*), Virginia creeper, grapes, and skunk cabbage.

The Southern Hardwood Swamp at Onion River SBP Area is characterized by a canopy dominated by red maple and silver x red maple hybrid, with yellow birch, American elm, black ash, silver maple, and northern white-cedar as common associates. There is high species diversity in the ground layer, very low invasive exotic species abundance, and a high potential for rare species. The Southern Hardwood Swamp at Allenton Wildlife Area is young and poor quality with no developed canopy. The subcanopy is dense and dominated by black ash, American elm, and yellow birch with a few tamaracks. The invasive exotic species glossy buckthorn is also present. Kiel Marsh and Mullet Creek Wildlife Areas have scattered poor quality patches of Southern Hardwood Swamp.

The bottomlands forests at LaBudde Creek Fishery Area, more typical of a (northern) Hardwood Swamp, are generally in a narrow corridor along the creek and vary from tamarack to black ash dominated and have a high diversity of herbaceous plants and shrubs. Exotic species such as reed canary grass and common and glossy buckthorn have varying levels of dominance.

### **Northern and Southern Sedge Meadow**

Sedge meadows, both southern (at Nichols Creek and Allenton Wildlife Areas) and northern (at Kiel Marsh and Mullet Creek Wildlife Areas), are present within the study area. Dominant species include tussock (*Carex stricta*) and other sedges (*Carex* spp.) and reed canary grass. Cattails are invading many of these areas.

### **Northern Wet-mesic Forest**

There are good quality Northern Wet-mesic Forests at Jackson Marsh, Mullet Creek, and Nichols Creek Wildlife Areas. The Northern Wet-mesic Forest at Jackson Marsh is centered in the SNA and is dominated by 6-12 inch diameter (dbh) northern white-cedar (*Thuja occidentalis*), tamarack (*Larix laricina*), and, to a lesser extent, black ash (*Fraxinus nigra*). The shrub layer is moderately dense and includes currant (*Ribes* spp.) species plus poison ivy (*Toxicodendron radicans*), sumac (*Rhus* spp.), grape (*Vitis* spp.), and Virginia creeper (*Perthenocissus quinquefolia*). The ground flora is diverse and includes species such as fowl manna grass (*Glyceria striata*), skunk cabbage (*Symplocarpus foetidus*), and gold-thread (*Coptis trifolia*). Invasive exotic species are present but in low numbers; there is some reed canary grass and limited common buckthorn (*Rhamnus cathartica*).

The Northern Wet-mesic Forest at Mullet Creek Wildlife Area is dominated by medium-aged northern white-cedar with lesser amounts of tamarack and black ash in the canopy. Northern white-cedar trees range from 6 to 28 inches dbh. Small openings are scattered through the forest. The ground flora is fairly diverse and includes wild sarsaparilla (*Aralia nudicaulis*), gold-thread, and fowl manna grass. Invasive exotic species, like glossy buckthorn, appear to be largely absent from this location. The areas of Northern Wet-mesic Forest at Nichols Creek Wildlife Area occur on the west and east sides of the North Branch Milwaukee River. On the west side of the river, the forest has springs and seepages and is dominated by Northern white-cedar that are mostly 9-15 inch dbh, with trees over 15 inch dbh common, and a few up to 50 inch dbh. The most common canopy associates were yellow (*Betula alleghaniensis*) and paper birch (*B. papyrifera*), black ash, and basswood (*Tilia americana*). Northern white-cedar reproduction is locally strong with patches of large saplings present. Characteristic groundlayer species include marsh marigold (*Caltha palustris*), blue marsh violet (*Viola cucullata*), and skunk cabbage. The forest on the east side of the river has similar vegetation but lacks springs and spring runs.

### **Shrub-carr**

Shrub-carrs are present to a lesser or greater degree on most of the areas. They are typically dominated by willows and dogwood.

### **Southern Dry-mesic Forest**

Southern Dry-mesic Forests are known from Jackson Marsh Wildlife Area and LaBudde Creek Fishery Area. At Jackson Marsh Wildlife Area, the Southern Dry-mesic Forest is dominated by large bur oak (*Quercus macrocarpa*), red oak, and basswood. Common buckthorn is present, although not abundant. At LaBudde Creek Fishery Area, the highest quality upland forests are classified as Southern Dry-mesic Forests dominated by red oak, sugar maple, American beech, white oak, and shagbark hickory in the canopy. The density of the shrub and sapling layers varies and consists of eastern hop-hornbeam, red and sugar maples, and American beech. The ground layer is diverse, including species indicating mesic conditions, although areas of very thin leaf litter and duff are also present and have few ground flora species. Garlic mustard and helleborine orchid are present, but not abundant.

### **Southern Mesic Forest**

There are good quality Southern Mesic Forests at Nichols Creek and Jackson Marsh Wildlife Areas. At Nichols Creek Wildlife Area, the upper portions of a northeast-facing slope support a mature mesic to dry-mesic hardwood forest dominated by medium to large sugar maple, red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), and basswood. Sugar maple saplings are common, and eastern hop-hornbeam (*Ostrya virginiana*) is a common small tree. The flora is richer down slope, with wild ginger (*Asarum canadense*), blue cohosh (*Caulophyllum thalictroides*), and zigzag goldenrod (*Solidago flexicaulis*). Springs are frequent on the lower slopes and the dominant canopy tree is northern white-cedar. The good quality mesic forest at Jackson Marsh Wildlife Area also has a similar species composition.

### **Southern Tamarack Swamp (Rich)**

There is a Southern Tamarack Swamp (Rich) at Allenton Wildlife Area bordering Limestone Creek. When the natural community was surveyed at Allenton in 1992, it was dominated by medium to large tamarack (10-14 inch dbh, at least one at 20 inch dbh), with black ash, red maple, and American elm, plus a few swamp white oak, green ash, and yellow birch in canopy. The shrub layer was dense to moderate, and no buckthorn was noted. Tamarack was not reproducing within stand, but there were some saplings along edges, near the road to the east.

### **Springs, Spring Runs, and Spring Ponds**

Springs, spring runs, and spring ponds are important features or inclusions at several areas including Nichols Creek Wildlife Area and the Onion River SBP Area.

### **Cedarburg Bog**

Cedarburg Bog is the most intact large bog system in southeastern Wisconsin and is a mosaic of several natural communities. Cedarburg Bog is a cluster of relict natural communities and a southern example of the types more commonly found in northern Wisconsin. The very diverse flora and fauna including many species that are more common in northern boreal forests and are at their southern range limits here. Cedarburg Bog is home to the University of Wisconsin-Milwaukee Field Station, and much research has been and continues to be done there. One valuable project has been long term vegetation monitoring, and the Station has detailed data on herbs, shrubs, trees and seedlings of woody plants from 165 permanently located sample units that were established in 1991.

Much of the property is wetlands with Northern Wet-mesic Forests, Patterned Peatland, Emergent Marsh, and Shrub-carr. There are stands of Northern Mesic Forest on the uplands. By areal extent, Northern Wet-mesic Forest has the greatest coverage. The canopy is dominated by northern white-cedar and includes yellow birch, green ash, black spruce (*Picea mariana*), and tamarack. The understory is rich in sedge species and also present are gold-thread, leatherleaf (*Chamaedaphne calyculata*), and poison sumac (*Toxicodendron vernix*). Patterned peatlands are very rare in Wisconsin, and this is the southernmost known occurrence in the state. Patterned peatlands are characterized by low narrow peat ridges that support ericaceous shrubs, bog birch (*Betula pumila*), and stunted conifers (i.e., northern white-cedar, tamarack). The ridges alternate with low swales, or flarks, that are generally sedge dominated and often partially inundated. Both strings and flarks are oriented parallel to the contours of the slope, perpendicular to the flow of groundwater. This Patterned Peatland contains a very diverse flora including numerous sedge species, round-leaf sundew (*Drosera rotundifolia*), shrubby cinquefoil (*Pentaphylloides floribunda*), pitcher plant (*Sarracenia purpurea*), and bog bean (*Menyanthes trifoliata*). Emergent Marsh occupies the shallowest parts of Mud Lake basin. Representative plants include cattail species, bulrushes (*Scirpus* spp.), arrowhead (*Sagittaria* sp.), common reed (*Phragmites australis*), and spike-rushes (*Eleocharis* spp.). Shrub-carr almost completely surrounds the Emergent Marsh at Mud Lake and extends into other parts of the wetlands. The Shrub-carr is dominated by alder (*Alnus* sp.), bog birch, dogwoods (*Cornus* spp.), leatherleaf, willows (*Salix* spp.), and poison sumac. Some of the common ground flora species include sedges, cottongrasses (*Eriophorum* spp.), and pitcher plants. Glossy buckthorn is present in many parts of the wetland.

The Northern Mesic Forest has a canopy dominated by sugar maple, red oak, basswood, and American elm. The ground flora includes such northern species as bunchberry (*Cornus Canadensis*) plus species that are more widely distributed like large-flowered trillium (*Trillium grandiflorum*) and large-flowered bellwort (*Uvularia grandiflora*).

## Rare Species and High Quality Natural Communities of the Northern Kettle Moraine Region Planning Group

Numerous rare species and high-quality examples of native communities have been documented within the NKMR (Table 3). Table 3 shows the rare species and high-quality natural communities currently known from the. See Appendix C for summary descriptions for the species and natural communities that occur on the NKMR.

**Table 3.** Documented rare species and high-quality natural communities for the Northern Kettle Moraine Region Planning Group. Years listed indicate the most recent documented observation. More than one element occurrence of a particular species or natural community may be at each property. For an explanation of state and global ranks, as well as state status, see Appendix D.

Common Name	Scientific Name	NKMR	State Rank	Global Rank	State Status	Federal Status
<b>Animal</b>						
Acadian Flycatcher	<i>Empidonax vireescens</i>	2009	S3B	G5	THR	
American Bittern*	<i>Botaurus lentiginosus</i>	1986	S3B	G4	SC	
American Bullfrog	<i>Lithobates catesbeianus</i>	2002	S3	G5	SC	
An Owlet Moth	<i>Macrochilo bivittata</i>	1983	S3	G3G4	SC/N	
Aurora Damselfly	<i>Chromagrion conditum</i>	1982	S3	G5	SC/N	
Black Tern	<i>Chlidonias niger</i>	2008	S2B	G4	SC/M	
Black-billed Cuckoo**	<i>Coccyzus erythrophthalmus</i>	2008	S4B	G5	SC/M	
Blanding's Turtle	<i>Emydoidea blandingii</i>	2006	S3	G4	THR	
Blue-winged Warbler**	<i>Vermivora pinus</i>	2010	S4B	G5	SC/M	
Bobolink**	<i>Dolichonyx oryzivorus</i>	2008	S4B	G5	SC/M	
Broad-winged Skipper	<i>Poanes viator</i>	1992	S3	G5	SC/N	
Butler's Gartersnake	<i>Thamnophis butleri</i>	2010	S3	G4	THR	
Canada Warbler	<i>Wilsonia canadensis</i>	2007*	S3B	G5	SC/M	
Common Moorhen	<i>Gallinula chloropus</i>	2008	S2B	G5	SC	
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>	1981	S1	G5	END	
Field Sparrow**	<i>Spizella pusilla</i>	2010	S4B	G5	SC/M	
Hine's Emerald	<i>Somatochlora hineana</i>	2003	S1	G2G3	END	LE
Hooded Warbler	<i>Wilsonia citrina</i>	2010*	S2S3B	G5	THR	
Least Bittern*	<i>Ixobrychus exilis</i>	2008	S3B	G5	SC	
Least Darter	<i>Etheostoma microperca</i>	1975	S3	G5	SC/N	

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Common Name	Scientific Name	NKMR	State Rank	Global Rank	State Status	Federal Status
Least Flycatcher**	<i>Empidonax minimus</i>	2008	S4B	G5	SC/M	
Longear Sunfish	<i>Lepomis megalotis</i>	1971	S2	G5	THR	
Midwestern Fen Buckmoth	<i>Hemileuca</i> sp. 3	2002	S3	G5T3T4	SC/N	
Mulberry Wing	<i>Poanes massasoit</i>	2001	S3	G4	SC/N	
Northern Ringneck Snake	<i>Diadophis punctatus</i>	1987	S3?	G5T5	SC	
Pickerel Frog	<i>Lithobates palustris</i>	1986	S3S4	G5	SC	
Pitcher Plant Moth	<i>Exyra fax</i>	1990	S2S3	G4	SC/N	
Prairie Crayfish	<i>Procambarus gracilis</i>	1978	S2?	G5	SC/N	
Pygmy Shrew	<i>Sorex hoyi</i>	1970	S3S4	G5	SC/N	
Queensnake	<i>Regina septemvittata</i>	1992	S1	G5	END	
Redfin Shiner	<i>Lythrurus umbratilis</i>	1971	S2	G5	THR	
Red-shouldered Hawk	<i>Buteo lineatus</i>	1974	S3S4B,S1 N	G5	THR	
Regal Fritillary	<i>Speyeria idalia</i>	1987	S1	G3	END	
Slippershell Mussel	<i>Alasmidonta viridis</i>	1977	S2	G4G5	THR	
Swamp Metalmark	<i>Calephelis muticum</i>	2010	S1	G3	END	
Tapered Vertigo	<i>Vertigo elatior</i>	2001	S3	G5	SC/N	
Veery**	<i>Catharus fuscescens</i>	2008	S4B	G5	SC/M	
Vesper Sparrow	<i>Poocetes gramineus</i>	2010	S4B	G5	SC/M	
Warpaint Emerald	<i>Somatochlora incurvata</i>	1993	S2	G4	END	
Willow Flycatcher**	<i>Empidonax traillii</i>	2008	S4B	G5	SC/M	
Wood Thrush**	<i>Hylocichla mustelina</i>	2010	S4B	G5	SC/M	
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	2010*	S3B	G5	SC/M	
Yellow-breasted Chat	<i>Icteria virens</i>	2008	S2B	G5	SC	
<b>Plant</b>						
American Gromwell	<i>Lithospermum latifolium</i>	1918	S3	G4	SC	
Autumn Coral-root	<i>Corallorhiza odontorhiza</i>	1932	S3	G5	SC	
Capitate Spikerush	<i>Eleocharis olivacea</i>	1934	S2	G5	SC	
Common Bog Arrow-grass	<i>Triglochin maritima</i>	2001	S3	G5	SC	

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Common Name	Scientific Name	NKMR	State Rank	Global Rank	State Status	Federal Status
Cuckooflower	<i>Cardamine pratensis</i>	2005	S3	G5	SC	
Dragon Wormwood	<i>Artemisia dracunculus</i>	1940	S2	G5	SC	
Early Anemone	<i>Anemone multifida</i> var. <i>hudsoniana</i>	1918	S1	G5T5	END	
Few-flower Spikerush	<i>Eleocharis quinqueflora</i>	1934	S2	G5	SC	
Forked Aster	<i>Aster furcatus</i>	2005	S3	G3	THR	
Hooker Orchis	<i>Platanthera hookeri</i>	1938	S2S3	G4	SC	
Large Roundleaf Orchid	<i>Platanthera orbiculata</i>	1928	S3	G5	SC	
Leafy White Orchis	<i>Platanthera dilatata</i>	2001	S3	G5	SC	
Livid Sedge	<i>Carex livida</i> var. <i>radicaulis</i>	1996	S2	G5T5	SC	
Marbleseed	<i>Onosmodium molle</i>	1908	S3	G4G5	SC	
Marsh Valerian	<i>Valeriana sitchensis</i> ssp. <i>uliginosa</i>	2010	S2	G4Q	THR	
Northern Bog Sedge	<i>Carex gynocrates</i>	1996	S3	G5	SC	
Northern Yellow Lady's-slipper	<i>Cypripedium parviflorum</i> var. <i>makasin</i>	2010	S3	G5T4Q	SC	
Prairie White-fringed Orchid	<i>Platanthera leucophaea</i>	2008	S2	G2G3	END	LT
Purple False Oats	<i>Trisetum melicoides</i>	1879	S1	G4	END	
Ram's-head Lady's-slipper	<i>Cypripedium arietinum</i>	1970	S2	G3	THR	
Richardson Sedge	<i>Carex richardsonii</i>	1923	S2	G4	SC	
Round-leaved Orchis	<i>Amerorchis rotundifolia</i>	1935	S2	G5	THR	
Showy Lady's-slipper	<i>Cypripedium reginae</i>	2007	S3	G4	SC	
Slender Bog Arrow-grass	<i>Triglochin palustris</i>	1992	S3	G5	SC	
Slenderleaf Sundew	<i>Drosera linearis</i>	1990	S1	G4	THR	
Slim-stem Small-reedgrass	<i>Calamagrostis stricta</i>	1995	S3	G5	SC	
Sparse-flowered Sedge	<i>Carex tenuiflora</i>	1999	S3	G5	SC	
Sticky False-asphodel	<i>Tofieldia glutinosa</i>	2002	S2S3	G4G5	THR	
Swamp-pink	<i>Arethusa bulbosa</i>	1991	S3	G4	SC	
Tufted Hairgrass	<i>Deschampsia cespitosa</i>	1965	S2	G5	SC	
Waxleaf Meadowrue	<i>Thalictrum revolutum</i>	1976	S2	G5	SC	

**Table 3.** Documented rare species and high-quality natural communities for the Northern Kettle Moraine Region Planning Group. Years listed indicate the most recent documented observation. More than one element occurrence of a particular species or natural community may be at each property. For an explanation of state and global ranks, as well as state status, see Appendix D.

Common Name	Scientific Name	NKMR	State Rank	Global Rank	State Status	Federal Status
White Adder's-mouth	<i>Malaxis monophyllos</i> var. <i>brachypoda</i>	1938	S3	G4Q	SC	
Yellow Evening Primrose	<i>Calylophus serrulatus</i>	1903	S2	G5	SC	
Yellow Gentian	<i>Gentiana alba</i>	1918	S3	G4	THR	
<b>Natural Community</b>						
Calcareous Fen		2010*	S3	G3		
Emergent Marsh		2006	S4	G4		
Floodplain Forest		2008	S3	G3?		
Forested Seep*		2010*				
Lake--Shallow, Hard, Drainage		1985	SU	GNR		
Northern Mesic Forest		2004	S4	G4		
Northern Wet Forest		1991	S4	G4		
Northern Wet-mesic Forest		2008	S3S4	G3?		
Patterned Peatland		2005	S1	GNR		
Southern Hardwood Swamp		2008	S2	G4?		
Southern Mesic Forest		2010*	S3	G3?		
Southern Sedge Meadow		1992	S3	G4?		
Southern Tamarack Swamp (Rich)		2008	S3	G3		
Spring Pond		1977	S3	GNR		
Springs and Spring Runs, Hard		2006	S4	GNR		
<b>Other</b>						
Herp Hibernaculum		2010	SU	GNR	SC	
Migratory Bird Concentration Site		2006	SU	G3	SC	

\*This record is not yet mapped in the NHI database or the last observation date is more recent than what is in the NHI database.

\*\*This is a Species of Greatest Conservation Need and will not be mapped in the NHI database.

