Rapid Ecological Assessment for Central Wisconsin Wildlife Areas Property Group

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

Properties included in this report are:

- Dewey Marsh State Wildlife Area (Portage Co.)
- Dewey Marsh State Natural Area (Portage Co.)
- George W. Mead State Wildlife Area (Marathon, Portage, and Wood Co.)
- Mead Conifer Bogs State Natural Area (Portage and Wood Co.)
- McMillan Marsh State Wildlife Area (Marathon Co.)

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Cover Photos:

Top (left to right): Muskeg at Dewey Marsh State Wildlife Area by Ryan P. O'Connor, Black Spruce Swamp at Mead Conifer Bogs State Natural Area by Ryan P. O'Connor.
Bottom (left to right): Black tern by Brian Collins, greater prairie-chicken by Gerald Bartelt, Le Conte's sparrow by Laura Erickson, pink lady's-slipper by Ryan P. O'Connor.

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Central Wisconsin Wildlife Areas Property Group At a Glance

Exceptional Characteristics of the Study Area

- **Extensive, High-quality Wetlands.** Large areas of high-quality forested and non-forested wetlands occur on the property group. These include pristine peatland complexes comprised of Black Spruce Swamp, Tamarack (Poor) Swamp, Muskeg, Open Bog, Poor Fen and Northern Sedge Meadow; as well as managed wetland complexes containing Northern Sedge Meadow and Emergent Marsh. These wetlands support significant populations of rare species as well as significant populations of ducks, geese, and mammal game species. Invasive species such as glossy buckthorn are currently very rare and a unique management opportunity exists to remove them before they become more widespread and significantly alter the habitat.
- **Globally Important Habitat for Wetland Birds and Grassland Birds.** Having significant habitat for wetland birds and grassland birds (many of which are area-sensitive), portions of the property group have been designated as Conservation Opportunity Areas of statewide and Midwest significance through the Wisconsin Wildlife Action Plan, a Land Legacy Place with global to continental significance, and an Important Bird Area.
- **Numerous Rare Bird Species.** Forty-seven rare breeding bird species have been documented from the property group including six State Threatened species and one proposed State Endangered species (black tern).

Site Specific Opportunities for Biodiversity Conservation

Four ecologically important sites, or "Primary Sites," were identified at Mead, McMillan Marsh & Dewey Marsh State Wildlife Areas. "Primary Sites" are typically delineated because they 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.

- **Mead Conifer Bogs.** This primary site is largely comprised of the State Natural Area (SNA) of the same name and includes mostly pristine Black Spruce Swamp, Tamarack (Poor) Swamp, Muskeg, Alder Thicket, Shrub-carr, and Northern Sedge Meadow.
- **Mead Big Eau Pleine Woods.** Encompassing the most significant block of mature hardwoods on the property group, this 300 acre primary site is located along the southern shore of the Big Eau Pleine River Flowage north and south of County Highway C. It contains high tree, shrub, and herbaceous plant diversity and is the only site to support rare forest interior birds, previously found more extensively on the property group.
- **Honey Island Wetland and Teal Marsh and Meadow.** This site encompasses several of the managed wetland complexes at George W. Mead State Wildlife Area and contains the highest diversity and most significant populations of rare bird species on the property group among managed wetlands.
- **Dewey Marsh and Muskeg.** This primary site encompasses most of Dewey Marsh State Wildlife Area and includes a peatland complex of exceptional size and pristine quality with characteristics of an ecological reference area. It includes Black Spruce Swamp, Muskeg, Open Bog, Poor Fen, and Northern Sedge Meadow and supports significant populations of rare bird species. Glossy buckthorn is currently rare and a management opportunity exists to control this species before it becomes widespread and significantly alters the habitat.

Introduction

Purpose and Objectives

This report is intended to be used as a source of information for developing a new master plan for the Central Wisconsin Wildlife Areas Planning Group (CWWA; Figure 1). The regional ecological context for the CWWA is provided to assist in developing the Regional and Property Analysis that is part of the master plan. Properties included in this assessment are:

- Dewey Marsh State Wildlife Area
- Dewey Marsh State Natural Area
- George W. Mead State Wildlife Area
- Mead Conifer Bogs State Natural Area
- McMillan Marsh State Wildlife Area

The primary objectives of this project were to collect biological inventory information relevant to the development of a master plan for the CWWA 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 CWWA 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. 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* 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 website (*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

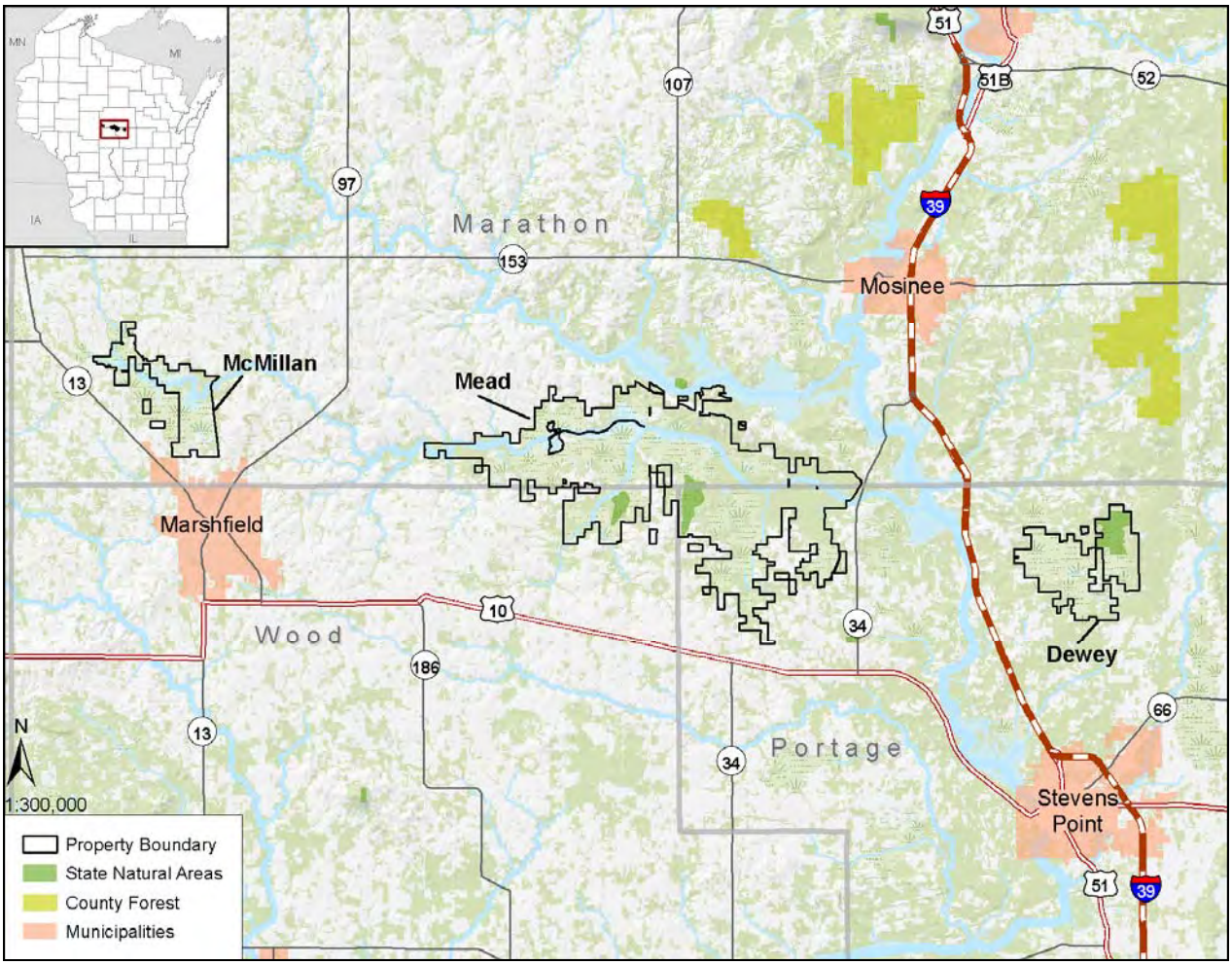

Figure 1. Location of the Central Wisconsin Wildlife Areas Planning Group

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 CWWA 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 and 2) taxa specific surveys.

The most recent taxa-specific field surveys for the study area were conducted during 2011. Surveys were limited in scope and focused on documenting high quality natural communities, breeding birds, aquatic and terrestrial invertebrates, small mammals, and herptiles. The collective results from all of these surveys were used, along with other information, to identify ecologically important areas (Primary Sites) of the CWWA.

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 CWWA, key

inventory considerations included the identification of high quality wetlands and the location of habitats that had the potential to support rare species. Private lands, including easements, surrounding the CWWA were not surveyed.

Scientific names for all species mentioned in the text are included in a list on page 50.

Background on Past Efforts

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

Important Bird Area

George W. Mead State Wildlife Area was identified as an Important Bird Area (IBA; WDNR 2007). These sites are critical for the conservation and management of Wisconsin's birds. George W. Mead State Wildlife Area received this designation due to the fact that its high diversity of habitats (including grassland, upland shrub, upland deciduous forest, shrub swamp, sedge meadow, marsh, and flowages) support a commensurately high diversity of bird species. Mead is one of four sites in the state that supports greater prairie-chicken (*Tympanuchus cupido*), a State Threatened species. Other declining grassland bird species found here include Henslow's sparrow (*Ammodramus henslowii*), Le Conte's sparrow (*Ammodramus leconteii*), savannah sparrow (*Passerculus sandwichensis*), bobolink (*Dolichonyx oryzivorus*), and eastern meadowlark (*Sturnella magna*).

Grassland Bird Priority Landscape

George W. Mead State Wildlife Area was also identified as a statewide grassland bird priority landscape in conjunction with Paul W. Olson State Wildlife Area to the south (Sample and Mossman 1997). McMillan Marsh State Wildlife Area was also identified as a priority landscape as a part of the North Central Prairie-Chicken Grasslands. In addition, Dewey Marsh State Wildlife Area was also noted as a high priority site.

Wisconsin Wildlife Action Plan: Conservation Opportunity Area

The Wisconsin Wildlife Action Plan (WAP; (WDNR 2006) recognized "Dewey Marsh" and "Mead" as Conservation Opportunity Areas (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.

Legacy Place

The Land Legacy Report (WDNR 2006b) was designed to identify Wisconsin's most important conservation and recreation needs for the next 50 years. Two related "Legacy Places" were identified:

- **Central Wisconsin Grasslands** is a large Legacy Place that encompasses Mead and McMillan Marsh State Wildlife Areas, as well as Paul Olson Wildlife Area and private lands. The site was given a four-star rating for conservation significance, i.e., it possesses outstanding ecological qualities, is of adequate size to meet the needs of critical components, and/or harbors natural communities or species of global or continental significance. The site was identified as perhaps the best location in Wisconsin to create a grassland landscape large enough to sustain viable populations of most grassland species. This Legacy Place harbors the state's largest populations of greater prairie-chicken and Henslow's sparrow.
- **Dewey Marsh and Woods** is a small Legacy Place that includes Dewey Marsh State Wildlife Area and State Natural Area. The site was given a three-star rating for conservation significance.

Ecoregional Functional Site
The Nature Conservancy's Prairie-Forest Border Ecoregion Conservation Plan (The Nature Conservancy 2001) recognized Dewey Marsh as an important "Functional Site." Dewey Marsh harbors a high-quality sedge meadow, and provides habitat for diverse wildlife, including sandhill crane (*Grus canadensis*) Henslow's sparrow, and, historically, greater prairie-chicken.

Wetland Designation
Dewey Marsh State Wildlife Area and George W. Mead State Wildlife Area were both recognized as a "Wetland Gem" by the Wisconsin Wetlands Association (Wisconsin Wetlands Association 2009). Wetland Gems are high quality habitats that represent the wetland riches that historically made up nearly a quarter of Wisconsin's landscape. Critically important to Wisconsin's biodiversity, these natural treasures also provide our communities with valuable functions and services as well recreational and educational opportunities. Wetland Gems were selected based on extensive conservation planning efforts that identified critical habitats, threats, and conservation actions to protect the state's natural communities, species, and special places. The designation process integrated many other conservation planning efforts including The Nature Conservancy's Ecoregional Plans, the Wisconsin Important Bird Areas Project, and the Wisconsin Department of Natural Resources' Land Legacy Report, Wildlife Action Plan, State Natural Areas Program, and Coastal Wetlands Assessment Report.

Special Management Designations

State Natural Areas (SNA) are places on the landscape that protect outstanding examples of native natural communities, significant geological formations, and archaeological sites. Designation confers a significant level of land protection through state statutes, administrative rules, and guidelines. **Mead Conifer Bogs** is a 932-acre State Natural Area within George W. Mead State Wildlife Area. **Dewey Marsh** is a 926-acre State Natural Area within Dewey Marsh State Wildlife Area.

The **Central Wisconsin Grassland Conservation Area** (CWGCA) stretches in an "S" shape from southeastern Taylor County, through parts of Clark and Marathon Counties, between Stevens Point and Wisconsin Rapids, and south to northeastern Adams County. It includes the Leola Marsh State Wildlife Area, Buena Vista Marsh State Wildlife Area, Paul J. Olson Wildlife Area, and George W. George W. Mead State Wildlife Area. The CWGCA's primary objectives are to: 1) establish more permanent grassland habitat (primarily focused on lands within 1 mile of active, or recently active, greater prairie-chicken booming grounds), and 2) maintain a predominantly open, unforested, undeveloped landscape where agriculture is the dominant land use, particularly in areas critical to the life history needs of grassland bird species.

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 its lands, supporting economic activities, protecting wildlife habitat, and providing recreational opportunities.

Regional Ecological Context

Forest Transition and Central Sand Plains Ecological Landscapes

This section is largely reproduced from two sources: The Ecological Landscapes of Wisconsin Handbook (WDNR In prep. a, *Forest Transition Ecological Landscape); and Wisconsin Wildlife Action Plan (WDNR 2006a, Central Sand Plains Ecological Landscape).*

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. George W. Mead State Wildlife Area and McMillan Marsh State Wildlife Area are completely within the Forest Transition Ecological Landscape. Dewey Marsh State Wildlife Area is 86% in the Central Sands Ecological Landscape, and 14% in the Forest Transition Ecological Landscape. See Figure 2 for the study area in relation to Ecological Landscapes.

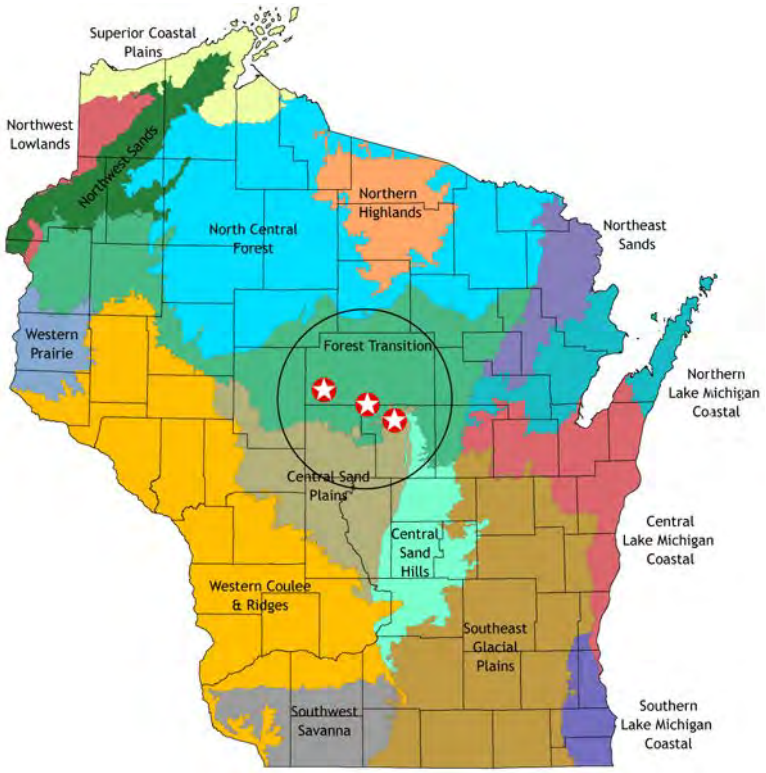

Figure 2. Ecological Landscapes of Wisconsin and the study area.

The **Forest Transition Ecological Landscape** lies along the northern border of Wisconsin's Tension Zone, through the central and western part of the state, and supports both northern forests and agricultural areas. Topography is typically undulating or rolling, but ranges from nearly level (wetlands, ice-walled lake plains, and outwash deposits) to hilly and steep (moraines, bedrock-cored hills, monadnocks, and

along river valleys). Glacial till is the major type of material deposited throughout the Ecological Landscape, and most landforms are glacial till plains or moraines. Throughout the area, post-glacial erosion, stream cutting, and deposition formed floodplains, terraces, and swamps along major rivers. Wind-deposited silt material (loess) formed a layer 6 to 48 inches thick. The Forest Transition Ecological Landscape lies along the northern border of Wisconsin's Tension Zone, through the central and western part of the state, and supports both northern forests and agricultural areas.

The historic vegetation of the **Forest Transition Ecological Landscape** was primarily northern hardwood and hemlock (*Tsuga canadensis*) – northern hardwood forests. Currently, 44% of this Ecological Landscape is forested compared to 86% forested before Euro-American settlement. Forested areas now consist primarily of northern hardwoods and aspen (*Populus* sp.), with smaller amounts of oak (*Quercus* sp.) and lowland hardwoods. Conifer and deciduous swamps are scattered throughout the Ecological Landscape and are often found near the headwaters of streams and associated with kettle lakes. The Ecological Landscape's flora shows characteristics of both northern and southern Wisconsin, corresponding to its position along the Tension Zone (Curtis 1959). The Forest Transition ranks third in the number of acres in wetlands among the 16 Ecological Landscapes and eighth in the percent of the Landscape in wetlands (15.5%). There are more than 686,000 acres of wetlands in the Forest Transition, over half of which are forested.

The **Central Sand Plains Ecological Landscape**, located in central Wisconsin, occurs on a flat, sandy lake plain, and supports agriculture, forestry, recreation, and wildlife management. The Ecological Landscape formed in and around what was once Glacial Lake Wisconsin, which contained glacial meltwater extending over 1.1 million acres at its highest stage. Soils are primarily sandy lake deposits, some with silt-loam loess caps. Sandstone buttes carved by rapid drainage of the glacial lake, or by wave action when they existed as islands in the lake, are distinctive features of this landscape. The historic vegetation of the area included extensive wetlands of many types, including open bogs, shrub swamps, and sedge meadows. Prairies, oak forests, savannas and barrens also occurred in the Ecological Landscape. An area of more mesic forest with white pine (*Pinus strobus*) and hemlock was found in the northwest portion, including a significant pinery in eastern Jackson County. Today, nearly half of the Ecological Landscape is nonforested, in agriculture and grassland. Most of the historic wetlands were drained early in the 1900s and are now used for vegetable cropping. The forested portion is mostly oak-dominated forest, with lesser amounts of aspen, pines, maple-basswood (*Tilia americana*) forest, and lowland hardwoods.

Black Spruce Swamp forms part of the extensive wetlands in both the Forest Transition and Central Sand Plains Ecological Landscapes. Photo by Ryan P. O'Connor.

Regional Biodiversity Needs and Opportunities

Opportunities for sustaining natural communities in the Forest Transition and Central Sand Plains Ecological Landscapes were developed by the Ecosystem Management Planning Team (EMPT 2007) and presented in the Wisconsin Wildlife Action Plan (WDNR 2006a). The goal of sustaining natural communities is to manage for natural community types that 1) historically occurred in a given landscape and 2) have a high potential to maintain their 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. Based on EMPT's criteria, these are the most appropriate community types that could be considered for management activities within the **Forest Transition** and **Central Sand Plains** Ecological Landscapes.

There are management opportunities for 27 natural communities in the **Forest Transition** Ecological Landscape. Of these, eight are considered "major" opportunities and an additional 15 communities are considered "important" in the **Forest Transition** Ecological Landscape (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 "important" opportunity indicates that although the natural community does not occur extensively or commonly in the Ecological Landscape, one to several occurrences are present 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 **Forest Transition** Ecological Landscape (WDNR 2006a, EMPT 2007). Communities present on the CWWA in this Ecological Landscape are highlighted with an asterisk.

Major Opportunities	**Important Opportunities**
Coldwater streams	*Alder Thicket
*Coolwater streams	Bedrock Glade
*Impoundments/Reservoirs	Dry Cliff
*Northern Mesic Forest	*Emergent Marsh
*Northern Wet Forest	*Ephemeral Pond
Northern Wet-mesic Forest	*Floodplain Forest
*Warmwater rivers	Inland lakes
*Warmwater streams	Moist Cliff
	*Northern Dry-mesic Forest
	*Northern Hardwood Swamp
	*Northern Sedge Meadow
	*Open Bog
	*Shrub-carr
	*Submergent Marsh
	*Surrogate Grasslands

There are management opportunities for 44 natural communities in the **Central Sand Plains** Ecological Landscape. Of these, 15 are considered "major" opportunities and an additional 18 natural communities are considered "important" in the Central Sand Plains Ecological Landscape (Table 2).

Table 2. Major Natural Communities Management Opportunities in the **Central Sand Plains** Ecological Landscape
(WDNR 2006a). Communities present on the CWWA in this Ecological Landscape are highlighted with an asterisk.

Major Opportunity	Important Opportunity
*Alder Thicket	Coastal Plain Marsh
Central Sands Pine - Oak Forest	Coldwater streams
Dry Cliff	*Coolwater streams
Floodplain Forest	Dry Prairie
Impoundments/Reservoirs	Dry-mesic Prairie
*Northern Sedge Meadow	*Emergent Marsh
*Northern Wet Forest	Moist Cliff
Oak Barrens	Northern Dry Forest
*Open Bog	*Northern Dry-mesic Forest
Pine Barrens	Northern Hardwood Swamp
Sand Prairie	*Northern Mesic Forest
*Shrub-carr	Southern Dry Forest
Southern Dry-mesic Forest	Southern Mesic Forest
*Surrogate Grasslands	Southern Sedge Meadow
White Pine - Red Maple Swamp	Southern Tamarack Swamp (rich)
	Submergent Marsh
	Warmwater rivers
	Warmwater streams

Bog rosemary (*Andromeda glaucophylla*) is commonly found in Open Bogs and Muskegs. Photo by Kitty Kohout.

Rare Species of the Forest Transition and Central Sand Plains Ecological Landscapes

Numerous rare species are known from the Forest Transition and Central Sand Plains Ecological Landscapes. "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." Tables 3 and 4 list the number of species known to occur in this landscape based on information stored in the NHI database as of 2012.

