



Rapid Ecological Assessment for Totagatic Wild River (Washburn and Douglas Counties)

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

Properties included in this report are:

- Totagatic Wild River (Washburn and Douglas Counties)
- Solar Property (Washburn County)

Wisconsin's Natural Heritage Inventory Program
Bureau of Endangered Resources
Department of Natural Resources
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Primary Authors: Ryan O'Connor, Richard Staffen

Contributors:

- Matthew Berg – aquatic invertebrates
- Julie Bleser – data management
- Andy Clark – plant and natural community surveys
- Kevin Doyle – data processing
- Ashley Hannah – maps, report editing
- Terrell Hyde – data processing
- Ryan Magana – zoology and natural community surveys
- Ryan O'Connor – inventory coordination, data processing
- Stacy Rowe – data processing
- William Smith – inventory coordination, terrestrial invertebrates
- Amy Staffen – data processing
- Richard Staffen – bird and herptile surveys, data processing

Cover Photos:

Top (left to right): Pine Barrens at Totagatic Wild River by Richard Staffen, pines along the Totagatic Wild River by Richard Staffen.

Bottom (left to right): bird's-foot violet by Richard Staffen, eastern pine elfin by Richard Staffen, bald eagle by Laura Erickson, wood turtle by Richard Staffen.



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Totagatic Wild River Property Group At a Glance

Exceptional Characteristics of the Study Area

- **Globally Rare Pine Barrens and Northern Dry Forest.** Both Pine Barrens and Northern Dry Forest were common historically but are now uncommon or rare in the state. Together, these communities were estimated to cover 2,300,000 acres (5.5% of Wisconsin's landscape) circa 1800. The TWR and other areas in the Northwest Sands Ecological Landscape present one of the best conservation opportunities in the state to manage for and restore a shifting mosaic of Pine Barrens and Dry Northern Forest.
- **Outstanding Resource Waterway.** The Totagatic River is currently one of only five rivers in the state designated as a Wild River, and is also designated as an Outstanding Resource Water (ORW), receiving the state's highest protection standards. Of Wisconsin's 53,413 streams and rivers, only 254, or less than 1%, are designated as ORW.
- **Mature Pine Forests.** A high-quality stand of closed canopy, mature red pine forest occurs on the Solar property. The Northwest Sands Ecological Landscape offers major opportunities to manage for this community type, but mature stands of natural origin pine are rare (WDNR 2006a).

Site Specific Opportunities for Biodiversity Conservation

Four ecologically important sites, or "Primary Sites," were identified at Totagatic Wild River & Solar Property. "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.

- **County Line Road Barrens and Forest.** This Primary Site encompasses a good-quality patch of Pine Barrens embedded within a larger closed canopy Northern Dry Forest. Five-mile Creek runs through the primary site with Alder Thicket along the banks. The site supports numerous rare birds in all of these natural communities and presents an excellent opportunity for a landscape scale barrens/Northern Dry Forest project with the adjacent Brule-St. Croix Legacy Forest and Namekagon Barrens Wildlife Area.
- **Solar Red Pines.** Encompassing the most significant block of mature red pine on the property group, this 128-acre Primary Site is located along the shores of the Totagatic River. The site is very diverse with a Forested Seep running from a narrow upland ridge into an Oxbow Lake. Over this rise lies a wetland complex containing a Tamarack (Rich) Swamp, Alder Thicket, and Northern Sedge Meadow with a Spring and Spring Run coursing through.
- **Kimball Barrens.** This site represents the largest and most intact example of the globally rare Pine Barrens found on the property group. The groundlayer contains native prairie forbs and grasses and scattered jack and red pine at various ages and sizes. Numerous rare species, including birds, herptiles, and a plant are found here.
- **Totagatic Wild River.** The lower portion of the Totagatic Wild River, found within this primary site, represents a high-quality free-flowing stretch of river below the Minong Flowage. The site is connected to the federally designated St. Croix National Scenic Riverway. The site includes both the wild river and its associated forested floodplain and adjoining slopes where significant numbers of rare species are found.

Introduction

Purpose and Objectives

This report is intended to be used as a source of information for developing a new master plan for the Totagatic Wild River (TWR; Figure 1). The regional ecological context for the TWR is provided to assist in developing the Regional and Property Analysis that is part of the master plan. Properties included in this assessment are:

- Totagatic¹ Wild River
- Solar Property

The primary objectives of this project were to collect biological inventory information relevant to the development of a master plan for the TWR 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 TWR 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 TWR 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 Endangered Resources and a member of an international network of natural heritage programs representing all 50 states, as well as portions of Canada, Latin America, and the Caribbean. These programs share certain standardized methods for collecting, processing, and managing data for rare species and natural communities. NatureServe, an international non-profit organization (see www.NatureServe.org for more information), coordinates the network.

Natural heritage programs track certain elements of biological diversity: rare plants, rare animals, high-quality examples of natural communities, and other selected natural features. The NHI Working List (WDNR 2011) contains the elements tracked in Wisconsin. They include endangered, threatened, and special concern plants and animals, as well as the natural community types recognized by NHI. The NHI Working List is periodically updated to reflect new information about the rarity and distribution of the state’s plants, animals, and natural communities. The most recent Working List is available from the Wisconsin DNR website (*Wisconsin Natural Heritage Working List*).

¹ The name "Totagatic" comes from the Ojibwa word "Totogan" meaning "place of floating bogs" or "boggy river" (Romance of Wisconsin Place Names 1988). Plat books, maps and tour books show a couple of spellings for the river and its namesake flowages. "Totagatic" and "Totogatic" are used interchangeably in these reference materials. Pronunciation is varied between "Tuh-TO-ga-tec," "To-TA-ga-tec," "To-to-GAT-ic," "To-BA-tec," and just "TO-ga-tec" according to long-time local residents. Each of these spellings and pronunciations seems to have a strongly-defended local following, and devotees of one will consider use of the others as incorrect.

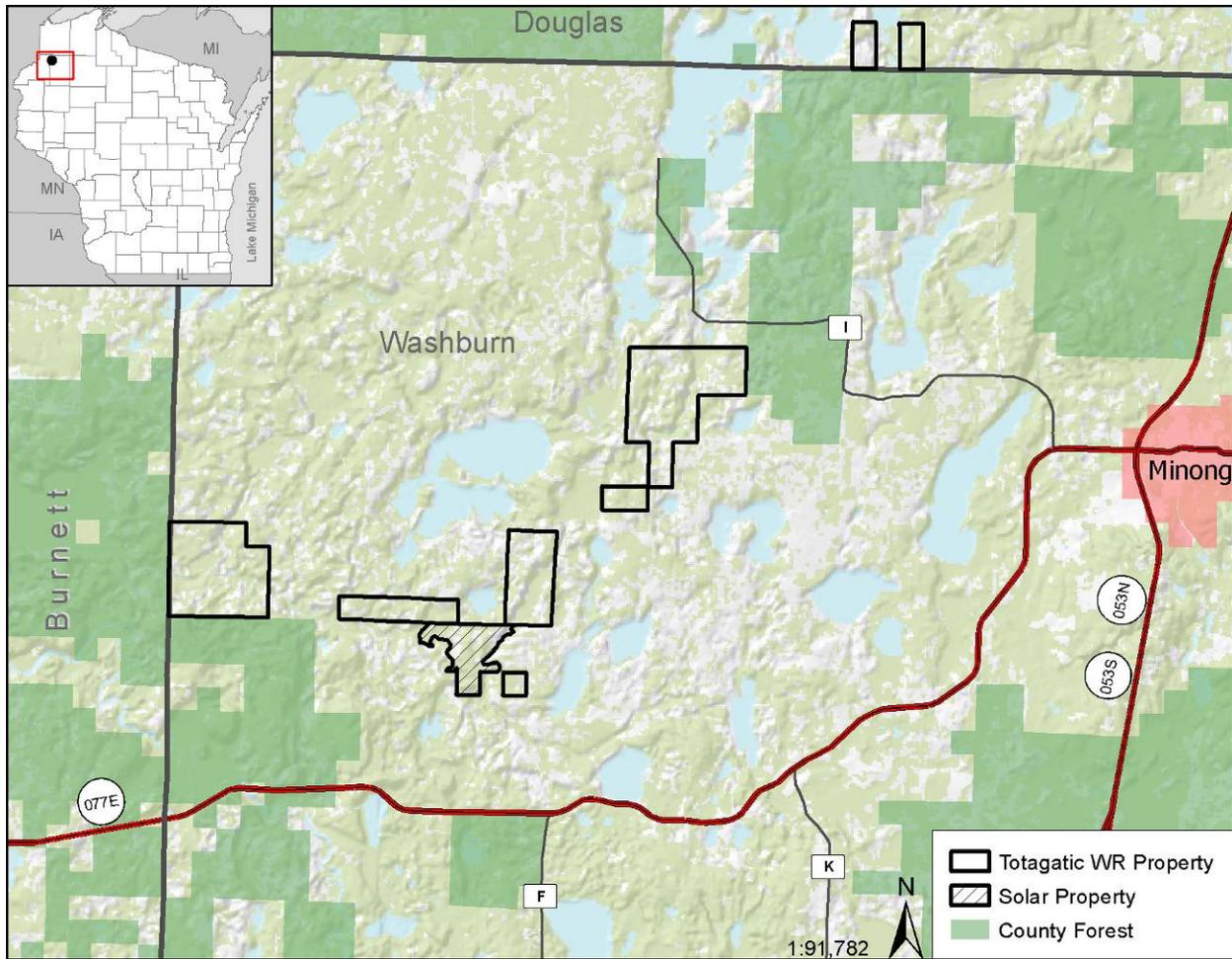


Figure 1. Location of the Totagatic Wild River Planning Group.

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 TWR were limited to: 1) the Statewide Natural Area Inventory, a county-by-county effort conducted by WDNR’s Bureaus of Research and Endangered Resources between 1969 and 1984 that focused on natural communities but include some surveys for rare plants and animals and 2) taxa specific surveys.

The most recent taxa-specific field surveys for the study area were conducted during 2012. Surveys were limited in scope and focused on documenting high quality natural communities, rare plants, breeding birds, aquatic and terrestrial invertebrates, and herptiles. The collective results from all of these surveys were used, along with other information, to identify ecologically important areas (Primary Sites) of the TWR.

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 TWR, key inventory considerations included the identification of Pine Barrens and barrens restoration opportunities, high-quality aquatic elements, and the location of habitats that had the potential to support rare species. Private lands, including easements, surrounding the TWR were not surveyed.

Scientific names for all species mentioned in the text are included in a list on page 38.

Background on Past Efforts

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

Important Bird Area

A portion of the Totagatic Wild River was identified as an Important Bird Area (IBA) as part of the larger Namekagon – Solon Springs IBA (WDNR 2007). Important Bird Areas are critical for the conservation and management of Wisconsin's birds. This site is considered a Pine Barrens core habitat, with up to 40,000 acres of habitat available for barrens species. Sharp-tailed grouse (*Tympanuchus phasianellus*), upland sandpiper (*Bartramia longicauda*), brown thrasher (*Toxostoma rufum*), and Connecticut warbler (*Oporornis agilis*) all breed here (WDNR 2007).

Grassland Bird Priority Landscape

Northwest Washburn County and Totagatic Wild River are included with Namekagon/Douglas County Barrens as one of the highest ranking priority landscapes in Wisconsin for grassland bird management (Sample and Mossman 1997). Their significance to grassland birds lies as diverse barrens, brush prairie barrens, and cut- or burned-over forest lands. Mechanical thinning and prescribed burning are noted as a tool to expand these barrens habitats (Sample and Mossman 1997).

Wisconsin Wildlife Action Plan: Conservation Opportunity Area

The Wisconsin Wildlife Action Plan (WAP; WDNR 2006a) recognized a portion of the Totagatic Wild River as part of the Namekagon Barrens Conservation Opportunity Area (COA; Appendix B). Conservation Opportunity Areas 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. Namekagon Barrens COA is of global significance because few examples of barrens ecosystems remain worldwide. Large-scale barrens management opportunities exist in this landscape due to the relatively large amount of public lands owned by state and county government (WDNR 2005).

Legacy Place

The Land Legacy Report (WDNR 2006b) was designed to identify Wisconsin's most important conservation and recreation needs for the next 50 years. The report identifies the Lower Totagatic River, a diverse, high-quality warmwater river, as a Legacy Site (WDNR 2006b). The report noted the river corridor as primarily undeveloped with large, high-quality forest blocks in the valley and significant portions of marshes, bog habitat, and oxbow ponds along its shores.

The Nature Conservancy's Superior Mixed Forest Ecoregion Conservation Plan

The Nature Conservancy's (TNC) Superior Mixed Forest Ecoregion Conservation Plan (2002) covers an area that encompasses much of northern Wisconsin, northern Minnesota, a small portion of Michigan's Upper Peninsula, and parts of southern Manitoba and southern Ontario. The plan resulted in

a set of terrestrial and aquatic “Conservation Areas” that represent viable natural community types, globally rare native species, and other selected features.

Totogatic Wild River is included within the Upper St. Croix Conservation Area. This site is over 829,000 acres and approximates the watershed above the Gordon Dam. The boundary has been expanded to the south and east to include the Land Type Associations that define the Namekagon River’s corridor.

Totogatic Wild River Lands Area Feasibility Study and Environmental Analysis

A combined feasibility study and environmental analysis was conducted to provide the public and decision-makers with a factual, unbiased analysis as a part of establishing, developing, and managing the new Totogatic Wild River property (Schalkowski 2011). The study took into account the physical and biological environment and its capabilities, the views of the public and of landowners adjoining the property, and the availability of funding and staffing to accomplish the project’s purpose adequately. This report should serve as an excellent resource in developing the Regional Property Analysis and Master Plan for the property.

St. Croix Watershed Conservation Priority Area

The St. Croix Conservation Collaborative (2006) is a coalition of 19 partner groups in Wisconsin and Minnesota who identify basin-wide conservation priorities and collaborate to pursue them. The coalition identified the Totogatic River as a Conservation Priority Area in 2006 and helped secure its Wild River designation.

