



Rapid Ecological Assessment for Central Sand Plains Planning Group

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

Properties included in this report are:

Adams County	Portage County
Big Roche a Cri Fishery Area	Buena Vista Wildlife Area
Colburn Wildlife Area	Paul J. Olson Wildlife Area
Leola Marsh Wildlife Area	Scattered Wildlife Habitat Areas
Scattered Wildlife Habitat Areas	
Waushara County	Wood County
Big Roche a Cri Fishery Area	Paul J. Olson Wildlife Area
	Tenmile Creek Streambank Protection Area
	Scattered Wildlife Habitat Areas

Wisconsin's Natural Heritage Inventory Program
 Bureau of Natural Heritage Conservation
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Central Sand Plains Planning Group At a Glance

Exceptional Characteristics of the Study Area

- **Grasslands.** Over 16,000 acres of grassland habitat occurs on CSPPG properties. The Buena Vista/Leola/Paul Olson WA complex is ranked a high priority landscape for grassland bird conservation in the state, and features 15 SGCN.
- **Oak Barrens.** Several rare bird and butterfly barrens associates have been detected on CSPPG properties, revealing important opportunities for barrens restoration that could further benefit these and numerous other rare and declining barrens species.
- **Streams and Wetlands.** Streams and wetlands are present on every property in the CSPPG, providing important habitat for a number of rare aquatic invertebrates and a rare turtle, as well as vital ecosystem services. Threats to aquatic habitats are numerous in the region, and require a unified stakeholder approach to address them.

Site Specific Opportunities for Biodiversity Conservation

Four ecologically important sites, or “Primary Sites,” were identified at the Central Sand Plains Planning Group. “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.

- **Buena Vista – Leola Grasslands.** This vast expanse of grassland (over 19,000 acres) was originally created as a refuge for the state-threatened greater prairie-chicken. Despite the fact that the grassland is mostly dominated by non-native cool-season grasses, it holds statewide significance for supporting rare and declining grassland birds as well as several rare butterflies. Two State Natural Areas lie within this primary site:
 - **Buena Vista Quarry Prairie State Natural Area.** This is one of the least-disturbed tracts within the Wildlife Area, and harbors remnant dry and dry-mesic prairie associated with a sandstone outcrop, while the flat lands surrounding it support former agricultural lands that have been recolonized by prairie species over time.
 - **Buena Vista Prairie Chicken Meadow State Natural Area.** This site harbors 80 acres of pesticide-free grassland, and holds historical importance for ground-breaking wildlife research conducted in the 1960’s by Fran and Frederick Hamerstrom.
- **Tenmile Creek Wetland-to-Forest Corridor.** This small site is unique in the area for supporting good-quality Central Sands Pine-Oak Forest and Alder Thicket, all in a habitat block that straddles Tenmile Creek and captures all aspects and habitat types. This integrated stream-to-wetland-to-upland complex meets the diverse habitat needs of wildlife species such as turtles.
- **Colburn Meadows and Savannas.** This site consists of extensive tracts of over 1,000 acres of sedge meadow and shrub-carr. Oak Barrens can be found on islands and linear terraces scattered throughout the core wetland complex, while Oak Opening/Woodland lies in the western part of the site. Carter Creek, a hard, cold-water stream, passes through the middle of the property from east to west. Similar to the primary site at Tenmile Creek, the provision of aquatic, wetland and sandy upland habitats in a large complex serves life history needs for numerous forms of wildlife, especially herptiles.
- **Fogarty Marsh.** Fogarty Marsh is a 500+-acre wetland complex comprised of Open Bog, Muskeg, Tamarack (poor) Swamp, and Northern Sedge Meadow that provides habitat for peatland birds and small mammals.

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 Sand Plains Planning Group (CSPPG; Map A). The regional ecological context for the CSPPG is provided to assist in developing the Regional and Property Analysis that is part of the master plan. Properties included in this assessment are as follows:

- Big Roche a Cri Fishery Area (FA)
- Buena Vista Wildlife Area (WA)
- Buena Vista Prairie Chicken Meadow State Natural Area (SNA)
- Buena Vista Quarry Prairie SNA
- Colburn WA
- Leola Marsh WA
- Paul J. Olson WA
- Scattered Wildlife Habitat Areas
- Tenmile Creek Streambank Protection Area (SBPA)

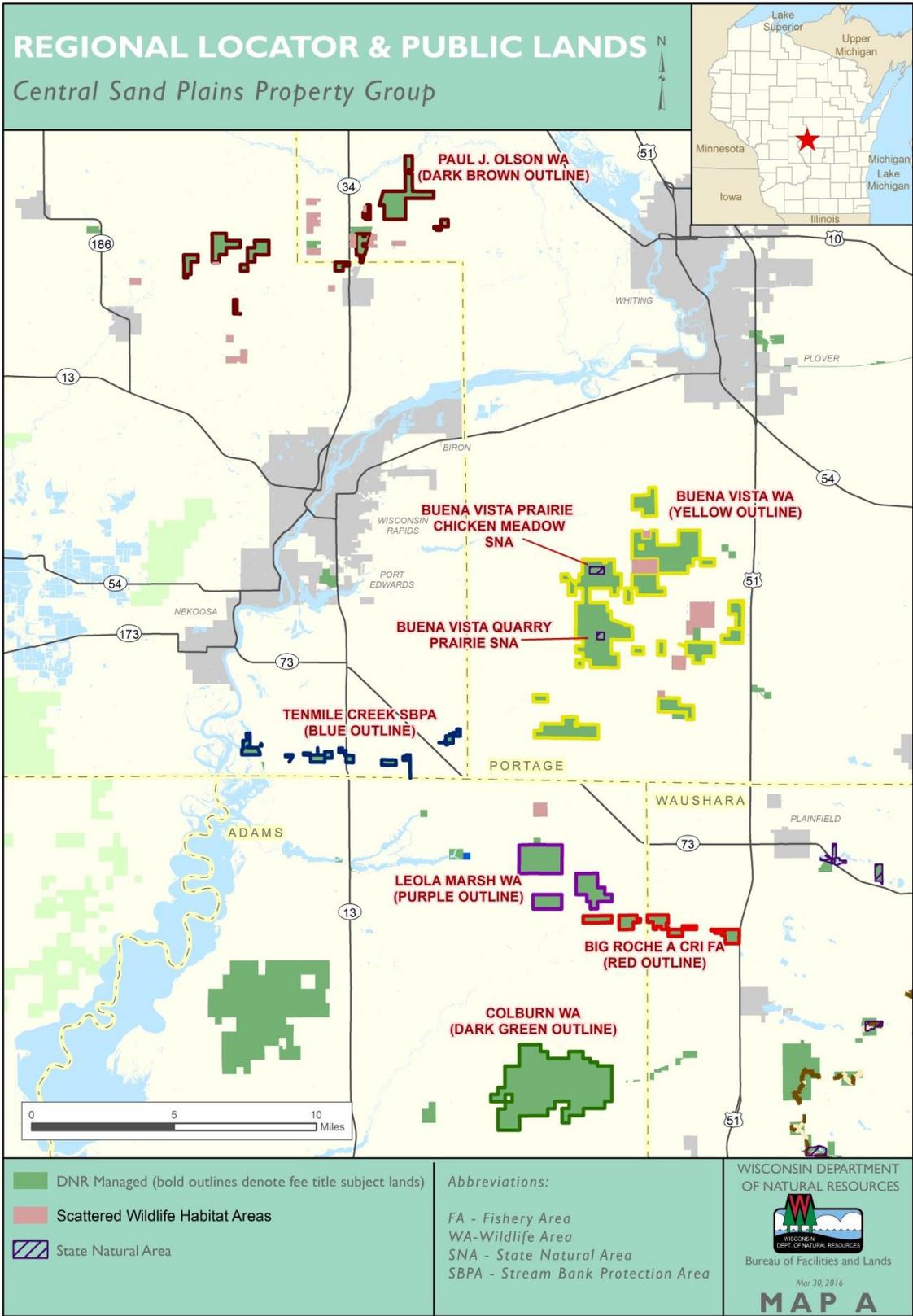
The primary objectives of this project were to collect biological inventory information relevant to the development of a master plan for the CSPPG and to analyze, synthesize and interpret this information for use by the master planning team. This effort focused on assessing areas of documented or potential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

Survey efforts for the CSPPG 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. Inventory data collected through this effort is a starting point for adaptive management of the CSPPG and should be revisited as opportunity allows and updated when new information becomes available.

Overview of Methods

The Wisconsin Natural Heritage Inventory (NHI) program is part of the Wisconsin DNR’s Bureau of Natural Heritage Conservation 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 (WDNR 2014b) 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.



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

Existing NHI data are often the starting point for conducting a biotic inventory to support master planning. Prior to this project, NHI data for the CSPPG were limited to the Statewide Natural Area Inventory, a county-by-county effort conducted by WDNR’s Bureau of Research and Endangered Resources between 1969 and 1984 that focused on natural communities but include some surveys for rare plants and animals and taxa-specific surveys.

The most recent taxa-specific NHI field surveys for the study area were conducted during 2015. 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 CSPPG, key inventory considerations included the identification of Oak Barrens, upland forest, prairie remnants, high-quality wetlands, and the location of habitats that had the potential to support rare species. With the exception of partner-owned lands at Buena Vista Grasslands, private lands, including easements, surrounding the CSPPG were not surveyed.

The 2015 NHI surveys were limited in scope and focused on documenting high quality natural communities, rare plants, breeding birds (terrestrial, marsh, forest raptors), aquatic and terrestrial invertebrates, small mammals, and herptiles. Survey work has also been done at the CSPPG for different purposes by other groups, including WDNR Wildlife Management, WDNR Science Services, University of Wisconsin (Madison, Stevens Point), U.S. Geological Survey, U.S. Fish and Wildlife Service, and Scott and Ann Swengel. The collective results from all of these surveys were used, along with other information, to identify ecologically important areas (Primary Sites) of the CSPPG. A summary of all surveys that informed this report are listed in Table 1. Recent Biotic surveys at Central Sand Plains Planning Group.

Table 1. Recent Biotic surveys at Central Sand Plains Planning Group

Description	Year(s)	Surveying Group
“Biodiversity in Selected Natural Communities Related to Global Climate Change” (aka “Peatlands Project”). Surveys of breeding passerine birds, amphibians, small mammals, terrestrial and aquatic invertebrates, secretive marsh birds, rare plants, and plant communities.	2004-2008	WDNR Bureau of Endangered Resources
Greater prairie-chicken breeding surveys.	2007-2015	Wisconsin DNR-Wildlife Management
“Evaluation of the Wisconsin Grassland Bird Conservation Area Model.” Over 1,400 roadside and in-field grassland bird surveys conducted.	2011-2013 - land cover mapping 2012-2014 - bird surveys	Wisconsin DNR University of Wisconsin-Madison

Description	Year(s)	Surveying Group
	2014-present - analysis and reporting	U.S. Geological Survey U.S. Fish and Wildlife Service
Breeding bird surveys (marsh birds, grassland birds, forest birds, forest raptors, nightjars)	2015	WDNR NHI staff
Central Wisconsin Kestrel Research	1968-1998; 2004-present	Central Wisconsin Kestrel Research Group
Winter raptor road surveys	1998-present	Alyssa DeRubeis, Dr. Scott Hull
Lepidopteran surveys	2003-present	Scott and Ann Swengel
Small mammal surveys	2015	UW-Stevens Point
Natural community surveys	2015	WDNR NHI staff
Plant surveys	2010	Golden Sands RC&D
Rare plant surveys	2015	WDNR NHI staff

Scientific names for all species mentioned in the text are included in a list on page **Error! Bookmark not defined.**

Background on Past Efforts

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

Important Bird Area

Paul J. Olson and Buena Vista-Leola WAs were identified as Important Bird Areas (IBA; WDNR 2007). Important Bird Areas are critical for the conservation and management of Wisconsin's birds. Birds that find habitat here include sedge wren (*Cistothorus platensis*), clay-colored sparrow (*Spizella pallida*), savannah sparrow (*Passerculus sandwichensis*), and many rare and declining species. The site also hosts small numbers of bitterns, herons, and rails. The "Buena Vista/Leola State Wildlife Areas" IBA represents one of the best opportunities in the state for large-scale grassland management, and support many of Wisconsin's priority grassland species.

Grassland Bird Priority Landscape

Buena Vista/Leola Grasslands were ranked as the second-highest priority grassland bird landscape in the "Central Plains" division (Sample and Mossman 1997). This long-standing model for large-scale grassland management is successful due to strong public-private partnerships. The greatest potential for habitat protection and enhancement lies in State Wildlife Areas and private lands with pasture, upland shrub, dry old field, idle cool-season grass/forb cover types.

Wisconsin Wildlife Action Plan: Conservation Opportunity Area

Conservation Opportunity Areas (COA) are places in Wisconsin containing 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. The Wisconsin Wildlife Action Plan (WAP; WDNR 2006b) identifies one Conservation Opportunity Area (COA) within which three CSPPG properties occur (see Appendix B for a map):

- **Buena Vista WA, Leola Marsh WA and Big Roche a Cri FA** lie within the Central Wisconsin Grassland COA, which holds statewide significance for extensive grassland communities

(especially surrogate), and for supporting rare and declining birds and butterflies. Parts of **Paul J. Olson WA** are also being considered for inclusion in this COA.

Legacy Places

The Land Legacy Report (WDNR 2006a) was designed to identify Wisconsin's most important conservation and recreation needs for the next 50 years. **Buena Vista WA** falls within the Central Wisconsin Grassland Land Legacy Site. This area consists of a mosaic of publicly and privately owned grasslands embedded in a primarily open agricultural landscape, and provides the best location in Wisconsin for large-scale grassland bird management. **Colburn WA** lies within the Colburn-Richfield Wetlands Land Legacy Site, a very large and diverse wetland complex that contains large areas of sedge meadow with oak savanna on associated dry ridges.

Wisconsin Greater Prairie-chicken Management Plan

For more than 75 years, Wisconsin has been involved in a significant effort to maintain its isolated population of greater prairie-chickens, a threatened species in the state. This management plan (Warmke 2015) builds upon the successes of past greater prairie-chicken management efforts and utilizes recent research studies to present a comprehensive strategy to conserve and maintain this species, including setting specific goals for acquisition and management, addressing genetic depression issues, and working with partners to maintain a viable landscape matrix.

Special Management Designations

Grassland Conservation Areas

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 WA, Buena Vista Marsh WA, Paul J. Olson WA, McMillan WA** and **George W. Mead WA**. Due to the size, quality and distribution of the existing public and private grasslands, this area is particularly attractive to grassland birds. Within this area, the WDNR proposes to protect, primarily through acquisition and easements, up to 15,000 acres of additional grassland habitat (mostly at **Leola Marsh, Buena Vista, and Paul J. Olson WAs**).

State Natural Areas

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. Two SNAs occur on the CSPPG:

- **Buena Vista Quarry Prairie SNA** is a 40-acre State Natural Area within **Buena Vista Wildlife Area**.
- **Buena Vista Prairie Chicken Meadow SNA** is an 80-acre State Natural Area within **Buena Vista Wildlife Area**.

Regional Ecological Context

Forest Transition and Central Sand Plains Ecological Landscapes

This section is largely reproduced from three sources: The Ecological Landscapes of Wisconsin Handbook and related chapters on the Forest Transition and Central Sand Plains Ecological Landscapes (WDNR 2012, 2014a, 2015a).

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. Most of the CSPPG properties lie within the Central Sand Plains Ecological Landscape. Approximately 80% of Paul J. Olson WA lies within the Forest Transition Ecological Landscape, with the remainder in the Central Sand Plains Ecological Landscape. The Scattered Wildlife Habitat Areas are divided about evenly between these two landscapes. See Figure 1 for the study area in relation to Ecological Landscapes.



Figure 1. Ecological Landscapes of Wisconsin and the study area.

(WDNR properties enlarged to allow visualization of their relative locations at a regional level).

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 eastern hemlock (*Tsuga canadensis*) 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 (*Populus* spp.), pines (*Pinus* spp.), maple-basswood forest (*Acer* spp - *Tilia americana*), and lowland hardwoods.

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 historic vegetation of the **Forest Transition Ecological Landscape** was primarily northern hardwood and hemlock – 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, 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.

Overview of Regional Natural Resources

Opportunities for sustaining natural communities in Ecological Landscapes were developed in 2005 by the Ecosystem Management Planning Team (EMPT; not published until 2007) and later focused on wildlife Species of Greatest Conservation Need and their habitat in the Wisconsin Wildlife Action Plan (WDNR 2006b, 2015b). 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 each Ecological Landscape.

There are "major" and "important" management opportunities for 50 natural communities in the **Central Sand Plains Ecological Landscape**, 10 of which occur within the CSPPG properties that lie within that landscape (see Appendix E). Similarly, there are major and important management opportunities for 46 natural communities in the **Forest Transition Ecological Landscape**, eight of which occur within the related CSPPG properties. For a description of these communities, see the Wildlife Action Plan Implementation section on page 47.

There are also 69 SGCN (animals) and 20 rare or declining plants significantly associated with the 10 natural community types in the **Central Sand Plains Ecological Landscape** described in the previous paragraph, and 42 SGCN and 7 rare or declining plants associated with the eight natural community types in the **Forest Transition Ecological Landscape** described above (see Appendix E). This means that these species are (and/or historically were) significantly associated with this Ecological Landscape, and that restoration of natural communities with which these species are associated would significantly improve their conditions.

For more details on regional natural community management opportunities and rare or declining species as they pertain to the CSPPG, see Appendix E.

Description of the Study Area

Location and Size

The Central Sand Plains Planning Group is located in Wood, Portage, Adams and Waushara Counties, and is made up of scattered properties totaling 22,440 acres. All acreages are based on fee simple ownership from DNR Facilities and Lands GIS records as of March 2015; acreage may not include easements, leases and some permanent water bodies.

Ecoregion

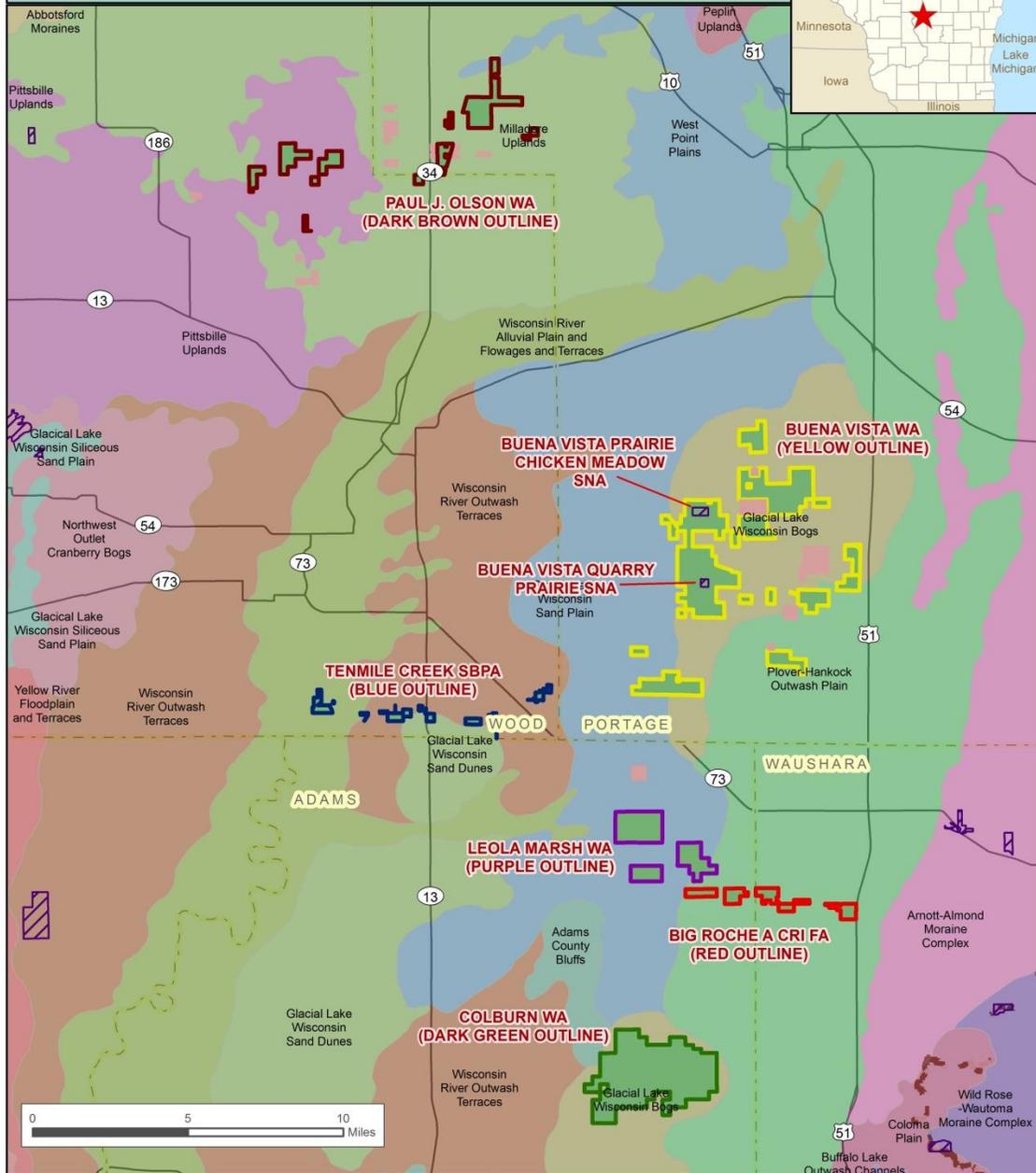
Land Type Associations (LTAs) of Wisconsin represent a further definition of the National Hierarchical Framework of Ecological Units (NHFEU). The NHFEU is a classification system that divides landscapes into ecologically significant regions at multiple scales. Ecological types are classified and units are mapped based on the associations of biotic and environmental factors which include climate, physiography, water, soils, air, hydrology, and potential natural communities. Map B shows the distribution of the CSPPG properties across eight LTAs.

Key to Map B

- **Wisconsin River Alluvial Plain and Flowages and Terraces (222Ra01).** The characteristic landform pattern is nearly level. Soils are moderately well drained to excessively drained sandy soils. Carbonate bedrock lies 5-50 feet from the surface. This LTA comprises 80% of Tenmile Creek Streambank Protection Area.
- **Glacial Lake Wisconsin Sand Dunes (222Ra06).** This LTA comprises 5% of Tenmile Creek Streambank Protection Area. The characteristic landform is gently rolling lake plain with dunes. Soils are excessively drained and moderately well-drained sands. Sandstone bedrock lies more than 100 feet from the surface.
- **Wisconsin River Outwash Terraces (222Ra07).** This LTA comprises 80% of Tenmile Creek Streambank Protection Area. The characteristic landform pattern is level lake plain. Soils are excessively drained and moderately well-drained sands. Sandstone bedrock lies more than 100 feet from the surface.
- **Milladore Uplands (222Qd03).** The characteristic landform pattern is undulating erosional surface. Soils are predominantly somewhat poorly drained sandy loam. The bedrock type is igneous/metamorphic. This LTA comprises 50% of Paul J. Olson WA. Ten of the Scattered Wildlife Habitat Areas also fall within this LTA.
- **Pittsville Uplands (222Rb03).** The characteristic landscape pattern is undulating erosional moraine; bedrock-controlled hills and ridges occur in places. Soils are predominantly moderately well drained loamy sands over sandstone-shale bedrock. This LTA comprises 50% of Paul J. Olson WA. One Scattered Wildlife Habitat Area also falls within this LTA.
- **Glacial Lake Wisconsin Sand Plain (222Ra03).** This LTA comprises 95% of Leola Marsh WA and 10% of Buena Vista Wildlife Area. The characteristic landform pattern is level lake plain. Soils are excessively drained to moderately well-drained sands. Sandstone bedrock lies 50-100 feet from the surface.
- **Plover-Hancock Outwash Plain (222Ra08).** The characteristic landform pattern is nearly level outwash plain. Soils are well-drained sandy and loamy soils. Sandstone bedrock lies between 50-100 feet from the surface. This LTA comprises 90% of Buena Vista Wildlife Area, 5% of Leola Marsh WA, and 100% of Big Roche a Cri FA.
- **Glacial Lake Wisconsin Bogs (222Ra05).** The characteristic landform pattern is nearly level lake plain. Soils are very poorly drained mucky soils along with poorly drained sandy soils. Carbonate bedrock lies more than 100 feet from the surface. This LTA comprises 80% of Buena Vista WA and 100% of Colburn WA. Three Scattered Wildlife Habitat Areas also fall within this LTA.

LAND TYPE ASSOCIATIONS

Central Sand Plains Property Group



- DNR Managed (bold outlines denote fee title subject lands)
- Scattered_Wildlife_Areas
- State Natural Area

Abbreviations:
 FA - Fishery Area
 WA - Wildlife Area
 SNA - State Natural Area
 SBPA - Stream Bank Protection Area

WISCONSIN DEPARTMENT OF NATURAL RESOURCES



Bureau of Facilities and Lands
 Mar 30, 2016
MAP B

Physical Environment

Geology and Glaciation

This section is largely reproduced from the Ecological Landscapes of Wisconsin (WDNR 2012, 2014a, 2015a)

The majority of the property group is underlain by Late Cambrian sandstone that contains strata of dolomite and shale. Precambrian igneous (granite) and metamorphic (gneiss) rocks lie beneath the sandstone. An extensive, nearly level expanse of lacustrine and outwash sand that originated from a huge glacial lake characterizes much of the area. Sand was deposited in Glacial Lake Wisconsin by outwash derived from melting glaciers to the north.

Metamorphic and igneous bedrock underlies most of the Paul J. Olson WA property (and proximate SWHAs). The northwestern part of Portage County and northeastern part of Wood County were unaffected by the Wisconsin glacier (USDA 1971, Martin 1974); Paul J. Olson WA and Scattered Wildlife Habitat Areas are found here.

Soils

Main reference: Natural Resources Conservation Service Soil Survey (USDA 1971)

For all properties except Paul J. Olson WA and associated Scattered Wildlife Habitat Areas, most soils formed from deep sand deposits of glacial lacustrine or outwash origin. Sands and loamy sands are associated with glacial lake plains, outwash plains, and stream terraces. In drainageways, depressions, and glacial lake basins, deep organic deposits built poorly-drained muck soils.

Approximately 75% of the soils at both **Buena Vista and Leola Wildlife Areas** are muck, with loamy sands capturing the remaining area. These two areas have numerous scattered frost pockets.

The two dominant soil series at **Colburn WA** are Adrian and Newton. The Adrian Series contains moderately deep organic soils of old lake basins. These soils have 18-40 inches of muck over sand or loamy sand. These poorly-drained soils correlate with the core sedge meadow-shrub-carr complex in the eastern, central and northwestern parts of the property. The remaining area has deep, poorly drained loamy sands that typify the Newton Series.