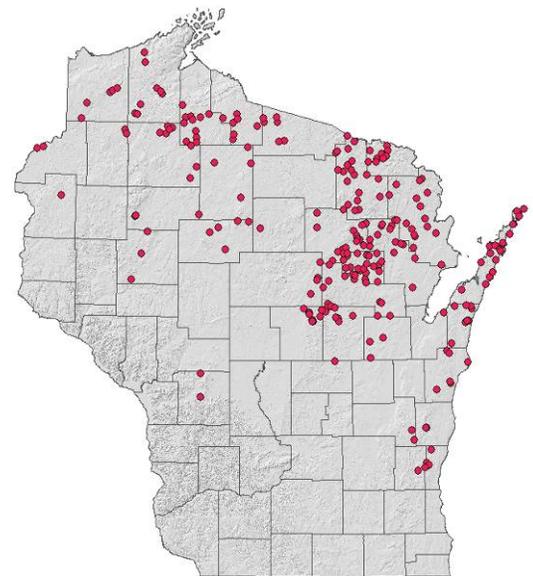
# Management Considerations and Opportunities for Biodiversity Conservation

## Coniferous Forests

Northern Wet-mesic Forests are near the edge of their range in southern Wisconsin (Figure 6) and are present in this landscape at **Mullet Creek Wildlife Area, Cedarburg Bog SNA, Jackson Marsh Wildlife Area, and Nichols Creek Wildlife Area**. Northern Wet-mesic Forests are regionally significant because they are one of the most diverse plant communities, providing habitat for many rare plants, including northern yellow lady's slipper, and important habitat to over 80 wildlife species (Forester et al. 2008). Regeneration of northern white-cedar has been rare in the upper Great Lakes region for decades (Rooney et al, 2002) because it is a preferred browse species for white-tailed deer and deer use Northern Wet-mesic Forests for winter habitat. Regeneration of northern white-cedar may benefit from white-tailed deer population reduction (Forester et al. 2008; Beals et al., 1960; Ullrey et al., 1968) or northern white-cedar may, in future centuries, become confined to 'browsing refugia' (Rooney, 1997; Borgmann et al., 1999).

Examples of Southern Tamarack Swamp (Rich) are located at **Allenton Wildlife Area and Cedarburg Bog SNA**. Southern Tamarack Swamp (Rich) is a relict conifer forest type that historically was much more common in southeast Wisconsin. The Southern Tamarack Swamp type is richer than the northern Tamarack (poor) Swamp which is a more acid dominated tamarack-spruce swamp. Although there are larger and better examples of this type in the region, the Southern Tamarack Swamps (Rich) on the NKMR add to the biological diversity of these properties. Many historical swamps were drained and cleared for agricultural purposes and intact examples are now uncommon but occur in this region on the margins of lakes or streams and at the base of moraines (WDNR 2006b). Concerns for this type include poor regeneration of tamarack, large die-offs attributed to larch sawfly infestations, non-native invasive plant species, and pollutants, pesticides, and altered hydrology. Many of the tamarack swamps in this region, including **Cedarburg Bog**, also have infestations of the invasive glossy buckthorn. The Southeast Glacial Plain Ecological Landscape is noted in the Wildlife Action Plan (WDNR 2006b) as a major opportunity area for this natural community.

Northern Wet-mesic Forests and Southern Tamarack Swamp (Rich) of the NKMR offer unique habitats not often found in this landscape and thus act as major reservoirs of 'northern' birds in southeastern Wisconsin. **Jackson Marsh Wildlife Area and Cedarburg Bog** both support breeding populations of 'northern' birds in Wisconsin including Brown Creeper, Winter Wren, Nashville Warbler, Black-throated Green Warbler, Northern Waterthrush, Mourning Warbler, and White-throated Sparrow. These refugia become increasingly important when considering the potential effects climate change may have on these northern species at their southern range edge. These species are present in remnants of relict natural communities that likely were much more common in previous decades or millennia and these habitats should be protected as a benchmark for the unique biodiversity of plant and animal habitats once present in this



**Figure 6:** NHI locations of Northern Wet-mesic Forest type in Wisconsin.

landscape.

An important component of preserving these unique conifer natural communities is maintaining or restoring hydrology that protects the groundwater flows associated with the seeps, springs, and spring runs present. Activities associated with road or right-of-way construction, dams or levees, and beaver activity can negatively impact the hydrology. Control of non-native invasive plants such as reed canary grass and glossy buckthorn is vital to preserving the integrity of these sites as these invasive plants out-compete or shade-out native plant species. Timber or deer management practices, in association with attempts at northern white-cedar regeneration like strip-cutting have been detrimental to regenerating northern white-cedar along with threatening the long-term viability of these sites (WDNR 2006b). Increasing winter deer numbers in these Northern Wet-mesic Forests can have extremely negative effects on the persistence of these habitats. Creating larger blocks of these natural communities with surrounding hardwood swamp, upland forests, or open wetland types would benefit animal diversity, protect them from invasion of non-native plants, improve water quality, and aid in tree regeneration (WDNR 2006b). Northern white-cedar is regenerating at **Nichols Creek and Jackson Marsh Wildlife Areas**; this may in part be due to existing buffers around the Northern Wet-mesic Forest, abundant food available in this agricultural landscape, less need for deer to “yard-up” in southern Wisconsin, and possibly increased deer hunting pressure associated with State Wildlife Areas.

Pine plantations are not common on the NKMR, although where they are, efforts to convert them to the original natural community would benefit native species. This also includes removing young plantations before the canopy closes and ground vegetation is changed.

## Migratory Birds

The wide range of habitats on the NKMR properties, from large wetlands, streams, and flowages present at **Theresa Marsh, Allenton, and Kiel Marsh Wildlife Areas** to undeveloped forests and shrub cover found at **Cedarburg Bog SNA, Jackson Marsh, Mullet Creek, and Nichols Creek Wildlife Areas**, offer important resources for numerous bird groups. Large numbers of individuals from many species accumulate here during migration because these areas offer the most important resources to migrating birds which are food, water, and shelter.

Large emergent wetlands and associated open water areas offer migratory birds such as waterfowl, shorebirds, songbirds, and waterbirds like herons and egrets diverse habitats during the migratory seasons. Important features include emergent aquatic plants such as cattails, smartweed (*Polygonum* spp.), and arrowheads; open water areas that team with amphibians, fish, and aquatic invertebrates; and mudflats with abundant invertebrates and insect larvae. This plant and animal life provide important foraging opportunities during spring and fall migration for waterfowl, herons, bitterns, geese, cranes, and shorebirds. In addition, lowland shrubs present in these wetlands offer migrating songbirds protection from severe weather and predators and feeding during a critical time in their life cycle. Lowland shrubs offer perches for capturing emerging aquatic insects in spring and food in the form of fruiting shrubs in fall, which are high in energy and are utilized by migrants to build fat reserves necessary for sustaining long migratory flights.

Modeling was done by the Wisconsin DNR for the Western Great Lakes Coastal region for Bird Migration Stopover Habitats Project (Grveles and Matteson 2008) using parameters based on high amounts of oak forest, undeveloped tracts of land, good quality aquatic features, and prevalence of fruit-producing low shrubs. Results of this modeling include **Cedarburg Bog SNA** being identified as having high potential for shorebirds, waterbirds, and waterfowl in the areas around Long Lake. **Kiel Marsh and Mullet Creek Wildlife Areas** had very high potential for waterfowl and landbirds based around the river, streams, and flowages at these areas. **Jackson Marsh Wildlife Area** had high potential for waterfowl

along the creek. It should be noted, the stopover models are predictive of high concentrations, but have not been verified with ground studies. More work should be done to focus on these important stages of bird's lives.

Mature forest stands of the NKMR sites also contribute important migratory stopover habitat for songbirds, particularly those forest blocks that are large in size and have high structural diversity with a strong oak component. Because agriculture and urban development dominate the surrounding landscape, these forest patches offer respite to exhausted birds traversing across mainly inhospitable terrain. **Mullet Creek and Nichols Creek Wildlife Areas** were identified as having high potential for migrating landbirds. The proximity of both of these areas to the Kettle Moraine State Forest - Northern Unit enhances their value as a migratory corridor for songbirds by increasing the amount of crucial stopover habitat available in this region.

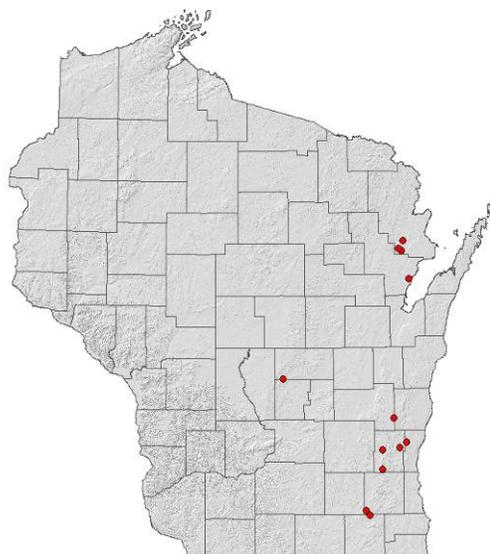
Threats to Migratory Bird Stopover Sites and migratory birds include habitat destruction and habitat alteration (Duncan 2002). Habitat alteration includes the simplification of forest structure or the alteration of forest composition, including non-native invasive species that may change the kinds, quantity, and quality of food resources (Duncan 2002). Many wetlands, typical to those found on the NKMR, have been filled for agriculture or developed, threatening the viability of this declining resource. Streams are susceptible to pollutants from nutrient runoff and road salts which could harm prey species if water quality diminishes, thus close monitoring should be done.

## Rare Invertebrates and Their Habitats

Southern Sedge Meadows at one time covered nearly one million acres in the state, but wetland losses increased with technological advancements in converting wetlands to agriculture in the mid 1900's. Now only about 200,000 acres remain and many of these acres are now dominated by the invasive reed canary grass (Hoffman 2002). Calcareous Fens have always been rare in Wisconsin due to their unique requirements, but now likely cover less than 1,000 acres currently in the state (Hoffman 2002). Many are small in size and are threatened by the encroachment of trees, shrubs, and non-native invasive plants.

Protecting, managing, and restoring the remaining Calcareous Fens and sedge meadows would benefit the many specialized plants and animals, especially invertebrates that require these open wetland types. One example is a rare dragonfly which is found at **Cedarburg Bog SNA**. Cedarburg Bog and the Lower Wisconsin State Riverway represent the only verified current breeding locations in Wisconsin outside of Door County. There is a matrix of vegetation types present at **Cedarburg Bog** with open seepage sedge meadows and cool calcareous marsh areas providing important larval habitat. Open herbaceous areas associated with these meadows are also important for hunting adult dragonflies.

Rare invertebrates are known from Calcareous Fen and meadow habitats at or near **Allenton Wildlife Area and Cedarburg Bog**. Another extremely rare invertebrate (Figure 7) is also found in these types of habitats. Although potential habitat exists at **Allenton and Theresa Marsh Wildlife Areas**, no populations were found (Borkin 2008). However, surveys in a high-



**Figure 7:** NHI point locations of current and historical rare invertebrate populations in Wisconsin

quality fen at **Onion River SBP Area** resulted in a new population of this rare species. This is the first time in 18 years that a new population has been found and one of only three current populations in the state.

## **Springs, Headwater Streams, and other Aquatic Resources**

Unique aquatic resources are present in the NKMR and include seeps, Springs, Spring Ponds, Spring Runs, and headwater streams. All add significantly to the overall diversity of the properties. More research is needed to better understand the representative plants and animals of these aquatic types. The Springs and Spring Runs generally originate from and have direct outflow attributed to artesian openings in the underground dolomite and often represent headwaters or low-order tributaries of coolwater streams (FFWCC 2005). Springs typically have high water clarity, low sedimentation, and are a stable system with very little change in water temperature, water flow, or chemical composition.

Examples of these types are found at **Nichols Creek Wildlife Area**, an area that is laced with many springs and spring runs. The Springs and Spring Runs are small, with cold, clear water and bottom substrates of muck, gravel, and sand. A Spring Pond lies at the woods edge with glacial deposits to the north, forested with oaks, and a white-cedar-ash swamp on the east and south. **Jackson Marsh and Mullet Creek Wildlife Areas** have springy seeps that exhibit calcareous groundwater flows present in the Northern Wet-mesic Forest and Hardwood Swamp. **Mullet Creek Wildlife Area** protects the headwaters of the Mullet River. **Theresa Marsh and Allenton Wildlife Areas** protect the headwaters of the East Branch Rock River. The **Onion River SBP Area** has Springs and Spring Runs that originate below a wooded hill and flow downhill through Forested Seeps and feed Kamrath and Ben Nutt Creeks.

Rare fish species have been documented in the upper reaches of warm water streams at **Theresa, Allenton, and Jackson Marsh Wildlife Areas** where low gradient streams with cobble, boulders, sand, and detritus along with clear, quiet, shallow streams help support their populations. The aquatic resource and associated marsh areas at **Theresa Marsh Wildlife Area** serves as an important foraging area for marshbirds such as rails and waterbirds. And the close proximity of **Theresa Marsh Wildlife Area** to Horicon Marsh, where these birds likely nest, makes this an important foraging area.

Both rare and common plants and animals are strongly associated with the coldwater spring community types present in the NKMR. Plants known from these types include water parsnip (*Berula erecta*), mare's tail (*Hippurus vulgaris*), round-leaved monkey flower (*Mimulus glabratus*), brook grass (*Catabrosa aquatica*) (END), marsh valerian (*Valeriana sitchensis*) (THR) and the invasive watercress (*Nasturtium officinale*). Seepage areas with more calcareous groundwater flows often can signify the likelihood of more fen-loving species that would include many additional uncommon plant species.

Vertebrate species that are likely to be found using these spring areas include adult pickerel frogs (SC) which require cold water habitats associated with springs and trout streams for much of their life cycle including hibernation. Blanchard's cricket frogs (END) which were common in southern Wisconsin until the 1970's have the potential for showing up in these types of habitats. Recently, there have been some reports of individuals being found in southeast Wisconsin, so further investigation may be warranted. Many of these spring areas are relatively fish-free except for the very small central mudminnow and brook stickleback (pers. comm. J. Lyons). These fishless aquatic areas would make them attractive to wood frogs, chorus frogs, and spring peepers for breeding. In forested landscapes these Spring Ponds would present excellent opportunities for salamander breeding ponds. Turtles may include the semi-aquatic Blanding's turtle (THR) when open wetland habitat is nearby. Queensnakes (END) are historically known from **Cedarburg Bog** and require cold, clear streams with moderate to fast currents and rocky bottoms which are conditions present in these types. Waterfowl, wading birds, and forest raptors such as Red-shouldered Hawk (THR) and Broad-winged hawk would favor these areas as

plentiful amphibian prey items are present. Springs would be important feeding areas for many bat species. Invertebrate species likely to be found in these aquatic habitats include crayfish, freshwater shrimp, diving beetles, mayflies, stoneflies, caddisflies, dragonflies, and damselflies.

Threats to these aquatic communities include hydrological alterations associated with groundwater withdrawal for commercial or industrial development, or agricultural irrigation systems. In addition, beaver activity should be monitored and controlled to allow for natural hydrology to continue. Changes to hydrology can allow for invasive plant infestations, increased sedimentation, and poor water quality thereby changing the conditions necessary for the continued health of rare species populations and some natural communities (WDNR 2002). Other concerns include nutrient loading from agricultural or urban runoff, road construction and road salt, and incompatible forestry practices or recreational activities such as off-road vehicle use. Off-road vehicles and ATV's can de-stabilize soils which could add sedimentation to the springs or headwater streams and would be detrimental to these systems. Hydric soils within the study area that are being planted to crops should be restored to wetlands to provide habitat and limit potential impacts. Where cropping is utilized, no nitrates, herbicides or pesticides should be allowed within 1,000 ft of any amphibian breeding sites, as these are contact poisons and disrupt limb and gonad development. Non-native invasive plants such as watercress, reed canary grass, and weedy shrubs like buckthorn can simplify these areas and negatively impact wildlife dependent upon them. Water quality and quantity should be one of the primary considerations when management is planned near these areas.

## **Ecological Priorities for SGCN**

The Wisconsin Wildlife Action Plan identifies ecological priorities in each Ecological Landscape. Ecological priorities are the natural communities in each Ecological Landscape that are most important to the Species of Greatest Conservation Need. Appendix D highlights the Ecological Priorities for vertebrate SGCN on the NKMR. Note that these Ecological Priorities include all of the natural communities that we have determined to provide the best opportunities for management on the NKMR from an ecological/biodiversity perspective.

## Natural Community Management Opportunities

The Wisconsin Wildlife Action Plan (WAP) (WDNR 2006b) identifies 34 natural communities for which there are “Major” or “Important” opportunities for protection, restoration, or management in the Southeast Glacial Plains Ecological Landscape. Sixteen of these natural communities are present on the NKMR:

- Calcareous Fen
- Coolwater Streams
- Emergent Marsh
- Floodplain Forest
- Inland Lakes
- Northern Sedge Meadow
- Northern Wet Forest
- Northern Wet-mesic Forest
- Shrub-carr
- Southern Dry-mesic Forest
- Southern Hardwood Swamp
- Southern Mesic Forest
- Southern Sedge Meadow
- Southern Tamarack Swamp (rich)
- Warmwater Rivers
- Warmwater Streams

## Invasive Plants

Several non-native invasive plants are well-established on the study area. Reed canary grass is the dominant species in some of the open wetlands and has begun to invade canopy gaps in the Southern Hardwood Swamp at **Jackson Marsh Wildlife Area** and the Floodplain Forest at **Mullet Creek Wildlife Area**. Logging and other management activities at **Jackson Marsh or Mullet Creek Wildlife Areas** should be assessed for their impact on the spread of reed canary grass and other invasives present that is often associated with opening up the canopy. The sedge meadow community types were once much more widespread in southeast Wisconsin and throughout the entire state but land conversion, including to reed canary meadows, has destroyed much of this important wetland type and associated plant diversity.

Both species of European buckthorn are present at **Jackson Marsh Wildlife Area**, and glossy buckthorn is found at **Cedarburg Bog SNA** and **Allenton Wildlife Area**. The buckthorn invasion at **Allenton Wildlife Area** threatens the high-quality Calcareous Fen present there. In Wisconsin, this rare community type is restricted to southeast Wisconsin and many of these sites have already been degraded due to buckthorn and other invasive shrubs. Buckthorn control efforts have been made at the **Cedarburg Bog** and should be continued to preserve the integrity of that unique natural area. Other invasive plants are present, but not dominant in the NKMR. Possible future threats to diversity include: helleborine orchid (*Epipactis helleborine*), garlic mustard, common reed grass, bush honeysuckle (*Lonicera x bella*), and invasive cattails. For species that are still in manageable populations, control measures should begin before the spread becomes too vast to reasonably manage them. Once this has occurred, high quality areas should be prioritized for removal. Control efforts could be expanded once these areas are no longer threatened.

# Primary Sites: Site-specific Opportunities for Biodiversity Conservation

Seven ecologically important sites were identified on the NKMR. These “Primary Sites” were delineated because they generally encompass the best examples of 1) rare and representative natural communities, 2) documented occurrences of rare species populations, and/or 3) opportunities for ecological restoration or connections. These sites warrant high protection and/or restoration consideration during the development of the property master plan. This report is meant to be considered along with other information when identifying opportunities for various management designations during the master planning process.

Descriptions for each of the Primary Sites can be found in Appendix F. Information provided in the summary paragraphs includes location information, a site map, a brief summary of the natural features present, the site’s ecological significance, and management considerations.

## **Wildlife, Fishery, and State Natural Areas of the Northern Kettle Moraine Region Planning Group Primary Sites**

- NKMR01. Kiel Marsh Breeding and Migratory Bird Area
- NKMR02. Mullet Creek Forested Wetland
- NKMR03. Kamrath Creek Forest and Fen
- NKMR04. Nichols Creek Cedar Swamp and Springs
- NKMR05. Cedarburg Bog State Natural Area
- NKMR06. Jackson Marsh Cedar Swamp
- NKMR07. Jackson Marsh Southern Hardwood Swamp

## Future Needs

This project was designed to provide a rapid assessment of the biodiversity values for the NKMR. Although the report should be considered adequate for master planning purposes, additional efforts could help to inform future adaptive management efforts, along with providing useful information regarding the natural communities and rare species contained in the NKMR.