Special Management Designations

Wild River

The Wisconsin Wild Rivers program was established by the 1965 Legislature with the enactment of s. 30.26, Wis. Stats. in order to afford the people of the state an opportunity to enjoy natural streams, to attract out-of-state visitors and assure the well-being of the tourist industry, and to preserve some rivers in a free-flowing condition and protect them from development. Currently, five rivers, or portions of those rivers, are designated as Wild Rivers, including the Totogatic River. Within DNR-owned lands of a designated Wild River, state statute specifies: no vegetative control within 150 feet from the bank on either side of the river, walk-in access only, no motorized vehicles, no stream alterations, no maintained trails, and few developed parking lots or canoe put-ins. These rules are intended to preserve the wild and scenic qualities of the river.

Outstanding Resource Water

The Totogatic River is a designated Outstanding Resource Water (ORW), receiving the state’s highest protection standards. Of Wisconsin’s 53,413 streams and rivers, only 254, or less than 1%, are designated as ORW. Outstanding Resource Waters typically do not have any point sources discharging pollutants directly to the water (for instance, no industrial sources or municipal sewage treatment plants), though they may receive runoff from nonpoint sources. New discharges may be permitted only if their effluent quality is equal to or better than the background water quality of that waterway at all times—no increases of pollutant levels are allowed.

Forest Certification

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



Mature red pine grows on a slope above the Totagatic River. Photo by Andy Clark.

Regional Ecological Context

Northwest Sands Ecological Landscape

This section is largely reproduced from *The Ecological Landscapes of Wisconsin Handbook* (WDNR In prep. a, *Northwest Sands Ecological Landscape*).

The WDNR has mapped the state into areas of similar ecological potential and geography called Ecological Landscapes. The Ecological Landscapes are based on aggregations of smaller ecoregional units (Subsections) from a national system of delineated ecoregions known as the National Hierarchical Framework of Ecological Units (NHFEU) (Cleland et al. 1997). These ecoregional classification systems delineate landscapes of similar ecological pattern and potential for use by resource administrators, planners, and managers. Totagatic Wild River falls completely within the Northwest Sands Ecological Landscape. See Figure 2 for the study area in relation to Ecological Landscape.

The Northwest Sands Ecological Landscape is a large glacial outwash system in northwest Wisconsin. Major landforms of the landscape include flat plains or terraces along glacial meltwater channels, and pitted or "collapsed" outwash plains containing kettle lakes. Soils are predominantly deep sands, low in organic material and nutrients.

Historic vegetation for the Northwest Sands Ecological Landscape at the time of the General Land Office survey was predominantly jack pine (*Pinus banksiana*) and "Scrub oak" (*Quercus spp.*) forest and barrens. Eastern white pine (*Pinus strobus*) and red pine (*Pinus resinosa*) forests were also a sizable component of the Ecological Landscape. Numerous barrens occurred in the southwest half, where the TWR is now located, and a few large barrens within the northeast half. Most of the trees in the barrens were jack pine, but red pine savannas were present and oak savannas occurred in the south central section.

Current vegetation of the Northwest Sands Ecological Landscape is a mix of forest, agriculture, grassland and barrens, with some wetlands in the river valleys. Within the forested portion, pine (*Pinus sp.*), aspen (*Populus sp.*), birch (*Betula sp.*) and oak (*Quercus sp.*) are equally dominant. The maple (*Acer sp.*), basswood (*Tilia americana*), spruce (*Picea sp.*), fir (*Abies sp.*), and lowland hardwood forest type groups occupy small percentages. Within the open lands, there is a relatively large proportion of grassland and shrubland, a small but significant amount of emergent/wet meadow and open water in the southern part of the Northwest Sands, and very little row-crop agriculture.

Several hundred kettle lakes occur in the pitted outwash plain. The headwaters of the St. Croix-Namekagon and Brule River systems are located here amid flat plains, sedge meadows, bog complexes, and large barrens. Water quality in seepage lakes is generally very good. Groundwater conditions are among the least polluted yet most vulnerable in the state.



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

Regional Biodiversity Needs and Opportunities

Opportunities for sustaining natural communities in the Northwest Sands 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 2006a). The goal of sustaining natural communities is to manage for natural community types that 1) historically occurred in a given landscape and 2) have a high potential to maintain their characteristic composition, structure, and ecological function over a long period of time (e.g., 100 years). This list can help guide land and water management activities so that they are compatible with the local ecology of the Ecological Landscape while maintaining important components of ecological diversity and function. Based on EMPT's criteria, these are the most appropriate community types that could be considered for management activities within the Northwest Sands Ecological Landscapes.

There are management opportunities for 26 natural communities in the Northwest Sands Ecological Landscape. Of these, 16 are considered "major" opportunities and an additional five communities are considered "important" in the Northwest Sands Ecological Landscape (Table 1). A "major" opportunity indicates that the natural communities can be sustained in the Ecological Landscape, either because many significant occurrences of the natural community have been recorded in the landscape or major restoration activities are likely to be successful in maintaining the community's composition, structure, and ecological function over a longer period of time. An "important" opportunity indicates that although the natural community does not occur extensively or commonly in the Ecological Landscape, one to several occurrences are present and are important in sustaining the community in the state. In some cases, important opportunities may exist because the natural community may be restricted to just one or a few Ecological Landscapes within the state and there may be a lack of opportunities elsewhere.

Table 1. Major and Important Natural Communities Management Opportunities in the Northwest Sands Ecological Landscape (WDNR 2006a, EMPT 2007). Communities present on the TWR in this Ecological Landscape are noted with an asterisk.

Major Opportunities	Important Opportunities
Coldwater streams*	Alder Thicket*
Coolwater streams	Impoundments/Reservoirs
Emergent Marsh	Northern Hardwood Swamp
Emergent Marsh – Wild Rice	Northern Wet-mesic Forest
Inland Beach	Warmwater streams
Inland lakes	
Northern Dry Forest*	
Northern Dry-mesic Forest*	
Northern Sedge Meadow	
Northern Wet Forest	
Open Bog	
Oak Barrens	
Pine Barrens*	
Submergent Marsh	
Surrogate Grasslands	
Warmwater rivers*	

Rare Species of the Northwest Sands Ecological Landscape

Numerous rare species are known from the Northwest Sands Ecological Landscape. “Rare” species include all of those species that appear on the WDNR’s NHI Working List (WDNR 2011) classified as “Endangered,” “Threatened,” or “Special Concern.” Table 2 lists the number of species known to occur in this landscape based on information stored in the NHI database as of 2012.

Table 2. Listing Status for rare species in the Northwest Sands Ecological Landscape as of January 2012. Source is the NHI database. Listing Status is based on the NHI Working List published June 2011.

Listing Status	Taxa					Total Fauna	Total Plants	Total Listed
	Mammals	Birds	Herptiles	Fishes	Invertebrates			
Federally Endangered	0	1	0	0	1	2	0	2
Federally Threatened	0	0	0	0	0	0	1	1
Federal Candidate	0	0	0	0	0	0	0	0
State Endangered	0	1	0	0	3	4	6	10
State Threatened	0	5	2	3	1	11	9	20
State Special Concern	4	18	2	2	37	63	19	82

The Wisconsin Wildlife Action Plan denoted Species of Greatest Conservation Need (SGCN; WDNR 2006a). Species of Greatest Conservation Need are animals that have low and/or declining populations that are in need of conservation action. They include various birds, fish, mammals, reptiles, amphibians, and invertebrates (e.g., dragonflies, butterflies, and freshwater mussels) that are:

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

There are 42 vertebrate SGCN significantly associated with the Northwest Sands Ecological Landscape (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.



Dwarf milkweed (*Asclepias ovalifolia*), a State Threatened plant strongly associated with the Northwest Sands Ecological Landscape.

Photo by Eric Epstein.

Description of the Study Area

Location and Size

The Totagatic Wild River property is located in northwestern Washburn County and is made up of several scattered parcels totaling 2,132 acres. At the time of the writing of this report, the Solar Property was in the process of being purchased by the DNR; it comprises approximately an additional 241 acres. All acreages are based on fee simple ownership from DNR Facilities and Lands GIS records as of June 2012; acreage may not include leases and some permanent water bodies.

Ecoregion

Land Type Associations (LTAs) of Wisconsin represent a further definition of the NHFEU (Cleland et al. 1997). The NHFEU is a classification system that divides landscapes into ecologically significant regions at multiple scales. Ecological types are classified and LTAs are mapped based on the associations of biotic and environmental factors which include climate, physiography, water, soils, air, hydrology, and potential natural communities. The study area encompasses three LTAs: Gordon Rolling Barrens, Webb Lake Collapsed Barrens, and Lower Namekagon Rolling Barrens (Figure 3).



Prairie skinks can be found in many of the barrens and openings in Northern Dry Forests with sandy soils associated with Barrens and Rolling Barrens LTAs. Photo by Richard Staffen.

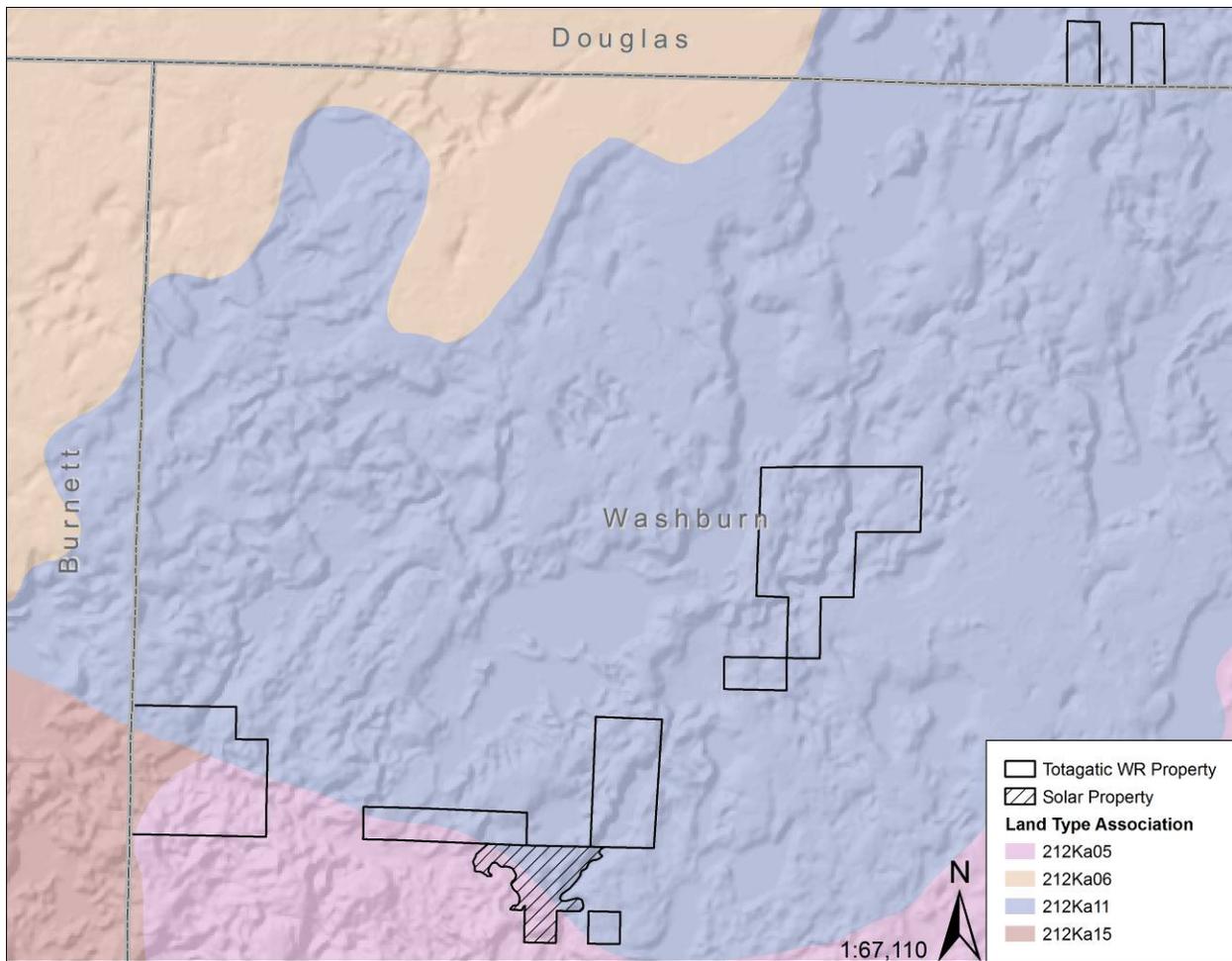


Figure 3. Landtype Associations for Totagatic Wild River Planning Group.

Landtype Associations for Totagatic Wild River Planning Group

- **Gordon Rolling Barrens (212Ka11).** The characteristic landform pattern is rolling outwash plain. Soils are predominantly excessively drained sand over acid sand outwash. Bedrock type is sandstone. Common landcover types are upland coniferous forest, upland deciduous forest, and upland mixed deciduous/coniferous forest. This LTA comprises approximately 80% of Totagatic Wild River.
- **Webb Lake Collapsed Barrens (212Ka05).** The characteristic landform pattern is rolling collapsed outwash plain with lakes common. Soils are predominately excessively drained loamy sand over outwash. Bedrock types are igneous, metamorphic, and volcanic rock. Common landcover types are upland deciduous forest, upland coniferous forest, grassland and forested wetland. This LTA comprises approximately 15% of Totagatic Wild River.
- **Lower Namekagon Rolling Barrens (212Ka15).** The characteristic landform pattern is rolling outwash plain. Soils are predominantly excessively drained sand over acid sand outwash. Bedrock type is sandstone. Common landcover types are upland coniferous forest, upland deciduous forest, and shrubland. This LTA comprises approximately 5% of Totagatic Wild River.