At **Big Roche a Cri FA**, the majority of the soils are loamy sand and sand, although in those parcels that fall in Waushara County, muck soils are associated with the creek, while higher terraces and gentle slopes harbor silt loams.

At **Tennile Creek Streambank Protection Area**, sand is by far the dominant soil type. In depressions and low areas in the floodplains of the creek, soil-forming processes have been inhibited by flooding; these soils are simply termed "Alluvial, wet," and comprise 25% of the property. An area of organic muck soils occurs where Tennile Creek joins the Wisconsin River.

At **Paul J. Olson WA**, most of the parcels in Wood County are dominated by silt loams; like the other properties in this group, these lie within the Central Sand Plains Ecological Landscape. The parcels to the east in Portage County (and one in Wood County) lie within the Forest Transition Ecological Landscape, and are also dominated by silt loams and loams, but also have significant amounts of muck and mucky peat associated with Fogarty Marsh in the large northeastern parcel.

Hydrology

The hydrology of the Central Sand Plains Ecological Landscape is characterized by large areas of wetlands and a number of generally low-gradient streams that range from small coldwater streams to large warmwater rivers. The Ecological Landscape has the fourth largest number of wetland acres (547,000) and the second largest percentage (25.8%) of wetlands of all ecological landscapes in the state (WDNR 2014a). Water bodies are associated with each of the CSPPG properties (Table 2. Major water bodies of the Central Sand Plains Planning Group), belying the importance of aquatic and wetland habitats in the early designation of these sites as fishery and wildlife areas. Glacial outwash, stratified sands, and fine-grained sediments that comprise the former bed of Glacial Lake Wisconsin, along with wind-blown sand deposits, create the foundation for the Central Sands aquifer, an unconfined aquifer that is directly connected to local surface water bodies. Recharge of this aquifer is vital for this water-challenged region, and is influenced by groundwater withdrawals, evapotranspiration rates of vegetation, rainfall amounts and infiltration, and air temperature, among other things. The hydrology of this Central Sands region has been greatly disrupted by past wetland drainage, stream channelization, and groundwater withdrawal; see “Aquatic Resources of the CSPPG” on page 36 for further details.

Table 2. Major water bodies of the Central Sand Plains Planning Group

Waterbody Name	Associated Properties	Comments
Bear Creek	Paul Olson WA	
Big Roche a Cri Creek	Big Roche a Cri FA	Class I Trout Stream
Buena Vista Creek (Ditch No. 2)	Buena Vista WA	Class II Trout Stream
Carter Creek (Mile 3-17)	Colburn WA	Class III Trout Stream
Fourmile Creek (Ditch No. 4)	Buena Vista WA, Scattered WHA (Portage Co.)	Class I Trout Stream
Fourteenmile Creek	Scattered WHA (Adams Co.)	
Hayden Creek	Paul Olson WA, Scattered WHA (Portage Co.)	
Leola Ditch	Leola Marsh WA	Warm water game fishery. A portion of the stream (river mile 3.5 - 9.0) used to be Class II trout waters; dredging and siltation may have eliminated trout spawning habitat.
Mill Creek	Paul Olson WA	
Moccasin Creek	Scattered WHA (Wood Co.)	
Mosquito Creek	Scattered WHA (Portage Co.)	
North Branch Tenmile Creek	Buena Vista WA, Scattered WHA (Portage Co.)	
South Branch Tenmile Creek	Buena Vista WA	Class I Trout Stream
Tenmile Creek - Mile 12-20	Tenmile Creek SBPA	
Tenmile Creek - Mile 1-5 (Ditch No. 10)	Buena Vista WA, Scattered WHA (Portage Co.)	
Unnamed Creek	Paul Olson WA	
Unnamed Creek	Paul Olson WA	

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 2015a).

The early vegetation of Wisconsin was mapped based on notes and maps from the original Public Land Surveys (Finley 1976), which were conducted for the area comprising CSPPG in 1833-1834. It's important to note that Public Land Surveys served to clearly establish a standardized grid for land ownership, not to describe early vegetation and natural communities. This data is most informative by looking for patterns at a landscape scale; property-specific details may or may not be entirely accurate.

Historic vegetation at **Buena Vista Marsh** (including the Wildlife Area and proximal **Scattered Wildlife Habitat Areas**) consisted of a core sedge meadow area surrounded by conifer swamp [tamarack (*Larix laricina*), black spruce (*Picea mariana*)]. Scattered sandy islands supported white pine stands here as well. At **Leola Marsh** (including the Wildlife Area and the **Scattered Wildlife Area** just to north), conifer swamp was the dominant cover type historically.

By 1900, most timber in the vicinity of **Buena Vista** and **Leola Marshes** had been logged. During the early 1900's, large scale drainage projects were initiated on both properties with the intention of converting the land to cropland. There are approximately 110 miles of drainage ditches at **Buena Vista Marsh** and 40 miles at **Leola Marsh**. Early farming attempts were generally unproductive. The production of Kentucky bluegrass (*Poa pratensis*) for seed harvest became the next dominant land use with many thousands of acres being cultivated. As the seed production industry fell to competition from foreign markets, a new land use materialized: cattle ranches. Beef ranching dominated the two marsh areas until the mid-1960's, when muck farming and, later, irrigated cash crops became more prevalent.

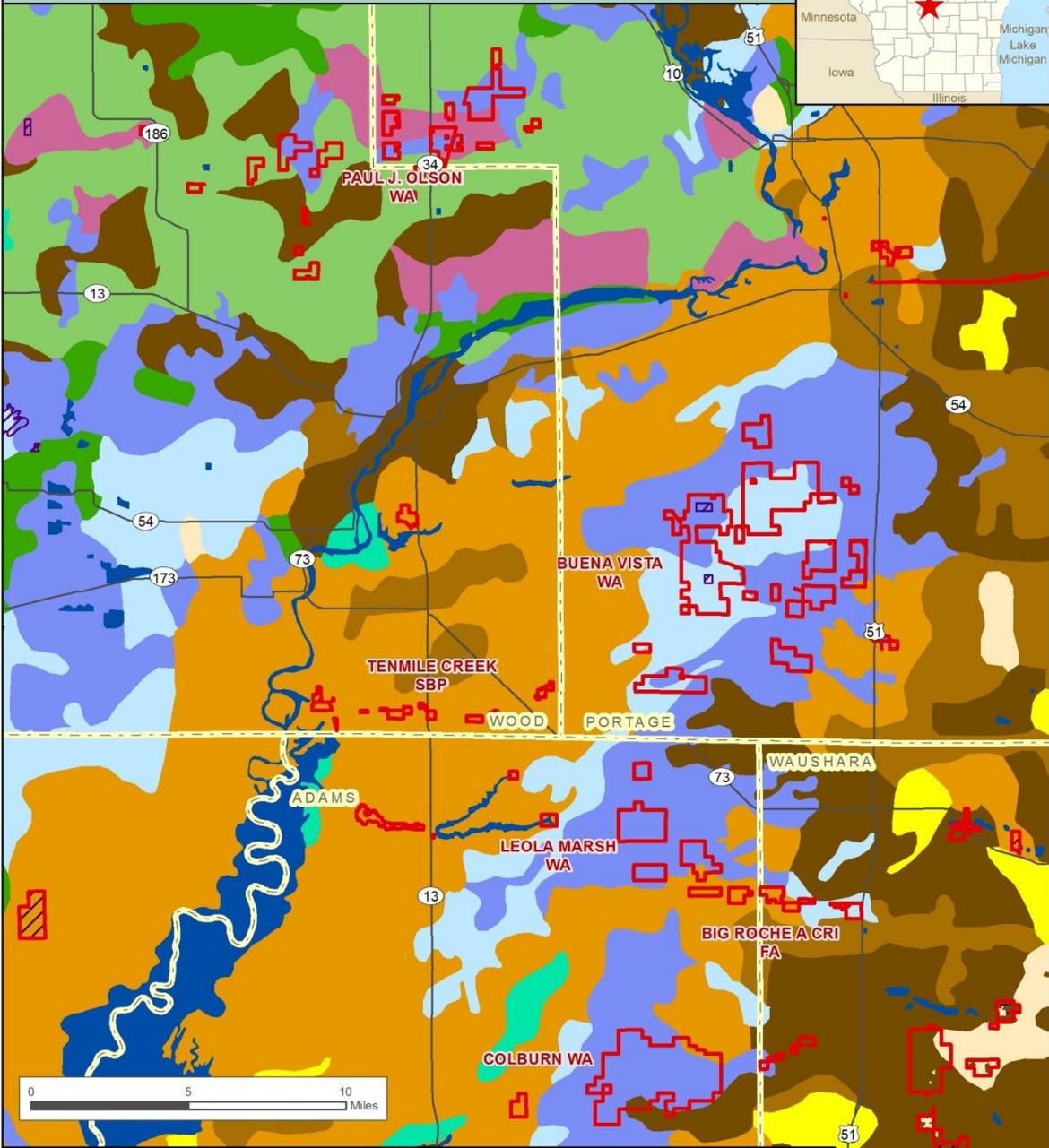
Originally covered by a mix of northern mesic forest and swamp conifers, the area including **Paul J. Olson WA** and proximal **Scattered Wildlife Habitat Areas** was logged off in the late 1800's and was converted to farmland. Farming initiatives were more successful here than at Buena Vista and Leola Marshes, especially dairy farming. A significant amount of land, however, was often too wet to farm; these wetlands were typically kept in grasses or sedges.

At **Colburn WA**, conifer swamp was the dominant cover type before settlement. Sandy uplands along the northeast, northwest and south boundaries and on scattered interior 'islands' harbored pine-oak barrens. When the land was settled in the late 1800's, much of the timber was logged or pulped, and drainage ditches were excavated. The resulting open marshes and meadows were used for grazing until the mid 1930's. A 2.5-mile-long access trail was constructed through the middle of the property to provide access for fire protection, further compromising the original site hydrology. A severe wildfire burned the area in 1948; the majority of the timber now growing on the wildlife area dates from this fire.

Historical vegetation at all parcels within the **Tennile Creek SBPA** and most of **Big Roche a Cri FA** was comprised of jack pine (*Pinus banksiana*) and northern pin oak (*Quercus ellipsoidalis*) barrens. A small area of open wetland also occurred at the easternmost parcel at **Big Roche a Cri FA**.

VEGETATION PRIOR TO EURO-AMERICAN SETTLEMENT (FINLEY 1976)

Central Sand Plains Property Group



- | | |
|---|---|
| DNR Fee Title Subject Lands | Prairie |
| White pine red pine | Brush |
| Sugar maple, yellow birch, white pine, red pine; some hemlock | Water |
| Sugar maple, basswood, red oak, white oak, black oak | Swamp conifers |
| Oak forest/barrens (Jack pine, Hill's oak) | Lowland hardwoods |
| Oak - white/black/burr oak | Marsh, sedge meadow, wet prairie, lowland shrub |
| Oak opening | |

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Feb 02, 2016

MAP C

Current Vegetation

The CSPPG represents a mosaic of grasslands (mostly non-native), non-forested wetlands, forested wetlands, upland forest, and oak barrens (Map D; WDNR 1993). Many of the factors that impacted vegetation historically continue to impact the study area today, and include but are not limited to geology, soils, hydrology, and climate. These factors are superseded in many areas, however, by more recent human influences on the land, particularly conversion of land to agriculture, draining of wetlands, grazing, logging, fire suppression, and the introduction and spread of non-native invasive species.

Grasslands

With one minor exception, grasslands of the CSPPG are “Surrogate Grasslands,” *i.e.*, they have the same basic structure as the original prairies that once covered parts of the state, but have been cleared, drained, plowed and/or heavily grazed and replanted with crops, non-native cool-season grasses, and native prairie plants. While they lack the elements of a remnant prairie ecosystem (intact soil structure, diverse soil microorganisms, diverse associated plants and animals, unimpaired nutrient cycling), they still provide important habitat for grassland species that key into structure rather than composition and processes, most notably the greater prairie-chicken.

Significant tracts of grassland are found at the following CSPPG properties:

- **Big Roche a Cri FA**
- **Buena Vista WA** and proximal **Scattered Wildlife Habitat Areas**
- **Buena Vista Prairie Chicken Meadow SNA**
- **Buena Vista Quarry Prairie SNA**
- **Leola Marsh WA**
- **Paul J. Olson WA** and proximal **Scattered Wildlife Habitat Areas**

Buena Vista and **Leola Marsh WAs** harbor over 14,000 acres of grassland habitat, with non-native cool-season grasses dominating the landscape, and moist depressions harboring slightly different species than the slightly higher ‘rises.’ Depressions support mostly disturbance-associated wetland species such as Kentucky bluegrass, reed canary grass (*Phalaris arundinacea*), Canada goldenrod (*Solidago canadensis*),



Figure 2. Typical surrogate grassland in wetland depression at **Leola Marsh WA** with reed canary grass, lake sedge, meadow willow, and Canada goldenrod. Photo by Andy Clark.

white meadowsweet (*Spiraea alba*), meadow willow (*Salix petiolaris*), and lake sedge (*Carex lacustris*), while shallow rises are dominated by smooth brome (*Bromus inermis*), quackgrass (*Elymus repens*), Canada bluegrass (*Poa compressa*), Kentucky bluegrass, reed canary grass, timothy (*Phleum pratense*), and spotted knapweed (*Centaurea stoebe*), along with sparse native prairie species such as little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*) and wormwood (*Artemisia campestris*). **Buena Vista Prairie Chicken Meadow SNA** is also somewhat unique on the wildlife area in that it has never been chemically treated with pesticides or herbicides, and a diverse mix of native prairie plants have

been reintroduced here. At **Buena Vista Quarry Prairie SNA**, an outcrop harbors approximately two acres of remnant Dry/Dry-mesic Prairie, the only location on the property group with remnant prairie.

Approximately 60 acres at **Big Roche a Cri FA** harbor open grasslands on sandy soils with a mix of native and non-native species. According to WDNR forest reconnaissance, approximately 70% of **Paul J. Olson WA** is in upland grass (mostly non-native cool-season grasses).

Non-forested Wetlands

In this property group, sedge meadows occur in outwash plain depressions and along the margins of streams, and are dominated by broad-leaved sedges (and sometimes blue-joint grass [*Calamagrostis canadensis*]) along with spotted Joe-Pye-weed (*Eutrochium maculatum*), sensitive fern (*Onoclea sensibilis*), swamp thistle (*Cirsium muticum*), and blue vervain (*Verbena hastata*). Their quality and extent is largely influenced by ditching and tiling, as well as by past land uses (e.g., cropping and grazing). Run-off from adjacent croplands, residential areas, and eroding streambanks can have negative impacts on sedge meadows, especially by fostering invasion and proliferation of non-native invasives such as reed canary grass and common reed (*Phragmites australis*). In undisturbed settings, Shrub-carr and Alder Thicket typically occupy areas that are transitional between open wetlands and forested wetlands or uplands. Past drainage of open wetlands has also fostered artificial development of these lowland shrub communities. In both types, the ground layer species are largely typical of sedge meadow, while the tall shrub associates differ: red-osier dogwood (*Cornus sericea*), silky dogwood (*Cornus amomum*), white meadowsweet (*Spiraea alba*), and willows (*Salix* spp.) are associated with Shrub-carr, while speckled alder (*Alnus incana*) dominates Alder Thicket, along with lesser amounts of red-osier dogwood, nannyberry (*Viburnum lentago*), cranberry viburnum (*Viburnum trilobum*) and willows.

Significant tracts of non-forested wetland are found at the following CSPPG properties:

- **Colburn WA** (including **Colburn Meadows and Savannas Primary Site**)
- **Big Roche a Cri Creek FA**
- **Paul J. Olson WA**

Northern Sedge Meadow, Shrub-carr and Alder Thicket are three major community types of the CSPPG. Three-fourths of **Colburn WA** consists of Northern Sedge Meadow and Shrub-carr. This sedge meadow constitutes the largest and highest quality example of this community type on the property group. Approximately 300 acres of good- to fair-quality Northern Sedge Meadow lie along Carter Creek and surrounding areas to the north, east, and south. Lake sedge and blue-joint grass are the dominant species, with scattered patches of reed canary grass, common reed grass, and tall swamp marigold (*Bidens trichosperma*). Another 180-acre area of sedge meadow lies in the northwest part of the site, and has similar species composition, but is lower quality due to abundant reed canary grass. Over 900 acres of good-quality Shrub-carr also is found at **Colburn WA**; willow is the dominant shrub here, along with lesser amounts of red-osier dogwood and speckled alder.

Small strands of sedge meadow, Shrub-carr and Alder Thicket are also found along Tenmile Creek and Big Roche a Cri Creek. On state-owned lands, all sedge meadow areas along these creeks are highly degraded and dominated by reed canary grass. The Alder Thicket along **Big Roche a Cri Creek FA** is fair- to poor-quality due to reed canary grass dominating the herbaceous layer and significant tree encroachment. A 54-acre area of good- to fair-quality Alder Thicket is also found on **Tenmile Creek SBPA** that has high floral diversity (at least 67 species), partly due to the influence of active spring seeps, oxbow ponds and floodplain scours. Here, speckled alder, common winterberry (*Ilex verticillata*) and chokecherry (*Prunus virginiana*) grow over herbs such as skunk cabbage (*Symplocarpus foetidus*) and rough bedstraw (*Galium asprellum*). According to WDNR forest reconnaissance, approximately 10% of

Paul J. Olson WA is in “lowland grass” (e.g., sedge meadow), and less than 10% is in lowland brush dominated by alder and willow.

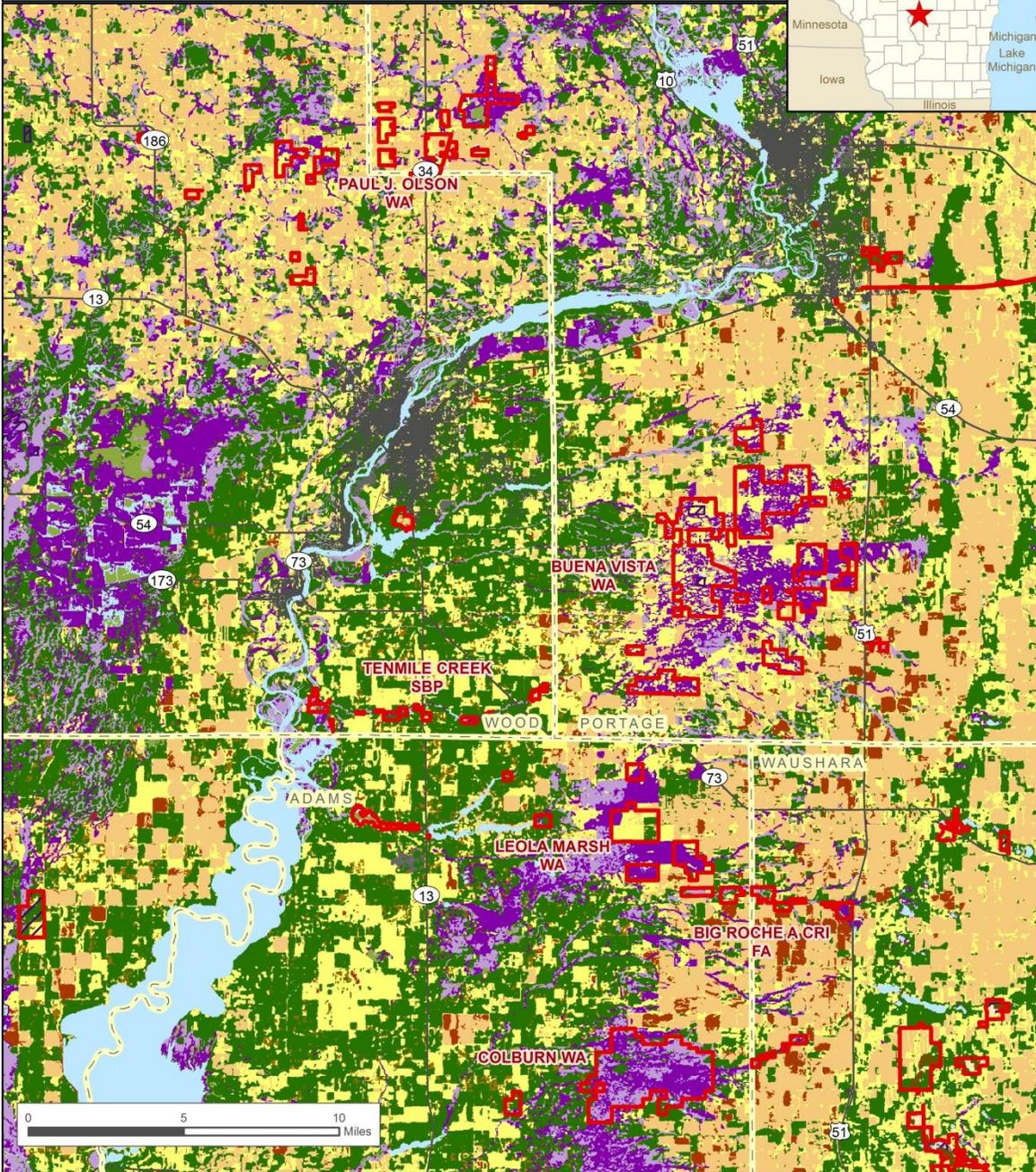
A large wetland complex (740 acres, including state-owned and private lands) is found at Fogarty Marsh at **Paul J. Olson WA**. This complex includes approximately 500 acres of Open Bog, 15 acres of Northern Sedge Meadow, and 85 acres of Tamarack (poor) Swamp (see Forested Wetlands below). Bogs are acidic, low nutrient wetlands dominated by sphagnum mosses that occur in deep layers and accumulate over time as peat. The bog often has pronounced hummock and hollow microtopography. Plant diversity is typically very low, but includes distinctive specialists such as narrow-leaved sedge species such as few-seeded sedge (*Carex oligosperma*) and few-flowered sedge (*C. pauciflora*), cotton-grasses (*Eriophorum* spp), and ericaceous shrubs, especially leatherleaf (*Chamaedaphne calyculata*), bog-laurel (*Kalmia polifolia*), bog rosemary (*Andromeda polifolia*), and small cranberry (*Vaccinium oxycoccos*). Trees are absent or stunted and achieve very low cover values.



Figure 3. Northern Sedge Meadow at Paul J. Olson WA with lake sedge, common yellow lake sedge, and meadow willow. Photo by Andy Clark.

LAND COVER

Central Sand Plains Property Group



DNR Fee Title Subject Lands	Forested wetland: deciduous	Upland Shrub
Agriculture	Forested wetland: coniferous	Golf Course
Barrens	Grassland	Developed
Upland forest	Open water	Open or brushy wetland

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Mar 29, 2016

MAP D

Forested Wetlands

NHI surveyors collected data on two unique types of forested wetlands at Paul J. Olson WA (Fogarty Marsh Primary Site): Black Spruce Swamp and Tamarack (poor) Swamp. These community types typically occur north of the Tension Zone but can also occur, as is the case here, in central Wisconsin at the margins of extinct Glacial Lake Wisconsin. Fogarty Marsh is a large acid peatland complex with a vegetative continuum that grades from Black Spruce Swamp at the periphery (especially to the west) to Tamarack (poor) Swamp and eventually to Open Bog in the interior. Black Spruce Swamp has the densest canopy cover within this continuum, which is created by 6-8" DBH black spruce and tamarack, as well as paper birch (*Betula papyrifera*) saplings. Shrubs such as Labrador-tea (*Rhododendron groenlandicum*) and velvet-leaf blueberry (*Vaccinium myrtilloides*) punctuate deep carpets of hummocky Sphagnum. Characteristic herb species include three-leaf Solomon's plume (*Maianthemum trifolium*), few-seeded sedge, and pink lady's-slipper (*Cypripedium acaule*). As one transitions from the Black Spruce Swamp to Tamarack (poor) Swamp, the canopy opens up but shrub cover increases, with leatherleaf and bog-rosemary added to the mix (Figure 4). Tussock cotton-grass (*Eriophorum vaginatum*) presents small white feathery plumes throughout this area. Tamarack is very sensitive to hydrological alteration, thus ditching and draining of these forested wetlands pose a significant threat.

A good example of Tamarack (poor) Swamp is found at:

- **Paul J. Olson WA (Fogarty Marsh Primary Site)**



Figure 4. Tamarack (poor) Swamp at Fogarty Marsh Primary Site.

At the other CSPPG properties, forested wetlands were too small or fragmented to warrant NHI surveys, or access may have been limited. For these tracts, we rely on WDNR Forest Reconnaissance to provide information on their composition (WDNR WisFIRS, accessed February 4, 2016). At several CSPPG properties, WDNR Forest Reconnaissance describes some forest tracts as ‘Swamp Hardwoods’. These occur on wet soils with a fluctuating water table at or above the soil surface and experience periodic subsurface water flow. Dominant canopy species of this forest type typically include swamp white oak

(*Quercus bicolor*), red maple (*Acer rubrum*), green ash (*Fraxinus pensylvanica*), and American elm (*Ulmus americana*). Swamp Hardwoods is the primary forest type on 150 acres at Big Roche a Cri FA and 39 acres on Tenmile Creek SBPA.

At Colburn WA, a 60-acre tract in the northeast part of the site is typed as “Bottomland Hardwoods” in WDNR WisFIRS, with black ash (*Fraxinus nigra*) as the dominant species. Furthermore, over 1,300 acres across Colburn WA is typed as “Aspen,” and mostly occur on wetland soils. These are the areas of former tamarack swamp that were logged, drained and grazed between the late 1800’s and 1930’s. NHI staff observed these areas as harboring willow, cottonwood (*Populus deltoides*) and aspen poles growing over dense reed canary grass and lake sedge in 2015.

Upland Forest

Upland forests of the CSPPG occur on dry and dry-mesic sands and sandy loams, and constitute major landscape elements at Colburn WA, Tenmile Creek SBPA and Big Roche a Cri FA. At the two stream-associated properties, the dominant canopy trees include black oak, northern pin oak, white oak (*Quercus alba*), jack pine, and red maple. White pine occurs in lesser proportions, occupying the canopy and supercanopy, especially on dry-mesic sites. At Colburn WA, the canopy dominants are similar, but big-tooth aspen (*Populus grandidentata*) also figures prominently, while pines are less frequent. Also, conifer plantations occupy 63 acres at Tenmile Creek SBPA, and 23 acres at Big Roche a Cri FA. (Summary based on WDNR WisFIRS, accessed February 5, 2016.)

A number of factors make it difficult to equate these forest cover types with specific NHI natural communities, including cessation of regular fire, past logging/grazing, location within the Tension Zone (Tenmile Creek SBPA and the Adams County-part of Big Roche a Cri FA only) where northern and southern elements can commingle, and lack of detailed NHI survey data. These forests can be equated with two Habitat Types as described by Kotar and Burger (1996): White pine/Flowering spurge (*Pinus strobus/Euphorbia corollata*, or “PEu”), typical of dry, nutrient poor sites, and White pine/Blueberry-wintergreen (*Pinus/Vaccinium-Gaultheria*, or “PVG”), typical of dry-mesic sites with slightly higher nutrient status.

