



## **Biotic Inventory Report for the Brule River State Forest**

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**An Updated Inventory and Analysis of Rare Plants and Animals and High-quality Natural Communities in Support of a Master Plan update**

Wisconsin's Natural Heritage Inventory Program  
Bureau of Natural Heritage Conservation  
Department of Natural Resources  
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## Brule River State Forest At a Glance

### Exceptional Characteristics of the Study Area

- **The Spillway: Headwaters of the Brule and St. Croix Rivers.** The Brule Spillway is a feature incomparable to any other headwater system in Wisconsin. The source of both the Brule and St. Croix Rivers, as well as containing the entirety of the Upper Brule, this area supports exemplary forested and non-forest wetlands, significant populations of uncommon boreal birds, as well as the largest populations in the state for several rare plants.
- **Boreal Forest.** The Brule River State Forest offers the single best opportunity for Boreal Forest restoration on state-owned land on the entire Superior Coastal Plain Ecological Landscape and in the state. Boreal Forests support significantly more Species of Greatest Conservation Need (especially birds and mammals) as well as rare plants relative to other forested habitats on the state forest.
- **Wood turtle conservation.** The lower half of the Brule River is critically important for wood turtles, a Species of Greatest Conservation Need in Wisconsin. Suitable overwintering, foraging, gestating, and nesting habitat are all present on the lower segment of the river. Innovative, ongoing management to create predator-protected nesting sites bolster the state forest's contribution toward the conservation of this species.
- **Migratory Birds, Brule Lagoon, and Lake Superior Dunes and Beaches.** The mouth of the Brule supports a 35-acre marsh and natural lagoon, as well as a sparsely vegetated beach and small dune system. The area is crucial for both migratory land birds as well as waterbirds and shorebirds. The river mouth is considered a freshwater estuary due to the influence of Lake Superior, and ranks as one of the higher quality estuarine complexes on the south shore of Lake Superior. The low dunes and beach that stretch from the Brule River Mouth west to Pearson Creek are one of largest stretches of undeveloped Lake Superior shoreline in state ownership and also support a state endangered invertebrate.
- **Pine Barrens and Northern Dry Forest.** The southern portion of the Brule River State Forest contains one of the best opportunities in the state to increase the size and landscape connectivity of regional pine barrens and dry forest. Strategically located in the central portion of the Northwest Sands, the state forest is an important habitat corridor for sharp-tailed grouse, birds, reptiles, invertebrates, and rare plants between other adjacent, large barrens complexes in the region.
- **Northern Dry-mesic Forest.** Mature, natural-origin white pine-red pine forests may be one of the rarest forest types in Wisconsin. There are significant opportunities to conserve high-quality Northern Dry-mesic Forest, especially along the slopes and adjacent terraces of the Brule Spillway, where stands occur that are up to 165 years old.
- **Seepage Lakes and Shorelines.** Small inland lakes in the southern portion of the state forest contain good-quality plant communities, have high water quality, and provide habitat for a variety of rare plants and animals, including a rare amphibian. In addition, seepage lake shorelines support the rare Inland Beach community, which provides habitat for a number of rare plants. The Northwest Sands is the best region in the state to conserve these unique communities.
- **Highway 13 Grasslands and Birds.** Grasslands in the vicinity of Highway 13 support numerous uncommon grassland birds. Many of these species are uncommon in the Superior Coastal Plain, and are found nowhere else on the state forest.

## Brule River State Forest At a Glance

### Site Specific Opportunities for Biodiversity Conservation

Twenty-five ecologically important sites, or Primary Sites, were identified on the Brule River State Forest. 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.

- **Eau Claire River.** The Eau Claire River contains high aquatic species richness, including many warm water and cold water fishes, mussels and aquatic insects. In addition, the Eau Claire is a headwater tributary to the St. Croix River system, globally significant due to its diverse aquatic biota.
- **Gordon Correctional Bog.** Containing one of the only true bogs on the state forest, this site contains unique wetland plants as well as a rare plant in adjacent uplands.
- **Deer Print, Black Fox, Jack Pine, and Paradise Lakes Complex.** Consisting of seven shallow soft-water seepage lakes in the southeast region of the state forest boundary, these lakes have undeveloped shorelines characterized by fluctuating water levels, good-quality aquatic communities and examples of the unusual Inland Beach community, a rare amphibian, and rare plants.
- **Jerseth Creek and Smith-Cheney-Shoberg Lakes Complex.** High-quality undeveloped soft-water seepage lakes support Inland Beach, rare plants, and a rare amphibian. They also feed Jerseth Creek, itself a high-quality stream supporting rare invertebrates, which flows through a pine barrens landscape.
- **North Country Trail Barrens and Mott's Ravine SNA.** Lying in the heart of the Northwest Sands, this site supports birds, reptiles, and rare lichens associated with barrens habitats. It is part of the larger globally significant Douglas and Bayfield County Barrens Conservation Opportunity Area (COA).
- **Divide Swamp.** Straddling a drainage divide and containing the headwaters of both the Bois Brule and St. Croix Rivers, this site contains a diversity of wetlands including Northern Wet-mesic Forest of mature white-cedar, Northern Tamarack Swamp, Hardwood Swamp, Alder Thicket, and Springs and Spring Runs. It also supports several rare plants and a rare dragonfly.
- **Angel Creek and Beaupre Springs.** Part of the larger Brule Spillway, Angel Springs and its outlet, Angel Creek, feed the upper reaches of the Bois Brule River, flowing through a floristically rich conifer swamp and alder thicket. Beaupre Springs is a series of soft water Springs and Spring Runs that form the East Fork of the Brule River. Both support a notably large number of rare invertebrates.
- **Stone Chimney Cedar Swamp.** Situated in the heart of the Brule Glacial Spillway SNA, Stone Chimney Cedar Swamp features one of the largest and highest quality cedar swamps in the state, as well as upland slopes with exceptionally large red and white pine. Numerous rare birds and rare plants can also be found here.
- **Blue Springs – McDougal Springs.** Located in the northern portion of the Brule Spillway, this site contains high-quality Northern Wet-mesic Forest and large, undisturbed Spring Ponds. In addition to contributing to the exceptional Spillway cedar swamp, it also supports rare birds and plants.
- **Cedar Island – Winneboujou.** Encompassing the northern portion of the Spillway, this site harbors high-quality Northern Wet-mesic Forest, Northern Dry-mesic Forest, Hardwood Swamp, and contains large beds of aquatic plants found nowhere else on the Brule River.

## Brule River State Forest At a Glance

### Site Specific Opportunities for Biodiversity Conservation (continued)

- **Mills Lake.** This shallow, muck-bottomed, soft water seepage lake is bordered by the best example of Poor Fen on the state forest.
- **Lake Minnesuing.** Containing a Northern Mesic Forest, Hardwood Swamp, and Ephemeral Ponds, this site supports a rare amphibian, and contains one the northwestern-most stands of hemlock in North America. It also supports high lichen diversity.
- **Vapa Road Pines and Ponds.** This site features a significant stand of large pines, as well as a complex of ponds and wetlands containing exemplary aquatic invertebrate communities.
- **Willard Pines.** This site supports one of the oldest and largest examples of natural origin red pine stands on the state forest. It also contains Ephemeral Ponds that support a rare amphibian.
- **Kurt's Deep Depression.** A shallow marshy pond surrounded by forest and barrens, situated in the bottom of a steep-sided depression, this site supports an exemplary assemblage of aquatic invertebrates, as well as a small but nice Pine Barrens on south-facing slopes.
- **Brule Rush Lake SNA.** With an undisturbed shoreline, this soft-water seepage lake supports one of the best examples of an Inland Beach on state land and also contains an exemplary aquatic invertebrate community.
- **Devil's Hole Pines.** This site, though small, features a natural stand of mature red pine over 150 years old on rough, sandy, collapsed glacial outwash topography.
- **Hoodoo Lake.** One of the only kettle bogs found on the state forest, this site supports several uncommon odonates and unique plants.
- **CCC Miller Boreal Forest and Pines.** This site supports a small stand of Boreal Forest and contributes to a larger forested block and corridor. It also supports a rare herptile.
- **Sugar Camp Hill.** This site features the state forest's largest acreage of northern mesic forest, supporting several species of uncommon birds. Ephemeral Ponds and low cliffs are also present.
- **The Promontory.** An igneous rock outcropping associated with the Copper Range, this site supports Dry Cliff, Bedrock Glade, and Northern Dry Forest, as well as a rare plant and several unusual lichens.
- **Lenroot Ledges.** This site contains one the best examples of forest dominated by mature pine and boreal conifers along the Brule River and supports uncommon songbirds and a rare herptile.
- **Brule River Boreal Forest SNA.** This site contains the best example of mature conifer-dominated clay plain Boreal Forest along the Brule River. It also supports a rare herptile, a rare plant, and several unusual lichens.
- **Brule River Mouth Marsh and Lagoon.** This freshwater estuary and low dune system ranks as one of the higher quality estuarine complexes on the south shore of Lake Superior, and is also a hot-spot for migratory birds. A rare marsh bird also nests here, along with a state-endangered invertebrate.
- **Bear Beach SNA and Pearson Creek Boreal Forest.** Bear Beach SNA stretches 6.5 miles from the Brule River mouth to west of Pearson Creek and contains one of the largest stretches of undeveloped beach along the Lake Superior shore on state land. Together with the Brule River Mouth, it is part of a critical shoreline migratory bird corridor, in addition to supporting a rare invertebrate found nowhere else on the state forest.

# Introduction

## Purpose and Objectives

This report is intended to be used as a source of information for revising the master plan for the Brule River State Forest (BRRSF). The regional ecological context for the BRRSF is provided to assist in developing the Regional and Property Analysis that is part of the master plan.

The primary objectives of this project were to collect biological inventory information relevant to the master plan revision for the BRRSF 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 BRRSF were focused on 1) identifying and evaluating ecologically important areas, including re-evaluating previously designated Primary Sites, 2) documenting or updating rare species occurrences, and 3) documenting or updating occurrences of high quality natural communities. This report can serve as the “Biotic Inventory” document used for master planning. 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 BRRSF and should be revisited periodically and updated when new information becomes available.

## Overview of Methods

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

Natural heritage programs track certain elements of biological diversity: rare plants, rare animals, high-quality examples of natural communities, and other selected natural features. The NHI Working List (WDNR 2016) contains the elements tracked in Wisconsin. They include endangered, threatened, and special concern plants and animals, as well as the natural community types recognized by NHI. The NHI Working List is periodically updated to reflect new information about the rarity and distribution of the state’s plants, animals, and natural communities. The most recent Working List is available from the Wisconsin DNR website (*Wisconsin Natural Heritage Working List*).

The Wisconsin NHI 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. NHC’s biotic inventory projects typically start with a coarse-filter assessment, followed by targeted surveys for priority taxa, then data processing, analysis and report writing. Survey scope and intensity corresponds to the study area size and ecological complexity, as well as resource availability.

NHC staff previously conducted a baseline Biotic Inventory of the Brule River State Forest from 1995-1997. These surveys and related Biotic Inventory and Analysis (WDNR 1999) served as the foundation of 2014-2016 surveys.

The most recent taxa-specific field surveys for the forest were focused on documenting high quality natural communities, rare plants, breeding birds (forest raptors and terrestrial birds, with a particular emphasis on boreal and barrens birds), mussels, odonates, small mammals, and herptiles (Table 1). The collective results from all of these surveys were used, along with other information, to identify and evaluate ecologically important areas (Primary Sites) of the BRRSF.

**Table 1. Survey Targets and Methods for Biotic Inventory on the BRRSF 2014-2016.**

Survey Target	Surveyors	Methods
Animals		
Breeding Birds	NHC Staff, Brian Collins	Point counts at CFI plots, other surveys followed Wisconsin Breeding Bird Atlas II protocols. Emphasis placed on rare boreal and barrens birds.
Migratory Landbirds	Frank Nicoletti (Hawk Ridge Bird Observatory)	Point counts following Migratory Landbird Monitoring Protocol. Surveys focused on Brule River mouth and Lake Superior shoreline.
Herps	NHC Staff	Egg mass surveys and terrestrial searches for frogs and salamanders in Ephemeral Ponds, calling surveys for mink and other frogs in lakes, cover board surveys for prairie skink and snakes in barrens. Mark-recapture study of wood turtles along Brule River.
Small Mammals	NHC Staff, Paula Anich (Northland College)	Transects with Sherman traps in boreal forests and conifer forests targeting woodland jumping mouse, northern flying squirrel, and water shrew, broadcast call surveys for Franklin's ground-squirrel.
Bats	NHC Bat Team	Mist netting for Northern Long-eared Bat.
Mussels	NHC Staff, Matt Berg	Visual searches in mid-lower stretches of Brule River.
Odonates	NHC Staff, Matt Berg	Visual encounter surveys in conjunction with mussel and lake surveys.
Beetles	NHC Staff, Wayne Steffens	Visual encounter surveys along Lake Superior sand beaches for beach dune tiger beetle.
Rare plants	NHC Staff, Paul Hlina et al. (See acknowledgements for all surveyors)	Meander surveys targeting cedar and hardwood swamps, barrens, boreal forests, mesic and dry-mesic forest, rock outcrops, bogs, and poor fens.
Natural Communities	NHC Staff, Matt Berg Paul Hlina et al. (See acknowledgements for all surveyors)	Meander surveys focused on characteristic species, community boundaries, threats and management issues. Long-term monitoring plots (modified Davidson methods) established in Boreal Forests and Northern Dry-mesic Forests. Timed meander surveys conducted in Boreal Forests, Northern Dry-mesic Forests, and Northern Mesic Forests. Aquatic macrophyte point sampling conducted in select inland seepage lakes.

**Table 2. Previous inventory or monitoring work conducted on the BRRSF by NHI and partners.**

Survey Target/Project Name	Year	Lead Surveyors	Location	Methods
Setting Floristic Quality Assessment Benchmarks for Inland Wetland Plant Communities across Wisconsin	2012-13	Paul Hlina, Lake Superior Research Institute (LSRI), UW-Superior	Wetlands in the Brule Spillway	Timed meander surveys of vegetation with estimates of percent cover for all plant species
Great Lakes Coastal Wetlands Consortium Monitoring (GLCWC)	2011-12	LSRI	Lagoon at the Brule River mouth	GLCWC protocol
Lichens	2009	Clifford Wetmore	Brule River State Forest	Meander surveys
Invasive plants	2006	LSRI	Forest-wide, especially along roads	Meander and roadside surveys for 34 invasive plants
Previous NHI Biotic Inventory	1995-97		Brule River State Forest	See WDNR 1999
Animals				
Breeding Birds	1996-97	Eric Epstein Rebecca Schroeder	Brule River State Forest	See WDNR 1999
Forest Raptors	1996-97	Bill Smith Dr. Robert Rosenfield	Brule River State Forest	See WDNR 1999
Herps (wood turtles and four-toed salamanders)	1996-97	Dr. Gary Casper Kevin Brewster Cass Brewster	Brule River State Forest	See WDNR 1999
Odonates	1996-97	Bill Smith	Brule River State Forest	See WDNR 1999
Aquatic invertebrates	1996-97	Dr. Kurt Schmude Colin Dovichin Dr. William Hilsenhoff Dr. Ken Tensnessen Wayne Steffens	Brule River State Forest	See WDNR 1999
Terrestrial invertebrates	1996-97	Kathy Kirk Dick Bautz	Brule River State Forest	See WDNR 1999
Rare plants	1995-97	Dr. Emmet Judzewicz June Dobberpuhl Andy Clark	Brule River State Forest	See WDNR 1999
Mosses	1996	Dr. Frank Bowers	Stone Chimney Cedar Swamp	See WDNR 1999
Natural Communities	1995-97	Eric Epstein Elizabeth Spencer Dan Spuhler	Brule River State Forest	See WDNR 1999
Aquatic invertebrates	1993	Bob Dubois	Mainstem of Brule R.	

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 BRRSF, key inventory considerations included the identification of older forests, pine barrens, high-quality open wetlands, inland lakes, the Brule River corridor, and the location of habitats that had the potential to support rare species. Private lands, including easements, surrounding the BRRSF were not surveyed, with the exception of small areas of the Brule-St. Croix Legacy Forest easement within the BRRSF project boundary.

In this report, the first mention of plant species and invertebrate animals in the text is followed by scientific names in parenthesis. Plant nomenclature follows the Wisconsin State Herbarium (WIS). Vertebrate animals follow standard common names. Scientific names for all species mentioned in the text can be found in the Species List section on page 66.

## Background on Past Conservation Planning Efforts

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

### Wisconsin Wildlife Action Plan: Conservation Opportunity Area

Conservation Opportunity Areas (COA) are places in Wisconsin containing ecological features, natural communities, or Species of Greatest Conservation Need (SGCN) habitat for which Wisconsin has a unique responsibility for protection when viewed from the global, continental, upper Midwest, or state perspective. The Wisconsin Wildlife Action Plan (WAP) identifies three Conservation Opportunity Areas (COA) within which BRRSF sites occur (see Appendix B for maps):

- **Douglas and Bayfield County Barrens COA:** This COA of global significance is one of the best areas nationwide to manage for globally rare pine barrens and associated species like sharp-tailed grouse, upland sandpiper, and Connecticut warbler.
- **Blueberry Swamp COA:** This COA of statewide significance encompasses the Brule Spillway as well as Blueberry Swamp and is notable for supporting some of the most extensive and high-quality wetlands in the state, such as white-cedar swamps and hardwood swamps, along with associated rare species and highly regarded trout streams.
- **Brule Boreal Forest COA:** In addition to containing remnant stands of Boreal Forest, this COA of continental significance encompasses the most extensive restoration opportunities for clay plain Boreal Forest on public land in the state, and possibly North America. It also includes extensive undeveloped tracts of Lake Superior shoreline and the Brule River mouth, a small freshwater estuary supporting large concentrations of migratory birds.

### Important Bird Area (IBA)

- **Brule River Glacial Spillway IBA:** Encompassing the headwaters of the St. Croix and Brule Rivers, as well as the cedar swamps, springs, sedge meadows and alder thickets of the Upper Brule, this IBA supports a very diverse breeding avifauna including northern saw-whet owl, black-backed woodpecker, gray jay, boreal chickadee, olive-sided flycatcher, yellow-bellied flycatcher, winter wren, wood thrush, golden-winged warbler, Cape May warbler, Blackburnian warbler, and mourning warbler

### Legacy Places

The Land Legacy Report (WDNR 2006) was designed to identify Wisconsin's most important conservation and recreation needs for the next 50 years.