Physical Environment

Geology and Glaciation

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

The underlying bedrock for the TWR Planning Group is Precambrian basalt, lithic conglomerate, shale, and feldspathic to quartzose sandstone. Bedrock is covered with 100 to 600 feet of glacial drift (predominantly sand, as well gravel and silt). The property group lies within one of the most extensive and continuous xeric glacial outwash systems in northern Wisconsin. The glacial landform is predominantly rolling outwash plain deposited by meltwater near the end of the Wisconsin Glaciation.

Soils

Main references: Ecological Landscapes of Wisconsin Handbook (WDNR In prep. a.) and Web Soil Survey, Natural Resource Conservation Service, USDA.

Upland soils are typically sands or loamy sands over deeper-lying strata of sand, or sand mixed with gravel. These soils drain rapidly, leading to xeric, droughty conditions within the study area. Soils are derived from both sandy outwash deposits as well as wind-blown sand deposited post-glaciation.

The narrow floodplain of the Totagatic River is poorly drained sandy alluvium with thin layers of organic matter and occasional deposits of muck.

Hydrology

The TWR planning group is characterized by streams and river systems within the St. Croix River basin. A large portion of the TWR lies along the Totagatic River. Fivemile Creek is the only other named stream within the property group. A small portion of the Minong Flowage occurs within the property boundary but no other named lakes occur on the TWR planning group.

The Totagatic River is a fairly large, brown stained, warmwater drainage stream originating in Bayfield County, flowing through Sawyer County before entering Washburn County and draining into the Namekagon River. Because of the river's large watershed, flooding and subsequent extreme water level fluctuations occur in the spring and after heavy rainfalls (Sather & Busch 1978). The stream bottom type is stable consisting of sand, gravel, rubble, boulder, bedrock, and silt (Sather & Busch 1978). The fishery includes northern pike (*Esox lucius*), walleye (*Stizostedion vitreum*), largemouth (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*), and panfish (*Lepomis* sp.).

Fivemile Creek is a small, clear water brook trout (*Salvelinus fontinalis*) stream (Class II), starting at the outlet of Spring Lake and flowing southwesterly into the Totagatic River (Sather & Busch 1978). The stream is spring-fed and is largely in an unaltered state. The bottom conditions are stable consisting mainly of sand with gravel, rubble, and silt.

The Minong Flowage is a 1,587 acre lake located in Douglas County and maintained by an 18-foot head water control structure on the Totagatic River used for power production. The northernmost parcels of the TWR occur along the Minong Flowage. It has a maximum depth of 21 feet with low water clarity. The fishery includes panfish, largemouth and smallmouth bass, northern pike, and walleye. Common carp (*Cyprinus carpio*) have also been reported from the flowage.

Vegetation

Historical Vegetation

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

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 TWR in 1855. This reconstruction of historical vegetation shows most of the study area was jack pine, scrub oak (*Quercus* spp.), oak forest, and barrens, with a small inclusion of lowland hardwoods on the western edge, and small wet areas scattered in depressions on the landscape. Analysis of individual witness tree data from the PLS data within and along the border of the study area reflects both dry barrens and forest characteristics. Of the witness tree points recorded in the study area, 70% were jack pine, with red pine the second most common species noted (10%). Notably, the next most common category was "no trees in vicinity" (7%), indicating areas of open barrens. Consistent with a barrens landscape, surveyors occasionally noted very long distances from section corners to the nearest tree, sometimes in excess of 100 feet. These sparsely treed areas taken together with "no trees in vicinity" points account for 20% of witness tree point data. However, a majority of witness tree points were consistent with at least a partially forested landscape, and slightly over 50% of trees were recorded within 25 feet of the section corner. Taken together, these data indicate the historical vegetation of uplands consisted of scattered barrens openings, sometimes with scattered trees, embedded in a matrix of forest dominated by jack pine and occasional red pine.

Ecological processes that historically maintained these systems included frequent wildfire, in concert with drought, growing-season frosts, and low-nutrient soils. The vegetation pattern and structure documented in 1855 is typical for fire-prone landscapes such as TWR, in which periodic wildfires historically burned in an irregular fashion depending on timing, weather conditions, fuel loading, and natural fire breaks to create a shifting heterogeneous vegetation matrix.



A barrens opening with scattered jack pine transitions to a young forest at TWR. Photo by Andy Clark.

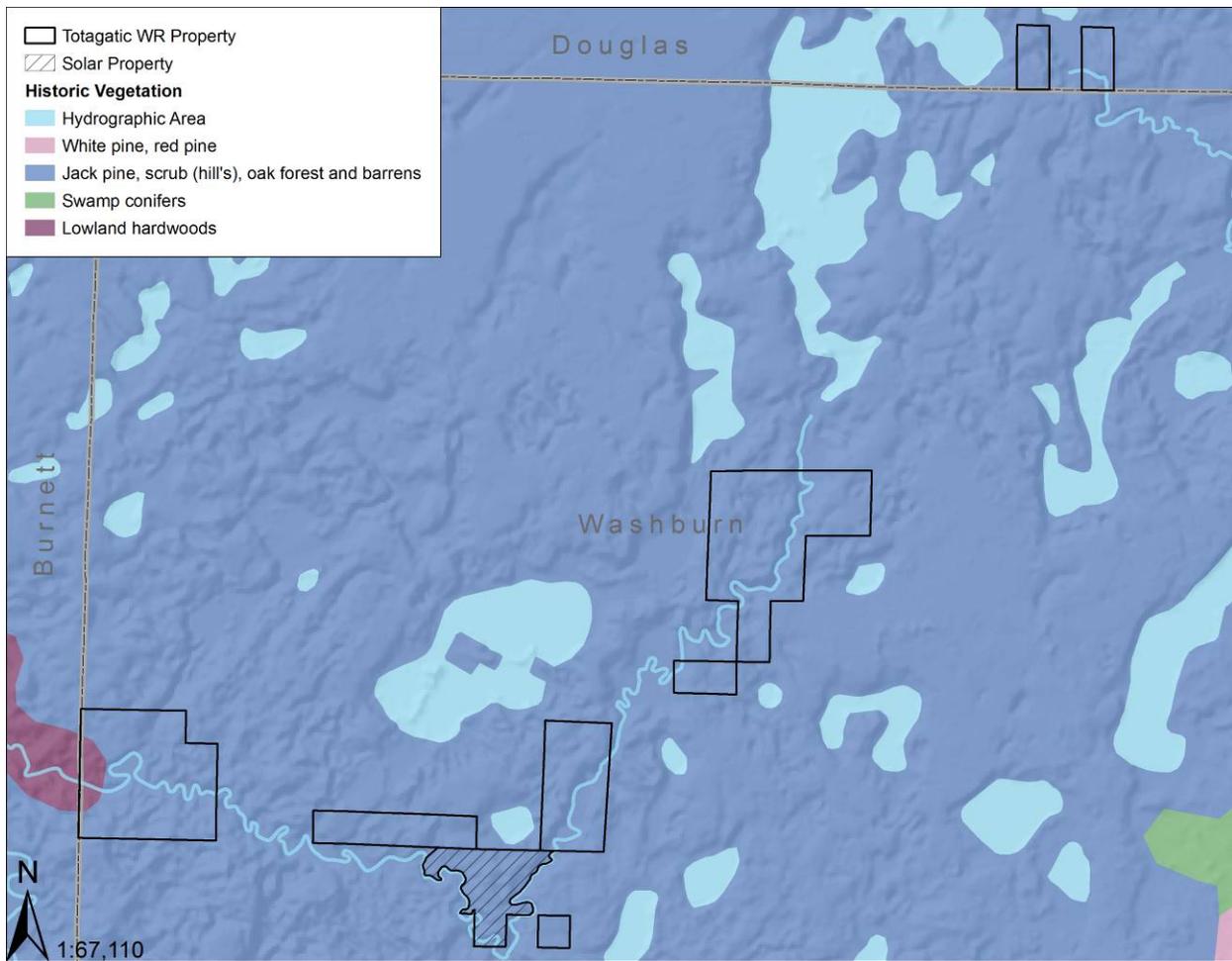


Figure 4. Vegetation of the Totagatic Wild River Planning Group prior to Euro-American settlement (Finley 1976).

Current Vegetation

Current vegetation of the TWR has been influenced by anthropogenic factors, principally logging in the mid- to late 1800s and subsequent wildfires. In addition, more recent timber management has influenced the vegetation including both timber harvesting and attempted reforestation to red pine. Ecological factors also influenced the vegetation both historically and in the present, particularly the drought-prone, excessively drained sandy soils and naturally occurring wildfires.

Like the landscape that surrounds it, the TWR is dominated by a mixture of coniferous forest (primarily dominated by jack pine) and deciduous forest (primarily dominated by northern pin [Hill's] oak), with barrens interspersed in areas that have been more recently disturbed by fire or logging (Figure 5). Along major drainages, deciduous forested wetlands occur. Numerous lakes and flowages are also scattered throughout the larger landscape.

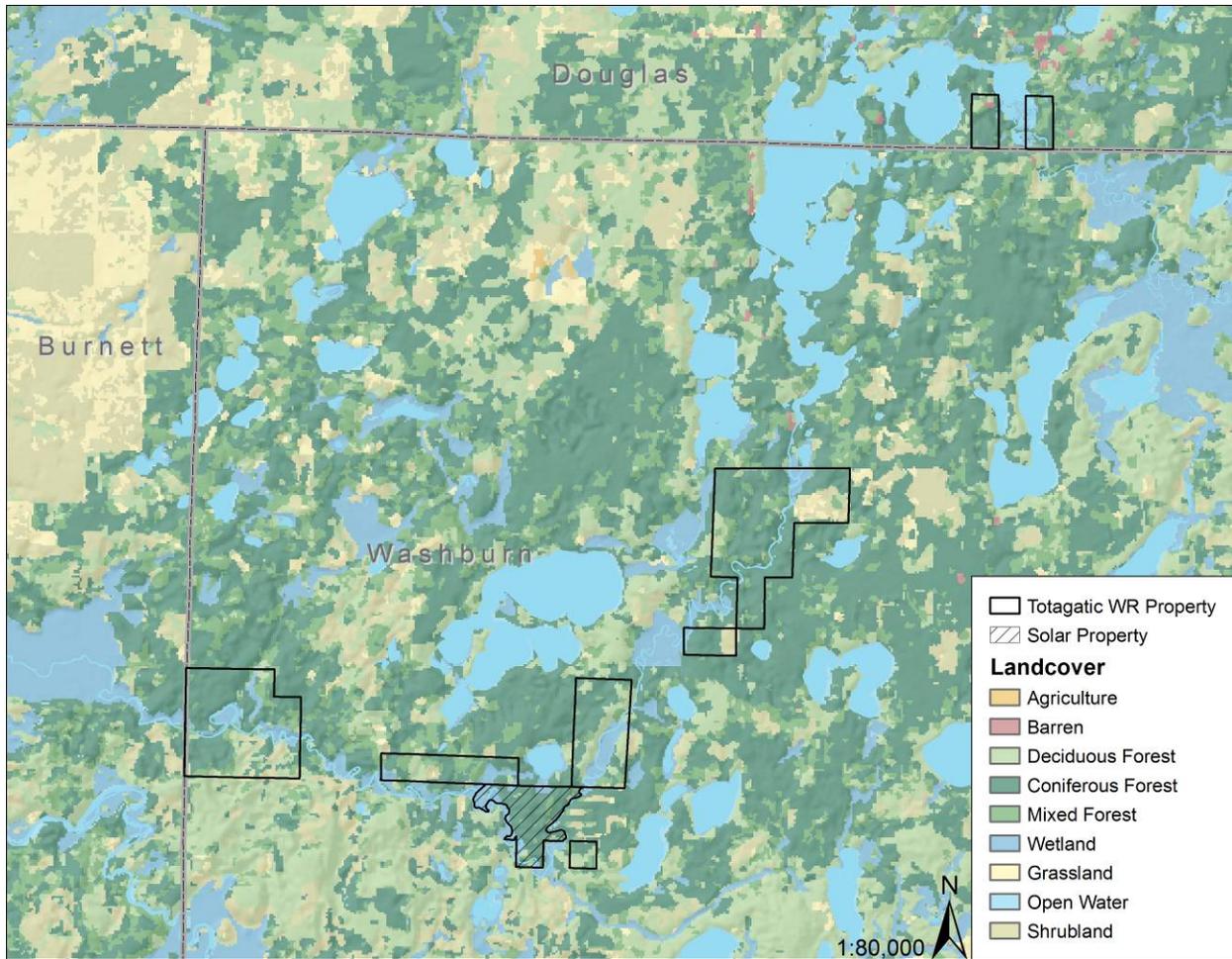


Figure 5. Landcover for Totagatic Wild River Planning Group from the Wisconsin DNR Wisland GIS coverage (WDNR 1993).

Consistent with the historic vegetation, Northern Dry Forest comprises a majority of the upland landscape on the TWR property, while barrens (poorly represented in the Wisland figure) currently occupy a smaller, yet still significant portion of the uplands. Forests are dominated by jack pine and northern pin (Hill's) oak with lesser amounts of red pine, white pine, bur oak (*Quercus macrocarpa*), American hazelnut (*Corylus americana*), low sweet blueberry (*Vaccinium angustifolium*), bracken fern (*Pteridium aquilinum*) as well as numerous grasses including poverty grass (*Danthonia spicata*), big bluestem (*Andropogon gerardii*), June grass (*Koeleria macrantha*), and Pennsylvania sedge (*Carex pensylvanica*). In some areas, timber management has created small canopy openings which are filled with hazelnut, tree saplings, and herbaceous plants characteristic of barrens. The highest quality Northern Dry Forest occurs in the western most WDNR parcel, north of the river.

On the Solar Property, a natural origin red pine forest occurs, dominated by trees up to 18 inches DBH (diameter at breast height). This forest is unique on the property, and very uncommon in this part of the Northwest Sands Ecological Landscape. It may owe its origin and maintenance in part to the large bend in the river that wraps around from the east, to the south, finally to the west, as well as wetlands to the north. Together these landscape features may have historically created lower intensity fire conditions, allowing the red pine to establish and grow into the closed canopy stand that exists today. Small pockets of trembling aspen (*Populus tremuloides*) also occur in this area.