One NHI type, however, was clearly identified on the CSPPG during NHI surveys: Central Sands Pine-Oak Forest. This fire-dependent forest type occurs on dry-mesic to dry sites with sandy soils of low fertility. In the CSPPG, canopy cover is created by large black oak and white pine, along with smaller red maple, jack pine, black cherry (*Prunus serotina*), white oak, and bur oak (*Quercus macrocarpa*). American hazelnut (*Corylus americana*) is a common shrub. While the consistent dominant ground layer species is Pennsylvania sedge (*Carex pensylvanica*), the ground flora is variable, capturing the full continuum from prairie/barrens associates (little bluestem, prairie tickseed [*Coreopsis palmata*], bracken fern [*Pteridium aquilinum*], early low blueberry [*Vaccinium angustifolium*]) to forest associates (Canada mayflower [*Maianthemum canadense*], starflower [*Trientalis borealis*], and wintergreen [*Gaultheria procumbens*]).

Good-quality Central Sands Pine-Oak Forest was identified at:

- **Tenmile Creek SBPA (Tenmile Creek Wetland-to-Forest Corridor Primary Site)**

At **Paul J. Olson WA**, several small tracts of Southern Mesic Forest are found on richer soils, and are characterized by large (18-25” DBH) red oak and lesser amounts of red maple, white oak and sugar maple (*Acer saccharum*).

Oak Barrens

Oak Barrens represents a fire-dependent, fire-maintained savanna community characterized by a scattering of oaks and shrubs interspersed with openings that are vegetated with prairie grasses and forbs [e.g., lead-plant (*Amorpha canescens*), black-eyed susan (*Rudbeckia hirta*), round-headed bush-clover (*Lespedeza capitata*), June grass (*Koeleria macrantha*), little bluestem, and wild lupine (*Lupinus perennis*)] along with true barrens associates such as bracken fern, blueberries (*Vaccinium* spp.), bearberry (*Arctostaphylos uva-ursi*), and sweet fern (*Comptonia peregrina*). On the CSPPG, Oak Barrens are found on sandy islands and linear terraces (ancient glacial lake beach ridges and dune fields) and on sandy terraces along streams.

On the CSPPG, Oak Barrens are found at:

- **Colburn WA (Colburn Meadows and Savannas Primary Site)**
- **Tenmile Creek SBPA**
- **Big Roche a Cri Creek FA**



Figure 5. Wild lupine is a barrens wildflower that is an important host plant for the Karner blue butterfly. Photo by Eunice Padley.

Rare Species and High-Quality Natural Communities of Central Sand Plains Planning Group

Rare species and high-quality natural communities have been documented at the Central Sand Plains Planning Group (CSPPG) (Table 3. Documented rare species and high-quality natural communities of the Central Sand Plains Planning Group). See Appendix C for rare species occurrences by property and Appendix D for summary descriptions of the species. It's important to note that other rare or declining species may be present on the CSPPG, but escaped detection during surveys. Please refer to Appendix E for a complete list of SGCN that may occur within the Central Sand Plains and Forest Transition Ecological Landscapes in natural communities of the CSPPG.

Table 3. Documented rare species and high-quality natural communities of the Central Sand Plains Planning Group

For an explanation of state and global ranks, as well as state status, see Appendix F. State Rank and Listing Status is based on Wisconsin Natural Heritage Inventory (NHI) Working List updates completed in April 2016 (unpublished). 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. Bird occurrences refer only to breeding activity.

Common Name	Scientific Name	Last Obs.	State Status	Global Status	State Rank	Federal Status	SGCN	Tracked by NHI?
Birds								
American Bittern	<i>Botaurus lentiginosus</i>	2014	S2S3B	G4	SC/M		Y	Y
Bobolink	<i>Dolichonyx oryzivorus</i>	2014	S2S3B	G5	SC/M		Y	Y
Dickcissel	<i>Spiza americana</i>	2014	S3B	G5	SC/M		Y	Y
Eastern Meadowlark	<i>Sturnella magna</i>	2014	S2S3B	G5	SC/M		Y	Y
Eastern Whip-poor-Will	<i>Antrostomus vociferus</i>	2015	S2B	G5	SC/M		Y	Y
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	2000 ¹	S3B	G4	SC/M		Y	Y
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	2014	S2S3B	G5	SC/M		Y	Y
Greater Prairie-Chicken	<i>Tympanuchus cupido</i>	2015	S1B	G4	THR		Y	Y
Henslow's Sparrow	<i>Ammodramus henslowii</i>	2014	S2S3B	G4	THR	SOC	Y	Y
Least Flycatcher	<i>Empidonax minimus</i>	2014	S3B	G5	SC/M		Y	Y
Loggerhead Shrike	<i>Lanius ludovicianus</i>	2015 ²	S1B	G4	END		Y	Y
Northern Bobwhite	<i>Colinus virginianus</i>	2014 ³	S1B	G5	SC/M		Y	Y

¹ Detected during first Wisconsin Breeding Bird Atlas at some time between 1995-2000 in two blocks that included Paul J. Olson WA and Colburn WA, both of which currently have suitable habitat.

² Occurrence is in or near Buena Vista WA.

³ Observation did not meet requirements for mapping in NHI database.

Common Name	Scientific Name	Last Obs.	State Status	Global Status	State Rank	Federal Status	SGCN	Tracked by NHI?
Birds (continued)								
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	2015	S3B	G5	SC/M		Y	Y
Short-eared Owl	<i>Asio flammeus</i>	2015	S1B, S3N	G5	SC/M		Y	Y
Upland Sandpiper	<i>Bartramia longicauda</i>	2014	S2B	G5	THR		Y	Y
Vesper Sparrow	<i>Poocetes gramineus</i>	2015	S2S3B	G5	SC/M		Y	Y
Western Meadowlark	<i>Sturnella neglecta</i>	2014	S2B	G5	SC/M		Y	Y
Herptiles								
Blanding's Turtle	<i>Emydoidea blandingii</i>	2015	S3S4	G4	SC/P		Y	Y
Wood Turtle	<i>Glyptemys insculpta</i>	1991 ⁴	S3	G3	THR		Y	Y
Mammals								
Gray Wolf	<i>Canis lupus</i>	2015	S4	G4G5	SC/H	LE	Y	Y
Butterflies and Moths								
Gray Copper	<i>Lycaena dione</i>	2013	S2	G5	SC/N		Y	Y
Karner Blue	<i>Lycaeides melissa samuelis</i>	2001	S3	G5T2	SC/FL	LE	Y	Y
Regal Fritillary	<i>Speyeria idalia</i>	2013	S1	G3	END		Y	Y
Dragonflies								
Sioux (Sand) Snaketail	<i>Ophiogomphus smithi</i>	2012	S2	G2G3	SC/N		Y	Y
Plants								
Missouri Rock-cress	<i>Boechera missouriensis</i>	2015	S2	G5	SC		NA	Y
Natural Communities								
Alder Thicket	Alder thicket	2015	S4	G4	NA		NA	Y
Central Sands Pine-Oak Forest	Central sands pine-oak forest	2015	S3	G3	NA		NA	Y
Northern Sedge Meadow	Northern sedge meadow	2015	S3	G4	NA		NA	Y
Oak Barrens	Oak Barrens	2015 ⁵	S2	G2?	NA		NA	Y

⁴ Multiple observations adjacent to Buena Vista WA.

⁵ Observation did not meet requirements for mapping in NHI database.

Common Name	Scientific Name	Last Obs.	State Status	Global Status	State Rank	Federal Status	SGCN	Tracked by NHI?
Natural Communities (continued)								
Open Bog	Open Bog	2015 ⁴	S4	G5	NA		NA	Y
Shrub-carr	Shrub-carr	2015	S4	G5	NA		NA	Y
Stream--Fast, Hard, Cold	Stream--slow, hard, cold	1980	SU	GNR	NA		NA	Y
Stream--Slow, Hard, Cold	Stream--slow, hard, cold	1979	SU	GNR	NA		NA	Y
Tamarack (poor) Swamp	Tamarack (poor) Swamp	2015 ⁴	S3	G4	NA		NA	Y

Management Considerations and Opportunities for Biodiversity Conservation

This section highlights the most significant opportunities for conservation of native plants, animals and natural communities on the CSPPG, which include:

- Conserving large grassland landscapes for birds, small mammals, and lepidopterans
- Protecting and restoring rare Oak Barrens ecosystems and associated plants and animals
- Preserving cold-water streams, wetlands, and the rare reptiles and aquatic invertebrates that live in them

There are also important considerations for conservation that are outlined below, including:

- Non-native invasive species
- Game species of the CSPPG
- Important WDNR plans, and how they relate to the CSPPG

Grassland Landscapes: Habitat for Birds, Small Mammals, and Lepidopterans

There are extensive areas of grassland within the CSPPG (Table 4. Grasslands of the Central Sand Plains Planning Group), most of which are “Surrogate Grasslands,” *i.e.*, they have the same basic structure as native grasslands, but have been logged, drained and/or plowed or heavily grazed and replanted with non-native cool-season grasses (some small areas have also been planted to native prairie species). Other habitat types that support grassland species that are present on the CSPPG include Northern Sedge Meadow (mainly at **Colburn WA**) and Open Bog (present at **Paul J. Olson WA**); lowland shrub areas are also present at all of these sites, and can contribute to the functional areas of adjacent open grasslands, especially if the brush isn’t too dense. Grasslands have drastically declined throughout Wisconsin due to fire suppression, conversion to agriculture, and intensification of agriculture. This has had a significant negative impact on wildlife that depends on grasslands for habitat, particularly birds, small mammals, and lepidopterans (butterflies and moths), emphasizing the importance of the CSPPG grasslands.

Table 4. Grasslands of the Central Sand Plains Planning Group

(Source: WDNR WisFIRS, accessed November 2015)

Property Name	Acres of Grassland
Buena Vista WA	12,453
Paul J. Olson WA	2,534
Leola Marsh WA	1,813
Colburn WA	1,553
Big Roche a Cri FA	71
Total	16,868

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 (Askins et al. 2007). Sample and Mossman (1997) identified 26 “priority landscapes” in Wisconsin that represent unique opportunities for landscape-scale grassland management for grassland birds. **Buena Vista/Leola Grasslands** was ranked as the second-highest priority grassland bird landscape in the "Central Plains" division, as well as an Important Bird Area (WDNR 2007) . These two properties contain high numbers of breeding SGCN birds (Table 5. Rare and declining grassland birds that breed on Central Sand Plains Planning Group properties). **Paul J. Olson WA** is also an IBA due to its harboring rare grassland bird habitat.

Table 5. Rare and declining grassland birds that breed on Central Sand Plains Planning Group properties (SGCN = Species of Greatest Conservation Need; WDNR 2015b)

Common Name	Scientific Name	State Rank	SGCN?
Bobolink	<i>Dolichonyx oryzivorus</i>	SC/M	Yes
Dickcissel	<i>Spiza americana</i>	SC/M	Yes
Eastern Meadowlark	<i>Sturnella magna</i>	SC/M	Yes
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	SC/M	Yes
Greater Prairie-Chicken	<i>Tympanuchus cupido</i>	THR	Yes
Henslow's Sparrow*	<i>Ammodramus henslowii</i>	THR	Yes
Short-eared Owl	<i>Asio flammeus</i>	SC/M	Yes
Upland Sandpiper	<i>Bartramia longicauda</i>	THR	Yes
Vesper Sparrow	<i>Poocetes gramineus</i>	SC/M	Yes
Western Meadowlark	<i>Sturnella neglecta</i>	SC/M	Yes

*Also identified as a Species of Concern by the U.S. Fish and Wildlife Service

The CSPPG grasslands are also important to a number of bird species from the Arctic that visit this region of Wisconsin during winter. These are birds of open grasslands and wetlands that move south to seek out more abundant prey and better conditions that will allow them to survive during a vulnerable period in their lives. These include rough-legged hawk (*Buteo lagopus*), gyrfalcon (*Falco rusticolus*), snowy owl (*Bubo scandiacus*), snow bunting (*Plectrophenix nivalis*), and Lapland longspur (*Calcarius lapponicus*).

The large grassland patches within the planning group provide critical habitat for numerous small mammals, and in turn, the small mammal community delivers many ecological benefits to the grassland ecosystem. Records (both recent and historical) of rare taxa are known from the properties, or in close proximity to them. These species served as targets for establishing survey protocols and transect placement in 2014-15. A large amount of survey effort over the course of two field seasons was put toward relocating these targets and establishing a baseline of the small mammals present on two properties in the group (**Buena Vista WA** and **Paul J. Olson WA**). Unfortunately, none of the target species were relocated at these properties, but some important findings of infrequently encountered species were discovered. The pygmy shrew (*Sorex hoyi*) was located in very low numbers (seven total captures) at both properties in cool-season grassland, Shrub-carr and Dry-mesic Prairie habitats, while arctic shrew (*Sorex arcticus*) was slightly more common (39 captures), and found primarily in cool-season grassland habitats at both properties. Both of these species were removed from the Special Concern list in 2011 because they are fairly widespread in the state and found in relatively common habitats, but are considered to occur in low numbers. New species records like this aid in refining detection methods, further knowledge of a species' distribution, and help to refine habitat associations.

Conservation Opportunity Areas of the CSPPG

The Wildlife Action Plan (WDNR 2006b) identifies Conservation Opportunity Areas (COAs), or places in Wisconsin that contain ecological features, natural communities, or SGCN habitat that present the greatest likelihood of successfully implementing conservation actions when viewed from the global, continental, upper Midwest, or state perspective.

Buena Vista Wildlife Area, Leola Marsh WA and Big Roche a Cri FA lie within the Central Wisconsin Grassland COA, which holds statewide significance for extensive grassland communities (especially surrogate), and for supporting rare and declining birds as well as the endangered regal fritillary butterfly. Parts of **Paul J. Olson WA** are also being considered for inclusion in this COA.

Although the target rare species were not detected during this effort, the geographic and temporal extent of this survey was limited. As we learn more about habitat needs for these species, the location of small mammal trapping transects could be improved, thereby increasing the probability of occurrence and detection (Anderson 2015).

Finally, grasslands provide habitat for numerous lepidopterans, including several rare butterfly species that are known to occur on the CSPPG.

The following properties present the best potential for managing for grassland species in the CSPPG due to their large size, species composition, and landscape context, in order of priority from highest to lowest:

- **Buena Vista – Leola Marsh – Paul J. Olson WA – Scattered Wildlife Habitat Areas complex**
- **Big Roche a Cri FA**
- **Colburn Wa**

Grassland Management

During both the master planning process and day-to-day management planning, careful consideration of the unique life history needs of the grassland birds, small mammals and lepidopterans of the CSPPG is recommended. In general, management for grassland birds also benefits small mammals, as these species key into habitat structure rather than plant community composition. Lepidopterans,

however, evolve with specific host plants, which can vary between larvae and adults. Protecting and promoting large open landscapes and rotating management spatially and temporally using a variety of management techniques (*e.g.*, timber harvest, prescribed fire, mowing, grazing, and herbicide application) can benefit the greatest number of species and taxa groups by creating a variety of habitat structures. Prairie-chickens, for example, require large blocks of habitats with different vegetation heights and densities during the breeding season: small areas of shortgrass for booming grounds, tall dense cover for nesting, and moderate height and density for brood-rearing. The keys are to: a) limit negative impacts associated with habitat fragmentation by maintaining large blocks of similar habitat while still providing diverse habitat structures -- this type of balance is possible only in exceptionally large landscapes such as Buena Vista-Leola Grasslands; and b) avoid significant temporal conflicts between detrimental management disturbances and critical parts of species' life cycles (*e.g.*, burning, mowing, and intensive grazing during the bird nesting season). Planners and managers may refer to numerous resources that can inform grassland preserve design and management decisions (

Table 6. Grassland Management and Preserve Design Resources).

Table 6. Grassland Management and Preserve Design Resources

Resource Title	URL	Pertinent Species
Managing Habitat for Grassland Birds: A Guide for Wisconsin (Sample and Mossman 1997)	Not applicable.	All grassland bird species of Wisconsin
Wisconsin Greater Prairie-Chicken Management Plan 2004-2014 (WDNR 2014)	http://dnr.wi.gov/files/pdf/pubs/wm/wm0623.pdf	greater prairie-chicken
WDNR Species Guidance Documents	http://dnr.wi.gov/topic/endangeredresources/guidance.asp	short-eared owl
WDNR Grassland and Savanna Management Incidental Take Protocols (WDNR [year after species at right])	http://dnr.wi.gov/topic/ERReview/ItGrasslands.html	greater prairie-chicken (2014), Henslow's sparrow (2011), upland sandpiper (2014), regal fritillary butterfly (2011)
Federal Karner Blue Butterfly Recovery Plan (USFWS 2003)	http://www.fws.gov/midwest/endangered/insects/kbb/pdf/kbb-final-rp2.pdf	Karner blue butterfly
Feasibility Study and Environmental Analysis for the Central Wisconsin Grassland Conservation Area (WDNR 2004)	http://dnr.wi.gov/topic/lands/Grasslands/documents/cwgcafeas.pdf	all grassland birds

The Wisconsin DNR recently formalized a vision for a large landscape managed for grassland birds in the “Central Wisconsin Grassland Conservation Area,” which includes **Buena Vista, Leola Marsh, and Paul J. Olson WAs** along with proximal **Scattered Wildlife Habitat Areas** and **Mead and McMillan WAs**. Beyond these current DNR holdings, the department proposes to protect, primarily through acquisition and easements, up to 15,000 acres of additional grassland habitat, for a grand total of approximately 33,600 acres.

Managing from a landscape-scale perspective can better accommodate the complex habitat needs of a greater number and variety of grassland birds and other grassland obligate species. Large grassland landscapes may include wetland, upland, shrub, and savanna components, but should have less than 5% cover from woody plants, and should lack hedgerows,⁶ which fragment grasslands and provide habitat/movement corridors for predators of grassland birds (Sample and Mossman 1997). Grassland bird habitat may be managed at a variety of scales, with the large landscape scale (>10,000 acres) being the most valuable. When possible the smallest scale should be more than 250 acres. Blocks of managed grassland can be even smaller if they are surrounded by/contiguous with a grassy landscape (e.g., with lots of pasture, grassy hayfields, and idle grassland). Recent research in Wisconsin has shown that grassland birds exhibit species-specific patterns of responses to both patch size and composition of the landscape surrounding the patch at a variety of scales (Guttery et al. In Review). Continued expansion and connection of prairies, wetlands, fallow fields, pastures, and surrogate grasslands on CSPPG properties can provide grassland bird habitat at a landscape scale.

Opportunities may be present to improve habitat for lepidopterans where their host plants are present or where host plants could be planted in suitable habitat (Table 7. Rare and declining butterflies of the Central Sand Plains Planning Group). While there is a small amount of remnant prairie on the property group, the butterflies are found in other habitat types such as old fields, and may be coming in on other as-of-yet unidentified habitat features (Swengel and Swengel 1999). Research suggests that prairie specialists may in fact be responding to the same landscape features as a rare type of bird (Swengel and Swengel 1999), identifying a possible opportunity for managing for two rare species with one management approach.

Wisconsin's Wildlife Action Plan and Management of Grasslands and Oak Barrens

The Wildlife Action Plan (WDNR 2015b) describes high-impact conservation actions that promote these fire-dependent natural communities:

- Maintain blocks of related fire-dependent communities that capture a complete gradient from grassland/open wetland to savanna to oak forest.
- Work with Wisconsin's Prescribed Fire Council (prescribedfire.org) to make the use of prescribed fire safe, effective, and more broadly accepted as a management tool.
- Take actions to facilitate rapid mobilization of prescribed burn crews (e.g., prepare units in advance of burn season).
- Maximize impacts of limited burn seasons by burning larger units.
- Promote drought- and frost-tolerant species and plant morphologies through regular prescribed burning.
- Research the impacts of grazing on grassland and herbaceous wetland communities, including control of invasive species and impacts to SGCNs.
- Avoid pesticide use that may impact bird SGCN species. Limit the use of chemicals and pesticides in grassland habitats because of known effects on reproduction and other aspects of biology. Integrated pest management practices that consider natural biological processes and biopesticides, preventative cultural practices, and emphasis on control, are important components of these actions.

⁶ A "hedgerow" is a row of shrubs or trees that form a hedge, especially around a field or along a road or path.

Table 7. Rare and declining butterflies of the Central Sand Plains Planning Group
(SGCN = Species of Greatest Conservation Need; WDNR 2015b)

Common Name	Scientific Name	Rank (State Rank unless otherwise specified)	SGCN?	Larval Host Plants	Favored Nectar Sources
Regal fritillary butterfly	<i>Speyeria idalia</i>	Endangered	Yes	Violets (<i>Viola</i> spp.)	Lavender flowers (bee balm [<i>Monarda fistulosa</i>] and thistles [<i>Cirsium</i> spp.], etc.)
Gray copper	<i>Lycaena dione</i>	Special Concern	Yes	Docks (<i>Rumex</i> spp.)	Dogbane (<i>Apocynum</i> spp.), milkweeds (<i>Asclepias</i> spp.), thistle (<i>Cirsium</i> spp.)
Karner blue butterfly	<i>Lycaeides melissa samuelis</i>	Special Concern (Federal Rank Endangered)	Yes	Lupine (<i>Lupinus perennis</i>)	Wide variety of flowering plants: milkweeds, sunflowers, lupine, leadplant

Oak Barrens: A Rare Savanna Type

Oak Barrens historically occupied approximately 1.8 million acres in Wisconsin prior to European settlement (Henderson, pers. comm.), but are now reduced to approximately 95,000 acres (Hoffman 2009; includes both Pine and Oak Barrens). Major opportunities for sustaining these barrens communities exist within the Central Sand Plains Ecological Landscape (WDNR 2014a). Historically, barrens sites occurred on sandy glacial outwash plains, extinct glacial lake beds, and outwash terraces along large rivers. This is a community that is dependent upon fire, yet the lack of regular burning continues to be the most limiting factor in barrens restoration and maintenance (WDNR 1995). An additional threat to barrens communities is their conversion to monotypic pine stands, which can render them inhospitable to many SGCN (especially herptiles), and can eliminate native ground layer plants (WDNR 2006b).

Black oak is the dominant tree of Oak Barrens, although white oak, bur oak, northern pin oak, and occasionally red oak (*Quercus rubra*) may also be present. Canopy closure is typically 10-50% (WDNR 2010a). Heath species such as bracken fern, blueberries, bearberry, and sweet fern grow in patches here, and can even achieve dominance. Common ground layer species include prairie associates such as lead-plant, goat's rue (*Tephrosia virginiana*), June grass, little bluestem, flowering spurge (*Euphorbia corollata*), long-branch frostweed (*Crocyanthemum canadense*), and wild lupine. Frequent fires can reduce some oaks to short, multi-stemmed “grubs.”

Barrens of the CSPPG lie on riverine terraces along streams (e.g., **Tenmile Creek** and **Big Roche a Cri Creek**) or on postglacial dunes within a wetland matrix (e.g., at **Colburn WA**, Figure 6); these are especially important locations in the landscape for species that live in aquatic or wetland habitats for much of the year but need semi-open upland areas nearby to complete critical parts of their life cycles (for example, turtle nesting).

Retaining and restoring connectivity of these barrens, wetlands and streams is thus an important conservation action.

Numerous SGCN would benefit from Oak Barrens restoration at these properties, and include birds, mammals, reptiles, and lepidopterans (Table 8. Rare or declining barrens species that occur or could occur at Central Sand Plains Planning Group).

The following properties have significant opportunities for Oak Barrens restoration due to current condition, species composition, and landscape context:

- **Colburn WA (Colburn Meadows and Savannas Primary Site)**
- **Tenmile Creek SBPA**
- **Big Roche a Cri FA**

While most of the barrens sites on these properties currently are low-quality, Oak Barrens is one of our most resilient natural communities and will respond readily to management (Mossman et al. 1991). Oak Barrens is a dynamic community that is continually influenced by the opposing forces of fire and woody succession. To maximize benefits for the greatest number of wildlife species, managers can strive to maintain a shifting mosaic of barrens types, from open grassland communities to savannas with dappled sunlight to more closed canopy communities. This can be achieved by rotating management activities among multiple management units from year to year. Such management activities might include timber harvest, prescribed fire, mowing, grazing, and herbicide application.

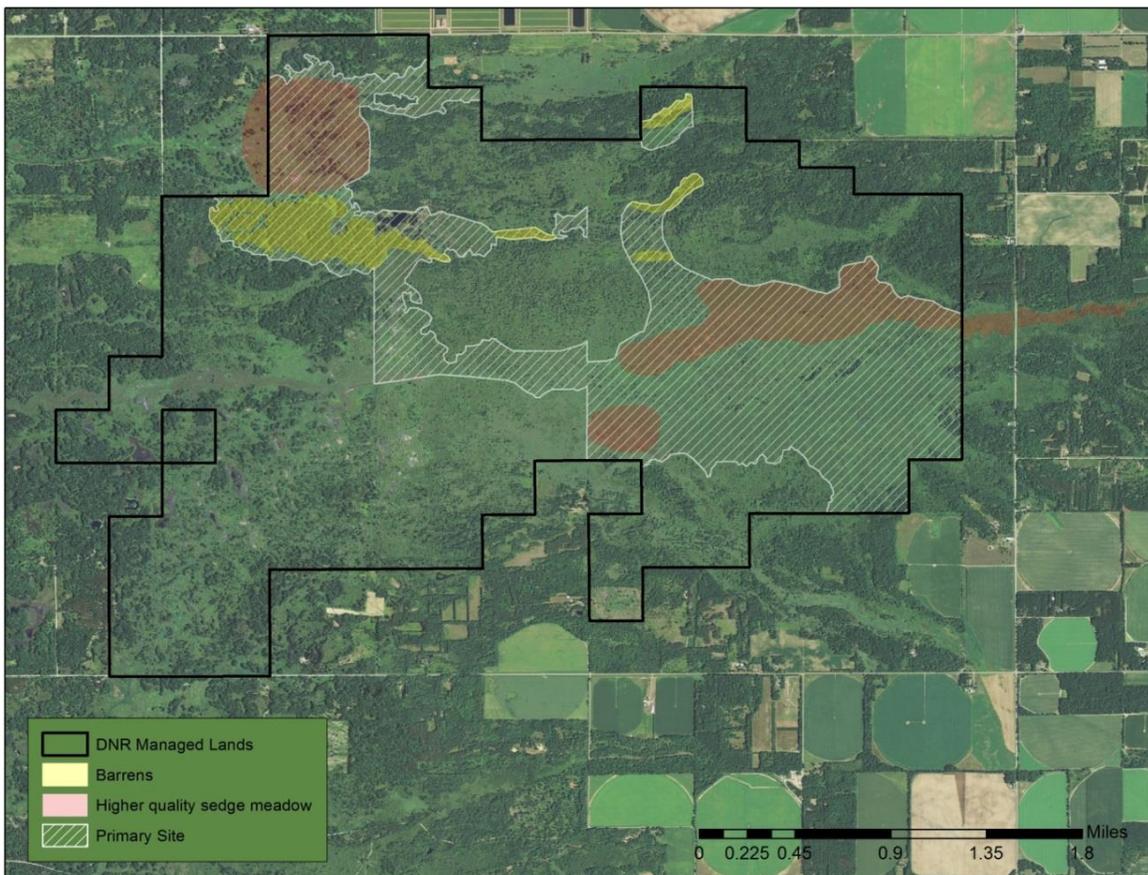


Figure 6. Colburn Meadows and Savannas Primary Site was designed in part to promote connectivity of barrens and open wetlands.