- Invasive species monitoring and control – establishing an invasives monitoring protocol will be critical for the NKMR. State wildlife areas and many other public lands throughout Wisconsin are facing major management problems because of serious infestations of highly invasive species such as emerald ash borer, gypsy moth, garlic mustard, reed canary grass, European buckthorns, and Eurasian honeysuckles. Some of these species are easily dispersed by humans and vehicles; others are spread by birds, mammals, insects, water, or wind. In order to protect the important biodiversity values of the NKMR, a comprehensive plan will be needed for detecting and rapidly responding to new invasive threats. Citizens, such as trail users or hunters, could be encouraged to report new sightings of invasive plants and animals and, perhaps, cooperate with property managers in control efforts.
- Emerald ash borer monitoring and control -- The emerald ash borer is of major concern for the NKMR as a population has been detected near Cedarburg Bog SNA and Jackson Marsh Wildlife Area. Southern Hardwood Swamps and Floodplain Forest types make up a considerable percentage of forest cover at these properties meaning that ash species are major components of the forest canopy and put them at risk for invasion. Monitoring for symptoms of EAB and rapid response to new invasions is necessary to slow or halt the spread and protect the ash resource and the forest diversity. To report suspect trees and insects contact should be made with the DNR regional health specialist.
- Vegetation plot data should be collected from the Northern Wet-mesic Forests, Calcareous Fens, and Southern Hardwood Swamps in this region. Establishing baseline vegetation transects will help to better understand these unique and diverse natural communities, help to determine if northern white-cedar is regenerating, and identify what effects deer browse are having on plant diversity
- Locations and likely habitats should be identified for conducting additional rare plant and animal surveys during appropriate seasons. This should include additional vertebrate and invertebrate animal taxon groups.
- Investigate whether increased hunting pressure on state wildlife areas can significantly decrease deer numbers to a level that allows for successful northern white-cedar regeneration.
- Inventory work focusing on identifying invertebrate assemblages associated with springs, spring runs, seeps, and fen areas should be done.
- Additional bird surveys should be done focusing on spring and fall migratory bird concentration areas and bird abundance.
- Consider updating the project boundary at Kiel Marsh Wildlife Area to include the private land that harbors the historical Southern Sedge Meadow element occurrence as well as the Muehl Springs preserve, to better protect these sensitive habitats.

# Glossary

**dolomite** – a sedimentary, often bedded rock similar to limestone but differing due to the addition of magnesium ions.

**drumlin** – streamlined, teardrop shaped hills created by glacial action. The long axis parallels the direction of past glacial movement.

**Ecological Landscape** - landscape units developed by the WDNR to provide an ecological framework to support natural resource management decisions. The boundaries of Wisconsin's sixteen Ecological Landscapes correspond to ecoregional boundaries from the National Hierarchical Framework of Ecological Units, but sometimes combine subsections to produce a more manageable number of units.

**ecological priority** – the natural communities (habitats) in each Ecological Landscape that are most important to the Species of Greatest Conservation Need, as identified in the Wisconsin Wildlife Action Plan (WDNR 2006b). Three sources of data were used to derive this information: 1) the probability that a species will occur in a given landscape, 2) the degree to which a species is associated with a particular natural community, and 3) the degree to which there are opportunities for sustaining a given natural community in any given Ecological Landscape. See [dnr.wi.gov/org/land/er/wwap/explore/tool](http://dnr.wi.gov/org/land/er/wwap/explore/tool) for more information.

**element** - the basic building blocks of the Natural Heritage Inventory. They include natural communities, rare plants, rare animals, and other selected features such as colonial bird rookeries, bat hibernacula, and mussel beds. In short, an element is any biological or ecological entity upon which we wish to gather information for conservation purposes.

**element occurrence** - an Element Occurrence (EO) is an area of land and/or water in which a rare species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential continued (or historic) presence and/or regular recurrence at a given location. For species, the EO often corresponds with the local population, but when appropriate may be a portion of a population (e.g., a single nest territory or long distance dispersers) or a group of nearby populations (e.g., metapopulation). For communities, the EO may represent a stand or patch of a natural community or a cluster of stands or patches of a natural community. Because they are defined on the basis of biological information, EOs may cross jurisdictional boundaries (modified from <http://whiteoak.natureserve.org/eodraft/index.htm>)

**esker** – a ridge, commonly sinuous, composed of sand and gravel deposited by a stream that flowed in an ice-walled channel beneath a glacier (Dott and Attig 2004).

**fen** – wetlands that receive nutrients via direct contact with mineral enriched groundwater and in which peat accumulates. “Rich” fens have relatively high concentrations of nutrients and support an assemblage of plants that often includes calcium-loving species absent from poor fens and bogs.

**kame** – steep-sided hills or mounds of water-sorted sands and gravels that were built when streams of meltwater draining from stagnant glacial ice dropped their load of sediment as their velocity decreased (Schultz 1986).

**kettle lake** – lakes formed from a depression caused by a block of buried glacier ice that gradually melted, causing the overlying land surface to collapse downward.

**Landtype Association (LTA)** - a level in the National Hierarchical Framework of Ecological Units (see next entry) representing an area of 10,000 – 300,000 acres. Similarities of landform, soil, and vegetation are the key factors in delineating LTAs.

**Migratory Bird Stopover Site** – describes a site comprising a set of habitats that birds select during migration. Ideal stopover sites provide accessible water, protection, and food so that birds can not only survive but also regain energy lost during their travels (Duncan 2002).

**moraine** – landforms composed of unsorted materials deposited by glaciers. They can cover broad geographic areas of millions of acres. Topography can vary from nearly level “til” plains to rough end moraine landscapes composed of steep dry ridges interspersed with deep kettle holes. These glacial “kettles” are frequent locations for lakes and wetlands.

**natural community** – an assemblage of plants and animals, in a particular place at a particular time, interacting with one another, the abiotic environment around them, and subject to primarily natural disturbance regimes. Those assemblages that are repeated across a landscape in an observable pattern constitute a community type. No two assemblages, however, are exactly alike.

**representative** - native plant species that would be expected to occur in native plant communities influenced primarily by natural disturbance regimes in a given landscape - e.g., see Curtis (1959).

**SGCN (or “Species of Greatest Conservation Need”)** – native wildlife species with low or declining populations that are most at risk of no longer being a viable part of Wisconsin’s fauna (from the “Wisconsin Wildlife Action Plan,” WDNR 2006b).

**Tension Zone** – a narrow region extending from northwest to southeast across Wisconsin. The tension zone separates the mixed conifer-hardwood forests of the north from the prairie/savanna/hardwood forests of the south. Many native plant and animal species occupy ranges roughly delineated by the tension zone.

# Species List

The following is a list of species referred to by common name in the report text.

Common Name	Scientific Name
<b>Animals</b>	
Acadian Flycatcher	<i>Empidonax vireescens</i>
Beaver	<i>Castor canadensis</i>
Black Tern	<i>Chlidonias niger</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>
Blanchard's Cricket Frog	<i>Acris crepitans blanchardi</i>
Blanding's Turtle	<i>Emydoidea blandingii</i>
Broad-winged Hawk	<i>Buteo platypterus</i>
Brook Stickleback	<i>Culaea inconstans</i>
Butler's Gartersnake	<i>Thamnophis butleri</i>
Canada Warbler	<i>Wilsonia canadensis</i>
Chorus Frog	<i>Pseudacris triseriata</i>
Central Mudminnow	<i>Umbra limi</i>
Common Moorhen	<i>Gallinula chloropus</i>
Great Egret	<i>Ardea alba</i>
Henslow's Sparrow	<i>Ammodramus henslowii</i>
Hine's Emerald Dragonfly	<i>Somatochlora hineana</i>
Hooded Warbler	<i>Wilsonia citrina</i>
Kentucky Warbler	<i>Oporornis formosus</i>
Least Bittern	<i>Ixobrychus exilis</i>
Least Darter	<i>Etheostoma microperca</i>
Longear Sunfish	<i>Lepomis megalotis</i>
Mudpuppy	<i>Necturus maculosus</i>
Pickereel Frog	<i>Rana palustris</i>
Queensnake	<i>Regina septemvittata</i>
Redfin Shiner	<i>Lythrurus umbratilis</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
River Otter	<i>Lutra canadensis</i>
Spring Peeper	<i>Pseudacris crucifer</i>
Swamp Metalmark Butterfly	<i>Calephelis muticum</i>
Veery	<i>Catharus fuscescens</i>
Warpaint Emerald	<i>Somatochlora incurvata</i>
Water Shrew	<i>Sorex palustris</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
Willow Flycatcher	<i>Empidonax traillii</i>
Wood Frog	<i>Rana sylvatica</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Yellow-crowned Night-heron	<i>Nyctanassa violacea</i>
<b>Plants</b>	
alder	<i>Alnus</i> spp.
alder-leaf buckthorn	<i>Rhamnus alnifolia</i>
American beech	<i>Fagus grandifolia</i>
American elm	<i>Ulmus americana</i>

<b>Common Name</b>	<b>Scientific Name</b>
<b>Plants continued...</b>	
arrowhead	<i>Sagittaria</i> spp.
basswood	<i>Tilia americana</i>
black ash	<i>Fraxinus nigra</i>
black spruce	<i>Picea mariana</i>
bloodroot	<i>Sanguinaria canadensis</i>
blue-bead-lily	<i>Clintonia borealis</i>
blue cohosh	<i>Caulophyllum thalictroides</i>
blue marsh violet	<i>Viola cucullata</i>
bog bean	<i>Menyanthes trifoliata</i>
bog birch	<i>Betula pumila</i>
brambles	<i>Rubus</i> spp
brook grass	<i>Catabrosa aquatica</i>
bur oak	<i>Quercus macrocarpa</i>
bulrushes	<i>Scirpus</i> spp.
bunchberry	<i>Cornus canadensis</i>
bush honeysuckle	<i>Lonicera x bella</i>
Canada mayflower	<i>Maianthemum canadense</i>
Canada bluejoint	<i>Calamagrostis canadensis</i>
cattails	<i>Typha</i> spp.
cinnamon fern	<i>Osmunda cinnamomea</i>
common buckthorn	<i>Rhamnus cathartica</i>
common reed	<i>Phragmites australis</i>
common winterberry	<i>Ilex verticillata</i>
cotton-grasses	<i>Eriophorum</i> spp
cuckoo-flower	<i>Cardamine pratensis</i>
currant	<i>Ribes</i> spp
dogwood	<i>Cornus</i> spp
early meadow-rue	<i>Thalictrum dioicum</i>
eastern hop-hornbeam	<i>Ostrya virginiana</i>
enchanter's nightshade	<i>Circaea alpina</i>
European honeysuckle	<i>Lonicera</i> spp.
false nettle	<i>Boehmeria cylindrica</i>
fen star sedge	<i>Carex sterilis</i>
forked aster	<i>Aster furcatus</i>
fringed brome	<i>Bromus ciliatus</i>
garlic mustard	<i>Alliaria petiolata</i>
gay-wings	<i>Polygala paucifolia</i>
glossy buckthorn	<i>Rhamnus frangula</i>
gold-thread	<i>Coptis trifolia</i>
grape	<i>Vitis</i> spp.
grass-of-Parnassus	<i>Parnassia glauca</i>
green ash	<i>Fraxinus pennsylvanica</i>
hackberry	<i>Celtis occidentalis</i>
helleborine orchid	<i>Epipactis helleborine</i>
impatiens	<i>Impatiens capensis</i>
Jack-in-the-pulpit	<i>Arisaema triphyllum</i>
Kalm's lobelia	<i>Lobelia kalmii</i>
lake sedge	<i>Carex lacustris</i>

<b>Common Name</b>	<b>Scientific Name</b>
<b>Plants continued...</b>	
large-flowered bellwort	<i>Uvularia grandiflora</i>
large-flowered trillium	<i>Trillium grandiflorum</i>
leatherleaf	<i>Chamaedaphne calyculata</i>
mare's tail	<i>Hippurus vulgaris</i>
marsh marigold	<i>Caltha palustris</i>
marsh muhly	<i>Muhlenbergia glomerata</i>
marsh valerian	<i>Valeriana sitchensis</i>
May-apple	<i>Podophyllum peltatum</i>
multiflora rose	<i>Rosa multiflora</i>
nettles	<i>Laportea</i> spp.
Northern white-cedar	<i>Thuja occidentalis</i>
Northern yellow lady's-slipper	<i>Cypripedium parviflorum</i>
Pennsylvania sedge	<i>Carex pensylvanica</i>
pitcher plant	<i>Sarracenia purpurea</i>
poison ivy	<i>Toxicodendron radicans</i>
prickly ash	<i>Zanthoxylum americanum</i>
poison sumac	<i>Toxicodendron vernix</i>
paper birch	<i>Betula papyrifera</i>
red maple	<i>Acer rubrum</i>
red oak	<i>Quercus rubra</i>
red-osier dogwood	<i>Cornus stolonifera</i>
reed canary grass	<i>Phalaris arundinacea</i>
round-leaved monkey flower	<i>Mimulus glabratus</i>
round-leaf sundew	<i>Drosera rotundifolia</i>
sedges	<i>Carex</i> spp
shagbark hickory	<i>Carya ovata</i>
shrubby cinquefoil	<i>Pentaphylloides floribunda</i>
silver maple	<i>Acer saccharinum</i>
skullcap	<i>Scutellaria</i> sp.
skunk cabbage	<i>Symplocarpus foetidus</i>
smartweed	<i>Polygonum</i> spp.
sneezeweed	<i>Helenium</i> sp.
spike-rushes	<i>Eleocharis</i> spp.
spring beauty	<i>Claytonia virginica</i>
starflower	<i>Trientalis borealis</i>
stiff cowbane	<i>Oxypolis rigidior</i>
stinging nettle	<i>Urtica dioica</i>
sugar maple	<i>Acer saccharum</i>
sumac	<i>Rhus</i> spp.
swamp white oak	<i>Quercus bicolor</i>
swamp lousewort	<i>Pedicularis lanceolata</i>
swamp thistle	<i>Cirsium muticum</i>
tamarack	<i>Larix laricina</i>
turtlehead	<i>Chellone</i> sp.
tussock sedge	<i>Carex stricta</i>
twinflower	<i>Linnaea borealis</i>
Virginia creeper	<i>Parthenocissus quinquefolia</i>
Virginia waterleaf	<i>Hydrophyllum virginianum</i>

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<b>Common Name</b>	<b>Scientific Name</b>
<b>Plants continued...</b>	
watercress	<i>Nasturtium officinale</i>
water parsnip	<i>Berula erecta</i>
white ash	<i>Fraxinus americana</i>
white avens	<i>Geum canadense</i>
white oak	<i>Quercus alba</i>
wild geranium	<i>Geranium maculatum</i>
wild ginger	<i>Asarum canadense</i>
wood nettle	<i>Laportea canadensis</i>
wood sedge	<i>Carex blanda</i>
willow	<i>Salix</i> spp
yellow birch	<i>Betula alleghaniensis</i>
yellow-bud hickory	<i>Carya cordiformis</i>
zigzag goldenrod	<i>Solidago flexicaulis</i>

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## Appendix A

### Natural Heritage Inventory Overview and General Methodology

This biotic inventory and analysis was conducted by the Wisconsin Natural Heritage Inventory (NHI) program. The Wisconsin NHI program is part of the Wisconsin DNR's Bureau of Endangered Resources and a member of an international network of Natural Heritage programs representing all 50 states, as well as portions of Canada, Latin America, and the Caribbean. These programs share standardized methods for collecting, processing, and managing data for rare species and natural communities. NatureServe, an international non-profit organization, coordinates the network. This appendix provides a general overview of the methodology we use for these projects. Please see the NatureServe Web site for more detailed information about standard methods used by the Heritage Network ([www.NatureServe.org](http://www.NatureServe.org)) for locating, documenting, and ranking rare species and natural community occurrences.

#### General Process Used when Conducting Biotic Inventories for Master Planning

The Wisconsin NHI Program typically uses a “coarse filter-fine filter” approach to conducting biotic inventory projects for master planning. This approach begins with a broad assessment of the natural communities and aquatic features present, along with their relative quality and condition. The area's landforms, soils, topography, hydrology, current land uses, and the surrounding matrix are also evaluated using Geographic Information Systems (GIS) and other electronic and hardcopy data sources. Data that describe conditions for the area prior to Euro-American settlement are often used during this step and at other times to further understand the ecological capabilities of the area. Often, we consult with local managers, biologists, or others familiar with the ecology of the area when preparing for an inventory project. The goals for this step are to identify the important ecological attributes and biological processes present, as well as to focus our inventory efforts.

The level of survey intensity varies based on the size and ecological complexity of the property, or group of properties, as well as the resources available. For larger properties such as state forests, biotic inventory efforts typically take more than one year. Ideally, taxa surveys are conducted following a coarse-filter analysis that sometimes include extensive natural community surveys. There is often time for “mop-up work” during the year following the completion of the main survey effort, whereby additional surveys are conducted for areas that could not be reached the first year or for which new information has become available. For smaller properties, a “Rapid Ecological Assessment” often takes the place of a full-scale biotic inventory. The level of effort for these projects varies based on the needs of the study area, although surveys are almost always completed during one field season. Coarse filter work for rapid assessments is often done based on GIS data, aerial photos, data acquired from previous efforts, and information from property managers and others knowledgeable about the area.

Taxa-specific surveys can be costly and intensive and sometimes must be completed during a very narrow period of time. For example, bird surveys must be completed within a one-month time window. For this and several other reasons, ***our surveys cannot locate every rare species occurrence within a given area.*** Therefore, it is important to use resources as efficiently as possible, making every effort to identify the major habitats present in the study area from the start. This approach concentrates inventory efforts on those sites most likely to contain target species to maximize efficient use of resources. Communication among biologists during the field season can help identify new areas of interest or additional priorities for surveys. The goal is to locate species populations with the highest conservation value whenever possible.

After all of the data are collected, occurrences of rare species and high-quality natural communities are documented, synthesized, and incorporated into the NHI Database. The NHI program refers to this

process as “mapping” the data and uses a tabular and spatial database application designed specifically for the Heritage Network. Other secondary databases are also used by the Wisconsin NHI Program for storing additional species and community information such as species lists, waypoints, photos, and other site documentation.

Once the data mapping and syntheses are completed, the NHI Program evaluates data from the various department biologists, contractors, and other surveyors. This information is examined along with many other sources of spatial and tabular information including topographic maps, various types of aerial photography, digital soil and wetland maps, hydrological data, forest reconnaissance data, and land cover data. Typically, GPS waypoints and other spatial information from the various surveys are superimposed onto these maps for evaluation by NHI biologists.

In addition to locating important rare species populations and high-quality natural community occurrences, the major products culminating from all of this work are the “Primary Sites.” These areas contain relatively undisturbed, high-quality, natural communities; provide important habitat for rare species; offer opportunities for restoration; could provide important ecological connections; or some combination of the above factors. The sites are meant to highlight, based on our evaluation, the best areas for conserving biological diversity for the study area. They often include important rare species populations, High Conservation Value Forests, or other ecologically important areas.

The final report describes the Primary Sites, as well as rare or otherwise notable species, and other ecological opportunities for conserving or enhancing the biological diversity of the study area. The report is intended for use by department master planning teams and others and strives to describe these opportunities at different scales, including a broad, landscape context that can be used to facilitate ecosystem management.

### **Select Tools Used for Conducting Inventory**

The following are descriptions of standard tools used by the NHI Program for conducting biotic inventories. Some of these may be modified, dropped, or repeated as appropriate to the project.

**File Compilation:** Involves obtaining existing records of natural communities, rare plants and animals, and aquatic features for the study area and surrounding lands and waters from the NHI Database. Other databases with potentially useful information may also be queried, such as: forest reconnaissance data; the DNR Surface Water Resources series for summaries of the physical, chemical, and biological characteristics of lakes and streams (statewide, by county); the Milwaukee Public Museum's statewide Herp Atlas; the Wisconsin Breeding Bird Atlas; other NHI “atlas” and site databases; museum/herbarium collections for various target taxa; soil surveys; and the department's fish distribution database.