Table 3. Listing Status for rare species in the **Forest Transition** Ecological Landscape as of January 2012. Source is the NHI database. Listing Status is based on the NHI Working List published June 2011.

	Taxa					Total Fauna	Total Plants	Total Listed
Listing Status	**Mammals**	**Birds**	**Herptiles**	**Fishes**	**Invertebrates**			
Federally Endangered	1	0	0	0	3	4	0	4
Federally Threatened	0	0	0	0	0	0	0	0
Federal Candidate	0	0	0	0	2	2	0	2
State Endangered	0	4	1	2	9	16	3	19
State Threatened	0	6	2	8	7	23	9	32
State Special Concern	4	13	1	8	22	48	21	69

Table 4. Listing Status for rare species in the **Central Sand Plains** Ecological Landscape as of January 2012. Source is the NHI database. Listing Status is based on the NHI Working List published June 2011.

	Taxa					Total Fauna	Total Plants	Total Listed
Listing Status	**Mammals**	**Birds**	**Herptiles**	**Fishes**	**Invertebrates**			
Federally Endangered	1	1	0	0	1	3	0	3
Federally Threatened	0	0	0	0	0	0	0	0
Federal Candidate	0	0	1	0	1	2	0	2
State Endangered	0	4	4	0	5	13	6	19
State Threatened	0	10	2	5	4	21	8	29
State Special Concern	4	14	3	6	40	67	27	94

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 32 vertebrate SGCN significantly associated with the Forest Transition Ecological Landscape and 43 vertebrate SGCN significantly associated with the Central Sand Plains Ecological Landscape (See Appendix E). This means that these species are (and/or historically were) significantly associated with these Ecological Landscapes, and that restoration of natural communities for which these species are associated with would significantly improve conditions for the species.

Description of the Study Area

Location and Size

George W. Mead State Wildlife Area is 32,238 acres, and spans the intersection of Wood, Portage and Marathon Counties (Mead Conifer Bogs State Natural Area lies within this wildlife area, and is 932 acres). McMillan Marsh State Wildlife Area is 4,140 acres, and is found in Marathon County. Dewey Marsh State Wildlife Area is 6,039 acres, and is found in Portage County (Dewey Marsh State Natural Area lies within this wildlife area, and is 926 acres). All acreages are based on fee simple ownership from DNR Facilities and Lands database as of January 2012; acreage may not include leases and some permanent water bodies.

Ecoregion

Land Type Associations (LTAs) of Wisconsin represent a further definition of the National Hierarchical Framework of Ecological Units (NHFEU). The NHFEU is a classification system that divides landscapes into ecologically significant regions at multiple scales. Ecological types are classified and units are mapped based on the associations of biotic and environmental factors which include climate, physiography, water, soils, air, hydrology, and potential natural communities. Figure 3 shows that the "Abbotsford Moraines," "Mead Marsh," and "Glacial Lake Wisconsin Bogs" are the most significant LTAs in the study area, although several others are also present within the periphery of the study area.

American bitterns (*Botaurus lentiginosus*) can be found in many of the open wetland habitats that occur in the Mead Marsh and Glacial Lake Wisconsin Bogs LTAs. Photo by Brian Collins.

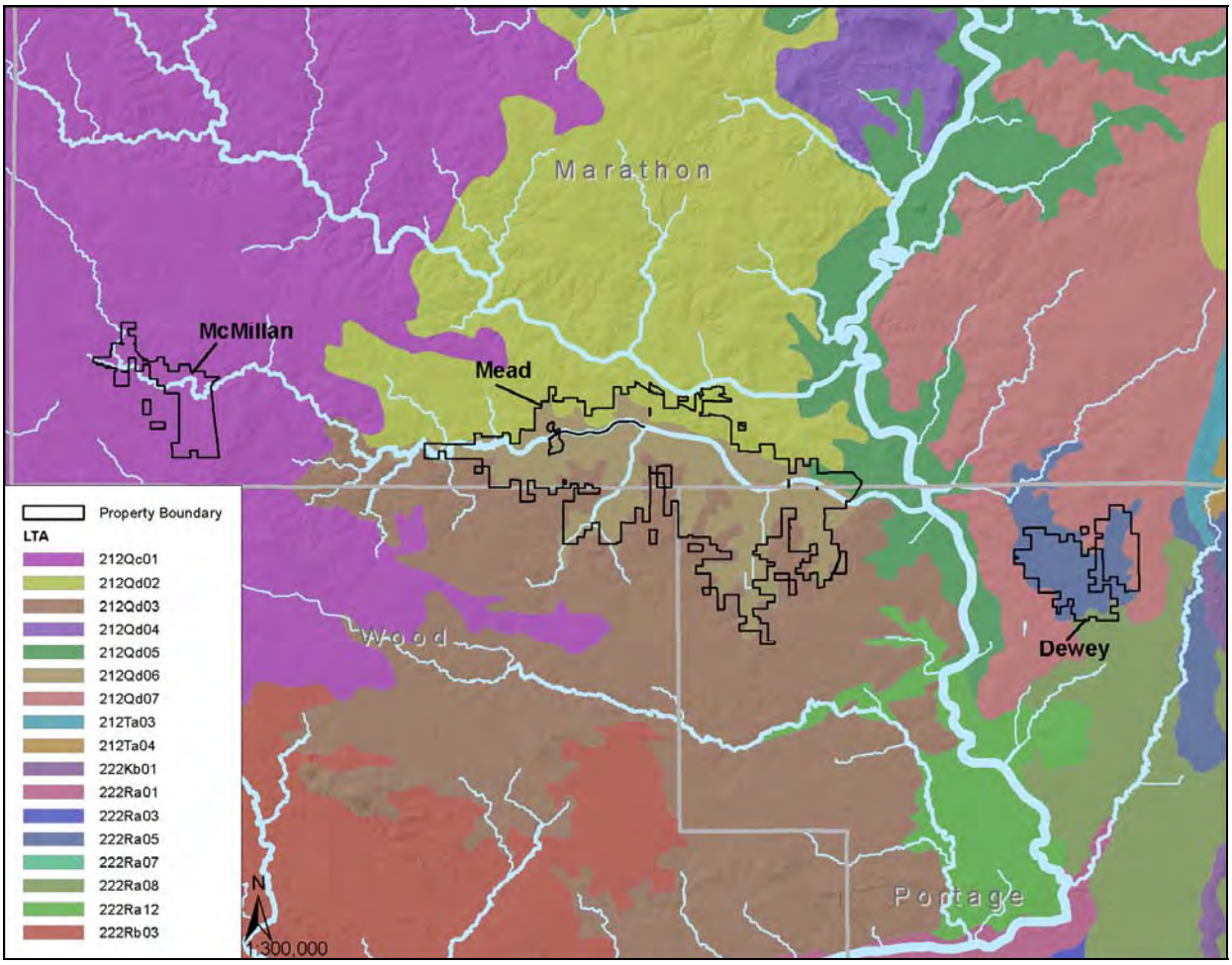

Figure 3. Landtype Associations for Central Wisconsin Wildlife Areas Planning Group.

Key to Figure 3

- **Abbotsford Moraines (212Qc01).** The characteristic landform pattern is undulating moraine. Soils are predominantly somewhat poorly drained silt loam over acid loam till. Bedrock types are igneous, metamorphic, and Volcanic Rock. This LTA comprises 100% of McMillan Marsh State Wildlife Area.
- **Mead Marsh (212Qd06).** The characteristic landform pattern is nearly level marsh. Soils are very poorly drained muck. Common habitat type is forested lowland. This LTA comprises approximately 80% of George W. Mead State Wildlife Area.
- **Milladore Uplands (212Qd03).** The characteristic landform pattern is undulating erosional surface. Soils are predominantly somewhat poorly drained sandy loam over loamy residuum, till, or igneous/metamorphic bedrock. This LTA comprises approximately 10% of George W. Mead State Wildlife Area.
- **Marathon Uplands (212Qd02).** The characteristic landform pattern is rolling bedrock-controlled erosional surface. Soils are predominantly well drained silt loam over acid loam till, loamy residuum, or igneous/metamorphic bedrock. This LTA comprises approximately 8% of George W. Mead State Wildlife Area along its northern boundary.
- **DuBay Plains (212Qd05).** The characteristic landform pattern is nearly level outwash plain, stream terrace, and floodplain complex. Soils are predominantly well drained loamy sand over outwash. This LTA comprises approximately 2% of George W. Mead State Wildlife Area.

- **Glacial Lake Wisconsin Bogs (212Ra05).** Land is nearly level. Carbonate bedrock underlies very poorly drained mucky soils with a muck surface over nonacid muck or non-calcareous sand outwash, along with poorly drained and somewhat poorly drained sandy soils with a sand surface over non-calcareous sand outwash. This LTA comprises approximately 80% of Dewey Marsh State Wildlife Area
- **Peplin Uplands (212Qd07).** The characteristic landform pattern is undulating erosional surface. Soils are predominantly somewhat poorly drained sandy loam over loamy residuum, till, or igneous/metamorphic bedrock. This LTA comprises approximately 15% of Dewey Marsh State Wildlife Area.
- **Plover-Hankock Outwash Plain (222Ra08).** Sandstone bedrock underlies well drained, excessively drained, and moderately well drained sandy and loamy soils with a sand or sandy loam surface over non-calcareous sand, gravelly sand, or loamy sand outwash or eolian. This LTA comprises approximately 5% of Dewey Marsh State Wildlife Area.

The Glacial Lake Wisconsin Bogs LTA comprises the majority of Dewey Marsh State Wildlife Area, and the basin supports extensive high-quality wetland communities including large expanses of Northern Sedge Meadow. Photo by Ryan P. O'Connor.

Physical Environment

Geology and Glaciation

This section is largely reproduced from the Ecological Landscapes of Wisconsin Handbook (WDNR In prep. a).

Throughout most of the study area, the uppermost layer of bedrock is Precambrian igneous and metamorphic rock that was formed during volcanic activity that occurred over 1 billion years ago. The rocks that comprise this Precambrian Shield are greatly diverse (e.g., granite, basalt, schist, diorite), having been subject to considerable metamorphism, erosion, and mixing during their existence. Along with igneous and metamorphic rock, carbonate and sandstone underlie significant areas of Dewey Marsh.

The entire study area was subject to glacial activity, though glacial ice thickness during the most recent Pleistocene glaciation was likely thin over much of the area (Brian Peters, pers. com.). Glacial till is the major type of material deposited throughout the Ecological Landscape, and most landforms are till plains or moraines. Throughout the area, post-glacial erosion, stream cutting, and deposition formed floodplains, terraces, and swamps along major rivers. Wind-deposited silt material (loess) formed a layer 6 to 48 inches thick.

Soils

Main reference: Soil Survey Staff, Natural Resource Conservation Service, USDA. Web Soil Survey.

All soils in the study area are derived from a combination of glacial deposits and bedrock residua (igneous and metamorphic), and are virtually all hydric, i.e., capable of supporting wetlands.

The soils of McMillan Marsh State Wildlife Area were formed in depressions and drainageways of ground moraines, and are poorly drained silt loams and mucks.

The most common soil type at George W. Mead State Wildlife Area is muck, though sandy loams, silt loams, loamy sands and loams are present in lesser amounts throughout the core area. In the western part of George W. Mead State Wildlife Area, the soils along the Little Eau Pleine River are alluvial in origin, and are mostly silt loams with lesser amounts of sandy loam. Mucky peat soils are dominant in the western tract of Mead Conifer Bogs State Natural Area and in the State Wildlife Area lands surrounding it. The limited upland areas here are mostly silt loams and sandy loams derived from bedrock.

The most common soil type at Dewey Marsh State Wildlife Area and State Natural Area is muck, corresponding with the core wetland areas. The upland areas here are underlain by mostly sandy loams derived from loamy residuum. In addition, small areas of bedrock outcrops occur in portions of the uplands.

Hydrology

The CWWA property group is characterized by extensive wetlands, flowages, streams and rivers systems in the Central Wisconsin River basin. Hydrology is critical to the type and function of wetland natural communities as well as recreational opportunities in the study area.

Both George W. Mead State Wildlife Area and McMillan Marsh State Wildlife Area lie along the Little Eau Pleine River. The lower portion of the Little Eau Pleine is classified as a Warm Mainstem river (WDNR 2011). Much of the core area of Mead was extensively ditched under the Dancy Drainage District project in the early 1900s to convert the area to better farmland, but the drainage project was later abandoned. Upon the dedication of Mead as a State Wildlife Area, restoration began on many of the ditched areas in an attempt to restore wildlife habitat and recreation opportunities. Much of the area is now managed by the WDNR for waterfowl production, wildlife habitat, and hunting, and the property

contains several large flowages with water chemistry ranging from very soft to medium hard. Other previously ditched areas have remained largely unmanaged hydrologically, such as portions of the Mead Conifer Bogs SNA.

The Big Eau Pleine Reservoir is maintained by a dam and occurs along the northern boundary of George W. Mead State Wildlife Area. It is classified as Deep Lowland and is considered an impaired waterbody due to low dissolved oxygen and high levels of bacteria (Krietlow 1991).

Hay Meadow Creek partially originates in and runs through portions of Dewey Marsh State Wildlife Area. It contains several springs and spring runs and is largely in an unaltered state. A few small areas of ditching also occur at Dewey Marsh State Wildlife Area, which have minor local impacts to hydrology.

Vegetation

Historical Vegetation

There is value in determining the nature of a site's vegetation before European settlement as well as its historical alterations and uses. The purpose of examining historical conditions is to identify ecosystem factors that formerly sustained species and communities that are now altered in number, size, or extent, or which have been changed functionally (for example, by constructing dams, or suppressing fires). Maintaining or restoring some lands to more closely resemble historic systems and including some structural or compositional components of the historic landscape within actively managed lands can help conserve important elements of biological diversity (WDNR In prep. a). Public Land Surveys for the area comprising CWWA were conducted between 1851 and 1853, with a few section corners near rivers set in 1839 and 1840.

From Draft EL Chapter for Forest Transition Ecological Landscape:
Public Land Survey (PLS) information has been converted to a database format, and relative importance values (RIV) for tree species were calculated based on the average of tree species density and basal area (He et al. 2000). Relative importance value (RIV) does not indicate the percentage of landcover of a species or group of species, rather it gives an indication of the importance of an individual species or group of species in a given forested land area. This analysis indicates that sugar maple (*Acer saccharum*, 16.4% of the RIV), eastern hemlock (15.7% of the RIV), and yellow birch (*Betula alleghaniensis,* 15.5% of the RIV) had the highest RIVs in the Forest Transition Ecological Landscape. Eastern white pine was the only other species with an RIV over 10% (11.8%).

The early vegetation of Wisconsin was mapped based on notes and maps from the original Public Land Surveys (Finley 1976). Based on Finley's map, most of the study area, including most of George W. Mead State Wildlife Area, most of Dewey Marsh State Wildlife Area, and portions of McMillan Marsh State Wildlife Area was dominated by the "Swamp Conifer" cover type (Figure 4), with the most common witness trees being tamarack (*Larix laricina*), spruce (likely black spruce, *Picea mariana*) and paper birch (*Betula papyrifera*, likely in Muskeg). A small amount of "marsh/sedge meadow/wet prairie/lowland shrubs" was noted in the northwestern property corner of McMillan Marsh. Significant portions of Northern Mesic Forest were also noted in and on the edges of all three wildlife areas, with the most common witness tree species being hemlock, yellow birch, white pine, and sugar maple.

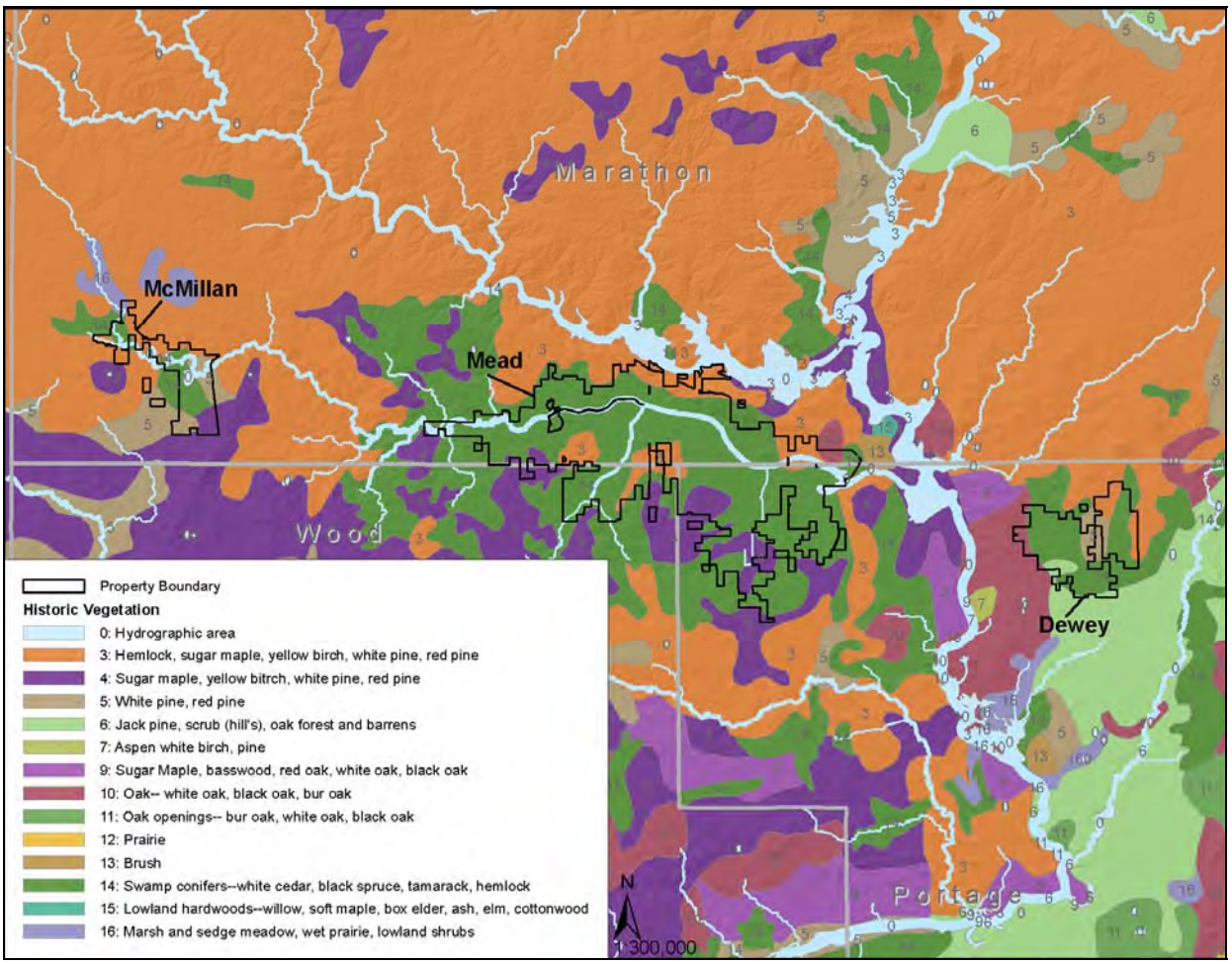

Figure 4. Vegetation of the Central Wisconsin Wildlife Areas Planning Group prior to Euro-American settlement (Finley 1976).

Current Vegetation

Current vegetation of the CWWA has been influenced by many historical factors including logging in the mid to late 1800s, wetland drainage projects (e.g., the Dancy Drainage District in the early 1900s), the creation of flowages, homesteading and farming attempts, and wildfires, including a large wildfire at Dewey Marsh State Wildlife Area in 1976. In addition, current factors influence the vegetation including hydrologic management, wildlife and recreation management, forest management, and ecological restoration. Finally, broad environmental factors have a profound impact on the vegetation including geology, soils, natural hydrology, and climate.

The landscape surrounding the CWWA is dominated by agriculture interspersed with smaller blocks of grassland, especially south of the study area (Figure 5). Toward the eastern portion of the study area and along the Big Eau Pleine River, the landscape becomes more dominated by deciduous forest, which is also present elsewhere as large to small wooded blocks within the agricultural matrix. Finally, several small to moderate-sized urbanized areas occur in the larger landscape, including Stevens Point, Mosinee, and Marshfield.

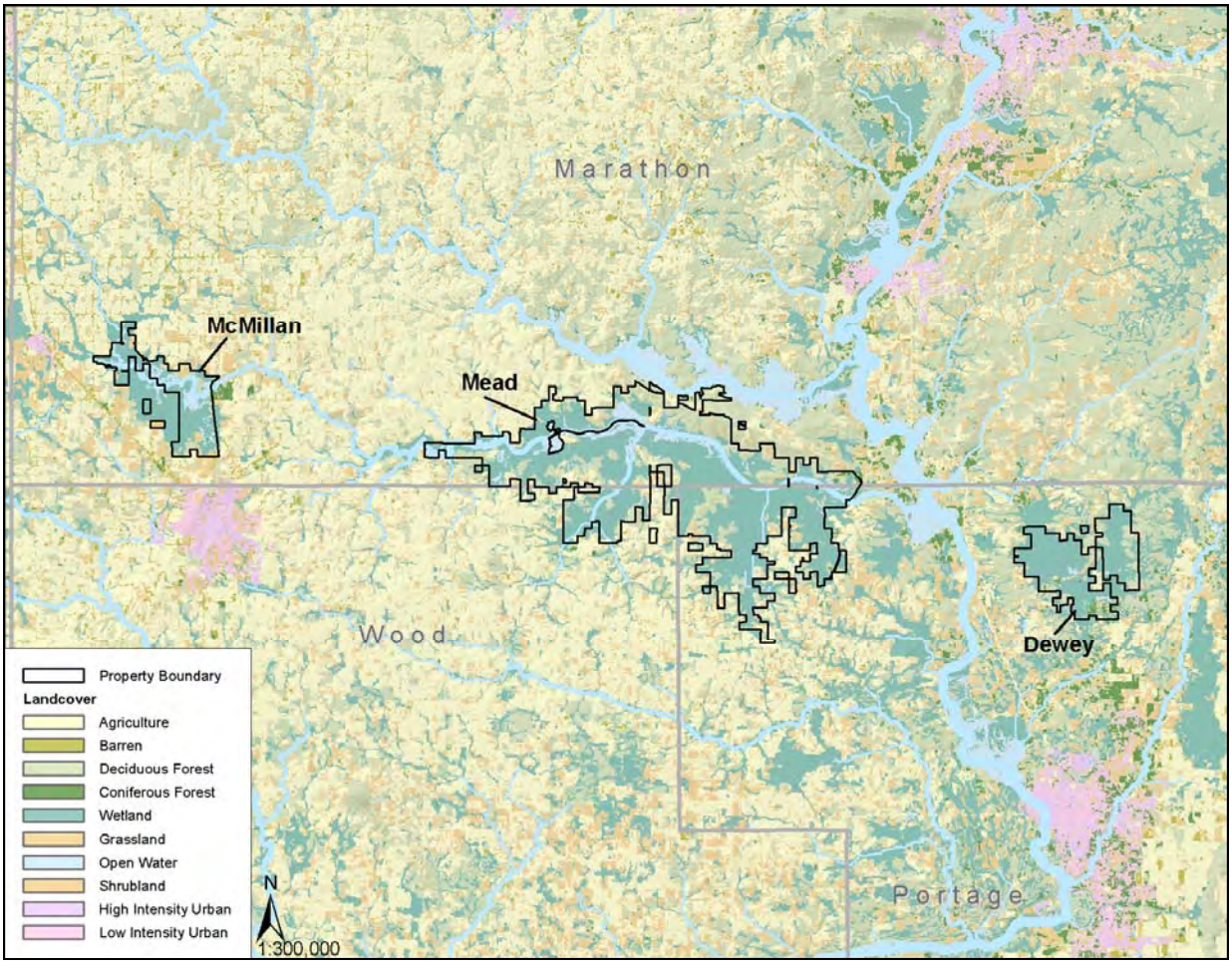

Figure 5. Landcover for Central Wisconsin Wildlife Areas Planning Group from the Wisconsin DNR Wiscland GIS coverage (WDNR 1993).