Table 8.

Rare or declining barrens species that occur or could occur at Central Sand Plains Planning Group
(SGCN = *Species of Greatest Conservation Need*; WDNR 2015b)

Common Name	Scientific Name	State Rank	SGCN?
Eastern Whip-poor-will	<i>Caprimulgus vociferous</i>	S2B	Yes
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	S2S3B	Yes
Lark Sparrow	<i>Chondestes grammacus</i>	S2S3B	Yes
Red-headed Woodpecker	<i>Menanerpes erythrocephalus</i>	S3B	Yes
Vesper Sparrow	<i>Pooecetes gramineus</i>	S2S3B	Yes
slender glass lizard	<i>Ophisaurus attenuatus</i>	S1	Yes
Frosted elfin	<i>Callophrys irus</i>	S1	Yes
Karner blue butterfly	<i>Lycaeides melissa samuelis</i>	S3	Yes
Phlox moth	<i>Schinia indiana</i>	S2S3	Yes
Franklin’s ground squirrel	<i>Spermophilus franklinii</i>	S2	Yes
prairie deer mouse	<i>Peromyscus maniculatus bairdii</i>	S2S3	Yes
prairie vole	<i>Microtus ochrogaster</i>	S2	Yes

Aquatic Resources of the CSPPG

Streams and wetlands are present on every property in the CSPPG (see Table 2. Major water bodies of the Central Sand Plains Planning Group for list of streams), providing important habitat for rare turtles and a rare dragonfly (Table 9), as well as active trout fisheries (Big Roche a Cri Creek, South Branch Tenmile Creek, Fourmile Creek, Carter Creek, Buena Vista Creek). Despite extensive losses of wetlands in the past due to various factors detailed below, the Central Sand Plains Ecological Landscape still has the fourth largest number of wetland acres (547,000) and the second largest percentage (25.8%) of wetlands of all ecological landscapes in the state (WDNR 2014a). Wetlands serve to slow the release of water during storms (thus minimizing flooding), filter nutrients and pollutants that are carried in runoff, and provide moisture banks during low water periods or droughts. Threats to streams and wetlands of the CSPPG are numerous, and conservation of these resources warrants special attention.

Widespread drainage of wetlands and channelization of streams were done in the Central Sands region to create agricultural fields and cranberry beds. Many of the early attempts to farm on drained wetlands proved unsuccessful, mainly due to the high water table, low soil fertility, and growing season frosts. Some farms were abandoned (and are now to a large extent owned by the state as wildlife areas), and some wetlands were restored, at least in part, by plugging ditches and installing dikes. Other failed farms were resurrected through the introduction of center pivot irrigation to grow crops such as potatoes. This and other land use practices that require large volumes of water (e.g., very large dairy farms, frac sand mining) rely on high capacity wells.⁷

⁷ Wisconsin Administrative Code defines a high capacity well system as one or more wells, drillholes or mine shafts on a property that have a combined approved pump capacity of 70 or more gallons per minute.

Table 9. Rare aquatic species of the Central Sand Plains Planning Group

Common Name	Scientific Name	State Rank
Herptiles		
Blanding's Turtle	<i>Emydoidea blandingii</i>	SC/P
Wood Turtle	<i>Glyptemys insculpta</i>	THR
Dragonflies		
Sioux (Sand) Snaketail	<i>Ophiogomphus smithi</i>	SC/N

In recent years there have been documented declines in groundwater levels, stream flows and lake levels within the Central Sands region of Wisconsin (Kraft et al. 2012). Declines in surface water quantity have been attributed to numerous factors including pumping from low-volume wells and high-capacity wells associated with irrigated agricultural lands, pumping for municipal water supplies and industrial facilities, and surface water ditching, draining and irrigation associated with cranberry operations.

The Central Sands region contains the state's highest concentration of high-capacity wells (over 2,000 in 2012 [*Wisconsin Central Sands Strategic Analysis*]). Furthermore, in 2011, Portage, Adams and Waushara Counties were ranked first, third and fourth, respectively, for the counties with the greatest groundwater withdrawals in the state (WDNR 2012 Groundwater Monitoring Database, as cited in Kniffin et al. 2014).

Climate change may also play an important role in changing hydrology of the Central Sands region: Average annual temperatures have increased and will likely continue to increase, especially at night and during the winter months (WICCI 2011). This temperature increase will likely result in longer growing seasons (15-20 days in central Wisconsin) and, by extension, higher evapotranspiration (Kucharik et al. 2010, Motew and Kucharik 2013).

Lastly, some agricultural and cranberry operations can present issues for coldwater streams and associated wetlands or riparian areas. Runoff containing sediment, nutrients (*e.g.*, manure, fertilizer), and pesticides from such operations can be transported to the aquifer, resulting in indirect or unintended adverse impacts to water quality. Degraded water quality can result in reduction or loss of aquatic plant communities, fish or wildlife habitat, and loss of rare plants or animals. This is due to the fact that the region's sandy soils overlay sandy glacial deposits, thus exhibiting exceptionally high permeability. The WDNR and Wisconsin Geological and Natural History Survey identified the watersheds comprising the more agricultural eastern half of the Central Sand Plains Ecological Landscape (which includes **Buena Vista**, **Leola Marsh**, and **Colburn WAs**, **Big Roche a Cri FA**, and **Tenmile Creek SBPA**) among the most highly susceptible to groundwater contamination in the state (WDNR and WGNHS 1989). In addition, cranberry operations can alter stream thermal conditions when warm waters from impoundments are released – a particular issue for temperature sensitive species such as trout.

Regardless of the source(s), pronounced and long term lowering of the water table as well as sedimentation and nutrient enrichment can have dramatic negative impacts on waterways and wetlands. Invasion of woody species and non-native invasives is a major threat, along with loss of specialist wetland plants that have a narrow tolerance for variations in moisture. Other short- and long-term changes in water levels and flows associated with groundwater withdrawals can shift distribution and abundance of aquatic species by affecting availability of habitat for feeding, shelter, and breeding. Warmer streams may also cause mortality, slower growth or diminished reproductive fitness of trout and other coldwater fish associates.

The Central Sands aquifer is somewhat unique: If crop irrigation water is not evapotranspired, it can readily return to the aquifer (Kniffin et al. 2014). Determining rates of evapotranspiration associated with different vegetative cover types is thus extremely important when considering the potential effects of land use decisions on groundwater recharge. In an example that could be pertinent to the decisions CSPPG planners and managers make, researchers estimated that the conversion of grassland along **Big Roche a Cri Creek** to forest or tree plantations would yield similar impacts to crop irrigation due to three synergistic impacts: 1) an increase in evapotranspiration; 2) a decrease in soil moisture storage; and 3) a decrease in net recharge (Weeks and Stangland 1971).

The Wisconsin DNR and property managers are encouraged to continue working with local stakeholders to develop a comprehensive modeling program for effective water resource management in the Central Sands Region (Kniffin 2014). Three goals have already been identified by a large stakeholder group that may serve as a foundation for future initiatives: 1) maintain healthy waters and ecological resources in the

Wisconsin's Wildlife Action Plan and Aquatic Resources

The Wildlife Action Plan (WDNR 2015b) describes specific actions that can be taken to protect streams and wetlands:

- Maintain and restore native plant communities within the 100-year floodplain along rivers and streams.
- Target wetland restoration, enhancement, and preservation of priority areas identified through Wisconsin Watershed Approach to Wetland Functional Assessment.
- Follow forestry best management practices for water quality, especially near riparian areas, and consider additional buffers around sensitive wetland habitats.
- Identify priority groundwater recharge areas that supply fens, sedge meadows, springs, streams, and other wetlands and conduct groundwater quality and quantity monitoring in regions with high demand on groundwater resources.
- Work with agricultural stakeholders to balance water quality and water quantity with planting design, crop selection, discontinuous vegetative cover, tillage practices, nutrient management, pest management, and irrigation.

Central Sands region during future water development; 2) restore healthy waterways in the Central Sands region that have been compromised; and 3) promote and maintain a vibrant agriculture industry (WDNR *Central Sands Strategic Analysis*). Any approach will most likely require adaptive management that allows flexibility in light of an uncertain future. A comprehensive water resource management plan would serve to support natural wetland and aquatic communities and the plants and animals that rely on them, including both game species (especially trout) and non-game species.

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 preparation). 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 (e.g., by causing skin rashes). 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 white-tailed deer [*Odocoileus virginianus*] and wild turkey [*Meleagris gallopavo*]; Gorchov and Trisel 2003), by diminishing habitat for ground-nesting birds [e.g., ovenbird (*Seiurus aurocapillus*) and American woodcock (*Scolopax minor*); (Miller and Jordan 2011, Loss et al. 2012)] and by altering aquatic macroinvertebrate communities in streams, thereby impacting fish that feed on them (McNeish et al. 2012).

Recreational usage can contribute to the introduction and spread of non-native invasive species throughout the properties. Parking areas, trails, and other high-use areas are typical entry points for non-native invasive species that are introduced by visitors' footwear, clothing, vehicle tires, boats, and recreational equipment. Felt-bottomed waders are also suspected to be vectors of non-native invasives in streams (Kilroy and Unwin 2011). Once established, these invasives may continue to spread along natural corridors (e.g., waterways) and along human-made corridors (e.g. trails and roads). They even have the potential to invade remote natural areas via vectors such as wind, water, and wildlife. Non-native invasive species may also be spread inadvertently through management activities such as timber operations and roadside mowing, especially if Best Management Practices aren't followed.

Non-native invasive species that are widespread at CSPPG and pose the greatest immediate threat to native species diversity, rare species habitats, or high-quality natural communities are listed in Table 10. Non-native Invasive Species currently known at the Central Sand Plains Planning Group. See Table 11. Non-native invasives to watch for in the Central Sand Plains Planning Group for invasive species that are currently not known at CSPPG, but could appear there.

When resources for complete control of widespread invasives are lacking, containment (*i.e.*, limiting further spread) should be considered as an alternative action. Prevention of spread is, in fact, the most cost-effective means of dealing with invasive species. Forest inventory and management operations should take care to follow Best Management Practices related to non-native invasive species to avoid further spread. Roads, 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 (especially trenching for planting pine seedlings), roadside mowing, and right-of-way maintenance. All management activities should follow the Best Management Practices developed by the Wisconsin Council on Forestry (WDNR 2009). Furthermore, early detection and rapid control of new and/or small infestations should be considered for higher prioritization in any invasive species management strategy (Boos et al. 2010).

At Buena Vista and Leola Marsh WAs, the preponderance of non-native plants may necessitate a different approach to invasives monitoring and control:

1) Avoid favoring species that have the ability to disperse, spread, and overrun areas dominated by native grassland vegetation; and 2) Control invasive plants that affect grassland bird habitat either directly (by degrading habitat structure) or indirectly (by competing with desirable plants that provide important structure or function).



Wildlife Action Plan and Non-native Invasive Species

The Wildlife Action Plan (WDNR 2015b) describes priority conservation actions that make effective use of limited resources:

- At the site level, employ an eight-part approach to non-native invasive species: 1) careful planning; 2) prevention; 3) early detection and rapid response; 4) control; 5) slowing the spread; 6) reducing impacts; 7) monitoring; 8) restoration.
- At a landscape or statewide level, enforce and strengthen regulatory mechanisms and voluntary BMPs that address the introduction and spread of non-native invasives.
- Monitor riparian areas 1-2 years post-flooding for new invasive species.

Figure 7. Japanese knotweed (*Polygonum cuspidatum*) is a non-native invasive shrub that has potential to invade the CSPPG properties. It poses a significant threat to riparian areas where it prevents streamside tree regeneration, and increases soil erosion. Photos by Elizabeth Czarapata.

Table 10. Non-native Invasive Species currently known at the Central Sand Plains Planning Group
 Property abbreviations: BRAC = Big Roche a Cri Fishery Area, BUEN = Buena Vista Wildlife Area and proximal Scattered Wildlife Habitat Areas, COL = Colburn Wildlife Area, LEO = Leola Marsh Wildlife Area, PJO = Paul J. Olson Wildlife Area and proximal Scattered Wildlife Habitat Areas, TMC = Tenmile Creek Streambank Protection Area. Chapter NR 40 classification codes for CSPPG counties in superscript: P = Prohibited, R = Restricted, PR = Proposed Restricted.

Common Name	Latin Name	Upland Habitats		Wetland Habitats		Aquatic	Sites Where Present
		Open	Wooded	Open	Wooded		
Plants							
autumn olive ^R	<i>Elaeagnus umbellata</i>	x					BRAC
butter-and-eggs ^{NR}	<i>Linaria vulgaris</i>	x					COL, TMC, BUEN
Canada thistle ^R	<i>Cirsium arvense</i>	x		x			BUEN, LEO
common buckthorn ^R	<i>Rhamnus cathartica</i>		x		x		BRAC, TMC
Common St. John's-wort ^{NR}	<i>Hypericum perforatum</i>	x					BUEN
curly-leaf pondweed ^R	<i>Potamogeton crispus</i>					x	BRAC, BUEN
cypress spurge ^R	<i>Euphorbia cyparissias</i>	x					BUEN
Eurasian bush honeysuckle ^R	<i>Lonicera sp.</i>	x	x		x		COL, TMC
glossy buckthorn ^R	<i>Frangula alnus</i>			x	x		BRAC, TMC, PJO
Japanese barberry ^R	<i>Berberis thunbergii</i>		x				BRAC, TMC, COL
Kentucky bluegrass ^{NR}	<i>Poa pratensis</i>	x					BRAC, COL, LEO
orange hawkweed ^{NR}	<i>Hieracium aurantiacum</i>	x					BUEN, COL
Phragmites ^{P/R}	<i>Phragmites australis</i>			x			COL, BUEN
purple loosestrife ^R	<i>Lythrum salicaria</i>			x			PJO
quackgrass ^{NR}	<i>Elymus repens</i>	x					BUEN
reed canary grass ^{NR}	<i>Phalaris arundinacea</i>	x		x	x		BRAC, COL, TMC, BUEN, PJO, LEO
scotch pine ^{NR}	<i>Pinus sylvestris</i>	x	x				BRAC
smooth brome ^{NR}	<i>Bromus inermis</i>	x					BUEN, PJO
spotted knapweed ^R	<i>Centaurea stoebe</i>	x					BRAC, BUEN, COL, LEO, TMC, PJO
tansy ^R	<i>Tanacetum vulgare</i>	x		x			PJO
watercress ^{NR}	<i>Nasturtium officinale</i>			x		x	Often found in headwaters to the streams in these areas, except PJO.
wild parsnip ^R	<i>Pastinaca sativa</i>	x					PJO
Pathogens							
oak wilt	<i>Ceratocystis fagacearum</i>		x		x		TMC, COL

*Phragmites australis Prohibited in Wood and Adams Counties (and other counties in western half of Wisconsin), Restricted in Portage and Waushara Counties (and other counties in eastern half of Wisconsin).

Table 11. Non-native invasives to watch for in the Central Sand Plains Planning Group

Property abbreviations: BRAC = Big Roche a Cri Fishery Area, BUEN = Buena Vista Wildlife Area and proximal Scattered Wildlife Habitat Areas, COL = Colburn Wildlife Area, LEO = Leola Marsh Wildlife Area, PJO = Paul J. Olson Wildlife Area and proximal Scattered Wildlife Habitat Areas, TMC = Tenmile Creek Streambank Protection Area. Chapter NR 40 classification codes for CSPPG counties in superscript: P = Prohibited, R = Restricted, PR = Proposed Restricted.

Common Name	Latin Name	Upland Habitats		Wetland Habitats		Aquatic	Comments
		Open	Wooded	Open	Wooded		
Plants							
Amur cork tree ^P	<i>Phellodendron amurense</i>	x					Adams County
Amur maple ^R	<i>Acer ginnala</i>	x	x				
black swallow-wort ^P	<i>Vincetoxicum nigrum</i>	x	x				Central Waushara County
dame's rocket ^R	<i>Hesperis matronalis</i>	x	x	x	x		
cut-leaved teasel ^R	<i>Dipsacus laciniatus</i>	x					
cypress spurge ^R	<i>Euphorbia cyparissias</i>	x					
Eurasian water-milfoil ^R	<i>Myriophyllum spicatum</i>					x	
garlic mustard ^R	<i>Alliaria petiolata</i>		x		x		
Grecian foxglove ^P	<i>Digitalis lanata</i>	x	x				East-central Portage County
hybrid cattail ^R	<i>Typha x glauca</i>			x			
Japanese hedge-parsley ^{P/R}	<i>Torilis japonica</i>		x				Southeast Portage County
Japanese knotweed ^R	<i>Fallopia japonica</i>			x			Invasives riparian corridors.
leafy spurge ^R	<i>Euphorbia esula</i>	x					
narrow-leaf cattail ^R	<i>Typha angustifolia</i>			x			
sweet clover ^{NR}	<i>Melilotus spp.</i>	x					
tall manna grass ^P	<i>Glyceria maxima</i>			x			Northwest Wood County
Animals							
European earthworms	Families of Acanthodrilida, Lumbricidae, Megascolecidae	x	x				
New Zealand mud snail ^P	<i>Potamopyrgus antipodarum</i>					x	
rusty crayfish ^R	<i>Orconectes rusticus</i>					x	

*Japanese hedge-parsley Prohibited in Wood County (and other counties to the north), Restricted in Adams, Portage and Waushara Counties (among others).

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>).

Following is more detailed information on several non-native invasives that are widespread or of particular concern on the CSPPG.

Reed canary grass

Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. Hatch and Bernthal (2008) determined that approximately 500,000 acres of wetlands in Wisconsin are infested with reed canary grass. In addition to incurring devastating impacts on native plants and animals, reed canary grass can also alter hydrology by trapping silt and constricting waterways, and reduce the carbon sequestration capacity of wetlands (WRCGMWG 2009). This species prefers disturbed areas, but can also move into intact native wetlands. Invasion is most often associated with disturbances including erosion, ditching, stream channelization, logging of forested wetlands, and planting. Nutrient inputs such as sedimentation, fertilizer or agricultural runoff also encourage invasion and proliferation of reed canary grass.

Reed canary grass is extremely difficult to eradicate due to a number of factors: 1) A formidable seed bank may persist on a restoration site for many years; 2) A dense network of persistent rhizomes are difficult to eliminate; 3) Recolonization from proximal sites is likely, given the ubiquitous distribution of this species; and 4) Establishment of desirable native vegetation may be costly and difficult (especially in a riparian setting that is prone to flashy flooding). No single control method is universally applicable, and in fact a combination of approaches applied over many years may be necessary. Each site has to be evaluated based on agricultural history, hydrological alteration, landscape context, and invasion pattern. Development of a comprehensive restoration plan is recommended to address not just reed canary grass control but also rapid re-establishment of desirable native vegetation and long-term monitoring.

A working group of Wisconsin natural resource professionals with experience in reed canary grass control developed guidelines for the control of this invasive grass in Wisconsin wetlands (WRCGMWG 2009). Their management guide is an excellent reference for land managers, and includes information on how to set up a management plan using a combination of practices and timing of treatments that's tailored to specific site conditions, a table of available control techniques, and a listing of native plant species and seed mixes that will compete with reed canary grass. Additionally, the herbicide Sethoxydim is showing great promise for reed canary grass control in Wisconsin (Annen et al. 2005, Annen 2008).

Oak Wilt

Oak wilt (*Ceratocystis fagacearum*) is caused by a fungus that effects water movement within oak trees, often killing the trees. The fungus was thought to be native, but the most recent science suggests that it is not (J. Cummings Carlson, pers. comm.). It has been in the state for at least 100 years and is widespread throughout the southern part of the state. Oak wilt is often not a major concern for woodland or barrens restoration areas where open canopy conditions are favored, and dead oak trees can make long-lasting wildlife cavity trees. It can, however, have significant impacts to forested stands with a heavy oak component. Oak wilt was noted in a number of stands at Tenmile Creek SPA and Colburn WA, prompting timber management to halt or reduce its spread within the stands in some areas.

Game Species of the CSPPG

The following information was provided by WDNR wildlife managers

The properties in the Central Sand Plains Planning Group are managed for outdoor recreation and critical habitat protection. Popular game species on these properties currently include muskrat (*Ondatra zibethicus*) and American beaver (*Castor canadensis*) in the wetlands and waterways. Secondary wetland game species include ducks, Canada geese (*Branta canadensis*), American mink (*Neovison vison*), and river otter (*Lontra canadensis*). The uplands host white-tailed deer, wild turkey, mourning dove (*Zenaidura*

macroura), black bear (*Ursus americanus*), coyote (*Canis latrans*), ruffed grouse (*Bonasa umbellus*), eastern gray squirrel (*Sciurus carolinensis*), eastern fox squirrel (*Sciurus niger*), eastern cottontail rabbit (*Sylvilagus floridanus*), and American woodcock. Secondary game species include red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), fisher (*Martes pennanti*), bobcat (*Lynx rufus*), and short-tailed weasel (*Mustela erminea*) in uplands.

Found throughout the central Wisconsin area are gray wolves (*Canis lupus*) which are currently listed as a Federally Endangered Species. Regulated harvest did occur in Wisconsin in 2013 and 2014 but has since ceased as the gray wolf was delisted in December 2014.

The primary focus of several properties in this group including **Buena Vista, Paul J. Olson, and Leola Marsh WA** is to preserve, protect, and increase open habitat that is critical for grassland dependent species, such as state-threatened greater prairie-chickens, upland sandpipers, Henslow's sparrows, other grassland birds of greatest conservation need, and many insect species. These areas provide the habitat needed for the persistence of grassland-dependent species into the future.

Wildlife Management staff conduct terrestrial habitat projects at **Big Roche a Cri FA**, including prescribed burning and tag alder mowing. The prescribed burns occur on several small prairies to promote prairie and grassland wildlife. Dense stands of speckled alder found along the creek are mowed periodically to provide a variety of age classes to promote ruffed grouse and white-tailed deer habitat as well.

Additional comments from Natural Heritage Inventory:

Although not stocked on state properties within the Central Sand Plains, ring-necked pheasants (*Phasianus colchicus*) are present as a result of captive releases on private lands for dog training and other purposes. There is evidence that ring-necked pheasants interfere with greater prairie-chicken (and sharp-tailed grouse [*Tympanuchus phasianellus*]) courtship and nesting. In Wisconsin, pheasants have been videotaped interfering with breeding activity on sharp-tailed grouse leks at Crex Meadows Wildlife Area (Hull 2007), as well as observed interfering with prairie-chicken leks on the **Paul J. Olson WA** (Lesa Kardash, pers. com.). 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 predated 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."

Big Roche a Cri Creek is an important stream and trout fishery located in Adams and Waushara Counties. The portion of stream above Big Roche a Cri Lake (21.5 miles) is classified trout water, but most of the natural reproduction occurs in the upper two miles. Upstream of County Highway W in Adams County to the headwaters in Waushara County, the stream is Class I trout water. The stream is classified as Class II trout water upstream of Big Roche a Cri Lake to County Highway W. The stream supports both brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). Brown trout have been stocked into the lower reaches of Big Roche a Cri Creek to provide more angling opportunities for anglers, but stocking is being discontinued in 2016 to focus management on brook trout only.

In 1980, **Big Roche a Cri Creek** was the first stream in Adams County to receive trout habitat improvement work, which included installing 29 overhead structures (also called boom structures; some had to be replaced in 1999). In 2015, a habitat maintenance project was completed for the entire 1980 project site. Additionally, monitoring for adult trout occurred at this work site (a designated Index Site) in 1999, 2002, 2004, and annually since 2007.

Tenmile Creek has historically been a popular trout fishery and is the best trout fishing opportunity in Wood County. Tenmile Creek in Wood County is Class II trout waters from the mouth at the Wisconsin River to Bell Road (7.6 miles) and is Class III trout water from Bell Road to County Trunk Highway U (5.0 miles). Brook trout and brown trout inhabit the waters of Tenmile Creek, but brown trout are the primary species for management. The fisheries manager annually requests brown trout stocking, stocking occurs if the State Hatcheries can produce the fish.

Important WDNR Plans: How They Relate to the CSPPG

Wisconsin's Statewide Forest Strategy and the CSPPG

Wisconsin's Statewide Forest Assessment (WDNR 2010b) was based on Wisconsin's Forest Sustainability Framework 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 2010c) 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 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 CSPPG planning efforts in regard to opportunities to maintain or enhance biological diversity (Table 12, WDNR 2010b).

Table 12. Selection of Wisconsin Statewide Forest Strategies Relevant to the CSPPG

Strategy Number	Strategy
11	Encourage the management of under-represented forest communities.
13	Increase forest structure and diversity.
14	Encourage the use of disturbance mechanisms to maintain diverse forest communities.
15	Maintain appropriate forest types for the ecological landscape while protecting forest health and function.
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.

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).

Wildlife Action Plan Implementation

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 SGCN. The Wisconsin Wildlife Action Plan (WAP; WDNR 2015b) identifies 28 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 on CSPPG properties that lie within that landscape:

- Coolwater Streams
- Coldwater Streams
- Northern Sedge Meadow
- Alder Thicket
- Shrub-carr
- Oak Barrens
- Conifer Plantation
- Dry-mesic Prairie
- Dry Prairie
- Surrogate Grassland

A major opportunity for sustaining a natural community exists when many significant occurrences of the natural community have been recorded in the landscape or when restoration activities that maintain the community's composition, structure, and ecological function are likely to be successful over a long period of time.

The WAP also identifies 17 natural communities for which there are “Major” or “Important” opportunities for protection, restoration, or management in the **Forest Transition Ecological Landscape**. Of these, three are present at the CSPPG, and are rated as “important” within the landscape:

- Coolwater Streams
- Coldwater Streams
- Northern Sedge Meadow
- Poor Fen
- Open Bog
- Surrogate Grassland
- Tamarack (poor) Swamp
- Black Spruce Swamp

Appendix E highlights the Ecological Priorities for vertebrate SGCN at CSPPG properties. Note that these ecological priorities include all of the SGCN that may possibly occur on the CSPPG within the existing natural communities, not just those species detected during surveys. The associated natural communities contain essential biological, physical and ecological habitat elements for the associated species, which must be present in quality and quantity to sustain the species. This intersection of SGCN with priority natural communities in the Central Sand Plains and Forest Transition Ecological Landscapes represents the best opportunities for management at the CSPPG 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 CSPPG. Priority conservation actions identified in the Wisconsin Wildlife Action Plan (WDNR 2015b) that apply to the CSPPG are noted in ‘call-out’ boxes in the major theme sections above for grasslands, Oak Barrens, aquatic resources, and invasive species.