Additional data sources are sought out as warranted by the location and character of the site, and the purpose of the project. Manual files maintained within the Bureau of Endangered Resources, including the State Natural Area files, often contain information on a variety of subjects relevant to the inventory of natural features for an area.

**Literature Review:** Field biologists involved with a given project consult basic references on the natural history and ecology of the area. This sometimes broadens and/or sharpens the focus of the inventory efforts.

**Target Elements:** Lists of target elements including natural communities, rare plants and animals, and aquatic features are developed for the study area. Field inventory is then scheduled for the times when these elements are most identifiable or active. Inventory methods follow accepted scientific standards for each taxon.

**Compilation of Maps and Other Spatial Data:** USGS 7.5 minute topographic quadrangles, most often in digital form, serve along with aerial photos as the base maps for field survey and often yield useful clues regarding access, extent of area to be surveyed, developments, and the presence and location of special features. These are used in conjunction with numerous Geographic Information Systems (GIS) layers, which are now a basic resource tool for the efficient and comprehensive planning of surveys and the analysis of their results.

WDNR wetland maps consist of aerial photographs upon which all wetlands down to a scale of 2 or 5 acres have been delineated. Each wetland polygon is classified based on characteristics of vegetation, soils, and water depth. These polygons have been digitized for most counties, and the resulting GIS layers can be superimposed onto other maps.

Ecoregion GIS layers are useful for comprehensive projects covering large geographic areas such as counties, national and state forests, and major watersheds. These maps integrate basic ecological information on climate, landforms, geology, soils, and vegetation. Ecological Landscapes provide the broad framework most often used in Wisconsin; however smaller units, including Landtype Associations, can be very helpful for evaluating ecoregions at finer scales.

**Aerial photographs:** These provide information on a study area not available from maps, paper files, or computer printouts. Examination of both current and historical photos, taken over a period of decades, can be especially useful in revealing changes in the environment over time. The Wisconsin NHI Program uses several different types of both color and black and white air photos. Typically, these are in digital format, although paired photos in print format can be valuable for stereoscopic viewing. High-resolution satellite imagery is often cost-prohibitive but is available for some portions of the state and is desirable for certain applications.

**Original Land Survey Records:** The surveyors who laid out the rectilinear Town-Range-Section grid across the state in the mid-nineteenth century recorded trees by species and size at all section corners and along section lines. Their notes also included general impressions of vegetation, soil fertility, and topography, and note aquatic features, wetlands, and recent disturbances such as windthrow and fire. As these surveys typically occurred prior to extensive settlement of the state by Europeans, they constitute a valuable record of conditions prior to extensive modification of the landscape by European technologies and settlement patterns. The tree data are available in GIS format as raw points or interpreted polygons, and the notes themselves can provide helpful clues regarding the study area's potential ecological capabilities.

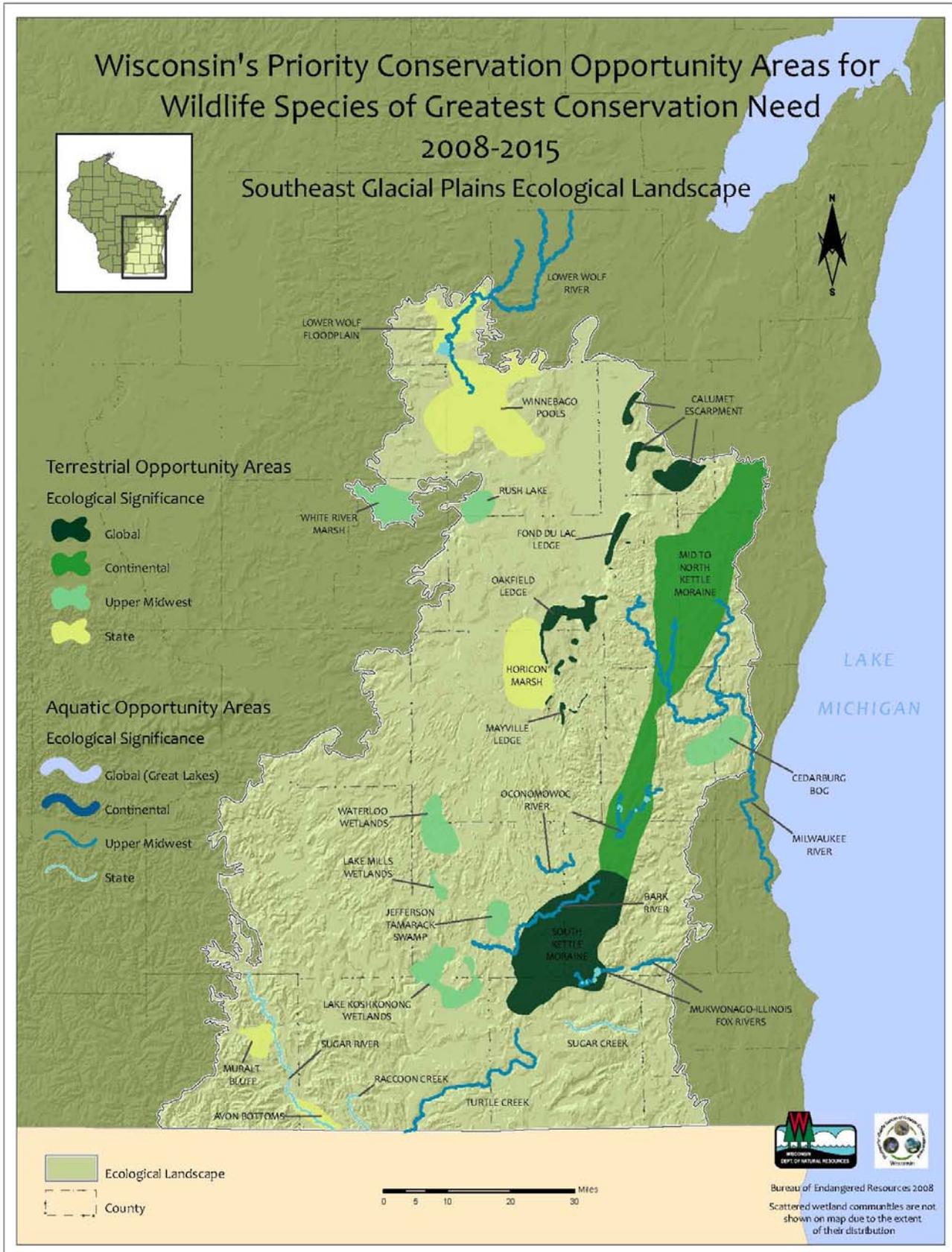
**Interviews:** Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield invaluable information.

**Global Positioning Systems (GPS):** Small, portable GPS units are now a routine piece of field equipment used for virtually all NHI survey work. Collecting coordinates (waypoints) facilitates mapping and makes it easy to quickly communicate specific locations among biologists. Often waypoints are paired with photos and/or other information and stored in a waypoint tracking database.

**Aerial Reconnaissance:** Fly-overs are desirable for large sites, and for small sites where contextual issues are especially important. When possible, this should be done both before and after ground level work. Flights are scheduled for those times when significant features of the study area are most easily identified and differentiated. They are also useful for observing the general lay of the land, vegetation patterns and patch sizes, aquatic features, infrastructure, and disturbances within and around the site.



# Appendix B



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## Appendix C

### Summary Descriptions for Rare Species and High Quality Natural Communities Documented on the Northern Kettle Moraine Region Planning Group

The following paragraphs give brief summary descriptions for some of the rare species and high quality natural communities documented on the Wildlife, Fishery, and State Natural Areas of the Northern Kettle Moraine Region Planning Group and mapped in the NHI Database. More information can be found on the Endangered Resources Web site (<http://dnr.wi.gov/org/land/er/>) for several of these species and natural communities.

#### **Rare Animals**

##### **Acadian Flycatcher**

Acadian Flycatcher (*Empidonax virescens*) prefers lowland deciduous forests and heavily wooded hillsides in large blocks of southern forests. The breeding season extends from mid-May through late July.

##### **American Bullfrog**

American Bullfrog (*Rana catesbeiana*), a State Special Concern frog, may be found throughout Wisconsin in any permanent body of water - lakes, ponds, rivers, and creeks, although they have a very patchy distribution. In Wisconsin, bullfrogs appear to favor oligotrophic to mesotrophic waters, often breeding where dense submergent vegetation filters out the majority of the suspended solids. Adult bullfrogs overwinter in water to avoid freezing. Bullfrogs are active from April through mid-October. They breed from mid-May through late July or later. Larvae overwinter before transforming the following year or, in rare situations, in their second full year.

##### **Aurora Damselfly**

Aurora dancer (*Chromagrion conditum*), a State Special Concern damselfly has been found in pools and slow backwaters of clean, often spring-fed streams. Their flight period is from mid to late July.

##### **Black-crowned Night Heron**

Black-crowned Night-heron (*Nycticorax nycticorax*) prefer freshwater wetlands dominated by bulrush and cattail with small groves of alder, willow, or other brush. Their breeding season occurs from mid-April through mid-September.

##### **Black Tern**

Black Tern (*Chlidonias niger*) prefers large shallow marshes with abundant vegetation adjacent to open water. Nesting occurs from May through the end of July.

##### **Blanding's Turtle**

Blanding's turtles (*Emydoidea blandingii*) are listed as a Threatened species in Wisconsin. They utilize a wide variety of aquatic habitats including deep and shallow marshes, shallow bays of lakes and impoundments where areas of dense emergent and submergent vegetation exists, sluggish streams, oxbows and other backwaters of rivers, drainage ditches (usually where wetlands have been drained), and sedge meadows and wet meadows adjacent to these habitats. This species is semi-terrestrial and individuals may spend a good deal of time on land. They often move between a variety of wetland types

during the active season, which can extend from early March to mid-October. They overwinter in standing water that is typically more than 3 feet in deep and with a deep organic substrate but will also use both warm and cold-water streams and rivers where they can avoid freezing. Blanding's generally breed in spring, late summer or fall. Nesting occurs from about mid-May through June depending on spring temperatures. They strongly prefer to nest in sandy soils and may travel well over a mile to find suitable soils. This species appear to display nest site fidelity, returning to its natal site and then nesting in a similar location annually. Hatching occurs from early August through early September but hatchlings can successfully overwinter in the nest, emerging the following late April or May. This species takes 17 to 20 years or more to reach maturity.

### **Broad-winged Skipper**

Broad-winged skipper (*Poanes viator*), a State Special Concern butterfly, is a wetland obligate. It is found in small localized colonies in sedge marsh/swamp with *C. lacustris*, *aquatilis*, *lasiocarpa*. Perhaps needs a relatively high water table where it is found with cattails and sedges. This is a univoltine species with adults present in July or into early August. The hibernation site is unknown but broadwinged skippers overwinter as partially grown larvae.

### **Butler's Gartersnake**

Butler's gartersnake (*Thamnophis butleri*), a snake listed as Threatened in Wisconsin, prefers wet-mesic prairies, marshes and adjacent grassy and vacant areas, requiring a moderately open to open canopy habitat, preferably with both upland and wetland habitat. The breeding season occurs from late March to late April and young are born in mid to late summer.

### **Canada Warbler**

Canada Warblers (*Dendroica cerulean*) are typically most abundant in moist, mixed coniferous-deciduous forests with a well-developed understory. In Wisconsin they occur in spruce, hemlock, and balsam fir forest types in the northern counties. Important components of breeding habitat include conifers and often creeks and streams. The Canada Warbler nests in dense vegetation, often in areas with mosses, ferns, and decaying stumps or logs. The breeding season occurs from early June to early July.

### **Common Moorhen**

Common Moorhen (*Gallinula chloropus*), a Special Concern bird, prefers shallow marshes, especially where shallow lakes are rimmed with ample marsh vegetation. The breeding season extends from mid-May to late July.

### **Eightfold Pinecone**

Eightfold Pinecone, (*Strobilops affinis*), a terrestrial snail listed as Special Concern, has a brown shell that ranges from 2.75-2.8mm in width. It is often found in forest habitat in leaf litter and woody debris.

### **Hine's Emerald Dragonfly**

Hine's Emerald Dragonfly (*Somatochlora hineana*), a Federal and State Endangered dragonfly, has been found in small cool calcareous marshy streams on bedrock. The flight period extends from early to late July.

### **Hooded Warbler**

Hooded Warbler (*Wilsonia citrina*) is found in large upland forest tracts in southern Wisconsin, where they occur in pockets of dense understory near small or partial canopy openings. Breeding occurs from late May through mid July.

**Kentucky Warbler**

Kentucky Warbler breeds in large tracts of unfragmented hardwood forest in southern Wisconsin, especially along the Mississippi and Wisconsin rivers, as well as in the Baraboo Hills. They nest in moist thickets with heavy undergrowth and lush ground vegetation, building their nests on or near the ground. The breeding season extends from mid-May through July. Based on information from the Wisconsin Wildlife Action Plan (WDNR 2006b) the habitats of highest Ecological Priority for this species in the Western Coulee and Ridges Ecological Landscape are large stands of Southern Dry-mesic Forest, Southern Mesic Forest and Floodplain Forest.

**Least Bittern**

Least Bittern (*Ixobrychus exilis*), a Special Concern bird in Wisconsin. This species prefers freshwater marshes where cattails and reeds predominate in swamps and marshes and dense emergent vegetation. Breeding occurs from mid May to mid July.

**Least Darter**

Least Darter (*Etheostoma microperca*), a fish listed as Special Concern, prefers clear, warm, quiet waters of overflow ponds, pools, lakes and streams over substrates of gravel, silt, sand, boulders, mud or clay with dense vegetation or filamentous algal beds. Spawning occurs from late April through July.

**Longear Sunfish**

Longear Sunfish (*Lepomis megalotis*), a fish listed as Threatened in Wisconsin, prefers clear, shallow, moderately warm, still waters of streams and occasionally in lakes. Found in or near vegetation. Spawning occurs from late May through mid-July, sporadic to August.

**Mulberry Wing**

Mulberry wing (*Poanes massasoit*), a Special Concern butterfly, has been found in marshes and sedge meadows. Host plants appear to be arrow-leaved sedges including *Carex stricta*, and possibly *C. aquatilis*. This butterfly is univoltine with the flight period from mid to late June through July. Mulberry wings overwinter as partially grown larvae.

**Pleistocene Catinella**

Pleistocene Catinella, (*Catinella exile*), a terrestrial snail listed as Special Concern, has an orange colored shell that measures approximately 4.9mm long. It is most often found in leaf litter under *Salix candida* and in moist depressions on open fen mats.

**Pickerel Frog**

Pickerel frogs (*Lithobates palustris*) are a Species of Special Concern in Wisconsin. It has a rather complex habitat range as it prefers to overwinter in cold water streams, seepage pools or spring holes, often taking advantage of water cress for cover. It moves to warmer water ponds to breed and lay eggs from April through mid-June. Adults spend most of the active season foraging on land in riparian habitats along streams and rivers. This species is active from late March to early November but can remain semi-active in winter under water. Larvae metamorphose from mid-July to mid-August.

**Prairie Crawfish**

Prairie crayfish (*Procambarus gracilis*) is a State Special Concern crayfish. This primarily burrowing crayfish inhabits prairie regions of southeastern Wisconsin. This species frequents burrows in banks of ponds, roadside ditches, small sluggish creeks, marshes, swamps, and small artificial lakes, as well as wet pastures and flat fields in prairies. This is the rarest crayfish in Wisconsin. Breeding occurs and young hatch in early spring, as early as March, with juveniles occurring through spring and summer.

### **Pygmy Shrew**

Pygmy Shrew (*Sorex hoyi*) is found in among debris and heavy vegetation in woods, clearings, and meadows, particularly those grown to high grass. Avoiding swampy or excessively wet areas, though can be found in cold sphagnum or tamarack bogs.

### **Queen Snake**

Queen snake (*Regina septemvittata*), a snake listed as Endangered in Wisconsin, prefers clear, spring-fed streams with moderate to fast currents and rock bottoms, southern lowland forests, and shrub-carr communities. Breeding occurs during Spring and Fall.

### **Redfin Shiner**

Redfin Shiner (*Lythrurus umbratilis*), a fish listed as Threatened in Wisconsin, prefers clear to turbid waters of pools in low-gradient streams over substrates of cobble, sand, clay, silt or bedrock. Spawning occurs from early June through mid-August in sunfish nests and they coexist with the sunfish in the nesting territory.

### **Red-shouldered Hawk**

Red-shouldered Hawk (*Buteo lineatus*) prefers larger stands of medium-aged to mature lowland deciduous forests, dry-mesic and mesic forest with small wetland pockets. Breeding occurs from mid-March through early August.

### **Regal Fritillary**

Regal fritillary (*Speyeria idalia*), a butterfly presently listed as a Federal Species of Concern and Endangered in Wisconsin, has been found in large grassland areas with tallgrass prairie remnants or lightly grazed pasture lands containing prairie vegetation. The larval food plants are violets, primarily prairie violet (*Viola pedatifida*), birdsfoot violet (*V. pedata*) and arrowleaf violet (*V. sagittata*). Adults are present between late June and early September with peak flight usually the first part of July

### **Slipper shell**

Slipper shell (*Alasmidonta viridis*), a mussel listed as Threatened in Wisconsin, is found in small to medium-sized streams with flowing hard water, sand or gravel bottoms. It is presently found only in the eastern and southern parts of Wisconsin. The known hosts are banded and mottled sculpins and johnny darter.

### **Swamp Metalmark**

Swamp metalmark (*Calephelis mutica*), a butterfly listed as Endangered in Wisconsin, has been found in alkaline wetlands (fens). Wet meadows, marshes or tamarack bogs may surround fen areas. Its host plant is swamp thistle, *Cirsium muticum*. The single two-week flight period occurs between mid-July and mid-August.

### **Tapered Vertigo**

Tapered Vertigo, (*Vertigo elatior*), a terrestrial snail listed as Special Concern, has a shell that is tan to cinnamon in color, and ranges from 2.1-2.2mm in length. It prefers high quality fen habitats.

### **Warpaint Emerald**

Warpaint emerald (*Somatochlora incurvata*), a State Endangered dragonfly, occurs has been found in spring-fed bogs, poor fens, and heaths. Wisconsin larval habitat is central poor fens with sphagnum moss. The flight period extends from mid July through late August.

### **Yellow-billed Cuckoo**

Yellow-billed Cuckoo (*Coccyzus americanus*) prefer open deciduous woodlands with dense shrubby undergrowth, especially along the backwaters of a major river or slow moving creek. Breeding occurs most often in early June, but can be found as late as mid-August.

### **Yellow-crowned Night-heron**

Yellow-crowned Night-heron (*Nyctanassa violacea*), a bird listed as Threatened in Wisconsin, is found in swamps and river bottomlands.

## **Rare Plants**

*Amerorchis rotundifolia* (Round-leaved orchis) was historically known from Cedarburg Bog SNA. This Threatened orchid species grows in cold springy mixed conifer swamps. Most records are from the northeastern part of the state plus several from northwestern Wisconsin and Ozaukee County. There are 14 occurrences in the NHI database, nine of which are considered extant.

*Anemone multifida* var. *hudsoniana* (Early anemone) was collected in the early 1900s in the vicinity of Kiel Marsh. This Endangered species grows on sandy or limey cliffs and dry prairies. It has only been found twice in Wisconsin, historically in Sheboygan County and currently in Adams County.

*Arethusa bulbosa* (Swamp-pink) This showy orchid occurs on neutral bog and fen mats with a mix of sedges, ericads, and Sphagnum mosses. With the exception of the Driftless Area, swamp-pink has been found in many counties throughout the state. However, some of the more southerly locations have not been documented recently.