Within the study area, wetland communities comprise a majority of the area, including open wetlands such as Submergent Marsh (primarily in flowages), Emergent Marsh, Northern Sedge Meadow, Alder Thicket, Poor Fen, Open Bog, and Shrub-carr. In addition, forested wetland communities are common, including Muskeg, Black Spruce Swamp (sometimes also termed Northern Wet Forest), Tamarack (Poor) Swamp, Northern Hardwood Swamp, and Floodplain Forest. Uplands include Northern Mesic Forest, Northern Dry-mesic Forest, and Surrogate Grassland. Current vegetation is described in detail for each property below. Properties are listed alphabetically.

Dewey Marsh State Wildlife Area

The highest quality natural communities at Dewey Marsh State Wildlife Area include Northern Sedge Meadow, Springs and Spring Runs, Poor Fen, Open Bog, Muskeg, and Black Spruce Swamp. Additional communities include Alder Thicket, Shrub-carr, Northern Mesic Forest and Surrogate Grasslands. High-quality natural communities were surveyed and mapped at a high level of detail for the large wetland complex at this site (Figure 6.)

Northern Sedge Meadow dominates the large wetland basin east of Haymeadow Drive and also occurs along the margins of the wetland complex west of Haymeadow Drive (Figure 6). The community is underlain by peat of varying thickness and is dominated by a diverse assemblage of grasses and sedges including lake sedge (*Carex lacustris*), common yellow lake sedge (*C. utriculata*), and blue-joint grass (*Calamagrostis canadensis*). Scattered throughout the meadow are varying densities of ericaceous shrubs including leatherleaf (*Chamaedaphne calyculata*), bog-rosemary (*Andromeda glaucophylla*), bog laurel (*Kalmia polifolia*), and Labrador tea (*Ledum groenlandicum*). Diverse hydrologic conditions create a variety of microhabitats within the meadow including low wet areas in swales and small intermittent streams dominated by broad-leaved cat-tail (*Typha latifolia*) and broad-leaved arrow-head (*Sagittaria latifolia*). Also present in the Northern Sedge Meadow are patches of Alder Thicket and areas of minerotrophic groundwater upwelling, described under Springs and Spring Runs. West of Haymeadow Drive and south of the Philippine Islands, several small shrubs of glossy buckthorn (*Rhamnus frangula*) were found growing in the Northern Sedge Meadow. Overall, over 100 plant species were documented in this community, making it very diverse. In addition, largely intact hydrology and a relative lack of invasive species, especially east of Haymeadow Drive, contribute to the exceptional quality of this natural community.

Spring and Spring Runs occur within the Northern Sedge Meadow east of Haymeadow Drive in an area of minerotrophic groundwater upwelling and form the headwaters of the northwestern branch of Hay Meadow Creek. Both woody and herbaceous plants indicative of calcareous groundwater occur here, including indicator species such as Buxbaum's sedge (*Carex buxbaumii*), bristle-stalked sedge (*C. leptalea*), bog birch (*Betula pumila*), Bebb's willow (*Salix bebbii*), and poison sumac (*Toxicodendron vernix*), along with other, more common species such as speckled alder (*Alnus incana* ssp. *rugosa*) and tamarack. In addition, one mature glossy buckthorn was found in (and removed from) this community.

Poor Fen occurs north of the Philippine Islands in the central portion of the wetland complex west of Haymeadow Drive (Figure 6). This community is a large, open, wet, moderately minerotrophic peatland dominated by sedges. Characteristic of the site are large areas of very shallow open water bordered by "lawns" of *Sphagnum* moss (*S. cuspidatum*) and minerotrophic species such as large cranberry (*Vaccinium macrocarpon*), hair beak-rush (*Rhynchospora capillacea*), and narrow-leaved sundew (*Drosera intermedia*). Trees are absent except on small islands. Dominant species include few-seeded sedge (*Carex oligosperma*), narrow-leaved woolly sedge (*C. lasiocarpa*), gray bog sedge (*C. canescens*), common yellow lake sedge, common tussock sedge (*C. stricta*), large-fruited star sedge (*C. echinata*), tussock cotton-grass (*Eriophorum vaginatum*), narrow-leaved cotton-grass (*E. angustifolium*), and *Sphagnum* mosses. Poor Fen grades into Open Bog to the north and west (Figure 6).

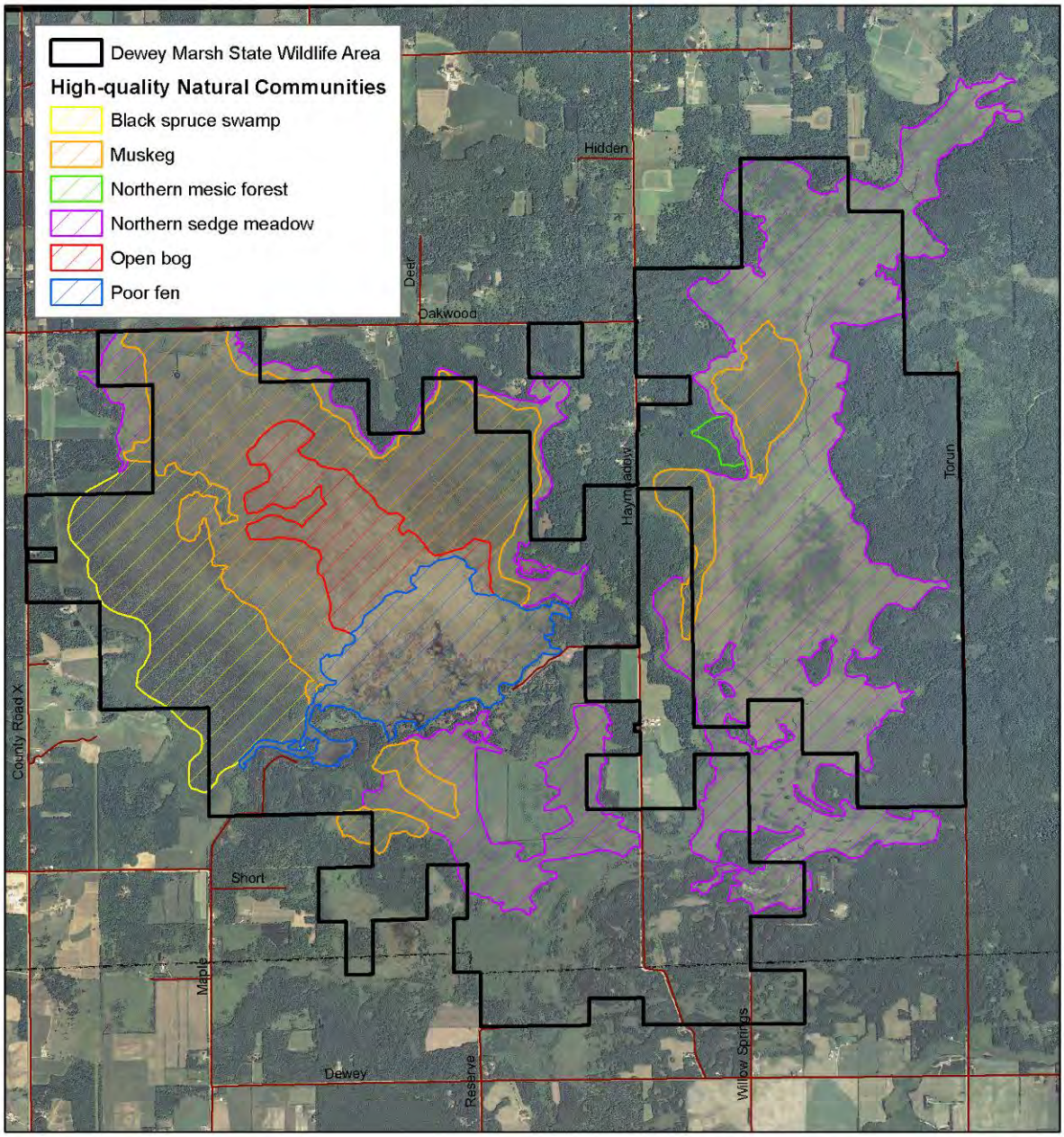

Figure 6. High-quality natural communities at Dewey Marsh State Wildlife Area.

Open Bog occurs in the north-central portion of the wetland complex west of Haymeadow Drive (Figure 6). Located in the center of an extensive peatland complex, it is largely hydrologically isolated from groundwater inputs by hummock-forming ericaceous shrubs including leatherleaf, bog-rosemary, and bog laurel interspersed with *Sphagnum* moss hollows. Very widely scattered trees are present (<1% canopy) including tamarack, black spruce, and white pine. Characteristic groundlayer species include few-seeded sedge, small cranberry (*Vaccinium oxycoccos*) and *Sphagnum* moss. Plant species diversity is low, a natural phenomenon which does not detract from the exceptionally high quality of the community. Large portions of Open Bog were burned in the 1976 wildfire. Open Bog grades into Muskeg to the north, east, and west, and into Poor Fen to the south (Figure 6).

Muskeg occurs in large areas of the wetland complex west of Haymeadow Drive both north and south of the Philippine Islands and in portions of the wetland complex east of Haymeadow Drive (Figure 6). Much more typical of more northern peatland complexes, the Muskeg at Dewey Marsh represents one of the largest, highest quality, and southernmost examples of this community in the state. The community is dominated by trees with a canopy coverage ranging from 5% to 30% consisting of stunted tamarack and black spruce (10-25 feet tall) with lesser amounts of stunted white pine, jack pine, and paper birch (*Betula papyrifera*). The shrub layer is composed of dense ericaceous shrubs including leatherleaf, bog-rosemary, and bog laurel. Characteristic groundlayer species include few-seeded bog sedge, tussock cotton-grass, tawny cotton-grass (*Eriophorum virginicum*) and *Sphagnum* mosses. Large portions of Muskeg were likely burned in the 1976 wildfire, and an old plowline from fire suppression efforts in the northwest portion of the wildlife area now forms part of the boundary between this community and Black Spruce Swamp to the east. Glossy buckthorn was also found in low concentrations in this community south of the Philippine Islands.

Black Spruce Swamp occurs along the western portion of the wetland complex west of Haymeadow Drive (Figure 6). The community is dominated by black spruce and tamarack with a canopy of 40-90% (trees 3 to 8 inches DBH) over scattered shrubs of leatherleaf and Labrador tea, with bog laurel and bog-rosemary in more open areas. A nearly continuous bed of *Sphagnum* moss was present throughout. Characteristic herbaceous species include pink lady's-slipper (*Cypripedium acaule*), small cranberry, creeping snowberry (*Gaultheria hispidula*), and three-fruited sedge (*Carex trisperma*). Several small upland islands also occur within the community and appear to have been disturbed by blowdowns and are now dominated by regenerating paper birch. A moderate-sized infestation of glossy buckthorn occurs on the west margin of this natural community and is a major threat to the entire wetland complex. Black Spruce Swamp grades into Muskeg to the west (Figure 6), sometimes with an abrupt transition where the communities are separated by an old plowline from the 1976 wildfire. This plowline is approximately 10-20 meters wide, stretches for well over one mile, and has recovered to vegetation resembling Poor Fen and Northern Sedge Meadow.

Other communities present at Dewey Marsh State Wildlife Area include Alder Thicket, Shrub-carr, Northern Mesic Forest and Surrogate Grasslands. Alder Thicket is dominated by speckled alder and occurs along the margins of open wetland complexes and adjacent to Springs and Spring Runs. Shrub-carr is dominated by speckled alder, willow (*Salix* sp.), bog birch, and paper birch and also occurs at the margins of wetland complexes and in areas with hydrologic alteration, such as a rectangular area surrounded by ditches south of the Philippine Islands and west of Haymeadow Drive. Northern Mesic Forest occurs primarily east of Haymeadow Drive and along Torun Road. Small portions of this forest within Dewey Marsh SNA are high in quality (Figure 6), and are dominated by northern red oak (*Quercus rubra*), white ash (*Fraxinus americana*), and basswood with understory sugar maple, hop-hornbeam (*Ostrya virginiana*), musclewood (*Carpinus caroliniana*), and maple-leaf viburnum (*Viburnum acerifolium*). However, the majority of the Northern Mesic Forest is variable in age with a heterogeneous landscape pattern of mostly even-aged stands including several areas managed for aspen. Finally, small but significant areas of Surrogate Grasslands occur at Dewey Marsh, including much of the Philippine Island chain and old fields in the south portion of the wildlife area.

McMillan Mash Wildlife Area

The highest quality and significant natural communities at McMillan Marsh State Wildlife Area include Hardwood Swamp, Northern Mesic Forest, Emergent Marsh, Northern Sedge Meadow, and Shrub-carr, though no communities were of exceptional quality. Additional natural communities include Riverine Mud Flat, Floodplain Forest and Surrogate Grasslands.

Hardwood Swamp occupies most of the low, wet, forested areas at McMillan Marsh and is the dominant forest community type across the property. Many areas have been previously logged and have younger, smaller trees. One of the higher quality Hardwood Swamps is located in the northeast portion of the property east of Lincoln Road. It is dominated by red maple (*Acer rubrum*) (10-16 inches DBH) with white ash and black ash (*Fraxinus nigra*), and some northern red oak noted in the sapling layer. The groundcover is dominated by scattered dwarf red raspberry (*Rubus pubescens*) and a dense layer of jewelweed (*Impatiens capensis*), fowl manna grass (*Glyceria striata*), fringed sedge (*Carex crinita*), and white avens (*Geum canadense*). As with many of the hardwood swamps on the property, areas of shallow water (1-6 inches deep) are common, and upon drying reveal exposed silty muck. Though not large enough to include in the NHI database, this Hardwood Swamp is important from a conservation perspective as one of the higher quality examples of this community type in the wildlife area. Non-native invasive species that occur in Hardwood Swamps at McMillan include common buckthorn (*Rhamnus cathartica*) and showy bush honeysuckle (*Lonicera* x *bella*). This community also supports a rare plant species in the western portion of the property.

Northern Mesic Forest occurs in scattered uplands at McMillan Marsh State Wildlife Area, and often grades into Hardwood Swamp at slightly lower elevations. As with Hardwood Swamp, one of the higher quality sites is located in the northeast portion of the property east of Lincoln Road, where a mesic upland supports a dense canopy (90% cover) of sugar maple, basswood, red oak, red maple, and black ash (trees 12-16 inches DBH). Silver maple (*Acer saccharinum*), hemlock, and yellow birch are also present in this community. The shrub and small tree layer is dominated by musclewood, flowering dogwood (*Cornus florida*) and tree saplings, and the groundcover is dominated by a dense layer of Virginia waterleaf (*Hydrophyllum virginianum*), lady-fern (*Athyrium filix-femina*), hog-peanut (*Amphicarpaea bracteata*), wild leek (*Allium tricoccum*), wild geranium (*Geranium maculatum*), and hairy sedge (*Carex hirtifolia*).

Emergent marsh, Shrub-carr, and Northern Sedge Meadow occur in extensive wetland complexes in and adjacent to flowages in the central and eastern portion of the property. Emergent marsh is dominated by cat-tails, which contains pockets of Northern Sedge Meadow dominated by common lake sedge, blue-joint grass, marsh fern (*Thelypteris palustris*), sensitive fern (*Onoclea sensibilis*), marsh cinquefoil (*Comarum palustre*), reed canary grass (*Phalaris arundinacea*), and water-arum (*Calla palustris*). This in turn intergrades with Shrub-carr, dominated by slender willow (*Salix petiolaris***),** pussy willow (*Salix discolor*), meadowsweet and speckled alder interspersed with numerous herbaceous species typical of marsh and sedge meadow.

Additional natural communities at McMillan Marsh State Wildlife Area include Riverine Mud Flat, Floodplain Forest, and Surrogate Grasslands. Riverine Mud Flat is found along the margins of drawn-down flowages and along free-flowing stretches of the Little Eau Pleine River. These exposed, wet silty-sandy flats can be variable in size and are highly dependent on water levels. They support plants species such as smartweed *Polygonum* sp.), reed canary grass, marsh purslane (*Ludwigia palustris*), as well as stranded aquatic species such as coon-tail (*Ceratophyllum demersum*), Canadian waterweed (*Elodea canadensis*) and curly dock (*Potamogeton crispus*). Floodplain Forest occurs along stretches of the Little Eau Pleine River. This community often occurs in a forested matrix of other, more widespread community types such as Hardwood Swamp and Northern Mesic Forest, with the spatial pattern of these communities determined by topography, soils, and hydrology (e.g. periodic inundation due to flooding versus consistently saturated soils due to groundwater inputs). Floodplain Forests are dominated by silver maple, red maple, American elm (*Ulmus americana*), and white ash (12-18 inches DBH) with scattered glossy buckthorn, and a dense groundcover of fringed sedge, brome-like sedge (*Carex bromoides*), false nettle (*Boehmeria cylindrica*), wood nettle (*Laportea canadensis*), bristly buttercup (*Ranunculus hispidus*), sensitive fern, and halberd-leaved tear-thumb (*Polygonum arifolium*).

Finally, Surrogate Grasslands make up a small community type on the property, including an area east of Lincoln Road and an area north of the west end of Swamp Road. These grasslands contain a mixture of old field species such as quack grass (*Elytrigia repens*), timothy (*Phleum pratense*), old field goldenrod (*Solidago altissima*), and hawkweeds (*Hieracium* spp.). However, species of adjacent natural communities are also common, including shrubs such as willows, meadowsweet, alder, and red-osier dogwood (*Cornus stolonifera*). These grassland areas are relatively small in size, and few grassland birds were noted utilizing this habitat. Where small grasslands are located in a largely forested or shrub-dominated matrix, there may be opportunities to allow these areas to convert to shrubs and/or to forest without a significant loss of grassland bird habitat. This is particularly true of the area east of Lincoln Road.

George W. Mead State Wildlife Area

The highest quality natural communities at George W. Mead State Wildlife Area include Emergent Marsh, Northern Sedge Meadow, Alder Thicket, Shrub-carr, Black Spruce Swamp, Tamarack (Poor) Swamp, Muskeg, and Northern Mesic Forest. Additional communities include Submergent Marsh, Floodplain Forest, Southern Dry-mesic Forest, and Surrogate Grassland.

Black Spruce Swamp occurs throughout the Mead Conifer Bogs SNA as well as other locations in the central portion of the wildlife area. These extensive, high-quality swamps are characterized by peat soils and are highly acidic (at least at the surface). They are dominated by black spruce and tamarack (3-6 inches DBH) over ericaceous shrubs such as leatherleaf, Labrador tea, bog-rosemary, and bog laurel. Characteristic groundcover species include tussock cotton-grass, three-fruited sedge, few-seeded sedge, creeping snowberry, three-leaved Solomon's seal (*Smilacina trifolia*), small cranberry, pink lady's-slipper, and a dense layer of *Sphagnum* mosses. Ditches run through or adjacent to several Black Spruce Swamps on the Wildlife Area with minor to moderate affects on hydrology. Mineral spoils associated with the ditches support upland species such as red oak, white pine, red maple, and a diversity of shrubs, including occasional glossy buckthorn. Black Spruce Swamp grades into other wetland community types including Alder Thicket, Shrub-carr, Muskeg, and Tamarack (Poor) Swamp.

Tamarack (Poor) Swamp is closely related to Black Spruce Swamp and commonly co-occurs with this community in large forested wetland complexes at the Wildlife Area (e.g. in and near Mead Conifer Bogs SNA). A nutrient-poor community on acidic peat soils (at least at the surface), this community is dominated by a semi-open canopy of tamarack over sapling tamarack, red maple, and paper birch. The shrub layer is moderate to dense and composed of speckled alder, steeple-bush (*Spiraea tomentosa*), leatherleaf, Labrador tea, and velvet-leaved blueberry (*Vaccinium myrtilloides*). The groundlayer is moderate to sparse with few-seeded sedge, common lake sedge, common yellow lake sedge, tussock cotton-grass, bristly dewberry (*Rubus hispidus*), marsh fern, three-leaved Solomon's seal, round-leaved sundew (*Drosera rotundifolia*) and dense *Sphagnum* mosses. The hydrology of Tamarack (Poor) Swamps at Mead ranges from intact to moderately impacted by ditches and dikes.

Alder Thicket and Shrub-carr are closely related and vary primarily in the degree of dominance by alder. Both natural communities occur throughout the wetlands on the Wildlife Area, with the highest quality areas generally located in large, diverse wetland complexes (e.g. Mead Conifer Bogs SNA and vicinity). Soils are generally organic, ranging from firm to soupy peat over mineral soil. Alder Thickets are primarily dominated by speckled alder, while Shrub-carr may contain alder along with other shrub species including winterberry (*Ilex verticillata*), black chokeberry (*Aronia melanocarpa*), Bebb's willow, and sandbar willow (*Salix exigua*). Additional less common shrubs may include mountain holly (*Ilex mucronata*), poison sumac, and glossy buckthorn. The herbaceous layer in both communities is diverse and includes characteristic species such as flat-topped aster (*Aster umbellatus*), blue-joint grass, common

lake sedge, sensitive fern, and halberd-leaved tear-thumb. The hydrology of this community varies by site and ranges from largely undisturbed to moderately altered to heavily altered by ditches, dikes, roads, and other man-made structures that alter natural surface and ground water movement. The impact of hydrologic alteration varies by site, but in general lowered water levels (e.g. near ditches) favor more woody vegetation; in some cases, Alder Thicket and Shrub-carr may have replaced what was formerly a Northern Sedge Meadow prior to drainage. Conversely, higher water levels (e.g. near dikes) tend to favor more open wetland vegetation such as Northern Sedge Meadow and Emergent Marsh.