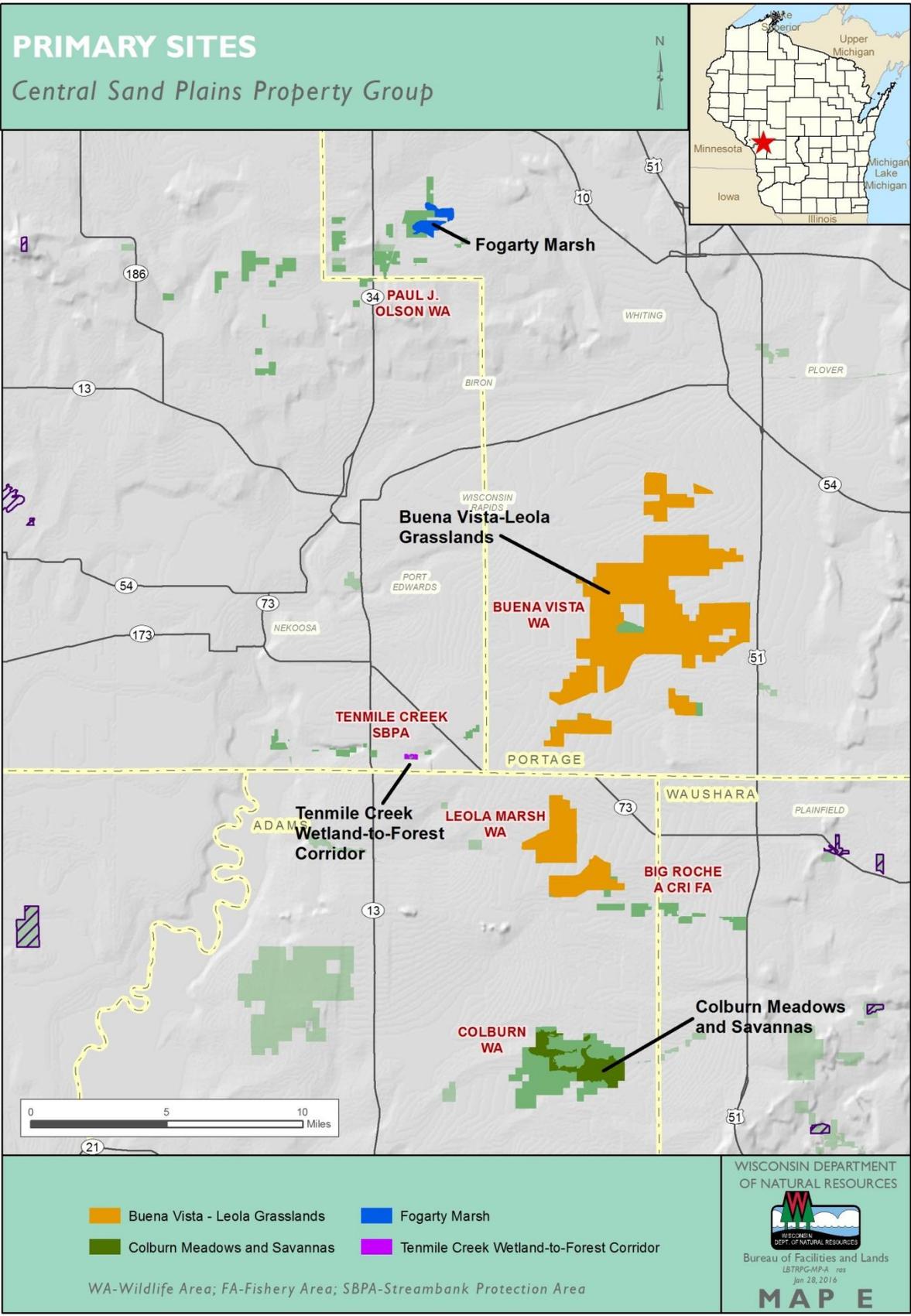
Primary Sites: Site-specific Opportunities for Biodiversity Conservation

Four ecologically important sites, or “Primary Sites,” were identified within the CSPPG (Table 13. Central Sand Plains Planning Group Primary Sites and Map E). 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 CSPPG.

Table 13. Central Sand Plains Planning Group Primary Sites

Code	Name
CSPPG01	Buena Vista – Leola Grasslands
CSPPG02	Tenmile Creek Wetland-to-Forest Corridor
CSPPG03	Colburn Meadows and Savannas
CSPPG04	Fogarty Marsh



Future Needs

This project was designed to provide a rapid assessment of the biodiversity values for the Central Sand Plains 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 CSPPG.

- Create a comprehensive invasive species inventory for each property, along with development of invasive species management plans. These plans should include a monitoring strategy for detecting and rapidly responding to new invasive threats.
- Monitor sites where sanitation cuts have been implemented to limit impact and spread of oak wilt; this may help inform future management strategies for this difficult-to-control pathogen.
- Conduct a more comprehensive assessment of wetland plants and communities of Colburn WA in areas that are remote and difficult to access.
- Consider monitoring groundwater levels and impacts of lowered levels on property streams and wetlands.
- Consider monitoring water quality, especially along Tenmile and Big Roche A Cri Creeks.
- Continue rare species monitoring (grassland birds, lepidopterans), especially in relation to the response of these species to management regimes (burning, rotational grazing, etc.).
- Additional terrestrial invertebrate inventory and monitoring (especially lepidopterans).
- Conduct breeding bird surveys at Fogarty Marsh primary site.

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.

Evapotranspiration - The sum of evaporation and plant transpiration from the Earth's land and ocean surface to the atmosphere. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and waterbodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapor through stomata in its leaves.

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) (from the “Wisconsin Wildlife Action Plan,” WDNR 2015b).

Species List

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

Common Name	Scientific Name
Plants	
American basswood	<i>Tilia americana</i>
American elm	<i>Ulmus americana</i>
American hazelnut	<i>Corylus americana</i>
aspen	<i>Populus</i> spp.
bearberry	<i>Arctostaphylos uva-ursi</i>
big bluestem	<i>Andropogon gerardii</i>
big-tooth aspen	<i>Populus grandidentata</i>
black ash	<i>Fraxinus nigra</i>
black cherry	<i>Prunus serotina</i>
black- eyed Susan	<i>Rudbeckia hirta</i>
black spruce	<i>Picea mariana</i>
blue- joint grass	<i>Calamagrostis canadensis</i>
blue vervain	<i>Verbena hastata</i>
blueberries	<i>Vaccinium</i> spp.
bog-laurel	<i>Kalmia polifolia</i>
bog-rosemary	<i>Andromeda glaucophylla</i>
bracken fern	<i>Pteridium aquilinum</i>
bur oak	<i>Quercus macrocarpa</i>
Canada bluegrass	<i>Poa compressa</i>
Canada goldenrod	<i>Solidago canadensis</i>
Canada mayflower	<i>Maianthemum canadense</i>
chokecherry	<i>Prunus virginiana</i>
common reed	<i>Phragmites australis</i>
common winterberry	<i>Ilex verticillata</i>
cottongrasses	<i>Eriophorum</i> spp.
cottonwood	<i>Populus deltoides</i>
cranberry Viburnum	<i>Viburnum trilobum</i>
early low-blueberry	<i>Vaccinium angustifolium</i>
eastern hemlock	<i>Tsuga canadensis</i>
few- seeded Sedge	<i>Carex oligosperma</i>
few-flowered Sedge	<i>Carex pauciflora</i>
flowering Spurge	<i>Euphorbia corollata</i>
goat's rue	<i>Tephrosia virginiana</i>
green ash	<i>Fraxinus pensylvanica</i>
jack pine	<i>Pinus banksiana</i>
Japanese knotweed	<i>Polygonum cuspidatum</i>
June grass	<i>Koeleria macrantha</i>
Kentucky bluegrass	<i>Poa pratensis</i>
lake sedge	<i>Carex lacustris</i>
lead-plant	<i>Amorpha canescens</i>
leatherleaf	<i>Chamaedaphne calyculata</i>
little bluestem	<i>Schizachyrium scoparium</i>

Common Name	Scientific Name
long-branch Frostweed	<i>Helianthemum canadense</i>
maples	<i>Acer</i> spp.
meadow willow	<i>Salix petiolaris</i>
nannyberry	<i>Viburnum lentago</i>
northern pin oak	<i>Quercus ellipsoidalis</i>
oaks	<i>Quercus</i> spp.
paper birch	<i>Betula papyrifera</i>
Pennsylvania sedge	<i>Carex pensylvancia</i>
pin	<i>Pinus</i> spp.
pink lady's-slipper	<i>Cypripedium acuale</i>
prairie tickseed	<i>Coreopsis palmata</i>
red maple	<i>Acer rubrum</i>
red oak	<i>Quercus rubra</i>
red-osier dogwood	<i>Cornus stolonifera</i>
reed canary grass	<i>Phalaris arundinacea</i>
rough bedstraw	<i>Galium asprellum</i>
round- headed bush-clover	<i>Lespedeza capitata</i>
sensitive fern	<i>Onoclea sensibilis</i>
silky dogwood	<i>Cornus amomum</i>
skunk cabbage	<i>Symplocarpus foetidus</i>
small cranberry	<i>Vaccinium oxycoccos</i>
smooth brome	<i>Bromus inermis</i>
speckled alder	<i>Alnus incana</i>
spotted Joe-Pye-weed	<i>Eupatorium maculatum</i>
sugar maple	<i>Acer saccharum</i>
swamp thistle	<i>Cirsium muticum</i>
swamp white oak	<i>Quercus bicolor</i>
sweet fern	<i>Comptonia peregrina</i>
tall swamp marigold	<i>Bidens coronatus</i>
tamarack	<i>Larix laricina</i>
three-leaf Solomon's plume	<i>Maianthemum trifolium</i>
timothy	<i>Phleum pratense</i>
tussock cotton-grass	<i>Eriophorum vaginatum</i>
velvet-leaf blueberry	<i>Vaccinium myrtilloides</i>
water lettuce	<i>Pistia stratiotes</i>
white meadowsweet	<i>Spiraea alba</i>
white oak	<i>Quercus alba</i>
white pine	<i>Pinus strobus</i>
wild lupine	<i>Lupinus perennis</i>
willows	<i>Salix</i> spp.
wintergreen	<i>Gaultheria procumbens</i>
wormwood	<i>Artemisia campestris</i>
Animals	
American Beaver	<i>Castor canadensis</i>
American Mink	<i>Neovison vison</i>
American Woodcock	<i>Scolopax minor</i>
Artic Shrew	<i>Sorex artcticus</i>

Common Name	Scientific Name
Black bear	<i>Ursus americanus</i>
Blanding's turtle	<i>Emydoidea blandingii</i>
bobcat	<i>Lynx rufus</i>
bobolink	<i>Dolichonyx oryzivorus</i>
brook trout	<i>Salvelinus fontinalis</i>
brown thrasher	<i>Toxostoma rufum</i>
brown trout	<i>Salmo trutta</i>
Canada goose	<i>Branta canadensis</i>
clay-colored sparrow	<i>Spizella pallida</i>
coyote	<i>Canis latrans</i>
eastern cottontail	<i>Sylvilagus floridanus</i>
eastern fox squirrel	<i>Sciurus niger</i>
eastern gray squirrel	<i>Sciurus carolinensis</i>
eastern meadowlark	<i>Sturnella magna</i>
fisher	<i>Martes pennant</i>
Franklin's ground squirrel	<i>Spermophilus franklinii</i>
gray copper	<i>Lycaena dione</i>
gray fox	<i>Urocyon cinereoargenteus</i>
gray wolf	<i>Canis lupus</i>
greater prairie-chicken	<i>Tympanuchus cupido</i>
gyrfalcon	<i>Falco rusticolus</i>
Henslow's sparrow	<i>Ammodramus henslowii</i>
Karner blue	<i>Lycaeides melissa samuelis</i>
Lapland longspur	<i>Calcarius lapponicus</i>
least weasel	<i>Mustela nivalis</i>
mourning dove	<i>Zenaida macroura</i>
muskrat	<i>Ondatra zibethicus</i>
northern harrier	<i>Circus cyaneus</i>
ovenbird	<i>Seiurus aurocapillus</i>
prairie vole	<i>Microtus ochrogaster</i>
pygmy shrew	<i>Sorex hoyi</i>
raccoon	<i>Procyon lotor</i>
red fox	<i>Vulpus vulpes</i>
regal fritillary	<i>Speyeria idalia</i>
ring-necked pheasant	<i>Phasianus colchicus</i>
river otter	<i>Lontra canadensis</i>
Rough-legged hawk	<i>Buteo lagopus</i>
ruffed grouse	<i>Bonasa umbellus</i>
savannah sparrow	<i>Passerculus sandwichensis</i>
sedge wren	<i>Cistothorus platensis</i>
sharp-tailed grouse	<i>Tympanuchus phasianellus</i>
short-eared owl	<i>Asio flammeus</i>
short-tailed weasel	<i>Mustela ermine</i>
slender glass lizard	<i>Ophisaurus attenuatus</i>
snow bunting	<i>Plectrophenix nivalis</i>
snowy owl	<i>Bubo scandiacus</i>
upland sandpiper	<i>Bartramia longicauda</i>

Common Name	Scientific Name
vesper sparrow	<i>Pooecetes gramineus</i>
water shrew	<i>Sorex palustris</i>
western harvest mouse	<i>Reithrodontomys megalotis</i>
western meadowlark	<i>Sturnella neglecta</i>
white-tailed deer	<i>Odocoileus virginianus</i>
wild turkey	<i>Meleagris gallopavo</i>
Fungi	
oak wilt	<i>Ceratocystis fagacearum</i>

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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. WDNR Natural Heritage Conservation Webpages for Animals, Plants, and Communities**
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 Natural Heritage Conservation's main source of information for species and communities. dnr.wi.gov keyword "*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 keywords "*working list*"
- 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 keywords "*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 keyword "*wildlife action plan*"
 - Wildlife Action Plan Implementation: dnr.wi.gov keywords "*wap 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 keywords "*wildlife action plan*"

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 keywords "*forest strategy*"

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 keywords "*forest assessment*"

8. **Oak Savanna State Natural Area Management Guide (Oak Opening, Oak Woodland, Oak Barrens). Chapter 100.60 of WDNR State Natural Areas Handbook.**

This management guide contains the Wisconsin Department of Natural Resources' format for addressing actions on State Natural Areas where the primary feature is oak savanna (more specifically, Oak Opening, Oak Woodland and Oak Barrens). The guide was developed in consultation with Department of Natural Resources savanna management specialists and property managers, and further supported by an analysis of peer-reviewed literature, and leads the reader through the process of developing a detailed management plan. An overview of management techniques is provided, along with pertinent regulations.

9. **Species Guidance Documents.**

Species guidance documents are peer-reviewed publications with comprehensive information for rare species tracked by the Natural Heritage Inventory or identified in the Wisconsin Wildlife Action Plan as a Species of Greatest Conservation Need (SGCN). They contain identification, life history, management guidelines, screening guidance and avoidance measures and are intended for a wide variety of users, including resource managers, private landowners, contractors, students and the general public.

dnr.wi.gov keywords "*species guidance*"

10. **Wisconsin Greater Prairie-chicken Management Plan 2004-2014 (Warmke 2015).**

Information on national and state status, management history in Wisconsin, current management approaches, and specific management goals.

dnr.wi.gov keywords "*prairie-chicken management plan*"

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.

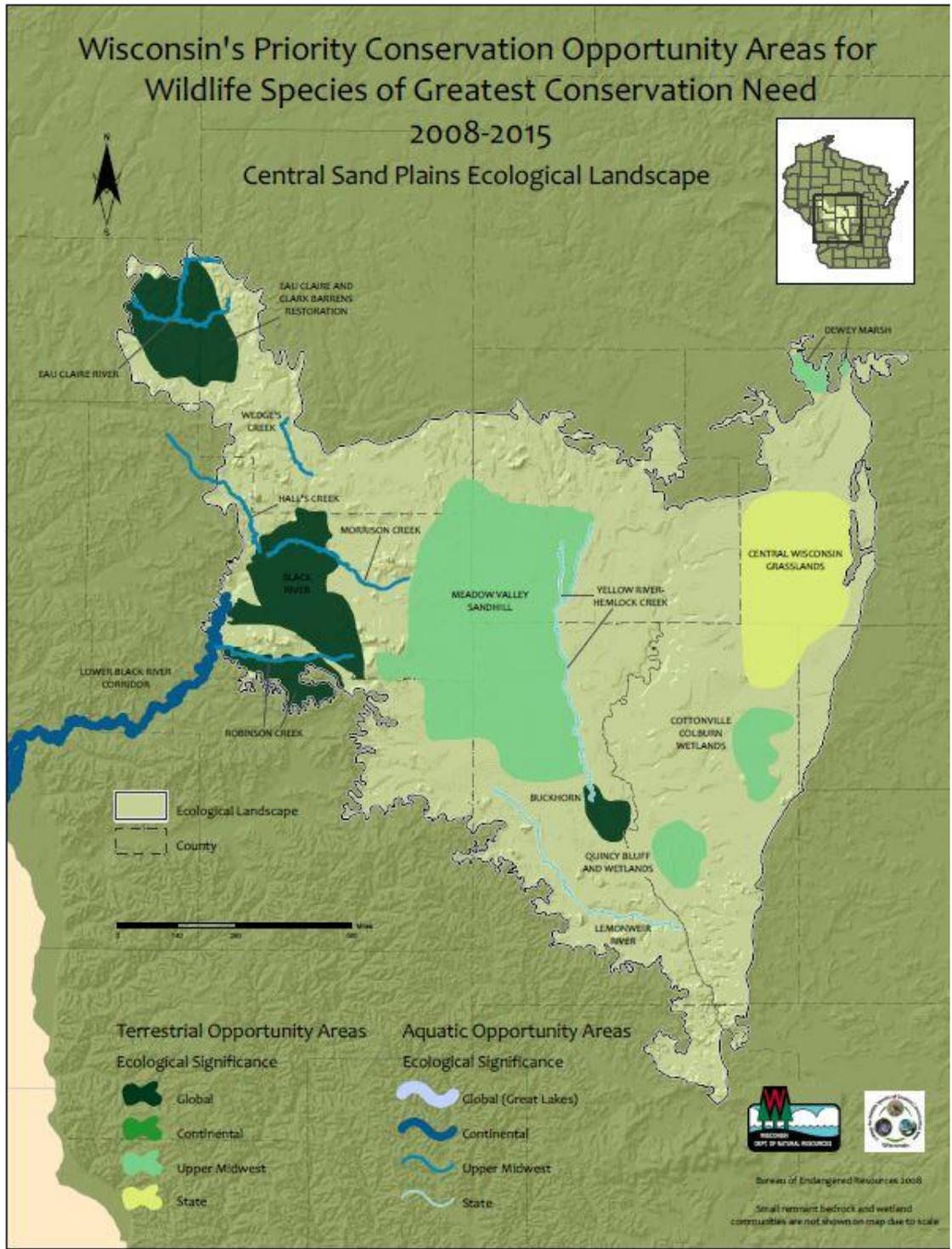
Original Land Survey Records: The surveyors who laid out the rectilinear Town-Range-Section grid across the state in the mid-nineteenth century recorded trees by species and size at all section corners and along section lines. Their notes also included general impressions of vegetation, soil fertility, 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.

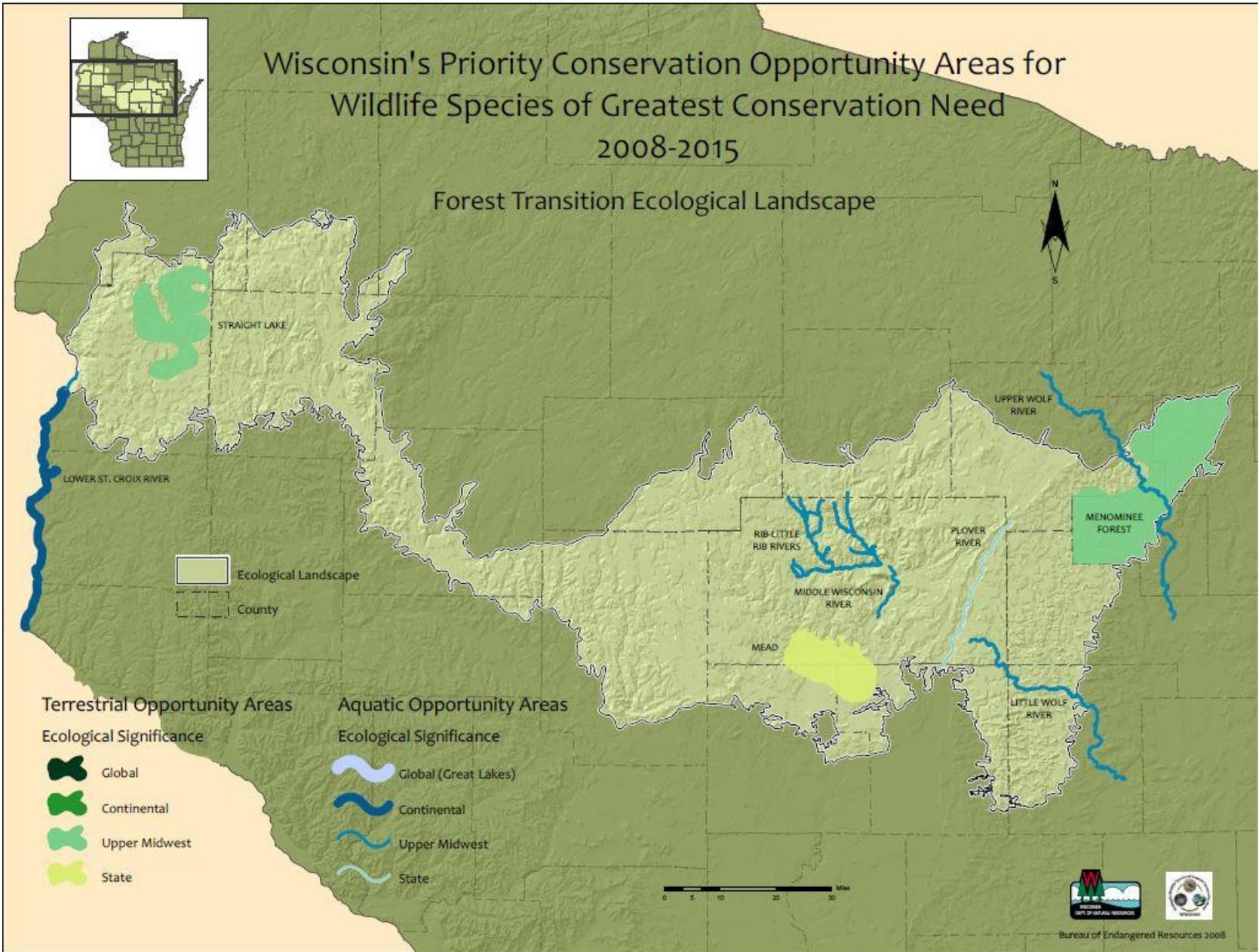
Aerial Reconnaissance: Fly-overs are desirable for large sites, and for small sites where contextual issues are especially important. When possible, this should be done both before and after ground level work. Flights are scheduled for those times when significant features of the study area are most 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



Appendix C

Rare Species and High Quality Natural Communities of the Central Sand Plains Planning Group by Property

Numerous rare species and high-quality examples of native communities have been documented within the Central Sand Plains Planning Group (CSPPG). The table below shows the rare species and high-quality natural communities currently known from the CSPPG and listed by property with the year last observed. See Appendix D for summary descriptions for the species and natural communities that occur on the CSPPG. State Rank and Listing Status is based on Wisconsin Natural Heritage Inventory (NHI) Working List updates completed in April 2016 (unpublished).

INFORMATION PERTAINING TO PLANTS AND ANIMALS

REMOVED FROM PUBLIC VERSION OF REPORT

DUE TO LOCATIONAL INFORMATION OF SENSITIVE SPECIES.

NATURAL COMMUNITY INFORMATION WAS RETAINED

(SEE BELOW)

Common Name	Scientific Name	Big Roche-a-Cri FA	Buena Vista WA	Colburn WA	Leola Marsh WA	Paul J. Olson WA	Tenmile Creek SBPA	State Status	Global Status	State Rank	Federal Status	SGCN	Tracked by NHI?
Natural Communities													
Alder Thicket	Alder thicket	2015					2015	S4	G4	NA		NA	Y
Central Sands Pine-Oak Forest	Central sands pine-oak forest						2015	S3	G3	NA		NA	Y
Northern Sedge Meadow	Northern sedge meadow			2015				S3	G4	NA		NA	Y
Oak Barrens	Oak Barrens			2015 ⁸				S2	G2?	NA		NA	Y
Open Bog	Open Bog					2015 ⁵		S4	G5	NA		NA	Y
Shrub-carr	Shrub-carr			2015				S4	G5	NA		NA	Y
Stream--Fast, Hard, Cold	Stream--fast, hard, cold	1979						SU	GNR	NA		NA	Y
Stream--Slow, Hard, Cold	Stream--slow, hard, cold						1980					NA	Y
Tamarack (poor) Swamp	Tamarack (poor) Swamp					2015 ⁵		S3	G4	NA		NA	Y

⁸ Observation did not meet requirements for mapping in NHI database.

Appendix D

Descriptions of Rare Species and High Quality Natural Communities Documented at Central Sand Plains Planning Group

The following paragraphs give brief summary descriptions for some of the rare species documented within the Central Sand Plains Planning Group 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

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, reed, and bulrushes. One to five buff-brown to olive-brown colored eggs are laid and incubated by the female for 24-28 days. The species is threatened by the degradation and destruction of wetlands from drainage, filling and conversion to agriculture.

Blanding's Turtle

Blanding's turtles (*Emydoidea blandingii*) are listed as a Threatened species in Wisconsin. They utilize a wide variety of aquatic habitats including deep and shallow marshes, shallow bays of lakes and impoundments where areas of dense emergent and submergent vegetation exists, sluggish streams, oxbows and other backwaters of rivers, drainage ditches (usually where wetlands have been drained), and sedge meadows and wet meadows adjacent to these habitats. This species is semi-terrestrial and individuals may spend a good deal of time on land. They often move between a variety of wetland types during the active season, which can extend from early March to mid-October. They overwinter in standing water that is typically more than 3 feet in deep and with a deep organic substrate but will also use both warm and cold-water streams and rivers where they can avoid freezing. Blanding's generally breed in spring, late summer or fall. Nesting occurs from about mid-May through June depending on spring temperatures. They strongly prefer to nest in sandy soils and may travel well over a mile to find suitable soils. This species appear to display nest site fidelity, returning to its natal site and then nesting in a similar location annually. Hatching occurs from early August through early September but hatchlings can successfully overwinter in the nest, emerging the following late April or May. This species takes 17 to 20 years or more to reach maturity.