*Artemisia dracunculus* (Dragon wormwood) was collected in the vicinity of Kiel Marsh in 1940. This Special Concern species has only been documented 16 times in the state and only five of those are considered extant. Locations are scattered in far western, far eastern, and south-central Wisconsin. Dragon wormwood grows on dry bluff prairie and also been found along railroads.

*Aster furcatus* (Forked aster) Forked aster is listed as Threatened and occurs only in the southeastern part of the state, ranging only as far north as Sheboygan County. This aster grows in dry to mesic hardwood forests, often on stream sides or slopes with dolomite near the surface.

*Calamagrostis stricta* (Slim-stem small-reedgrass) This Special Concern grass has been found scattered, with the exception of the Driftless Area, throughout the state. Slim-stem small-reedgrass has been found in a variety of habitats including dry to moist dunes, barrens, and dolomite or sandstone ledges (mostly near the Great Lakes) as well as in calcareous wetlands such as fens.

*Calylophus serrulatus* (Yellow evening primrose) was collected in the vicinity of Kiel Marsh around 1900. Yellow evening primrose grows mostly on steep bluff prairies as well as cedar glades and, occasionally, in moister prairies. Most populations of this Special Concern plant are from along the Mississippi and lower St. Croix Rivers but there are scattered locations in the eastern part of the state too.

*Cardamine pratensis* (Cuckooflower), a species of Special Concern, is found in cold, seeping calcareous swamps. Most of the occurrence of this member of the mustard family are south of a line that runs roughly between Forest and Vernon counties, with a couple of records in west-central Wisconsin.

*Carex gynocrates* (Northern bog sedge) This Special Concern sedge prefers cold, wet neutral to calcareous conifer swamps. The Ozaukee County record is the southern most in the state; the remaining records are in the northeast quarter of the state.

*Carex livida var. radicaulis* (Livid sedge) Livid sedge grows in fens or, less commonly, on bog mats and occasionally in ditches. Distribution of livid sedge is patchy with clusters in central Wisconsin, Door County, and a few in the northeast and southeast.

*Carex richardsonii* (Richardson sedge) was found near Kiel Marsh in the 1920s. This Special Concern sedge grows in dry prairies and barrens. Most of the records for Richardson sedge are from northwest, southwest, and south-central Wisconsin, and the Sheboygan County record is isolated from the remaining occurrences.

*Carex tenuiflora* (Sparse-flowered sedge) Sparse-flowered sedge grows in open to closed canopy cold, wet, coniferous forests, usually on neutral to calcareous substrates. Most of the records are in the northern tier of counties with a few occurrences as far south as Racine County.

*Corallorhiza odontorhiza* (Autumn coral-root) is a small orchid that was collected at Cedarburg Bog in the 1930s and has not been relocated since. Autumn coral-root can be found in dry-mesic to mesic deciduous forests. With the exception of a couple of records, most populations of autumn coral-root are from the southern third of the state.

*Cypripedium arietinum* (Ram's-head lady's-slipper) This diminutive orchid grows on basic substrates in various habitats, but it is most characteristic of conifer swamps. Most of the occurrences are from the northern third of the state, and almost all of the records from east-central Wisconsin are historic without having been observed recently.

*Cypripedium parviflorum var. makasin* (Northern yellow lady's-slipper) Northern yellow lady's-slipper grows in fens, calcareous swales, northern wet-mesic forests, and rich springy forest edges. The Special Concern orchid has been documented at scattered locations throughout much of the state.

*Cypripedium reginae* (Showy lady's-slipper) had been collected in the vicinity of Kiel Marsh in 1918. It grows in neutral to alkaline forested wetlands; it is also found in rich upland forests in seeps and on moist to dry clay bluffs. Showy lady's-slipper is a species of Special Concern and is scattered throughout Wisconsin in the appropriate habitat.

*Drosera linearis* (Slenderleaf sundew) Threatened carnivorous plant grows on open bog and fen mats. There only five populations known to exist in the state and all of them are in the southeastern quarter of the state.

*Eleocharis olivacea* (Capitate spikerush) was collected at Cedarburg Bog in 1934. Capitate spikerush is found on sandy, mucky, or peaty shorelines, as well as bog and poor fen mats. The 12 extant populations of this Special Concern spikerush are scattered in the eastern half of the state.

*Eleocharis quinqueflora* (Few-flower spikerush) was also collected at Cedarburg Bog in 1934. It grows on cold coniferous poor fen mats and also in a variety of moist meadows in calcareous areas. Statewide distribution is similar to capitate spikerush.

*Gentiana alba* (Yellow gentian) was collected in the vicinity of Kiel Marsh in 1918. Yellow gentian is a Threatened species and can be found in thin soil in dry, open woodlands, ridges, and bluffs (often with

dolomite near the surface), as well as mesic prairies, moist sand prairies and roadside ditches. Most of the known populations are south of the tension zone.

*Lithospermum latifolium* (American gromwell) was also collected in the vicinity of Kiel Marsh in 1918. American gromwell is a species of upland hardwood forests, often in those having dolomite near the surface. Populations are mainly south of the tension zone, with a large concentration of this Special Concern species in southeastern Wisconsin.

*Malaxis monophyllos var. brachypoda* (White adder's-mouth) There are about 45 populations known to be extant in the state but many of those are small. Habitat for white adder's-mouth is in neutral or calcareous conifer or black ash swamps. Most of the occurrences are in northern Wisconsin with a large concentration in the northeast; Ozaukee County is the southernmost extent of this orchid.

*Onosmodium molle* (Marbleseed) was collected in the vicinity of Cedarburg Bog in the early 1900s. Marbleseed grows in dry prairies and woodlands. Two varieties occur in Wisconsin, and there is some overlap in their distribution. All of the 19 known populations of this Special Concern species are south of the tension, mostly within the first two counties in from the state borders.

*Platanthera dilatata* (Leafy white orchis) Leafy white orchis grows on neutral to calcareous bog and fen mats, sometimes with scattered tamarack and white cedar. There are about 25 populations of this Special Concern orchid known in Wisconsin. Many are found in the northern part of the state with a few in the southeast.

*Platanthera hookeri* (Hooker orchis) Populations are scattered across the state, but fewer than half of the documented occurrences are known to be extant. Hooker orchis (Special Concern) grows in a variety of dry to moist habitats but mostly in mixed coniferous-hardwood forests.

*Platanthera leucophaea* (Prairie White-fringed Orchid) is listed as Endangered by Wisconsin and Threatened by the federal government. This spectacular orchid is pollinated by sphinx moths. *Platanthera leucophaea* grows in moist, deep-soiled, often calcareous, prairies and rarely in tamarack fens; populations have also been found in sedge meadows and in a patterned peatland. Most of the populations are in southeast and south-central Wisconsin, but a couple of populations are as far north as Winnebago County.

*Platanthera orbiculata* (Large roundleaf orchid) was collected in the vicinity of Kiel Marsh in 1915. A species of Special Concern, large roundleaf orchid grows in moist hardwood or mixed conifer-hardwood forests. Populations have been documented throughout much of the state excepting the Driftless Area. There are a large number of occurrences in northwestern Wisconsin. About half of the occurrences are considered to be historic.

*Thalictrum revolutum* (Waxleaf meadowrue) was documented near Cedarburg Bog in 1976. Waxleaf meadowrue grows in moist, often calcareous meadows. It is also naturalized on railroad embankments. This is a Special Concern species that is related to buttercups and has been documented in eastern Wisconsin extending as far north as southern Oconto County. Fewer than half of the occurrences are considered extant.

*Tofieldia glutinosa* (Sticky false-asphodel) This interesting species is listed as Threatened, and there are about 23 populations known to be extant in the state with most in the southeast quarter and Door County. Sticky false-asphodel grows on marly shorelines, cold calcareous seeps, and fens.

*Triglochin maritima* (Common bog arrow-grass) is another species of Special Concern. Common bog arrow-grass occurs on fen mats, open neutral to calcareous conifer swamps, and in Great Lakes swales. Most of the populations are in eastern Wisconsin, but there are scattered occurrences in the western part of the state especially near Lake Superior.

*Triglochin palustris* (Slender bog arrow-grass) was collected near Kiel Marsh in the early 1900s. Slender bog arrow-grass grows on muddy to marly fen and bog edges, as well as in calcareous sedge meadows. The vast majority of populations are in eastern Wisconsin from Marinette County south, with a couple of other populations on Lake Superior.

*Trisetum melicoides* (Purple false oats) were collected in the late 1870s in the vicinity of Kiel Marsh. This Endangered species grows in rich hardwood or mixed forests near Lake Michigan, as well as on shoreline dolomite and in swales in dunes. Only two of a documented five populations are considered to be extant.

*Valeriana sitchensis ssp uliginosa* (Marsh valerian) was collected in the vicinity of Kiel Marsh in 1938. A Threatened species, marsh valerian grows in calcareous conifer swamps. There are about 16 extant records in the state.

## **Natural Communities**

### **Calcareous Fen**

Calcareous fens occur mostly in southern Wisconsin, on sites that are fed by carbonate-enriched groundwater. Most fens are small, covering no more than a few acres, and are often associated and can intergrade with more abundant and widespread wetland communities such as southern sedge meadow, wet prairie, shrub-carr, emergent marsh, and southern tamarack swamp. An accumulation of peat can raise the fen surface to a height of several meters above the adjoining lands. The diverse fen flora is distinctive, containing many calciphiles of restricted distribution. Common or representative plants include sedges, marsh fern, shrubby cinquefoil, shrubby St. John's-wort, Ohio goldenrod, grass-of-parnassus, twig-rush, brook lobelia, boneset, swamp thistle, and asters. Many fens have a significant number of prairie or sedge meadow components, and some contain plants often associated with bogs, such as tamarack, bog birch and pitcher plant. Fens occur in several landscape settings, including the bases of morainal slopes, on sloping deposits of glacial outwash, in the headwaters regions of spring runs and small streams, and on the shores of alkaline drainage lakes.

### **Emergent marsh**

These open, marsh, lake, riverine and estuarine communities with permanent standing water are dominated by robust emergent macrophytes, in pure stands of single species or in various mixtures. Dominants include cat-tails (*Typha spp.*), bulrushes (particularly *Scirpus acutus*, *S. fluviatilis*, and *S. validus*), bur-reeds (*Sparganium spp.*), giant reed (*Phragmites australis*), pickerel-weed (*Pontederia cordata*), water-plantains (*Alisma spp.*), arrowheads (*Sagittaria spp.*), and the larger species of spikerush such as (*Eleocharis smallii*). Aquatic plants, including both emergent and submergent aquatic vegetation, form the foundation of healthy and flourishing aquatic ecosystems - both within lakes and rivers and on the shores and wetlands around them. They not only protect water quality, but they also produce life-giving oxygen. Aquatic plants are a lake's own filtering system, helping to clarify the water by absorbing nutrients like phosphorus and nitrogen that could stimulate algal blooms. Plant beds stabilize soft lake and river bottoms and reduce shoreline erosion by reducing the effect of waves and current. Aquatic plants also serve as spawning habitat for fish and amphibians, as shelter for various life stages of a variety of species, and as nesting habitat for birds. Plant beds support populations of

aquatic insects that serve as a food base for other species. Seeds and other plant parts provide vital nutrition to a number of waterfowl and other bird species. Healthy, native aquatic plant communities also help prevent the establishment of invasive exotic plants like Eurasian watermilfoil.

### **Floodplain Forest**

This is a lowland hardwood forest community that occurs along large rivers, usually stream order 3 or higher, that flood periodically. The best-development occurs along large rivers in southern Wisconsin, but this community is also found in the north. Canopy dominants may include silver maple (*Acer saccharinum*), river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), hackberry (*Celtis occidentalis*), swamp white oak (*Quercus bicolor*), and cottonwood (*Populus deltoides*). Northern stands are often species poor, but balsam-poplar (*Populus balsamifera*), bur oak (*Quercus macrocarpa*), and box elder (*Acer negundo*) may replace some of the missing “southern” trees. Buttonbush (*Cephalanthus occidentalis*) is a locally dominant shrub and may form dense thickets on the margins of oxbow lakes, sloughs and ponds within the forest. Nettles (*Laportea canadensis* and *Urtica dioica*), sedges, ostrich fern (*Matteuccia struthiopteris*) and gray-headed coneflower (*Rudbeckia laciniata*) are important understory herbs, and lianas such as Virginia creepers (*Parthenocissus* spp.), grapes (*Vitis* spp.), Canada moonseed (*Menispermum canadense*), and poison-ivy (*Toxicodendron radicans*) are often common. Among the striking and characteristic herbs of this community are cardinal flower (*Lobelia cardinalis*) and green dragon (*Arisaema dracontium*).

### **Forested Seep**

These are shaded seepage areas with active spring discharges in (usually) hardwood forests that may host a number of uncommon to rare species. The overstory dominant is frequently black ash (*Fraxinus nigra*), but yellow birch (*Betula allegheniensis*), American elm (*Ulmus americana*) and many other tree species may be present including conifers such as hemlock (*Tsuga canadensis*) or white pine (*Pinus strobus*). Understory species include skunk cabbage (*Symplocarpus foetidus*), water-pennywort (*Hydrocotyle americana*), marsh blue violet (*Viola cucullata*), swamp saxifrage (*Saxifraga pennsylvanica*), golden saxifrage (*Chrysosplenium americanum*), golden ragwort (*Senecio aureus*), silvery spleenwort (*Athyrium thelypteroides*) and the rare sedges (*Carex scabrata* and *C. prasina*). Most documented occurrences are in the Driftless Area, or locally along major rivers flanked by steep bluffs.

### **Northern Mesic Forest**

Prior to Euro-American settlement, the northern mesic forest covered the largest acreage of any Wisconsin vegetation type. It is still very extensive, but made up of second-growth forests that developed following the Cutover. It forms the matrix for most of the other community types found in northern Wisconsin, and provides habitat for at least some portion of the life cycle of many species. It is found primarily north of the Tension Zone (Figure 2-2), on loamy soils of glacial till plains and moraines deposited by the Wisconsin glaciation. Sugar maple (*Acer saccharum*) is dominant or co-dominant in most stands. Historically, eastern hemlock (*Tsuga canadensis*) was the second most important species, sometimes occurring in nearly pure stands with eastern white pine; both of these conifer species are greatly reduced in today’s forests. American beech (*Fagus grandifolia*) can be a co-dominant with sugar maple in the counties near Lake Michigan. Other important tree species were yellow birch (*Betula allegheniensis*), basswood (*Tilia americana*), and white ash (*Fraxinus americana*). The groundlayer varies from sparse and species poor (especially in hemlock stands) with woodferns, blue-bead lily (*Clintonia borealis*), club-mosses (*Lycopodium* spp.), and Canada mayflower (*Maianthemum canadense*), to lush and species-rich with fine spring ephemeral displays. Historically, Canada yew was an important shrub, but it is now absent from nearly all locations. Historic disturbance regimes were dominantly gap-phase windthrow; large windstorms occurred with long return periods. After old-growth stands were cut, trees such as quaking and bigtoothed aspens (*Populus tremuloides* and *P. grandidentata*), white birch (*Betula papyrifera*), and red maple (*Acer rubrum*) became abundant and still are important in many

second-growth northern mesic forests. Several distinct associations within this complex warrant recognition as communities, and draft abstracts of these are currently undergoing review.

### **Northern Sedge Meadow**

This open wetland community is dominated by sedges and grasses and occurs primarily in northern Wisconsin. There are several common, fairly distinctive, subtypes: Tussock meadow, dominated by tussock sedge and Canada bluejoint grass; Broad-leaved sedge meadow, dominated by the robust sedges (*Carex lacustris* and/or *C. utriculata*); and Wire-leaved sedge meadow, dominated by woolly sedge and/or few-seeded sedge. Frequent associates include blue flag, marsh fern, marsh bellwort, manna grasses, paniced aster, Joe-Pye weed, and the bulrushes (*Schoenoplectus tabernaemontani* and *Scirpus cyperinus*). Sphagnum mosses are either absent or they occur in scattered, discontinuous patches. Sedge meadows occur on a variety of landforms and in several ecological settings that include depressions in outwash or ground moraine landforms in which there is groundwater movement and internal drainage, on the shores of some drainage lakes, and on the margins of streams and large rivers.

### **Northern Wet Forest**

Northern wet forest encompasses a group of weakly minerotrophic, conifer-dominated, acid peatlands located mostly north of the Tension Zone. The dominant trees are black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Jack pine is a significant component in parts of the type's range. This community is found primarily in kettle depressions or partially filled basins, on glacial outwash landforms, moraines, and till plains, where the water table is near the surface or where drainage is somewhat impeded. The community also occurs along the margins of lakes and low-gradient streams. On the wetter side of the moisture gradient, this community tends to grade into muskeg, open bog, or poor fen. On the drier side, the spruce-tamarack swamps may grade into "rich" swamp forests of northern white cedar (*Thuja occidentalis*) or black ash (*Fraxinus nigra*), if a source of nutrient-enriched groundwater is present. In much of the type's current range the adjacent uplands are still forested, most often with second-growth stands of northern hardwoods, pine, or aspen. A minerotrophic "moat" (or "lagg") may occur at the upland-wetland interface, and can support a diverse assemblage of tall shrubs, swamp hardwoods, and "rich" swamp conifers such as northern white cedar.

Northern wet forest was widespread and relatively common historically, although due to the landforms with which it was associated, it did not typically occur in large patches in Wisconsin. Northern wet forest remains relatively common in much of its range today. WDNR's Natural Heritage Inventory Program has recently split northern wet forest into two types (described below) to better reflect community variability. Community composition and water chemistry were used as the primary factors that differentiate the types. Because the Natural Heritage Inventory Program's older inventory information did not consider those factors when classifying coniferous wetlands, northern wet forest (Curtis 1959) has been retained as a type.

### **Northern Wet-mesic Forest**

This forested minerotrophic wetland is dominated by white cedar (*Thuja occidentalis*), and occurs on rich, neutral to alkaline substrates. Balsam fir (*Abies balsamea*), black ash (*Fraxinus nigra*), and spruces (*Picea glauca* and *P. mariana*) are among the many potential canopy associates. The understory is rich in sedges (such as *Carex disperma* and *C. trisperma*), orchids (e.g., *Platanthera obtusata* and *Listera cordata*), and wildflowers such as goldthread (*Coptis trifolia*), fringed polygala (*Polygala pauciflora*), and naked miterwort (*Mitella nuda*), and trailing sub-shrubs such as twinflower (*Linnaea borealis*) and creeping snowberry (*Gaultheria hispidula*). A number of rare plants occur more frequently in the cedar swamps than in any other habitat. Older cedar swamps are often structurally complex, as the easily wind-thrown cedars are able to root from their branch tips. Some of the canopy associates have the potential to reach heights considerably beyond those usually attained by cedar, producing a multi-layered canopy. The tall shrub layer is often well-developed and may include speckled alder, alder-leaved buckthorn, wild

currants, and mountain maple. Canada yew was formerly an important tall shrub in cedar swamps but is now rare or local.

### **Patterned Peatland**

Very rare in Wisconsin, this wetland type can be characterized as a herb- and shrub-dominated minerotrophic peatland with alternating moss and sedge-dominated peat ridges (strings) and saturated and inundated hollows (flarks). These are oriented parallel to the contours of a slope and perpendicular to the flow of groundwater. Within a patterned peatland the peat "landforms" differ significantly in nutrient availability and pH. The flora may be quite diverse and includes many sedges of bogs and fens, along with ericads, sundews, orchids, arrow-grasses (*Triglochin* spp.), and calciphilic shrubs such as bog birch (*Betula pumila*) and shrubby cinquefoil (*Potentilla fruticosa*).