Northern Sedge Meadow is one of the dominant wetland community types on the wildlife area. It occurs both as a component of pristine wetland complexes (e.g. Mead Conifer Bogs SNA) and as a major component of actively managed wetland complexes (e.g. adjacent to flowages, pools, reservoirs, and areas adjacent to the Little Eau Pleine River). Northern Sedge Meadows at Mead are dominated by common lake sedge and common yellow lake sedge, with a diversity of other plants including gray bog sedge, cord-root sedge (*Carex chordorrhiza*), few-seeded sedge, narrow-leaved woolly sedge, blue-joint grass, wool-grass (*Scirpus cyperinus*), marsh fern, bog goldenrod (*Solidago uliginosa*), and *Sphagnum* mosses. Shrubs are sparse and include scattered slender willow and meadowsweet. The hydrology of this community varies by site and ranges from largely undisturbed to moderately altered to heavily altered by ditches, dikes, roads, and other man-made structures that alter natural surface and ground water movement.

Muskeg occurs in a small but high-quality wetland southeast of the Haumschild Hill area. Sometimes also called treed bog, this peatland community is dominated by a moderate to sparse canopy of stunted tamarack with black spruce and white pine. The shrub layer is dense and dominated by leatherleaf, Labrador tea, bog laurel, bog-rosemary, and mountain holly. The groundlayer includes three-leaved Solomon's seal, tussock cotton-grass and dense *Sphagnum* mosses. The hydrology of this community is largely intact and contributes to its high quality.

Northern Mesic Forest occurs primarily in two areas: at Haumschild Hill, and along a broad, gently sloping moraine on the northern edge of the property, north and south of County Highway C. Canopy cover ranges from 60% to 90% and species include sugar maple, red oak, white oak, bitternut hickory (*Carya cordiformis*), basswood, hemlock, paper birch, yellow birch, and big-tooth aspen (*Populus grandidentata*). Tree sizes range from 12-16 inches DBH for sugar maple and aspen to 24 inches DBH or more for red oak, basswood, and hemlock in some sites. Shrubs and small trees include white ash, mountain maple (*Acer spicatum*) (near rocky ravines), witch-hazel (*Hamamelis virginiana*), hazelnut (*Corylus americana*), and maple-leaf viburnum. The groundcover is often diverse with species indicative of a nutrient rich site including large-flowered trillium (*Trillium grandiflorum*), maidenhair fern (*Adiantum pedatum*), blue cohosh (*Caulophyllum thalictroides*), and sharp-lobed hepatica (*Anemone acutiloba*).

Emergent Marsh occurs adjacent to man-made impoundments such as flowages, pools, and reservoirs and is dominated by cat-tails with scattered sedges and wool-grass. It is relatively uncommon on the property and large stands occur only in a few areas.

Finally, several other natural communities occur at George W. Mead State Wildlife Area. These include Submergent Marsh, found in flowages, pools, and reservoirs, and dominated by various floating and submerged aquatic plants**.** Floodplain Forest is found on the far western edge of the wildlife area along an unchannelized portion of the Little Eau Pleine River, where silver maple dominates a diverse complex of bottoms and swales. Moderate quality Southern Dry-mesic Forest occurs just west of the dog trial area north of the Little Eau Pleine River and just west of County Highway O. This forest is dominated by red oak, trembling aspen (*Populus tremuloides*), and nearly pure stands of paper birch. Finally, large areas of

Mead State Wildlife Area are dominated by Surrogate Grassland consisting of old fields and planted prairies. These areas are extremely important for many grassland species (birds as well as small mammals, herptiles, butterflies, etc.). Dominant species include smooth brome (*Bromus inermis*), timothy, Kentucky bluegrass (*Poa pratense*), old field goldenrod, and, in moist areas, Canada goldenrod (*Solidago canadensis*), wool-grass and reed canary grass. Various aspects of Surrogate Grasslands, including their importance to grassland birds and management opportunities are discussed below in the section on Management Considerations and Opportunities for Biodiversity Conservation.

Leatherleaf, tussock cotton-grass and tamarack dominate a wetland complex near Honey Island at George W. Mead State Wildlife Area. Photo by Ryan P. O'Connor.

Rare Species of the Central Wisconsin Wildlife Areas Planning Group

Rare species have been documented at the CWWA properties (Table 5). Appendix C shows the rare species currently known at these sites listed by property; see Appendix D for summary descriptions of the species. Bird occurrences refer only to breeding activity.

Table 5. Documented rare species of the Central Wisconsin Wildlife Area Planning Group.

*For an explanation of state and global ranks, as well as state status, see Appendix A. State status, tracking status, and ranks are based on the working list published June 1, 2011. Species with a "W" in the "Tracked by NHI" column are on the Watch List (see Appendix F) and are not mapped in the NHI database. Various sources were used to determine the Watch List species and SGCN present and this may not be a complete list. *Species reported but not confirmed or did not meet criteria as an element occurrence.*

Common Name	Scientific Name	Last Observed	State Rank	Global Rank	State Status	Federal Status	SGCN	Tracked by NHI
Bird								
Acadian Flycatcher	*Empidonax virescens*	2005*	S3B	G5	THR		Y	Y
American Bittern	*Botaurus lentiginosus*	2011	S3B	G4	SC/M		Y	Y
American Black Duck	*Anas rubripes*	2011	S2S3	G5	SC/M		Y	W
American Coot	*Fulica americana*	2011	S3S4B	G5	SC/M			W
American White Pelican	*Pelecanus erythrorhynchos*	2011	S3B	G4	SC/M			Y
American Woodcock	*Scolopax minor*	2011	S3S4B	G5	SC/M		Y	W
Bald Eagle	*Haliaeetus leucocephalus*	2011	S4B,S4N	G5	SC/P		Y	Y
Black Tern	*Chlidonias niger*	2011	S2B	G4	SC/M		Y	Y
Black-billed Cuckoo	*Coccyzus erythropthalmus*	2011	S3S4B	G5	SC/M		Y	W
Black-crowned Night-Heron	*Nycticorax nycticorax*	1983	S2B	G5	SC/M			Y
Blue-winged Teal	*Anas discors*	2011	S3S4B	G5	SC/M		Y	W
Blue-winged Warbler	*Vermivora pinus*	2011	S4B	G5	SC/M		Y	W
Bobolink	*Dolichonyx oryzivorus*	2011	S3S4B	G5	SC/M		Y	W
Canada Warbler	*Wilsonia canadensis*	2011	S3S4B	G5	SC/M		Y	W
Cerulean Warbler	*Dendroica cerulea*	2011	S2S3B	G4	THR		Y	Y
Common Loon	*Gavia immer*	2011	S3S4B	G5	SC/M			W
Common Moorhen	*Gallinula chloropus*	2011	S3	G5	SC/M			W
Common Nighthawk	*Chordeiles minor*	2011	S2S3B	G5	SC/M			Y
Dickcissel	*Spiza americana*	2011	S3B	G5	SC/M		Y	W
Eastern Meadowlark	*Sturnella magna*	2011	S3S4B	G5	SC/M		Y	W
Field Sparrow	*Spizella pusilla*	2011	S3S4B	G5	SC/M		Y	W
Golden-winged Warbler	*Vermivora chrysoptera*	2011	S3S4B	G4	SC/M		Y	W
Grasshopper Sparrow	*Ammodramus savannarum*	2011	S3B	G5	SC/M		Y	W

Common Name	Scientific Name	Last Observed	State Rank	Global Rank	State Status	Federal Status	SGCN	Tracked by NHI
Great Blue Heron	*Ardea herodias*	2011	S4B	G5	SC/M			W
Great Egret	*Ardea alba*	2011	S2B	G5	THR		Y	Y
Greater Prairie-Chicken	*Tympanuchus cupido*	2011	S1B,S2N	G4	THR		Y	Y
Henslow's Sparrow	*Ammodramus henslowii*	2011	S2S3B	G4	THR		Y	Y
Le Conte's Sparrow	*Ammodramus leconteii*	2011	S2S3B	G4	SC/M		Y	Y
Least Bittern	*Ixobrychus exilis*	2011	S2S3B	G5	SC/M			Y
Least Flycatcher	*Empidonax minimus*	2011	S4B	G5	SC/M		Y	W
Northern Goshawk	*Accipiter gentilis*	1992	S2B,S2N	G5	SC/M		Y	Y
Northern Harrier	*Circus cyaneus*	2011	S3B,S2N	G5	SC/M		Y	W
Osprey	*Pandion haliaetus*	2011	S4B	G5	SC/M		Y	W
Prothonotary Warbler	*Protonotaria citrea*	2011	S3B	G5	SC/M		Y	Y
Red-shouldered Hawk	*Buteo lineatus*	1979	S3S4B,S1N	G5	THR		Y	Y
Trumpeter Swan	*Cygnus buccinator*	2011	S4B	G4	SC/M		Y	Y
Veery	*Catharus fuscescens*	2011	S3S4B	G5	SC/M		Y	W
Whip-poor-will	*Caprimulgus vociferus*	2011	S3B	G5	SC/M		Y	W
Whooping Crane	*Grus americana*	2011	SXB	G1	SC/FL	NEP	Y	W
Willow Flycatcher	*Empidonax traillii*	2011	S4B	G5	SC/M		Y	W
Wood Thrush	*Hylocichla mustelina*	2011	S4B	G5	SC/M		Y	W
Yellow-bellied Flycatcher	*Empidonax flaviventris*	2011	S3S4B	G5	SC/M			W
Yellow-billed Cuckoo	*Coccyzus americanus*	2011	S3B	G5	SC/M		Y	W
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	2011	S3	G5	SC/M			Y
Reptile and Amphibian								
Blanding's Turtle	*Emydoidea blandingii*	2011	S3S4	G4	THR		Y	Y
Mink Frog	*Lithobates septentrionalis*	2011	S3	G5	SC/H		Y	W
Northern Leopard Frog	*Lithobates pipiens*	2011	S4?	G5	SC/H			W
Invertebrate								
A Broad-shouldered Water Strider	*Microvelia fontinalis*	2004	S3	GNR	SC/N		Y	W
A Long-horned Casemaker Caddisfly	*Triaenodes nox*	2011	S2S3	G5	SC/N		Y	Y
A Predaceous Diving Beetle	*Celina hubbelli*	2011	S3S4	GNR	SC/N		Y	W
A Predaceous Diving Beetle	*Hydroporus columbianus*	2011	S3S4	GNR	SC/N		Y	W
A Predaceous Diving Beetle	*Hydroporus dichrous*	2011	S3	GNR	SC/N		Y	W
A Predaceous Diving Beetle	*Ilybius picipes*	2011	S4S5	GNR	SC/N		Y	W

Common Name	Scientific Name	Last Observed	State Rank	Global Rank	State Status	Federal Status	SGCN	Tracked by NHI
A Predaceous Diving Beetle	*Matus bicarinatus*	2011	S3S4	GNR	SC/N		Y	W
A Predaceous Diving Beetle	*Neoscutopterus hornii*	2011	S3S4	GNR	SC/N		Y	W
A Predaceous Diving Beetle	*Rhantus sinuatus*	2011	S4	GNR	SC/N		Y	W
A Small Square-gilled Mayfly	*Caenis diminuta*	2011	SU	G5	SC/N		Y	W
A Water Measurer	*Hydrometra martini*	2011	S4	G5	SC/N		Y	W
A Water Scavenger Beetle	*Enochrus consortus*	2011	S3S4	GNR	SC/N		Y	W
A Water Scavenger Beetle	*Enochrus hamiltoni*	2011	S5	GNR	SC/N		Y	W
Ebony Boghaunter	*Williamsonia fletcheri*	2011	S3S4	G4	SC/N			W
Eyed Brown	*Satyrodes eurydice*	2011	S4	G4	SC/N			W
Midwestern Fen Buckmoth	*Hemileuca nevadensis ssp. 3*	2002	S3	G5T3T4	SC/N		Y	Y
Wingless Mountain Grasshopper	*Booneacris glacialis*	2004	S3	G5	SC/N		Y	W
Mammal								
Franklin's Ground Squirrel	*Spermophilus franklinii*	2010	S2	G5	SC/N		Y	Y
Gray Wolf	*Canis lupus*	2007	S4	G4	SC/FL		Y	Y
Water Shrew	*Sorex palustris*	1967	S3	G5	SC/N		Y	Y
Plant								
American Ginseng	*Panax quinquefolius*	2011	S4	G3G4	SC		n/a	W
Butternut	*Juglans cinerea*	2011	S3?	G4	SC		n/a	W
Georgia Bulrush	*Scirpus georgianus*	2011	S1	G5	SC		n/a	Y
Small Forget-me-not	*Myosotis laxa*	2011	S2	G5	SC		n/a	Y
Natural Community								
Alder Thicket		2011	S4	G4				
Black Spruce Swamp		2011	S3?	G5				
Muskeg		2011	S4	G4G5				
Northern Mesic Forest		2011	S4	G4				
Northern Sedge Meadow		2011	S3	G4				
Open Bog		2011	S4	G5				
Poor Fen		2011	S3	G3G4				
Shrub-carr		2007	S4	G5				
Stream--Slow, Soft, Warm		1983	SU	GNR				
Tamarack (Poor) Swamp		2007	S3	G4				

Management Considerations and Opportunities for Biodiversity Conservation

Landscape Level Opportunities and Considerations

Wildlife Action Plan Conservation Opportunity Area

Conservation Opportunity Areas (COAs) are places in Wisconsin that contain ecological features, natural communities, or Species of Greatest Conservation Need habitat for which Wisconsin has a unique responsibility for protection when viewed from the global, continental, upper Midwest, or state perspective. George W. Mead State Wildlife Area lies within the Mead COA, identified as having state significance for extensive grassland communities and large areas of managed Surrogate Grassland, Impoundments, and Northern Mesic Forest (see Appendix B for map). Dewey Marsh State Wildlife Area lies partially within the Dewey Marsh COA, identified as having Upper Midwest significance for large wetlands including natural communities such as Northern Wet Forest, Alder Thicket, Shrub-carr, Northern Sedge Meadow, and Open Bog (see Appendix B for map).

Wisconsin's Statewide Forest Strategy

Wisconsin's Statewide Forest Assessment (WDNR 2010a) was based on Wisconsin's Forest Sustainability Framework (Wisconsin Council on Forestry 2008) and was designed to assess the current state of Wisconsin's public and private forests and analyze the sustainability of our forested ecosystems. Wisconsin's Statewide Forest Strategy (WDNR 2010b) contains a collection of strategies and actions designed to address the management and landscape priorities identified in the Statewide Forest Assessment. The strategies are broad guides intended to focus the actions of the forestry community.

These documents noted above include topics related to biological diversity in Wisconsin's forests, and provide information useful for department master planning and management activities. Several Statewide Forest Strategies are particularly pertinent to the CWWA planning efforts in regard to opportunities to maintain or enhance biological diversity (Table 6, WDNR 2010b).

Table 6. Selection of Wisconsin Statewide Forest Strategies Relevant to the CWWA.

Strategy Number	Strategy
11	Encourage the management of under-represented forest communities.
12	Improve all forested communities with a landscape management approach that considers the representation of all successional stages.
13	Increase forest structure and diversity.
14	Encourage the use of disturbance mechanisms to maintain diverse forest communities.
15	Maintain the appropriate forest types for the ecological landscape while protecting forest health and function.
18	Encourage the forestry community to be engaged in deer management issues with an understanding of the long term significance of deer impacts on sustainable forestry.
19	Adapt forest management practices to sustainably manage forests with locally high deer

	populations.
22	Strive to prevent infestations of invasive species before they arrive.
23	Work to detect new (invasive species) infestations early and respond rapidly to minimize impacts to forests.
24	Control and manage existing (invasive species) infestations.
25	Rehabilitate, restore, or adapt native forest habitats and ecosystems.
29	Attempt to improve the defenses of the forest and increase the resilience of natural systems to future climate change impacts.
30	Intentionally accommodate (climate) change and enable forest ecosystems to adaptively respond.

High Conservation Value Forests

The Wisconsin DNR manages 1.5 million acres that are certified by the Forest Stewardship Council (FSC) (Forest Stewardship Council 2009) and the Sustainable Forest Initiative (SFI). Forest certification requires forests to be managed using specified criteria for ecological, social, and economic sustainability. Principle 9 of the *Draft 7 FSC-US Forest Management Standard* concerns the maintenance of High Conservation Value Forests (HCVF). High Conservation Value Forests are defined as possessing one or more of the following:

- Contain globally, regionally, or nationally significant concentrations of biodiversity values, including rare, threatened, or endangered species and their habitats.
- Globally, regionally, or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.
- Are in or contain rare, threatened, or endangered ecosystems.
- Provide basic services of nature in critical situations (e.g., watershed protection, erosion control).
- Are fundamental to meeting basic needs of local communities (e.g., subsistence, health).
- Are critical to local communities' traditional cultural identity (areas of cultural, ecological, economic, or religious significance identified in cooperation with such local communities).

Non-Native Invasive Species

Non-native invasive species thrive in newly disturbed areas, but also may invade and compromise high-quality natural areas. They establish quickly, tolerate a wide range of conditions, are easily dispersed, and are relatively free of the diseases, predators, and competitors that kept their populations in check in their native range. Non-native invasive plants can out-compete and even kill native plants by monopolizing light, water, and nutrients, and by altering soil chemistry and mycorrhizal relationships. In situations where non-native invasive plants become dominant, they may even alter ecological processes by limiting use of prescribed fire, by modifying hydrology, and by limiting tree regeneration and ultimately impacting forest composition (WDNR In prep. b). In addition to the threats to native communities and native species diversity, non-native invasive species negatively impact forestry (by reducing tree regeneration, growth and longevity), recreation, agriculture, and human health (by causing skin rashes and increasing incidence of tick-borne diseases). For example, in bottomland forests, dense patches of reed canary grass can prevent regeneration of trees and a minor infestation can become dense if the

canopy is opened beyond 80% cover (WDNR In prep. b). Non-native invasive plants and animals can also have negative impacts on fish and wildlife species by long-term displacement of native food sources (e.g. for deer and turkey; Gorchov and Trisel 2003), diminishing habitat for ground-nesting birds (e.g. ovenbirds and woodcock; Miller and Jordan 2011, Loss et al. 2012) and altering aquatic macroinvertebrate communities in streams, thereby impacting fish that feed on them (McNeish et al. 2012).

Non-native invasive plant species of the CWWA are found within both the wetland and upland habitats. Wetland non-native invasive plants include reed canary grass, purple loosestrife, narrow-leaved cat-tail, and glossy buckthorn. In particular, glossy buckthorn is of concern because of its ability to drastically alter Northern Sedge Meadow, Shrub-carr, and tamarack-dominated swamps by changing soil pH, eliminating sedge hummocks, decreasing light availability, and reducing grass and sedge cover (Fiedler and Landis 2012). Because of its relative lack of abundance, an excellent opportunity exists to control glossy buckthorn before it becomes more widespread and has more adverse impacts to natural community quality and wildlife habitat. Glossy buckthorn was found very locally scattered at Dewey Marsh State Wildlife Area south of the Philippine Islands in high-quality Northern Sedge Meadow and Muskeg, and along the northern edge of the Philippine Islands near the upland-wetland interface along the south edge of a high-quality Poor Fen. In addition, glossy buckthorn was found near the western boundary of the property (just east of County Highway X) beneath tamaracks at the edge of a Black Spruce Swamp. Many of these localities were passed along to the property manager and areas were treated for glossy buckthorn; continued monitoring is recommended to detect and remove additional populations and seedlings.

At George W. Mead State Wildlife Area, glossy buckthorn was found east of Deer Run Road along the west margin of the Mead Conifer Bog State Natural Area mixed with speckled alder and tamarack as well as locally scattered on spoil piles along the ditch that runs north-south through the central portion of the State Natural Area parcel. Finally, glossy buckthorn was also noted on small spoil piles adjacent to wildlife ponds created in a sedge meadow located immediately east of a north-south dike that runs north from Blueberry Lane. At McMillan Wildlife Area, glossy buckthorn was noted in several areas: in a Shrub-carr west of the railroad grade in the southeast portion of the property east of Frey Avenue, in hardwood swamps west of Meadow Avenue and southwest of Lincoln Avenue, and in areas of Floodplain Forest. Surveys for glossy buckthorn were not comprehensive, and the species likely occurs in additional areas. Targeted surveys are recommended, especially focusing on disturbed areas with mineral soil in or near wetlands such as spoil piles from ditches and ponds as well as areas with concentrations of tamarack.

In uplands, surveys targeted higher-quality areas and were limited in the lower-quality uplands where non-native invasive species are more likely to occur, thus information on their presence, distribution, and abundance is incomplete. A few high-priority species that were found include common buckthorn (*Rhamnus cathartica*), garlic mustard (*Alliaria petiolata*), common hemp-nettle (*Galeopsis tetrahit*), and Japanese knotweed (*Polygonum cuspidatum*). Common buckthorn was noted with showy bush honeysuckle along a trail near a parking area on County Highway M at George W. Mead State Wildlife Area. It was also found in McMillan Marsh State Wildlife Area in several hardwood swamps including one west of Meadow Avenue and one southwest of the southern end of Lincoln Avenue. A small area of garlic mustard was found at Mead State Wildlife Area in a weedy upland near the edge of an old field near Deer Run Road, approximately a quarter mile north of where the road turns sharply from running north-south to east-west. This was the only location of garlic mustard found on the property and a rare opportunity exists to control and monitor the species before it becomes widespread. Common hemp-nettle was found dominating old two-tracks and skid trails in the Haumschild Hill area of George W. Mead State Wildlife Area. Forest inventory and management operations should take care to follow Best Management Practices related to non-native invasive species to avoid further spread of this rapidly

increasing plant. Finally, Japanese knotweed was found in two areas at George W. Mead State Wildlife Area, at the south end of Memory Lane (south of County Highway H), and on a dike southwest of Rangeline Flowage. Efforts to control these populations should continue.

Trails, access points for fishing, and other high-use areas are typical entry points for invasive species that are introduced by visitors' footwear, clothing, vehicle tires, boats, and recreational equipment. Once established, these invasives may continue to spread along natural corridors (e.g. streams) and along recreational corridors (e.g. hunting/fishing walking trails). Invasive species may also be spread inadvertently through management activities such as timber operations and roadside mowing, especially if Best Management Practices (*Invasive Species Best Management Practices*) aren't followed.

When resources for complete control of widespread invasives are lacking, containment (i.e., limiting further spread) may be considered as an alternative action. Early detection and rapid control of new and/or small infestations, however, may be considered for higher prioritization in an invasive species management strategy (Boos et al. 2010).

For recommendations on controlling specific invasive species consult with DNR staff, refer to websites on invasive species, such as that maintained by the DNR (http://dnr.wi.gov/topic/Invasives/) and by the Invasive Plants Association of Wisconsin (http://www.ipaw.org), and seek assistance from local invasive species groups:

- Aquatic Invasive Species (Marathon, Portage, and Wood Co.) contact: Amy Thorstenson, Regional Invasive Species Coordinator (thorstea@co.portage.wi.us, Golden Sands RC&D, 715-346-1264).