Bobolink

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.

Dicksissel

Dicksissel (*Spiza americana*), a bird of Special Concern in Wisconsin. This species prefers open pasture and fields of clover and alfalfa. Grasslands, meadows, and savanna are also important nesting areas. This bird requires vegetation with medium to tall height-density and a significant component of forbs, some stiff-stemmed. Breeding occurs from late May to early August.

Eastern Meadowlark

Eastern Meadowlark (*Sturnella magna*) is a bird of Special Concern in Wisconsin. This species nests in mesic to dry grasslands of moderate to low height with few shrubs. Breeding occurs from early May to late July.

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.

Grasshopper Sparrow

Grasshopper Sparrow (*Ammodramus savannarum*), a bird listed as Special Concern, prefers prairies, retired cropland, unmowed highway right-of-ways, pastures (Kentucky bluegrass and timothy), shrub-carr wetlands, northern sedge meadows, and managed grasslands maintained for duck production. This bird will nest in areas of 5-25 cm height-density that has bare patches and a diverse structure with stiff forbs for song perches. The recommended avoidance period is from early May through mid-August.

Gray Copper

Gray Copper (*Lycaena dione*) a Special Concern butterfly. This species is found in wet areas in open grasslands, including stream edges, roadside ditches where their host plant, docks (*Rumex* spp.) grow. Adults fly from late June to mid-August with peak flight in July. Larvae feed in spring and have been noted in late April in southeastern Wisconsin.

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.

Henslow's Sparrow

Henslow's Sparrow (*Ammodramus henslowii*) a bird listed as Threatened in Wisconsin, prefers old fields, open grasslands, wet meadows, unmowed highway right-of-ways, undisturbed pastures, timothy hay fields, and fallow land grown up to tall weeds. The recommended avoidance period is from May 20 - August 15.

Karner Blue

Karner blue (*Lycaeides melissa samuelis*), butterfly listed as Federally Endangered and Special Concern in Wisconsin, has been found in pine barrens and oak savanna in close association with its larval hostplant lupine (*Lupinus perennis*). In Wisconsin, also found along utility and road right-of-ways, abandoned agricultural fields, and managed forests. This butterfly has two flight periods: adults are present from late May through late June and again from late July through late August.

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.

Loggerhead Shrike

Loggerhead Shrike (*Lanius ludovicianus*), a bird listed as Endangered in Wisconsin, prefers open country with scattered trees and shrubs (usually hawthorne and red cedar), and edge habitat such as open areas in forests. Nesting occurs from April 16 - August 15.

Northern Bobwhite

The Northern Bobwhite (*Colinus virginianus*) is a species of Special Concern in Wisconsin. A medium-sized quail, it has a small head with a round body covered by reddish-brown plumage that is spotted with many white patches on its breast. Its head is white with a black crown and eye stripe stretching to its nape. The Northern Bobwhite prefers a wide variety of vegetated habitats, particularly those at an early successional stage, like grasslands, hayfields, fallow fields, dry-mesic prairies, brushy forest edges and oak savanna. During the avoidance period from late April to late September, the females will lay, on average, 12-14 eggs in nests on the ground that are lined with grasses and other dead vegetation. Incubation is done by one or both sexes, for an average of 23 days. The Northern Bobwhite has a very high mortality rate due to low survival during severe winter weather conditions. Most individuals live less than one year, with adult females suffering from higher mortality than adult males. Loss of nesting and brood-rearing cover is also a limiting factor for this species.

Regal Fritillary

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

Red-headed Woodpecker

Red-headed Woodpecker (*Melanerpes erythrocephalus*), a bird listed as Special Concern in Wisconsin, prefers a wide variety of habitat types, including deciduous woodlands, lowland and upland habitats, and residential areas. In Wisconsin, it often occurs in oak savanna, oak barrens, and other open upland sites with scattered trees. The recommended avoidance period is May 10 to August 15.

Short-eared Owl

Short-eared Owl (*Asio flammeus*), a bird listed as Special Concern in Wisconsin, prefers large grasslands with a well-developed litter layer and significant residual vegetation, especially grasslands dominated by tall grass (> 14 in) and little to no woody vegetation. It has been categorized as an area-sensitive species that requires blocks of idle grasslands 100-250 acres or larger. The recommended avoidance period is March 20 to August 31.

Sioux (Sand) Snaketail

Sand snaketail (*Ophiogomphus smithi*), a State Special Concern dragonfly, has been found in small to medium clean, fast-flowing sandy warm streams. The flight period extends from late May through mid June.

Upland Sandpiper

Upland Sandpiper (*Bartramia longicauda*), a bird listed as Threatened, prefers grasslands with low to moderate forb cover, < 5% woody cover, moderate grass cover, moderate litter cover, and little bare ground. Dominant breeding habitats in Wisconsin include lightly grazed pastures, old fields, idle upland grasslands, barrens, and hayfields for nesting; heavily grazed pasture, hayfields, fallow fields, and row crops are used for foraging. The recommended avoidance period is from April 25 - Aug 10.

Vesper Sparrow

The Vesper Sparrow (*Poocetes gramineus*) is a Special Concern species in Wisconsin. It prefers dry, open habitats with short, sparse vegetation, some bare ground, and short to moderate shrub or tall forb cover. In Wisconsin, this includes Dry to Dry-mesic Prairie, short to medium height idle grasslands, shrubby grasslands, dry old fields, pastures, hay fields, small grain fields, weedy fence lines and roadsides, orchards, woodland edges, and shelterbelts. Nesting occurs from late April to mid-July.

Western Meadowlark

The Western Meadowlark (*Sturnella neglecta*), a Special Concern species, is medium-sized bird that is a chunkier equivalent to a robin. It is distinguishable by its bright yellow throat and breast marked by a black "V". The rest of the body is intricately patterned with a multitude of brown, black spots and stripes. The species is typically found in open landscapes like pastures and hay fields, grasslands, prairies and meadows where there is a mix of short to medium-high grasses. During the avoidance period from April 20 - August 15, nests are constructed by the females from weaving grass and shrub stems in a 7-8 inch wide depression in the soil. Five to six eggs are laid that are white with brown, rust and lavender spots. Incubation lasts 13-16 days. The Western Meadowlark has suffered from significant population decline over the past three decades, likely due to loss of habitat caused by fragmentation, land use conversion and succession from grasslands to brush or forests.

Wood Turtle

Wood turtles (*Clemmys insculpta*), a Threatened species in Wisconsin, prefer clean rivers and streams with moderate to fast flows and adjacent riparian wetlands and upland deciduous forests. This species often forages in open wet meadows or in shrub-carr habitats dominated by speckled alder. They overwinter in streams and rivers in deep holes or undercut banks where there is enough water flow to prevent freezing. This semi-terrestrial species tends to stay within about 300 meters of rivers and streams but exceptions certainly occur, especially within the driftless area of southwestern and western Wisconsin. This species becomes active in spring as soon as the ice is gone and air temperatures reach around 50 degrees in March or April. They can remain active into mid-October but have been seen breeding under the ice. Wood turtles can breed at any time of year, but primarily during the spring or fall. Nesting usually begins in late May in northern WI and early June in southern WI and continues through June. This species nests in sand or gravel, usually very close to the water, although it is known to nest along sand and gravel roads or in abandoned gravel pits some distance from water. Hatching occurs in 55-75 days (August) depending on air temperatures. This species does not overwinter in nests, unlike other WI turtles.

Rare Plants

Missouri Rock-cress

Missouri Rock-cress (*Arabis missouriensis*), a Wisconsin Special Concern plant, is found in soil pockets on acidic cliffs, as well as in pine forests on sterile sand and gravel outwash plains. Blooming occurs late May through late June; fruiting occurs late June through late July. The optimal identification period for this species is late May through late June.

Natural Communities

Alder Thicket

The alder thicket is a minerotrophic wetland community dominated by tall shrubs, especially speckled alder. Shrub associates may include red-osier dogwood, nannyberry, cranberry viburnum, wild currants, and willows. Among the characteristic herbaceous species are Canada bluejoint grass, orange jewelweed, asters, boneset, rough bedstraw, marsh fern, arrow-leaved tearthumb, and sensitive fern. This community type is sometimes a seral stage between northern sedge meadow and northern conifer swamp or northern hardwood swamp, but occurrences can be stable and persist at given locations for long periods of time. This type is common and widespread in northern and central Wisconsin, but also occurs at isolated locales in the southern part of the state. Alder thicket often occurs as a relatively stable community along streams and around lakes, but can occupy large areas formerly covered by conifer swamps that were logged during the Cutover and/or where water tables were raised. Stands of alder that originated following logging and/or wildfire will usually revert to forest, although on heavy, poorly drained soils, forest re-growth can be problematic owing to "swamping" effects.

Central Sands Pine-Oak Forest

This forest community is associated with, but not limited to, the Central Sands ecoregion. Moisture conditions vary from dry to borderline dry-mesic. Soils are coarse-textured, acid sands, on landforms that can include glacial outwash, lakeplain, old dunes, and eroded sandstone-cored ridges. The canopy co-dominants vary, but in older, relatively undisturbed stands they may include white and red pines, various oaks, and sometimes red maple, black cherry and bigtooth aspen. The depauperate understory of the drier sites is composed of a small number of vascular plants that usually include huckleberry, early blueberry, bracken fern, wood anemone, and Pennsylvania sedge. Jack pine is sometimes co-dominant on the driest sites (jack pine - black/Hill's oak-dominated stands may be split out in the future).

Northern Sedge Meadow

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

Oak Barrens

Black oak (*Quercus velutina*) is the dominant tree in this fire-adapted savanna community of xeric sites, but other oaks may also be present. Common understory species are lead plant (*Amorpha canescens*), black-eyed susan (*Rudbeckia hirta*), round-headed bush clover (*Lespedeza capitata*), goat's rue (*Tephrosia virginiana*), june grass (*Koeleria cristata*), little bluestem (*Schizachyrium scoparium*), flowering spurge (*Euphorbia corollata*), frostweed

(*Helianthemum canadense*), false Solomon's-seals (*Smilacina racemosa* and *S. stellata*), spiderwort (*Tradescantia ohioensis*), and lupine (*Lupinus perennis*). Distribution of this community is mostly in southwestern, central and west central Wisconsin.

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.

Shrub-carr

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

Coldwater Streams

Coldwater streams are best described as flowing waters with maximum summer water temperatures that are typically below 22 degrees Celsius. The watersheds of these streams are usually less than 100 square miles, and the streams exhibit mean annual flow rates of less than 50 cubic feet per second. Coldwater streams can be found statewide, but they are concentrated in southwestern and parts of central and northern Wisconsin. These communities contain relatively few fish species and are dominated by trout and sculpins. The unglaciated Driftless Area in the state's southwestern corner, exhibits a classically branched stream pattern, and sharper, more eroded terrain. The rest of the state, smoothed by glaciers, has less topographic relief, creating sinuous streams with less average elevation drop.

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 Sand Plains Planning Group Species of Greatest Conservation Need and Rare Plants

The following tables represent high priorities for conservation based on Wisconsin's Wildlife Action Plan in that they identify the intersection of Species of Greatest Conservation Need (SGCN), Natural Communities, and Ecological Landscapes (EL; Figure 1). Tables are provided for each ecological landscape that intersects the property group. The CSPPG lies within two EL (Figure 2): See Table E1 for priorities in the Central Sand Plains EL and Table E2 for priorities in the Forest Transition EL. Note that a natural community only appears in a table below if it meets two criteria: 1) It is considered to represent a major or significant conservation opportunity in that ecological landscape; and 2) It occurs on the property group within that ecological landscape. Also note that species that have been documented on the CSPPG are highlighted in yellow. The non-highlighted species could occur on the property group given the presence of available habitat, but escaped detection during surveys.

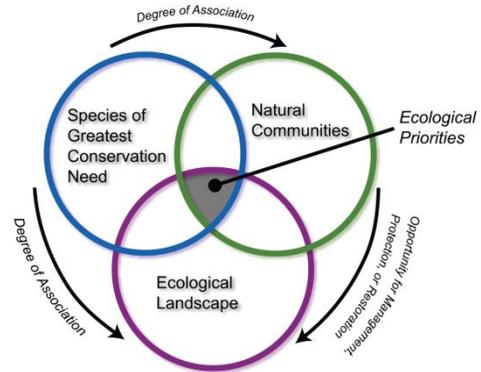


Figure 8. Identifying conservation priorities in Wisconsin's Wildlife Action Plan

Sample interpretations:

Table E1: In the Central Sand Plains Ecological Landscape (which includes all CSPPG properties except parts of Paul J. Olson WA), American Bittern is significantly associated with Northern Sedge Meadow and moderately Associated with Alder Thicket. Protecting this species and those associated community types thus represent priority conservation actions. Since it is highlighted in the table, American Bittern was detected as breeding on the property group during recent surveys.

Table E2: American Bittern is also strongly associated with the Forest Transition Ecological Landscape, although associated natural community targets are slightly different in this EL. Here, Poor Fen, Open Bog, and Northern Sedge Meadow are important conservation targets, primarily because they are the only associated habitat types present on the CSPPG within this EL (at Paul J. Olson WA [Fogarty Marsh]). Yellow Rail is also associated with the same habitat types, and is an important associate of this EL. Although it was not detected during recent surveys, this species also represents a viable and important conservation target given the presence of available habitat, thus protecting and restoring Poor Fen, Open Bog, and Northern Sedge Meadow within this ecological landscape is a high priority, and would benefit at least two SGCN.

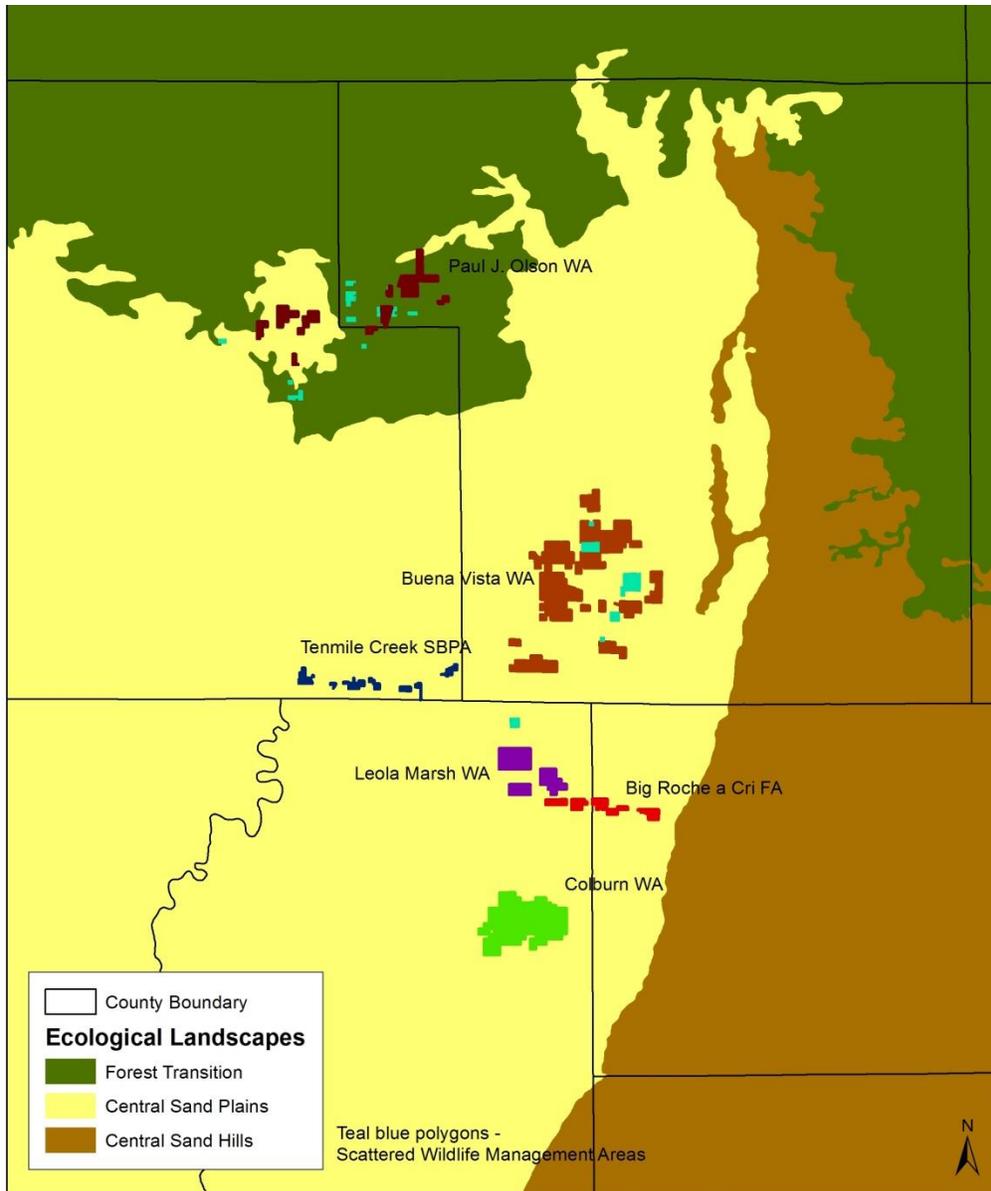


Figure 2. How Central Sand Plains Planning Group fits into Wisconsin's Ecological Landscapes

Table E14. Species of Greatest Conservation Need and Natural Community Combinations that represent high priority conservation actions in the Central Sand Plains Ecological Landscape. (S = Significantly associated, M = moderately associated.)

Common Name	Scientific Name	Coolwater streams	Coldwater streams	Northern Sedge Meadow	Alder Thicket	Shrub Carr	Oak Barrens	Conifer Plantation	Dry-mesic Prairie	Dry Prairie	Surrogate Grasslands
Birds											
American Bittern	<i>Botaurus lentiginosus</i>			S	M						
American Woodcock	<i>Scolopax minor</i>				S	S					M
Black Tern	<i>Chlidonias niger</i>			M							
Bobolink	<i>Dolichonyx oryzivorus</i>			S					S		S
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>						M		M	M	S
Common Nighthawk	<i>Chordeiles minor</i>			M			S		M	M	M
Dickcissel	<i>Spiza americana</i>								S		S
Eastern Meadowlark	<i>Sturnella magna</i>								S	M	S
Eastern whip-poor-will	<i>Antrostomus vociferus</i>						S				
Golden-winged Warbler	<i>Vermivora chrysoptera</i>				S	S					
Grasshopper Sparrow	<i>Ammodramus savannarum</i>						M		S	S	S
Greater Prairie-Chicken	<i>Tympanuchus cupido</i>			M					S	M	S
Henslow's Sparrow	<i>Ammodramus henslowii</i>								S		S
Lark Sparrow	<i>Chondestes grammacus</i>						S			M	
Le Conte's Sparrow	<i>Ammodramus leconteii</i>			S							S
Northern Goshawk	<i>Accipiter gentilis</i>							M			
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>						M				
Rusty Blackbird	<i>Euphagus carolinus</i>				M	M					
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>			M			S		M	M	M

Common Name	Scientific Name	Coolwater streams	Coldwater streams	Northern Sedge Meadow	Alder Thicket	Shrub Carr	Oak Barrens	Conifer Plantation	Dry-mesic Prairie	Dry Prairie	Surrogate Grasslands
Short-eared Owl	<i>Asio flammeus</i>			M					M	M	S
Upland Sandpiper	<i>Bartramia longicauda</i>						M		S	S	S
Vesper Sparrow	<i>Pooecetes gramineus</i>						S		M	S	
Western Meadowlark	<i>Sturnella neglecta</i>						M		S	M	S
Whooping Crane	<i>Grus americana</i>			M							
Wilson's Phalarope	<i>Phalaropus tricolor</i>			S							
Yellow Rail	<i>Coturnicops noveboracensis</i>			S							
Herptiles											
Blanding's Turtle	<i>Emydoidea blandingii</i>	M	M	M	M	M	S		M	S	M
Eastern Massasauga	<i>Sistrurus catenatus catenatus</i>				S	S	S		S	M	S
Four-toed Salamander	<i>Hemidactylium scutatum</i>	M	M	M	S	S					
Gophersnake	<i>Pituophis catenifer</i>						S		S	S	M
North American Racer	<i>Coluber constrictor</i>						M		M	S	M
Slender Glass Lizard	<i>Ophisaurus attenuatus</i>						S		S	S	M
Wood Turtle	<i>Glyptemys insculpta</i>	S	S	M	S	S	S		M	S	M
Mammals											
Big Brown Bat	<i>Eptesicus fuscus</i>	M	M								M
Franklin's Ground Squirrel	<i>Spermophilus franklinii</i>						S		S		M
Little Brown Bat	<i>Myotis lucifugus</i>	S	S	S		M					
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	S	S	M	M	M	M				
Prairie Deer Mouse	<i>Peromyscus maniculatus bairdii</i>						M		M	M	M
Prairie Vole	<i>Microtus ochrogaster</i>						M			M	
Silver-haired Bat	<i>Lasiorycteris noctivagans</i>	S	S	M	M	M					

Common Name	Scientific Name	Coolwater streams	Coldwater streams	Northern Sedge Meadow	Alder Thicket	Shrub Carr	Oak Barrens	Conifer Plantation	Dry-mesic Prairie	Dry Prairie	Surrogate Grasslands
Water Shrew	<i>Sorex palustris</i>	S	S		M						
Invertebrates											
A Predaceous Diving Beetle	<i>Agabus leptapsis</i>				M						
A Predaceous Diving Beetle	<i>Lioporeus triangularis</i>	M									
Clamp-tipped Emerald	<i>Somatochlora tenebrosa</i>	S	M								
Ghost Tiger Beetle	<i>Ellipsoptera lepida</i>						S				
Sioux (Sand) Snaketail	<i>Ophiogomphus smithi</i>	S									
A Leaf Beetle	<i>Distigmoptera impennata</i>						S				
A Leaf Beetle	<i>Pachybrachis luridus</i>						M				
A Leafhopper	<i>Driotura robusta</i>								M	S	
A Leafhopper	<i>Paraphlepsius altus</i>								S	S	
A Leafhopper	<i>Paraphlepsius maculosus</i>						S		S	S	
Ash-brown Grasshopper	<i>Trachyrhachys kiowa</i>						M				
Blue-legged Grasshopper	<i>Melanoplus flavidus</i>						M				
Doll's Merolonche	<i>Acronicta dolli</i>						S				
Dusted Skipper	<i>Atrytonopsis hianna</i>						M			M	
Frosted Elfin	<i>Callophrys irus</i>						S				
Gladston's Spur-throat Grasshopper	<i>Melanoplus gladstoni</i>								M	M	
Huckleberry Spur-throat Grasshopper	<i>Melanoplus fasciatus</i>						M				
Karner Blue	<i>Lycaeides melissa samuelis</i>						S				
Persius Dusky Wing	<i>Erynnis persius</i>						S				

Common Name	Scientific Name	Coolwater streams	Coldwater streams	Northern Sedge Meadow	Alder Thicket	Shrub Carr	Oak Barrens	Conifer Plantation	Dry-mesic Prairie	Dry Prairie	Surrogate Grasslands
Phlox Moth	<i>Schinia indiana</i>						S		S		
Prairie Leafhopper	<i>Polyamia dilata</i>						M		S	S	
Red-tailed Prairie Leafhopper	<i>Aflexia rubranura</i>								S	S	
Regal Fritillary	<i>Speyeria idalia</i>								M		M
Speckled Rangeland Grasshopper	<i>Arphia conspersa</i>						M		M	M	
Spotted-winged Grasshopper	<i>Orphulella pelidna</i>			M					M	S	
Sprague's Pygarcia	<i>Pygarcia spraguei</i>						M				
Stone's Locust	<i>Melanoplus stonei</i>						S				
Plants											
Arrow-headed Rattle-box	<i>Crotalaria sagittalis</i>									S	
Azure Bluets	<i>Houstonia caerulea</i>								M	S	
Bog Bluegrass	<i>Poa paludigena</i>					M					
Brittle Prickly-pear	<i>Opuntia fragilis</i>						M				
Canada Mountain-ricegrass	<i>Piptatherum canadense</i>						M				
Capitate Spike-rush	<i>Eleocharis flavescens var. olivacea</i>			M							
Catfoot	<i>Pseudognaphalium micradenium</i>						M				
Dwarf Milkweed	<i>Asclepias ovalifolia</i>						S				
Field Dodder	<i>Cuscuta pentagona</i>								S		
Georgia Bulrush	<i>Scirpus georgianus</i>			M							
Grassleaf Rush	<i>Juncus marginatus</i>						M				

Common Name	Scientific Name	Coolwater streams	Coldwater streams	Northern Sedge Meadow	Alder Thicket	Shrub Carr	Oak Barrens	Conifer Plantation	Dry-mesic Prairie	Dry Prairie	Surrogate Grasslands
Hairy Beardtongue	<i>Penstemon hirsutus</i>								S	S	
Pale Green Orchid	<i>Platanthera flava</i> var. <i>herbiola</i>			M							
Prairie Fame-flower	<i>Phemeranthus rugospermus</i>						M				
Sand Violet	<i>Viola sagittata</i> var. <i>ovata</i>						S				
Shrubby St. John's-wort	<i>Hypericum prolificum</i>								M	M	
Small-flowered Woolly Bean	<i>Strophostyles leiosperma</i>									S	
Toothcup	<i>Rotala ramosior</i>			S							
Torrey's Bulrush	<i>Schoenoplectus torreyi</i>			M							
Twining Screwstem	<i>Bartonia paniculata</i>			M							

Table E2. Species of Greatest Conservation Need and Natural Community Combinations that represent high priority conservation actions in the Forest Transition Ecological Landscape. (S = Significantly associated, M = moderately associated.)