- **The Bois Brule River** was given five out of five stars for both conservation significance and recreation potential, recognized for its pristine trout stream and miles of coniferous bog of mature white-cedar, balsam fir, and spruce. The conifer swamp remains in near pre-settlement condition and the ground layer is rich, with many ferns, mosses and several species of orchids present. In addition, the Brule River State Forest, a long, narrow band of public land centered upon the river, harbors a greater diversity of birds and mammals than any other northern Wisconsin area of similar size.
- **The Namekagon-Brule Barrens** was given five out of five stars for conservation significance. Running from west central Bayfield County to northwest Polk County, this swath of land

represents one of the best places to combine large scale pine barrens restoration with active forestry practices.

- **The Eau Claire River** was given three out of five stars for conservation significance for its mixed warmwater fishery, including walleye, muskellunge, northern pike, smallmouth bass, panfish, and suckers and several small, high quality lakes occur near the river.

#### **The Nature Conservancy's Superior Mixed Forest Ecoregion Conservation Plan**

- **The Brule River Corridor and Barrens** was recognized for its significant conservation value to birds, rare plants, and pristine ecological systems (TNC 2002).

#### **Wetland Gem Designation**

- The Brule Glacial Spillway was also recognized as a Wetland Gem by the Wisconsin Wetlands Association (Wisconsin Wetlands Association 2009).

## **Special Management Designations**

### **State Natural Areas**

State Natural Areas (SNA) are places on the landscape that protect outstanding examples of native natural communities, significant geological formations, and archaeological sites. Some SNAs, though not all, are legally dedicated, which confers a significant level of land protection through state statutes, administrative rules, and guidelines. Three SNAs occur on the BRRSF:

- **Brule Glacial Spillway SNA** is a 2,642-acre SNA encompassing the headwaters of the St. Croix and Brule Rivers as well as much of the Upper Brule River.
- **Mott's Ravine SNA** is a 655-acre SNA on an old glacial outwash channel containing the full range of vegetation expected on glacial outwash including natural jack pine forest, scrubby northern pin oak and bur oak thickets, and small pine barrens remnants.
- **Brule Rush Lake SNA** is a 22-acre SNA featuring a soft-water seepage lake with an undeveloped shoreline and a good example of an inland lake beach.
- **Brule River Boreal Forest SNA** is a 652-acre SNA situated along the steep slopes and terraces bordering the lower Brule River supporting a boreal forest that includes mature stands of large white pine, white spruce, balsam fir, balsam poplar, and occasionally white cedar.
- **Bear Beach SNA** is a 103-acre SNA featuring over five miles of undeveloped beach along the Lake Superior shore, west of the Brule River mouth.

### **Outstanding/Exceptional Resource Waters**

Numerous streams and several lakes on the BRRSF have been designated Outstanding and Exceptional Resource Waters (ORW and ERW). These officially designated (Wisconsin Administrative Code NR 102.11) waters provide outstanding recreational opportunities, support valuable fish and wildlife habitat, have good water quality, are not significantly impacted by human activities, and, thereby recognized as being the highest quality waters in the state. While ORWs typically do not have any point sources discharging pollutants directly to the water, ERWs have existing point sources at the time of designation. Many ORW and ERW streams and lakes occur on the BRRSF; many of these are also Class I trout streams (Table 3).

**Table 3.** Outstanding Resource Waters (ORWs) and Exceptional Resource Waters (ERWs) that flow through the BRRSF.

<b>Waterbody Name</b>	<b>WBIC</b>	<b>ORW/ERW</b>	<b>Trout Stream</b>
Lake Minnesuing	2866200	ORW	n/a
Upper St. Croix Lake	2747300	ORW	n/a
St. Croix Creek	2749100	ERW	Class I
Catlin Creek	2748600	ERW	Class I
West Fork of the Brule River	2870700	ORW	Class I
East Fork of the Brule River	2870900	ORW	Class I
Bois Brule River	2861800	ORW	Class I
Wilson Creek	2870800	ORW	Class I
Angel Creek	2870600	ORW	Class I
Jerseth Creek	2870400	ORW	Class I
McDougal Springs	2869400	ORW	n/a
Unnamed creek (tributary to Brule R. T47N R10W S33-34)	2868100	ORW	Class I
Unnamed creek (tributary to Brule R. T47N R10W S34)	2868200	ORW	Class I
Little Bois Brule River	2863100	ORW	Class I
Sandy Run Creek	2863200	ORW	Class I
Unnamed creek (tributary to Brule R., T47N R10W S14-15)	2864100	ORW	No status
Unnamed creek (tributary to Brule R., T47N R10W S10-11)	2863000	ORW	Class I
Unnamed creek (tributary to Brule R., T47N R10W S11-12)	2862900	ORW	Class I
Rocky Run	2862600	ORW	Class I
Casey Creek	2862400	ORW	Class I
Unnamed creek (tributary to Casey Cr, T47N R10W S3)	2862450	ORW	No status
Unnamed creek (tributary to Brule R., T48N R10W S35-36)	2862300	ORW	No status
Percival Creek	2862200	ORW	Class I
Trask Creek	2861900	ORW	Class II, III

**Wisconsin's Impaired Waters (303d)**

Section 303(d) of the federal Clean Water Act requires states to develop a list of impaired waters ("303(d) list"). The identification and listing of waters as impaired is one step in a continual process of waterbody classification, assessment, and management, the ultimate goal of which is to protect, restore, and maintain the full potential of each waterbody to the maximum extent possible. Lake Minnesuing is listed as an impaired water due to mercury contamination of fish tissue from atmospheric mercury deposition.

**Forest Certification**

Forest Certification is established on all DNR-managed lands, including state forests, parks, wildlife and fishery areas, and natural areas. Certified forests are recognized by the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI) as being responsibly managed (Forest Stewardship Council 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.

**North Country National Scenic Trail**

The North Country Scenic Trail (NCT) passes through the southern portion of the Brule River State Forest. The NCT is one of America's eleven National Scenic Trails and was authorized by the U.S. Congress in 1980. It is predominantly an off-road hiking trail and stretches approximately 4,600 miles from eastern New York to central North Dakota, passing through seven states including New York, Pennsylvania, Ohio, Michigan, Wisconsin, Minnesota, and North Dakota. Besides providing an excellent opportunity for hiking, the trail preserves some of the finest features of Wisconsin's glacial landscape as well as other scenic and natural resources. The NCT is administered by the National Park Service, managed by federal, state, and local agencies, and built and maintained primarily by the volunteers of the North Country Trail Association (NCTA) and its partners.

# Description of the Study Area

## Location and Size

The Brule River State Forest is located in Douglas County and totals 47,461 acres. Acreage is based on fee simple ownership from DNR Facilities and Lands GIS records as of February 2016; acreage may not include easements, leases and some permanent water bodies.

## Physical Environment

### Overview of Ecological Landscapes

This section is reproduced in part from *Ecological Landscapes of Wisconsin* (WDNR 2015a).

The BRRSF falls within three Ecological Landscapes: the Northwest Sands Ecological Landscape, Northwest Lowlands Ecological Landscape, and the Superior Coastal Plain Ecological Landscape (Map A). The Northwest Sands dominates the southern portion of the forest, while the Superior Coastal Plain encompasses most of the northern portion, while the Northwest Lowlands makes up a small portion in the west central portion of the forest.

Ecological Landscapes are similar in their ecological potential and geography. In the BRRSF region, they generally conform to Subsections, an ecoregional unit of 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.

#### Northwest Sands Ecological Landscape

The Northwest Sands Ecological Landscape is a large glacial outwash ecosystem consisting primarily of two major landforms: flat plains or terraces along glacial meltwater channels and pitted or “collapsed” outwash plains containing kettle lakes (WDNR 2015c). Other landforms and soils are found here but are of comparatively minor extent. Soils are predominantly deep sands, low in organic material and nutrients, and lie 100 to 600 feet thick over underlying bedrock, with the thickest deposits in the northern half. This ecological landscape is comprised entirely of the Bayfield Sand Plains Subsection 212Ka (Cleland et al. 1997).

Historical vegetation at the time of the federal General Land Office’s public land survey (mid-1800s) was predominantly jack pine (*Pinus banksiana*) and “scrub oak” (*Quercus ellipsoidalis* and *Quercus* spp.) forest and barrens. Eastern white pine (*Pinus strobus*) and red pine (*Pinus resinosa*) forests were also a sizable vegetative component of the ecological landscape. Numerous barrens occurred in the southwest



**Map A.** Ecological Landscapes of Wisconsin and the BRRSF.

half, and a few large barrens occurred within the northeastern 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 (WDNR 2015c).

#### Northwest Lowlands Ecological Landscape

The Northwest Lowlands Ecological Landscape forms a triangular wedge in northwestern Wisconsin, bounded on the north by the Superior Coastal Plain and on the south and east by the Northwest Sands Ecological Landscape (WDNR 2015b). The major landforms are ground and end moraines, with drumlins present in the southwestern portion. Topography is gently undulating. Soils are predominantly loams, with significant acreages of peat deposits in the poorly drained lowlands. This ecological landscape comprises a small portion of the Mille Lacs Uplands Subsection (212Kb) that extends westward into Minnesota (Cleland et al. 1997).

The historical upland vegetation of this ecological landscape was almost entirely forest, composed mostly of white birch (*Betula papyrifera*), balsam fir (*Abies balsamea*), sugar maple (*Acer saccharum*), aspen (*Populus* spp.), and white spruce (*Picea glauca*), with some eastern white (*Pinus strobus*) and red pine (*Pinus resinosa*) on the drier ridges. The lowlands supported extensive wet forests of black spruce (*Picea mariana*) and tamarack (*Larix laricina*) and some northern white-cedar (*Thuja occidentalis*) and black ash (*Fraxinus nigra*) swamps (WDNR 2015b). The notes made by federal General Land Office surveyors during the mid-19th century indicate that overall tree densities were high in this ecological landscape, and witness trees included many large individuals (Schulte and Mladenoff 2001). The ecological landscape at that time was likely a mosaic made up of young, recently disturbed forests interspersed with patches of old-growth.

#### Superior Coastal Plain Ecological Landscape

The Superior Coastal Plain is Wisconsin's northernmost Ecological Landscape, bordered on the north by southwestern Lake Superior and strongly influencing the local climate, resulting in cooler summers, warmer winters, and greater precipitation compared to more inland locations (WDNR 2014). The major landform in this Ecological Landscape on the BRRSF is a nearly level plain of lacustrine clays, the Douglas Lake-Modified Till Plain LTA, which slopes northward toward Lake Superior (WDNR 2014).

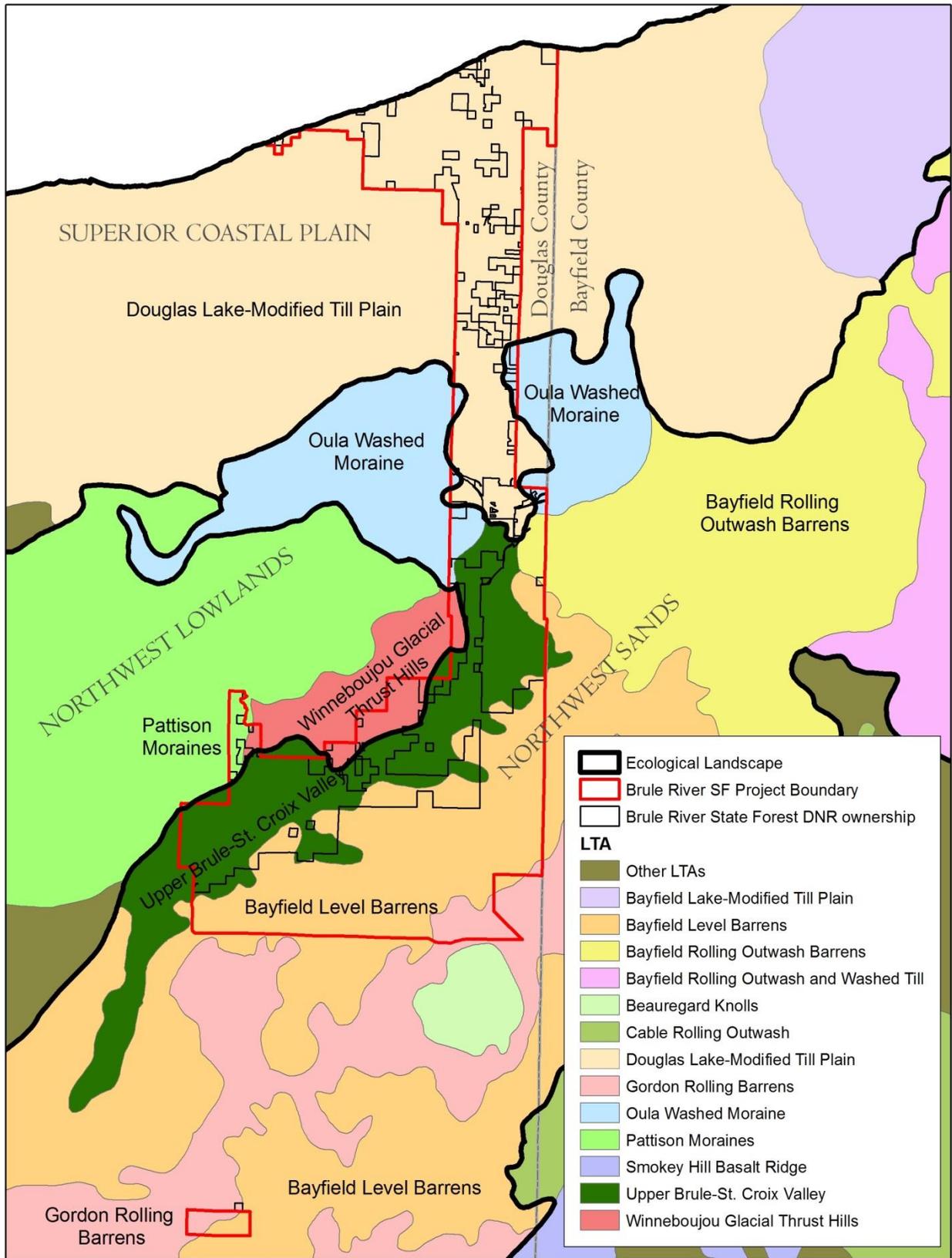
Historically this Ecological Landscape was almost entirely forested with a mixture of white pine (*Pinus strobus*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*), trembling aspen (*Populus tremuloides*), and northern white-cedar (*Thuja occidentalis*) (WDNR in prep.). The present coastal plain forest has been fragmented by agricultural use, and today approximately one-third of this landscape is non-forested. Aspen and birch forests occupy about 40% of the total land area, having increased in prominence over the boreal conifers (WDNR 2014).

### **Land Type Associations**

Land Type Associations (LTAs) of Wisconsin represent a further finer subdivision within the NHFEU (Cleland et al. 1997). In general, LTAs nest within Ecological Landscapes, although there is imperfect alignment between the two classification systems. The BRRSF contains eight LTAs within the three Ecological Landscapes present on the property (Table 4, Map B).

**Table 4.** Ecological Landscapes and Associated Land Type Associations on the BRRSF.

<b>Ecological Unit</b>	<b>Brief Description of Landforms and Soils</b>	<b>Approximate Acreage, Percent (BRRSF fee-title land), and example sites</b>
Northwest Sands Ecol. Landscape ≈ Bayfield Sand Barrens Subsection		22,126 acres (47.3%) Example sites: Brule Spillway and areas south.
Gordon Rolling Barrens LTA	Rolling outwash plain. Soils are predominantly excessively drained sand over acid sand outwash.	525 acres (1.1%) Examples sites: Gordon Correctional Bog, Deer Print Lake
Bayfield Level Barrens LTA	Nearly level outwash plain. Soils are predominantly excessively drained sand over outwash.	4,251 acres (9.1%) Example site: Motts Ravine SNA and areas to the south
Upper Brule-St. Croix Valley LTA	Sloping outwash valley with stream terraces and floodplains common. Soils are predominantly excessively drained sand over acid sand outwash.	14,965 acres (32%) Example sites: Divide Swamp, Stone Chimney, Blue Springs-McDougal Springs
Bayfield Rolling Outwash Barrens LTA	Collapsed outwash plain with lakes common. Soils are predominantly excessively drained sand over outwash.	906 acres (1.9%) Example sites East of Hoodoo Lake along and north of Troy Road.
Oula Washed Moraine LTA (western portion in Mille Lacs Upland Subsection)	Undulating outwash plain and moraine. Soils are predominantly excessively drained loamy sand over outwash or acid loamy sand debris flow.	1,490 acres (3.2%) Example site: Afterhours Tamaracks (1999 Primary Site)
Northwest Lowlands Ecol. Landscape ≈ Mille Lacs Uplands Subsection		3,336 acres (7.1%)
Pattison Moraines LTA	Rolling collapsed moraine. Soils are predominantly well drained sandy loam over acid loamy sand till.	702 acres (1.5%) Example site: Lake Minnsuing Hemlock-Hardwoods
Winneboujou Glacial Thrust Hills LTA	Rolling glacial thrust mass hills. Soils are predominantly excessively drained loamy sand over outwash or loamy debris flow.	2,634 acres (5.6%) Example sites: Vapa Road Pines and Ponds, Willard Pines
Superior Coastal Plain Ecol. Landscape ≈ Lake Superior Clay Plain Subsection		21,296 acres (45.5%)
Douglas Lake-modified Till Plain LTA	Undulating modified lacustrine moraine with deep v-shaped ravines. Soils are predominantly somewhat poorly drained clay over calcareous clay till or loamy lacustrine.	21,296 acres (45.5%) Example sites: Sugar Camp Hill, Lenroot Ledges, Brule River Boreal Forest SNA, Brule River Mouth, Bear Beach SNA



**Map B.** Landtype Associations (LTAs) and Ecological Landscapes of the BRRSF.

# Vegetation

## Historical Vegetation

The historical vegetation of the BRRSF differed substantially by Ecological Landscape (Figure 1).

Areas in the Northwest Sands were dominated nearly exclusively by jack pine and red pine. Alder thickets were also present along the Brule River, though they did not qualify as witness trees.

Areas in the Northwest Lowlands were also dominated by a mixture of jack pine and red pine, as well as aspen, paper birch, northern hardwoods, and oak.