### **Poor Fen**

This acidic, weakly minerotrophic peatland type is similar to the Open Bog, but can be differentiated by higher pH, nutrient availability, and floristics. Sphagnum (*Sphagnum* spp.) mosses are common but don't typically occur in deep layers with pronounced hummocks. Floristic diversity is higher than in the Open Bog and may include white beak-rush (*Rhynchospora alba*), pitcher-plant (*Sarracenia purpurea*), sundews (*Drosera* spp.), pod grass (*Scheuchzeria palustris*), and the pink-flowered orchids (*Calopogon tuberosus*, *Pogonia ophioglossoides* and *Arethusa bulbosa*). Common sedges are (*Carex oligosperma*, *C. limosa*, *C. lasiocarpa*, *C. chordorrhiza*), and cotton-grasses (*Eriphorum* spp.).

### **Shrub-carr**

This wetland community is dominated by tall shrubs such as red-osier dogwood (*Cornus stolonifera*), meadow-sweet (*Spiraea alba*), and various willows (*Salix discolor*, *S. bebbiana*, and *S. gracilis*). Canada bluejoint grass (*Calamagrostis canadensis*) is often very common. Associates are similar to those found in Alder Thickets and tussock-type Sedge Meadows. This type occupies areas that are transitional between open wetlands such as wet prairie, calcareous fen, or southern sedge meadow, and forested wetlands such as floodplain forest or southern hardwood swamp. Shrub-carr can persist at a given site for a very long time if natural hydrologic cycles are maintained. This type often occurs in bands around lakes or ponds, on the margins of river floodplains, or, more extensively, in glacial lakebeds. It is common and widespread in southern Wisconsin but also occurs in the north. In the south, shrub-carr was often an integral part of prairie-savanna landscapes, though it also occurred in wetlands within more forested regions. In the north, the landscape matrix around the shrub-carr type was usually upland forest. Statewide, shrub-carr remains quite common, and has fared considerably better than many of the other native wetland types within its range.

Past drainage and marsh hay mowing likely had a negative effect on shrub-carr, whereas clearing of conifer swamps likely produced more of this habitat. Once fire was controlled and hay mowing was discontinued in lowland meadows, shrub-carr likely increased in extent. Drainage of meadows and marshes has also allowed shrub-carr habitats to increase in some areas. As a result of wetland drainage and fire suppression, shrub-carr now occupies many sites that formerly supported much more extensive marsh, wet meadow, prairie, and fen vegetation, and therefore, it is sometimes targeted for elimination. However, it is an important native wetland type that has its place on our landscape and should be protected, managed, and restored at appropriate locations.

### **Southern Hardwood Swamp**

This is a deciduous forested wetland community type found in insular basins with seasonally high water tables. It is best developed in glaciated southeastern Wisconsin, but was not of large extent even prior to EuroAmerican settlement. Finley (1976) classified less than 1% of southeastern Wisconsin as lowland hardwood forest, and this figure includes bottomland forests along rivers as well as hardwood swamps in closed basins. The dominant trees are red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and formerly, American elm (*Ulmus americana*). The exotic reed canary grass (*Phalaris arundinacea*) is

often dominant in the understory. Southern hardwood swamps are noted for a high component of lianas, including poison ivy, Virginia creepers, and grapes. In the relatively undisturbed sites, there can be a rich spring flora. Microtopographic differences account for the existence of patches of spring ephemerals as well as many wetland species. The exotic reed canary grass has become dominant in the understory of many hardwood swamps.

This Natural Heritage Inventory community type partly includes the southern wet-mesic forest of the Curtis (1959) classification. Curtis describes these types as occurring on lake plains, both around the margins of larger existing lakes and on extinct glacial lakes. He referred to them as “lacustrine forests”, and noted that their soils have a high organic matter content, approaching peat conditions. This differentiates them in part from floodplain forests where processes of flooding and scouring tend to remove organic detritus. Also, in floodplains, much of the water movement is lateral, while in hardwood swamps the water table tends to fluctuate vertically. Southern hardwood swamps are not necessarily restricted to lake plains; some occur in lower-lying portions of till plains that may not have held ponded water for any significant length of time during or after glaciation.

### **Southern Mesic Forest**

This upland forest community occurs on rich, well-drained soils. The dominant tree species is sugar maple (*Acer saccharum*), but basswood (*Tilia americana*) and (near Lake Michigan) beech (*Fagus grandifolia*) may be co-dominant. Many other trees are found in these forests, including those of the walnut family (*Juglandaceae*). The understory is typically open (sometimes brushy with species of gooseberry (*Ribes*) if there is a past history of grazing) and supports fine spring ephemeral displays. Characteristic herbs are spring-beauty (*Claytonia virginica*), trout-lilies (*Erythronium* spp.), trilliums (*Trillium* spp.), violets (*Viola* spp.), bloodroot (*Sanguinaria canadensis*), blue cohosh (*Caulophyllum thalictroides*), mayapple (*Podophyllum peltatum*), and Virginia waterleaf (*Hydrophyllum virginianum*). Historically, southern mesic forests were quite common throughout southern Wisconsin. For example, forests dominated by sugar maple or beech occupied 41% of the Southern Lake Michigan Coastal, 25% of the Southeast Glacial Plains, and 18% of the Western Coulees and Ridges Ecological Landscapes (Finley 1976). Most of these forests were cleared for agriculture, as the soils are very fertile.

### **Southern Sedge Meadow**

Widespread in southern Wisconsin, this open wetland community is most typically dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*). Common associates are water-horehound (*Lycopus uniflorus*), paniced aster (*Aster simplex*), blue flag (*Iris virginica*), Canada goldenrod (*Solidago canadensis*), spotted joe-pye-weed (*Eupatorium maculatum*), broad-leaved cat-tail (*Typha latifolia*), and swamp milkweed (*Asclepias incarnata*). Reed canary grass (*Phalaris arundinacea*) may be dominant in grazed and/or ditched stands. Ditched stands can succeed quickly to Shrub-Carr. Sedge meadows are most common in glaciated landscapes, where they often border streams or drainage lakes. The southern sedge meadow community occurred with prairie, savanna, and hardwood forest communities, and many of them apparently burned periodically. In the absence of fire, shrubs and trees are able to readily encroach on the open wetlands; encroachment can be exacerbated when wetlands are drained. Many sedge meadows in southeastern Wisconsin are influenced by alkaline groundwater, and occur in complexes with emergent marsh, calcareous fen, wet prairie, wet-mesic prairie, and shrub-carr. Differentiating between these communities can be difficult, as they frequently intergrade.

### **Southern Tamarack Swamp (Rich)**

This forested wetland community type is a variant of the Tamarack Swamp, but occurs south of the Tension Zone within a matrix of "southern" vegetation types. Poison-sumac (*Toxicodendron vernix*) is often a dominant understory shrub. Successional stages and processes are not well understood but fire, windthrow, water level fluctuations, and periodic infestations of larch sawfly are among the important dynamic forces influencing this community. Groundwater seepage influences the composition of most if not all stands. Where the substrate is especially springy, skunk cabbage (*Symplocarpus foetidus*), marsh

marigold *Caltha palustris*), sedges, and a variety of mosses may carpet the forest floor. Drier, more acid stands may support an ericad and sphagnum dominated groundlayer. In Wisconsin, the tamarack seepage swamps occur statewide but may be more common south of the tension zone. Historically, tamarack swamps occurred extensively in parts of southeastern Wisconsin and on the margins of Glacial Lake Wisconsin. Many of the swamps were drained and cleared for agricultural purposes. Intact examples are now uncommon but occur in a wide variety of settings, such as on the margins of lakes or streams, at the base of moraines, in outwash areas, and in a few Driftless Area stream valleys.

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## Appendix D

### Wisconsin Natural Heritage Working List Explanation

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked and we encourage data submissions on these species. This list is meant to be dynamic - it is updated as often as new information regarding the biological status of species becomes available. See the Endangered Resources Program web site for the most recent Natural Heritage Inventory Working List (<http://dnr.wi.gov/org/land/er/wlist/>).

### Key

**Scientific Name:** Scientific name used by the Wisconsin Natural Heritage Inventory Program.

**Common Name:** Standard, contrived, or agreed upon common names.

**Global Rank:** Global element rank. See the rank definitions below.

**State Rank:** State element rank. See the rank definitions below.

**US Status:** Federal protection status in Wisconsin, designated by the Office of Endangered Species, U.S. Fish and Wildlife Service through the U.S. Endangered Species Act. LE = listed endangered; LT = listed threatened; XN = non-essential experimental population(s); LT,PD = listed threatened, proposed for de-listing; C = candidate for future listing.

**WI Status:** Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern.

WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are SC/P = fully protected; SC/N = no laws regulating use, possession, or harvesting; SC/H = take regulated by establishment of open closed seasons; SC/FL = federally protected as endangered or threatened, but not so designated by WDNR; SC/M = fully protected by federal and state laws under the Migratory Bird Act.

Special Concern species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

## **Global & State Element Rank Definitions**

### **Global Element Ranks:**

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single state or physiographic region) or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

G4 = Apparently globally secure, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered.

GU = Possibly in peril range-wide, but their status is uncertain. More information is needed.

GX = Believed to be extinct throughout its range (e.g. Passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? = Not ranked.

Species with a questionable taxonomic assignment are given a "Q" after the global rank.

Subspecies and varieties are given subranks composed of the letter "T" plus a number or letter. The definition of the second character of the subrank parallels that of the full global rank. (Examples: a rare subspecies of a rare species is ranked G1T1; a rare subspecies of a common species is ranked G5T1.)

### **State Element Ranks**

S1 = Critically imperiled in Wisconsin because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 = Imperiled in Wisconsin because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 = Rare or uncommon in Wisconsin (21 to 100 occurrences).

S4 = Apparently secure in Wisconsin, with many occurrences.

S5 = Demonstrably secure in Wisconsin and essentially ineradicable under present conditions.

SA = Accidental (occurring only once or a few times) or casual (occurring more regularly although not every year); a few of these species (typically long-distance migrants such as some birds and butterflies) may have even bred on one or more of the occasions when they were recorded.

SE = An exotic established in the state; may be native elsewhere in North America.

SH = Of historical occurrence in Wisconsin, perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an element would become SH without such a 20-year delay if the only known occurrence were destroyed or if it had been extensively and unsuccessfully looked for.

SN = Regularly occurring, usually migratory and typically non-breeding species for which no significant or effective habitat conservation measures can be taken in Wisconsin. This category includes migratory birds and bats that pass through twice a year or, may remain in the winter (or, in a few cases, the summer) along with certain lepidoptera which regularly migrate to Wisconsin where they reproduce, but then completely die out every year with no return migration. Species in this category are so widely and unreliably distributed during migration or in winter that no small set of sites could be set aside with the hope of significantly furthering their conservation.

SZ = Not of significant conservation concern in Wisconsin, invariably because there are no definable occurrences in the state, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long-distance migrants whose occurrence during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. Typically, the SZ rank applies to a non-breeding population.

SR = Reported from Wisconsin, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports that are hard to dismiss because the habitat is now destroyed.

SRF = Reported falsely (in error) from Wisconsin but this error is persisting in the literature.

SU = Possibly in peril in the state, but their status is uncertain. More information is needed.

SX = Apparently extirpated from the state.

### **State Ranking of Long-Distance Migrant Animals:**

Ranking long distance aerial migrant animals presents special problems relating to the fact that their non-breeding status (rank) may be quite different from their breeding status, if any, in Wisconsin. In other words, the conservation needs of these taxa may vary between seasons. In order to present a less ambiguous picture of a migrant's status, it is necessary to specify whether the rank refers to the breeding (B) or non-breeding (N) status of the taxon in question. (e.g. S2B,S5N).

## Appendix E

### The Northern Kettle Moraine Region Planning Group Species of Greatest Conservation Need

The following are vertebrate Species of Greatest Conservation Need (SGCN) associated with natural community types that are present on the Wildlife, Fishery, and State Natural Areas of the Northern Kettle Moraine Region Planning Group (NKMR) in the Southeast Glacial Plains Ecological Landscape. Only SGCN with a high or moderate probability of occurring in the Southeast Glacial Plains Ecological Landscape are shown. Communities shown here are limited to those identified as “Major” or “Important” management opportunities in the Wisconsin Wildlife Action Plan (WDNR 2006b). Letters indicate the degree to which each species is associated with a particular habitat type (S=significant association, M=moderate association, and L=low association). Animal-community combinations shown here that are assigned as either “S” or “M” are also Ecological Priorities, as defined by the Wisconsin Wildlife Action Plan (see <http://dnr.wi.gov/org/land/er/WWAP/> for more information about these data). Shaded species have been documented for the NKMR.

	Major										Important					
	Calcareous Fen	Emergent Marsh	Floodplain Forest	Inland lakes	Shrub Carr	Southern Dry-mesic Forest	Southern Sedge Meadow	Southern Tamarack Swamp (rich)	Warmwater rivers	Warmwater streams	Coolwater streams	Northern Sedge Meadow	Northern Wet Forest	Northern Wet-mesic Forest	Southern Hardwood Swamp	Southern Mesic Forest
<b>Species that are Significantly Associated with the Southeast Glacial Plains Ecological Landscape</b>																
Acadian Flycatcher			M			S										S
American Bittern		S			L		M					S				
American Golden Plover		M					L					L				
American Woodcock	M		L		S			M				L	L	L	L	
Black Tern		S		M				L				M				
Black-billed Cuckoo			M		S			M				L	L		L	
Blanding's Turtle		S	M	S	M	M	M	M	M	M	M	M			M	M
Blue-winged Teal		S	M	M			M		L			M			L	
Blue-winged Warbler			M		M	M		M							L	M
Bobolink	L						M					S				
Buff-breasted Sandpiper		M														
Butler's Garter Snake	S	S	M		S		S					S				
Canvasback		L		M					S							
Cerulean Warbler			S			S										M
Common Tern		M		L												
Dunlin		M							M							
<b>Species that are Significantly Associated with the Southeast Glacial Plains Ecological Landscape</b>																
Eastern Massasauga Rattlesnake	S	S	S		S		S									M

	Major								Important							
	Calcareous Fen	Emergent Marsh	Floodplain Forest	Inland lakes	Shrub Carr	Southern Dry-mesic Forest	Southern Sedge Meadow	Southern Tamarack Swamp (rich)	Warmwater rivers	Warmwater streams	Coolwater streams	Northern Sedge Meadow	Northern Wet Forest	Northern Wet-mesic Forest	Southern Hardwood Swamp	Southern Mesic Forest
Eastern Meadowlark	L						M									
Forster's Tern		S		L			L									
Four-toed Salamander		S	S		S		M	M			M	M	M	S	S	S
Gravel Chub									S							
Greater Redhorse				M					M	S						
Henslow's Sparrow							L					L				
Hooded Warbler						S										S
Hudsonian Godwit		S														
King Rail		S					M					L				
Lake Chubsucker				M					L	L						
Lake Sturgeon				S					S							
Least Darter				M					M	M						
Least Flycatcher			M		L	L								L	L	L
Lesser Scaup		L		M					M							
Longear Sunfish				M					M	M						
Louisiana Waterthrush						S					S					S
Northern Harrier	L	L			L		M					S				
Northern Ribbon Snake				S	M											
Ornate Box Turtle						S										M
Ozark Minnow										S						
Pickereel Frog	M	S	M	M	M		S		S	S	S	S	M	M	M	M
Prothonotary Warbler			S													
Queen Snake		S		M	S		S		S	S	M					
Redfin Shiner				L					S	M	L					
Redhead		S														
Red-headed Woodpecker			M			M										
Red-necked Grebe		S														
Redside Dace										M	M					
River Redhorse									M							
Rusty Blackbird	M	M	S		M			M							S	
Short-billed Dowitcher		S														
Short-eared Owl		L			M		M					M				
Slender Madtom										S						
Starhead Topminnow				S					S	S						
Whooping Crane		S					M					M				
Willow Flycatcher	M		L		S		M	L							L	
Wood Thrush			M			S		L					L	L	L	S

	Major										Important					
	Calcareous Fen	Emergent Marsh	Floodplain Forest	Inland lakes	Shrub Carr	Southern Dry-mesic Forest	Southern Sedge Meadow	Southern Tamarack Swamp (rich)	Warmwater rivers	Warmwater streams	Coolwater streams	Northern Sedge Meadow	Northern Wet Forest	Northern Wet-mesic Forest	Southern Hardwood Swamp	Southern Mesic Forest
Yellow-billed Cuckoo			S		M	M		L							M	M
<b>Species that are Moderately Associated with the Southeast Glacial Plains Ecological Landscape</b>																
Banded Killifish				M						L						
Bell's Vireo					M											
Black Buffalo									M							
Eastern Red Bat	M	M	M	M	M	M	M	L	M	M	S	M	M	M	M	M
Golden-winged Warbler					S	L		L					M	L	L	L
Hoary Bat	M	M	M	M	M	L	M	L	M	M	S	M	M	M	L	L
Marbled Godwit		S														
Mudpuppy				S					S		L					
Northern Long-eared Bat	M	M	M	M	M	M	M		M	M	S	M	L	L	M	M
Pugnose Shiner				M						M						
Red-shouldered Hawk			S			M		L						L	L	M
Silver-haired Bat	M	M	M	M	M	L	M	L	M	M	S	M	M	M	L	L
Snowy Egret		S														
Solitary Sandpiper		S	S		L		L			M	M	L			L	
Upland Sandpiper							L					L				
Veery			M		S	M		L					M	L	L	M
Western Sand Darter									M							
Whimbrel		M														
Whip-poor-will			L		S											L
Wilson's Phalarope		S					L					S				
Woodland Vole			L		S											L
Yellow-bellied Racer						M										
Yellow-crowned Night-Heron		M	S		M				M						M	
Yellow-throated Warbler			S			M										

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## APPENDIX F

### Primary Inventory Sites within the Wildlife, Fishery, and State Natural Areas of the Northern Kettle Moraine Region Planning Group<sup>1</sup>

Seven ecologically important sites were identified on the Wildlife, Fishery, and State Natural Areas of the Northern Kettle Moraine Region Planning Group (NKMR). These “Primary Sites” were delineated because they generally encompass the best examples of 1) rare and representative natural communities, 2) documented occurrences of rare species populations, and/or 3) opportunities for ecological restoration or connections. These sites warrant high protection and/or restoration consideration during the development of the property master plan. This report is meant to be considered along with other information when identifying opportunities for various management designations during the master planning process.

Information provided in the summary paragraphs includes location information, a site map, a brief summary of the natural features present, the site’s ecological significance, and management considerations.

<b>Primary Sites</b>	page
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<sup>1</sup> A list of species referred to by common name is found at the end of this appendix.

# NKMR01. KIEL MARSH BREEDING AND MIGRATORY BIRD AREA

## **Location**

Property:	Kiel Marsh Wildlife Area
County:	Sheboygan, Calumet, and Manitowoc
Landtype Association:	222Ke06. Millhome Moraines
Approximate Size (acres):	1255

## **Description of Site**

This site is primarily a cattail-dominated Emergent Marsh along the Sheboygan River with scattered willow dominated Shrub-carr areas. The river is a Slow, Warm Hardwater Stream meandering through the cattail marsh. The main channel and backwaters have submerged and floating leaved aquatic vegetation. There are scattered patches of swamp hardwoods on slightly elevated patches of riverbank. Data from field surveys in 1978 indicate that a Southern Sedge Meadow natural community occurrence that is partially on private land on the south end of the property is a diverse open meadow bordering a small spring-fed tributary with dominant plants being Canada bluejoint, numerous sedge species, sneezeweed (*Helenium* sp.), turtlehead (*Chellone* sp.), skullcap (*Scutellaria* sp.), and fringed brome (*Bromus ciliatus*). Aerial photos of the sedge meadow appear to show the site has been overtaken by reed canary grass. The Kiel Marsh primary site is primarily owned by the Wisconsin Department of Natural Resources (WDNR) and partially by private landowners.