Also refer to invasive species Best Management Practices (BMPs) for forestry, recreation, urban forestry, and rights-of-way, which were developed by the Wisconsin Council on Forestry (*Invasive Species Best Management Practices*).

Emerald Ash Borer

The emerald ash borer (*Agrilus planipennis*), an invasive, wood-boring beetle that attacks ash trees, was positively identified for the first time in Wisconsin in 2008, and is now found in 12 counties. The beetle attacks all species of ash (*Fraxinus* spp.) in Wisconsin, and the risk to forests is high: models predict that a healthy forest could lose 98% of its ash trees in six years (http://www.emeraldashborer.wi.gov).

The lowland forests of the CWWA are vulnerable to the effects of emerald ash borer, as white, green, and black ash are important tree species within this ecosystem. Large-scale loss of ash in this area, whether through EAB-caused mortality or harvesting, could cause a cascade of negative impacts. Degradation of diverse, high-quality forests and loss of forest cover could further lead to diminishment of important habitat for rare plants and animals (especially forest interior birds), elevated water tables, and infestation of disturbance-loving invasives such as reed canary grass (WDNR 2010a). It is important to note that removal of all ash as a stopgap measure against EAB is not recommended; instead maintenance of a healthy forest and ash resource is suggested (WDNR 2010c).

Non-native Invasive Earthworms

The invasion of forests by European earthworms of the families *Acanthodrilidae*, *Lumbricidae*, and *Megascloedidae* is a concern throughout Wisconsin. While native earthworms were absent from this landscape after the last glaciation, non-native invasive earthworms have been introduced since Euro-American settlement, primarily as discarded fishing bait (Hendrix and Bohlen 2002, Hale et al. 2005). Non-native invasive earthworms can have dramatic impacts on forest floor properties by greatly reducing

organic matter (Hale et al. 2005), microbial biomass (Groffman et al. 2004), nutrient availability (Suárez et al. 2004, Bohlen et al. 2004), and fine-root biomass (Groffman et al. 2004). These physical changes in the forest floor reduce densities of tree seedlings and rare herbs (Gundale 2002) and can favor invasive plants (Kourtev et al. 1999). In a study of 51 Northern Wisconsin forest stands, Wiegmann (2006) found that shifts in understory plant community composition due to non-native invasive earthworms were more severe in stands with high white-tailed deer densities. While surveys of upland forested sites in the CWWA did not directly assess degree of earthworm invasion, their presence is highly likely given the prominence of recreational fishing on the properties, particularly at George W. Mead State Wildlife Area and McMillan Marsh State Wildlife Area.

Table 7. Invasive Species of the Central Wisconsin Wildlife Areas Planning Group.

		Upland Habitats		Wetland Habitats			
Common Name	**Latin Name**	**Open**	**Wooded**	**Open**	**Wooded**	**Aquatic**	**Abundance Comments**
Plants							
Canada thistle	*Cirsium arvense*	x					Locally common in moist old fields
common buckthorn	*Rhamnus cathartica*		x		x		Common in hardwood swamps at McMillan, rare near parking lot on CTH M and present in river corridor at Rangeline Road at Mead
common burdock	*Arctium minus*	x	x				Locally scattered, especially along trails
common hemp-nettle	*Galeopsis tetrahit*		x				Locally dominant on old two-tracks and skid trails at Haumschild Hill at Mead
curly pondweed	*Potamogeton crispus*					x	Common on a riverine mud flat at McMillan; likely throughout the Little Eau Pleine and associated flowages
garlic mustard	*Alliaria petiolata*	x	x				Rare at Mead north of Deer Run Road.
glossy buckthorn	*Rhamnus frangula*			x	x		Rare to infrequent in sedge meadow, alder thicket, and edges of black spruce swamps at Dewey and Mead, locally common in hardwood swamps at McMillan.
Japanese barberry	*Berberis thunbergii*		x				Rare in hardwood swamps at McMillan
Japanese knotweed	*Polygonum cuspidatum*	x					Two colonies known at Mead: at south end of Memory Lane and on a dike south of Rangeline Flowage
Kentucky bluegrass	*Poa pratensis*	x					Locally dominant in old fields.
moneywort	*Lysimachia nummularia*				x		Rare in floodplains at McMillan
Morrow's honeysuckle	*Lonicera morrowii*	x	x				Present in floodplains and hardwood swamps at McMillan
purple	*Lythrum salicaria*			x			Locally common in Shrub-

		Upland Habitats		Wetland Habitats			
Common Name	**Latin Name**	**Open**	**Wooded**	**Open**	**Wooded**	**Aquatic**	**Abundance Comments**
loosestrife							carr and sedge meadows in flowages and in ditched or diked wetlands at Mead and McMillan
reed canary grass	*Phalaris arundinacea*	x		x	x		Common near ditches and dikes, but also in floodplains, hardwood swamps, shrub-carr, and marsh at Mead and McMillan.
showy bush honeysuckle	*Lonicera* X *bella*	x	x				Present in floodplains and hardwood swamps at McMillan
smooth brome	*Bromus inermis*	x					Locally dominant in old fields
timothy	*Phleum pratense*	x					Locally dominant in old fields.
spotted knapweed	*Centaurea biebersteinii*	x					Present at Mead, likely at McMillan and Dewey
leafy spurge	*Euphorbia esula*	x					Present at Mead, likely at McMillan and Dewey
multiflora rose	*Rosa multiflora*	x	x				Small population at McMillan
tall manna grass*	*Glyceria maxima**			x			Known in Wood Co., possible location in a sedge meadow at Mead (B. Peters, pers. com.)
Animals							
gypsy moth			x				Likely present on all three properties (M. Hillstrom, pers. com.)
Chinese mystery snail	*Bellamya chinensis*					x	Present at Mead and McMillan
banded mystery snail	*Viviparus georgianus*					x	Found at McMillan in Little Eau Pleine River
*NR-40 Prohibited Species in Marathon, Portage and Wood Counties							

Table 8. Non-Native Species to watch for, currently unknown in the Central Wisconsin Wildlife Areas.

		Upland Habitats		Wetland Habitats			
Common Name	**Latin Name**	**Open**	**Wooded**	**Open**	**Wooded**	**Aquatic**	**Abundance Comments**
Plants							
bigleaf lupine	*Lupinus polyphyllus*	x					Known in Marathon Co.
Eurasian water-milfoil	*Myriophyllum spicatum*					x	Known from Lake Du Bay and other lakes in region
giant hogweed*	*Heracleum mantegazzianum**	x					Known in Portage Co. (Stevens Point area)
hounds tongue	*Cynoglossum officinale*	x					Known in Marathon Co.
Siberian pea shrub	*Caragana arborescens*	x	x				Known in Marathon Co.
Animals							
emerald ash borer*	*Agrilus planipennis**		x		x		Currently not known from property group.

		Upland Habitats		Wetland Habitats			
Common Name	**Latin Name**	**Open**	**Wooded**	**Open**	**Wooded**	**Aquatic**	**Abundance Comments**
rusty crayfish	*Orconectes rusticus*					x	Known from Lake Du Bay and other lakes in region
*NR-40 Prohibited Species in Marathon, Portage and Wood Counties							

Community Level Opportunities and Considerations

Natural Community Management Opportunities

The Wisconsin Wildlife Action Plan (WAP) (WDNR 2006a) identifies 23 natural communities for which there are "Major" or "Important" opportunities for protection, restoration, or management in the **Forest Transition** Ecological Landscape. Of these, 17 are present at George W. Mead State Wildlife Area and McMillan State Wildlife Area (Table 9). The WAP identifies 33 natural communities for which there are "Major" or "Important" opportunities for protection, restoration, or management in the **Central Sand Plains** Ecological Landscape. Of these, ten are present at Dewey Marsh State Wildlife Area (Table 10).

Table 9. Major and Important Natural Community Management Opportunities in the **Forest Transition** Ecological Landscape that occur in the CWWA (WDNR 2006a).

Major Opportunity	Important Opportunity
Northern Mesic Forest	Surrogate Grasslands
Northern Wet Forest	Northern Dry-mesic Forest
Coolwater streams	Ephemeral Pond
Warmwater rivers	Floodplain Forest
Warmwater streams	Northern Hardwood Swamp
Impoundments/Reservoirs	Alder Thicket
	Shrub-carr
	Open Bog
	Northern Sedge Meadow
	Emergent Marsh
	Submergent Marsh

Table 10. Major and Important Natural Community Management Opportunities in the **Central Sand Plains** Ecological Landscape that occur in the CWWA (WDNR 2006a).

Major Opportunity	Important Opportunity
Northern Wet Forest	Northern Dry-mesic Forest
Alder Thicket	Northern Mesic Forest
Shrub Carr	Coolwater streams
Open Bog	Emergent Marsh
Northern Sedge Meadow	
Surrogate Grasslands	

High-quality wetlands

High-quality wetlands on the CWWA are diverse and include Black Spruce Swamp, Muskeg, Tamarack (Poor) Swamp, Alder Thicket, Shrub-carr, Open Bog, Poor Fen, and Northern Sedge Meadow. These communities often occur in large wetland complexes with their distribution and extent based on hydrology, geology, and past disturbance. These wetland complexes range in size from several hundred

acres to over 4,000 acres, and include both portions of the Mead Conifer Bogs SNA, a muskeg southeast of Haumschild Hill at Mead State Wildlife Area, and most of the wetlands at Dewey Marsh State Wildlife Area. Many of these wetland communities primarily occur north of the Transition Zone, and reach their southernmost extent in the state on the CWWA. In addition, several of these natural communities are also among the highest quality in the state. In particular, the wetland complex at Dewey Marsh of intergrading Black Spruce Swamp, Muskeg, Open Bog, Poor Fen, and Northern Sedge Meadow provides an opportunity for protecting an ecological reference area; many of these communities currently fall outside of the existing boundary of the Dewey Marsh State Natural Area.

These high-quality wetlands provide significant habitat to numerous rare and SGCN birds such as golden-winged warbler (*Vermivora chrysoptera*), Le Conte's sparrow, American bittern (*Botaurus lentiginosus*), and northern harrier (*Circus cyaneus*). In addition, high-quality wetlands on the CWWA support significant populations of Blanding's turtle as well as uncommon amphibians such as mink frog (*Lithobates septentrionalis*) and northern leopard frog (*Lithobates pipiens*). Finally, high-quality wetlands provide habitat for the rare Midwestern fen buckmoth (*Hemileuca nevadensis ssp. 3*), which is thought to lay its eggs on bog birch.

These wetlands remain in a high-quality condition in large part due to lack of significant hydrologic alterations (e.g., ditching or flooding). Some, such as the Mead Conifer Bogs SNA, remain in a relatively high-quality condition in spite of ditching attempts in the early 1900s. In addition, other areas adjacent to high-quality wetlands have been heavily impacted from ditching, resulting in a lowered water table and subsequent shrub invasion. Some areas that have experienced hydrologic alteration may present opportunities for hydrological restoration by plugging or filling ditches. However, the benefits of such restoration should be weighed against both financial and ecological costs, which include the potential to introduce or spread invasive species through equipment or soil disturbance.

A relative lack of non-native invasive species also contributes to the high quality of these wetlands, though glossy buckthorn was noted as just beginning to invade some areas. Glossy buckthorn is a major threat to these wetlands and a rare opportunity exists to control the population before it becomes widespread. Other non-native invasive species that pose a threat to these areas include purple loosestrife and narrow-leaf cat-tail.

Wildfires have had a profound impact on wetlands in the CWWA, in particular at Dewey Marsh State Wildlife Area, which experienced an extensive wildfire in 1976. It is important to recognize that fire is a natural ecological process, even in extensive peatlands (Curtis 1959, Cleland et al. 2004). Estimates of fire return intervals for forested peatlands range widely from over a hundred to several hundred years in naturally fire-prone landscapes to several hundred to over a thousand years in systems in naturally fire-protected landscapes (Cleland et al. 2004). Muskeg fire regimes most likely also spanned this wide range depending on the landscape context (Cohen 2006). Fire control efforts can have long-lasting impacts on wetlands, as noted from the plow line at Dewey Marsh that has persisted since 1976. Due to the high-quality nature of some of the wetlands in the CWWA there may be opportunities to explore the development of a wildfire plan for the properties. This could outline areas in which fires should be aggressively controlled for safety and resource protection and outline other areas that might be allowed to burn with careful monitoring (given the right conditions) or controlled using techniques that minimize wetland soil disturbance (e.g. tankers, water bombers or hand crews).

In addition to the wetlands noted above, extensive wetlands also occur elsewhere in the CWWA in and adjacent to numerous flowages and water control structures that are significantly affected by human hydrological manipulation. These wetlands provide significant habitat to numerous game and non-game

wildlife species and are discussed in the section on Marsh Birds in the Species Level Opportunities and Considerations.

A plow line from 1976 fire suppression efforts is still clearly visible more than 35 years later in a pristine wetland complex at Dewey Marsh State Wildlife Area. Photo by Ryan P. O'Connor.

Northern Mesic Forest: an Opportunity for Older Forest Management

Several blocks of Northern Mesic Forest occur on the CWWA, including areas at George W. Mead State Wildlife Area north and south of County Highway C and at Dewey Marsh State Natural Area east of Haymeadow Drive. Although many of these stands are somewhat fragmented by early successional forest management, they represent the best quality remaining upland forests on the CWWA and provide habitat that is uncommon in the property group. In addition, Northern Mesic Forest is noted as a major Natural Community Management Opportunity in the Forest Transition Ecological Landscape in the Wisconsin WAP (WDNR 2006a).

An opportunity exists at McMillan Wildlife Area east of Lincoln Road to restore a brushy old field to forest and connect two blocks of good-quality Northern Mesic Forest and Floodplain Forest/Hardwood Swamp. This would be beneficial to forest birds and could provide a focal management area for promoting a stand of older growth forest with forest interior conditions. In addition, an adjacent forested block south of the Little Eau Pleine River and north of the large open wetland is one of the higher quality forest areas of McMillan Wildlife Area and presents an opportunity for older forest management.

Older forests in Wisconsin are rare and declining, largely due to timber harvesting and conversion to other land uses (WDNR 2010a). The WDNR has identified a need to conserve, protect, and manage old-growth forests (WDNR 1995, 2004) and old-growth management is a component of Forest Certification.

Old-growth stands are sometimes characterized by a multi-layered, uneven age and size class structure; a high degree of compositional and structural patchiness and heterogeneity; and significant amounts of coarse woody debris and tip-up mounds (WDNR In prep. b). The structural diversity provided by old-growth and older forests support unique assemblages of plants, birds, and other animals. Old-growth forest management is one important facet of providing the diverse range of habitats needed for sustainable forest management (WDNR 2010b).

Older forests can provide habitat for many rare and declining species, including cerulean warbler (*Dendroica cerulea*), prothonotary warbler (*Protonotaria citrea*), Acadian flycatcher (*Empidonax virescens*), wood thrush (*Hylocichla mustelina*), veery (*Catharus fuscescens*), red-shouldered hawk (*Buteo lineatus*), and northern goshawk (*Accipiter gentilis*). Of the birds noted above, cerulean warbler, prothonotary warbler, Acadian flycatcher, wood thrush, and veery were found in Northern Mesic Forests on or adjacent to the CWWA. Older forests also provide habitat for Wisconsin's summer resident forest bats, including big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), eastern pipistrelle (*Perimyotis subflavus*), and northern long-eared bat (*Myotis septentrionalis*), all of which were recently listed as State Threatened due to the imminent threat of White-nose Syndrome.

Species Level Opportunities and Considerations

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 E highlights the Ecological Priorities for vertebrate SGCN at CWWA properties. Note that these Ecological Priorities include all of the natural communities and associated SGCN that we have determined to provide the best opportunities for management at the CWWA properties from an ecological/biodiversity perspective.

The Wildlife Action Plan also describes Priority Conservation Actions that make effective use of limited resources and address multiple species with each action. Implementing these actions and avoiding activities that may preclude successful implementation of these actions in the future would greatly benefit the SGCN at CWWA. Priority Conservation Actions identified in the Wisconsin Wildlife Action Plan (WDNR 2006b) for the Forest Transition and Central Sand Plains Ecological Landscapes that apply to CWWA include:

- Maintain the largest blocks of northern mesic and oak forest, especially in the identified Conservation Opportunity Areas.
- Increase connectivity of forest patches, especially in the identified conservation opportunity areas.
- Encourage regeneration and reestablishment of eastern hemlock, Canada yew, northern white-cedar, other conifers and yellow birch, where appropriate through adaptive management techniques.
- Maintain and connect large blocks of older floodplain forest to provide habitat for the large number of SGCN that use this habitat while addressing the regeneration difficulties associated with dense stands of reed canary grass.
- Maintain large blocks of Open Bog/Muskeg habitat and other surrounding wetlands as co-occurring peatland communities by maintaining hydrology and controlling invasive plant species.

- Maintain large blocks of open sedge meadow within a complex of associated wetlands such as Open Bog, Poor Fen, Emergent Marsh, Shrub-carr, Alder Thicket and Northern Wet Forest by maintaining hydrology, tree cutting and harvest, prescribed fire and eradicating invasive plant species.
- Maintain lowland shrub communities like Alder Thicket and Shrub-carr, and manage the surrounding working forest to benefit golden-winged warblers by leaving scattered off-site aspen, ash and tamarack in shrub-dominated areas and managing the adjacent upland forest in a shifting mosaic of patch sizes and age classes to provide continuous habitat.
- This landscape has an especially important role for managing shorebird habitat at the Big Eau Pleine Flowage and other flowages and impoundments. Through dams and dikes, water levels can be raised to flood these areas, and through water control structures, water levels can be manipulated to benefit shorebirds. Migration phenology and specific habitat requirements must be considered when managing for shorebirds.
- Work with private land owners to manage wetland impoundments to conserve marsh-nesting birds.
- Implement the Greater Prairie-Chicken Management Plan.
- Implement the Wisconsin Whooping Crane Management Plan.

Grassland Wildlife Conservation

Grasslands have declined extensively throughout Wisconsin due to fire suppression and conversion to agriculture. Many former native grassland areas on the CWWA, particularly at George W. Mead State Wildlife Area, have been restored via plantings of native prairie species or maintained as Surrogate Grasslands dominated by non-native plant species (e.g., smooth brome, timothy, etc.) but function as good wildlife habitat. Rare and declining wildlife supported by grasslands on the CWWA includes birds, small mammals, butterflies, and reptiles. From a wildlife habitat perspective, plant species composition in these grasslands is important primarily from a structural and functional habitat standpoint (i.e. density and height of vegetation, proportion and density of grasses to wildflowers, etc.). Also important in these grasslands is the size of functional habitat and the surrounding landscape content (e.g. proximity and spatial arrangement of adjacent natural communities).

Biologists and birders are concerned about population declines of many grassland bird species. Since the North American Breeding Bird Survey (BBS) began in 1966, grassland birds have declined more steeply than any other group of birds in North America and the Midwest (Sample and Mossman 1997, Askins et al. 2007). In 1997, Sample and Mossman identified 26 “priority landscapes” in Wisconsin that represent unique opportunities for landscape-scale grassland management for grassland birds. State-owned lands surrounding George W. Mead State Wildlife Area were identified as part of the “Mead/Paul J. Olsen Grasslands ” priority landscape. These areas were noted as having 4,900 acres of grassland habitat including Northern Sedge Meadow, Surrogate Grasslands and Open Bog, all of which can benefit grassland bird species when considered as a whole and within the larger landscape. In general, the more contiguous acres of grassland, the better for conservation of open grassland species. Numerous grassland bird species are found on the CWWA including two State Threatened species (greater prairie-chicken and Henslow's sparrow) and several Special Concern species (dickcissel (*Spiza americana*), field sparrow (*Spizella pusilla*), bobolink and eastern meadowlark). Management to benefit grassland birds can also benefit game species such as sharp-tailed grouse (*Tympanuchus phasianellus*).

Grasslands also provide habitat for small mammals including the rare Franklin's ground squirrel (*Spermophilus franklinii*), which has been observed recently at Mead State Wildlife Area. Areas with

open unmowed grassland, forest edge, and wetlands within relatively close proximity make good habitat for Franklin's ground squirrels and offer the best opportunity for their management.

In addition, grasslands, particularly open sandy areas, are used as nesting areas for turtles. While turtles were also found nesting on the edges of roads and dikes, these nest sites are usually not productive, as the nests are quickly found by predators such as raccoon (*Procyon lotor*) which use the roads and dikes as travel corridors. In addition, turtles are vulnerable to vehicle mortality when they cross roads and two-tracks. There may be opportunities for targeted turtle nesting site management or construction, particularly in sandy uplands adjacent to wetlands (Anderson 2011). Restoration of sandy old fields to short grass prairie with scattered sandy openings may also encourage turtle nesting in areas with a lower risk of nest predation. Grasslands with sandy openings could also support the rare slender glass lizard (*Ophisaurus attenuatus*).

Finally, grasslands provide potential habitat for several rare butterfly species, including the rare regal fritillary (*Speyeria idalia*), which is known from large grassland complexes nearby. Larvae of regal fritillary depend on violets (*Viola* spp.) as a host plant. Additional species that could be found in grasslands include gorgone checkerspot (*Chlosyne gorgone*), Karner blue butterfly (*Lycaeides melissa samuelis*) and Persius dusky wing (*Erynnis persius*). Opportunities may be present to improve habitat for these species where their host plants are present or where host plants could be planted in suitable habitat. The host plants of gorgone checkerspot include plants in the aster family (Asteraceae), particularly sunflower (*Helianthus* spp.), aster (Aster spp.), and black-eyed Susan (*Rudbeckia hirta*), while the host plant of both Karner blue butterfly and Persius duskywing is wild lupine (*Lupinus perennis*).

Marsh Bird, Lowland Shrub Bird, and Colonial Waterbird Conservation

Many of the wetlands of the CWWA have undergone significant changes since Euro-American settlement. Around the turn of the century, peat-dominated wetlands were extensively ditched in an attempt to create more suitable farmland through projects like the Dancy Drainage District. In addition, extensive logging during the cutover era occurred in many of the conifer and hardwood swamps. Since the properties have been owned by the Wisconsin DNR, much emphasis has been placed on recreating wetland habitat, and management has focused on waterfowl production.

The large wetlands of the CWWA provide important habitat for rare species, including birds and amphibians. A large majority of the impressive diversity of rare birds found on the CWWA is due to this abundance of large, high-quality wetland habitats in addition to their connection to the open upland grasslands. This makes this one of the premiere open landscapes in the state for birds. The importance of this landscape-scale concept for preserving biodiversity holds true for other taxa as well, including reptiles, insects (including moths and butterflies), and mammals.