In contrast, areas of the BRRSF on the Superior Coastal Plain were dominated by a unique type of conifer-hardwood boreal forest, sometimes nicknamed the "white forest" due to the combination of white pine, white spruce, paper (white) birch, and northern white-cedar. Notably, conifers constituted a majority (64%) of the witness trees in the portion of the BRRSF on the Superior Coastal Plain.

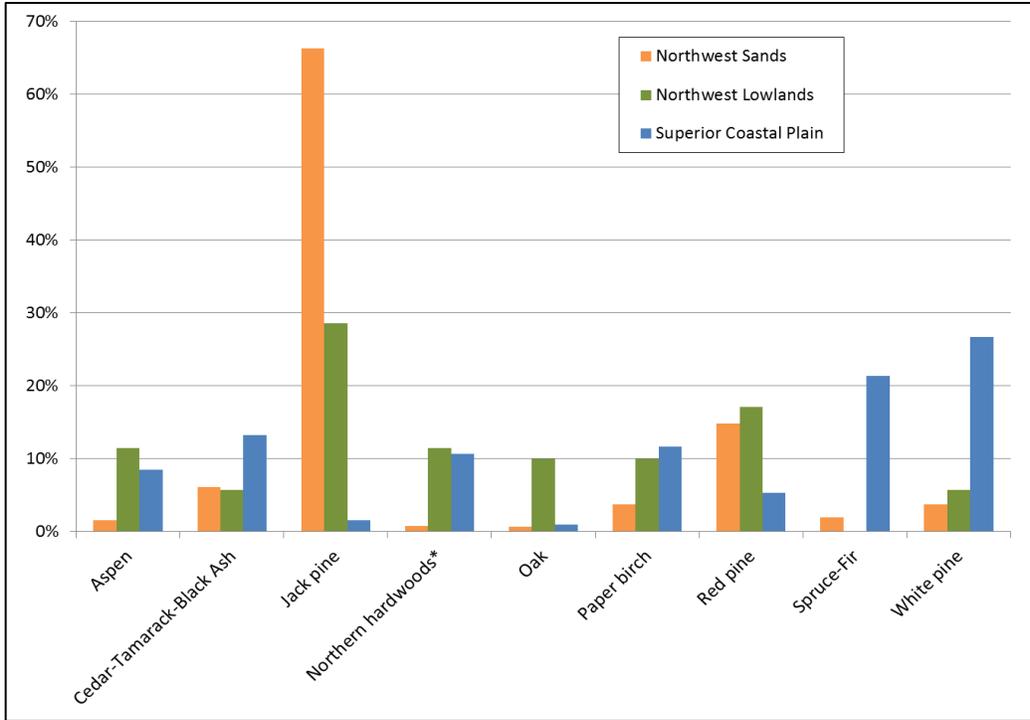
These data are based primarily on notes and maps from the original Public Land Surveys (Finley 1976, Map C), which were conducted for the area comprising BRRSF in 1852-1856. It is important to note that Public Land Surveys served to clearly establish a standardized grid for land ownership, not to describe early vegetation and natural communities. This data is most informative by looking for patterns at a landscape scale. 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. 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 preparation).

## Landuse Change and Current Vegetation

Cutting of the area's pine forests began in the 1890s and logging dams and log drives had severe impacts on the Brule River during this period. Extensive logging was followed by wildfire and burning to clear the land for agricultural purposes. By the 1930s, most attempts at agriculture were abandoned and a fledgling forestry program was put in place. The Civilian Conservation Corps camp at Brule assisted in early fire control and reforestation efforts from 1933 to 1941. A brief summary of vegetation by Ecological Landscape is presented below, followed by a more detailed description of natural communities present on the forest.

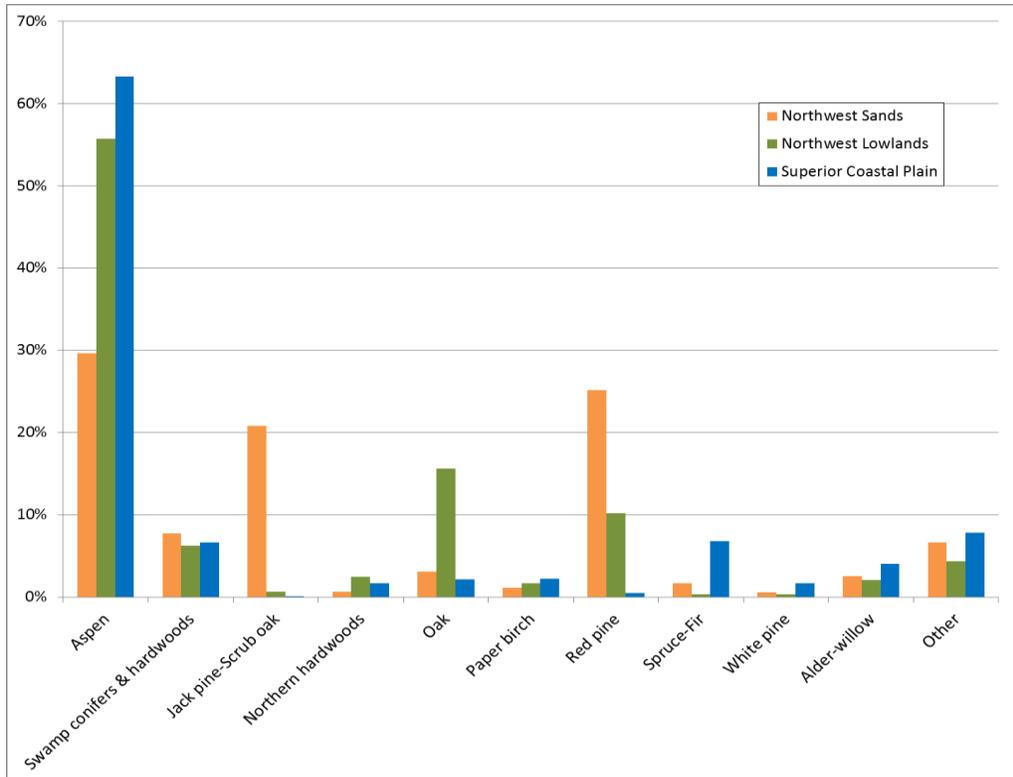
### Northwest Sands

The BRRSF is now dominated by a mixture of jack pine, red pine plantations, and aspen on the level plains of the Northwest Sands (Bayfield Sand Barrens subsection) (Figure 2, Map D). Pockets of Pine Barrens and Northern Dry Forest occur within the jack pine plains and red pine plantations. Scattered softwater seepage lakes dot the barrens landscape, some of which contain sandy-peaty shorelines known as Inland Beach. Occasional bogs and poor fens also occur in conjunction with lakes, but generally are rare on the landscape. The Brule Glacial Spillway holds cedar, black spruce, black ash, and occasional tamarack, comprising high-quality forests of Northern Wet-mesic Forest, Hardwood Swamp, and Northern Tamarack Swamp. The river itself is lined with Alder Thicket and Northern Sedge Meadow, and is fed by numerous softwater springs. The slopes of the Spillway are notable for having remnant pockets of large (up to 48 inches in diameter) red pine, white pine, and widely scattered spruce, and though aspen and balsam fir dominate much of the canopy, these Spillway slopes are examples of Northern Dry-mesic Forest and Boreal Forest on south/west facing slopes and on north facing slopes, respectively.



**Figure 1.** Relative density of PLSS witness trees in the BRRSF project boundary by Ecological Landscape circa 1800. Note dominance of boreal conifers (Spruce-Fir, White pine) on the Superior Coastal Plain.

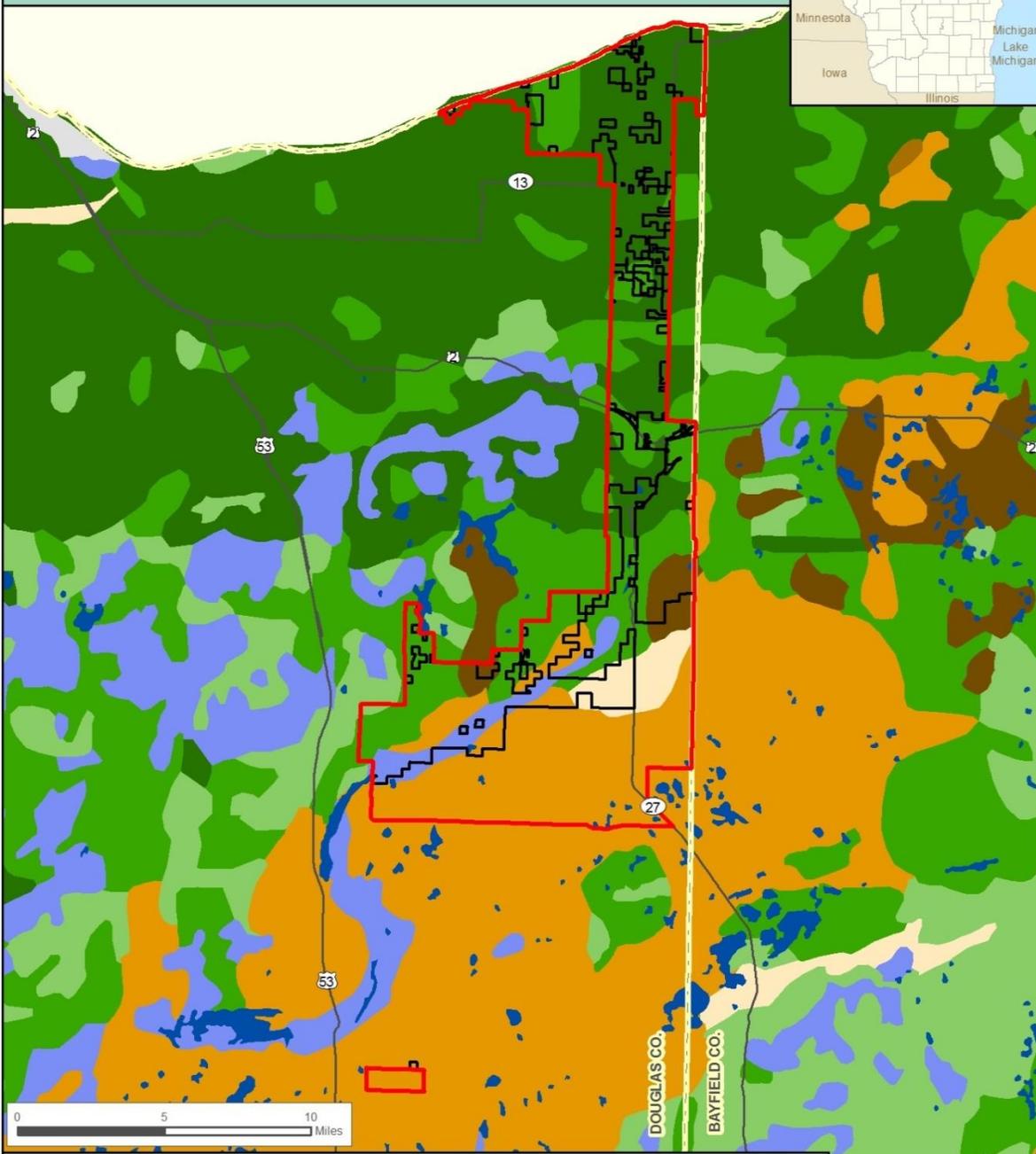
\*Northern hardwoods consists of sugar maple, yellow birch, basswood, white ash, and elm.



**Figure 2.** Current land cover (Forest Recon, percent of acres) of the BRRSF by Ecological Landscape. Note large increase of aspen in all ELs and large decrease of boreal conifers (spruce-fir, white pine) on Superior Coastal Plain relative to Pre-EuroAmerican settlement.

# VEGETATION PRIOR TO EURO-AMERICAN SETTLEMENT (FINLEY 1976)

Brule River State Forest



- |  |  |
|--|--|
| <span style="display:inline-block; width:15px; height:15px; background-color:darkgreen; border:1px solid black;"></span> White Spruce, balsam fir, tamarack, white cedar, white birch, aspen | <span style="display:inline-block; width:15px; height:15px; background-color:darkbrown; border:1px solid black;"></span> Oak - white/black/burr oak  |
| <span style="display:inline-block; width:15px; height:15px; background-color:mediumseagreen; border:1px solid black;"></span> White pine red pine  | <span style="display:inline-block; width:15px; height:15px; background-color:lightbrown; border:1px solid black;"></span> Oak opening  |
| <span style="display:inline-block; width:15px; height:15px; background-color:lightgreen; border:1px solid black;"></span> Sugar maple, yellow birch, white pine, red pine; some hemlock      | <span style="display:inline-block; width:15px; height:15px; background-color:yellow; border:1px solid black;"></span> Brush  |
| <span style="display:inline-block; width:15px; height:15px; background-color:lightyellowgreen; border:1px solid black;"></span> Aspen, white birch, pine                                     | <span style="display:inline-block; width:15px; height:15px; background-color:blue; border:1px solid black;"></span> Water  |
| <span style="display:inline-block; width:15px; height:15px; background-color:orange; border:1px solid black;"></span> Oak forest/barrens (Jack pine, Hill's oak)                             | <span style="display:inline-block; width:15px; height:15px; background-color:lightblue; border:1px solid black;"></span> Swamp conifers  |
|  | <span style="display:inline-block; width:15px; height:15px; background-color:lightgrey; border:1px solid black;"></span> Area with vegetation cover type not interpreted on the source map |

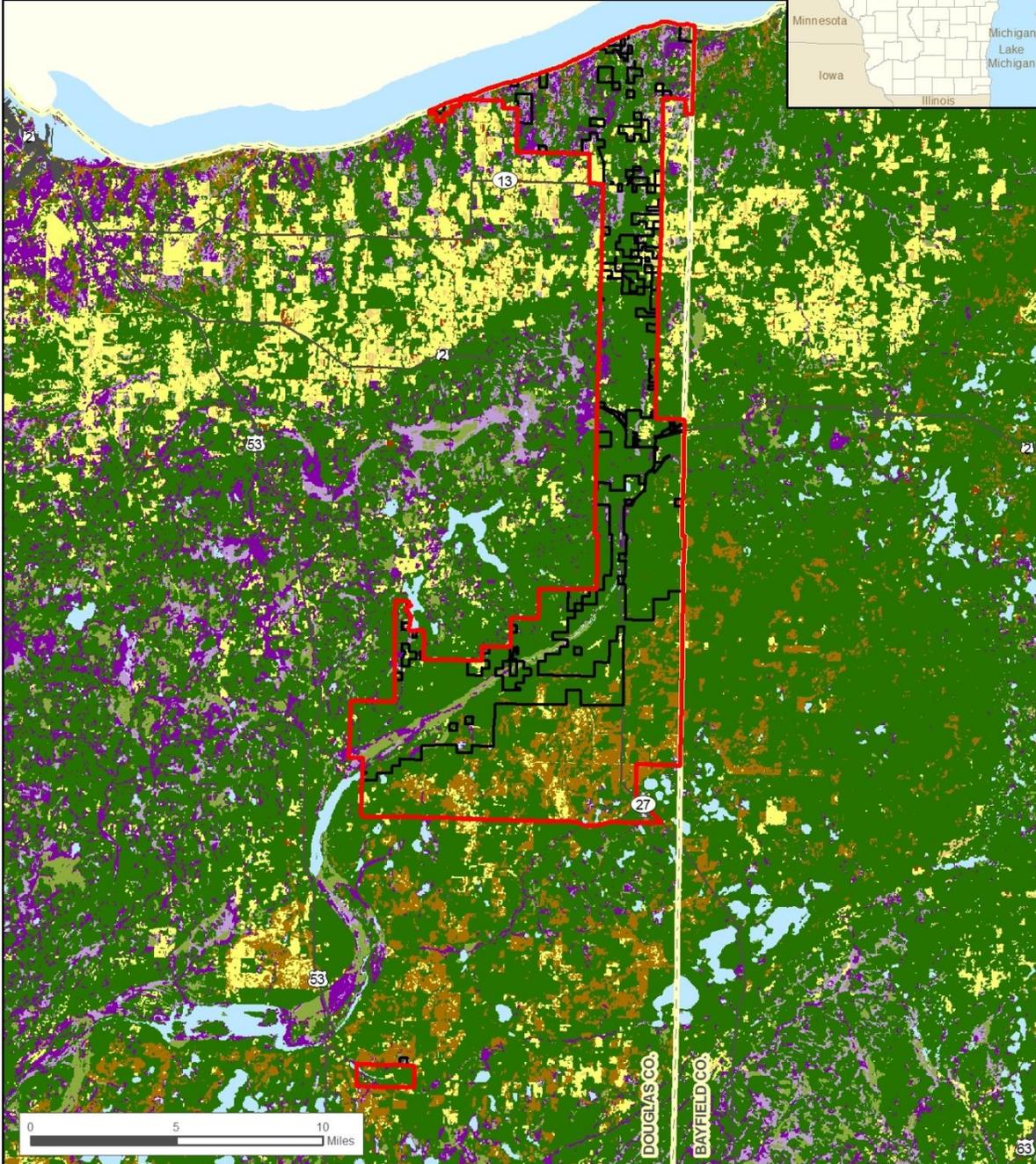
WISCONSIN DEPARTMENT OF NATURAL RESOURCES

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Mar 08, 2016

## MAP C

# LAND COVER

## Brule River State Forest



- |   |                              |                        |
|---|------------------------------|------------------------|
| Brule River State Forest Project Boundary | Forested wetland: deciduous  | Developed              |
| Brule River State Forest DNR ownership    | Forested wetland: coniferous | Open or brushy wetland |
| Agriculture                               | Grassland                    |                        |
| Barrens                                   | Open water                   |                        |
| Upland forest                             | Upland Shrub                 |                        |

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Mar 08, 2016

# MAP D

## **Northwest Lowlands**

Aspen, oak, pine plantations, and hemlock-hardwood forest dominate the narrow band of the Northwest Lowlands, which encompasses the Mille Lacs Uplands subsection.

## **Superior Coastal Plain**

Roughly the northern third of the BRRSF lies on the Lake Superior Clay Plain and is heavily dominated by aspen, much of it young, having been relatively recently acquired former industrial forest land. However, remnant stands of clay plain Boreal Forest dominated by white pine and spruce remain in pockets along the Brule River, especially at Lenroot Ledges and the Brule River Boreal Forest SNA. Just south of Lenroot Ledges, the Sugar Camp Hill area is dominated by a Northern Mesic Forest of sugar maple, basswood, red oak, yellow birch, and white ash. At the mouth of the Brule lies an Emergent Marsh in a small freshwater estuary complex, while the narrow but long stretch of Lake Superior shoreline contains small dunes, beach, and occasional clay seepage bluffs where the clay plain meets the lake.