Pine Barrens occur scattered across several areas of the property, with the highest quality sites being in the northeast part of the property east of Kimball Lake Road and in the southwest part of the property east of County Line Road. Pine Barrens have resulted, in part, from recent clear cutting and a failed effort to replant red pine on some sites, where recent furrowing and scattered surviving red pines are evident. Pine Barrens at TWR are characterized by scattered young jack pine, red pine, northern pin (Hill's) oak, and American hazelnut with a relatively diverse ground flora including big bluestem, little bluestem (*Schizachyrium scoparium*), June grass, poverty grass, Pennsylvania sedge, hoary puccoon (*Lithospermum canescens*), long-leaved bluets (*Houstonia longifolia*), prairie phlox (*Phlox pilosa*), showy goldenrod (*Solidago speciosa*), prairie goldenrod (*S. ptarmicoides*), western sunflower (*Helianthus occidentalis*), and bird's-foot violet (*Viola pedata*).

In many places the rolling uplands drop over 150 feet in elevation down steep sandy slopes to the floodplain and associated terraces of the Totagatic River. The forest along the river is characterized by a variable canopied forest of bur oak (*Quercus macrocarpa*), basswood, American elm (*Ulmus americana*), trembling aspen, silver maple (*Acer saccharinum*), and white ash (*Fraxinus americana*) with low open areas of bluejoint grass (*Calamagrostis canadensis*), tussock sedge (*Carex stricta*), white meadowsweet (*Spiraea alba*), and winterberry (*Ilex verticillata*). Previous active timber management is evident in wider areas of the Floodplain Forest.

Small wetland pockets also occur on the property, including Springs and Spring Runs, Forested Seep, Alder Thicket, and Tamarack Poor Swamp, particularly southeast of Banks Lake between the lake and the Totagatic River. An Oxbow Lake also occurs on the northwest portion of the Solar Property, a remnant of an old channel scour. This topographically diverse portion of the Solar Property also contains pockets of Northern Wet Forest in depressions dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*). An Open Bog occurs along the south end of Banks Lake and is dominated by few-seeded sedge (*Carex oligosperma*), leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), cotton-grass (*Eriophorum* sp.), scattered tamarack and jack pine, and Sphagnum moss (*Sphagnum cuspidatum*). Alder Thicket and Northern Sedge Meadow also occur on margins of several of these wetlands and in drainageways to the east where small streams enter the main stem of the Totagatic River.



The Totagatic River winds past steep slopes dominated by pine and oak.
Photo by Richard Staffen.

Rare Species of Minong Township

Rare species have been documented within Minong Township, which encompasses all TWR properties (Table 3). See Appendix C for rare species occurrences by property and Appendix D for summary descriptions of the species. Bird occurrences refer only to breeding activity.

Table 3. Documented rare species of Minong Township.

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

Common Name	Scientific Name	Last Observed	State Rank	Global Rank	State Status	Federal Status	SGCN	Tracked by NHI
Birds								
American Woodcock	<i>Scolopax minor</i>	2012	S3S4B	G5	SC/M		Y	W
Bald Eagle	<i>Haliaeetus leucocephalus</i>	2012	S4B,S4N	G5	SC/P		Y	Y
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	2012	S3S4B	G5	SC/M		Y	W
Blue-winged Teal	<i>Anas discors</i>	2012	S3S4B	G5	SC/M		Y	W
Brown Thrasher	<i>Toxostoma rufum</i>	2012	S3S4B	G5	SC/M		Y	W
Common Nighthawk	<i>Chordeiles minor</i>	2012	S2S3B	G5	SC/M		N	Y
Connecticut Warbler	<i>Oporornis agilis</i>	2012	S2S3B	G4	SC/M		Y	Y
Field Sparrow	<i>Spizella pusilla</i>	2012	S3S4B	G5	SC/M		Y	W
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	2012	S3S4B	G4	SC/M		Y	W
Kirtland's Warbler	<i>Dendroica kirtlandii</i>	1988	S1B	G1	SC/FL	LE	Y	Y
Least Flycatcher	<i>Empidonax minimus</i>	2012	S4B	G5	SC/M		Y	W
Merlin	<i>Falco columbarius</i>	2012	S3B,S2N	G5	SC/M		N	W
Northern Goshawk	<i>Accipiter gentilis</i>	1994	S2B,S2N	G5	SC/M		Y	Y
Northern Harrier	<i>Circus cyaneus</i>	2012	S3B,S2N	G5	SC/M		Y	W
Osprey	<i>Pandion haliaetus</i>	2012	S4B	G5	SC/M		Y	W
Purple Martin	<i>Progne subis</i>	2012	S2S3B	G5	SC/M		N	Y
Veery	<i>Catharus fuscescens</i>	2012	S3S4B	G5	SC/M		Y	W
Vesper Sparrow	<i>Pooecetes gramineus</i>	2012	S3S4B	G5	SC/M		Y	W
Whip-poor-will	<i>Caprimulgus vociferus</i>	2012	S3B	G5	SC/M		Y	W
Fishes								
Gilt Darter	<i>Percina evides</i>	2009	S2S3	G4	THR		Y	Y

Common Name	Scientific Name	Last Observed	State Rank	Global Rank	State Status	Federal Status	SGCN	Tracked by NHI
Least Darter	<i>Etheostoma microperca</i>	1977	S3	G5	SC/N		Y	Y
Reptile and Amphibian								
American Bullfrog	<i>Lithobates catesbeianus</i>	2012	S3S4	G4	SC/H		N	W
Blanding's Turtle	<i>Emydoidea blandingii</i>	2011	S3S4	G4	THR		Y	Y
Prairie Skink	<i>Plestiodon septentrionalis</i>	2012	S2	G5	SC/H		Y	Y
Wood Turtle	<i>Glyptemys insculpta</i>	2012	S2	G4	THR		Y	Y
Invertebrate								
Broad-winged Skipper	<i>Poanes viator</i>	1995	S4	G5	SC/N		N	W
Lancet Clubtail	<i>Gomphus exilis</i>	1995	S4	G5	SC/N		Y	W
Mammal								
Franklin's Ground Squirrel	<i>Spermophilus franklinii</i>	1948	S2	G5	SC/N		Y	Y
Little Brown Bat	<i>Myotis lucifugus</i>	1995	S2S4	G5	THR		N	Y
Mussels								
Black Sandshell	<i>Ligumia recta</i>	2012	S3	G5	SC/P		N	W
Creek Heelsplitter	<i>Lasmigona compressa</i>	2012	S3S4	G5	SC/P		N	W
Elktoe	<i>Alasmidonta marginata</i>	2012	S3	G4	SC/P		N	Y
Purple Wartback	<i>Cyclonaias tuberculata</i>	2012	S2	G5	END		Y	Y
Round Pigtoe	<i>Pleurobema sintoxia</i>	2012	S3	G4G5	SC/P		N	W
Plant								
Dwarf Milkweed	<i>Asclepias ovalifolia</i>	2012	S3	G5?	THR		NA	Y
Northern Bur-reed	<i>Sparganium glomeratum</i>	2001	S2	G4?	THR		NA	Y
Northern Yellow Lady's-slipper	<i>Cypripedium parviflorum</i> var. <i>makasin</i>	2001	S4	G5T4T5	SC		NA	W
Prairie Sagebrush	<i>Artemisia frigida</i>	1917	S2	G5	SC		NA	Y
Natural Community								
Northern Dry Forest		2012	S3	G3?	NA		NA	Y
Northern Dry-mesic Forest		2012	S3	G4	NA		NA	Y
Pine Barrens		2012	S2	G2	NA		NA	Y

Management Considerations and Opportunities for Biodiversity Conservation

Landscape Level Opportunities and Considerations

Patch Size and Ecological Connections

Forest fragmentation and the overall loss of both dry northern forests and pine and oak barrens have been identified as major threats to northern forests and barrens in the Lake States (Radeloff et al. 1999). Many SGCN that depend on these habitats have experienced population declines and range contractions within the barrens ecosystem largely as a result of habitat loss, land-use change, fire suppression and habitat fragmentation. Since many pine forest and barrens areas in the state have undergone landuse changes (either parcelization and development or succession to other vegetation types), TWR and surrounding forests and barrens properties in the Northwest Sands Ecological Landscape collectively represent an important opportunity to maintain an intact dry forest and barrens landscape, serving critical functions on a statewide and regional level.

Though small in acreage, the TWR presents opportunities to maintain connectivity between ecologically significant sites and adjacent barrens and dry forest tracts within the surrounding landscape (WDNR 2006b). In particular, TWR is located near an area identified in the Northwest Sands Corridor Plan as an important habitat corridor between other adjacent, large barrens complexes, such as Namekagon Barrens and Douglas County Wildlife Areas (Fig. 6; Reetz et al. 2012). In addition, the TWR lies adjacent to the recently designated Brule-St. Croix Legacy Forest, a working forest easement in partnership with Lyme Timber Company preserving more than 67,000 acres of forested land concentrated in Washburn and Douglas counties near TWR (WDNR 2012).

It is important to recognize both the spatial and temporal pattern of forest and barrens, as well as relative patch sizes of these habitats in the regional landscape. As noted above, barrens were highly variable across the landscape, and included areas of open barrens and savanna-like forests with scattered medium to large pine trees embedded in a matrix of jack pine forest of varying ages (Radeloff et al. 1999). This spatial heterogeneity was historically maintained by stochastic disturbances such as fire and infrequent catastrophic windstorms. Management that mimics natural spatial patterns on TWR and surrounding properties will maximize benefits across the landscape. Specifically, there are opportunities to provide moderate sized open barrens as "stepping stones" (such as Kimball Road barrens) between larger barrens complexes in the larger landscape (i.e., Namekagon

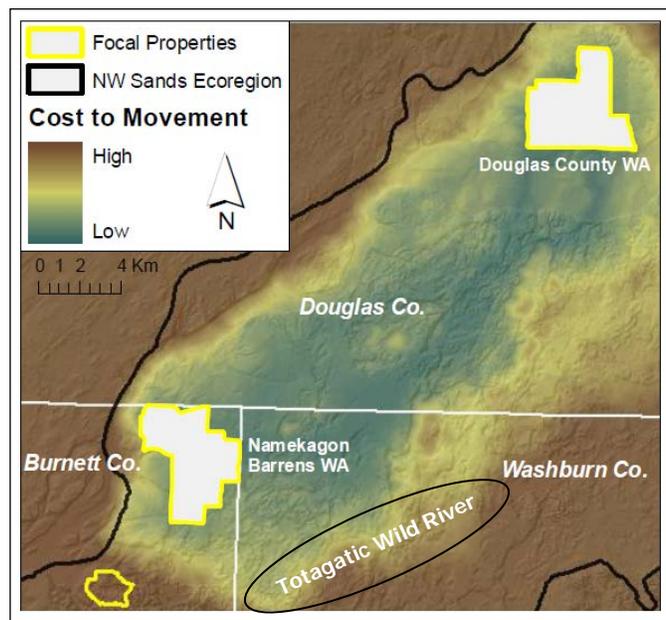


Figure 6. Landscape-level habitat corridors between Namekagon Barrens and Douglas County Wildlife Areas; low Cost to Movement (blue-gray) represents the best potential pathways for wildlife to move from one site to another (modified from Reetz et al. 2012, used with permission). Location of Totogatic Wild River is approximate.

Barrens and Douglas Co. Wildlife Areas). In addition, on the Solar Property and adjacent state parcels, there are opportunities to maintain and restore savanna-like areas with large diameter red pines, which has largely been lost from the historical landscape (Radeloff et al. 1999). Finally, opportunities exist to maintain and enhance a shifting mosaic of the full spectrum of age classes of jack pine forest (including mature or overmature forests), particularly if management can be coordinated with adjacent lands in the County Forest Program and Brule-St. Croix Legacy Forest.

The Wisconsin Wildlife Action Plan – Implementation Plan (WDNR 2008) has identified several statewide priorities related to dry forests and barrens in the Northwest Sands and the TWR and the surrounding landscape. These include:

1. Implement the Northwest Sands Integrated Ecosystem Management Plan to manage the full range of barrens succession stages and diverse habitats in a landscape context. A comprehensive landscape plan requires identification and management of early succession cores. The “barrens” also needs to have places managed in a shifting mosaic of timber harvest with many clearcuts, some older than rotation-age stands, some thinning of stands for savanna structure and a few protected groves. Many stands should be thinned to a safe amount of residual standing timber then burned for stand regeneration while leaving charred legacies. Manage shallow publicly-owned lakes by maintaining open shorelines. To enhance landscape attributes, red pine plantations can be applied to appropriate sites where the historic fire regime indicates groves occurred.
2. Identify additional sites containing high quality or restorable barrens.
3. Integrate planning efforts across federal, state, county, local and industrial ownership boundaries.

Finally, the river and associated wetlands, seeps, streams, and slopes, represents an important habitat and migration corridor in a mostly remote, forested context. These areas connect with other more remote wetlands and forested features surrounding the TWR to provide habitat for a diverse group of species. This part of the state has the potential to provide an important travel corridor via roadless areas, riverine corridors, and other contiguous wilderness areas for immigration of several wide-ranging animal species including gray wolf (*Canis lupus*) and cougar (*Puma concolor*) (Wydeven et al. 2009; Wiedenhoef et al. 2011). Opportunities to enhance these connections through protecting and expanding both forested uplands and wetlands on a landscape scale would be beneficial to these and other species. The importance of the river corridor to fish and wildlife species is discussed in greater detail below.

Wildlife Action Plan Conservation Opportunity Area

Conservation Opportunity Areas (COAs) are places in Wisconsin that contain ecological features, natural communities, or SGCN habitat for which Wisconsin has a unique responsibility for protection when viewed from the global, continental, upper Midwest, or state perspective. Portions of the Totagatic Wild River lies within the Namekagon Barrens COA, identified as having global significance for the large-scale barrens management opportunity of this globally rare ecosystem present in this area (see Appendix B for map). Connecting and managing the barrens present across large acreages of public lands owned by state and county government would benefit rare plants and the full suite of animal’s dependant upon this rare natural community (WDNR 2005). The Totagatic River also connects directly to the Namekagon – St. Croix National Scenic Riverway, an Aquatic Conservation Opportunity Area of Upper Midwest significance.