Black spruce, tamarack, and sphagnum moss dominated areas provide habitat for a diversity of sparrows including white-throated sparrow (*Zonotrichia albicollis*), song sparrow (*Melospiza melodia*), and Lincoln's sparrow (*M. lincolnii*) as well as many species of warblers including palm warbler (*Dendroica palmarum*), yellow-rumped warbler (*Setophaga coronata),* Nashville warbler (*Oreothlypis ruficapilla*), and black-and-white warbler (*Mniotilta varia*).

Lowland shrubs, either on the margins of open wetlands or as the dominant cover in a wetland, provide breeding habitat for many species, including willow flycatcher (*Empidonax traillii*), golden-winged warbler, veery, and sedge wren.

The numerous large sedge meadows provide important breeding habitat for bobolink, American bittern, Le Conte's sparrow, sedge wren, sandhill crane, northern harrier, and blue-winged teal (*Anas discors*). In

particular, the CWWA provides excellent management opportunities for Le Conte's sparrow and American bittern.

Of particular interest are relatively large populations of golden-winged warbler, found in lowland shrubs and shrubby sedge meadows. Minnesota and Wisconsin have a unique responsibility to maintain the globally uncommon golden-winged warbler, as an estimated 57% of its global range is found in these two states (USFWS In prep.). Populations of golden-winged warblers have declined across their range; annual rates of decline average 2.3% throughout its breeding range and 2.6% in Wisconsin, for an overall decline of 69% in Wisconsin from 1966-2009 (Buehler et al. 2012). Range contraction at the southern edge of its Midwestern range, loss of early successional nesting habitat, and hybridization with blue-winged warbler (*Vermivora pinus*) appear to be driving these declines (Buehler et al. 2007).

On the CWWA, our surveys indicated golden-winged warblers were primarily found in shrubby Northern Sedge Meadow, Shrub-carr, and Alder Thicket. At other sites in Wisconsin and Minnesota, other researchers have documented golden-winged warblers in both young aspen stands and more mature forests as well (WDNR 2005, Martin et al. 2007, Streby et al. 2012). When considering management focusing on enhancing habitat for golden-winged warblers, landscape-scale planning should be emphasized and equal consideration should be given to other important groups of declining bird species (i.e. grassland birds and forest interior birds).

While golden-winged warblers have traditionally been considered a species of early successional habitats, recent research indicates that they require more mature forests as well, particularly for fledgling and post-breeding adult survival (Cutright et al. 2006, Streby et al. 2012). These studies reveal golden-winged warbler habitat associations are more complicated than initially thought and the species should be considered a diverse forest obligate. Our surveys indicate that abundant habitat is already present in the form of shrubby wetlands and adjacent forests. In general, providing for a matrix of open shrub wetlands, upland areas with edges of scattered shrubs, and other edge habitats (power-line right-of-way) adjacent to more mature forests could maximize benefits to golden-winged warblers as well as other rare or uncommon species (brown thrasher [*Toxostoma rufum*], field sparrow [*Spizella pusilla*], veery, and American woodcock [*Scolopax minor*]), without compromising habitat for species requiring open grasslands or interior forest conditions.

Flowages, containing open water, emergent vegetation, and occasional standing dead trees, are important resources for yellow-headed blackbird, black tern, least bittern, trumpeter swan, whooping crane, American white pelican, and heron species. Constructed nesting platforms in and adjacent to flowages and marshes are crucial for herons and cormorants. In addition, the CWWA is one of the few areas in the state that supports a breeding pair of whooping cranes and it plays a key role in its reintroduction. Flowages and Emergent Marsh complexes within the CWWA also consistently support one of the largest breeding colonies of black terns in the state, which has suffered a significant contraction in breeding sites over the past 30 years (Shealer and Matteson 2011). Black terns are currently recommended for listing as State Endangered. Shallow flowages and Emergent Marsh areas on the CWWA are also used by numerous other birds for feeding, loafing, and roosting, and occasionally attract unusual migrating shorebirds not normally found in central Wisconsin. Flowages can also support habitat for American bullfrog (*Lithobates catesbeianus*) and mink frog.

Maintaining a relatively diverse, open, sedge meadow community and intact Emergent Marsh are important considerations for management. This can be accomplished by maintaining ecological processes that historically kept these types of communities open, particularly hydrology. Hydrologic manipulations must balance resource objectives, including habitat for waterfowl, shorebird migration, and rare and declining breeding birds. In particular, drawdowns should minimize potential impacts to black tern

colonies to avoid disrupting nesting success of this very rare species. Additionally, new hydrologic disruptions such as ditching, new dikes, or the creation of additional duck ponds are likely to have significant adverse impacts to natural communities and associated species. Frequent fire is also an important ecological process that historically maintained sedge meadows in an open condition by removing dead thatch, setting back tree saplings and shrubs, and stimulating herbaceous vegetation; a lack of fire is closely correlated with an increase in shrub dominance in sedge meadows (Davis 1979). In addition, fire plays an important role in nutrient cycling, and can stimulate greater flowering and fruiting of herbaceous plants and low shrubs.

Migratory Birds

The diversity of habitats on the CWWA, from large wetlands and flowages to surrogate grassland to Shrub-carr, Muskeg and Black Spruce Swamp, to Northern Mesic Forest offers important resources for numerous bird groups. Large numbers of individuals from many species accumulate here during migration because these areas offer food, water, and shelter, the most important resources to migrating birds.

Large emergent wetlands and associated open water areas offer migratory birds such as waterfowl, shorebirds, songbirds, and waterbirds like herons diverse habitats during the migratory seasons. Important features include emergent aquatic plants such as cat-tails, smartweed (*Polygonum* spp.), and arrowheads (*Sagittaria* spp.); open water areas that team with amphibians, fish, and aquatic invertebrates; and mudflats with abundant invertebrates and insect larvae. This plant and animal life provides important foraging opportunities during spring and fall migration. These areas are also important staging areas for waterfowl that later disperse to breeding areas.

In addition, lowland shrubs present in these wetlands offer migrating songbirds protection from severe weather and predators as well as feeding opportunities 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 used by migrants to build fat reserves necessary for sustaining long migratory flights.

Threats to migratory birds include habitat destruction and habitat alteration (Duncan et al. 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 et al. 2002). Many wetlands in the surrounding landscape of the CWWA have been filled for agriculture or developed, threatening the availability of habitat for migrating birds.

Three bird conservation plans have been developed that can provide further guidance on promoting bird habitat during property management planning: 1) North American Waterfowl Management Plan (Upper Mississippi River/Great Lakes Joint Venture Implementation Plan; (USFWS 1986); 2) Shorebird Habitat Conservation Strategy (Upper Mississippi Valley/Great Lakes Region Joint Venture; Potter et al. 2007); and 3) Upper Mississippi Valley/Great Lakes Waterbird Conservation Plan (Wires et al. 2010).

Small Mammals

Numerous small mammals were recorded from the property, reflecting the diversity and quality of habitats (Table 11, Stephens 2011). Habitats with the greatest diversity of species included black ash swamp, Northern Mesic Forest, and Alder Thicket. In addition, several reed canary grass meadows had high mammalian species diversity, though this may simply reflect the high diversity and quality of surrounding habitat and lack of extensive areas dominated by reed canary grass. In particular, arctic shrew (*Sorex arcticus*) was frequently captured in a variety of open wetland habitats. This species was recently removed from the NHI working list and appears to have robust populations on the CWWA.

Franklin's ground squirrel (*Spermophilus franklinii*, SGCN) have been reported by staff at Mead State Wildlife Area within the past three years at several locations. Although these sightings were not confirmed by capture or photograph, their presence was deemed likely (Stephens 2011). Maintaining open, unmowed grasslands will provide suitable habitat for this species. Areas with open grassland, forest edge, and wetlands within relatively close proximity make good habitat for Franklin's ground squirrels and offer the best opportunity for management.

Also notable was the lack of capture of two SGCN species, water shrew (*Sorex palustris*) and woodland jumping mouse (*Napaeozapus insignis*), despite the fact that there are historical records of both species at Mead State Wildlife Area. It is possible that both of these species may still occur on the property but were not encountered due to low abundance (Stephens 2011). Water shrew typically occurs in habitats such as marshes, bogs, and cold, small streams with cover along the banks, while woodland jumping mouse occurs in forested areas near water, bogs, and stream borders. Maintaining these habitats will help conserve these species.

Table 11. Small mammals documented on the CWWA.

Common name	Scientific name	SGCN	Capture Frequency	Predominant habitats
arctic shrew	*Sorex arcticus*		frequent	Northern Sedge Meadow, Alder Thicket, reed canary grass meadow
masked shrew	*Sorex cinereus*		frequent	Alder thicket, Open Bog, Black Spruce Swamp, Northern Mesic Forest
meadow vole	*Microtus pennsylvanicus*		frequent	Northern Sedge Meadow, Alder Thicket, reed canary grass meadow
white-footed mouse	*Peromyscus leucopus*		frequent	Northern Mesic Forest
short-tailed shrew	*Blarina brevicauda*		occasional	black ash swamp, Northern Mesic Forest, Northern Sedge Meadow
southern red-backed vole	*Myodes gapperi*		occasional	black ash swamp, Northern Mesic Forest
eastern chipmunk	*Tamias striatus*		occasional	black ash swamp, Northern Mesic Forest
pygmy shrew	*Sorex hoyi*		infrequent	black ash swamp, Black Spruce Swamp, Tamarack (Poor) Swamp
star-nosed mole	*Condylura cristata*		infrequent	Black Spruce Swamp, reed canary grass meadow
short-tailed weasel	*Mustela erminea*		infrequent	reed canary grass meadow
Franklin's ground-squirrel*	*Poliocitellus franklinii**	Y	not captured*	open grasslands

*Reported by staff at Mead State Wildlife Area; likely present but not confirmed.

Game Species

The following information was provided by WDNR wildlife managers

The properties in the CWWA are managed as State Wildlife Areas. Important game species on these properties currently include ducks, geese, muskrat (*Ondatra zibethicus*), and beaver (*Castor canadensis*) in wetlands, and white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), black bear (*Ursus americanus*), ruffed grouse (*Bonasa umbellus*), eastern gray squirrel (*Sciurus carolinensis),* eastern fox squirrel (*Sciurus niger),* eastern cottontail rabbit (*Sylvilagus floridanus),* and American woodcock (*Scolopax minor*) in uplands (Brian Peters, pers. com.). Lesser game species currently include mink (*Neovison vison)* and river otter (*Lontra canadensis)* in wetlands, and coyote (*Canis latrans*), red fox (*Vulpes vulpes)*, raccoon, fisher (*Martes pennanti),* mourning dove (*Zenaida macroura),* snowshoe hare (*Lepus americanus),* and short-tailed weasel (*Mustela erminea*) in uplands (Brian Peters, pers. com.). Bobcat (*Lynx rufus)* also occur on the CWWA but under current rules and regulations cannot be hunted

south of State Highway 64 (Cortney Schaefer, pers. com.). In addition, ring-necked pheasants are stocked at McMillan Wildlife Area. Species with possible potential to increase populations or their habitat include pheasant and sharp-tailed grouse at George W. Mead Wildlife (Brian Peters, pers. com.) and wild turkey at Dewey Wildlife Area (Cortney Schaefer, pers. com.). Management to support wildlife dependent on large open landscapes such as pheasant and sharp-tailed grouse will also benefit rare and declining species like the greater prairie-chicken and grassland birds, noted above. Finally, gray wolf occurs on the CWWA and is a potential future game species given the recent authorization of a gray wolf hunting season.

Additional comments from Natural Heritage Inventory:
There is evidence that ring-necked pheasants interfere with greater prairie-chicken (and sharp-tailed grouse) courtship rituals and nesting. In Wisconsin, ring-necked pheasants have been videotaped interfering with breeding activity on sharp-tailed grouse leks at Crex Meadows Wildlife Area (Hull 2007). Extensive documentation of interference has occurred in Illinois, as described in detail in that state's greater prairie-chicken recovery plan (Walk 2004):

> *Extirpation of Greater Prairie-Chickens from many areas in the early 20th century actually pre-dated the elimination of suitable grassland habitat. These local extinction events were often correlated with the local establishment of Ring-necked Pheasants (Calahane et al. 1942, Sharp 1957). At PRSNA [Prairie Ridge State Natural Area] in Jasper County, pheasants became established around 1970 and gradually increased in abundance (Vance and Westemeier 1979). Male pheasants were observed disrupting male prairie-chickens on leks, and female pheasants laid eggs in prairie-chicken nests. Pheasant eggs require about 23 days of incubation to hatch, versus about 25 days for prairie-chicken eggs. In several instance, prairie-chicken hens incubated mixed-species clutches until the pheasant eggs hatched, and abandoned many or all of their own eggs prior to hatching. By 1983, 43% of prairie-chicken nests contained pheasant eggs. Greater Prairie-Chicken nests containing pheasant eggs suffer lower egg success and higher abandonment than unparasitized nests (Westemeier et al. 1998).*

In a 2007 issue brief, Scott Hull recommends "selective removal of ring-necked pheasant males that are interfering with prairie grouse breeding activity on the lek and the removal of pheasant hens on core prairie-grouse management areas within key [WDNR] properties." He also suggests placing additional restrictions on locating pheasant hunting preserves within "traditional prairie grouse range," to prevent or limit possible conflicts between pheasants and "prairie grouse."

Primary Sites: Site-specific Opportunities for Biodiversity Conservation

Four ecologically important sites, or "Primary Sites," were identified within the CWWA (Figure 7). Primary Sites are 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.

A complete description of the Primary Sites can be found in Appendix G. 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. Appendix H lists the rare species and high-quality natural communities currently known from these Primary Sites in the CWWA.

Table 12. Central Wisconsin Wildlife Areas Planning Group Primary Sites.

Code	Name
CWWA01	Mead Conifer Bogs
CWWA02	Mead Big Eau Pleine Woods
CWWA03	Honey Island Wetland and Teal Marsh and Meadow
CWWA04	Dewey Marsh and Muskeg

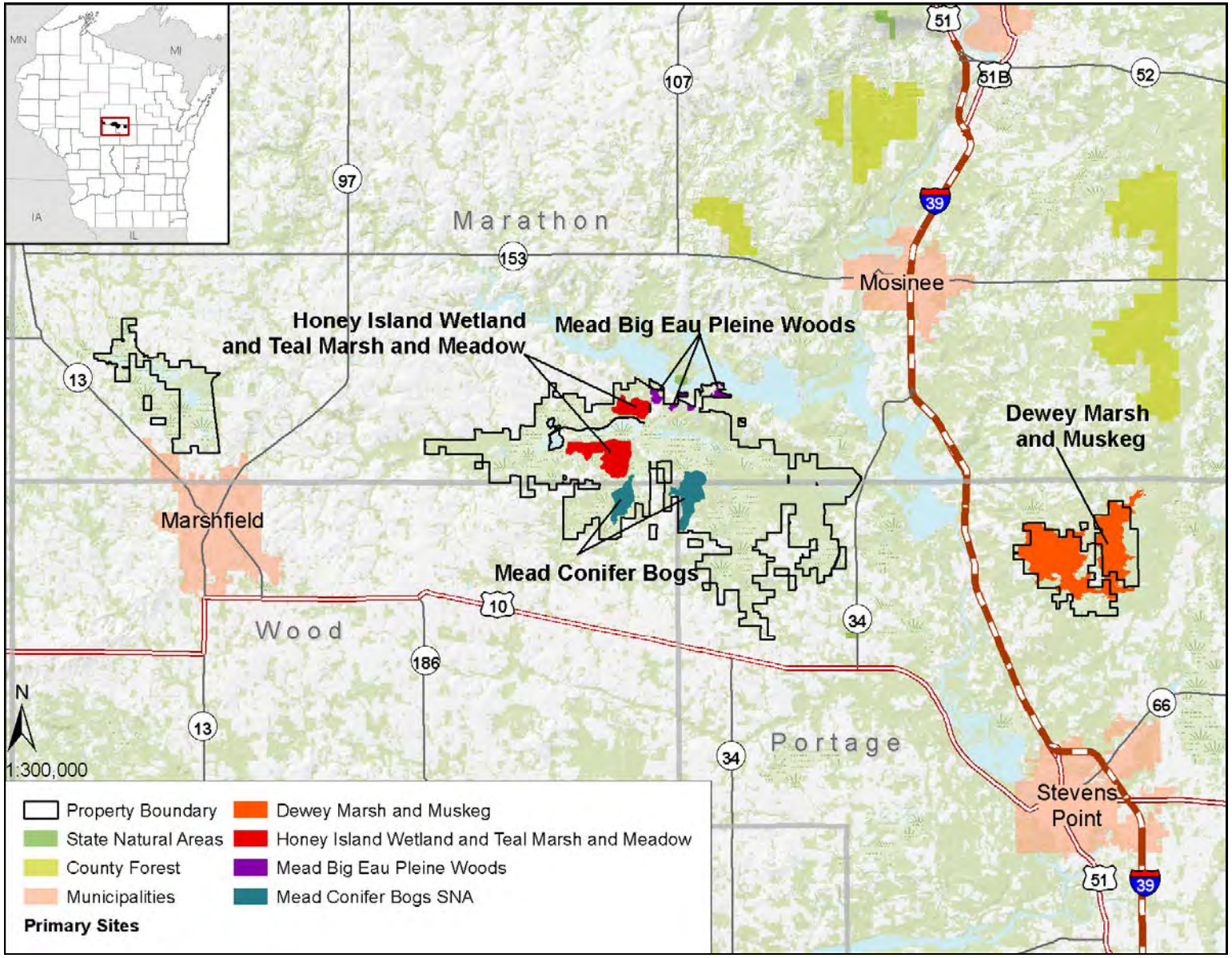

Figure 7. Primary Sites of the Central Wisconsin Wildlife Areas Planning Group

Future Needs

This project was designed to provide a rapid assessment of the biodiversity values for the Central Wisconsin Wildlife Areas Planning Group. 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 of the CWWA.

- Continued invasive species monitoring and control is needed. Public lands throughout Wisconsin are facing major management problems because of serious infestations of highly invasive species. 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 CWWA, a comprehensive invasive species monitoring and control plan will be needed for detecting and rapidly responding to new invasive threats.
- 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. Specific taxa are listed below.
- Additional surveys for the special concern plant Georgia bulrush (*Scirpus georgianus*) are warranted. Several new and updated locations for this species were found on and adjacent to Mead State Wildlife Area, but thorough surveys were not conducted. This property group and the region surrounding it contain a majority of the recent Georgia bulrush observations in the state, and the area may play a significant role in the conservation of this species.
- Additional surveys for terrestrial invertebrates in open uplands would be beneficial. Though some surveys were conducted, they were relatively small in scope and time.
- Surveys for wetland lepidopterans (butterflies, moths, and close relatives) is needed. This taxa group was not surveyed, and significant habitat for rare species is present on the CWWA, especially the extensive high-quality Muskeg, Poor Fen, Northern Sedge Meadow, and Open Bog habitats at George W. Mead State Wildlife Area and Dewey Wildlife Area.
- Additional small mammal surveys are recommended in an effort to verify the rare Franklin's ground squirrel and identify key habitat characteristics for this species. Efforts should also be made to relocate water shrew and woodland jumping mouse, both of which are historically known from the property group.
- Continued monitoring of important bird taxa is recommended, particularly for greater prairie-chicken, black tern, and colonial nesting waterbirds.
- Additional surveys are recommended for rare herptiles, particularly Blanding's turtle, formerly documented at Mead and McMillan wildlife areas, but not observed during this study on these properties despite their extensive wetland habitats. Given the rarity of this species, and the fact that two of the three observations during this study were found dead on a road, a more detailed monitoring project may be beneficial to determine important areas in wetlands, upland nesting sites, and important travel corridors.

Blanding's turtle are known from the study area, but few individuals were found and more surveys are recommended. Photo by Brian Collins.

Glossary

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.

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.

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.

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 2006a).

Tension Zone – a climatic transition area that crosses Wisconsin from northwest to southeast, and separates the conifer-hardwood forests of northern Wisconsin from the mosaic of prairie, savanna, and mainly deciduous forests of the south.