Many of the factors that impacted vegetation historically continue to impact the study area today, and include but are not limited to geology, soils, hydrology, and climate. These factors are superseded in many areas, however, by more recent human influences on the land, particularly previous attempts to convert land to agriculture, grazing, logging, fire suppression, and the introduction and spread of non-native invasive species.

## **Description of Natural Communities Present on BRRSF**

The BRRSF contains numerous natural communities defined by the NHI Natural Community classification. Descriptions of natural communities are provided here, along with associated Habitat Types for upland forests (Kotar et al. 2002). Sites containing examples of each natural community are also provided.

### **Forest and Barrens Communities**

#### **Northern Dry Forest**

This forest community is associated with sites featuring coarse-textured soils of low fertility. On the BRRSF, these are mostly associated with deep outwash sands of the Northwest Sands Ecological Landscape. Common canopy dominants are jack pine and northern pin oak, sometimes mixed with bur oak and/or red pine. Hazelnut is the most common shrub, and density is variable. Low shrubs and herbs include bracken fern (*Pteridium aquilinum*), Pennsylvania sedge (*Carex pensylvanica*), wintergreen (*Gaultheria procumbens*), early low blueberry (*Vaccinium angustifolium*), and narrow-leaved cow wheat (*Melampyrum lineare*). Catastrophic wild fire at relatively short intervals (50-100 years) was the primary disturbance factor responsible for regenerating stands prior to the settlement of the region by Europeans and the widespread implementation of fire suppression policies. Northern Dry Forest historically intergraded with Pine Barrens in a shifting landscape mosaic; vestiges of this type of mosaic can still be found, in part, at Mott's Ravine SNA.

Associated Forest Habitat Types (Kotar et al. 2002): PArV-U, PQG

Sites with high ecological integrity: Mott's Ravine SNA, portions of Jerseth Creek area.

#### **Northern Dry-mesic Forest**

Mature stands are usually composed of large white and red pines, with red oak and red maple among the common canopy associates. Pines can reach impressive sizes, and average 18-24 inches dbh, with one white pine measured at over 48 inches dbh. In some stands, big-tooth and trembling aspen are also common associates, and balsam fir can be abundant in the sapling layer. Beaked hazelnut can form a

locally dense shrub layer, while typical ground layer species include bracken fern, low sweet blueberry, wild sarsaparilla, large-leaved aster, Canada mayflower, starflower, and rough-leaved rice grass (*Oryzopsis asperifolia*).

Fire, at infrequent intervals (several centuries), was the primary disturbance factor responsible for regenerating stands. On the BRSF, there are several small to medium size remnants (10s to 100s of acres) of Northern Dry-mesic Forest. The least disturbed and most mature stands occur on three landforms: 1) gravelly ridges within the Brule Spillway; 2) steep sandy slopes forming the flanks of the upper Brule Valley; and 3) rolling, sandy terrain north and west of the river, east of County Highway S.

Associated Forest Habitat Types (Kotar et al. 2002): ACI, AVCI, PArVAa-Vb

Sites with high ecological integrity: Stone Chimney Cedar Swamp (slopes and terraces), Blue Springs-McDougal Springs (slopes and terraces), Cedar Island-Winneboujou, Vapa Road Pines, Willard Pines.

### **Northern Mesic Forest**

This classic "northern hardwoods" community occurs primarily on the Pattison Moraine near Lake Minnesuing and the Copper Range at Sugar Camp Hill. It is dominated by sugar maple, red oak, red maple and basswood, with scattered individuals of white ash (*Fraxinus americana*) and yellow birch (*Betula alleghaniensis*). Hemlock is uncommon, and found only in the Lake Minnesuing area, one of the westernmost locations for this species in Wisconsin and in North America. The sapling layer is dominated by sugar maple and red maple, as well as ironwood (*Ostrya virginiana*) and balsam fir. Common groundlayer species include wild sarsaparilla, large-leaved aster, Canada mayflower, starflower, wood anemone (*Anemone quinquefolia*), long-awned wood grass (*Brachyelytrum aristosum*), and graceful sedge (*Carex gracillima*).

Associated Forest Habitat Types (Kotar et al. 2002): AAs, AAtRp, ACI, ATM

Sites with high ecological integrity: Sugar Camp Hill; Lake Minnesuing Hemlock-Hardwoods.

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

Northern white-cedar dominates these forests, which are the dominant feature of the Brule Spillway from its headwaters downstream to Winneboujou. Associated trees include black spruce, balsam fir, black ash, and occasionally tamarack. Many stands are mature and with excellent ecological integrity, with white-cedar reaching over 24 inches dbh in some areas. The shrub and sapling layer contains fir, black ash, and speckled alder. Northern white-cedar regeneration is sparse, and is limited to layering in small pockets of blow down. The groundlayer is diverse and includes naked miterwort (*Mitella nuda*), Canada mayflower, three-leaf Solomon's-seal, blue-bead-lily, starflower, as well as a rich assemblage of orchids and sedges. Mosses are also common, covering up to 90% of the ground surface in some areas. Numerous springs and seepages that feed the Brule and its tributaries are also present. This community supports a high concentration of rare or otherwise important species, perhaps rivaled in northwestern Wisconsin only by the estuarine fens and dune systems along Lake Superior.

Sites with high ecological integrity: Divide Swamp, Angel Creek and Beaupre Springs, Stone Chimney Cedar Swamp, Blue Springs-McDougal Springs, Cedar Island-Winneboujou.

### **Northern Tamarack Swamp**

This tamarack-dominated conifer swamp is relatively rare on the Brule, occurring primarily at Divide Swamp in the Brule Spillway, as well as a few small stands along Afterhours Road. Small patches also occur elsewhere within the Brule Spillway intermixed with cedar swamp. In addition to tamarack,

black ash and alder are important components, and northern white-cedar is often also present in low numbers. Sphagnum carpets the groundlayer, interspersed with a wide variety of herbaceous plants, the most common being bunchberry (*Cornus canadensis*), manna grass (*Glyceria striata*), dwarf red raspberry, royal fern, and cinnamon fern.

Sites with high ecological integrity: Divide Swamp.

### **Boreal Forest**

Boreal Forest primarily occurs on the Superior Coastal Plain where it is dominated by a supercanopy of white pine as well as occasional white spruce over trembling aspen, white-cedar, paper birch, balsam fir and red oak. The sapling layer is typically dense with balsam fir, while the groundlayer is dominated by boreal elements such as large-leaved aster (*Eurybia macrophylla*), blue-bead lily (*Clintonia borealis*) and thimbleberry (*Rubus parviflorus*).

Associated Forest Habitat Types (Kotar et al. 2002): ArAbSn, ArAbVCo

Sites with high ecological integrity: Brule River Boreal Forest SNA, Lenroot Ledges, Pearson Creek.

### **Northern Hardwood Swamp**

This community occurs in areas of groundwater seepage, and includes areas of active springs and rivulets. On the BRRSF this community is dominated by black ash with close associates of balsam fir and northern white-cedar, usually over a layer of tall shrubs such as alder and mountain maple. Characteristic groundlayer species include alder-leaved buckthorn (*Rhamnus alnifolia*), dwarf red raspberry, cinnamon fern, naked miterwort and sedges (*Carex trisperma*, *C. leptalea*). This community is widespread in northern Wisconsin but relatively rare within the BRRSF. A few small stands composed of medium-size trees occur in the Brule headwaters area, and at scattered locations downstream to Winneboujou. Other small stands occupy level terraces along the lower Brule close to Lake Superior.

Sites with high ecological integrity: Divide Swamp, Cedar Island-Winneboujou, Lake Minnesuing.

### **Pine Barrens**

This savanna-like community occurs on sandy outwash of the Northwest Sands south of the Brule River. It can occur on flat to rolling topography as well as steep south- and west-facing slopes associated with kettle depressions and stream valleys. Pine Barrens are dominated by jack pine with occasional mature red pine, with canopy cover high averaging 30%, though both locally open and locally dense areas are common. Where open, grub oaks (northern pin and bur) are common, as are hazelnut and heath plants such as blueberries, sweet-fern (*Comptonia peregrina*), and bearberry (*Arctostaphylos uva-ursi*). Perhaps most indicative are groundlayer prairie grasses such as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Pennsylvania sedge, poverty grass (*Danthonia spicata*), and June grass (*Koeleria macrantha*). Indicator forbs include goldenrods (*Solidago speciosa*, *S. nemoralis*, *S. ptarmicoides*), rough blazing star (*Liatris aspera*), hoary puccoon (*Lithospermum canescens*), and western sunflower (*Helianthus occidentalis*). Pine Barrens was historically widespread in northwestern Wisconsin but has declined greatly due to the suppression of fire, conversion of barrens vegetation to pine plantations, logging, and conversion of former pine savannas to open barrens. It is important to note that while open treeless barrens provide important wildlife habitat, they were relatively ephemeral on the landscape historically, with jack pine typically reestablishing after large fires and areas returning to savanna-like conditions.

Associated Forest Habitat Types (Kotar et al. 2002): PQG

Sites with high ecological integrity: North Country Trail Barrens and Mott's Ravine SNA, Jerseth Creek and Smith, Shoberg, and Cheney Lakes Complex.

## **Wetland Communities**

### **Alder Thicket**

An extensive Alder Thicket occurs along the river and stretches for over 5 miles (~15 river miles) along the upper reaches of the Brule River. Ranging in width from 30 yards to 300 yards, it is dominated by 6- to 10-foot tall speckled alder. Numerous springs add diversity and hydrologic integrity. A good diversity of other shrubs are also present, including meadowsweet (*Spiraea alba*), slender willow (*Salix petiolaris*), balsam willow (*Salix pyrifolia*), red-osier dogwood (*Cornus stolonifera*), winterberry (*Ilex verticillata*), bog birch (*Betula pumila*), alder-leaved buckthorn, and mountain fly honeysuckle (*Lonicera villosa*). The groundlayer contains tussock sedge (*Carex stricta*), bluejoint grass, and a variety of other species. The Alder Thicket appears to be a stable community that has been self-perpetuating for well over 200 years, as it was noted by early explorers and fur traders in the early 1800s (Schoolcraft 1855, Bardon and Nute 1948).

Thickets of alder are also presently common on the heavy red clays near Lake Superior, where a combination of past logging, severe fire and resulting loss of humus, and altered hydrology allowed wetland plants to replace the region's boreal forests in some areas.

Sites with high ecological integrity: Divide Swamp, Angel Creek and Beaupre Springs, Stone Chimney Cedar Swamp, Blue Springs-McDougal Springs, Cedar Island-Winneboujou, scattered locations in the Brule River Boreal Forest SNA.

### **Open Bog**

Open Bog is limited in extent and is best developed at the Gordon Correction Bog on the Brule Annex. There, deep layers of sphagnum mosses form a hummocky acidic substrate which supports a specialized flora including few-seeded sedge (*Carex oligosperma*), ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), bog laurel, and small cranberry, and insectivorous plants such as round-leaved sundew (*Drosera rotundifolia*).

Sites with high ecological integrity: Gordon Correctional Bog.

### **Poor Fen**

This community is uncommon and found primarily at Mills Lake and Hoodoo Lake. It is similar to Open Bog, but is usually less acidic with fewer Sphagnum hummocks. Narrow leaved woolly sedge (*Carex lasiocarpa*) is usually dominant, and shrubs such as bog birch and leatherleaf are also important. Characteristic herbaceous plants include three-way sedge (*Dulichium arundinaceum*), bog-bean (*Menyanthes trifoliata*) and numerous species of insectivorous plants including round-leaved sundew, pitcher-plant (*Sarracenia purpurea*) and flat-leaved bladderwort (*Utricularia intermedia*).

Sites with high ecological integrity: Mills Lake, Hoodoo Lake.

### **Emergent Marsh**

Emergent Marsh primarily occurs at the Brule River Mouth where a sand spit partially bars the river mouth, forming a 35-acre lagoon and marsh complex west of the main channel. The marsh surrounding the lagoon is composed of sedges, bulrushes, bur-reeds, water cinquefoil (*Comarum palustre*), wild calla (*Calla palustris*), as well as cat-tails. Smaller examples of Emergent Marsh also

occur in places along the middle reaches of the Brule where the channel widens and the current slows, such as Big Lake.

Sites with high ecological integrity: Brule River Marsh and Lagoon; Cedar Island - Winneboujou (Big Lake).

### **Submergent Marsh**

Beds of submergent aquatic vegetation occupy sites similar to Emergent Marsh, though water depth is typically greater. Important plants include common waterweed (*Elodea canadensis*), sago pondweed (*Stuckenia pectinatus*), Richardson's pondweed (*Potamogeton richardsonii*), and white water crowfoot (*Ranunculus aquatilis*). Common spike-rush (*Eleocharis palustris*) and stiff arrowhead (*Sagittaria rigida*) are common along the shore.

Submergent Marsh also occurs in high-quality inland seepage lakes. Species diversity is naturally low to moderate due to low fertility, as is typical for low-nutrient soft-water seepage lakes. Prominent aquatic plants groups include pondweeds (*Potamogeton* spp.), bladderworts, stoneworts (*Nitella* spp.), naiads (*Najas* spp.), watershield (*Brasenia schreberi*), and fragrant water-lily (*Nymphaea odorata*).

Sites with high ecological integrity: Brule River Marsh and Lagoon, Cedar Island - Winneboujou (Big Lake and Lucius Lake), Deer Print, Black Fox, Jack Pine, and Paradise Lakes Complex, Jerseth Creek and Smith-Cheney, Shoberg Lakes Complex.

### **Northern Sedge Meadow**

This community generally occurs in small patches of the BRRSF, usually associated with open areas within Alder Thicket as well as around spring systems. It is dominated by a variety of narrow-leaved sedges (e.g., *Carex stricta*, *C. lasiocarpa*) and coarse sedges (e.g., *C. utriculata* and *C. lacustris*) along with grasses such as bluejoint grass and reed manna grass (*Glyceria grandis*) and a wildflowers such as joe-pye-weed (*Eupatorium maculatum*), boneset (*E. perfoliatum*), and swamp loosestrife (*Lysimachia thyrsiflora*). On the Lake Superior clay plain, pockets of Northern Sedge Meadow have also developed on formerly forested lands due to hydrologic alteration, swamping, and soil compaction associated with past land use.

Sites with high ecological integrity: Stone Chimney Cedars, Blue Springs - McDougal Springs.

## **Primary Communities**

### **Great Lakes Dune**

Dunes on the BRRSF are restricted to narrow sand spits at the mouth of streams entering Lake Superior. It is best developed near the mouth of the Brule, where the dune is sparsely vegetated with Canada wild rye (*Elymus canadensis*), sandbar willow (*Salix interior*), and red-osier dogwood which act as sand binders and prevent erosion. Though this is a small, floristically depauperate dune system, it plays an integral role in the mosaic of natural communities occurring at the mouth of this important river.

Sites with high ecological integrity: Brule River Marsh and Lagoon.

### **Great Lakes Beach**

Great Lake Lakes Beach occurs primarily along Bear Beach SNA. As is typical of most of the beaches along Wisconsin's Lake Superior coast, the beach is largely unvegetated. The dynamic interplay of wind, wave, and ice prevent the development of a permanent plant community on these exposed features, but

they are important nonetheless as resting and foraging areas for migrating birds and for the role they play in coastal processes, such as the erosion and deposition of sediments.

Sites with high ecological integrity: Bear Beach SNA.

### **Inland Beach**

Occurring on the shores of inland seepage lakes, Inland Beach is influenced by strongly fluctuating water levels that can vary by four to six vertical feet from year to year depending on regional and local precipitation patterns (Sather and Johannes 1972).

Vegetation typically occurs in distinct zones: 1) the lower beach, frequently inundated and dominated by sedges and bluejoint grass, 2) the middle beach, damp with frequent seasonal fluctuations of water and dominated by annual grasses and sedges and other specialists, and 3) the upper beach, which is typically dry and dominated by prairie species, shrubs, and a mix of wetland species capable of thriving in seasonally dry sites (e.g., bluejoint grass, boneset, etc.). Previous low water levels associated with a decade-long drought resulted in shoreline colonization by jack pine at several sites. In 2015, water levels had rebounded with many dead seedling jack pine in several inches of standing water.

Sites with high ecological integrity: Brule Rush Lake SNA, Cheney Lake, Deer Print Lake.

### **Bedrock Glade**

Bedrock Glade is the dominant feature at The Promontory, where stunted but mature red pine (up to 16 inches dbh), white pine, and red oak create savanna-like conditions over igneous rock and broken talus with low sweet blueberry, northern bush honeysuckle (*Diervilla lonicera*) and pale corydalis (*Capnoides sempervirens*). On short vertical rock exposures, dry-site ferns such as common polypody (*Polypodium virginianum*), rusty woodsia (*Woodsia ilvensis*), and fragrant fern (*Dryopteris fragrans*) occur.

Site with high ecological integrity: The Promontory.

### **Clay Seepage Bluff**

Also known as Alkaline Clay Seep, these semi-stabilized clay bluffs occur along the Lake Superior shoreline as well as in small pockets along steep clay slopes along the lower portion of the Brule River. Clay Seepage Bluff tends to contain sparse trees and saplings similar to the surrounding forest. Other characteristic plants include golden sedge (*Carex aurea*) and buffalo berry (*Shepherdia canadensis*).

Sites with high ecological integrity: Brule River Boreal Forest SNA, Bear Beach SNA.

## Rare Species and High-Quality Natural Communities of the Brule River State Forest

Rare species and high-quality natural communities have been documented at the Brule River State Forest (BRRSF) (Table 5). Bird occurrences refer only to breeding activity. Additional rare or declining species may be present on the BRRSF that were not found during surveys. Please refer to Appendix C for a complete list of SGCN that may occur within the Ecological Landscapes in natural communities of the BRRSF.

**Table 5.** Documented rare species and high-quality natural communities of the BRRSF.

For an explanation of state and global ranks, as well as state status, see Appendix D. State status, tracking status, and ranks are based on the working list published May 2016. Under the column SGCN Status, SGCN = Species of Greatest Conservation Need, SINS = Species with Information Needs. Under the column, Tracked by NHI, Y = Tracked in the NHI database, “W” = Watch List (not mapped in the NHI database; see Appendix D). Various sources were used to determine the Watch List species and SGCN present and this may not be a complete list.