Wisconsin's Statewide Forest Strategy

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

These documents noted above include topics related to biological diversity in Wisconsin's forests, and provide information useful for department master planning and management activities. Several Statewide Forest Strategies are particularly pertinent to the TWR planning efforts in regard to opportunities to maintain or enhance biological diversity (Table 4, WDNR 2010b).

Table 4. Selection of Wisconsin Statewide Forest Strategies Relevant to the TWR.

Strategy Number	Strategy
11	Encourage the management of under-represented forest communities.
12	Improve all forested communities with a landscape management approach that considers the representation of all successional stages.
13	Increase forest structure and diversity.
14	Encourage the use of disturbance mechanisms to maintain diverse forest communities.
15	Maintain the appropriate forest types for the ecological landscape while protecting forest health and function.
18	Encourage the forestry community to be engaged in deer management issues with an understanding of the long term significance of deer impacts on sustainable forestry.
19	Adapt forest management practices to sustainably manage forests with locally high deer populations.
22	Strive to prevent infestations of invasive species before they arrive.
23	Work to detect new (invasive species) infestations early and respond rapidly to minimize impacts to forests.
24	Control and manage existing (invasive species) infestations.
25	Rehabilitate, restore, or adapt native forest habitats and ecosystems.
29	Attempt to improve the defenses of the forest and increase the resilience of natural systems to future climate change impacts.
30	Intentionally accommodate (climate) change and enable forest ecosystems to adaptively respond.

High Conservation Value Forests

The Wisconsin DNR manages 1.5 million acres that are certified by the Forest Stewardship Council (FSC) (Forest Stewardship Council 2009) and the Sustainable Forest Initiative (SFI). Forest certification

requires forests to be managed using specified criteria for ecological, social, and economic sustainability. Principle 9 of the *Draft 7 FSC-US Forest Management Standard* concerns the maintenance of High Conservation Value Forests (HCVF). High Conservation Value Forests are defined as possessing one or more of the following:

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

River Corridors

The Totagatic Wild River is connected to the federally designated Namekagon - St. Croix National Scenic Riverway. These combined river corridors protect more than 255 miles of undisturbed river system, forming one of the most pristine and wildest river corridors in the state. The entire corridor (St. Croix – Namekagon – Totagatic) is recognized as an Outstanding Resource Waterway and the Namekagon – St. Croix National Scenic Riverway is an Aquatic Conservation Opportunity Area of Upper Midwest significance. Development pressure is high in this area due to its proximity to the Twin Cities urban center in Minnesota and presents a major threat to remaining wild river areas, water quality, and wildlife habitat.

The porous sandy soils of this landscape reduce surface runoff, acting like a sponge to rapidly absorb, store, and later discharge groundwater to surrounding rivers and streams supporting regionally important fisheries and high aquatic biodiversity. The good water quality and free-flowing nature of these rivers provide important habitat for many rare or declining animal species (e.g., turtles, fishes, mussels, bats, and aquatic macroinvertebrates) allowing for long-distance movements required by a variety of wide-ranging resident and migratory species.

Management of lands adjacent to these rivers will have important impacts on water quality, directly affecting all of these species as sandy soils are highly susceptible to erosion. In addition to the 150-foot river buffer already utilized, additional buffer distance may be warranted for timber harvests to account for steepness of slope, soil type, vegetative cover, and the habitat needs of sensitive species to most effectively protect both rare and common species associated with the river.

Non-Native Invasive Species

Non-native invasive species thrive in newly disturbed areas, but also may invade and compromise high-quality natural areas. They establish quickly, tolerate a wide range of conditions, are easily dispersed, and are relatively free of the diseases, predators, and competitors that kept their populations in check in their native range. Non-native invasive plants can out-compete and even kill native plants by monopolizing light, water, and nutrients, and by altering soil chemistry and mycorrhizal relationships. In situations where non-native invasive plants become dominant, they may even alter ecological processes by limiting use of prescribed fire, by modifying hydrology, and by limiting tree regeneration and ultimately

impacting forest composition (WDNR In prep. b). In addition to the threats to native communities and native species diversity, non-native invasive species negatively impact forestry (by reducing tree regeneration, growth and longevity), recreation, agriculture, and human health (by causing skin rashes and increasing incidence of tick-borne diseases). For example, in bottomland forests, dense patches of reed canary grass (*Phalaris arundinacea*) can prevent regeneration of trees and a minor infestation can become dense if the canopy is opened beyond 80% cover (WDNR In prep. b). Non-native invasive plants and animals can also have negative impacts on fish and wildlife species by long-term displacement of native food sources (e.g., for deer [*Odocoileus virginianus*] and turkey [*Meleagris gallopavo*]; Gorchoff and Trisler 2003), diminishing habitat for ground-nesting birds (e.g. ovenbirds [*Seiurus aurocapillus*] and woodcock [*Scolopax minor*]; Miller and Jordan 2011, Loss et al. 2012) and altering aquatic macroinvertebrate communities in streams, thereby impacting fish that feed on them (McNeish et al. 2012).

Non-native invasive plant species of the TWR are found in both upland and wetland habitats (Table 5). Upland species are more abundant and problematic at the property group, and include spotted knapweed (*Centaurea biebersteinii*), common tansy (*Tanacetum vulgare*), woolly mullein (*Verbascum thapsus*), bull thistle (*Cirsium vulgare*), and Kentucky bluegrass (*Poa pratensis*), all of which are associated with open, dry, sandy habitats.

Wetland non-native invasive plants on TWR include glossy buckthorn (*Rhamnus frangula*), reed canary grass (*Phalaris arundinacea*), and showy bush honeysuckle (*Lonicera x bella*). Only one stem of glossy buckthorn was found (along the south bank of the river south of County Line Road) and may represent a high priority for eradication, although targeted surveys for invasive plants were not within the scope of this project. Glossy buckthorn is of particular concern because of its ability to drastically alter wetlands by changing soil pH, eliminating sedge hummocks, decreasing light availability, and reducing grass and sedge cover (Fiedler and Landis 2012). Because of its apparent relative lack of abundance, an excellent opportunity exists to control glossy buckthorn before it becomes more widespread and has more adverse impacts to natural community quality and wildlife habitat. In addition, showy bush honeysuckle was found along the Totagatic River corridor on floodplains and river banks.

Similarly to terrestrial invasives, aquatic invasives are successful because they originate in other regions or continents, thus lacking natural checks and balances. Early and abundant growth of non-native aquatic plants not only overwhelms native plants, it may disrupt aquatic predator-prey relationships by inhibiting larger fish, and may limit important aquatic food plants for waterfowl. The die-off of plants such as curly-leaf pondweed in summer can cause oxygen depletion in waterbodies, and decaying plants can contribute to nutrient loading and algal blooms. Aquatic invasive animals similarly present overwhelming competition to their native counterparts (e.g., rusty crayfish [*Orconectes rusticus*] versus native crayfish). Apart from environmental impacts, aquatic invasives diminish aquatic recreational resources by inhibiting boat and swimming access, and by negatively affecting game fish populations. Eurasian water-milfoil, curlyleaf pondweed (*Potamogeton crispus*), common carp (*Cyprinus carpio*) and rusty crayfish have been reported in the Minong Flowage near the Washburn-Douglas county line.

Prevention of spread is 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 following the Best Management Practices developed by the Wisconsin Council on Forestry ([Invasive Species Best Management Practices](#)).

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

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

- Aquatic Invasive Species: contact: Lisa Burns, Regional Invasive Species Coordinator, Washburn County Land & Water Conservation District, (Lburns@co.washburn.wi.us, 715-468-4654).
- North Woods CWMA (Ashland, Bayfield, Douglas, Iron), Darienne McNamara (darienne.mcnamara@gmail.com, 715-373-5964), www.northwoodscwma.org.

Emerald Ash Borer

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

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

Table 5. Non-native Invasive Species of the Totagatic Wild River Planning Group.

Common Name	Latin Name	Upland Habitats		Wetland Habitats		Aquatic	Abundance Comments
		Open	Wooded	Open	Wooded		
Plants							
bull thistle	<i>Cirsium vulgare</i>	x					Uncommon in far northeast parcels near Minong Flowage
common mullein	<i>Verbascum thapsus</i>	x					Occasional in barrens near Kimball Rd
common tansy	<i>Tanacetum vulgare</i>	x					Occasional in barrens near Kimball Rd
curly-leaved pondweed	<i>Potamogeton crispus</i>					x	Known from Minong Flowage
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>					x	Known from Minong Flowage

Common Name	Latin Name	Upland Habitats		Wetland Habitats		Aquatic	Abundance Comments
		Open	Wooded	Open	Wooded		
glossy buckthorn	<i>Rhamnus frangula</i>			x	x		One large shrub/small tree near south end of County Line Road on south bank of Totagatic River
Kentucky bluegrass	<i>Poa pratensis</i>	x	x				Common to uncommon in barrens throughout property
reed canary grass	<i>Phalaris arundinacea</i>			x	x		GIS coverage shows scattered patches along Totagatic River floodplain
showy bush honeysuckle	<i>Lonicera X bella</i>	x	x				Sparse in floodplain and bank of river
spotted knapweed	<i>Centaurea biebersteinii</i>	x					Sparse throughout pine barrens and common in disturbed ground (e.g. roads, trails, furrows)
Animals							
common carp	<i>Cyprinus carpio</i>					x	Known from Minong Flowage
rusty crayfish	<i>Orconectes rusticus</i>					x	Known from Minong Flowage

Table 6. Non-Native Invasive Species to watch for; currently unknown in the Totagatic Wild River.

Common Name	Latin Name	Upland Habitats		Wetland Habitats		Aquatic	Abundance Comments
		Open	Wooded	Open	Wooded		
Plants							
bird's-foot trefoil	<i>Lotus corniculatus</i>	x					Known from Douglas Co. Wildlife Area
black locust	<i>Robinia pseudoacacia</i>	x	x				Known from Douglas Co. Wildlife Area
common buckthorn	<i>Rhamnus cathartica</i>						Known from Douglas Co. and Burnett Co.
cypress spurge	<i>Euphorbia cyparissias</i>	x					Known from Namekagon Barrens Wildlife Area
Japanese knotweed	<i>Polygonum cuspidatum</i>	x		x			Known from Burnett and Douglas Co.
leafy spurge	<i>Euphorbia esula</i>	x					Known from Namekagon Barrens Wildlife Area
narrow-leaved cattail	<i>Typha angustifolia</i>			x			Known from wetlands and lakes in vicinity
purple loosestrife	<i>Lythrum salicaria</i>			x			Known from wetlands and lakes in vicinity
Scot's pine	<i>Pinus sylvestris</i>	x	x				Known from Douglas Co. Wildlife Area
Animals							
Chinese mystery snail	<i>Cipangopaludina chinensis</i>					x	Known from several lakes in vicinity.
freshwater jellyfish	<i>Craspedacusta sowerbii</i>					x	Known from Lower Kimball Lake
emerald ash borer*	<i>Agrilus planipennis*</i>		x		x		Currently not known from property group
*NR-40 Prohibited Species							

Community Level Opportunities and Considerations

Natural Community Management Opportunities

The Wisconsin Wildlife Action Plan (WAP) (WDNR 2006a) identifies 21 natural communities for which there are “Major” or “Important” opportunities for protection, restoration, or management in the Northwest Sands Ecological Landscape. Of these, six are present at the Totagatic Wild River Planning Group (Table 7).

Table 7. Major and Important Natural Community Management Opportunities in the Northwest Sands Ecological Landscape that occur in the TWR (WDNR 2006a).

<u>Major Opportunity</u>	<u>Important Opportunity</u>
Pine Barrens	Alder Thicket
Northern Dry Forest	
Northern Dry-mesic Forest	
Coldwater streams	
Warmwater rivers	

Pine Barrens and Northern Dry Forest

Both Pine Barrens and Northern Dry Forest were common historically but are now uncommon or rare in the state. Together, these communities were estimated to cover 2,300,000 acres (5.5% of Wisconsin's landscape) circa 1800 (Finley 1976). Today, this acreage has been greatly reduced by logging and conversion to other landuses; only 0.7% of Wisconsin's pre-settlement pine barrens remain (Eckstein and Moss 1995).

Ecological processes that historically maintained these systems included frequent wildfire, in concert with drought, growing-season frosts, and low-nutrient soils. By its nature, fire is a dynamic process, often burning areas in irregular patterns, setting succession back in some areas while leaving other areas unburned. This creates a shifting landscape mosaic of open barrens, savanna-like barrens, young forest, and mature forest. In addition, soils, topography, and past land use also exert an influence on vegetation that adds to this variability. These different habitats support different suites of plant and wildlife species. For example, open barrens and sparsely treed Pine Barrens support dwarf milkweed (*Asclepias ovalifolia*), a light-loving rare plant found in the region. In contrast, the rare Connecticut warbler (*Oporornis agilis*) prefers mature, multi-layered jack pine stands typical of older Northern Dry Forests.

The TWR and other areas in the Northwest Sands Ecological Landscape present one of the best conservation opportunities in the state to manage for and restore a shifting mosaic of Pine Barrens and Northern Dry Forest (WDNR 2006a). Specific areas on the property that have the highest potential for restoration and management include the **Kimball Barrens Primary Site**, particularly for the open barrens community, and the **County Line Road Barrens and Forest Primary Site**, for both its central area of open barrens and adjacent forest stands in various states of maturation. For more on these Primary Sites, see page 33.