Species List

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

Common Name	Scientific Name
Plants	
American elm	*Ulmus americana*
Arrowhead	*Sagittaria* spp.
Aspen	*Populus* sp.
Bebb's willow	*Salix bebbii*
Big-tooth aspen	*Populus grandidentata*
Bitternut hickory	*Carya cordiformis*
Black ash	*Fraxinus nigra*
Black chokeberry	*Aronia melanocarpa*
Black-eyed Susan	*Rudbeckia hirta*
Black spruce	*Picea mariana*
Blue cohosh	*Caulophyllum thalictroides*
Blue-joint grass	*Calamagrostis canadensis*
Bog birch	*Betula pumila*
Bog goldenrod	*Solidago uliginosa*
Bog laurel	*Kalmia polifolia*
Bog-rosemary	*Andromeda glaucophylla*
Broad-leaved arrow-head	*Sagittaria latifolia*
Broad-leaved cat-tail	*Typha latifolia*
Bristly buttercup	*Ranunculus hispidus*
Bristly dewberry	*Rubus hispidus*
Bristle-stalked sedge	*Carex leptalea*
Brome-like sedge	*Carex bromoides*
Buxbaum's sedge	*Carex buxbaumii*
Canada goldenrod	*Solidago canadensis*
Canadian waterweed	*Elodea canadensis*
Common buckthorn	*Rhamnus cathartica*
Common hemp-nettle	*Galeopsis tetrahit*
Common tussock sedge	*Carex stricta*
Common yellow lake sedge	*Carex utriculata*
Coon-tail	*Ceratophyllum demersum*
Cord-root sedge	*Carex chordorrhiza*
Creeping snowberry	*Gaultheria hispidula*
Curly pondweed	*Potamogeton crispus*
Dwarf red raspberry	*Rubus pubescens*
False nettle	*Boehmeria cylindrica*
Few-seeded sedge	*Carex oligosperma*
Flat-topped aster	*Aster umbellatus*
Flowering dogwood	*Cornus florida*
Fowl manna grass	*Glyceria striata*
Fringed sedge	*Carex crinita*
Garlic mustard	*Alliaria petiolata*

Common Name	Scientific Name
Glossy buckthorn	*Rhamnus frangula*
Gray bog sedge	*Carex canescens*
Hair beak-rush	*Rhynchospora capillacea*
Hairy sedge	*Carex hirtifolia*
Halberd-leaved tear-thumb	*Polygonum arifolium*
Hardhack	*Spiraea tomentosa*
Hawkweed	*Hieracium* spp.
Hazelnut	*Corylus americana*
Hemlock	*Tsuga canadensis*
Hop-hornbeam	*Ostrya virginiana*
Hog-peanut	*Amphicarpaea bracteata*
Jack pine	*Pinus banksiana*
Japanese knotweed	*Polygonum cuspidatum*
Jewelweed	*Impatiens capensis*
Kentucky bluegrass	*Poa pratense*
Labrador tea	*Ledum groenlandicum*
Lady-fern	*Athyrium filix-femina*
Lake sedge	*Carex lacustris*
Large cranberry	*Vaccinium macrocarpon*
Large-flowered trillium	*Trillium grandiflorum*
Large-fruited star sedge	*Carex echinata*
Leatherleaf	*Chamaedaphne calyculata*
Maidenhair fern	*Adiantum pedatum*
Maple-basswood	*Tilia americana*
Maple-leaf viburnum	*Viburnum acerifolium*
Marsh cinquefoil	*Comarum palustre*
Marsh fern	*Thelypteris palustris*
Marsh purslane	*Ludwigia palustris*
Meadowsweet	*Spiraea alba*
Mountain holly	*Ilex mucronata*
Mountain maple	*Acer spicatum*
Muscle-wood	*Carpinus caroliniana*
Narrow-leaved cotton-grass	*Eriophorum angustifolium*
Narrow-leaved sundew	*Drosera intermedia*
Narrow-leaved woolly sedge	*Carex lasiocarpa*
Northern red oak	*Quercus rubra*
Old field goldenrod	*Solidago altissima*
Paper birch	*Betula papyrifera*
Pussy willow	*Salix discolor*
Pink lady’s-slipper	*Cypripedium acaule*
Poison sumac	*Toxicodendron vernix*
Quack grass	*Elytrigia repens*
Red maple	*Acer rubrum*
Red oak	*Quercus rubra*
Red-osier dogwood	*Cornus stolonifera*
Reed canary grass	*Phalaris arundinacea*
Round-leaved sundew	*Drosera rotundifolia*

Common Name	Scientific Name
Sandbar willow	*Salix exigua*
Sensitive fern	*Onoclea sensibilis*
Sharp-lobed hepatica	*Anemone acutiloba*
Showy bush honeysuckle	*Lonicera* X *bella*
Silver maple	*Acer saccharinum*
Slender willow	*Salix petiolaris*
Small cranberry	*Vaccinium oxycoccos*
Smartweed	*Polygonum* spp.
Speckled alder	*Alnus incana* spp. *rugosa*
Solomon's seal	*Smilacina trifolia*
Sugar maple	*Acer saccharum*
Sunflower	*Helianthus* spp.
Sphagnum moss	*Sphagnum cuspidatum*
Steeple-bush	*Spiraea tomentosa*
Tamarack	*Larix laricina*
Tawny cotton-grass	*Eriophorum virginicum*
Three-fruited sedge	*Carex trisperma*
Three-leaved Solomon's seal	*Smilacina trifolia*
Timothy	*Phleum pratense*
Tussock cotton-grass	*Eriophorum vaginatum*
Trembling aspen	*Populus tremuloides*
Velvet-leaved blueberry	*Vaccinium myrtilloides*
Violets	*Viola* spp
Virginia waterleaf	*Hydrophyllum virginianum*
Water-arum	*Calla palustris*
White ash	*Fraxinus americana*
White avens	*Geum canadense*
White pine	*Pinus strobus*
Wild geranium	*Geranium maculatum*
Wild lupine	*Lupinus perennis*
Winterberry	*Ilex verticillata*
Witch-hazel	*Hamamelis virginiana*
Wood nettle	*Laportea canadensis*
Wool grass	*Scirpus cyperinus*
Yellow birch	*Betula alleghaniensis*
Animals	
Acadian flycatcher	*Empidonax virescens*
American bittern	*Botaurus lentiginosus*
American bullfrog	*Lithobates catesbeianus*
American woodcock	*Scolopax minor*
Beaver	*Castor canadensis*
Big brown bat	*Eptesicus fuscus*
Black-and-white warbler	*Mniotilta varia*
Black bear	*Ursus americanus*
Black tern	*Chlidonias niger*
Blanding's turtle	*Emydoidea blandingii*

Common Name	Scientific Name
Blue-winged teal	*Anas discors*
Blue-winged warbler	*Vermivora pinus*
Bobolink	*Dolichonyx oryzivorus*
Brown thrasher	*Toxostoma rufum*
Cerulean warbler	*Dendroica cerulea*
Coyote	*Canis latrans*
Dickcissel	*Spiza americana*
Eastern cottontail rabbit	*Sylvilagus floridanus*
Eastern fox squirrel	*Sciurus niger*
Eastern gray squirrel	*Sciurus carolinensis*
Eastern meadowlark	*Sturnella magna*
Eastern pipistrelle	*Perimyotis subflavus*
Emerald ash borer	*Agrilus planipennis*
Field sparrow	*Spizella pusilla*
Fisher	*Martes pennanti*
Franklin's ground squirrel	*Spermophilus franklinii*
Golden-winged warbler	*Vermivora chrysoptera*
Gorgone checkerspot	*Chlosyne gorgone*
Henslow's sparrow	*Ammodramus henslowii*
Karner blue butterfly	*Lycaeides melissa samuelis*
Le Conte's sparrow	*Ammodramus leconteii*
Lincoln sparrow	*Melospiza lincolnii*
Little brown bat	*Myotis lucifugus*
Midwestern fen buckmoth	*Hemileuca nevadensis* ssp. 3
Mink	*Neovison vison*
Mink frog	*Lithobates septentrionalis*
Mourning dove	*Zenaida macroura*
Muskrat	*Ondatra zibethicus*
Nashville warbler	*Oreothlypis ruficapilla*
Northern goshawk	*Accipiter gentilis*
Northern harrier	*Circus cyaneus*
Northern leopard frog	*Lithobates pipiens*
Northern long-eared bat	*Myotis septentrionalis*
Palm warbler	*Dendroica palmarum*
Persius duskywing	*Erynnis persius*
Prairie chicken	*Tympanuchus cupido*
Prothonotary warbler	*Protonotaria citrea*
Raccoon	*Procyon lotor*
Red fox	*Vulpes vulpes*
Red-shouldered hawk	*Buteo lineatus*
Regal fritillary	*Speyeria idalia*
Ring-necked pheasants	*Phasianus colchicus*
River otter	*Lontra canadensis*
Ruffed grouse	*Bonasa umbellus*
Sandhill crane	*Grus canadensis*
Savannah sparrow	*Passerculus sandwichensis*
Sharp-tailed grouse	*Tympanuchus phasianellus*

Common Name	Scientific Name
Short-tailed weasel	*Mustela erminea*
Slender glass lizard	*Ophisaurus attenuatus*
Snowshoe hare	*Lepus americanus*
Song sparrow	*Melospiza melodia*
Veery	*Catharus fuscescens*
Water shrew	*Sorex palustris*
White-tailed deer	*Odocoileus virginianus*
White-throated sparrow	*Zonotrichia albicollis*
Wild turkey	*Meleagris gallopavo*
Willow flycatcher	*Empidonax traillii*
Woodland jumping mouse	*Napaeozapus insignis*
Wood thrush	*Hylocichla mustelina*
Yellow-bellied flycatcher	*Empidonax flaviventris*
Yellow-rumped warbler	*Setophaga coronata*

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Additional Resources

Numerous online resources are available for learning more about the rare species, natural communities, and ecological concepts contained within this report. These are just a few of the resources that we recommend.

1. **Bureau of Endangered Resources' Animals, Plants, and Communities Web Pages**
   Information for plants, animals, and natural communities on the Wisconsin Working List, as well as Species of Greatest Conservation Need from the Wisconsin Wildlife Action Plan. For reptiles and amphibians, information for more common species is also provided here. At this time, the level of detail available varies among species; some have detailed factsheets while others have only a short paragraph or a map. These pages will continue to evolve as more information becomes available and are the Bureau of Endangered Resources' main source of information for species and communities. ***dnr.wi.gov/org/land/er/biodiversity/***

2. **Wisconsin Natural Heritage Inventory Working List**

   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. This Web page offers a printable pdf file and a key to the Working List for use in conjunction with the information provided in #1 above. ***dnr.wi.gov/org/land/er/wlist/***

3. **Ecological Landscapes of Wisconsin Handbook**
   Wisconsin's 16 Ecological Landscapes have unique combinations of physical and biological characteristics such as climate, geology, soils, water, or vegetation. This handbook will contain a chapter for each of these landscapes with detailed information about their ecology, socioeconomics, and ecological management opportunities. An additional introductory chapter will compare the 16 landscapes in numerous ways, discuss Wisconsin's ecology on the statewide scale, and introduce important concepts related to ecosystem management in the state. The full handbook is in development as of this writing, and chapters will be made available online as they are published. Currently, a set of Web pages provide brief Ecological Landscape descriptions, numerous maps, and other useful information, including management opportunities for natural communities and Species of Greatest Conservation Need. ***dnr.wi.gov/topic/landscapes/***

4. **The Wisconsin Wildlife Action Plan**
   This plan is the result of a statewide effort to identify native Wisconsin animal species of greatest conservation need. The plan also presents priority conservation actions to protect the species and their habitats. The plan itself is available online, and there are several online tools to explore the data within the plan. The Web pages are closely integrated with the pages provided in items #1 and #3 above. The Wildlife Action Plan Web pages are quite numerous, so we recommend the following links as good starting points for accessing the information.
   - the plan itself: ***dnr.wi.gov/org/land/er/wwap/***
   - explore Wildlife Action Plan data: ***dnr.wi.gov/org/land/er/wwap/explore/***
   - Wildlife Action Plan Implementation: ***dnr.wi.gov/org/land/er/wwap/implementation/***

5. **Wisconsin's Biodiversity as a Management Issue - A Report to Department of Natural Resources Managers**
   This now out-of-print report presents a department strategy for conserving biological diversity. It provides department employees with an overview of the issues associated with biodiversity and

provides a common point of reference for incorporating the conservation of biodiversity into our management framework. The concepts presented in the report are closely related to the material provided in this report, as well as the other resources listed in this section.
dnr.wi.gov/org/es/science/publications/rs915_95.htm

6. **Wisconsin's Statewide Forest Strategy**
   Wisconsin's Statewide Forest Strategy is a collection of many strategies and actions designed to address major issues and priority topics over the next five to ten years. It provides a long-term, comprehensive, coordinated approach for investing resources to address the management and landscape priorities identified in the Statewide Forest Assessment. Several of the strategies contain issues related to biodiversity and ecosystem management.
   dnr.wi.gov/forestry/assessment/strategy/overview.htm

7. **2010 Wisconsin's Statewide Forest Assessment**
   The goal of this project was to assess the "state of affairs" of Wisconsin's public and private forests and analyze the sustainability of our forested ecosystems. The Statewide Forest Assessment helps to explain trends, identify issues, and present an updated view of the status of forests in Wisconsin. The first chapter deals with biological diversity in Wisconsin's forests, and the major conclusions from this assessment were used to develop the strategies in # 6 above.
   dnr.wi.gov/forestry/assessment/strategy/assess.htm

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, natural communities, and certain other natural features (e.g., bird rookeries). 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*) 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 an approximately 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, high-quality natural communities, and certain other features 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, GPS 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; geological 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, as well as any documented rare species. 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 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.

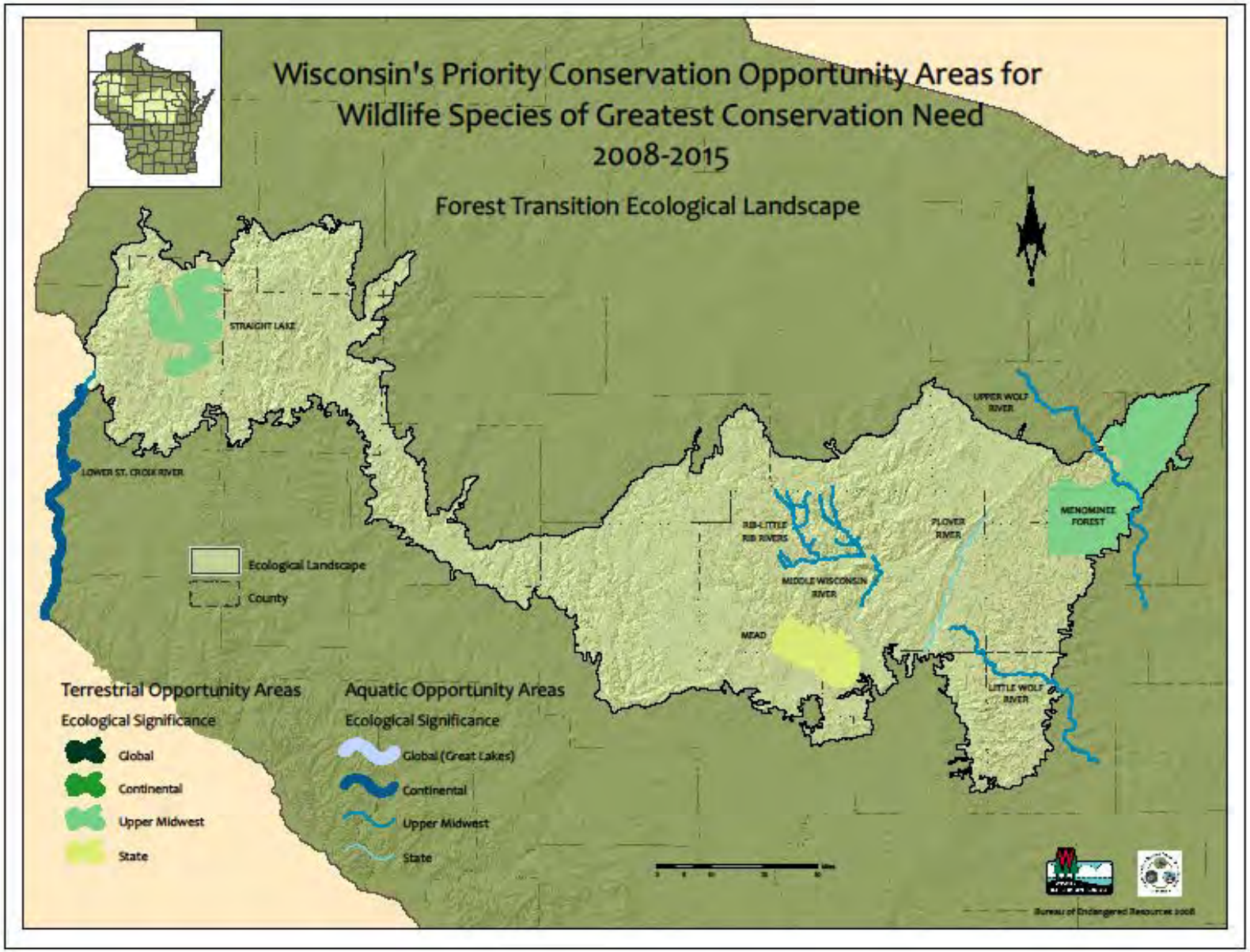
Interviews: Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield invaluable information.

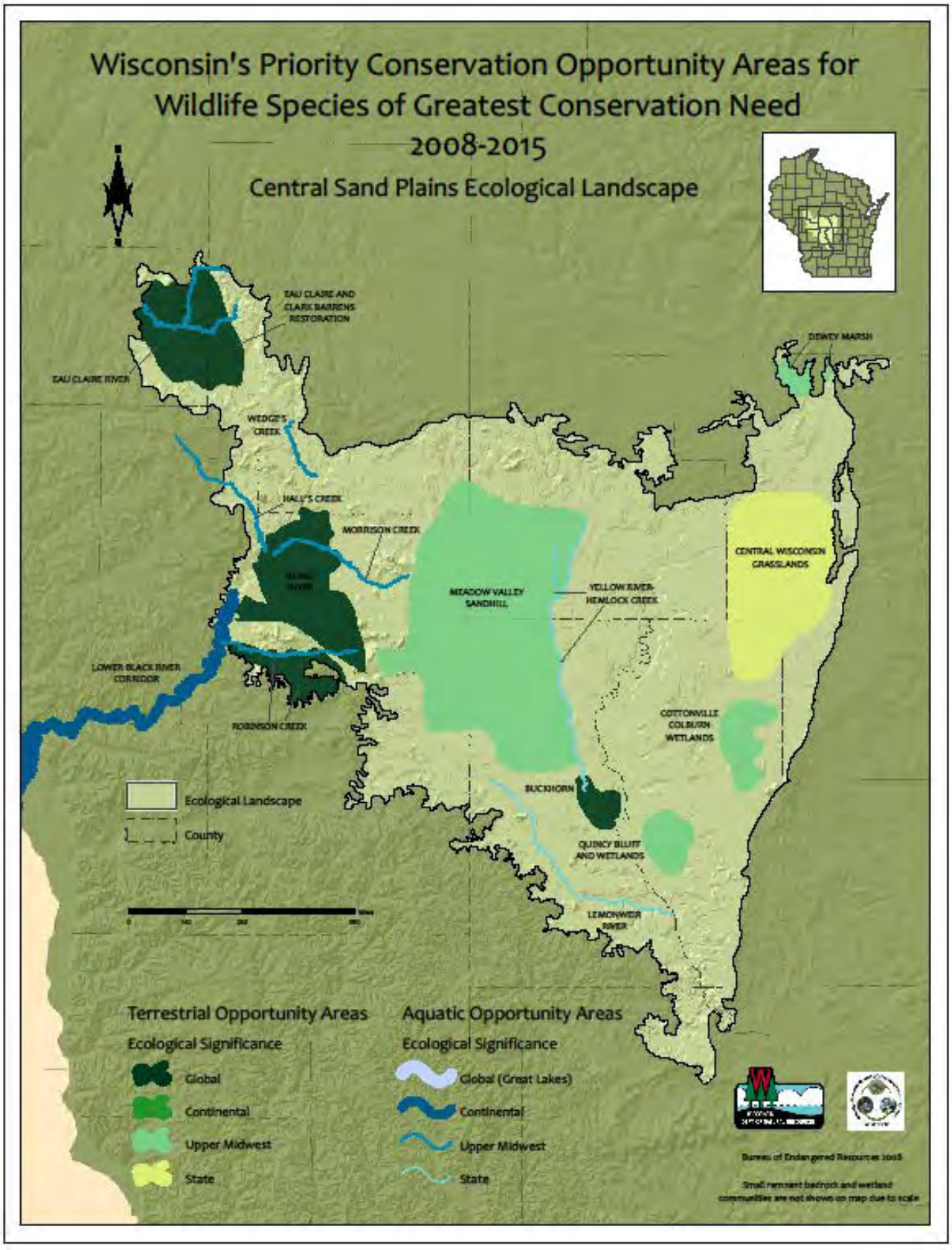
Global Positioning Systems (GPS): Small, portable GPS units are now a routine piece of field equipment used for virtually all NHI survey work. Collecting coordinates (waypoints) facilitates mapping and makes it easy to quickly communicate specific locations among biologists. Often waypoints are paired 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


Wisconsin's Priority Conservation Opportunity Areas for
Wildlife Species of Greatest Conservation Need
2008-2015
Forest Transition Ecological Landscape
STRAIGHT LAKE
LOWER ST. CROIX RIVER
UPPER WOLF RIVER
RIB-LITTLE RIB RIVERS
FLOWER RIVER
MENOMINEE FOREST
MIDDLE WISCONSIN RIVER
MEAD
LITTLE WOLF RIVER
Ecological Landscape
County
Terrestrial Opportunity Areas
Ecological Significance
Global
Continental
Upper Midwest
State
Aquatic Opportunity Areas
Ecological Significance
Global (Great Lakes)
Continental
Upper Midwest
State


Wisconsin's Priority Conservation Opportunity Areas for Wildlife Species of Greatest Conservation Need
2008-2015
Central Sand Plains Ecological Landscape
EAU CLAIRE AND CLARK BARRENS RESTORATION
EAU CLAIRE RIVER
DEWEY MARSH
WEDGE'S CREEK
HALL'S CREEK
MORRISON CREEK
CENTRAL WISCONSIN GRASSLANDS
MEADOW VALLEY SANDHILL
YELLOW RIVER-HEMLOCK CREEK
LOWER BLACK RIVER CORRIDOR
ROBINSON CREEK
COTTONVILLE COLBURN WETLANDS
BUCKHORN
QUINCY BLUFF AND WETLANDS
LEMONWEIR RIVER
Ecological Landscape
County
Terrestrial Opportunity Areas
Ecological Significance
Global
Continental
Upper Midwest
State
Aquatic Opportunity Areas
Ecological Significance
Global (Great Lakes)
Continental
Upper Midwest
State
Bureau of Endangered Resources 2008
Small remnant bedrock and wetland communities are not shown on map due to scale

Appendix D

Descriptions of Rare Species and High Quality Natural Communities Documented at Central Wisconsin Wildlife Areas Property Group

The following paragraphs give brief summary descriptions for some of the rare species documented Central Wisconsin Wildlife Area properties and mapped in the NHI Database. More information can be found on the Endangered Resources Web site (*dnr.wi.gov*, keyword "*ER*") for several of these species. Not all species documented on the properties have descriptive paragraphs available.

Rare Animals

Acadian Flycatcher

Acadian Flycatcher (*Empidonax virescens*), a State Threatened bird, prefers lowland deciduous forests and heavily wooded hillsides in large blocks of southern forests. Recommended avoidance period for this species is May 1 - August 31.

American Bittern

American Bittern (*Botaurus lentiginosus*) is a Special Concern bird species in Wisconsin. It is a medium-sized wading bird with a stout body, long neck, and bill. It has brown plumage on the back and is streaked with brown and white stripes on the chest and throat. The plumage does not change seasonally. Most distinctive is an elongated, black patch extending from below the eye down the side of the neck. The species can be found in shallow marshes, meadows, and wetlands of many sizes but prefers large open marshes and meadows. During the breeding season, from 25 Apr - 31 July, it nests in areas with thick, emergent vegetation like cattails, sedges, reeds, and bulrushes. One to five buff-brown to olive-brown colored eggs are laid and incubated by the female only for 24-28 days. The species is threatened by the degradation and destruction of wetlands from drainage, filling, and conversion to agriculture.

American White Pelican

The American White Pelican (*Pelecanus erythrorhynchos*), a Special Concern species, is a large, heavy-bodied white waterbird with a characteristic long bill with an extensible pouch. Its wings are long and broad with a black trailing edge. The species is typically found in estuarine systems along the Great Lakes coastal bays and inlets along with large inland lakes and marsh complexes. During the breeding season between April 15 and July 31, it prefers habitats such as isolated islands while foraging in freshwater lakes, rivers, or impoundments. Pelicans generally lay two eggs that are uniform white in nests that are in open areas with little to no vegetation, typically composed of bare gravel, sand, or soil. The eggs are incubated by both adults for 21-28 days. The American White Pelican is threatened by the loss of breeding and foraging sites due to hydrological alterations.