\*Species reported but did not meet criteria as an element occurrence and may not appear in NHI database.

Taxa Group	Common Name	Scientific Name	Last observed	State Rank	Global Rank	State Status	Federal Status	SGCN Status	Tracked by NHI
Amphibian	Four-toed Salamander	<i>Hemidactylium scutatum</i>	2015	S3?	G5	SC/H		SGCN	Y
Amphibian	Mink Frog	<i>Lithobates septentrionalis</i>	2015	S3	G5	SC/H		SGCN	Y
Bird	American Bittern	<i>Botaurus lentiginosus</i>	2015	S3B	G4	SC/M		SGCN	Y
Bird	American Woodcock	<i>Scolopax minor</i>	2015	S3S4B	G5	SC/M		SGCN	Y
Bird	Black-backed Woodpecker	<i>Picoides arcticus</i>	2015	S1S3B	G5	SC/M		SGCN	Y
Bird	Cerulean Warbler	<i>Setophaga cerulea</i>	1996	S2S3B	G4	THR		SGCN	Y
Bird	Common Nighthawk	<i>Chordeiles minor</i>	2015	S2S3B	G5	SC/M		SGCN	Y
Bird	Connecticut Warbler	<i>Oporornis agilis</i>	2015	S2B	G4	SC/M		SGCN	Y
Bird	Eastern Meadowlark	<i>Sturnella magna</i>	2015	S3S4B	G5	SC/M		SGCN	Y
Bird	Evening Grosbeak	<i>Coccothraustes vespertinus</i>	2015	S2B,S2N	G5	SC/M		SGCN	Y
Bird	Golden-winged Warbler	<i>Vermivora chrysoptera</i>	2015	S3S4B	G4	SC/M		SGCN	Y
Bird	Least Flycatcher	<i>Empidonax minimus</i>	2015	S3B	G5	SC/M		SGCN	Y
Bird	Northern Goshawk	<i>Accipiter gentilis</i>	2015	S2B,S2N	G5	SC/M		SGCN	Y
Bird	Ruby-crowned Kinglet	<i>Regulus calendula</i>	2015	S2S3B	G5	SC/M		SGCN	Y
Bird	Spruce Grouse	<i>Falcipectnis canadensis</i>	1990	S1S2B	G5	THR		SGCN	Y
Bird	Swainson's Thrush	<i>Catharus ustulatus</i>	2015	S2B	G5	SC/M		SGCN	Y
Bird	Upland Sandpiper	<i>Bartramia longicauda</i>	2015	S2B	G5	THR		SGCN	Y
Bird	Vesper Sparrow	<i>Poocetes gramineus</i>	2015	S2S3B	G5	SC/M		SGCN	Y
Bird	Western Meadowlark	<i>Sturnella neglecta</i>	2015	S2B	G5	SC/M		SGCN	Y
Mammal	Big Brown Bat*	<i>Eptesicus fuscus</i> *	2015*	S2S4	G5	THR		SGCN	Y
Mammal	Little Brown Bat*	<i>Myotis lucifugus</i> *	2015*	S2S4	G3	THR		SGCN	Y
Mammal	Northern Flying Squirrel	<i>Glaucomys sabrinus</i>	2015	S3	G5	SC/P		SGCN	Y
Mammal	Northern Long-eared Bat*	<i>Myotis septentrionalis</i> *	2015*	S1S2	G1G2	THR	LT	SGCN	Y

Taxa Group	Common Name	Scientific Name	Last observed	State Rank	Global Rank	State Status	Federal Status	SGCN Status	Tracked by NHI
Mammal	Silver-haired Bat*	<i>Lasionycteris noctivagans</i> *	2015*	S3	G5	SC/N		SGCN	Y
Mammal	Water shrew*	<i>Sorex palustris</i> *	2016*	S3	G5	SC/N		SGCN	Y
Reptile	Prairie Skink	<i>Plestiodon septentrionalis</i>	2015	S3	G5	SC/H		SGCN	Y
Reptile	Wood Turtle	<i>Glyptemys insculpta</i>	2015	S3	G3	THR		SGCN	Y
Fish	American Eel	<i>Anguilla rostrata</i>	1986	S2	G4	SC/N		SGCN	Y
Beetle	A Crawling Water Beetle	<i>Haliplus canadensis</i>	1996	SU	GNR	SC		SINS	W
Beetle	A Predaceous Diving Beetle	<i>Hygrotus falli</i>	1996	S1S2	GNR	SC/N		SGCN	Y
Beetle	A Predaceous Diving Beetle	<i>Hygrotus fartcus</i>	1996	S2S3	GNR	SC/N		SGCN	Y
Beetle	Hairy-necked Tiger Beetle	<i>Cicindela hirticollis rhodensis</i>	2014	S1	G5T4	END		SGCN	Y
Beetle	Northern Barrens Tiger Beetle	<i>Cicindela patruela patruela</i>	2001	S2	G3T3	SC/N		SGCN	Y
Dragonfly	Forcinate Emerald	<i>Somatochlora forcipata</i>	1989	S2S3	G5	SC/N		SGCN	Y
Dragonfly	Plains Emerald	<i>Somatochlora ensigera</i>	2013	S2S3	G4	SC/N		SGCN	Y
Dragonfly	Pronghorn Clubtail	<i>Gomphus graslinellus</i>	1996	S2S3	G5	SC/N		SGCN	Y
Stonefly	A Perlodid Stonefly	<i>Isogenoides olivaceus</i>	1992	S2S3	G3	SC/N		SGCN	Y
Plant	Arrow-leaved Sweet-coltsfoot	<i>Petasites sagittatus</i>	2015	S3	G5	THR			Y
Plant	Autumnal Water-starwort	<i>Callitriche hermaphroditica</i>	1996	S2	G5	SC			Y
Plant	Calypso Orchid	<i>Calypso bulbosa</i>	2016	S2	G5	THR			Y
Plant	Dwarf Milkweed	<i>Asclepias ovalifolia</i>	2014	S3	G5?	THR			Y
Plant	Fir Clubmoss	<i>Huperzia selago</i>	1996	S1S2	G5	SC			Y
Plant	Hooker's Orchid	<i>Platanthera hookeri</i>	1907	S2	G4	SC			Y
Plant	Lapland Buttercup	<i>Ranunculus lapponicus</i>	2016	S1	G5	END			Y
Plant	Lesser Wintergreen	<i>Pyrola minor</i>	2015	S1	G5	END			Y
Plant	Long-leaved Aster	<i>Symphyotrichum robynsonianum</i>	2010	S1	G5	SC			Y
Plant	Marsh Horsetail	<i>Equisetum palustre</i>	2015	S2	G5	SC			Y
Plant	Marsh Ragwort	<i>Tephrosieris palustris</i>	1897	S1	G5	SC			Y
Plant	Mountain Cranberry	<i>Vaccinium vitis-idaea</i>	2015	S1S2	G5	END			Y
Plant	Northern Yellow Lady's-slipper	<i>Cypripedium parviflorum var. makasin</i>	2016	S3S4	G5T4T5	SC			Y
Plant	Ram's-head Lady's-slipper	<i>Cypripedium arietinum</i>	2006	S2	G3	THR			Y
Plant	Rocky Mountain Sedge	<i>Carex backii</i>	2015	S1	G5	SC			Y
Plant	Rugulose Grape-fern	<i>Sceptridium rugulosum</i>	1931	S2	G3	SC			Y
Plant	Small Yellow Pond Lily	<i>Nuphar microphylla</i>	1897	S1	G5T4T5	SC			Y
Plant	Torrey's bulrush	<i>Schoenoplectus torreyi</i>	2015	S2	G5?	SC			Y
Plant	Vasey's Rush	<i>Juncus vaseyi</i>	1995	S3	G5	SC			Y
Plant	White Adder's-mouth	<i>Malaxis monophyllos var. brachypoda</i>	2005	S3	G4Q	SC			Y

Taxa Group	Common Name	Scientific Name	Last observed	State Rank	Global Rank	State Status	Federal Status	SGCN Status	Tracked by NHI
Community	<a href="#">Alder Thicket</a>	Alder thicket	2015	S4	G4	NA			Y
Community	<a href="#">Bedrock Glade</a>	Bedrock glade	2015	S3	G2	NA			Y
Community	<a href="#">Boreal Forest</a>	Boreal forest	2016	S2	G3?	NA			Y
Community	<a href="#">Emergent Marsh</a>	Emergent marsh	2012	S4	G4	NA			Y
Community	<a href="#">Hardwood Swamp</a>	Hardwood swamp	2015	S3	G4	NA			Y
Community	<a href="#">Inland Beach</a>	Inland beach	2015	S3	G4G5	NA			Y
Community	<a href="#">Northern Dry Forest</a>	Northern dry forest	2005	S3	G3?	NA			Y
Community	<a href="#">Northern Dry-mesic Forest</a>	Northern dry-mesic forest	2015	S3	G4	NA			Y
Community	<a href="#">Northern Mesic Forest</a>	Northern mesic forest	2015	S4	G4	NA			Y
Community	<a href="#">Northern Tamarack Swamp</a>	Northern Tamarack swamp	2016	S3	G4	NA			Y
Community	<a href="#">Northern Wet-mesic Forest</a>	Northern wet-mesic forest	2015	S3S4	G3?	NA			Y
Community	<a href="#">Open Bog</a>	Open bog	2014	S4	G5	NA			Y
Community	<a href="#">Pine Barrens</a>	Pine barrens	2014	S2	G2	NA			Y
Community	<a href="#">Poor Fen</a>	Poor fen	2015	S3	G3G4	NA			Y
Community	<a href="#">Spring Pond</a>	Spring pond	2015	S3	GNR	NA			Y
Community	<a href="#">Springs and Spring Runs, Soft</a>	Springs and spring runs, soft	2015	SU	GNR	NA			Y
Community	<a href="#">Stream--Fast, Hard, Cold</a>	Stream--fast, hard, cold	1996	S4	GNR	NA			Y
Community	<a href="#">Stream--Fast, Soft, Cold</a>	Stream--fast, soft, cold	1996	SU	GNR	NA			Y
Community	<a href="#">Submergent Marsh</a>	Submergent marsh	2016	S4	G5	NA			Y
Other	<a href="#">Migratory Bird Concentration Site</a>	Migratory Bird Concentration Site	2015	SU	G3	SC			Y

# Management Considerations and Opportunities for Biodiversity Conservation

## The Spillway: Headwaters of the Brule and St. Croix Rivers

The Brule Spillway is a feature incomparable to any other headwater system in Wisconsin. The source of both the Brule and St. Croix Rivers, as well containing the entirety of the Upper Brule, this areas supports exemplary forested and non-forested wetlands, significant populations of uncommon boreal birds, as well as the largest populations in the state for several rare plants (Table 6).

### Natural Communities: Cedar Swamps, associated wetlands, and upland forests

The Brule Spillway includes the full spectrum of wetland and aquatic communities, from numerous springs and spring ponds, to sedge meadows and Alder Thickets, to forested swamps of black ash, tamarack, black spruce, and northern white-cedar. The river retains its natural meanders and bordering wetland habitat. The nearly unaltered headwaters area and associated riparian corridor host a diverse flora and fauna found virtually nowhere else in the state.

It also contains one of the largest and highest quality cedar swamps in the state, spanning over eight linear miles and nearly 1,500 acres. In addition to its size and unfragmented state, the cedar swamp has virtually unaltered hydrology, rich diversity of orchids, other flowering plants, and mosses, and among the largest and oldest northern white-cedar known from wetlands in the state.

The steep slopes of the Spillway are also notable, containing relict natural-origin red pine and white pine of two to four feet in diameter along with large white spruce. Large blocks of Northern Dry-mesic Forest and Boreal Forest with trees of this size are rare throughout the state. In addition, both wetland and upland communities are juxtaposed in an exceptional geologic and ecological context, with the full spectrum of forest to cedar swamp to Alder Thicket to the river and back again to the opposite ridgetop.

The northerly location of the spillway, local cold air sink, and presence of numerous cold water springs and seeps may also make the site resistant to long-term environmental change, including climate change, potentially making it one of the best places in the state to conserve these communities and the rare species they support.

### Birds

Recognized as an Important Bird Area, the Brule Glacial Spillway is of statewide significance for many breeding birds of conservation concern. The remote and undisturbed nature of the Spillway supports numerous rare bird species, including one of the only known nesting sites for a rare raptor on the state forest. The Spillway and the Boreal Forests on the north end of the property are also major refuges for boreal birds on the property. Important boreal birds found here are Cape May warbler, Canada warbler, golden-crowned kinglet, white-winged crossbill, yellow-bellied flycatcher, and black-backed woodpecker.

### Rare plants

The cedar swamps of the Brule Spillway provide excellent habitat for a number of rare plants (Table 6). This area is particularly important for three species of rare plants that likely have their largest population in the state in the Spillway. Because this site is so extensive, new populations of rare plants have been found recently and more will likely be discovered with future inventory efforts.

**Table 6.** Rare species associated with the Brule Spillway.

Common Name	State Status
Birds	
Black-backed woodpecker	SC
Northern goshawk	SC
Ruby-crowned kinglet	SC
Spruce grouse	T
Mammals	
Little brown bat*	T
Northern flying squirrel	SC
Northern long-eared bat*	T
Silver haired bat*	T
Invertebrates	
Forcipate emerald	SC
Pronghorn clubtail	SC
Plants	
Autumnal water-starwort	SC
Calypso orchid	T
Fir clubmoss	SC
Lapland buttercup	E
Lesser wintergreen	E
Marsh horsetail	SC
Mountain cranberry	E
Northern yellow lady's-slipper	SC
Ram's-head lady's-slipper	T
White adder's-mouth	SC

\*Bats were documented in stands adjacent to the Spillway, and are suspected to use the river corridor extensively for foraging and commuting.

### Spillway Summary

The Brule Spillway and Upper Brule River is located within the Blueberry Swamp COA, a conservation opportunity of statewide significance, and spans from Divide Swamp straddling County Highway P downstream to Cedar Island, and from bluff top to bluff top across the Brule valley. The Brule Spillway has also been recognized as an Important Bird Area (IBA), Land Legacy Place (WDNR 2006), Wetland Gem (Wisconsin Wetlands Association 2009), and identified in The Nature Conservancy's Superior Mixed Forest Ecoregion Conservation Plan for its significant conservation value to birds, rare plants, and pristine ecological systems (TNC 2002). Much of the Brule Spillway is also designated as a State Natural Area.

More thorough descriptions of the Brule Spillway, its significance, and management considerations can be found in the Primary Site descriptions in Appendix E for:

- Divide Swamp
- Angel Creek and Beaupre Springs
- Stone Chimney Cedar Swamp
- Blue Springs – McDougal Springs

## **Middle and Lower Brule River**

The Middle and Lower stretches of the Brule River support an active trout fishery, healthy populations of wood turtle, tracts of Boreal Forest, and where the river meets Lake Superior, a high-quality freshwater estuary and small dune complex that supports an endangered beetle and thousands of migrating birds.

Around Cedar Island, the low gradient and meandering stream levels out and the river widens to form features like Big Lake. Supporting large trout as well as a rare, extensive cold-water bed of submerged aquatic plants (also termed Submergent Marsh), this area contains significant aquatic features. Several lakes along the Brule River corridor within this Primary Site were also identified as important conservation targets in The Nature Conservancy's Lake Conservation Portfolio (Blann and Wagner 2014). These include Big Lake and three unnamed lakes, further illustrating the site's aquatic significance.

The river is bordered by occasional stands of remnant red and white pine as well as hardwood swamp with trees of impressive size, likely having escaped the cutover, and representing some of the best quality examples of these forests in the state. While large portions of the Middle Brule are privately owned, it has equally high conservation significance and management of state land should complement adjacent private land, much of which is protected through conservation easements.

Downstream of U.S. Highway 2, the river quickens and drops 328 feet in the last 19 miles through boulder-filled runs and deep pools. Here the river is bordered by steep sand and clay banks and Boreal Forest with occasional large white pine and white spruce, especially as it enters the Superior Clay Plain.

### **Hydrology and the Lower Brule**

The Brule River State Forest was established, in part, for the purpose of protecting the Brule River and its famed trout fishery from siltation and sedimentation. This is especially important today along the Superior Coastal (Clay) Plain, where clay soils are prone to erosion, a phenomenon often seen in the form of a plume of clay sediment entering Lake Superior from the Brule River at its mouth. Although erosion of clay soils and exposed clay seepage areas are a natural phenomenon in this landscape, primarily from slumping of clay banks, erosion and sedimentation have been greatly exacerbated by human impacts. Clearing of forest land during the late 1800s and early 1900s drastically altered the streams, rivers, and associated fish and wildlife habitat of the Superior Clay Plain. The loss of conifer cover resulted in increased seasonal run-off volumes, increased peak discharges, and increased soil moisture levels. The excess volume and velocity of water exacerbated erosion of riparian soils, increasing the slumping of clay banks and steep slopes. The resulting sediment buried gravel beds used for fish spawning and filled deep pools critical for sheltering fish and other aquatic organisms. In more recent times in some areas of the Coastal Plain, use of recreational vehicles such as ATVs and UTVs have caused localized but significant problems with soil compaction and erosion, particularly near stream crossings, which are numerous on the landscape.

With the natural reforestation that has occurred on much of the lower BRRSF, the health of the river has improved since the early 1900s. However, siltation remains a primary management concern. Analysis of the nearby Nemadji River, which has similar landscape characteristics, estimated that more than 131,100 tons of sediment are deposited into Superior-Duluth Harbor annually (equivalent to about 17 dump truck loads per day) (NRCS 1988).

The percentage of open land in a given watershed has a significant impact on erosion, with open land defined as non-forested uplands as well as forests dominated by tree less than 16 years old. Snowmelt is more rapid and tends to occur at the same rate in watersheds with more open land, producing higher bank-full flows (Jereczek et al. 2011). In watersheds with more mature forest, and in particular, more

coniferous forest, peak flows are up to three times lower (Verry et al. 1983) due in part to the shading effect of evergreen trees, which can contribute to the asynchronization of snowmelt. Thus, maintaining a high percentage of mature forest and increasing the percentage of conifer cover in the lower BRRSF would be highly beneficial to water quality. These strategies and rationale are outlined in more detail in a Wisconsin DNR initiative to "Slow the Flow" of snowmelt and runoff throughout the Superior Coastal Plain Ecological Landscape on the Wisconsin Lake Superior south shore (Jereczek et al. 2011). Additional recommendations are outlined in Managing Woodlands on Lake Superior's Red Clay Plain: Slowing the Flow of Runoff (WDNR2007).