Species Level Opportunities and Considerations

Ecological Priorities for SGCN

The Wisconsin Wildlife Action Plan identifies ecological priorities in each Ecological Landscape. Ecological priorities are the natural communities in each Ecological Landscape that are most important to the SGCN. Appendix E highlights the Ecological Priorities for vertebrate SGCN at TWR properties. Note

that these Ecological Priorities include all of the natural communities and associated SGCN that are determined to provide the best opportunities for management at the TWR 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 TWR. Priority Conservation Actions identified in the Wisconsin Wildlife Action Plan (WDNR 2006a) for the Northwest Sands Ecological Landscapes that apply to TWR include:

- Create financial incentives to manage for jack pine.
- Develop educational tools and demonstration/training areas that promote prescribed fire and other barrens management practices.
- Implement the Northwest Sands Integrated Ecosystem Management Plan (see section under Landscape Level Opportunities and Considerations on page 23).
- Restore jack pine and oak barrens and shrub habitats on public lands in appropriate Conservation Opportunity Areas through fire, ground layer enhancement, and timber management.
- Identify additional sites containing high quality or restorable barrens.
- Develop a practical “toolkit” for maintaining structural and compositional characteristics of barrens ecosystems.
- The landscape is especially well suited to conduct research to determine Franklin’s ground squirrel (*Spermophilus franklinii*) distribution, habitat use, population, and mortality factors.

Herptiles

The aquatic resources associated with the Totagatic River, along with the sandy soils of the barrens provide excellent conditions for numerous rare herptiles. The Totagatic River and its tributaries provide foraging, basking, and overwintering habitat for several rare and common aquatic turtles. Sandy river banks and adjacent sandy uplands, particularly open sand blows, provide critical nesting habitat for many of these turtles but also for snakes and lizards. Pine Barrens and Northern Dry Forest provide excellent foraging and thermoregulation opportunities for numerous snakes and lizards. Connecting barrens habitats and Northern Dry Forests and increasing patch size of these areas would be beneficial in enhancing these populations and allowing safe movement between sites for terrestrial herptiles and other taxa.

Wetlands are uncommon on TWR but are an important ecological feature surrounding the property group and in much of the Northwest Sands Ecological Landscape. These wetland areas along with scattered lakes on or near the property support good numbers of breeding frogs and toads and also support populations of semi-aquatic turtle species including Blanding’s (*Emydoidea blandingii*), painted (*Chrysemys picta*), and snapping turtles (*Chelydra serpentina*).

A number of herptile species occur or have the potential to occur on the TWR property group near their range limits. Several southern species at the northern extent of their range, including eastern hog-nosed snake (*Heterodon platirhinos*), northern watersnake (*Nerodia sipedon*), gophersnake (*Pituophis catenifer*), common map turtle (*Graptemys geographica*), and Blanding’s turtle occur here or nearby. At range limits, species are generally thought to be encountering physical or physiological limits to successful competition, and are therefore more sensitive to stressors which may tip the balance of success at these limits. Because of this strong association and range limit status, these species should be excellent indicator species for environmental monitoring, including monitoring the effects of ongoing climate change (Casper 2010).

Additional inventory and monitoring would be beneficial as several rare or uncommon species have the potential to occur within the property group. The Spring and Spring Run, Northern Sedge Meadow, Alder Thicket, and Tamarack Poor Swamp complex southeast of Banks Lake, partially on state-owned property and on the Solar Property, has the potential to support pickerel frog (*Lithobates palustris*) and northern leopard frog (*Lithobates pipiens*) along with four-toed salamanders (*Hemidactylium scutatum*). The Totagatic River could support a population of common mudpuppy (*Necturus maculosus*), a species of Special Concern in Wisconsin. Additional efforts to locate more turtle nesting areas would also be beneficial. Once the nesting areas are located, protecting these sites would be aided by limiting disturbances such as recreational activities, limiting forest succession and maintaining an open canopy around them.

Birds

The TWR and surrounding area provide excellent opportunities to support significant populations of regionally and globally rare birds associated with the full spectrum of grassland/barrens and Northern Dry Forest communities. Barrens and Northern Dry Forest habitats are globally rare, and populations of bird specialists of these communities are likewise doing poorly due to loss of habitat, small or isolated patch size, and conversion to other types. Bird rarities of these types include the Federally Endangered Kirtland's warbler (*Dendroica kirtlandii*) and globally uncommon species like sharp-tailed grouse and Connecticut warbler (WDNR 2011). In addition, numerous SGCN in Wisconsin were also located during breeding bird surveys within barrens habitats of the TWR.

Of critical importance for many uncommon birds of barrens and bracken grassland habitats is patch size. Many of these uncommon species are area-sensitive, meaning they require large patches of habitat for nesting and are highly sensitive to habitat fragmentation. Sharp-tailed grouse are considered a signature species for barrens habitats. They are area-sensitive with research suggesting they need a 10,000-acre minimum parcel for long-term stability (WDNR 1995). Currently, species of low area-sensitivity like field sparrow, vesper sparrow, and clay-colored sparrow (*Spizella pallida*) are found at TWR. Area-sensitive species of conservation concern like sharp-tailed grouse, upland sandpiper, and northern harrier are known from the surrounding landscape, and connecting these parcels could effectively increase patch size and likely improve bird species diversity and richness. **Kimball Barrens Primary Site** currently offers the best opportunity to consider connecting grassland/barrens habitat patches to enhance habitat for area-sensitive birds. The surrounding landscape includes large tracts of County Forest lands and the Brule-St. Croix Legacy Forest enhancing early successional management opportunities.

Diversity of age classes is an important factor for barrens ecosystem function. Providing for the full spectrum of age classes within the barrens system will maximize the diversity of birds and associated animals. Historically, fire played a large role in determining the makeup of these landscapes. They were a patchwork of open grassland with very few scattered trees, grading into areas with more shrubs or scrub oak and young patches of jack and red pines, and finally to areas with larger diameter scattered trees along with closed canopy forests. This entire successional spectrum is very important in providing nesting and foraging habitat for a variety of rare or declining birds. At the more open barrens end of the spectrum, grassland birds can be prevalent. When more brush and young trees are present sharp-tailed grouse, common nighthawk, whip-poor-will, brown thrasher, field sparrow, vesper sparrow, and Kirtland's warbler would be found. Finally, an important stage not often accounted for in barrens management is areas of denser canopy pines or Northern Dry Forest. This stage is important for Connecticut warbler, black-billed cuckoo (*Coccyzus erythrophthalmus*), black-backed woodpecker (*Picoides arcticus*), and gray jay (*Perisoreus canadensis*). **County Line Road Barrens and Forest Primary Site** presents an opportunity to further enhance this full spectrum of barrens to dry forest continuum.

Terrestrial Invertebrates

Barrens habitats with intact and diverse prairie forbs and grasses are critically important areas for a large number of butterflies and moths. This encompasses both common and rare species with many butterflies and moths being limited to specific larval host plants. Some of the best Pine Barrens found on the TWR, especially those noted as Primary Sites (**Kimball Barrens, County Line Road Barrens and Forest**) during this inventory effort, support a moderate diversity of native prairie flora, increasing the likelihood that a diverse Lepidoptera community could be present. Additionally, open sand areas on the property have potential to support uncommon tiger beetles, while barrens and sand prairies are important habitats for many grasshoppers.

Although no rare butterflies or moths were detected during limited surveys, identifying and managing barrens habitats for a diversity of native plants and important host plants like wild lupine (*Lupinus perennis*), prairie phlox (*Phlox pilosa*), blueberries (*Vaccinium* spp.) and New Jersey tea (*Ceanothus* spp.) would facilitate this ecological relationship between plants and animals and aid in conserving any rare species on the landscape. Prairie phlox, blueberries and New Jersey tea were all found on the property and are known host plants for rare butterflies. In addition, several barrens-associated butterflies, including olympia marble (*Euchloe olympia*), eastern pine elfin (*Callophrys niphon*), and hoary elfin (*C. polios*) were noted during inventory efforts, pointing to the potential of the property to support rare barrens Lepidoptera.

Game Species

The Totagatic Wild River property provides good opportunities for hunting, trapping, and fishing. Important game species utilizing the river currently include ducks, geese, smallmouth bass, northern pike, and walleye. The lower portion of the Totagatic River receives a fair amount of fishing pressure, but also gets used seasonally by fish migrating up from the Namekagon River (Wendell pers. comm.). White-tailed deer, wild turkey, gray wolf, black bear (*Ursus americanus*), ruffed grouse (*Bonasa umbellus*), eastern gray squirrel (*Sciurus carolinensis*), red squirrel (*Tamiasciurus hudsonicus*), eastern cottontail rabbit (*Sylvilagus floridanus*), and American woodcock are present in forested uplands throughout the property.

Lesser game species, including burrowing mammals common in barrens or dry forests on sandy soils, are coyote (*Canis latrans*), red fox (*Vulpes vulpes*), and gray fox (*Urocyon cinereoargenteus*). Additional upland game species known to be present on the property based upon museum records, inventory work, or tracks and sign are bobcat (*Lynx rufus*), fisher (*Martes pennanti*), mourning dove (*Zenaidura macroura*), snowshoe hare (*Lepus americanus*), and ermine or short-tailed weasel (*Mustela erminea*). Common raccoon (*Procyon lotor*), American mink (*Mustela vison*), beaver (*Castor canadensis*) and river otters (*Lontra canadensis*) are found near the river or in wetlands of the property. Game species with potential to increase populations or their habitat on TWR include sharp-tailed grouse and wild turkey. Management to support game species dependent on large open or barren landscapes such as sharp-tailed grouse would also benefit other rare species like the Kirtland's warbler and grassland birds.

Primary Sites: Site-specific Opportunities for Biodiversity Conservation

Four ecologically important sites, or “Primary Sites,” were identified within the TWR (Figure 7). Primary Sites are delineated because they generally encompass the best examples of 1) rare and representative natural communities, 2) documented occurrences of rare species populations, and/or 3) opportunities for ecological restoration or connections. These sites warrant high protection and/or restoration consideration during the development of the property master plan. This report is meant to be considered along with other information when identifying opportunities for various management designations during the master planning process.

A complete description of the Primary Sites can be found in Appendix G. Information provided in the summary paragraphs includes location information, a site map, a brief summary of the natural features present, the site’s ecological significance, and management considerations. Appendix H lists the rare species and high-quality natural communities currently known from these Primary Sites in the TWR.

Table 8. Totagatic Wild River Planning Group Primary Sites.

Code	Name
TWR01	County Line Road Barrens and Forest
TWR02	Solar Red Pines
TWR03	Kimball Barrens
TWR04	Totagatic Wild River



American woodcock nest on Solar Property. Photo by Richard Staffen.

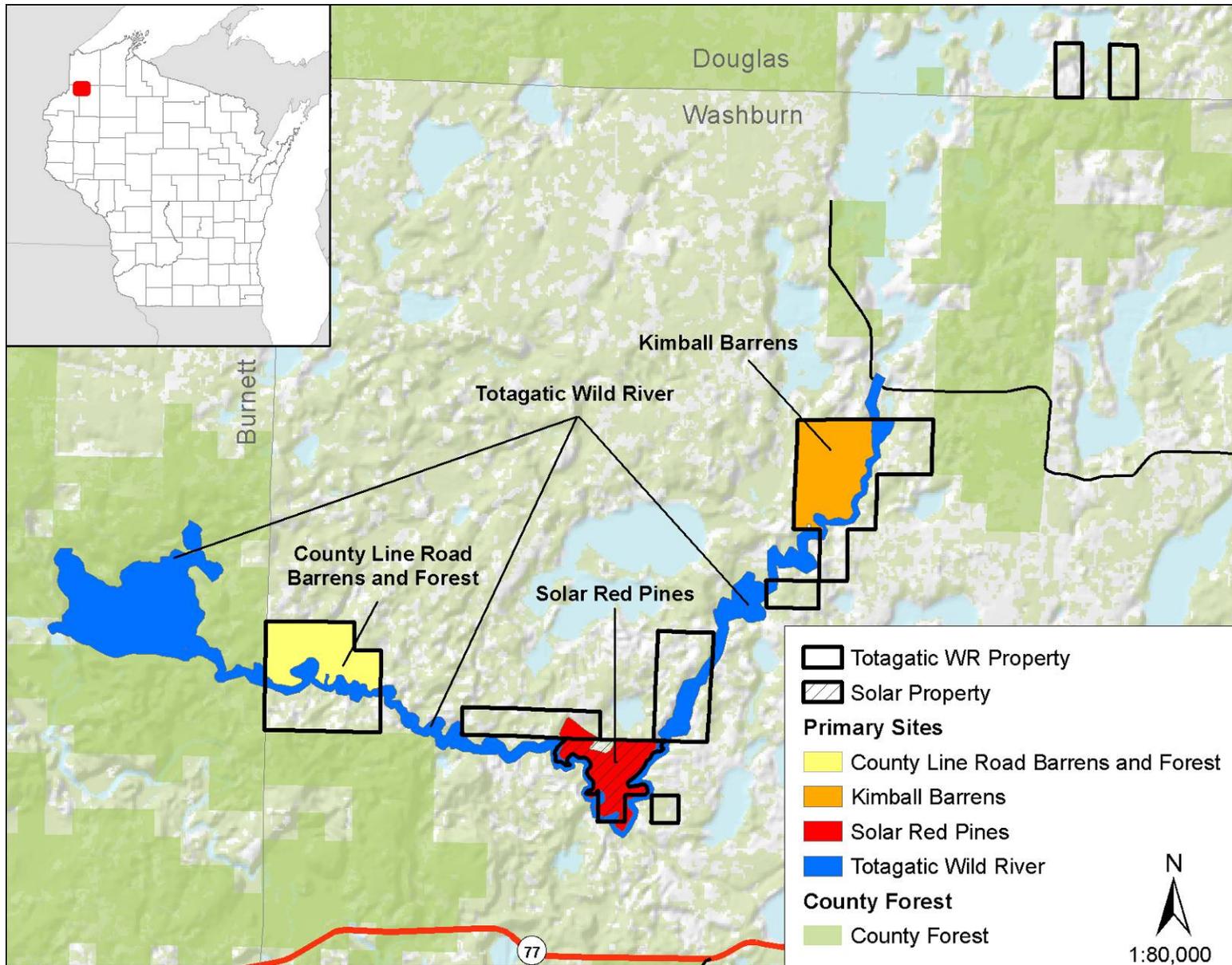


Figure 7. Primary Sites of the Totagatic Wild River Planning Group.