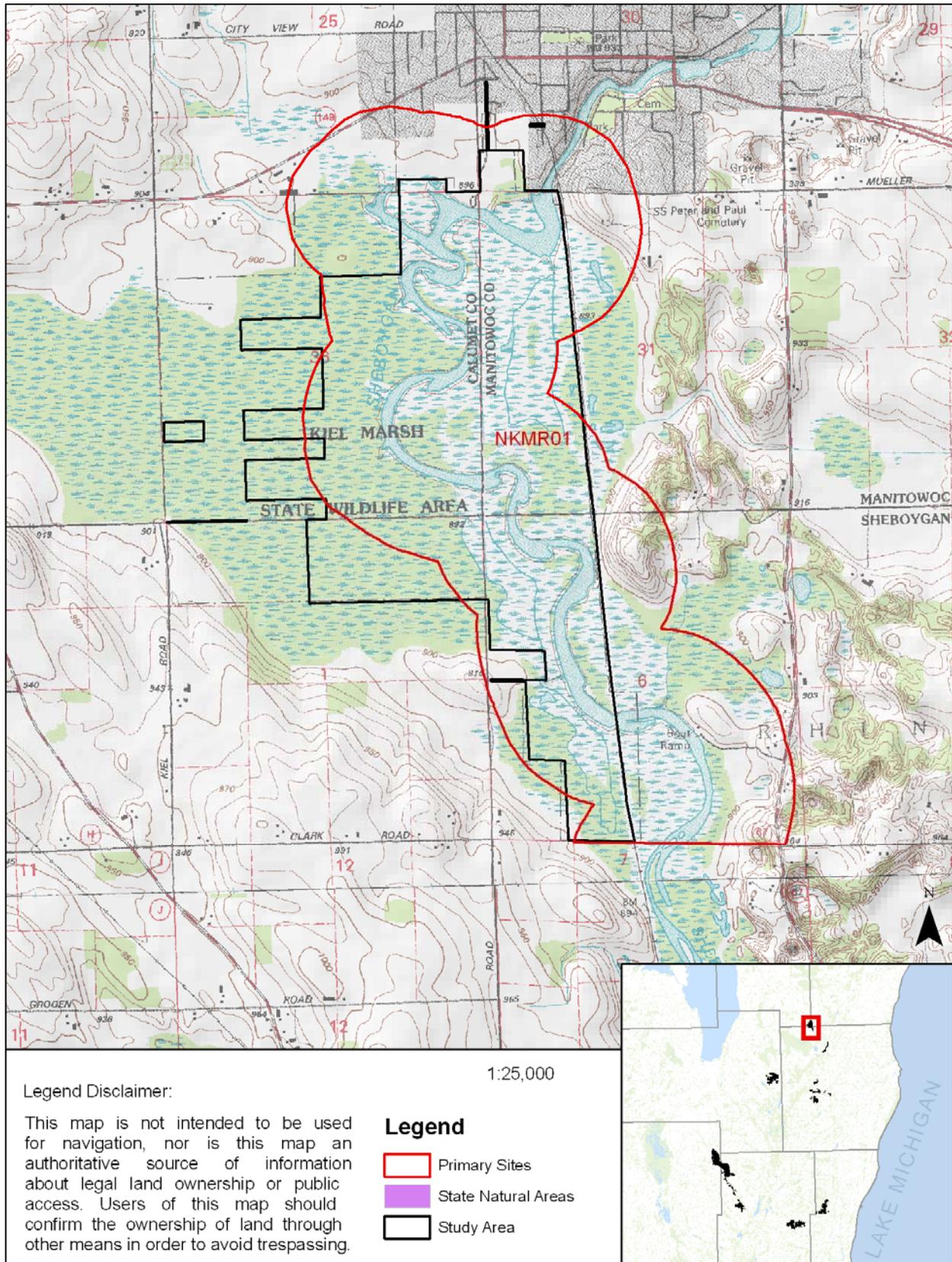
## **Significance of Site**

Bird survey data indicate that many rare birds are using the Sheboygan River as a breeding and migratory bird stopover area. Thus, the site was delineated based on a 400 meter buffer on both sides of the river, a buffer outlined in the Migratory Bird Stopover Site Project. According to the Migratory Bird Stopover Project modeling efforts, Kiel Marsh Wildlife Area had very high potential for migratory waterfowl and landbirds. Many uncommon birds are present during the breeding season.

## **Management Considerations**

Sedimentation, eutrophication, and water pollution can cause detrimental changes to Emergent Marsh community composition, structure, and function (WDNR, 2006b). Dams and impoundments can raise water levels, flooding these areas and causing shrub die-offs which would negatively impact migratory birds. In addition, protecting water levels would favor bird species that require emergent aquatic vegetation for nesting. Invasive species monitoring and control of reed canary grass in the sedge meadow area on the south end of Kiel Marsh Wildlife Area should be addressed.

**NKMR01. Kiel Marsh Breeding and Migratory Bird Area Primary Site at Kiel Marsh Wildlife Area**



## NKMR02. MULLET CREEK FORESTED WETLAND

### **Location**

Property:	Mullet Creek Wildlife Area
County:	Fond du Lac
Landtype Association:	222Ke19. Mt. Calvary Moraine
Approximate Size (acres):	319

### **Description of Site**

This large Primary Site (Figure 8) contains a good quality Northern Wet-mesic Forest surrounded by a Southern Hardwood Swamp. The Northern Wet-mesic Forest is of medium age with a canopy dominated by northern white-cedar (tree diameters ranging from 6” to 28”) with tamarack and some black ash. The groundlayer includes the typical Northern Wet-mesic Forest associates, such as gold-thread, starflower (*Trientalis borealis*), and Canada mayflower (*Maianthemum canadense*). There are good amounts of swamp lousewort which indicates calcium rich water and increases the likelihood of more fen species. The surrounding Southern Hardwood Swamp has a canopy dominated by silver maple, green ash, and American elm with some red maple and inclusions of northern white-cedar. The groundlayer includes some skunk cabbage which indicates seepage is present. The site is primarily owned by Wisconsin DNR and partially by private landowners.

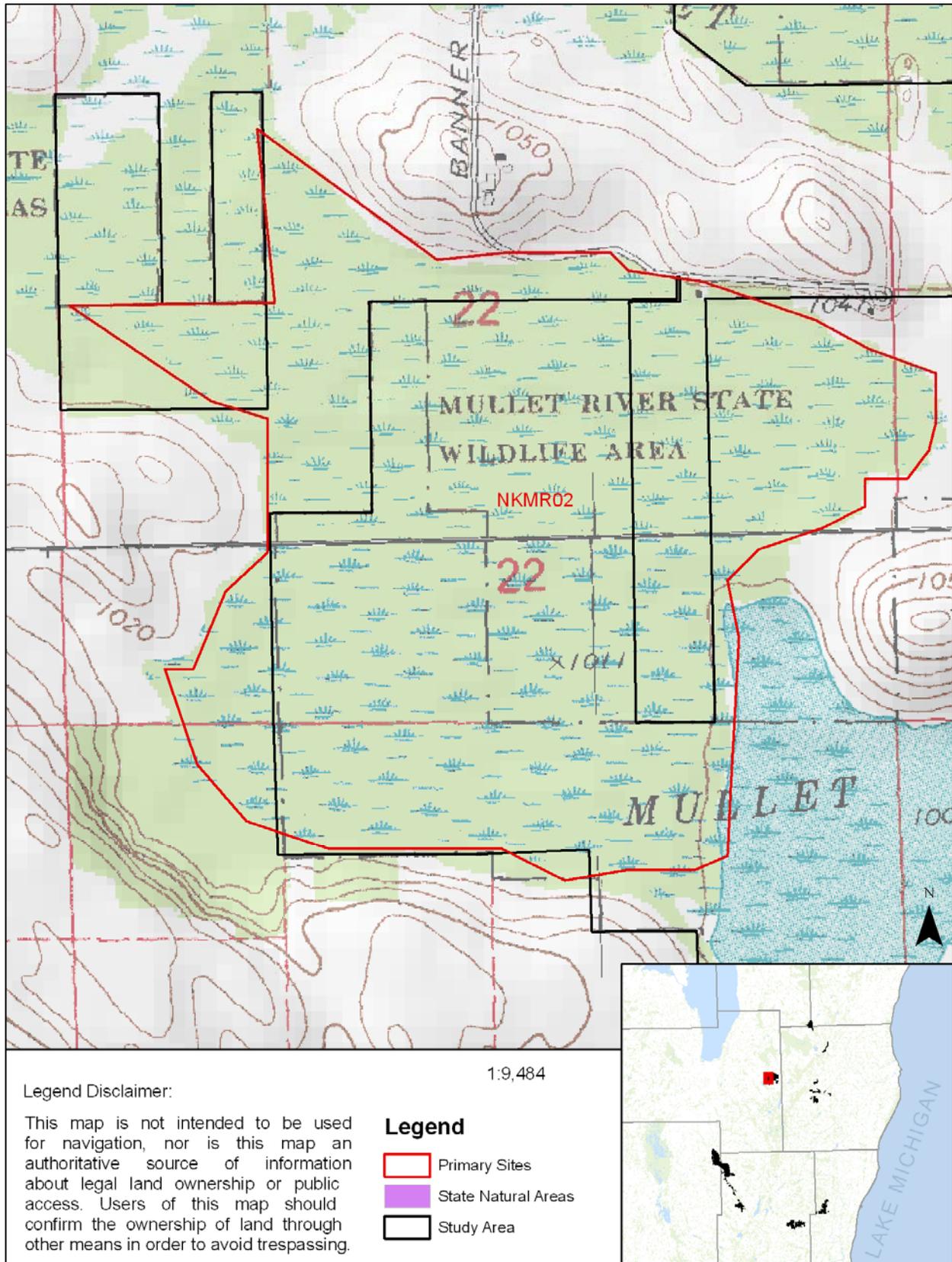
### **Significance of Site**

The surrounding landscape includes high amounts of agricultural land and even includes some private holdings within the Wildlife Area. A large block of high-quality forest, free of invasives, in this fragmented landscape, is quite rare and should be left intact. In addition, leaving the forest undisturbed could aid in preventing the spread of the invasive reed canary grass, which is present at the site on the periphery of this forested block.

### **Management Considerations**

Several rare forest interior birds were found on or adjacent to this site. Maintaining large blocks with high canopy cover and a good structural diversity including a good shrub layer would be beneficial for all of these birds. Buffering the good-quality Northern Wet-mesic Forest and its associated ‘northerly’ plants would help limit invasion of exotic plants and provide a larger block of forest in this fragmented landscape.

**NKMR02. Mullet Creek Forested Wetland Primary Site at Mullet Creek Wildlife Area**



## **NKMR03. KAMRATH CREEK FOREST AND FEN**

### ***Location***

Property: Onion River Stream Bank Protection Area  
County: Sheboygan  
Landtype Association: 222Kf08. Beechwood Plains, 222Kf06. Waubeka Moraines.  
Approximate Size (acres): 60

### ***Description of Site***

This small site features high-quality natural communities that are of regional importance. On the highest ground, Southern Dry-mesic forests of moderate quality consist of red oak and shagbark hickory. Of note in this forest is a patch of shooting star that is about ¼ acre in size. At the base of this forest water seeps in springs and spring runs from the ground onto a moderately sloped semi-open Calcareous Fen that is sedge dominated with scattered tamarack and poison sumac. Many calciphile plant species are present. These springs continue further down slope where the forest canopy becomes more closed and they become Forested Seeps. The forest is dominated by sugar maple, yellow birch, and basswood with large areas of skunk cabbage, wild ginger, and species of both rich mesic forests and wetlands. Also present is a rich Southern Mesic Forest with sugar maple, basswood, and American beech and a diverse ground layer, including many spring ephemerals. Spring runs are common in the Southern Mesic Forest and feed into Kamrath Creek. Invasive species were very limited to the more disturbed edges of the forests.

### ***Significance of Site***

A rare invertebrate was located during recent surveys in a high-quality fen and is the first time in 18 years that a new population has been found and one of only three currently known populations in the state. This site warrants special management consideration because of presence of high quality natural communities, a rare plant and animal population, and potential habitat for other rare species.

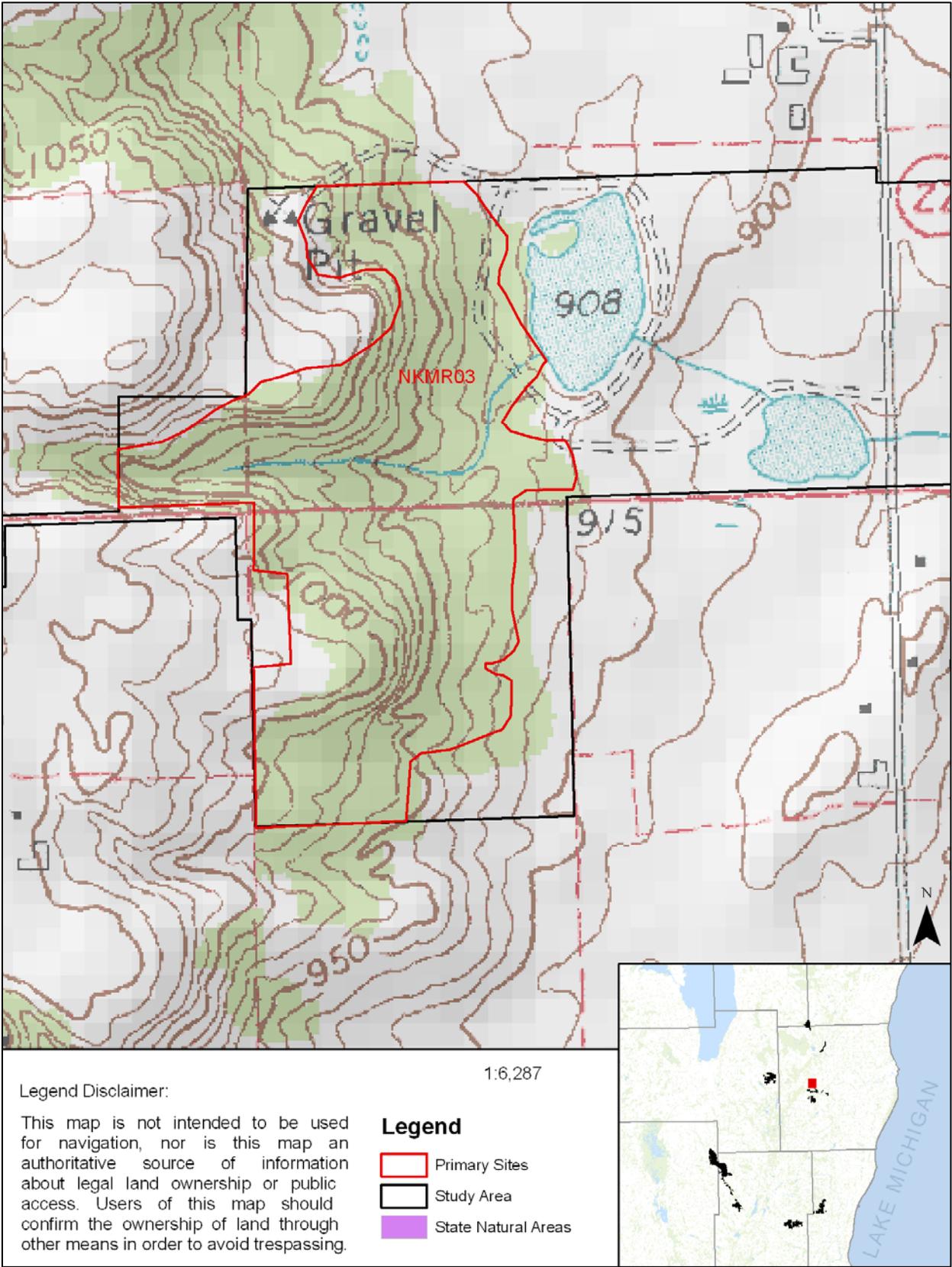
### ***Management Considerations***

Habitat for the rare invertebrate is small and some important plant species were noticeably absent. Augmentation of plants may be needed. Reed canary grass and European buckthorn are starting to invade portions of the site and should be controlled. Surveys and monitoring should be done due to the small size of the population. Additional management options to consider during the master plan include enlarging the habitat and creating additional openings. This should be done gradually and with monitoring that assesses the response of vegetation and the invertebrate.

To the east of this site a Herp Hibernaculum was located in loose rock fill. No rare species are currently known to be using the hibernaculum, although its presence in a well-used public location warrants possible management considerations.

Also outside of this site there is potential habitat for pickerel frogs along the restored stream and in spring ponds that could be created. These can be excavations with ground water feeds, backwater pools with stream connections, or impoundments of the stream.

**NKMR03. Kamrath Creek Forest and Fen Primary Site at Onion River Stream Bank Protection Area**



## NKMR04. NICHOLS CREEK CEDAR SWAMP AND SPRINGS

### **Location**

Property:	Nichols Creek Wildlife Area
County:	Sheboygan
Landtype Association:	222Kf08. Beechwood Plains, 222Kf06. Waubeka Moraines.
Approximate Size (acres):	238

### **Description of Site**

This primary site is split into two units separated by anthropogenic habitat such as old field; the two units are connected by the spring-fed headwaters of the North Branch Milwaukee River. The site is a complex of good quality Northern Wet-mesic Forest, Springs and Spring Runs, Spring Ponds, a couple of small Calcareous Fens in the lowlands, and variable quality Southern Mesic and Southern Dry-mesic Forest in the uplands. Good quality Northern Wet-mesic Forest occurs in both units, with each being dominated by northern white-cedar. There is also paper birch, yellow birch, black ash, and some basswood in the canopy. Somewhat unusual is strong northern white-cedar reproduction in patches within the forest. Ground flora is diverse and includes marsh marigold, skunk cabbage, impatiens, and fowl manna grass. Invasive species are relatively uncommon within the Northern Wet-mesic Forests. The western unit is bisected by a power line ROW that is dominated by cattails.

The most significant difference between the two units is that the Northern Wet-mesic Forest in the western part of the Wildlife Area is laced with Springs and Spring Runs and the Calcareous Fens, while the eastern unit does not have these types. The Springs and Spring Runs are small with cold, clear water. The substrates consist of gravel, sand, and muck. The small Calcareous Fens support an unusual assemblage of herbs that are associated with alkaline groundwater such as marsh muhly, fen grass-of-Parnassus, and stiff cowbane (*Oxypolis rigidior*). Invasive species are limited but include a small patch of reed canary grass at the north end of the fens.

There are two connected Spring Ponds in the eastern unit. Each is nearly oval and about 250 feet long with sand and gravel bottoms. The ponds have an outlet to the North Branch Milwaukee River. In places the ponds are covered with floating aquatic macrophytes and standing dead trees are present.

A small (ca. 9 acre), fair to good quality Southern Mesic to Southern Dry-mesic Forest covers part of the upper portions of a northeast-facing morainal slope in the western unit. The canopy is mature and dominated by medium to large sugar maple, red oak, American beech, and basswood. White ash (*Fraxinus americana*), yellow-bud (*Carya cordiformis*) and shagbark hickory (*C. ovata*), and white oak (*Quercus alba*) are also canopy species. The shrub layer is sparse and dominated by young sugar maples. The ground is also sparse and includes wild geranium (*Geranium maculatum*), May-apple (*Podophyllum peltatum*), and early meadow-rue (*Thalictrum dioicum*). It becomes richer further down slope where species such as wild ginger and zigzag goldenrod grow. The Southern Dry-mesic Forest in the eastern unit has a lower quality forest; the canopy is a mix of oaks, maple, and ash. The ground flora includes wild geranium, Jack-in-the-pulpit (*Arisaema triphyllum*), and Pennsylvania sedge (*Carex pensylvanica*). The site is primarily owned by Wisconsin DNR and partially by private landowners.