## **Boreal Forest**

The Brule River State Forest offers the single best opportunity for clay plain Boreal Forest restoration on state-owned land on the entire Superior Coastal Plain Ecological Landscape and possibly North America. Historically, Boreal Forest was the predominant forest type on the Coastal (Clay) Plain. Currently, documented high-quality Boreal Forest on the Superior Coastal Plain occupies less than 3,000 acres (WDNR, unpublished data), compared to nearly 600,000 acres circa 1850 (Finley 1976), a loss of over 99%. With over 17,000 acres of forested (non-hardwood) lands in the Coastal Plain, restoration of Boreal Forest along the Lower Brule could more than quadruple the amount of Boreal Forest on the Superior Coastal Plain Ecological Landscape. While complete restoration of all areas may not be feasible, undertaking long-term restoration on even a portion of the Coastal Plain would be laudable for both wildlife as well as water quality.

The best examples of Boreal Forests can be found at Lenroot Ledges and the Brule River Boreal Forest SNA. These are likely the best mature, conifer-dominated boreal forest occurring on clay plain in the state. They feature large white pine, white spruce, balsam fir, balsam poplar (*Populus balsamifera*), and occasionally northern white-cedar on the slopes. Younger stands (more common on level areas above and away from the river) are generally dominated by aspen and paper birch, often with an understory of boreal conifers. In addition to serving as ecological references for boreal forest restoration, these forests are important for boreal songbirds including Canada warbler. They are also hotspots for Blackburnian warbler. While not rare, this species is indicative of mature coniferous forest with high canopy cover consisting of spruce, balsam fir, or hemlock.

Boreal Forests support substantially more Species of Greatest Conservation Need (especially birds and mammals) as well as rare plants relative to other forested habitats on the BRRSF (Figure 4, page 49). Allowing the conifer component to increase over time would be beneficial to both water quality and to wildlife that prefer boreal forests with a coniferous component (Table 7).

Although many stands are currently dominated by trembling aspen, there are opportunities to expand Boreal Forest. Challenges to restoration include a lack of existing conifer seed trees and regeneration, partly due to deer herbivory. In addition, some areas currently have a high water table, which may be a function of the near complete removal of trees during historic logging during the Cutover era and subsequent slash fires. With water tables already shallow due to poor drainage in clay soils, the sudden reduction of trees likely reduced evapotranspiration, allowing water to rise to the point that trees now have difficulty establishing, a process known as swamping (WDNR 2012). Ancient white pine stumps in alder and blue-joint grass meadows bear mute witness to this phenomenon. In addition, clay soils are at a high risk of compaction during modern forest management activities. In general, strategies for reducing the risk of swamping include maintaining a partial tree canopy, preserving understory vegetation, retaining woody debris, and limiting surface ponding by careful layout of skid trails, the use of low-pressure equipment, and harvesting during frozen conditions (Dube et al. 1995, WDNR 2012). For sites where regeneration has failed, planting nurse crops to promote evapotranspiration has been recommended

(Smerdon et al. 2009). For other recommendations related to management on the clay plain, see other WDNR publications noted in the Hydrology section above.

**Table 7.** Species of Greatest Conservation Need and Rare Plants Associated with Boreal Forest on or near the BRRSF.

Common Name	Status
<b>Birds</b>	
black-backed woodpecker	SC
least flycatcher	SC
northern goshawk	SC
ruby-crowned kinglet	SC
spruce grouse	T
<b>Mammals</b>	
northern flying squirrel	SC
silver-haired bat	SC
<b>Plants</b>	
Fir clubmoss	SC
Mountain cranberry	E
Ram's-head lady's-slipper	T

Finally, any restoration should take into account the potential for altered future environmental conditions, including but not limited to climate change as well as invasions of non-native species and forest pests (e.g., common buckthorn, emerald ash borer, etc.). Reforestation efforts should favor trees native to the Superior Coastal Plain Ecological Landscape that are expected to be well suited to anticipated future conditions. Current information suggests that a warmer climate could be unfavorable to northerly species such as trembling aspen, balsam poplar, paper birch, and white spruce while other species such as white pine and red maple may fare better (Janowiak et al. 2014). Local landscape factors such as north-facing slopes and close proximity to Lake Superior could also mediate climate change impacts, and the BRRSF may offer one of the best places to maintain Boreal Forest in Wisconsin from a landscape perspective.

## Wood Turtle

The lower half of the Brule River harbors one of the more significant wood turtle populations in the state, a Species of Greatest Conservation Need in Wisconsin. Suitable overwintering, foraging, gestating, and nesting habitat are all present on the lower segment of the river. Some naturally occurring sand cliffs, loosely packed roads and parking areas along or in close proximity (within 200 feet) of the river are being utilized for nesting. Throughout the state suitable nesting habitat is a major limiting factor for wood turtles, and for this reason, Brule River State Forest staff have started a very effective project to create protected nesting sites along the river. These critical management activities appear to be greatly benefitting wood turtle populations on the State Forest. Turtle nesting along roads is one of the most serious threats to the species, as nests are quickly dug up by predators and the turtles themselves are at risk of mortality as they try to cross roads. In order to discourage turtle use of these areas, installing low fencing major road crossings could be considered, along with the creation of other suitable nesting habitat nearby. Turtle fencing has been used successfully in other areas with high road crossing mortality, such as along the Muskegon River in Michigan.

The first year of a two year mark-recapture study to estimate wood turtle population numbers identified 39 unique individuals on the lower Brule River. A second year of the study will provide more information and enable a more precise population estimate to further inform wood turtle management on the property.

The upper reaches of the Brule River were also surveyed in 2015, and consistent with previous studies, do not appear to support an overwintering population of wood turtles. It is possible that some traveling individuals may utilize the upper reaches during the summer months, however.

## **Bats**

Acoustic bat surveys were performed at fifteen locations on the BRRSF. The results of these surveys were consistent with the understanding that bats need water sources for drinking and foraging, and that aquatic features like rivers and Ephemeral Ponds are heavily utilized in the summer. Six of the seven species of Wisconsin's summer resident bats were recorded on the BRRSF during surveys.

River systems have been found to produce higher diversity and species richness of bats than virtually any other habitat. This is likely because river systems have greater amounts of insects and are also utilized by bats for commuting and navigating. Forested areas in close proximity to water provide the best summer roosting habitat for bats (especially for maternal colonies), which try to minimize travel distances to good foraging habitats. In addition, trails and old logging roads provide excellent travel corridors and foraging opportunities for bats; small forest openings also provide good feeding areas. Maintaining such areas, as well as maintaining northern hardwood and boreal forests near the Brule River and surrounding Ephemeral Ponds will help conserve bat populations on the BRRSF.

While bat maternity roosts were not identified during Brule River bat surveys, it's recommended to maintain dead, dying or live trees with cracks, crevices and loose bark. Trees with such characteristics provide roosting opportunities for multiple species of bats in Wisconsin, particularly to pregnant and/or nursing mothers, and pre-volant bat pups.

## **Migratory Birds: Brule River Mouth and Adjacent Forests**

The mouth of the Brule supports a 35-acre marsh and natural lagoon, as well as a sparsely vegetated beach and small dune system. The area is crucial for both migratory land birds as well as birds that frequent the water and shorelines, including red-necked grebe, common loon, double-crested cormorants, terns, shorebirds, gulls. Waterfowl also use the river mouth, lagoon, and near-shore area for foraging and resting, sometimes in substantial numbers.

The north-south orientation of the northern stretch of the Bois Brule River funnels large numbers of migratory birds through this corridor. The substantial forests provide suitable cover from predators while the wetlands present ideal foraging areas for migrant land birds looking to load up on insects as they prepare to navigate Lake Superior to their summer nesting grounds.

Threats to Migratory Bird Stopover Sites and migratory birds include habitat destruction and alteration (Duncan et al. 2002). Habitat alteration includes the simplification of forest structure or the alteration of forest composition, including invasive species that may change the kinds, quantity, and quality of food resources (Duncan et al. 2002). Important considerations for conserving migratory birds within the BRRSF include:

1. diversifying forest composition to maintain or promote coniferous component as well as the diversity of the shrub layer,
2. keeping these forests connected to wetlands,
3. control of invasive species in forests and wetlands,
4. maintaining natural hydrology of the watershed,
5. protecting water quality to promote insect life and plant diversity.

**Table 8.** Summary of Migratory Bird Use near mouth of Brule River. Surveys were conducted over five days spanning May 12-28, 2015.

Type of Bird	Number of Species	Number of Individuals
Landbird	229	2502
Raptor	13	20
Shorebird	9	24
Waterbird	31	280
Waterfowl	21	65
Total	303	2891

### Lagoon and Marsh: A Freshwater Estuary

The river mouth is considered a freshwater estuary due to the influence of Lake Superior, including short-term water level changes and related mixing of lake and river water due to seiches and other wind events. In addition to providing a variety of wetland habitat, freshwater estuaries are also important nursery areas for young gamefish. Despite its modest size, the area ranks as one of the higher quality estuarine complexes on the south shore of Lake Superior in terms of its floristic quality, after only Bark Bay and Lost Creek (LSRI, unpublished data, not including the St. Louis River or Bad River). The marsh surrounding the lagoon is composed of sedges, bulrushes, bur-reeds, and many other wetland plants, while the lagoon itself is comprised of diverse aquatic plants including bull-head pond-lily, spike-rushes, arrowheads, bur-reed and pondweeds.

As a wetland near the mouth of the Brule catchment, the area serves as a barometer for the health of the watershed. In particular, the degree of nutrient loading and sedimentation is closely related to the percentage of open lands, including hayfields and young forest, upstream (Verry et al. 1983, Jereczek et al. 2011). The lagoon and marsh are monitored periodically as part of the Great Lakes Coastal Wetland Consortium. The most recent detailed sampling of the marsh revealed that non-native invasive species seem to be increasing in the marsh, with a marked increase observed in percent cover of both narrow-leaf cat-tail (*Typha angustifolia*) and hybrid cat-tail (*T. x glauca*) over a one-year timespan (LSRI 2012, unpublished data). While total cover was still low in 2012, this is cause for concern and may signal changes in the watershed related to an increase in nutrient loading and sedimentation. For more information on causes and strategies to reduce sedimentation see the section on Hydrology and the Lower Brule on page 35.

### Dunes, Beaches and Invertebrates

The low dunes and beach that stretch from the Brule River Mouth west to Pearson Creek are one of largest stretches of undeveloped Lake Superior shoreline in state ownership. The beaches are mostly sand and cobbles, and are unvegetated due to their exposure to wave and ice action. The portion of the beach near the Brule River mouth and other nearby streams provide habitat for a state endangered beetle. This is one of only a handful of known sites in the state for this species, and in the mid-2000s, this site was the largest known population west of the Apostle Islands (Steffens 2014).

### Middle and Lower Brule Summary

The northern portion of the BRRSF has been noted in several previous conservation planning initiatives. It is located within the Brule Boreal Forest COA, a conservation opportunity of continental significance

as it encompasses the most extensive restoration opportunities for clay plain Boreal Forest on public land in the state, and possibly North America. It also lies partially within the Bois Brule Land Legacy Place (WDNR 2006), contains numerous TNC Portfolio Lakes, and supports two State Natural Areas.

More thorough descriptions of the Middle and Lower Brule, its significance, and management considerations can be found in the Primary Site descriptions in Appendix E for:

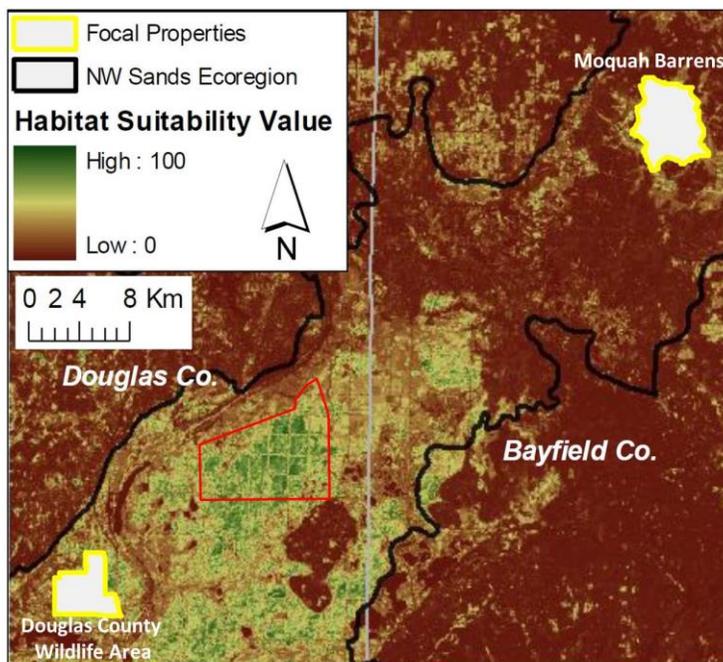
- Cedar Island – Winnebougou
- CCC Miller Boreal Forest
- Lenroot Ledges Boreal Forest
- Brule River Boreal Forest SNA
- Brule River Mouth and Lagoon
- Bear Beach SNA and Pearson Creek Boreal Forest

## Barrens and Northern Dry Forest

The BRRSF contains one of the best opportunities in the state to increase the size and landscape connectivity of regional barrens and dry forest. Strategically located in the central portion of the Northwest Sands, the BRRSF has been identified in the Northwest Sands Corridor Plan as an important habitat corridor for sharp-tailed grouse and other barrens species between other adjacent, large barrens complexes such as Douglas County Wildlife Area, the Bayfield Rolling Barrens, and Moquah Barrens (Reetz et al. 2012, Figure 3).

Located south of the Brule Spillway in sandy rolling uplands, the barrens of the BRRSF are located in the Douglas and Bayfield County Barrens COA, a conservation opportunity of global significance identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) - Implementation Plan (WDNR 2008). The barrens have also been identified as a Land Legacy Place (WDNR 2006) and identified in The Nature Conservancy's Superior Mixed Forest Ecoregion Conservation Plan for its significant conservation value to birds, rare plants, and pristine ecological systems (TNC 2002).

It is important to recognize that forests and barrens were historically dynamic in time and space, as were their relative patch sizes across the regional landscape, ranging from mostly open to savanna-like forests embedded in a larger landscape matrix of pine forests (Pulic Land Survey data; Radeloff et al. 1999). It is important to consider the full spectrum of barrens in management planning, including mature forest stands, as outlined in the Northwest Sands Integrated Ecosystem



**Figure 3.** Habitat suitability of corridors for sharp-tailed grouse and other barrens species between large habitat blocks at Douglas County Wildlife Area and Moquah Barrens. Approximate area outlined in red for several Primary Sites on the BRRSF including North Country Trail Barrens, Jerseeth Creek and Lakes Complex, and Deer Print Lakes Complex. Modified from Reetz et al. 2012.

Management Plan (WDNR 2008). This natural variability was historically maintained by disturbances such as fire and infrequent catastrophic windstorms. Benefits to wildlife and ecological integrity of the barrens can be maximized when management mimics natural variability, management creates and maintains habitat of sufficient size for area-sensitive wildlife, and habitat collectively provides for various species, including those that need large open areas (e.g., sharp-tailed grouse), shrubby barrens with scattered jack pine (e.g., common nighthawk), as well as those that need blocks of mature to over-mature jack pine forests (e.g., Connecticut warbler, see Table 9).

**Table 9.** Species of Greatest Conservation Need and Rare Plants Found in a Continuum of Barrens to Dry Forest on or near the BRRSF.

Species	State Status	Open barrens	Shrubby barrens/ young forest	Mature forest
<i>Birds</i>				
black-backed woodpecker	SC		x	x
common nighthawk	SC		x	
Connecticut warbler	SC			x
evening grosbeak	SC			x
golden-winged warbler	SC	x	x	
Kirtland's warbler	E		x	
least flycatcher	SC			x
sharp-tailed grouse	T	x		
upland sandpiper	T	x		
vesper sparrow	SC	x		
whip-poor-will	SC	x	x	x
<i>Herps</i>				
prairie skink	SC	x		
<i>Mammals</i>				
Franklin's ground squirrel	SC	x	x	
northern flying squirrel	SC			x
northern long-eared bat	T			x
silver-haired bat	SC			x
<i>Invertebrates</i>				
northern barrens tiger beetle	SC	x		
<i>Plants</i>				
dwarf milkweed	T	x		

### North Country Trail Barrens Extended Zone (Management Area 10)

Encompassing over 30,000 acres, the North Country Trail Barrens Extended Zone (NCTBEZ) is part of the 2003 Brule River State Forest Master Plan Management Area 10 – Pine Forest and Barrens Native Community Management Area (WDNR 2003) and encompasses private land within the Brule River State Forest Project Boundary. A large majority of the area is owned by the Lyme Timber Company, industrial forestland that is part of the Brule-St. Croix Legacy Forest and protected under a conservation easement that is held by the State of Wisconsin. The easement places an emphasis on managing the area for barrens wildlife.

In May of 2013, approximately 2,000 acres of the NCTBEZ burned in the Germann Road Wildfire. Currently this burned-over area contains timber-salvaged, open lands mixed with unsalvaged, charred stands of red and jack pine that remain following the wildfire.

Due to its size, current cover types and proximity to state-owned lands, the NCTBEZ presents an opportunity to provide habitat for numerous wildlife SGCN. Primarily made up of even-aged timber types of red pine and jack pine, this area is capable of providing large patches of suitable habitat for

numerous SGCN barrens birds, including upland sandpiper, brown thrasher, whip-poor-will, nighthawk, and Kirtland's Warbler.

Additionally, there is a population of sharp-tailed grouse that uses portions of the NCTBEZ. In the late 1990's and early 2000's when habitat conditions were more favorable, this area held a significant number of sharp-tailed grouse. This species, which is in decline statewide, requires large areas of relatively open habitat and could especially benefit from the large-scale management that is possible in this area adjacent to the State Forest.