Common Name	Scientific Name	Coolwater streams	Coldwater streams	Poor Fen	Open Bog	Northern Sedge Meadow	Tamarack (poor) Swamp	Black Spruce Swamp	Surrogate Grasslands
Birds									
American Bittern	<i>Botaurus lentiginosus</i>			S	S	S			
American Woodcock	<i>Scolopax minor</i>								M
Black Tern	<i>Chlidonias niger</i>					M			
Bobolink	<i>Dolichonyx oryzivorus</i>			M		S			S
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>								S
Dickcissel	<i>Spiza americana</i>								S
Eastern Meadowlark	<i>Sturnella magna</i>								S
Golden-winged Warbler	<i>Vermivora chrysoptera</i>						M		
Grasshopper Sparrow	<i>Ammodramus savannarum</i>								S
Greater Prairie-Chicken	<i>Tympanuchus cupido</i>					M			S
Henslow's Sparrow	<i>Ammodramus henslowii</i>								S
Le Conte's Sparrow	<i>Ammodramus leconteii</i>					S			S
Rusty Blackbird	<i>Euphagus carolinus</i>			M	M				
Upland Sandpiper	<i>Bartramia longicauda</i>								S
Western Meadowlark	<i>Sturnella neglecta</i>								S
Yellow Rail	<i>Coturnicops noveboracensis</i>			S	S	S			
Herptiles									
Blanding's Turtle	<i>Emydoidea blandingii</i>	M	M			M			M
Four-toed Salamander	<i>Hemidactylium scutatum</i>	M	M	S	S	M	M	M	

Common Name	Scientific Name	Coolwater streams	Coldwater streams	Poor Fen	Open Bog	Northern Sedge Meadow	Tamarack (poor) Swamp	Black Spruce Swamp	Surrogate Grasslands
Wood Turtle	<i>Glyptemys insculpta</i>	S	S			M	M	M	M
Aquatic Invertebrates									
A Fingernet Caddisfly	<i>Wormaldia moesta</i>	M	M						
A Flat-headed Mayfly	<i>Maccaffertium pulchellum</i>	M							
A Giant Casemaker Caddisfly	<i>Banksiola dossuaria</i>				M				
A Non-biting Midge	<i>Pseudodiamesa pertinax</i>		M						
A Predaceous Diving Beetle	<i>Agabus discolor</i>							S	
A Predaceous Diving Beetle	<i>Ilybius confusus</i>	M							
A Predaceous Diving Beetle	<i>Lioporeus triangularis</i>	M							
A Small Minnow Mayfly	<i>Plauditus cestus</i>	M							
American Sand Burrowing Mayfly	<i>Dolania americana</i>	M							
Elktoe	<i>Alasmidonta marginata</i>	M							
Ellipse	<i>Venustaconcha ellipsiformis</i>	M							
Sioux (Sand) Snaketail	<i>Ophiogomphus smithi</i>	S							
Terrestrial Invertebrates									
Cantrall's Bog Beetle	<i>Liodessus cantralli</i>			M					
Crackling Forest Grasshopper	<i>Trimerotropis verruculata</i>				M				
Mammals									
Big Brown Bat	<i>Eptesicus fuscus</i>	M	M						M
Franklin's Ground Squirrel	<i>Spermophilus franklinii</i>								M
Little Brown Bat	<i>Myotis lucifugus</i>	S	S	M	M	S	S	S	
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>						S	S	
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	S	S	M	M	M			

Common Name	Scientific Name	Coolwater streams	Coldwater streams	Poor Fen	Open Bog	Northern Sedge Meadow	Tamarack (poor) Swamp	Black Spruce Swamp	Surrogate Grasslands
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	S	S	M	M	M	M	M	
Water Shrew	<i>Sorex palustris</i>	S	S				S	S	
Woodland Jumping Mouse	<i>Napaeozapus insignis</i>							M	
Plants									
Autumnal Water-starwort	<i>Callitriche hermaphroditica</i>	M							
Georgia Bulrush	<i>Scirpus georgianus</i>					M			
Marsh Valerian	<i>Valeriana uliginosa</i>						S		
Pale Bulrush	<i>Scirpus pallidus</i>	M							
Round-leaved Orchis	<i>Amerorchis rotundifolia</i>						M		
Slender Pondweed	<i>Stuckenia filiformis ssp occidentalis</i>	S							
Torrey's Bulrush	<i>Schoenoplectus torreyi</i>					M			

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).

Appendix G

Primary Sites within the Central Sand Plains Planning Group

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

Information provided in the summary paragraphs includes location information, a site map, a brief summary of the natural features present, important plant and animal species, the site’s ecological significance, and management considerations. For a table of rare species and natural communities associated with each Primary Site, please see Appendix H.

Primary Sites

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CSP01. Buena Vista – Leola Grasslands

Location

Properties:	Buena Vista Wildlife Area, Leola Marsh Wildlife Area, Scattered Wildlife Habitat Areas
Counties:	Portage, Adams
Landtype Association:	222Ra03. Glacial Lake Wisconsin Sand Plain. 222Ra05. Glacial Lake Wisconsin Bogs. 222Ra08. Plover-Hancock Outwash Plain
Approximate Size:	19,708 acres
Ownership:	WDNR, Dane County Conservation League, Private

Description of Site

This area was formerly wetlands dominated by tamarack (*Larix laricina*), black spruce (*Picea mariana*) and cattails (*Typha* spp). In the early 1900's, it was drained for agricultural purposes. In the mid 1950's, a successful partnership between the WDNR, Dane County Conservation League and Society of Tympanuchus Cupido Pinnatus was created to purchase land specifically for management of grassland habitat for the greater prairie-chicken (*Tympanuchus cupido*; a state-threatened species in Wisconsin) and other grassland dependent species in the “Buena Vista Marsh” landscape. Today, the WDNR owns more than half of the area within the primary site, while approximately one-quarter is owned each by Dane County Conservation League and private landowners.



Figure 9. Buena Vista Prairie Chicken Meadow SNA. Photo by Aaron Carlson.

Buena Vista – Leola Grasslands are fairly level with shallow depressions and low rises, and are primarily covered by non-native grasses, including smooth brome (*Bromus inermis*), quackgrass (*Elytrigia repens*), Kentucky bluegrass (*Poa pratensis*), reed canary grass (*Phalaris arundinacea*), and timothy (*Phleum pratense*). Low rises can support both non-native grasses along with native prairie species, mostly little bluestem. Owen’s Rock is a small, isolated sandstone outcrop in Leola Wildlife Area with 20- to 50-foot-high dry cliffs with lichens, mosses, and sparse vegetation. Pastures on private lands contribute to the functionality of this grassland landscape as wildlife habitat.

Two State Natural Areas (SNAs) are embedded within Buena Vista WA and, by extension, this primary site. Buena Vista Quarry Prairie SNA contains one of the least disturbed tracts within the Wildlife Area, while Buena Vista Prairie Chicken Meadow SNA contains a pesticide-free tract that was studied extensively by Frederick and Frances Hamerstrom, pioneering wildlife biologists that were instrumental in initiating greater prairie-chicken conservation in the region.

Significance of Site

This primary site contains high numbers of grassland bird Species of Greatest Conservation Need (SGCN; WDNR 2006b). The CSPPG grasslands are also important to a number of bird species from the Arctic that visit this region of Wisconsin during winter.

The large grassland patches within the planning group provide critical habitat for numerous small mammals, and in turn, the small mammal community delivers many ecological benefits to the grassland ecosystem. Grasslands also provide habitat for numerous lepidopterans, some of which are rare.

A rare plant is also found on this site that is associated with soil pockets on acidic cliffs, as well as on sterile sand and gravel outwash plains.

The site also holds statewide significance as a conservation area, with numerous special designations:

- Within the Central Wisconsin Grassland Conservation Opportunity Area (WDNR 2006b), which holds statewide significance for extensive grassland communities, and for supporting rare and declining birds as well as the regal fritillary butterfly.
- Within the WDNR Central Wisconsin Grassland Conservation Area (Figure 4), which also includes Paul J. Olson and George W. Mead Wildlife Areas. The WDNR proposes to protect, primarily through acquisition and easements, up to 15,000 acres of additional grassland habitat.
- The “Buena Vista/Leola State Wildlife Areas” Important Bird Area represents one of the best opportunities in the state for large-scale grassland management (WDNR 2007).

Management Considerations

In general, management for grassland birds also benefits small mammals, as these species key into habitat structure rather than plant community composition. Lepidopterans, however, evolve with specific host plants, which can vary between larvae and adults. Protecting and promoting large open landscapes and rotating management spatially and temporally using a variety of management techniques (e.g., timber harvest, prescribed fire, mowing, grazing, and herbicide application) can benefit the greatest number of species and taxa groups by creating a variety of habitat structures. One rare bird species in particular, for example, requires large blocks of habitats with different vegetation heights and densities during the breeding season: small areas of shortgrass for booming grounds, tall dense cover for nesting, and moderate height and density for brood-rearing. The key is to limit negative impacts associated with habitat fragmentation by maintaining large blocks of similar habitat while still providing diverse habitat structures -- this type of balance is possible only in exceptionally large landscapes such as Buena Vista-Leola Grasslands.

Managing from a landscape-scale perspective can better accommodate the complex habitat needs of a greater number and variety of grassland birds and other grassland obligate species. Continued expansion and connection of prairies, wetlands, fallow fields, pastures, and surrogate grasslands on CSPPG properties can provide grassland bird habitat at a landscape scale. Opportunities may also be present to improve habitat for lepidopterans where their host plants are present or where host plants could be planted in suitable habitat. For more detailed information on management of grassland landscapes, please see “Grassland Management” in the Rapid Ecological Assessment for the CSPPG, pages 32-35. Also make reference to the Wisconsin Greater Prairie-chicken Management Plan 2004-2014 (Warmke 2015).

A large number of non-native invasive species are present on this primary site, including butter-and-eggs (*Linaria vulgaris*), Canada thistle (*Cirsium arvense*), common St. John's-wort (*Hypericum perforatum*), cypress spurge (*Euphorbia cyparissias*), orange hawkweed (*Hieracium aurantiacum*), Phragmites (*Phragmites australis*), quackgrass (*Elytrigia repens*), reed canary grass (*Phalaris arundinacea*), smooth brome (*Bromus inermis*), spotted knapweed (*Centaurea biebersteinii*). While control is not likely to be feasible on such a large landscape, managers may consider the value of mapping out the most problematic invasives, setting goals such as limiting spread and containment, and implementing an “Early Detection Rapid Response” approach for new invasives.

The primary goal for both the Buena Vista Quarry Prairie SNA and Buena Vista Prairie Chicken Meadow SNA is to manage them as rare animal conservation areas. Management focuses on keeping the sites in a mostly open condition. Opportunities for research and education can be provided on a portion of the chicken habitat. The grassland habitat is kept open via prescribed fire, mowing and grazing. Other allowable activities include control of invasive plants and access to view Prairie-Chicken mating rituals.

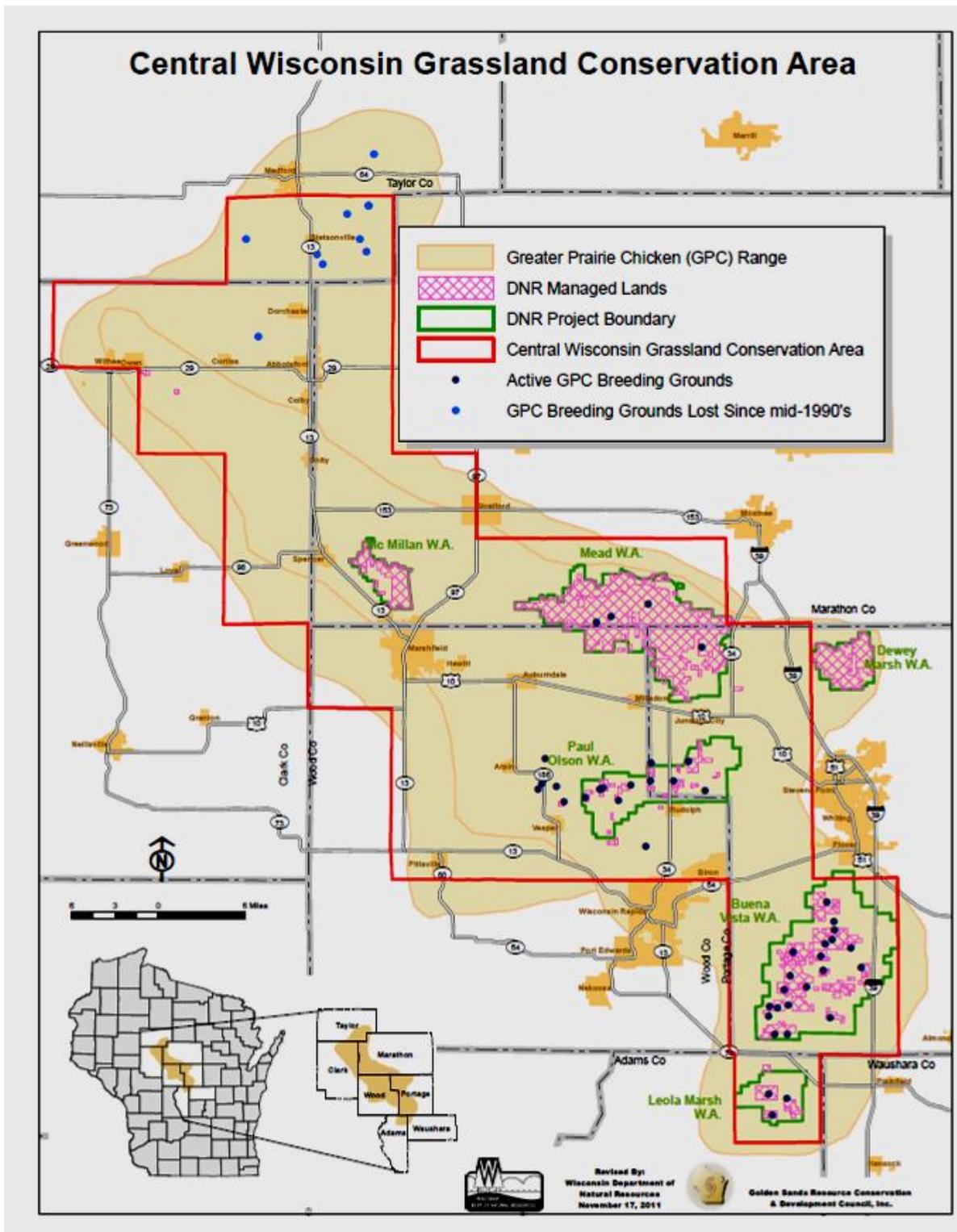
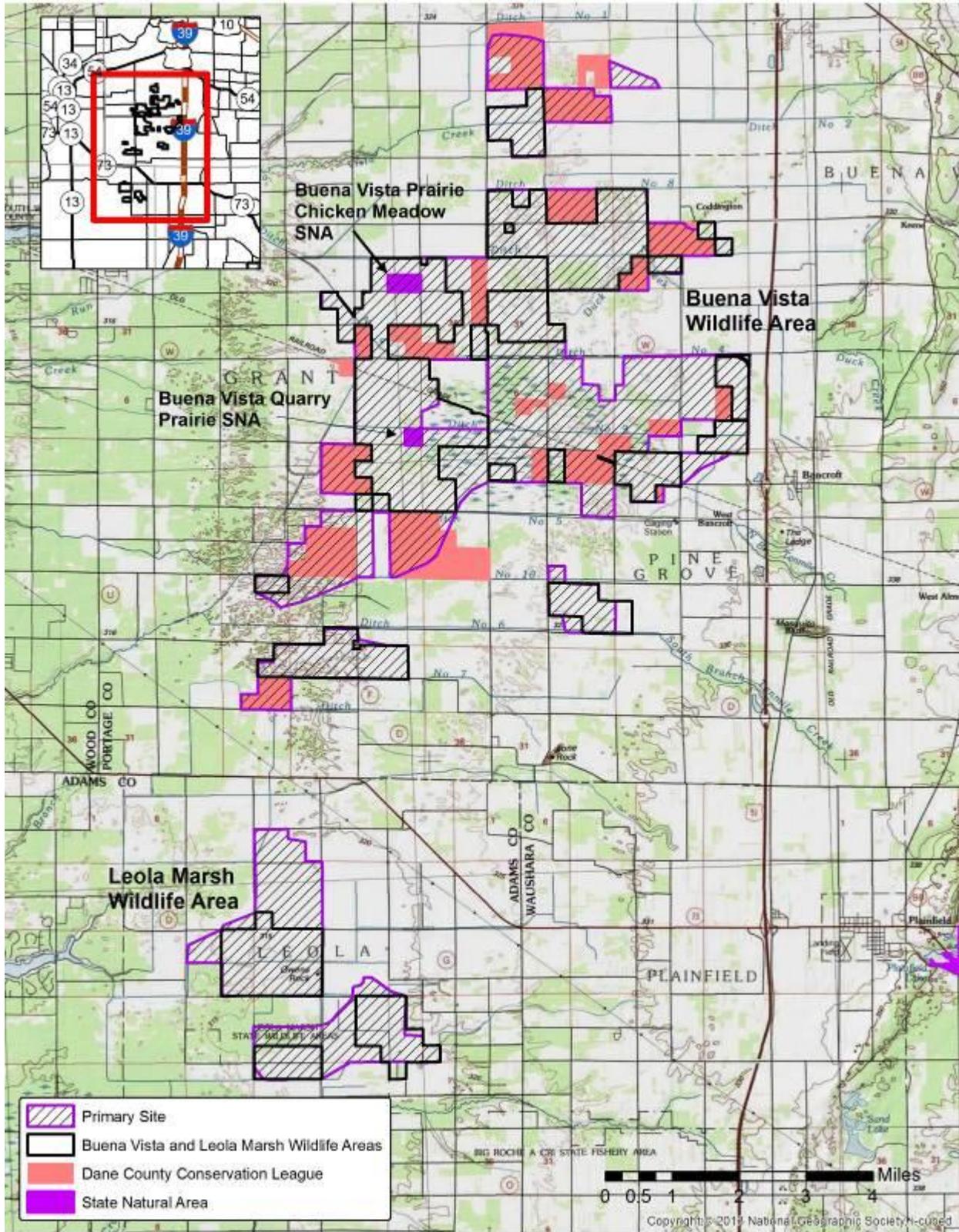


Figure 10. Central Wisconsin Grassland Conservation Area.



CSP01. Buena Vista – Leola Grasslands, Buena Vista Quarry Prairie State Natural Area, and Buena Vista Prairie Chicken Meadow State Natural Area Primary Sites.

CSP02. TENMILE CREEK WETLAND-TO-FOREST CORRIDOR

Location

Property:	Tenmile Creek Streambank Protection Area
County:	Adams
Landtype Association:	222Ra07. Wisconsin River Outwash Terraces.
Approximate Size:	48 acres
Ownership:	WDNR

Description of Site

Tenmile Creek is a clear, cold, sand-bottomed stream. The slopes bordering the narrow floodplain support Central Sands Pine-Oak Forest, Oak Barrens and pine plantations. An Alder Thicket with high floral diversity lies along Tenmile Creek. The Alder Thicket shrub layer is dominated by speckled alder (*Alnus incana*), common winterberry (*Ilex verticillata*), and chokecherry (*Prunus virginiana*), which creates 70-80% cover. The ground layer is exceptionally diverse (over 67 species), and can be partially attributed to the influence of active spring seeps on the upper banks, oxbow ponds, and floodplain scours; the dominant herbs are skunk cabbage (*Symplocarpus foetidus*) and rough bedstraw (*Galium asprellum*).

Central Sands Pine-Oak Forest occupies slopes and terraces above the creek (Figure 4), and has 60-75% canopy cover created by 9-12" dbh black oak (*Quercus velutina*; up to 24"), and small amounts of 5-9" red maple (*Acer rubrum*), jack pine (*Pinus banksiana*), black cherry (*Prunus serotina*), white oak (*Quercus alba*), and burr oak (*Q. macrocarpa*). Large (15-30") white pines (*Pinus strobus*) dominate the terraces and slopes closer to the creek, but are also scattered throughout the higher areas, and create a moderate supercanopy. Shrub cover is sparse, with occasional American hazelnut (*Corylus americana*). While the consistent dominant ground layer species is Pennsylvania sedge (*Carex pensylvanica*), the ground flora is variable, capturing the full continuum from barrens associates such as little bluestem (*Schizachyrium scoparium*), prairie tickseed (*Coreopsis palmata*), bracken fern (*Pteridium aquilinum*), and early low blueberry (*Vaccinium angustifolium*) to forest associates such as Canada mayflower (*Maianthemum canadense*), starflower (*Trientalis borealis*), and wintergreen (*Gaultheria procumbens*). Characteristic birds of the upland forest include brown thrasher (*Toxostoma rufum*), yellow-bellied sapsucker (*Sphyrapicus varius*), pileated woodpecker (*Dryocopus pileatus*), and eastern towhee (*Pipilo erythrophthalmus*).

Significance of Site

This site is small but harbors good-quality examples of stream corridor natural communities that are now rare within the region. This combination of stream, wetland and upland communities is especially important for species that live in aquatic or wetland habitats for much of the year but need semi-open upland areas nearby to complete critical parts of their life cycles (for example, turtle nesting). Retaining and restoring connectivity of forests (or Oak Barrens), wetlands and streams is thus an important conservation action.

Birds such as a certain Special Concern warbler are known to breed in the region. While they nest in shrub-dominated wetlands or other brushy habitats, fledglings will seek shelter in mature forest nearby – this site provides just such conditions.

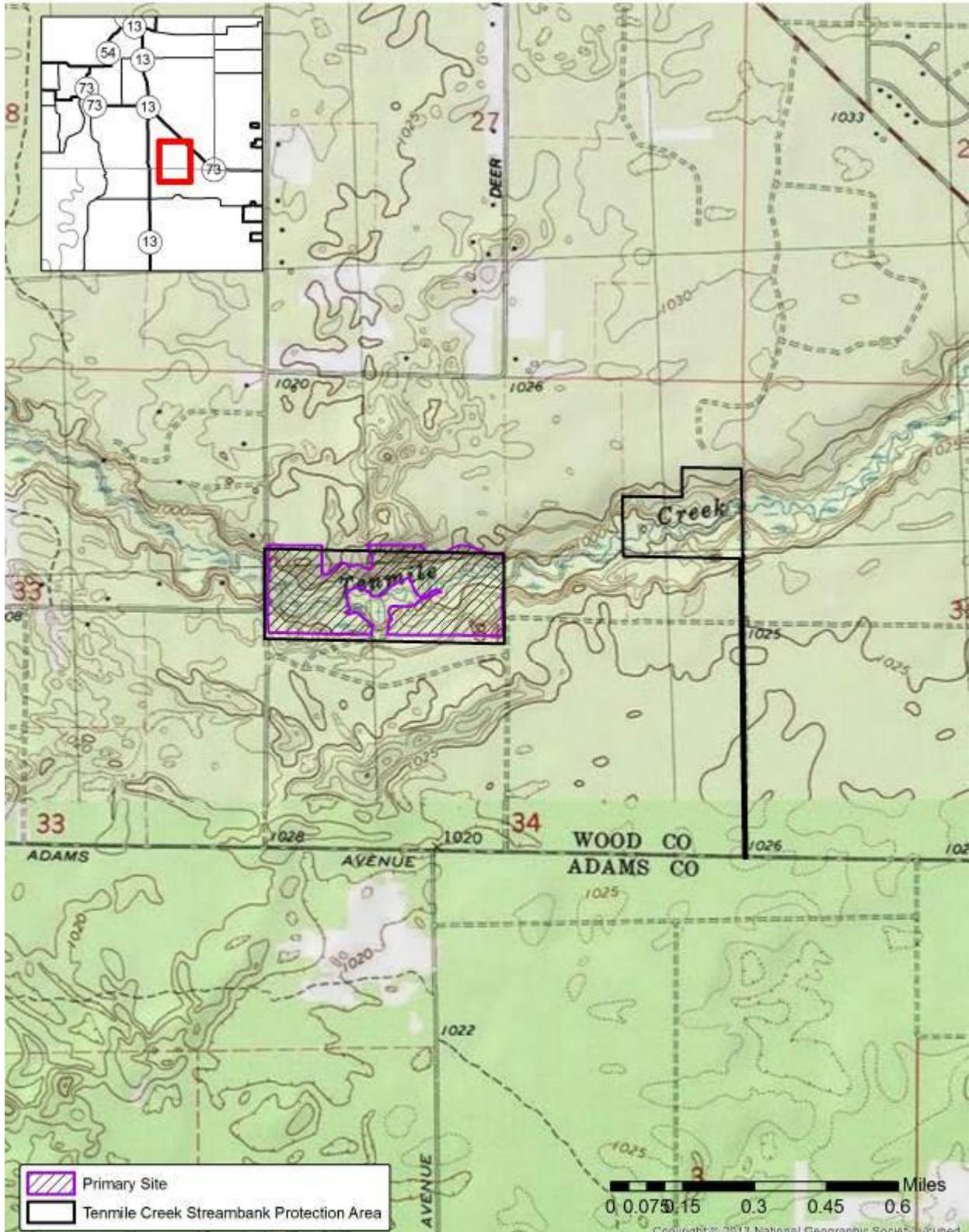
Wetlands are vital for helping to conserve the aquifer of the Central Sands region. They serve to slow the release of water during storms (thus minimizing flooding), filter nutrients and pollutants that are carried in runoff, and provide moisture banks during low water periods or droughts. Tenmile Creek provides important habitat for rare aquatic invertebrates, emphasizing the importance of sites like this in protecting the streambed and water quality.

Management Considerations

Oak wilt (*Ceratocystis fagacearum*) is posing a significant threat to this block of forest, with many dead black oak trees already present. A sanitation cut is planned for 2016 to address the oak wilt at this site. Glossy buckthorn (*Rhamnus frangula*) and Eurasian bush-honeysuckle (*Lonicera* spp.) are also scattered throughout the forest and the part of the Alder Thicket within the primary site; a large patch of glossy buckthorn has also invaded the interior of the Alder Thicket (not included in primary site boundary). Butter-and-eggs grows in a large patch in an open barrens-like area north of the creek. Spotted knapweed (*Centaurea biebersteinii*) occurs at the open edges of the property, and could invade more open areas of forest.



Figure 11. View from north side of Tenmile Creek looking south, with Alder Thicket spanning the stream below and Central Sands Pine-Oak Forest in adjacent uplands on both sides of stream. Photo by Amy Staffen.



CSP02. Tenmile Creek Wetland-to-Forest Corridor Primary Site.

CSP03. COLBURN MEADOWS AND SAVANNAS.

Location

Property:	Colburn Wildlife Area
County:	Adams
Landtype Association:	222Ra05. Glacial Lake Wisconsin Bogs.
Approximate Size:	1,614 acres
Ownership:	WDNR

Description of Site

Colburn Meadows and Savannas consists of extensive tracts of good- to fair-quality Northern Sedge Meadow and Shrub-carr. Oak Barrens can be found on islands and linear terraces scattered throughout the core wetland complex, while Oak Opening/Woodland lies in the western part of the site. Carter Creek, a hard, cold-water stream, passes through the middle of the property from east to west. These microsites are found within the larger Colburn Wildlife Area, an almost 5,000-acre complex with roughly equal parts of open wetland and forest/savanna. For a map showing locations of the various natural communities of this site, see Figure 6 in the Rapid Ecological Assessment for the CSPPG.