Bald Eagle

Bald Eagle (*Haliaeetus leucocephalus*), a bird listed as Special Concern in Wisconsin and Federally protected by the Bald & Golden Eagle Protection Act, prefers large trees in isolated areas in proximity to large areas of surface water, large complexes of deciduous forest, coniferous forest, wetland, and shrub communities. Large lakes and rivers with nearby tall pine trees are preferred for nesting. In southern Wisconsin, the recommended avoidance period extends from February 15 - July 1. In northern Wisconsin, the recommended avoidance period is from March 15 - August 1. Please see also the National bald eagle management guidelines.

Bird Rookery
A bird rookery is an area where more than one pair of birds nest in a group. The number of nests can vary from just a few to hundreds and can include one to many different species of birds. Sites can include rare and non-rare species. The breeding time will vary based on the species present at the site. Rookeries are typically located in inaccessible locations including forests, shrub communities, wetlands adjacent to water (lakes, rivers or streams), and islands. These sites are important as large numbers of breeding individuals can be found in a single place.

Black Tern
Black Tern (*Chlidonias niger*), a bird listed as Special Concern, prefers large shallow marshes with abundant vegetation adjacent to open water. The recommended avoidance period is from May 15 to July 31.

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 then 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.

Black-billed Cuckoo
Black-billed cuckoo (*Coccyzus erythropthalmus*) is a Special Concern species in Wisconsin. They typically nest in deciduous and mixed deciduous-coniferous woodlands near lakes or streams, and less often in coniferous forests. Their breeding season occurs from mid May to late August.

Blue-winged Teal
Blue-winged teal (*Anas discors*), a Special Concern bird, prefers idle grasslands, wet meadows, and alfalfa fields during breeding season. They typically build their nests in upland habitats with residual cover from the previous year. Their breeding season occurs from mid April to mid July.

Blue-winged Warbler (*Vermivora pinus*) is a Special Concern species in Wisconsin. During breeding season, this species prefers early- to mid-successional habitats with dense vegetation, especially young trees, shrubs, and thickets. Its nesting season occurs from early May to mid June.

Bobolink (*Dolichonyx oryzivorus*) is a Special Concern species in Wisconsin. During breeding season, this species prefers open grasslands with a moderate litter layer and standing residual vegetation, including hay fields, pastures, idle grasslands, old fields, mesic prairies, and sedge meadows. Their breeding season occurs from mid May to mid July.

Eastern Meadowlark (*Sturnella magna*) is a Special Concern species in Wisconsin. This species frequents pastures, idle grasslands, old fields, dry-mesic prairies and oak savannas, reflecting their

preference for moderate density vegetation, a high litter layer, and few shrubs. Their breeding season occurs from early April to early August.

Field Sparrow (*Spizella pusilla*) is a Special Concern species in Wisconsin. This species prefers dry, moderately brushy or early successional upland habitats such as dry prairies and old fields, idle grasslands, pastures, areas that have recently been cut and burned, pine barrens, young plantations, and oak savannas. Their breeding season occurs from late April to late August.

Franklin's Ground Squirrel
Franklin's Ground Squirrel (*Spermophilus franklinii*) is a mammal listed as Special Concern. This semi-colonial species prefers brushy and partly wooded areas, dense grassy, shrubby marshland, as well as prairie edges. Mating occurs from the late April to mid-May and young are born between late May to mid-June.

Golden-winged Warbler
Golden-winged Warbler (*Vermivora chrysoptera*) is a Special Concern species in Wisconsin. Although once thought to be associated with early-successional habitats, this species requires a diverse landscape mosaic of habitat types to fulfill all of its life history needs. This habitat mosaic includes brushy forest openings, shrubby wetlands, or brushy grasslands and adjacent areas of more mature forest. This species builds well-concealed nests on the ground. Nesting occurs from late May to late July.

Gray Wolf
Gray wolf (*Canis lupus*), also referred to as timber wolf, was removed from the federal threatened and endangered species list in January 2011. Gray wolves are social animals, living in a family group, or pack. Pack sizes in Wisconsin average 2-6 individuals, with a few packs as large as 10-12 animals. A territory represents the geographic extent that a particular wolf pack will utilize in search of food and shelter. A wolf pack's territory may cover 20-80 square miles.

Greater Prairie-Chicken
Greater Prairie chicken (*Tympanuchus cupido*), a bird listed as Threatened in Wisconsin, prefers mixed grasslands and managed grasslands including wheatgrass, switchgrass, timothy, bromegrass, hoary alyssum, yarrow, blue vervain, daisy fleabane and goldenrods. The recommended avoidance period is from early March to late September.

Le Conte's Sparrow
Le Conte's Sparrow (*Ammodramus leconteii*), a Special Concern species, is a small, chunky sparrow with an orange-yellow face and chest. Its head is marked by a white crown stripe between two black streaks. Black streaks also mark the sides and flanks. Its nape is pinkish-brown. Le Conte's Sparrow is found in habitats with tall, dense, moist vegetation such as sedge meadows, wet hayfields and prairies. Other breeding habitats include marshy meadows and open bogs. Most individuals have been documented in the northern one-third of the state. The avoidance period is from May 5 to early September. Two to six pale greenish covered eggs with fine brown specks are laid in open cup nests, composed of fine grasses, on or above the ground. The females incubate the eggs for 11 to 13 days. Promoting practices that maintain tall grassland and open wetland habitats will benefit this species.

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. The recommended avoidance period is from 25 Apr - 31 July.

Least Flycatcher
The Least Flycatcher (*Empidonax minimus*) is a State Special Concern species that is found in almost every major type of deciduous and mixed forest, although less commonly in conifers. Although Least Flycatcher historically bred throughout Wisconsin, the breeding range shifted mostly to the northern part of the state as deciduous forest cover was lost in the south. Nesting occurs from mid-May to mid-July.

Midwestern Fen Buckmoth
The Midwestern fen buckmoth (*Hemileuca nevadensis ssp. 3*) is a Special Concern invertebrate. This rare moth is found as an adult in the fall and is thought to lay its eggs on bog birch. The taxonomy of the species is uncertain, and it is currently considered a subspecies of the Nevada Buckmoth (*H. nevadensis*).

Prothonotary Warbler
Prothonotary Warbler (*Protonotaria citrea*) is a bird of Special Concern in Wisconsin. This species breeds in floodplain hardwoods in the southern 2/3 of the state, typically in truncated snags among flooded timber. The recommended avoidance period is from May 8 to September 1.

Red-shouldered Hawk
Red-shouldered Hawk (*Buteo lineatus*)I s a bird listed as Threatened in Wisconsin. This species prefers larger stands of medium-aged to mature lowland deciduous forests, dry-mesic and mesic forest with small wetland pockets. The recommended avoidance period is from March 1 - July 31.

Water Shrew
Water Shrew (*Sorex palustris*) is a state Special Concern mammal. This species is found in marshes, bogs, and cold, small streams with cover along the banks.

Wingless Mountain Grasshopper
The Wingless Mountain grasshopper (*Booneacris glacialis*) is a state Special Concern invertebrate. Most occurrences of this species are within jack pine barrens habitat or pine forest. It is also known from sphagnum bogs, but little collecting has been conducted in these habitats in Wisconsin and little is know about this species.

Yellow-headed Blackbird
The Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) is a Special Concern species in Wisconsin. It is a large songbird where the males have a distinguishable bright yellow head, neck, and breast. The body is black with a partially visible white wing patch while perched. The females have a yellow face and neck, though the body is dull brown. The species is most prevalent in southeastern Wisconsin. During the avoidance period from mid-April to early August, it prefers aquatic environments where cat-tails, reeds, and bulrushes are present, such as deep-water marshes and prairie wetlands. The nests are constructed above water using various grasses, reeds, and cat-tails that are woven together. Up to 5 eggs are laid that are grayish white marked by multiple brown spots. Alteration of wetland habitats for agriculture or urban development threatens the viability of the species.

Rare Plants

American Ginseng
American ginseng (*Panax quinquefolius*), a state Special Concern plant, is found in rich, hardwood forests throughout state. Blooming occurs June through July; fruiting occurs September through October. The optimal identification period for this species is September through October.

Butternut
Butternut (*Juglans cinerea*), a state Special Concern plant, is found in mesic hardwoods and riparian hardwood forests. Blooming occurs April to June; fruiting occurs in October. This species can be identified year-round.

Georgia Bulrush
Georgia Bulrush (*Scirpus georgianus*), a State Special Concern plant, is found in moist acid sandy meadows. Rangewide, it has been found in moist meadows (including sedge meadows), shallow marshes, edges of wet forests, and ditches. Blooming occurs late May through late June; fruiting occurs late June through early August. The optimal identification period for this species is late June early August.

Small Forget-me-not
Small Forget-me-not (*Myosotis laxa*), a State Special Concern plant, is found in cold, clear forested streams. Blooming occurs early July through early August; fruiting occurs late July through late September. The optimal identification period for this species is early July through early September.

Natural Communities

Alder Thicket
These wetlands are dominated by thick growths of tall shrubs, especially speckled alder (*Alnus incana*). Among the common herbaceous species are Canada bluejoint grass (*Calamagrostis canadensis*), orange jewelweed (*Impatiens capensis*), several asters (*Aster lanceolatus, A. puniceus,* and *A. umbellatus*), boneset (*Eupatorium perfoliatum*), rough bedstraw (*Galium asprellum*), marsh fern (*Thelypteris palustris*), arrow-leaved tearthumb (*Polygonum sagittatum*), and sensitive fern (*Onoclea sensibilis*). This type is common and widespread in northern and central Wisconsin, but also occurs in the southern part of the state.

Black Spruce Swamp
An acidic conifer swamp forest characterized by a relatively closed canopy of black spruce (*Picea mariana*) and an open understory in which Labrador-tea (*Ledum groenlandicum*) and sphagnum mosses (*Sphagnum* spp.) are often prominent, along with three-leaved false Solomon's-seal (*Smilacina trifolia*), creeping snowberry (*Gaultheria hispidula*), and three-seeded sedge (*Carex trisperma*). The herbaceous understory is otherwise relatively depauperate. This community is closely related to Open Bogs and Muskegs, and sometimes referred to as Forested Bogs outside of Wisconsin.

Muskeg
Muskegs are cold, acidic, sparsely wooded northern peatlands with composition similar to the Open Bogs (*Sphagnum* spp. *mosses, Carex* spp., and ericaceous shrubs), but with scattered stunted trees of black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Plant diversity is typically low, but the community is important for a number of boreal bird and butterfly species, some of which are quite specialized and not found in other communities.

Northern Mesic Forest
This forest complex covered the largest acreage of any Wisconsin vegetation type prior to European settlement. Sugar maple (*Acer saccharum*) is dominant or co-dominant in most stands, while hemlock (*Tsuga canadensis*) was the second most important species, sometimes occurring in nearly pure stands with white pine (*Pinus strobus*). 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 (especially *Dryopteris intermedia*), blue-

bead lily (*Clintonia borealis*), clubmosses (*Lycopodium* spp.), and Canada mayflower (*Maianthemum canadense*) prevalent, to lush and species-rich with fine spring ephemeral displays. After old-growth stands were cut, trees such as quaking and big-tooth aspens (*Populus tremuloides* and *P. grandidentata*), white birch (*Betula papyrifera*), and red maple (*Acer rubrum*) became and still are important in many second-growth Northern Mesic Forests.

Northern Sedge Meadow
This open wetland community is dominated by sedges and grasses. There are several common subtypes: tussock meadows, dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*); broad-leaved sedge meadows, dominated by robust sedges (*Carex lacustris* and/or *C. utriculata*); and wire-leaved sedge meadows, dominated by such species as woolly sedge (*Carex lasiocarpa*) and few-seeded sedge (*C. oligosperma*). Frequent associates include marsh bluegrass (*Poa palustris*), manna grasses (*Glyceria* spp.), panicled aster (*Aster lanceolatus*), joy-pye-weed (*Eupatorium maculatum*), and bulrushes (*Scirpus atrovirens* and *S. cyperinus*).

Open Bog
These non-forested bogs are acidic, low nutrient, northern Wisconsin peatlands dominated by Sphagnum spp. mosses that occur in deep layers, often with pronounced hummocks and hollows. Also present are a few narrow-leaved sedge species such as (*Carex oligosperma* and *C. pauciflora*), cotton-grasses (*Eriophorum* spp.), and ericaceous shrubs, especially bog laurel (*Kalmia polifolia*), leatherleaf (*Chamaedaphne calyculata*), and small cranberry (*Vaccinium oxycoccos*). Plant diversity is very low but includes characteristic and distinctive specialists. Trees are absent or achieve very low cover values as this community is closely related to and intergrades with Muskeg. When this community occurs in southern Wisconsin, it is often referred to as a Bog Relict.

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 (*Eriophorum* 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 is common and widespread in southern Wisconsin but also occurs in the north.

Tamarack (poor) Swamp
These weakly to moderately minerotrophic conifer swamps are dominated by a broken to closed canopy of tamarack (*Larix laricina*) and a frequently dense understory of speckled alder (*Alnus incana*). The understory is more diverse than in Black Spruce Swamps and may include more nutrient-demanding species such as winterberry holly (*Ilex verticillata*) and black ash (*Fraxinus nigra*). The bryophytes include many genera other than Sphagnum. Stands with spring seepage sometimes have marsh-marigold (*Caltha palustris*) and skunk-cabbage (*Symplocarpus foetidus*) as common understory inhabitants. These seepage stands have been separated out as a distinct type or subtype in some nearby states and provinces.

Appendix E

The Central Wisconsin Wildlife Areas 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 Areas and State Natural Areas of the Central Wisconsin Wildlife Areas Planning Group (CWWA) in the Forest Transition Zone and Central Sand Plains Ecological Landscapes. Only SGCN with a high or moderate probability of occurring in these Ecological Landscapes are shown. Communities shown here are limited to those identified as "Major" or "Important" management opportunities in the Wisconsin Wildlife Action Plan (WDNR 2006b). Numbers indicate the degree to which each species is associated with a particular habitat type (3=significant association, 2=moderate association, and 1=low association). Animal-community combinations shown here that are assigned as either "3" or "2" are also Ecological Priorities, as defined by the Wisconsin Wildlife Action Plan (see dnr.wi.gov/org/land/er/WWAP/ for more information about these data). Shaded species have been documented for the CWWA.

	Major						Important										
	Coolwater streams*	Impoundments/Reservoirs*	Northern Mesic Forest*	Northern Wet Forest (Black Spruce Swamp)	Warmwater rivers*	Warmwater streams*	Alder Thicket	Emergent Marsh*	Ephemeral Pond*	Floodplain Forest*	Northern Dry-mesic Forest*	Northern Hardwood Swamp*	Northern Sedge Meadow	Open Bog*	Shrub-carr	Submergent Marsh*	Surrogate Grasslands*
Species that are Significantly Associated with the Forest Transition Landscape																	
American Bittern							1	3					3	3	1		1
American Golden Plover		2						2					1				2
American Woodcock			2	1			3		1	1	1	2	1	1	3		1
Bald Eagle		3			3					1						2	
Black Redhorse					3												
Black Tern		2						3					2			2	
Black-billed Cuckoo			2	1			3			2	1	1	1		3		
Black-throated Blue Warbler			3								2						
Blue-winged Teal		2			1			3	1	2			2			2	2
Bobolink													3	2			3
Brown Thrasher																	2
Eastern Meadowlark																	3
Eastern Red Bat	3	1	2	2	2	2	2	2	3	2	2	2	2	2	2	2	
Field Sparrow																	2
Four-toed Salamander	2		3	2			3	3	3	3		2	2	3	3		
Golden-winged Warbler			2	2			3				2	2		2	3		
Greater Prairie-Chicken													2		1		3
Least Flycatcher			3							2	2	2			1		

*Natural communities with an asterisk are not represented by an element occurrence in the NHI database in this Ecological Landscape in the CWWA.

	Major						Important										
	Coolwater streams*	Impoundments/Reservoirs*	Northern Mesic Forest*	Northern Wet Forest (Black Spruce Swamp)	Warmwater rivers*	Warmwater streams*	Alder Thicket	Emergent Marsh*	Ephemeral Pond*	Floodplain Forest*	Northern Dry-mesic Forest*	Northern Hardwood Swamp*	Northern Sedge Meadow	Open Bog*	Shrub-carr	Submergent Marsh*	Surrogate Grasslands*
Lesser Scaup		2			2			1								3	
Northern Harrier							1	1					3	2	1		3
Osprey		3			3											1	
Ozark Minnow						3											
Redfin Shiner	1	2			3	2											
Red-headed Woodpecker										2	1						
Red-shouldered Hawk			2						3	3	2	1					
Short-billed Dowitcher		2						3								1	
Trumpeter Swan		2			1			3					1	1		3	
Veery			2	2			3			2	2	3			3		
Vesper Sparrow																	1
Whip-poor-will			1							1	2						
Wood Thrush			2	1						2	1	1					
Wood Turtle	3		3	2	3	3	3		2	3		2	2		3	3	
Species that are Moderately Associated with the Forest Transition Landscape																	
Acadian Flycatcher										2							
Blue-winged Warbler										2					2		
Buff-breasted Sandpiper								2									2
Canada Warbler			2	2			2				2	3			1		
Canvasback		2			3			1								3	
Cerulean Warbler			1							3							
Dickcissel																	3
Dunlin		2			2			2									
Franklin's Ground Squirrel																	2
Grasshopper Sparrow																	3
Gray Wolf			3	3			3			2	3	2	1	2	2		
Henslow's Sparrow													1	2			3
Hoary Bat	3	1	2	2	2	2	2	2	3	2	2	2	2	2	2	2	
Hooded Warbler																	
Hudsonian Godwit		1						3								1	
Le Conte's Sparrow													3	2			3
Louisiana Waterthrush	3																
Mudpuppy	1	3			3												
Northern Flying Squirrel			3	3						2	3	2					
Northern Goshawk			3								2	1					
Northern Long-eared Bat	3	1	2	1	2	2	2	2	3	2	2	2	2	2	2	2	
Northern Prairie Skink											2						
Pickerel Frog	3	3	2	2	3	3	2	3	3	2			3	2	2	3	

	Major						Important										
	Coolwater streams*	Impoundments/Reservoirs*	Northern Mesic Forest*	Northern Wet Forest (Black Spruce Swamp)	Warmwater rivers*	Warmwater streams*	Alder Thicket	Emergent Marsh*	Ephemeral Pond*	Floodplain Forest*	Northern Dry-mesic Forest*	Northern Hardwood Swamp*	Northern Sedge Meadow	Open Bog*	Shrub-carr	Submergent Marsh*	Surrogate Grasslands*
Redside Dace	2					2											
Rusty Blackbird							2	2	2	3				2	2		
Silver-haired Bat	3	1	2	2	2	2	2	2	3	2	2	2	2	2	2	2	
Solitary Sandpiper	2					2	1	3	3	3			1	2	1		
Upland Sandpiper													1				3
Water Shrew	3	1	2	3	1	2	2			2		3	1	1	1		
Western Meadowlark																	3
Woodland Jumping Mouse			3	2			1		2	2	1	2	1	1	1		
Woodland Vole										1							
Yellow Rail													3	3			
Yellow-billed Cuckoo			1							3					2		

*Natural communities with an asterisk are not represented by an element occurrence in the NHI database in this Ecological Landscape in the CWWA.

	Major						Important			
	Alder Thicket*	Northern Sedge Meadow	Northern Wet Forest (Black Spruce Swamp)	Open Bog	Shrub-carr*	Surrogate Grasslands*	Coolwater streams	Emergent Marsh*	Northern Dry-mesic Forest*	Northern Mesic Forest
Species that are Significantly Associated with the Central Sand Plains Landscape										
American Bittern	1	3		3	1	1		3		
American Woodcock	3	1	1	1	3	1			1	2
Bald Eagle										
Black Tern		2						3		
Black-billed Cuckoo	3	1	1		3				1	2
Blanding's Turtle	2	2			2		2	3		
Blue-winged Teal		2				2		3		
Blue-winged Warbler					2					
Bobolink		3		2		3				
Brown Thrasher						2				
Dickcissel						3				
Eastern Meadowlark						3				
Field Sparrow						2				
Four-toed Salamander	3	2	2	3	3		2	3		3
Franklin's Ground Squirrel						2				
Golden-winged Warbler	3		2	2	3				2	2
Grasshopper Sparrow						3				
Gray Wolf	3	1	3	2	2				3	3
Greater Prairie-Chicken		2			1	3				
Henslow's Sparrow		1		2		3				
Least Flycatcher					1				2	3
Lesser Scaup								1		
Mudpuppy							1			
Northern Harrier	1	3		2	1	3		1		
Red-headed Woodpecker									1	
Red-shouldered Hawk									2	2
Short-billed Dowitcher								3		
Short-eared Owl		2		1	2	3		1		
Trumpeter Swan		1		1				3		
Upland Sandpiper		1				3				
Veery	3		2		3				2	2
Vesper Sparrow						1				
Western Meadowlark						3				
Whip-poor-will									2	1
Whooping Crane		2		2				3		
Willow Flycatcher					3	2				
Wood Thrush			1						1	2

	Major						Important			
	Alder Thicket*	Northern Sedge Meadow	Northern Wet Forest (Black Spruce Swamp)	Open Bog	Shrub-carr*	Surrogate Grasslands*	Coolwater streams	Emergent Marsh*	Northern Dry-mesic Forest*	Northern Mesic Forest
Wood Turtle	3	2	2		3		3			3
Yellow-billed Cuckoo					2					1
Species that are Moderately Associated with the Central Sand Plains Landscape										
American Golden Plover		1				2		2		
Canada Warbler	2		2		1				2	2
Canvasback								1		
Cerulean Warbler										1
Connecticut Warbler			2	2					1	
Dunlin								2		
Eastern Massasauga Rattlesnake	3			3	3			3		
Eastern Red Bat	2	2	2	2	2		3	2	2	2
Hoary Bat	2	2	2	2	2		3	2	2	2
Hudsonian Godwit								3		
King Rail		1						3		
Le Conte's Sparrow		3		2		3				
Louisiana Waterthrush							3			
Northern Goshawk									2	3
Northern Long-eared Bat	2	2	1	2	2		3	2	2	2
Pickerel Frog	2	3	2	2	2		3	3		2
Prairie Vole						2				
Red Crossbill			1						3	1
Red-necked Grebe								3		
Rusty Blackbird	2			2	2			2		
Sharp-tailed Grouse		2		1	1	2				
Silver-haired Bat	2	2	2	2	2		3	2	2	2
Solitary Sandpiper	1	1		2	1		2	3		
Water Shrew	2	1	3	1	1		3			2
White-tailed Jackrabbit						2				
Wilson's Phalarope		3						3		
Yellow Rail		3		3						

*Natural communities with an asterisk are not represented by an element occurrence in the NHI database in this Ecological Landscape in the CWWA.

Appendix F

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/topic/NHI/WList.html).

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).