On the adjacent, state-owned Mott's Ravine State Natural Area, management goals are to provide a permanently open barrens "core", as well as a shifting mosaic of early seral-stage barrens in those stands that surround the core. The NCTBEZ provides an opportunity to further enhance the available wildlife habitat at Mott's Ravine, through coordination of timber sale activity on these privately-owned lands. Integrating planning across land ownerships will be necessary given that substantial portions of the barrens landscape lie in non-state ownership. In particular, the adjoining Brule-St. Croix Legacy Forest easement lands and Cedar Island Conservancy property both present excellent opportunities to coordinate management across property boundaries, with the joint goal of enhancing and maintaining a shifting landscape mosaic of jack pine forest/barrens representing the full spectrum of age classes and structures.

More thorough descriptions of Pine Barrens and Northern Dry Forest, their significance, and management considerations can be found in the Primary Site descriptions in Appendix E for:

- Jerseeth Creek and Smith-Cheney-Shoberg Lake Complex
- North Country Trail Barrens and Mott's Ravine SNA



Franklin's ground squirrel, photo by Tom Schulz.

## Northern Dry-mesic Forest

Mature, natural-origin white pine-red pine forests may be one of the rarest forest types in Wisconsin. In a previous analysis of the BRRSF, mature to maturing red pine and white pine constituted only 354 acres across 24 stands, well under one percent of the state forest (Eckstein et al. 2001, table reproduced using updated Recon data below). With updated forest reconnaissance data from 2011, this acreage was reduced to 341 (Table 10). Though overall acreage is small, there are significant opportunities to conserve high-quality Northern Dry-mesic Forest on the BRRSF.

**Table 10.** BRRSF stands with mature, natural-origin red and white pine, based on updated analysis following Eckstein et al. 2001. Stand data follows WDNR Forest Recon, stands examined and updated 2011.

Compartment	Stand	Primary Coverttype	Year of Origin	Age (as of 2016)	Acres	Primary Site	Location
13	12	red pine	1915	101	32		NE of Jerseth Creek
15	8	white pine	1868	148	2		Buried Road Pines (1999 Primary Site)
19	17	red pine	1878	138	8	x	Stone Chimney Cedar Swamp
23	6	white pine	1840	176	5	x	Blue Springs-McDougal Springs
24	10	red pine	1878	138	71	x	Vapa Road Pines
26	4	red pine	1850	166	63	x	Willard Road Pines
34	4	red pine	1890	126	8		E of Willard Road Pines
41	8	red pine	1855	161	19	x	Devil's Hole Pines
42	3	white pine	1885	131	13		W of Cedar Island-Winneboujou
44	13	white pine	1897	119	15		Troy Road
46	3	red pine	1886	130	12		Little Joe Rapids/ west of Brule Ranger Station
47	5	red pine	1918	98	31		Fish Hatchery Road South
49	10	red pine	1910	106	4		Little Joe Rapids/ West of Brule Ranger Station
50	11	red pine	1900	116	5		NE of Pine Ridge Cemetery
51	1	red pine	1935	81	10		Brule Wastewater Treatment Pines
60	1	red pine	1935	81	5		Co-op Park Rapids
60	13	white pine	1891	125	4	x	Sugar Camp Hill
67	3	white pine	1903	113	34	x	McNeil's Landing
Total					341		

The best sites occur along the slopes and adjacent terraces of the Brule Spillway, at Vapa Road Pines, Willard Road Pines, and on private land in the Cedar Island-Winneboujou area. These sites escaped the cutover of the turn of the nineteenth century, and contain relict trees that average two feet in diameter, with scattered individuals up to four feet in diameter. Some stands, such as Willard Pines, are over 165 years old, with the origin of some trees dating to 1850 or prior (WDNR Forest Recon, stand examined in 2011). Snags, an important feature of old forests, are relatively common in some sites. In addition, the shrub and ground layer still supports classic dry-mesic forest plants, as well as characteristic bird species. These areas likely represent the best examples of older red and white pine forest on state forest land outside of the Northern Highland-American Legion State Forest.

Pine forests add important diversity to the landscape and are important for birds seeking cone crops. Moderate- to older-growth Northern Dry-mesic forests are important habitat for several SGCN birds and

include northern goshawk, whip-poor-will, long-eared owl, evening grosbeak, and least flycatcher. Other resident birds of these forests include many species characteristic of older coniferous forests such as purple finch, red-winged crossbill, blackburnian and pine warblers, and red-breasted nuthatch.

Similarly, older pine forests are important habitat for three SGCN bats. Little brown bat, silver-haired bat and northern long-eared bat were all recorded on the state forest during 2015 surveys. The northern flying squirrel (SGCN) was also captured in mist nets during bat surveys in older Northern Dry-mesic Forests. American marten, though not known from the Brule River State Forest, is also significantly associated with old-growth Northern Dry-mesic Forest within in this region.

Maintaining older age classes of natural red pine should be a priority in mature stands. Tyrrell et al. (1998) noted that the average stand age for older red pine ranged up to 250 years across eastern North America, with a maximum age of individual trees over 300 years. At the same time, pine regeneration is lacking at many sites. Historically, these forests likely originated following a large, stand-replacing fire, and were maintained by periodic low-intensity surface fires (Heinselman 1996). Currently, most regeneration consists of red maple, paper birch, and balsam fir, although white pine and red oak saplings are scattered.

The desired future condition of forests along the Brule Spillway slopes and adjacent terraces should be considered at a long-term (e.g., near end-of-century) landscape level, striving to strike a balance between protection of ecological reference areas, restoration of uncommon habitats like Northern Dry-mesic Forest, promoting wildlife habitat, and providing sustainable forest products. This is especially true for current red pine plantations adjacent to the Spillway that are approaching rotation age. Do opportunities exist to expand Northern Dry-mesic Forest through the gradual conversion of red pine plantations to multi-aged, multi-storied forests? In other areas, such as a site east of Vapa Road Pines Primary Site, stands are being managed for natural red pine regeneration using innovative silvicultural techniques. The result of this management should be monitored, as encouraging the growth of natural-origin pine and pine-oak forest is an ongoing challenge that managers face, and if successful could be applied elsewhere along the terraces of the Brule Spillway. Overall, encouraging natural red pine regeneration and increasing representation of pine in hardwood stands will benefit wildlife and increase the acreage of an uncommon forest type. Stands that are currently dominated by pine should be managed for older age classes to ensure the full range of structural and age class diversity is maintained across the landscape, including very large, old trees.

More thorough descriptions of Northern Dry-mesic Forest, its significance, and management considerations can be found in the Primary Site descriptions in Appendix E for:

- Stone Chimney Cedar Swamp
- Blue Springs – McDougal Springs
- Cedar Island - Winneboujou
- Vapa Road Pines and Ponds
- Willard Pines
- Devil's Hole Pines

## Seepage Lakes and Shorelines

Protection of soft-water seepage lakes with undeveloped shorelines represents a major conservation opportunity on the BRRSF. These lakes are clustered near the headwaters of Jersech Creek, at Rush Lake SNA, and on the southeast corner of the Brule River State Forest Project Boundary in a portion of Brule-St. Croix Legacy Forest Easement. The lakes contain good-quality plant communities, have high water quality, and provide habitat for a variety of rare plants and animals.

The shorelines of Rush Lake, Cheney Lake, and Deer Print Lake harbor good examples of the Inland Beach community, which is limited to landscapes with deep sandy outwash where water levels periodically fluctuate. The Northwest Sands Ecological Landscape contains the highest opportunities in the state to conserve Inland Beach in the state (WDNR 2015c). Several rare plants are known from these receding shorelines, including one species found in only two other locations in Wisconsin. Rare aquatic invertebrates are also present, and several of the lakes contained locally large populations of a rare frog.

Seepage lakes and Inland Beaches generally occur within a matrix of upland jack pine forest with scattered barrens openings, though stands managed for aspen occur as well. In general, the most critical long-term management issue is maintenance of site hydrology within its natural range of variability. Actions such as excessive groundwater withdrawal or channeling runoff from developed uplands within the local watershed can affect water quantity and water quality, and also introduce sediments, pollutants, and invasive species into the beach habitats and littoral zone. Other important management issues include the protection of sensitive areas from clearing, trampling due to vehicular use, livestock, or heavy foot traffic, and inappropriate use of herbicides on aquatic plant life. Poorly designed and sited recreational trails can also damage native beach flora, especially fragile annuals.

More thorough descriptions of Seepage lakes and Inland Beaches, their significance, and management considerations can be found in the Primary Site descriptions in Appendix E for:

- Deer Print, Black Fox, Jack Pine, and Paradise Lakes Complex
- Jersech Creek and Smith-Cheney-Shoberg Lakes Complex
- Rush Lake SNA

## Highway 13 Grasslands and Birds

Grasslands in the vicinity of Highway 13 support numerous uncommon grassland birds. The area was previously highlighted as a Primary Site (WDNR 1999), though might more appropriately be deemed a management opportunity due to its cultural origin.

Historically Boreal Forest, the area was cleared during the Cutover and was farmed and pastured in the early to mid-1900s. The area eventually reverted back to the state and was incorporated into the BRRSF. Managed as a grassland as well as a wetland mitigation bank, the area supports a wide variety of grassland birds in an otherwise largely forested landscape. This unique assemblage of grassland birds found at or near the site (see Table 11) are not present anywhere else on the state forest.

Grassland bird habitat is most effectively maintained as large landscapes of continuous grassland, uninterrupted by hedgerows, with the cover of woody plants less than 5% (Sample and Mossman 1997). Managing from a landscape perspective can better accommodate the complex habitat needs of a greater number and variety of grassland birds and other grassland obligate species, and may include wetland, upland, and shrub components. Grassland bird habitat may be managed at three different scales: large (>10,000 acres), medium (1,000-9,000 acres), and small (400-1,000 acres). Although it may be inappropriate to manage isolated grassland communities in landscapes where row crops are the dominant cover type, large (500 acres and greater) grassland restorations may be justifiable in that context.

Continued expansion and connection of prairies, wetlands, fallow fields, pastures, and surrogate grasslands on BRRSF properties can provide grassland bird habitat at a landscape scale. At 791 acres, the Highway 13 Grasslands is reliant upon additional private grassland and pastureland within the surrounding area to afford opportunities for area sensitive grassland birds.

Grassland bird habitat occurs on the BRRSF in both upland (idle warm-season grasses/forbs, idle cool-season grasses/forbs, old field, fallow fields, upland shrub) and wetland (Northern Sedge Meadow, wet meadow, wet old field) settings. The most important types for both common and uncommon/vulnerable birds are sedge meadow, idle warm- and cool-season grasses/forbs, and upland shrub (Sample and Mossman 1997).

**Table 11.** Grassland bird species of conservation concern at or near the Highway 13 Grasslands.

Common Name	State Status
American bittern	SC
bobolink	SC
eastern meadowlark	SC
Le Conte's Sparrow	SC
northern harrier	SC
sharp-tailed grouse	SC
upland sandpiper	T
western meadowlark	SC

## Wildlife Action Plan Implementation and the BRRSF

### Conservation Opportunity Areas

Conservation Opportunity Areas (COAs) are places in Wisconsin that contain ecological features, natural communities, or SGCN habitat that present the greatest likelihood of successfully implementing conservation actions when viewed from the global, continental, upper Midwest, or state perspective. Several COAs occur on the BRRSF (page 13, Appendix B).

### Opportunities for Natural Community Conservation

Opportunities for sustaining natural communities in Ecological Landscapes were developed in 2005 by the Ecosystem Management Planning Team (EMPT, published in 2007) and later focused on wildlife Species of Greatest Conservation Need and their habitat in the Wisconsin Wildlife Action Plan (WDNR 2015e). The goal of sustaining natural communities is to manage for natural community types that 1) historically occurred in a given landscape and 2) have a high potential to maintain their characteristic composition, structure, and ecological function over a long period of time (e.g., 100 years). This list can help guide land and water management activities so that they are compatible with the local ecology of the Ecological Landscape while maintaining important components of ecological diversity and function. Based on EMPT's criteria, these are the most appropriate community types that could be considered for management activities within each Ecological Landscape.

The Wisconsin Wildlife Action Plan (WDNR 2015e) identifies 40 natural communities for which there are "Major" or "Important" opportunities for protection, restoration, or management across the three Ecological Landscapes on which the BRRSF occurs: the Northwest Sands, Northwest Lowlands, and Superior Coastal Plain (keyword "Wildlife Action Plan").

Table 12). For information on conservation actions that are beneficial for these communities, please refer to the Wisconsin DNR website, keyword "Wildlife Action Plan".

**Table 12.** Major and Important Natural Community Management Opportunities by Ecological Landscape for communities that occur on the BRRSF (WDNR 2015d).

Communities are generally listed dry to wet, from terrestrial to wetland to aquatic, with the exception of some shoreline communities which are grouped with the aquatic systems near which they occur.

<b>Community Type (WAP)</b>	<b>Northwest Sands</b>	<b>Northwest Lowlands</b>	<b>Superior Coastal Plain</b>
Surrogate Grasslands	Major		Important
Pine Barrens	Major		
Conifer Plantation	Major	Important	
Northern Dry Forest--young seral	Major		Important
Northern Dry Forest--mid-seral	Major		Important
Northern Dry Forest--late seral	Major		Important
Northern Dry-mesic--young seral	Major	Important	Important
Northern Dry-mesic--mid-seral	Major	Important	Important
Northern Dry-mesic--late seral	Major	Important	Important
Northern Mesic Forest--young seral		Important	Important
Northern Mesic Forest--early seral		Important	Important
Northern Mesic Forest--mid seral		Important	Important
Northern Mesic Forest--late seral		Important	Important
Aspen-Birch	Major	Major	Major
Boreal Forest		Important	Major
Floodplain Forest			Important
Northern Hardwood Swamp	Important		Important
Northern Wet-mesic Forest	Important	Important	Important
Northern Wet Forest	Major	Major	Important
Northern Tamarack Swamp	Major	Major	Important
Black Spruce Swamp	Important	Important	Important
Open Bog	Major	Major	Major
Alder Thicket	Important	Important	Important
Poor Fen	Major	Major	Major
Northern Sedge Meadow	Major	Major	Important
Emergent Marsh	Major	Important	Major
Floating-leaved Marsh	Major	Major	Important
Submergent Marsh	Major	Important	Major
Inland Beach	Major		
Great Lakes Dune			Major
Great Lakes Beach			Major
Clay Seepage Bluff			Important
Lake Superior			Major
Large Lake--shallow, soft, seepage	Major		
Small Lake--Other	Major		
Spring Pond, Lake--Spring	Important		
Coldwater streams	Major		Major
Coolwater streams	Major	Important	Major
Springs and Spring Runs (Soft)	Important		
Riverine Impoundment	Important		

## Opportunities to Conserve Species of Greatest Conservation Need (SGCN) and Rare Plants

The Wisconsin Wildlife Action Plan also notes Species of Greatest Conservation Need (SGCN; WDNR 2015d) associated with each Ecological Landscape. 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:

- Are already listed as threatened or endangered;
- Have few, low, or declining populations, and/or threats their populations or habitats;
- Are stable in number in Wisconsin, but declining in adjacent states or nationally;
- Have biological, genetic or ecological characteristics that place them at risk or make them vulnerable to decline.

There are 114 SGCN and 58 rare plants significantly associated with the three Ecological Landscapes and natural communities that comprise the BRRSF (see Appendix C). This means that these species are (and/or historically were) significantly associated with these Ecological Landscapes, and that restoration of natural communities with which these species are associated would significantly improve their conditions.

The Wisconsin Wildlife Action Plan also identifies conservation opportunities by highlighting the natural communities in each Ecological Landscape that are most important to the SGCN. While many communities that occur on the BRRSF have major or important conservation opportunities, some of these communities support more SGCN and rare plant species than others (Figure 4 and 5). For example, Pine Barrens and Boreal Forest support a significant number of rare species in the Ecological Landscapes that comprise the BRRSF. Although all of these rare species do not necessarily occur on the BRRSF, communities with higher species counts provide a disproportionate benefit to a greater number of SGCN and rare plants across these Ecological Landscapes and may warrant special consideration in the master planning process. This intersection of SGCN and rare plants with priority natural communities represents the best opportunities for management on the BRRSF from an ecological and biodiversity perspective. For a complete list of which SGCN and rare plant species occur on the BRRSF, please see Appendix C.



Connecticut warbler prefers mature jack pine with a multi-layered canopy. Photo by Brian Collins.