Approximately 300 acres of fair- to good-quality Northern Sedge Meadow occur in the eastern part of the site, and about 180 acres of fair-quality sedge meadow lie in the northwestern part of the site. Lake sedge (*Carex lacustris*) and blue-joint grass (*Calamagrostis canadensis*) create a matrix for at least 38 other herbaceous species, including marsh bellflower (*Campanula aparinoides*), tussock sedge (*Carex stricta*), spotted Joe-Pye-weed (*Eupatorium maculatum*), orange jewel-weed (*Impatiens capensis*), swamp loosestrife (*Lysimachia thyrsiflora*), sensitive fern (*Onoclea sensibilis*), and marsh skullcap (*Scutellaria galericulata*). Characteristic birds of the sedge meadow habitat areas include Wilson's snipe (*Gallinago gallinago*), sandhill crane (*Grus canadensis*), swamp sparrow (*Melospiza georgiana*), and sedge wren (*Cistothorus platensis*). Over 900 acres of Shrub-carr also occupy the site, with the largest block lying to the southeast; alder and willow are the dominant shrubs here.

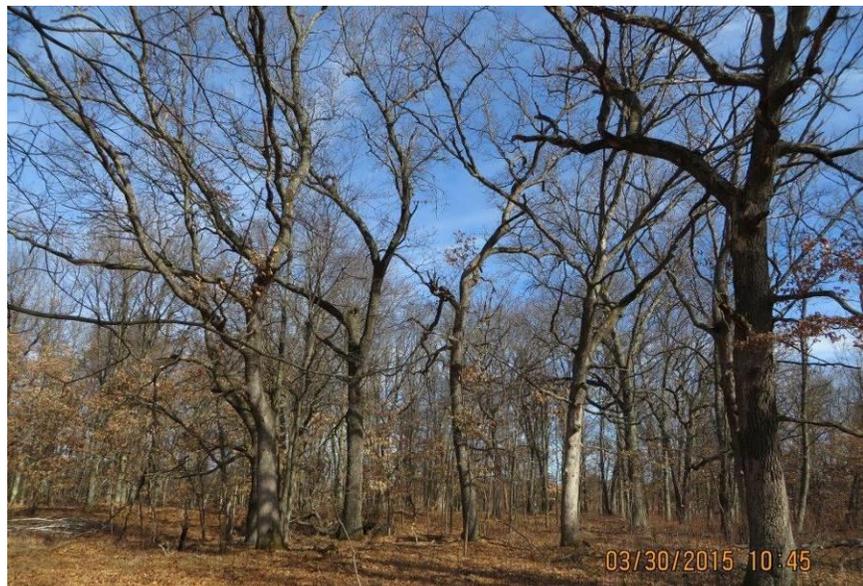


Figure 12. Oak Barrens at Colburn Meadows and Savannas Primary Site.
Photo by Richard Staffen.

Four Oak Barrens areas have been identified on sandy, linear ridges (presumably old beach ridges). Large black oaks preside over prairie grasses and forbs such as big bluestem (*Andropogon gerardii*), little

bluestem, bracken fern, wild lupine (*Lupinus perennis*), long-leaved bluets (*Houstonia longifolia*), and hoary puccoon (*Lithospermum canescens*). Non-native Kentucky bluegrass is also abundant here.

Scattered shrubs that grow here include American hazelnut, blueberries (*Vaccinium* spp.), and huckleberry (*Gaylussacia baccata*).

A roughly 100-acre area in the west-central part of the primary site occupies a sandy ridge, and is characterized by scattered groves of large (up to 24" dbh) open-grown white oaks intermixed with smaller black oak, white oak, red maple, and quaking aspen (*Populus tremuloides*). A grove of 30" dbh white pines lies in the eastern part of this ridge. Barrens vegetation underlies the mostly moderate tree canopy here, and includes blueberries, bracken fern, and Pennsylvania sedge. This represents the largest area with Oak Barrens restoration potential on the primary site.

Significance of Site

Colburn Wildlife Area lies within the Colburn-Richfield Wetlands Land Legacy Site (WDNR 2006a) a very large and diverse wetland complex that contains large areas of sedge meadow with Oak Barrens on associated dry ridges. Oak Barrens historically occupied approximately 1.8 million acres in Wisconsin prior to European settlement (Henderson, pers. comm.), but are now reduced to approximately 95,000 acres (Hoffman 2009; includes both Pine and Oak Barrens). This combination of stream, wetland and upland communities is especially important for species that live in aquatic or wetland habitats for much of the year but need semi-open upland areas nearby to complete critical parts of their life cycles (for example, turtle nesting). The Oak Barrens habitat at this site is also vital for rare or declining lepidopterans and birds. A different suite of birds utilize the large expanses of sedge meadow habitat at



Figure 13. Expanse of Northern Sedge Meadow at Colburn Meadows and Savannas Primary Site. Photo by Amy Staffen.

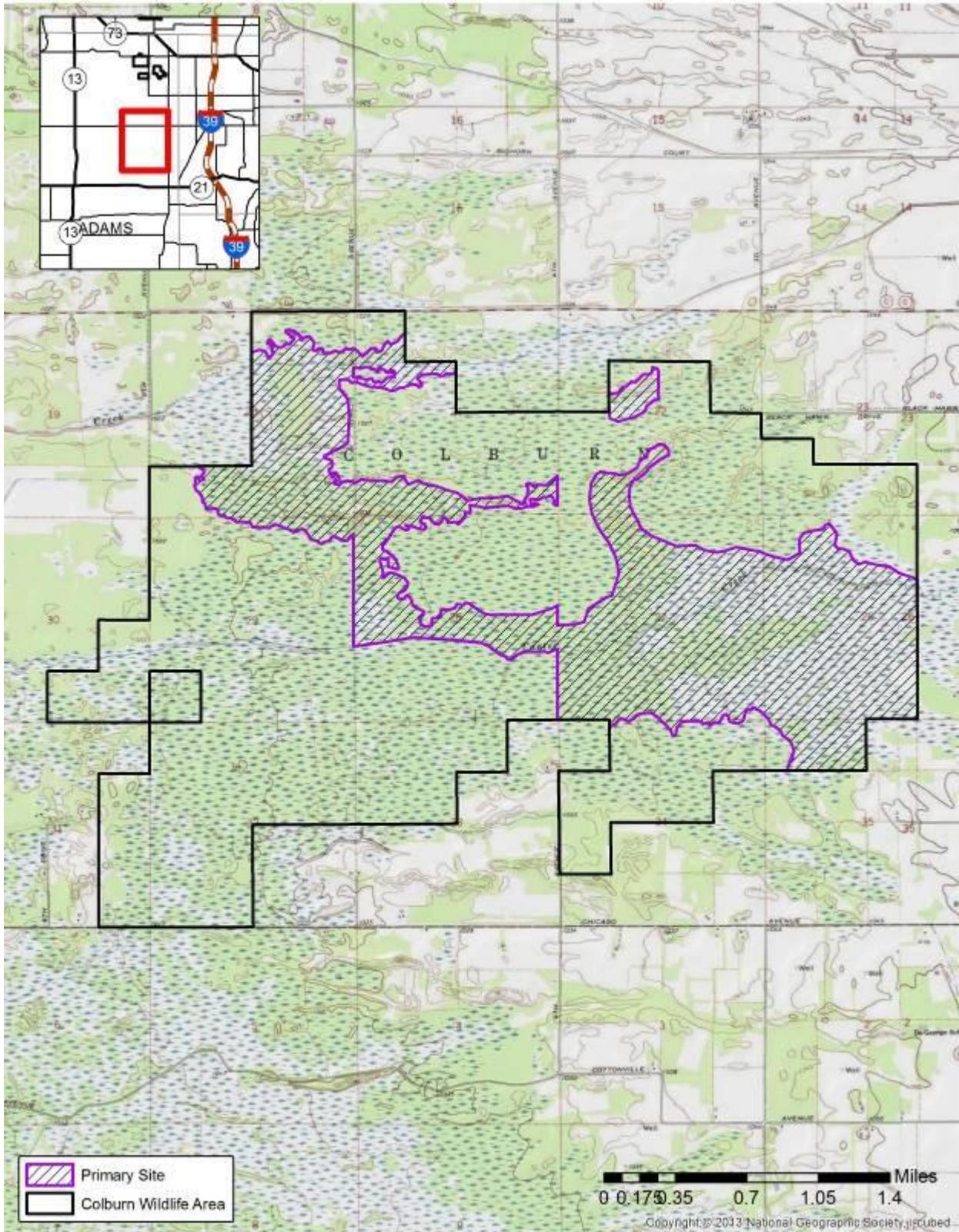
Wetlands are vital for helping to conserve the vulnerable aquifer of the Central Sands region. Wetlands serve to slow the release of water during storms (thus minimizing flooding), filter nutrients and pollutants that are carried in runoff, and provide moisture banks during low water periods or droughts. Carter Creek, which passes through the primary site, provides important habitat for rare aquatic invertebrates, emphasizing the importance of sites like this in protecting the streambed and water quality.

this primary site such as Wilson's snipe, blue-winged teal (*Anas discors*) and willow flycatcher (*Empidonax traillii*). A Special Concern warbler is known to breed in the region. While this species nests in shrub-dominated wetlands, fledglings seek shelter in mature forest nearby – this site and adjoining forest outside of the primary site provide just such conditions.

Wetlands are vital for helping to conserve the vulnerable aquifer of the Central Sands region. Wetlands serve to slow the release of water during storms (thus minimizing flooding), filter nutrients and pollutants that are

Management Considerations

In the SW1/4 of SW1/4 of Section 21, a barrens area with open sands provides important habitat for nesting turtles adjacent to impounded open water. Additional opening of the canopy here could allow for further opportunities for nesting. The greatest threats to the sedge meadow and shrub-carr include non-native invasive species and hydrological alteration. Reed canary grass is abundant in places, while common reed (*Phragmites australis*) occurs in scattered patches. Hydrology has been altered in the past by installation of ditches and berms. American beaver (*Castor canadensis*) have also played a role in modifying the flow of Carter Creek. Major threats to the barrens and Oak Opening/Woodland include fire suppression and non-native invasives, including Eurasian bush-honeysuckle, butter-and-eggs, and orange hawkweed (*Hieracium aurantiacum*). Oak wilt is also killing many oaks.



CSP03. Colburn Meadows and Savannas Primary Site.

CSP04. FOGARTY MARSH

Location

Property:	Paul J. Olson Wildlife Area
County:	Portage
Landtype Association:	212Qd03. Milladore Uplands.
Approximate Size:	531 acres
Ownership:	WDNR, private

Description of Site

Fogarty Marsh (a.k.a. Carson Bog or The Blueberry Bog) is a large acid peatland complex that lies in a largely agricultural landscape, just eight miles west of Stevens Point. While the entire wetland complex is about 740 acres, approximately 531 acres occupy areas where the direct influence of ditches and other anthropogenic disturbances are minimal, representing the highest quality examples of the various wetland types at the site. A vegetative continuum grades from Black Spruce Swamp at the periphery (especially

to the west) to Tamarack (poor) Swamp and eventually to Open Bog in the interior. Black Spruce Swamp has the densest canopy cover within this continuum, which is created by 6-8" dbh black spruce and tamarack, as well as paper birch (*Betula papyrifera*) saplings. Shrubs such as Labrador-tea (*Ledum groenlandicum*) and velvet-leaf blueberry (*Vaccinium myrtilloides*) punctuate deep carpets of hummocky Sphagnum (*Sphagnum* spp.). Characteristic herb species include three-leaf Solomon's plume (*Maianthemum trifolium*), few-seeded sedge (*Carex oligosperma*), and pink lady's-slipper (*Cypripedium*



Figure 14. Tamarack (poor) Swamp at Fogarty Marsh. Photo by Andy Clark.

acaule). As one transitions from the Black Spruce Swamp to Tamarack (poor) Swamp, the canopy opens up but shrub cover increases, with leatherleaf (*Chamaedaphne calyculata*) and bog-rosemary (*Andromeda glaucophylla*) added to the mix (Figure 4). Tussock cotton-grass (*Eriophorum vaginatum*) presents small white feathery plumes throughout this area. The most extensive natural community is Open Bog, which has a hummocky carpet of Sphagnum throughout, and paper birch, blueberries and leatherleaf growing on top of the hummocks. Jack pine, white pine, tamarack and black spruce create only 30% cover in the subcanopy layer, but this along with low cover from paper birch saplings and a modest shrub layer suggest that this community is transitioning to Muskeg. Small areas of Northern Sedge Meadow and even pockets of Poor Fen can also be found.

Significance of Site

This site is notable as a large expanse of good-quality wetland with minimal disturbance and no non-native invasives. Wetlands serve to slow the release of water during storms (thus minimizing flooding), filter nutrients and pollutants that are carried in runoff, and provide moisture banks during low water periods or droughts. This type of wetland and its varied habitat niches (from open to brushy to tree-covered) provides important habitat for wildlife, especially birds and mammals.

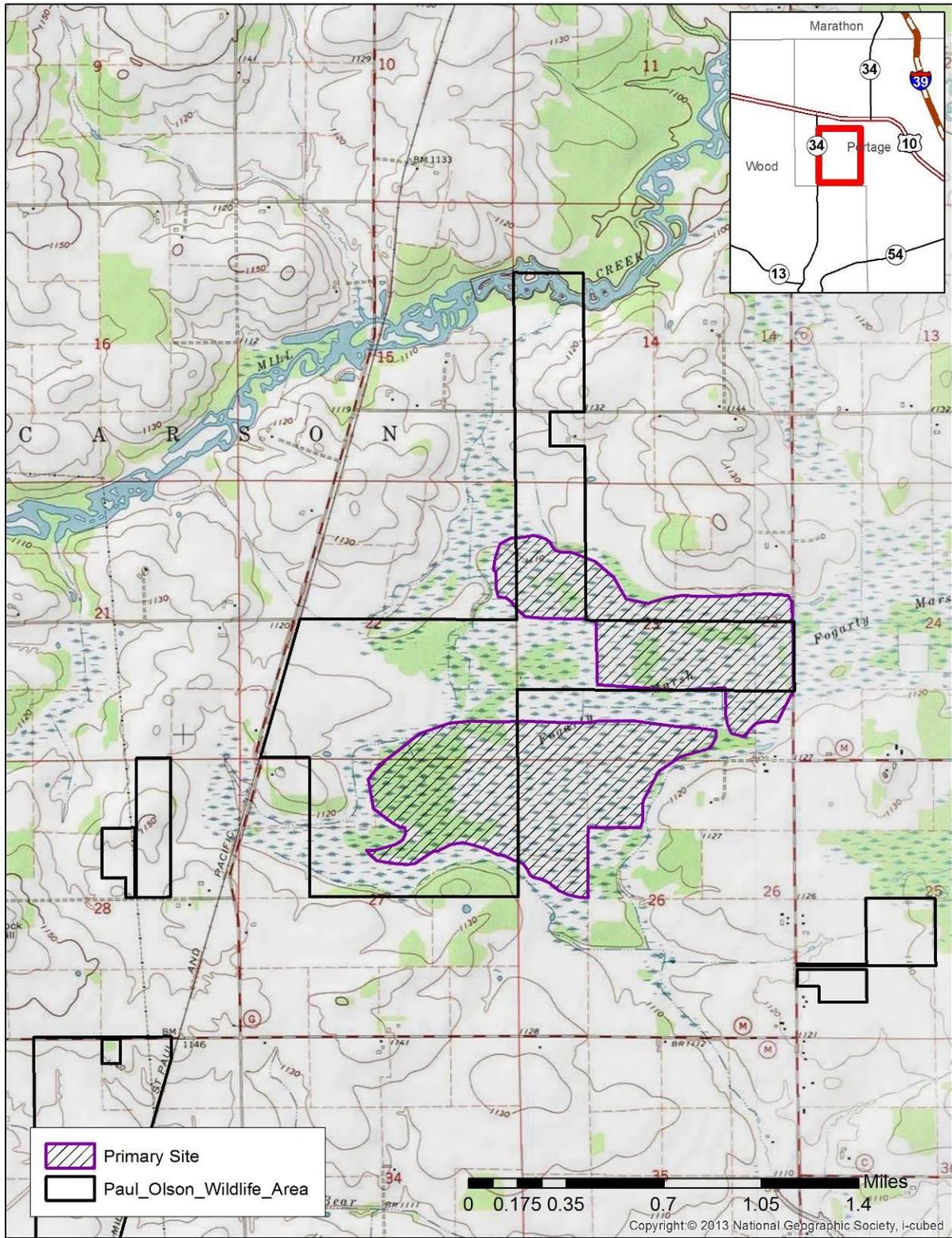
Open Bog habitat may support bird species that are more typically associated with grasslands, such as sedge wren, swamp sparrow, and northern harrier. As tree and brush cover increases, forest species such as hermit thrush (*Catharus guttatus*), yellow-rumped warbler (*Setophaga coronata*), Nashville warbler (*Vermivora ruficapilla*), and white-throated sparrow (*Zonotrichia albicollis*) may find suitable nesting habitat. Winter usage by irruptive northern boreal or arctic owls is likely as well here (e.g., snowy owl, great gray owl [*Strix nebulosa*], and northern hawk owl [*Surnia ulula*]). Arctic shrews (*Sorex arcticus*) were found here during small mammals surveys; while not formally listed as an SGCN, the status of this species is of concern to some mammalogists.

Management Considerations

Conservation projects need to consider the entire basin within which the wetland community is situated, and the impacts of activities in the watershed surrounding the basin. A high priority conservation need is protection and restoration of hydrology. This may include identifying priority groundwater recharge areas that supply the wetlands and conducting groundwater quality and quantity monitoring. Ditching and diking have significant impacts on bog vegetation, either by encouraging the growth of shrubs, or by inundating the peatland plants. Tamarack is particularly sensitive to hydrological manipulation. Opportunities to expand and restore the wetland complex exist in surrounding areas where extensive ditching and draining has occurred. Limitation of runoff carrying nutrients and sediment into the wetland is also of vital importance. This may involve working with local agricultural stakeholders to balance water quality and water quantity with planting design, crop selection, discontinuous vegetative cover, tillage practices, nutrient management, pest management, and irrigation.



Figure 15. Transition from Tamarack (poor) Swamp to Black Spruce Swamp at Fogarty Marsh. Photo by Andy Clark.



CSP04. Fogarty Marsh Primary Site.

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SPECIES LIST

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

Plants	
Common Name	Scientific Name
American hazelnut	<i>Corylus americana</i>
arrow-leaved tear-thumb	<i>Polygonum sagittatum</i>
big bluestem	<i>Andropogon gerardii</i>
black cherry	<i>Prunus serotina</i>
black oak	<i>Quercus velutina</i>
black spruce	<i>Picea mariana</i>
blueberries	<i>Vaccinium spp.</i>
blue-joint grass	<i>Calamagrostis canadensis</i>
bog-rosemary	<i>Andromeda glaucophylla</i>
bracken fern	<i>Pteridium aquilinum</i>
burr oak	<i>Quercus macrocarpa</i>
butter-and-eggs	<i>Linaria vulgaris</i>
Canada mayflower	<i>Maianthemum canadense</i>
cattails	<i>Typha spp</i>
chokecherry	<i>Prunus virginiana</i>
common reed	<i>Phragmites australis</i>
common winterberry	<i>Ilex verticillata</i>
early low blueberry	<i>Vaccinium angustifolium</i>
Eurasian bush-honeysuckle	<i>Lonicera spp.</i>
few-seeded sedge	<i>Carex oligosperma</i>
glossy buckthorn	<i>Rhamnus frangula</i>
hoary puccoon	<i>Lithospermum canescens</i>
huckleberry	<i>Galyussacia baccata</i>
jack pine	<i>Pinus banksiana</i>
Kentucky bluegrass	<i>Poa pratensis</i>
Labrador-tea	<i>Ledum groenlandicum</i>
lake sedge	<i>Carex lacustris</i>
leatherleaf	<i>Chamaedaphne calyculata</i>
little bluestem	<i>Schizachyrium scoparium</i>
long-leaved bluets	<i>Houstonia longifolia</i>
marsh bellflower	<i>Campanula aparinoides</i>
marsh skullcap	<i>Scutellaria galericulata</i>
orange hawkweed	<i>Hieracium aurantiacum</i>
orange jewel-weed	<i>Impatiens capensis</i>
paper birch	<i>Betula papyrifera</i>
Pennsylvania sedge	<i>Carex pensylvanica</i>
pink lady's-slipper	<i>Cypripedium acaule</i>
prairie tickseed	<i>Coreopsis palmata</i>

quackgrass	<i>Elytrigia repens</i>
quaking aspen	<i>Populus tremuloides</i>
red maple	<i>Acer rubrum</i>
reed canary grass	<i>Phalaris arundinacea</i>
rough bedstraw	<i>Galium asprellum</i>
sensitive fern	<i>Onoclea sensibilis</i>
skunk cabbage	<i>Symplocarpus foetidus</i>
speckled alder	<i>Alnus incana</i>
sphagnum	<i>Sphagnum spp.</i>
spotted Joe-Pye-weed	<i>Eupatorium maculatum</i>
spotted knapweed	<i>Centaurea biebersteinii</i>
starflower	<i>Trientalis borealis</i>
swamp loosestrife	<i>Lysimachia thyrsiflora</i>
tamarack	<i>Larix laricina</i>
three-leaf Solomon's plume	<i>Maianthemum trifolium</i>
timothy	<i>Phleum pratense</i>
tussock cotton-grass	<i>Eriophorum vaginatum</i>
tussock sedge	<i>Carex stricta</i>
velvet-leaf blueberry	<i>Vaccinium myrtilloides</i>
water smartweed	<i>Polygonum amphibium</i>
white oak	<i>Quercus alba</i>
white pine	<i>Pinus strobus</i>
wild lupine	<i>Lupinus perennis</i>
wintergreen	<i>Galutheria procumbens</i>
Animals	
American beaver	<i>Castor canadensis</i>
arctic shrew	<i>Sorex arcticus</i>
blue-winged teal	<i>Anas discors</i>
blue-winged warbler	<i>Vermivora cyanoptera</i>
brown thrasher	<i>Toxostoma rufum</i>
eastern towhee	<i>Pipilo erythrophthalmus</i>
great gray owl	<i>Strix nebulosa</i>
hermit thrush	<i>Catharus guttatus</i>
Lapland longspur	<i>Calcarius lapponicus</i>
Nashville warbler	<i>Vermivora ruficapilla</i>
northern harrier	<i>Circus cyaneus</i>
northern hawk owl	<i>Surnia ulula</i>
pileated woodpecker	<i>Dryocopus pileatus</i>
rough-legged hawk	<i>Buteo lagopus</i>
sandhill crane	<i>Grus canadensis</i>
sedge wren	<i>Cistothorus platensis</i>
snow bunting	<i>Plectorphenix nivalis</i>
snowy owl	<i>Bubo scandiacus</i>

swamp sparrow	<i>Melospiza georgiana</i>
white-throated sparrow	<i>Zonotrichia albicollis</i>
willow flycatcher	<i>Empidonax traillii</i>
Wilson's snipe	<i>Gallinago gallinago</i>
yellow-bellied sapsucker	<i>Sphyrapicus varius</i>
yellow-rumped warbler	<i>Setophaga coronata</i>
Fungi	
oak wilt	<i>Ceratocystis fagacearum</i>

Appendix H

Rare Species and High Quality Natural Communities of the Central Sand Plains Planning Group by Primary Site

Numerous rare species and high-quality examples of native communities have been documented within the Central Sand Plains Planning Group (CSPPG). The table below shows the rare species and high-quality natural communities currently known from the CSPPG and listed by Primary Site with the year last observed. See Appendix D for summary descriptions for the species and natural communities that occur on the CSPPG. State Rank and Listing Status is based on Wisconsin Natural Heritage Inventory (NHI) Working List updates completed in April 2016 (unpublished). Please note that all species and natural communities on this list are tracked by the NHI Program.

Common Name	Scientific Name	Buena Vista-Leola Grasslands	Colburn Meadows and Savannas	Fogarty Marsh	Tennile Creek Wetland-to-Forest Corridor	State Status	Global Status	State Rank	Federal Status	SGCN
Birds										
American Bittern	<i>Botaurus lentiginosus</i>	2014				S3B	G4	SC/M		Y
Bobolink	<i>Dolichonyx oryzivorus</i>	2014				S2S3B	G5	SC/M		Y
Dickcissel	<i>Spiza americana</i>	2014				S3B	G5	SC/M		Y
Eastern Meadowlark	<i>Sturnella magna</i>	2014				S2S3B	G5	SC/M		Y
Eastern Whip-poor-Will	<i>Antrostomus vociferus</i>					S3B	G5	SC/M		Y
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	2014				S2S3B	G5	SC/M		Y
Greater Prairie-Chicken	<i>Tympanuchus cupido</i>	2010				S1B	G4	THR		Y
Henslow's Sparrow	<i>Ammodramus henslowii</i>	2014				S2S3B	G4	THR	SOC	Y
Least Flycatcher	<i>Empidonax minimus</i>	2014				S3B	G5	SC/M		Y
Northern Bobwhite	<i>Colinus virginianus</i>					S1B	G5	SC/M		Y
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	2014	2015			S3B	G5	SC/M		Y
Short-eared Owl	<i>Asio flammeus</i>	2015				S1B, S3N	G5	SC/M		Y
Upland Sandpiper	<i>Bartramia longicauda</i>	2014				S2B	G5	THR		Y
Vesper Sparrow	<i>Pooecetes gramineus</i>	2014				S2S3B	G5	SC/M		Y
Western Meadowlark	<i>Sturnella neglecta</i>	2014				S2B	G5	SC/M		Y

Common Name	Scientific Name	Buena Vista-Leola Grasslands	Colburn Meadows and Savannas	Fogarty Marsh	Tenmile Creek Wetland-to-Forest Corridor	State Status	Global Status	State Rank	Federal Status	SGCN
Herptiles										
Blanding's Turtle	<i>Emydoidea blandingii</i>	2015	2015			S3S4	G4	SC/P		Y
Butterflies and Moths										
Gray Copper	<i>Lycaena dione</i>	2013				S2	G5	SC/N		Y
Karner Blue	<i>Lycaeides melissa samuelis</i>		2001			S3	G5T2	SC/FL	LE	Y
Regal Fritillary	<i>Speyeria idalia</i>	2013				S1	G3	END		Y
Dragonflies										
Sioux (Sand) Snaketail	<i>Ophiogomphus smithi</i>	2012				S2	G2G3	SC/N		Y
Mammals										
Gray Wolf	<i>Canis lupus</i>			2015		S4	G4G5	SC/H		Y
Plants										
Missouri Rock-cress	<i>Boechera missouriensis</i>	2015				S2	G5	SC		NA
Natural Communities										
Alder Thicket	Alder thicket				2015	S4	G4	NA		NA
Central Sands Pine-Oak Forest	Central sands pine-oak forest				2015	S3	G3	NA		NA
Northern Sedge Meadow	Northern sedge meadow		2015			S3	G4	NA		NA
Shrub-carr	Shrub-carr		2015			S4	G5	NA		NA
Stream--Slow, Hard, Cold	Stream--slow, hard, cold				1980	SU	GNR	NA		NA