### ***Significance of Site***

This site is a mixture of good quality natural communities. Northern Wet-mesic Forests have the potential to support many rare species such as the northern yellow lady's-slipper, a species that has been observed in the western unit. The flora associated with Calcareous Fens typically is unusual as growing conditions in these alkaline-rich communities are harsh. Swamp thistle, the host plant for a rare animal has been recorded from the fens at the site. Rare birds have been documented in and around the site. The majority of this site has been designated as NA-1, natural areas of statewide or greater significance, by Southeast Wisconsin Regional Planning Commission (SEWRPC, 2007).

### ***Management Considerations***

Good quality natural communities and several rare species are known from this site. The mosaic of natural communities contains several ecologically important characteristics. The forests provide valuable habitat for area sensitive bird species and provide valuable habitat for migrating birds. Protecting the hydrology of the Springs and Spring Ponds that feed the North Branch Milwaukee River is an important consideration. As with most of the sites across these properties, identifying and controlling invasive species is an important management consideration.



## **NKMR05. CEDARBURG BOG SNA**

### ***Location***

Property: Cedarburg Bog State Natural Area  
County: Ozaukee  
Landtype Association: 222Kf06. Waubeka Moraines.  
Approximate Size (acres): 1765

### ***Description of Site***

Cedarburg Bog is the most intact large bog in southeastern Wisconsin and composed of a mosaic of vegetation types. Once part of a large glacial lake, the bog is a complex of relict natural communities, including southern examples of types more commonly found in northern Wisconsin. There are six lakes remaining within the bog, all with varying sizes and depths. The 245-acre Mud Lake is the largest, followed by the 34-acre Long Lake. Surrounding the lakes are areas of emergent aquatic vegetation while just outside this zone is a successional shrub-carr area. Most unusual is a string or "patterned" bog, unique here because it lies far south of its usual range in North America and is one of only four known occurrences in Wisconsin. It is composed of ridges of stunted northern white-cedar and tamarack that lie in an open flat sedge mat. The meadow vegetation consists of narrow-leaved sedges, pitcher plant, bogbean, water horsetail, arrow-grass, orchids, and the insectivorous sundew and bladderwort. A conifer-swamp hardwood forest is adjacent to the bog.

### ***Significance of Site***

There is a very diverse flora and fauna; many that are more common in northern boreal forests and that are at their southern range limit here.

### ***Management Considerations***

This site is managed as a reserve for Patterned Peatland, Northern Wet and Wet-mesic Forest, and bog lakes, as an aquatic reserve and wetland protection site, and as an ecological reference area.



## NKMR06. JACKSON MARSH CEDAR SWAMP

### **Location**

Property:	Jackson Marsh Wildlife Area and Jackson Marsh State Natural Area
County:	Washington
Landtype Association:	222Kf06. Waubeka Moraines.
Approximate Size (acres):	796

### **Description of Site**

This site contains a core of good quality Northern Wet-mesic Forest surrounded by good to moderate quality Southern Hardwood Swamp. The uplands included in the site include a small area of moderate quality Southern Dry-mesic Forest on the west side of the site and good to moderate quality Southern Mesic Forest in the southeast. The canopy is dominated by northern white-cedar, tamarack, black ash, red maple, and yellow birch with common winterberry (*Ilex verticillata*), alder-leaf buckthorn (*Rhamnus alnifolia*), and poison sumac (*Toxicodendron vernix*) in the sparse shrub layer. The ground flora includes many northern species such as gold-thread, blue-bead-lily (*Clintonia borealis*), twinflower (*Linnaea borealis*), and gay-wings (*Polygala paucifolia*), and well as a variety of sedges and cinnamon fern (*Osmunda cinnamomea*). The surrounding Southern Hardwood Swamp has a canopy that includes red and silver maple, green and black ash, and some American elm. The ground flora is not diverse and includes abundant wood nettle (*Laportea canadensis*) and enchanter's nightshade (*Circaea alpina*). Invasive species, including common buckthorn, multiflora rose (*Rosa multiflora*), and reed canary grass, are present in both natural communities.

The Southern Mesic Forest covers about 19 acres and has a canopy dominated by sugar maple, American beech, basswood, ash species, and elm species. The ground flora is fairly diverse and includes spring beauty (*Claytonia virginica*), wild geranium, trilliums, bloodroot (*Sanguinaria canadensis*), and Virginia waterleaf (*Hydrophyllum virginianum*). The Southern Dry-mesic Forest has bur oak, red oak, and basswood in the canopy. Some of the oaks are about 30 inches in diameter. Ground flora includes wild geranium, white avens (*Geum canadense*), Jack-in-the-pulpit, and wood sedge (*Carex blanda*). The invasive common buckthorn is also present in the shrub/sapling layer. The site is owned by WDNR.

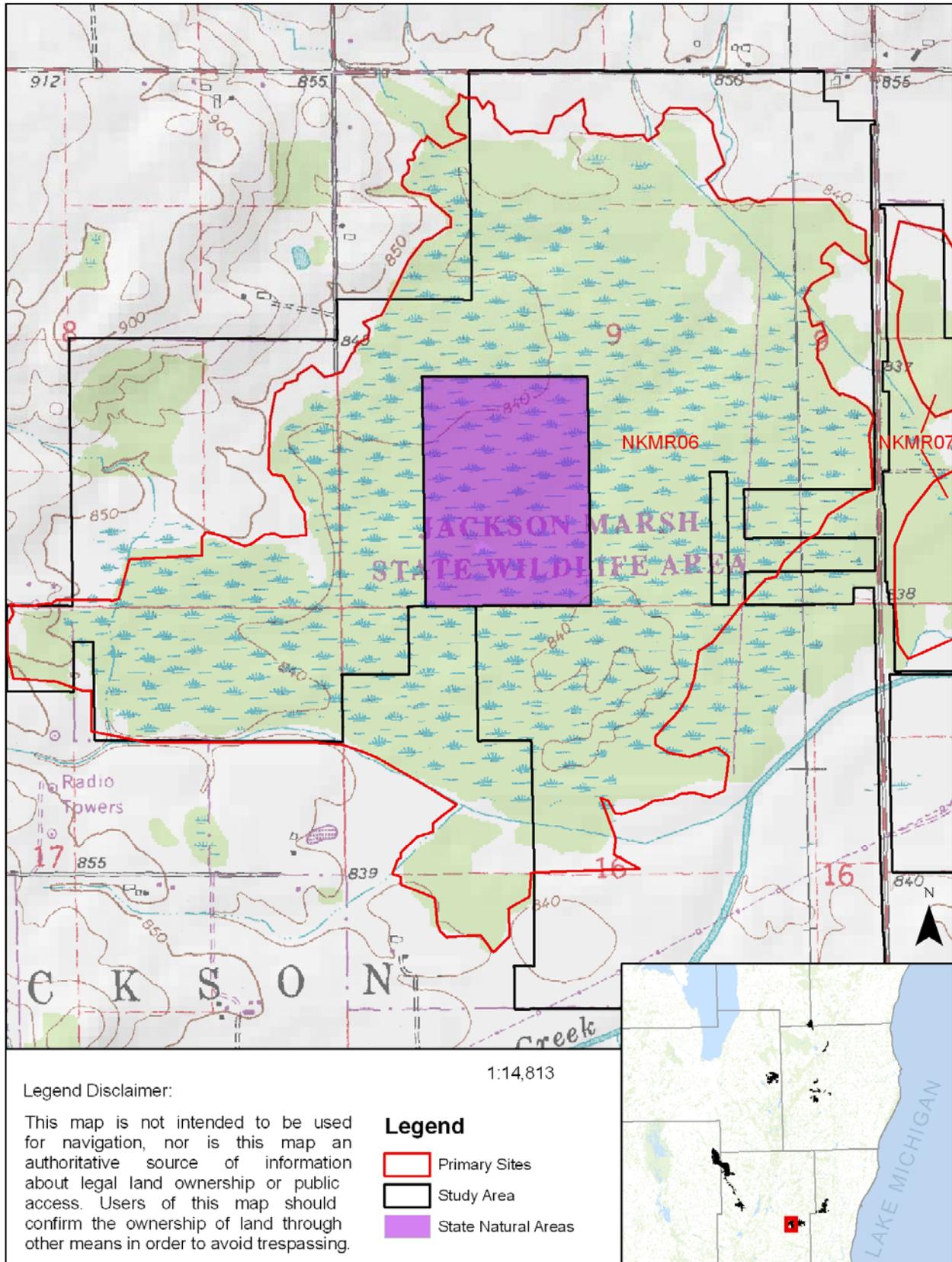
### **Significance of Site**

The extensive, minerotrophic Northern Wet-mesic Forest occurring on muck soils is a community type more common in northern Wisconsin and is near its southernmost extent at Jackson Marsh Wildlife Area. A rare bird has been documented in good numbers in the Northern Wet-mesic Forest during past breeding bird surveys. The Northern Wet-mesic Forest is already part of the Jackson Marsh State Natural Area. Because the upland forests are part of a large forested area within a largely agricultural landscape, they may be important stop-over habitat for migrating birds.

### **Management Considerations**

Good quality natural communities and several rare animals and a rare plant are known from this area. The mosaic of natural communities contains several ecologically important characteristics. This site presents an opportunity to continue protecting a regionally rare natural community feature that includes a suite of northerly plant species and important bird habitat. Identifying and controlling invasive species is an important management consideration for this site. Monitoring and control of emerald ash borer found near this site should be of high importance.

**NKMR06. Jackson Marsh Cedar Swamp Primary Site at Jackson Marsh Wildlife Area**



# NKMR07. JACKSON MARSH SOUTHERN HARDWOOD SWAMP

## **Location**

Property: Jackson Marsh Wildlife Area and Jackson Marsh State Natural Area  
County: Washington  
Landtype Association: 222Kf06. Waubeka Moraines.  
Approximate Size (acres): 308

## **Description of Site**

This site is dominated by large tracts of Southern Hardwood Swamps. The canopies are dominated by large silver maple with red maple, green ash, and elms. Other trees that are typically further north, including black ash and yellow birch are also part of the composition of the canopy. Shrubs and saplings are patchily distributed and include prickly ash (*Zanthoxylum americanum*), dogwoods, and the invasive species common buckthorn. Herbs include nettles, sedges, skunk cabbage, and impatiens. There are dense patches of reed canary grass in some of the canopy gaps. This site may have been affected by stream modifications, including a stretch of Cedar Creek that has been channelized. This site is owned by WDNR.

## **Significance of Site**

This site is in close proximity to NKMR06 described above. In combination, both sites constitute an extensive forested landscape in a largely agricultural landscape. Parts of both of these sites are already part of Jackson Marsh SNA. These forests provide habitat for many rare bird species including an area sensitive species that requires mature forests with good structural diversity including a strong shrub component. Other rare animals and plants have also been documented here.

## **Management Considerations**

This site presents an opportunity to continue protecting a good quality natural community feature that includes a suite of more northerly plant species and important bird habitat. As with many of the sites across these properties, identifying and controlling invasive species is an important management consideration for this site. Monitoring and control of emerald ash borer found near this site should be of high importance.



# SPECIES LIST

List of species referred to by common name in Appendix E.

Common Name	Scientific Name
<b>Animals</b>	
Acadian Flycatcher	<i>Empidonax virescens</i>
Beaver	<i>Castor canadensis</i>
Black Tern	<i>Chlidonias niger</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>
Blanchard's Cricket Frog	<i>Acris crepitans blanchardi</i>
Blanding's Turtle	<i>Emydoidea blandingii</i>
Broad-winged Hawk	<i>Buteo platypterus</i>
Brook Stickleback	<i>Culaea inconstans</i>
Butler's Gartersnake	<i>Thamnophis butleri</i>
Canada Warbler	<i>Wilsonia canadensis</i>
Chorus Frog	<i>Pseudacris triseriata</i>
Central Mudminnow	<i>Umbra limi</i>
Common Moorhen	<i>Gallinula chloropus</i>
Great Egret	<i>Ardea alba</i>
Henslow's Sparrow	<i>Ammodramus henslowii</i>
Hine's Emerald Dragonfly	<i>Somatochlora hineana</i>
Hooded Warbler	<i>Wilsonia citrina</i>
Kentucky Warbler	<i>Oporornis formosus</i>
Least Bittern	<i>Ixobrychus exilis</i>
Least Darter	<i>Etheostoma microperca</i>
Longear Sunfish	<i>Lepomis megalotis</i>
Mudpuppy	<i>Necturus maculosus</i>
Pickereel Frog	<i>Lithobates palustris</i>
Queensnake	<i>Regina septemvittata</i>
Redfin Shiner	<i>Lythrurus umbratilis</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
River Otter	<i>Lutra canadensis</i>
Spring Peeper	<i>Psuedacris crucifer</i>
Swamp Metalmark Butterfly	<i>Calephelis muticum</i>
Veery	<i>Catharus fuscescens</i>
Warpaint Emerald	<i>Somatochlora incurvata</i>
Water Shrew	<i>Sorex palustris</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
Willow Flycatcher	<i>Empidonax traillii</i>
Wood Frog	<i>Rana sylvatica</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Yellow-crowned Night-heron	<i>Nyctanassa violacea</i>
<b>Plants</b>	
alder	<i>Alnus</i> spp.
alder-leaf buckthorn	<i>Rhamnus alnifolia</i>
American beech	<i>Fagus grandifolia</i>
American elm	<i>Ulmus americana</i>
arrowhead	<i>Sagittaria</i> spp.

<b>Common Name</b>	<b>Scientific Name</b>
<b>Plants continued...</b>	
basswood	<i>Tilia americana</i>
black-eyed Susan	<i>Rudbeckia hirta</i>
black ash	<i>Fraxinus nigra</i>
black spruce	<i>Picea mariana</i>
bloodroot	<i>Sanguinaria canadensis</i>
blue-bead-lily	<i>Clintonia borealis</i>
blue cohosh	<i>Caulophyllum thalictroides</i>
blue marsh violet	<i>Viola cucullata</i>
bog bean	<i>Menyanthes trifoliata</i>
bog birch	<i>Betula pumila</i>
brambles	<i>Rubus spp</i>
brook grass	<i>Catabrosa aquatica</i>
bur oak	<i>Quercus macrocarpa</i>
bulrushes	<i>Scirpus spp.</i>
bunchberry	<i>Cornus canadensis</i>
bush honeysuckle	<i>Lonicera x bella</i>
Canada mayflower	<i>Maianthemum canadense</i>
Canada bluejoint	<i>Calamagrostis canadensis</i>
cattails	<i>Typha spp.</i>
cinnamon fern	<i>Osmunda cinnamomea</i>
common buckthorn	<i>Rhamnus cathartica</i>
common reed	<i>Phragmites australis</i>
common winterberry	<i>Ilex verticillata</i>
cotton-grasses	<i>Eriophorum spp</i>
cuckoo-flower	<i>Cardamine pratensis</i>
dogwood	<i>Cornus spp</i>
early meadow-rue	<i>Thalictrum dioicum</i>
eastern hop-hornbeam	<i>Ostrya virginiana</i>
enchanter's nightshade	<i>Circaea alpina</i>
European honeysuckle	<i>Lonicera spp</i>
false nettle	<i>Boehmeria cylindrica</i>
fen star sedge	<i>Carex sterilis</i>
forked aster	<i>Aster furcatus</i>
fringed brome	<i>Bromus ciliatus</i>
garlic mustard	<i>Alliaria petiolata</i>
gay-wings	<i>Polygala paucifolia</i>
glossy buckthorn	<i>Rhamnus frangula</i>
gold-thread	<i>Coptis trifolia</i>
grape	<i>Vitis spp</i>
grass-of-Parnassus	<i>Parnassia glauca</i>
green ash	<i>Fraxinus pennsylvanica</i>
hackberry	<i>Celtis occidentalis</i>
helleborine orchid	<i>Epipactis helleborine</i>
impatiens	<i>Impatiens capensis</i>
Jack-in-the-pulpit	<i>Arisaema triphyllum</i>
Kalm's lobelia	<i>Lobelia kalmii</i>
lake sedge	<i>Carex lacustris</i>
large-flowered bellwort	<i>Uvularia grandiflora</i>

<b>Common Name</b>	<b>Scientific Name</b>
<b>Plants continued...</b>	
large-flowered trillium	<i>Trillium grandiflorum</i>
leatherleaf	<i>Chamaedaphne calyculata</i>
mare's tail	<i>Hippurus vulgaris</i>
marsh marigold	<i>Caltha palustris</i>
marsh muhly	<i>Muhlenbergia glomerata</i>
marsh valerian	<i>Valeriana sitchensis</i>
May-apple	<i>Podophyllum peltatum</i>
mountian mint	<i>Pycnanthemum virginianum</i>
multiflora rose	<i>Rosa multiflora</i>
nettles	<i>Laportea</i> spp
northern white-cedar	<i>Thuja occidentalis</i>
northern yellow lady's-slipper	<i>Cypripedium parviflorum</i>
Pennsylvania sedge	<i>Carex pensylvanica</i>
pitcher plant	<i>Sarracenia purpurea</i>
poison ivy	<i>Toxicodendron radicans</i>
prickly ash	<i>Zanthoxylum americanum</i>
poison sumac	<i>Toxicodendron vernix</i>
paper birch	<i>Betula papyrifera</i>
red maple	<i>Acer rubrum</i>
red oak	<i>Quercus rubra</i>
red-osier dogwood	<i>Cornus stolonifera</i>
reed canary grass	<i>Phalaris arundinacea</i>
round-leaved monkey flower	<i>Mimulus glabratus</i>
round-leaf sundew	<i>Drosera rotundifolia</i>
sedges	<i>Carex</i> spp
shagbark hickory	<i>Carya ovata</i>
shrubby cinquefoil	<i>Pentaphylloides floribunda</i>
silver maple	<i>Acer saccharinum</i>
skullcap	<i>Scutellaria</i> sp.
skunk cabbage	<i>Symplocarpus foetidus</i>
smartweed	<i>Polygonum</i> spp.
sneezeweed	<i>Helenium</i> sp.
spike-rushes	<i>Eleocharis</i> spp.
spring beauty	<i>Claytonia virginica</i>
starflower	<i>Trientalis borealis</i>
stiff cowbane	<i>Oxypolis rigidior</i>
stinging nettle	<i>Urtica dioica</i>
sugar maple	<i>Acer saccharum</i>
sumac	<i>Rhus</i> spp.
swamp white oak	<i>Quercus bicolor</i>
swamp lousewort	<i>Pedicularis lanceolata</i>
swamp thistle	<i>Cirsium muticum</i>
tamarack	<i>Larix laricina</i>
turtlehead	<i>Chellone</i> sp.
tussock sedge	<i>Carex stricta</i>
twinflower	<i>Linnaea borealis</i>
Virginia creeper	<i>Perthenocissus quinquefolia</i>
Virginia waterleaf	<i>Hydrophyllum virginianum</i>

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<b>Common Name</b>	<b>Scientific Name</b>
<b>Plants continued...</b>	
watercress	<i>Nasturtium officinale</i>
water parsnip	<i>Berula erecta</i>
white ash	<i>Fraxinus americana</i>
white avens	<i>Geum canadense</i>
white oak	<i>Quercus alba</i>
wild geranium	<i>Geranium maculatum</i>
wild ginger	<i>Asarum canadense</i>
wood nettle	<i>Laportea canadensis</i>
wood sedge	<i>Carex blanda</i>
willow	<i>Salix spp</i>
yellow birch	<i>Betula alleghaniensis</i>
yellow-bud hickory	<i>Carya cordiformis</i>
zigzag goldenrod	<i>Solidago flexicaulis</i>

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