Future Needs

This project was designed to provide a rapid assessment of the biodiversity values for the Totagatic Wild River 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 TWR.

- Continued invasive species monitoring and control is needed, particularly for glossy buckthorn, showy bush honeysuckle, and spotted knapweed, as well as curly pondweed in the Totagatic River. Public lands throughout Wisconsin are facing major management problems because of serious infestations of highly invasive species. Some of these species are easily dispersed by humans and vehicles; others are spread by birds, mammals, insects, water, or wind. In order to protect the important biodiversity values of the TWR, a comprehensive invasive species inventory, monitoring, and control plan will be needed for detecting and rapidly responding to new invasive threats.
- Locations and likely habitats should be identified for conducting additional rare plant and animal surveys during appropriate seasons. This should include additional vertebrate and invertebrate animal taxon groups. Specific taxa are listed below.
- Additional surveys for terrestrial invertebrates in open uplands would be beneficial. Though some surveys were conducted, they were relatively small in scope and time. Efforts should especially focus on butterflies and moths, grasshoppers, and tiger beetles.
- Small mammal surveys are recommended for the full suite of small mammal species. Particular effort could be aimed at verifying extant records of the rare Franklin's ground squirrel (*Spermophilus franklinii*) and identifying key habitat characteristics for this species.
- Acoustical bat surveys along the Totagatic River, within open barrens or other forest openings, and along roads would be useful in identifying summer resident bat species utilizing the property group. To date, bat surveys have been limited to the mouth of the Totagatic River at its junction with the Namekagon River.
- Additional surveys for frogs (pickerel frog, northern leopard frog, and mink frog [*Lithobates septentrionalis*]), four-toed salamander, and snakes along with monitoring of existing populations of herptiles identified during this inventory are recommended.
- Monitoring of flowering and fruiting of dwarf milkweed would be beneficial, as this species is seldom observed with viable seed pods. Establishing a quantitative, regular monitoring program for this poorly understood State Threatened plant species will help inform conservation measures and state listing status.
- Complete forest cover type reconnaissance and mapping to aid in identifying various levels of forest management needs over time.

Glossary

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

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

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

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

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

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

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

Species List

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

Common Name	Scientific Name
Plants	
American elm	<i>Ulmus americana</i>
American hazelnut	<i>Corylus americana</i>
Basswood	<i>Tilia americana</i>
Big bluestem	<i>Andropogon gerardii</i>
Birds-foot violet	<i>Viola pedata</i>
Black ash	<i>Fraxinus nigra</i>
Black spruce	<i>Picea mariana</i>
Blue-joint grass	<i>Calamagrostis canadensis</i>
Bog laurel	<i>Kalmia polifolia</i>
Bracken fern	<i>Pteridium aquilinum</i>
Bull thistle	<i>Cirsium vulgare</i>
Bur oak	<i>Quercus macrocarpa</i>
Common buckthorn	<i>Rhamnus cathartica</i>
Common tansy	<i>Tanacetum vulgare</i>
Cotton-grass	<i>Eriophorum sp.</i>
Curly pondweed	<i>Potamogeton crispus</i>
Dwarf Milkweed	<i>Asclepias ovalifolia</i>
Eurasian water-milfoil	<i>Myriophyllum spicatum</i>
Few-seeded sedge	<i>Carex oligosperma</i>
Glossy buckthorn	<i>Rhamnus frangula</i>
Green ash	<i>Fraxinus pennsylvanica</i>
Hoary puccoon	<i>Lithospermum canescens</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>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Little bluestem	<i>Schizachyrium scoparium</i>
Long-leaved bluets	<i>Houstonia longifolia</i>
Low sweet blueberry	<i>Vaccinium angustifolium</i>
New Jersey tea	<i>Ceanothus spp.</i>
Pennsylvania sedge	<i>Carex pennsylvanica</i>
Poverty grass	<i>Danthonia spicata</i>
Prairie goldenrod	<i>S. ptarmicoides</i>
Prairie phlox	<i>Phlox pilosa</i>
Red pine	<i>Pinus resinosa</i>
Reed canary grass	<i>Phalaris arundinacea</i>
Northern pin (Hill's) oak	<i>Quercus ellipsoidalis</i>
Showy bush honeysuckle	<i>Lonicera X bella</i>
Showy goldenrod	<i>Solidago speciosa</i>
Silver maple	<i>Acer saccharinum</i>

Common Name	Scientific Name
Sphagnum moss	<i>Sphagnum cuspidatum</i>
Spotted knapweed	<i>Centaurea biebersteinii</i>
Tamarack	<i>Larix laricina</i>
Trembling aspen	<i>Populus tremuloides</i>
Tussock sedge	<i>Carex stricta</i>
Western sunflower	<i>Helianthus occidentalis</i>
White ash	<i>Fraxinus americana</i>
White meadowsweet	<i>Spiraea alba</i>
White pine	<i>Pinus strobus</i>
Wild lupine	<i>Lupinus perennis</i>
Winterberry	<i>Ilex verticillata</i>
Woolly mullein	<i>Verbascum thapsus</i>
Animals	
Cougar	<i>Puma concolor</i>
American Bullfrog	<i>Lithobates catesbeianus</i>
American mink	<i>Mustela vison</i>
American woodcock	<i>Scolopax minor</i>
Beaver	<i>Castor canadensis</i>
Black bear	<i>Ursus americanus</i>
black-backed woodpecker	<i>Picoides arcticus</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Blanding's turtle	<i>Emydoidea blandingii</i>
Bobcat	<i>Lynx rufus</i>
Brook trout	<i>Salvelinus fontinalis</i>
Brown Thrasher	<i>Toxostoma rufum</i>
Clay-colored sparrow	<i>Spizella pallida</i>
Common carp	<i>Cyprinus carpio</i>
Common map turtle	<i>Graptemys geographica</i>
Common mudpuppy	<i>Necturus maculosus</i>
Common Nighthawk	<i>Chordeiles minor</i>
Common raccoon	<i>Procyon lotor</i>
Connecticut Warbler	<i>Oporornis agilis</i>
Coyote	<i>Canis latrans</i>
Eastern cottontail rabbit	<i>Sylvilagus floridanus</i>
Eastern gray squirrel	<i>Sciurus carolinensis</i>
Eastern hog-nosed snake	<i>Heterodon platirhinos</i>
Eastern pine elfin	<i>Callophrys niphon</i>
Emerald ash borer	<i>Agrilus planipennis</i>
Field Sparrow	<i>Spizella pusilla</i>
Fisher	<i>Martes pennanti</i>
Four-toed salamander	<i>Hemidactylum scutatum</i>
Franklin's ground squirrel	<i>Spermophilus franklinii</i>
Gophersnake	<i>Pituophis catenifer</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Gray jay	<i>Perisoreus canadensis</i>
Gray wolf	<i>Canis lupus</i>

Common Name	Scientific Name
Hoary elfin	<i>Callophrys polios</i>
Kirtland's Warbler	<i>Dendroica kirtlandii</i>
Largemouth bass	<i>Micropterus salmoides</i>
Mink frog	<i>Lithobates septentrionalis</i>
Mourning dove	<i>Zenaida macroura</i>
Northern Harrier	<i>Circus cyaneus</i>
Northern leopard frog	<i>Lithobates pipiens</i>
Northern pike	<i>Esox lucius</i>
Northern watersnake	<i>Nerodia sipedon</i>
Olympia marble	<i>Euchloe olympia</i>
Ovenbird	<i>Seiurus aurocapillus</i>
Painted Turtle	<i>Chrysemys picta</i>
Pickerel	<i>Lithobates palustris</i>
Prairie Skink	<i>Plestiodon septentrionalis</i>
Raccoon	<i>Procyon lotor</i>
Red fox	<i>Vulpes vulpes</i>
Red squirrel	<i>Tamiasciurus hudsonicus</i>
River otter	<i>Lontra canadensis</i>
Ruffed grouse	<i>Bonasa umbellus</i>
Rusty crayfish	<i>Orconectes rusticus</i>
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>
Short-tailed weasel	<i>Mustela erminea</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Snapping Turtle	<i>Chelydra serpentina</i>
Snowshoe hare	<i>Lepus americanus</i>
Upland sandpiper	<i>Bartramia longicauda</i>
Vesper Sparrow	<i>Pooecetes gramineus</i>
Walleye	<i>Stizostedion vitreum</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
White-tailed deer	<i>Odocoileus virginianus</i>
Wild turkey	<i>Meleagris gallopavo</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. Bureau of Endangered Resources' Animals, Plants, and Communities Web Pages

Information for plants, animals, and natural communities on the Wisconsin Working List, as well as Species of Greatest Conservation Need from the Wisconsin Wildlife Action Plan. For reptiles and amphibians, information for more common species is also provided here. At this time, the level of detail available varies among species; some have detailed factsheets while others have only a short paragraph or a map. These pages will continue to evolve as more information becomes available and are the Bureau of Endangered Resources' main source of information for species and communities. dnr.wi.gov 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 keyword "*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 keyword "*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*"
- explore Wildlife Action Plan data by County:
dnr.wi.gov/topic/WildlifeHabitat/county.asp
- Wildlife Action Plan Implementation: dnr.wi.gov keyword "*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/files/PDF/pubs/rs/rs0915.pdf

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 keyword "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 keyword "forest assessment"

8. **The Northwest Sands Landscape Level Management Plan**

The plan was prepared by the Northwest Regional Planning Commission and Wisconsin Department of Natural Resources, includes the NWBPG. Many of the strengths within this landscape are linked to the large public land base, including state and county owned properties and the numerous options for habitat management of the rare Pine and Oak Barrens.

www.nwrpc.com/

9. **The Northwest Sands Habitat Corridor Model and Plan**

University of Wisconsin-Madison in collaboration with WDNR Science Services and Wildlife Management recently completed a habitat corridor model that identifies potential habitat corridors or stepping stones between core-managed barrens properties in the Northwest Sands Ecological Landscape. This new tool is designed to focus land management opportunities to benefit barrens-dependent SGCNs, with a specific focus on sharp-tailed grouse.

mywebpace.wisc.edu/mreetz/web/Home_files/NWSCorridorPlan.pdf

10. **The State of the St. Croix Basin**

The State of the St. Croix Basin Report (WDNR 2002) was prepared in consultation with local units of government, other agencies, private citizens and other conservation organizations in the St. Croix River Basin. The report is designed to give an overall assessment of the health and status of land and water resources throughout the Wisconsin portion of the basin. Issues and threats that affect the basin are discussed as are their impact on statewide resources.

http://dnr.wi.gov/water/basin/stcroix/stcroix_final_3-26-02.pdf

11. **Barrens State Natural Area Management Guide (Pine Barrens, Oak Barrens, Sand Barrens, and Bracken Grasslands). Chapter 100.61 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 barrens (more specifically, Pine Barrens, Oak Barrens, Sand Barrens, and Bracken Grasslands). 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. This resource can be found on the "Manual Codes and Handbooks" Intranet website.

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.

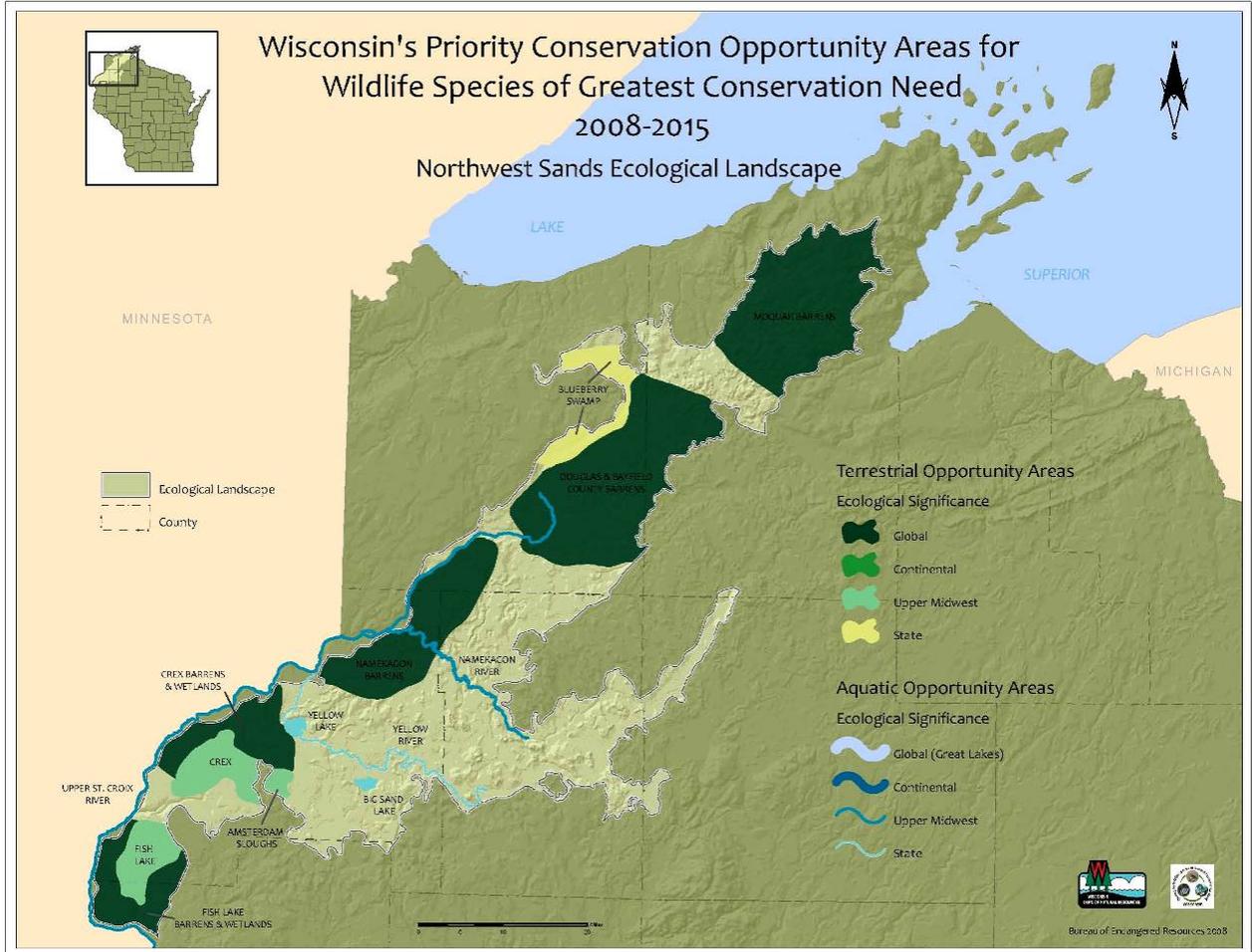
Interviews: Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield invaluable information.

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



Appendix D

Descriptions of Rare Species and High Quality Natural Communities Documented within Minong Township

The following paragraphs give brief summary descriptions for some of the rare species documented within Minong Township 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 Bullfrog

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

Bald Eagle

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

Black-billed Cuckoo

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

Black Sandshell

Black sandshell (*Ligumia recta*) is found throughout Wisconsin in large rivers, lakes and canals. Its preferred substrates are sand and gravel, but it is occasionally found in mud. Host fish include American eel, bluegill, largemouth bass and white crappie.

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.

Blue-winged Teal

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

Broad-winged Skipper

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

Brown Thrasher

Brown Thrasher (*Toxostoma rufum*) is a bird of Special Concern in Wisconsin. This species nests in hedgerows and in brushy edges of fields and forests. Breeding occurs from early May to mid July.

Creek Heelsplitter

Creek Heelsplitter (*Lasmigona compressa*) is most common in headwater streams with firm substrates, but can be found in larger rivers. Wherever it is found, it is usually quite rare.

Connecticut Warbler

Connecticut Warbler (*Oporornis agilis*), a bird listed as Special Concern, prefers mature, multi-layered pine stands, particularly jack pine, and occasionally in tamarack-pine stands with dense hardwood understory. The recommended avoidance period is from June 1 - August 25.

Elktoe

Elktoe (*Alasmidonta marginata*), a State Special Concern mussel, is found in various-sized streams with flowing water, sand, gravel or rock substrates that are stable. The known host fishes include widespread species including redbhorse, sucker species and rockbass.

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

Franklin's Ground Squirrel

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

Gilt Darter

Gilt Darter (*Percina evides*), a fish listed as Threatened in Wisconsin, prefers strong currents, deep riffles, and pools in clear, medium-to-large streams that have clean, silt-free bottoms of cobble and small boulders. Spawning occurs late May to late June.

Golden-winged Warbler

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

Kirtland's Warbler

Kirtland's Warbler (*Dendroica kirtlandii*), a bird listed as Special Concern in Wisconsin and Federally listed as Endangered, is found in areas at least 30 hectares in size, where scrubby jack pine (2 to 6 meters high) is interspersed with many small openings and minimal ground cover. The recommended avoidance period is from May 1 - August 30.

Least Darter

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

Least Flycatcher

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

Little Brown Bat

The little brown bat (*Myotis lucifugus*) is a Threatened species in Wisconsin. Its dorsal fur is a glossy dark-brown to olive-brown color with a lighter ventral side. The little brown bat is insectivorous and feeds on aquatic soft-bodied insects. The species is found roosting in warm microclimates provided by tree snags, bat houses and buildings during the summer. It forages primarily over open water and along edge habitat. This bat hibernates in caves and mines from October through April. Mating occurs in the fall, and females store sperm until emergence in the spring. Usually one pup is born in early June and matures after six weeks.

Merlin

Merlin (*Falco columbarius*), a bird listed as Special Concern, prefers coniferous forests especially stands of spruce, along lakeshores, but may be observed in agricultural areas. The recommended avoidance period is from early June through mid-August.

Northern Goshawk

Northern Goshawks (*Accipiter gentilis*) prefer mature deciduous, coniferous, or mixed forest types found in the northern 2/3 of Wisconsin. Territories are also known to occur in pine plantations in lower percentages, especially in the central part of the state. A mature, closed canopy forest with large diameter trees for nesting and foraging is predominately selected for by breeding pairs. Territorial adults are known to be very aggressive to humans entering within a half-mile or more of an active nest during most stages of the breeding season which extends from February 1 - July 31, with the most critical period between

February 1 and May 31. Nests are generally placed just below the canopy in the upper portion of the nest tree and one to five alternate nests are common within a nest stand.

Northern Harrier

Northern Harrier (*Circus cyaneus*), a bird listed as Special Concern, prefer retired cropland (timothy/quackgrass), old field habitat, sedge meadow, and restored prairies. The recommended avoidance period is from early April through late August.

Osprey

Osprey (*Pandion haliaetus*) prefer large trees in isolated areas in proximity to large areas of surface water, large complexes of deciduous forest, coniferous forest, wetland, and shrub communities. Large lakes and rivers with nearby tall pine trees are preferred for nesting. The recommended avoidance period is from April 1 - August 15.

Purple Martin

The Purple Martin (*Progne subis*), a Special Concern species in Wisconsin, is the largest of North American swallows with a large head and chest. The males are covered entirely with a glossy bluish-black plumage. Females have blue-black plumage on their back with a light gray chest and belly. While found throughout the state, the species is predominately concentrated in southeastern and eastcentral regions. The Purple Martin is generally found in open habitats and areas close to water, particularly near or in human settlements. Humans now provide nearly all nesting sites used by this species including established structures like birdhouses or nest boxes and gourds. Natural tree cavities were utilized historically and in a few cases to date. The avoidance period is from late April to late August. During this period, three to eight white eggs are laid that are incubated by the female for 15 to 18 days. After hatching, the hatchlings are tended by both adults.

Purple Wartyback

Purple wartyback (*Cyclonaias tuberculata*), a mussel listed as Endangered in Wisconsin, is found in large rivers in the western and southern parts of the state. It prefers a stable substrate containing rock, gravel and sand in swift current. Known hosts include bullhead and catfish species.

Round Pigtoe

Round pigtoe (*Pleurobema sintoxia*), a State Special Concern mussel. In Wisconsin, this species prefers various habitat types. It occurs only in clean water of small streams to large rivers on stable substrate. The known host fish include a number of cyprinid species.

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

Dwarf Milkweed

Dwarf Milkweed (*Asclepias ovalifolia*), a State Threatened plant, is found in oak barrens, open pockets within pine barrens, periodically brushed areas, and rights-of-way. Blooming occurs early June through early July; fruiting occurs late June through late August. The optimal identification period for this species is throughout June.

Northern Bur-reed

Northern Bur-reed (*Sparganium glomeratum*), a State Threatened plant, is found in cold ditches and pools within sedge meadows, willow-alder thickets and, occasionally, tamarack stands on the Lake Superior clay plain. Blooming occurs late June through late July; fruiting occurs late July through early September. The optimal identification period for this species is early July through early September.

Northern Yellow Lady's-slipper

Northern Yellow Lady's-slipper (*Cypripedium parviflorum* var. *makasin*), a State Special Concern plant, is found in fens, calcareous swales, and rich springy forest edges. 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 early July.

Prairie Sagebrush

Prairie Sagebrush (*Artemisia frigida*), a State Special Concern plant, is found in very dry dolomite bluff prairies and sand terraces along the upper Mississippi River; it is adventive elsewhere. Blooming occurs early August through late September; fruiting occurs throughout September. The optimal identification period for this species is early August through late September.

Natural Communities

Northern Dry Forest

This forest community occurs on nutrient-poor sites with excessively drained sandy or rocky soils. The primary historic disturbance regime was catastrophic fire at intervals of decades to approximately a century. Dominant trees of mature stands include jack and red pines (*Pinus banksiana* and *P. resinosa*) and/or Hill's oak (*Quercus ellipsoidalis*). Large acreages of this forest type were cut and burned during the catastrophic logging of the late 19th and early 20th century. Much of this land was then colonized by white birch (*Betula papyrifera*) and/or quaking aspen (*Populus tremuloides*), or converted to pine plantations starting in the 1920s. Common understory shrubs are hazelnuts (*Corylus* spp.), early blueberry (*Vaccinium angustifolium*) and brambles (*Rubus* spp.); common herbs include bracken fern (*Pteridium aquilinum*), starflower (*Trientalis borealis*), barren-strawberry (*Waldsteinia fragarioides*), cow-wheat (*Melampyrum lineare*), trailing arbutus (*Epigaea repens*), and members of the shinleaf family (*Chimaphila umbellata*, *Pyrola* spp.). Vast acreages of open "barrens" were also planted to pine, or naturally succeeded to densely stocked "dry" forests.

Northern Dry-mesic Forest

In this forest community, mature stands are dominated by eastern white (*Pinus strobus*) and red pines (*Pinus resinosa*), sometimes mixed with northern red oak (*Quercus rubra*) and red maple (*Acer rubrum*). Common understory shrubs are hazelnuts (*Corylus* spp.), blueberries (*Vaccinium* spp.), wintergreen

(*Gaultheria procumbens*), and partridgeberry (*Mitchella repens*). Among the dominant herbs are wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), and cow-wheat (*Melampyrum* sp.).

Northern dry-mesic forests are typically found on irregular glacial topography (e.g., heads-of-outwash, tunnel channel deposits), or in areas with mixed glacial features (e.g., pitted outwash interspersed with remnant moraines). Soils are loamy sands or sands, and less commonly, sandy loams. Some occurrences are in areas where bedrock is close to the surface. Areas of northern dry-mesic forest that were historically dominated by red and eastern white pines were considered the great "pineries" before the Cutover. Today, the extent of red and eastern white pine stands is greatly decreased, while red maple, sugar maple (*Acer saccharum*), aspen (*Populus* spp.), and oaks (*Quercus* spp.) have increased. Historically, fire disturbance of low to moderate intensity and frequency was key to maintaining the northern dry-mesic forest type.

Pine Barrens

This savanna community is characterized by scattered jack pines (*Pinus banksiana*), or less commonly red pines (*P. resinosa*), sometimes mixed with scrubby Hill's and bur oaks (*Quercus ellipsoidalis* and *Q. macrocarpa*), interspersed with openings in which shrubs such as hazelnuts, (*Corylus* spp.) and prairie willow (*Salix humilis*) and herbs dominate. The flora often contains species characteristic of "heaths" such as blueberries (*Vaccinium angustifolium* and *V. myrtilloides*), bearberry (*Arctostaphylos uva-ursi*), American hazelnut (*Corylus americana*), sweet fern (*Comptonia peregrina*), and sand cherry (*Prunus pennsylvanica*). Also present are dry sand prairie species such as june grass (*Koeleria macrantha*), little bluestem (*Schizachyrium scoparium*), silky and sky-blue asters (*Aster sericeus* and *A. azureus*), lupine (*Lupinus perennis*), blazing-stars (*Liatris aspera* and *L. cylindracea*), and western sunflower (*Helianthus occidentalis*). Pines may be infrequent, even absent, in some stands in northern Wisconsin and elsewhere because of past logging, altered fire regimes, and an absence of seed source.

Appendix E

Minong Township Species of Greatest Conservation Need

The following are vertebrate Species of Greatest Conservation Need (SGCN) associated with natural community types that are present in Minong Township in the Northwest Sands Ecological Landscape. Only SGCN with a high or moderate probability of occurring in these Ecological Landscapes are shown. Communities shown here are limited to those identified as “Major” or “Important” management opportunities in the Wisconsin Wildlife Action Plan (WDNR 2006b). Numbers indicate the degree to which each species is associated with a particular habitat type (3=significant association, 2=moderate association, and 1=low association). Animal-community combinations shown here that are assigned as either “3” or “2” are also Ecological Priorities, as defined by the Wisconsin Wildlife Action Plan (see dnr.wi.gov/org/land/er/WWAP/ for more information about these data). Shaded species have been documented for the TWR.

	Major					Important
	Coldwater streams	Northern Dry Forest	Northern Dry-mesic Forest	Pine Barrens	Warmwater rivers	Alder Thicket
Species that are Significantly Associated with the Northwest Sands Landscape						
American Bittern						L
American Woodcock		L	L	L		S
Bald Eagle					S	
Black-backed Woodpecker		M	L	L		
Black-billed Cuckoo		L	L	M		S
Blanding's Turtle	M			S	M	M
Blue-winged Teal					L	
Boreal Chorus Frog				S		
Brown Thrasher		L		S		
Bullsnake				S		
Connecticut Warbler		S	L	M		
Field Sparrow				M		
Franklin's Ground Squirrel				S		
Golden-winged Warbler		M	M	L		S
Gray Wolf		M	S	M		S
Greater Redhorse					M	
Least Darter					M	
Least Flycatcher		M	M			
Lesser Scaup					M	
Northern Flying Squirrel		M	S	L		
Northern Harrier				M		L

Northern Prairie Skink		M	M	S		
Osprey					S	
Red Crossbill		S	S	M		
Red-headed Woodpecker		L	L	L		
River Redhorse					M	
Sharp-tailed Grouse				S		
Trumpeter Swan					L	
Upland Sandpiper				M		
Veery		L	M			S
Vesper Sparrow				S		
Water Shrew	S				L	M
Whip-poor-will		M	M	M		
Wood Turtle	S			S	S	S
Species that are Moderately Associated with the Northwest Sands Landscape						
Blue-winged Warbler		L				
Canada Warbler		L	M			M
Canvasback					S	
Dunlin					M	
Four-toed Salamander	M					S
Gilt Darter					S	
Grasshopper Sparrow				L		
Lake Sturgeon					S	
Mink Frog	M				S	M
Mudpuppy	M				S	
Northern Goshawk		L	M			
Olive-sided Flycatcher		L	L	L		L
Pickerel Frog	S				S	M
Red-shouldered Hawk		L	M			
Rusty Blackbird						M
Solitary Sandpiper	M					L
Wood Thrush			L			
Woodland Jumping Mouse		L	L	L		L

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).