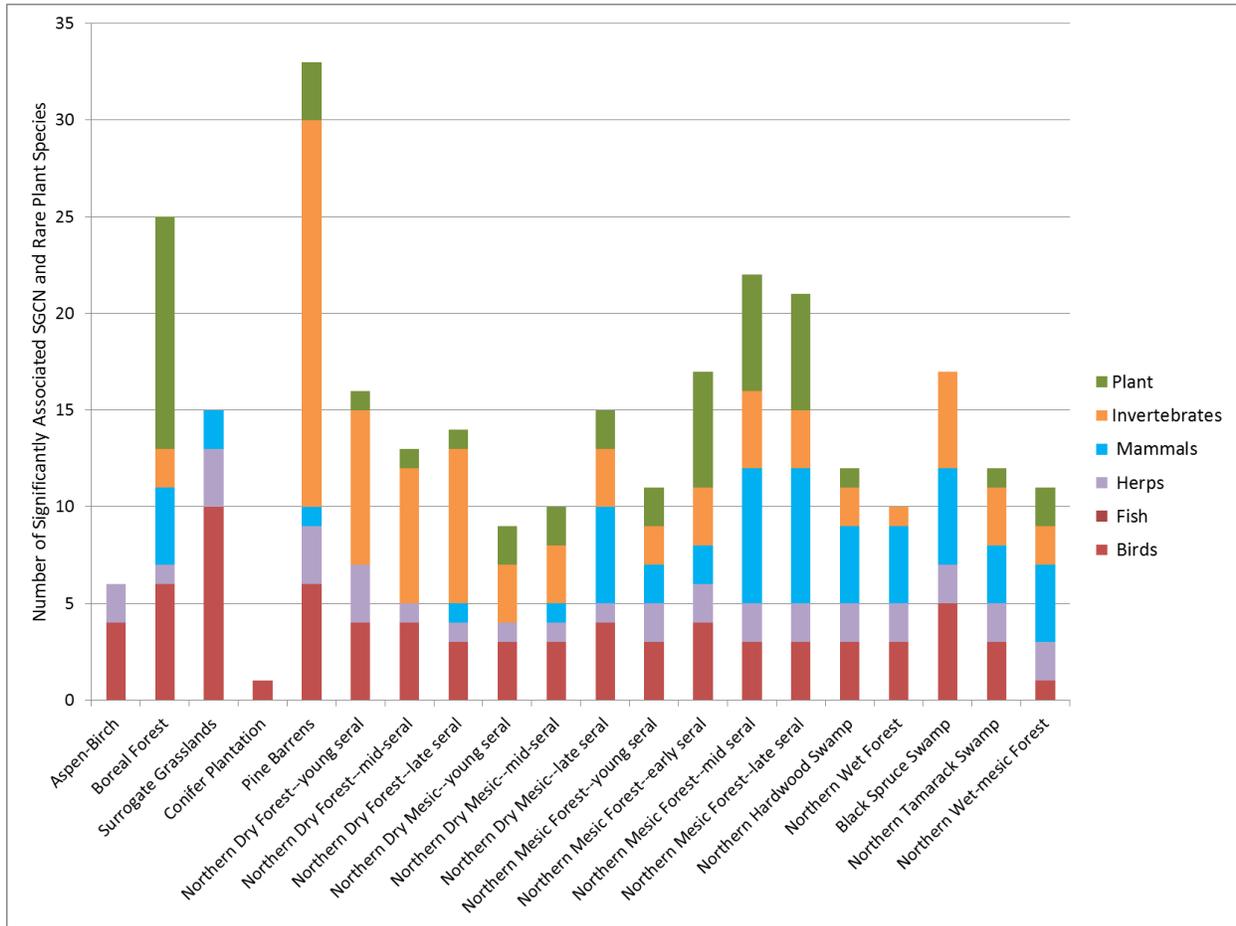
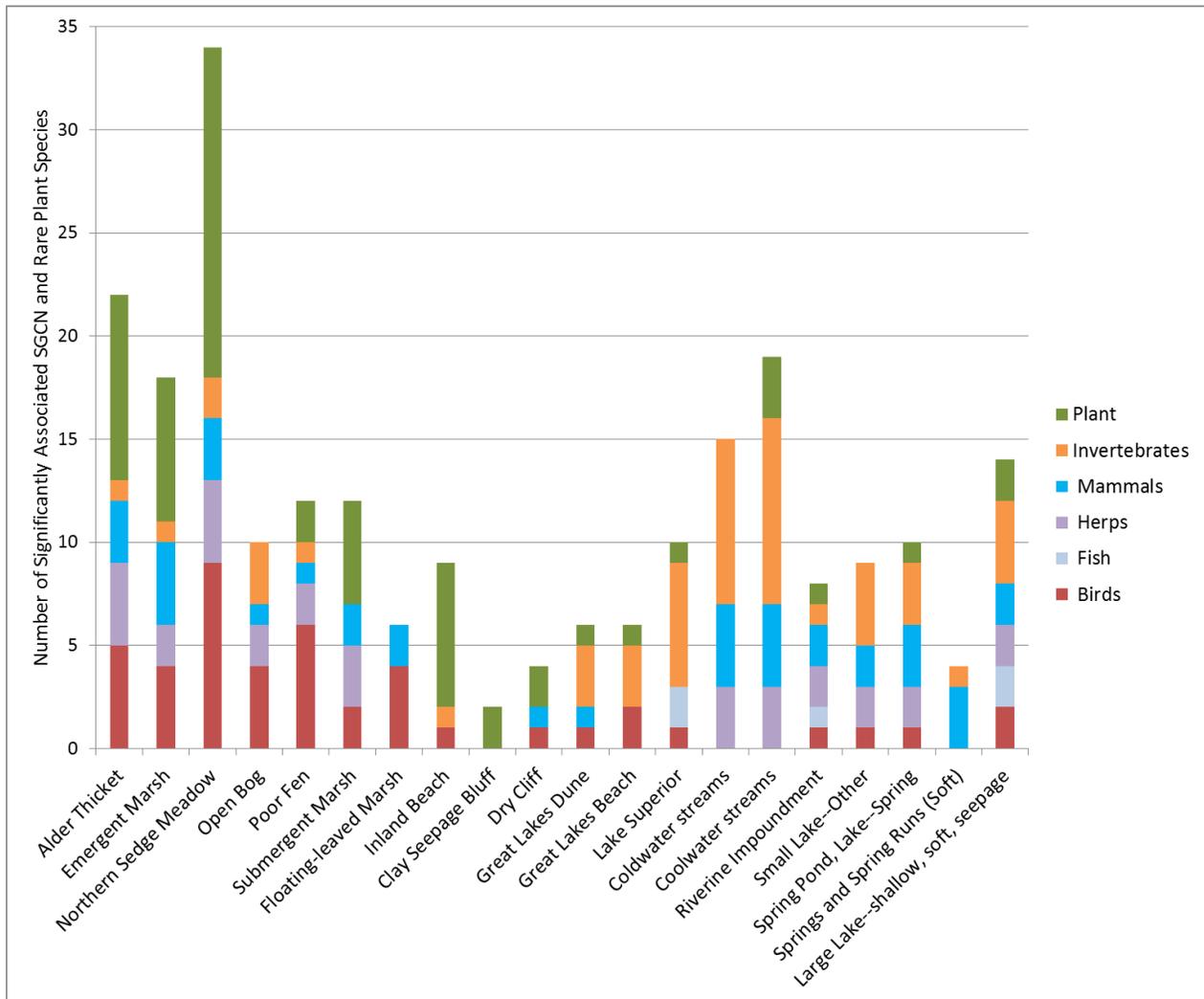


Figure 4. Number of SGCN and Rare Plant Species associated with Terrestrial and Forested Wetland Natural Communities of Conservation Significance on the Brule River State Forest (WDNR 2015d).<sup>1</sup>

<sup>1</sup> Chart represents the SGCN and rare plants that are moderately or highly associated with the respective natural communities. Species and natural communities represented are limited to those that are moderately to highly associated with the Ecological Landscapes in which the Brule River State Forest occurs.



**Figure 5.** Number of SGCN and Rare Plant Species associated with Non-forested Wetland, Aquatic, and associated Natural Communities of Conservation Significance on the Brule River State Forest (WDNR 2015d).<sup>1</sup>

<sup>1</sup> Chart represents the SGCN and rare plants that are moderately or highly associated with the respective natural communities. Species and natural communities represented are limited to those that are moderately to highly associated with the Ecological Landscapes in which the Brule River State Forest occurs.

## Priority Conservation Actions

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 the BRRSF. The WAP and all associated conservation actions are completely voluntary and non-regulatory. The following conservation actions are provided here for consideration where management goals are oriented toward maintaining or improving habitat for SGCN. These actions may not be applicable for stands or management units with other management goals. Priority Conservation Actions identified in the Wisconsin Wildlife Action Plan (WDNR 2008) that apply to BRRSF include:

- Increase representation of conifers such as white spruce, northern white cedar, eastern white pine, and balsam fir where feasible. Selective planting may be necessary in some areas.
- Reduce forest fragmentation by increasing forest patch size, increasing the proportion of interior to edge, and avoiding the placement of clearcuts in the immediate vicinity of stands with high conservation value or restoration potential.
- Provide for older forest developmental stages where they are missing.
- Use watershed-level planning and management to reduce impacts of conversion on water quality.
- Apply Best Management Practices for water quality during forest harvesting operations.
- Emphasize land management that incorporates protections against the introduction of invasive species.
- Develop techniques for using prescribed fire to reduce other woody competition when establishing red and white pine forests.
- Develop reliable natural regeneration techniques for red pine, and mixed red and white pine forests.
- Increase total acreages of conifer barrens and promote jack pine inclusions in existing barrens sites.
- Increase total acreages of jack pine including naturally regenerated stands where feasible.

## Wisconsin's Statewide Forest Strategy and the BRRSF

Wisconsin's Statewide Forest Assessment (WDNR 2010b) 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 2010c) contains a collection of strategies and actions designed to address the management and landscape priorities identified in the Statewide Forest Assessment. The strategies are broad guides intended to focus the actions of the forestry community. These documents include topics related to biological diversity in Wisconsin's forests, and provide information useful for department master planning and management activities. Several Statewide Forest Strategies are particularly pertinent to the BRRSF planning efforts in regard to opportunities to maintain or enhance biological diversity (Table 13, WDNR 2010b).

**Table 13.** Selection of Wisconsin Statewide Forest Strategies Relevant to the BRRSF.

Strategy Number	Strategy
11	Encourage the management of under-represented forest communities.
13	Increase forest structure and diversity.
14	Encourage the use of disturbance mechanisms to maintain diverse forest communities.
15	Maintain appropriate forest types for the ecological landscape while protecting forest health and function.
19	Adapt forest management practices to sustainably manage forests with locally high deer populations.
22	Strive to prevent infestations of invasive species before they arrive.
23	Work to detect new (invasive species) infestations early and respond rapidly to minimize impacts to forests.
24	Control and manage existing (invasive species) infestations.
25	Rehabilitate, restore, or adapt native forest habitats and ecosystems.

## 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. In addition to the threats to native communities and native species diversity, non-native invasive species negatively impact forestry (by reducing tree regeneration, growth and longevity), recreation, agriculture, and human health (by causing skin rashes and increasing incidence of tick-borne diseases). For example, in bottomland forests, dense patches of reed canary grass can prevent regeneration of trees and a minor infestation can become dense if the canopy is opened beyond 80% cover. Non-native invasive plants and animals can also have negative impacts on fish and wildlife species by long-term displacement of native food sources (e.g., for white-tailed deer and turkey; (Gorchov and Trisel 2003), diminishing habitat for ground-nesting birds (e.g., ovenbirds and woodcock; (Miller and Jordan 2011, Loss et al. 2012) and altering aquatic macroinvertebrate communities in streams, thereby impacting fish that feed on them (McNeish et al. 2012). The success of invasive species has been linked to invasive earthworms, which eliminate the duff layer and provide newly exposed bare mineral soil for invaders to colonize.

Non-native invasive species that are widespread at the BRRSF and pose the greatest immediate threat to native species diversity, rare species habitats, or high-quality natural communities are listed in Table 14. See Table 15 for invasive species to be vigilant for on the BRRSF that are not yet known, but are present in the vicinity.

When resources for complete control of widespread invasives are lacking, containment (i.e., limiting further spread) should be considered as an alternative action. Prevention of spread is, in fact, the most cost-effective means of dealing with invasive species. Forest inventory and management operations should take care to follow Best Management Practices related to non-native invasive species to avoid further spread. The frequent usage of the BRRSF for recreation also increases the potential for the introduction and spread of non-native invasive species on the property. Roads, trails, access points for fishing, and other high-use areas are typical entry points for invasive species that are introduced by visitors' footwear, clothing, vehicle tires, boats, and recreational equipment. Once established, these invasives may continue to spread along natural corridors (e.g., streams) and along recreational corridors (e.g. hunting/fishing walking trails). Invasive species may also be spread inadvertently through management activities such as timber operations (especially trenching for planting pine seedlings), roadside mowing, and right-of-way maintenance. All management activities should follow the Best Management Practices developed by the Wisconsin Council on Forestry (WDNR 2009). Furthermore, early detection and rapid control of new and/or small infestations should be considered for higher prioritization in any invasive species management strategy (Boos et al. 2010).

**Table 14.** Non-native Invasive Species currently known at the Brule River State Forest.  
*Chapter NR 40 classification codes in superscript: P = Prohibited, R = Restricted*

Common Name	Latin Name	Upland Habitats		Wetland Habitats		Aquatic
		Open	Wooded	Open	Wooded	
<b>PLANTS</b>						
aquatic forget-me-not <sup>R</sup>	<i>Myosotis scirpoides</i>			x		
Bell's honeysuckle <sup>R</sup>	<i>Lonicera X bella</i>	x	x		x	
big-leaf lupine	<i>Lupinus polyphyllus</i>	x				
bird's-foot trefoil	<i>Lotus corniculatus</i>	x				
bishop's gout-weed <sup>R</sup>	<i>Aegopodium podagraria</i>		x			
black locust <sup>R</sup>	<i>Robinia pseudoacacia</i>		x			
bull thistle	<i>Cirsium vulgare</i>	x				
Canada thistle <sup>R</sup>	<i>Cirsium arvense</i>	x		x		
common buckthorn <sup>R</sup>	<i>Rhamnus cathartica</i>		x		x	
common burdock	<i>Arctium minus</i>	x	x			
common hemp-nettle <sup>R</sup>	<i>Galeopsis tetrahit</i>		x			
common reed <sup>R</sup>	<i>Phragmites australis</i>			x		
common speedwell	<i>Veronica officinalis</i>		x			
common St. John's-wort	<i>Hypericum perforatum</i>	x				
common tansy <sup>R</sup>	<i>Tanacetum vulgare</i>	x				
crack willow	<i>Salix x fragilis</i>	x		x		
crown vetch <sup>R</sup>	<i>Coronilla varia</i>	x				
dame's rocket <sup>R</sup>	<i>Hesperis matronalis</i>		x			
elecampane	<i>Inula helenium</i>		x		x	
Eurasian water-milfoil <sup>R</sup>	<i>Myriophyllum spicatum</i>					x
false spiraea	<i>Sorbaria sorbifolia</i>	x				
garden forget-me-not <sup>R</sup>	<i>Myosotis sylvatica</i>				x	
garden valerian <sup>R</sup>	<i>Valeriana officinalis</i>	x	x			
glossy buckthorn <sup>R</sup>	<i>Frangula alnus</i>		x	x	x	
greater periwinkle	<i>Vinca minor</i>	x				
leafy spruce <sup>R</sup>	<i>Euphorbia esula</i>	x				
moneywort	<i>Lysimachia nummularia</i>				x	
orange daylily	<i>Hemerocallis fulva</i>	x	x			
orange hawkweed	<i>Hieracium aurantiacum</i>		x			
purple loosestrife	<i>Lythrum salicaria</i>			x		
reed canary grass	<i>Phalaris arundinacea</i>			x	x	
Siberian peashrub <sup>P</sup>	<i>Caragana arborescens</i>		x			
sneezeweed	<i>Achillea ptarmica</i>	x				
spotted knapweed <sup>R</sup>	<i>Centaurea stoebe ssp. micranthos</i>	x				
watercress	<i>Nasturtium officinale</i>			x		
yellow iris <sup>R</sup>	<i>Iris pseudacorus</i>			x		x
<b>ANIMALS</b>						
banded mystery snail <sup>R</sup>	<i>Viviparus georgianus</i>					x
non-native earthworms	<i>Lumbricus spp.</i>		x			

**Table 15.** Non-native invasives to watch for in the Brule River State Forest.  
Chapter NR 40 codes in superscript: P = Prohibited, R = Restricted.

Common Name	Latin Name	Upland Habitats		Wetland Habitats		Aquatic	Comments
		Open	Wooded	Open	Wooded		
<b>PLANTS</b>							
autumn-olive <sup>R</sup>	<i>Elaeagnus umbellata</i>	x					Present in Bayfield Co.
burning bush <sup>R</sup>	<i>Euonymus alatus</i>	x	x				Present in Washburn Co.
common teasel <sup>R</sup>	<i>Dipsacus fullonum</i> <i>ssp. sylvestris</i>	x					Present in Bayfield and Ashland Cos.
garlic mustard <sup>R</sup>	<i>Alliaria petiolata</i>		x		x		Present elsewhere in Douglas Co.
giant hogweed <sup>P</sup>	<i>Heracleum mantegazzianum</i>			x	x		Present in Iron Co.
Japanese barberry <sup>R</sup>	<i>Berberis thunbergii</i>		x				Present at Amnicon Falls SP.
Japanese/giant knotweed <sup>P</sup>	<i>Fallopia japonica</i> , <i>F. sachalinense</i>	x		x			Present elsewhere in Douglas Co.
oriental bittersweet <sup>P</sup>	<i>Celastrus orbiculata</i>	x	x	x			Present in Bayfield Co.
purple moor grass	<i>Molinia caerulea</i>			x			Present in Ashland Co.
queen-of-the-meadow <sup>R</sup>	<i>Filipendula ulmaria</i>			x	x		Found directly adjacent to BRRSF
wild chervil <sup>R</sup>	<i>Anthriscus sylvestris</i>	x	x				Present in Polk Co.
<b>ANIMALS</b>							
Asian long-horned beetle <sup>P</sup>	<i>Anoplophora glabripennis</i>		x				
Emerald ash borer <sup>P</sup>	<i>Agilus planipennis</i>		x		x		Discovered in Superior in 2013.
Hemlock woolly adelgid <sup>P</sup>	<i>Adelges tsugae</i>		x				
Gypsy moth <sup>P</sup>	<i>Lymantria dispar</i>		x		x		Present in Bayfield and Ashland Cos.
New Zealand mud snail <sup>P</sup>	<i>Potamopyrgus antipodarum</i>					x	Present in St. Louis River.
<b>FUNGUS</b>							
oak wilt	<i>Ceratocystis fagacearum</i>		x		x		Uncommon in northern WI, occurs in Burnett Co.

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:

- Douglas County Aquatic Invasive Species Coordinator - Farrah Wirtz: [fwirtz@uwsuper.edu](mailto:fwirtz@uwsuper.edu), (715) 394-8334. <http://www.douglascountywi.org/index.aspx?NID=637>
- Lake Superior Research Institute Outreach Specialist - Carrie Sanda. 715-394-8525. [csanda@uwsuper.edu](mailto:csanda@uwsuper.edu).
- Northwoods Cooperative Weed Management Area (CWMA): [info@northwoodscwma.org](mailto:info@northwoodscwma.org), <http://www.northwoodscwma.org/>
- Project RED: Riverine Early Detectors, River Alliance of Wisconsin – Laura McFarland. (608) 257-2424 x110. [lmcfarland@wisconsinrivers.org](mailto:lmcfarland@wisconsinrivers.org). <http://www.wisconsinrivers.org/our-work/project-red>

#### 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 39 counties, including Douglas County, are now under quarantine due to the beetle's presence in or near the county. 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 BRRSF are particularly vulnerable to the effects of emerald ash borer, as green ash, black ash, and occasionally white ash are important tree species within this ecosystem. Large-scale loss of ash in this area, whether through EAB-caused mortality or harvesting, could cause a cascade of negative impacts. Degradation of diverse, high-quality forests and loss of forest cover could further lead to diminishment of important habitat for rare plants and animals (especially forest interior birds and wood turtles), elevated water tables, conversion to alder thickets, and infestation of disturbance-loving invasives such as reed canary grass. It is important to note that removal of all ash as a stopgap measure against EAB is not recommended (WDNR 2010a) .

Increasing the resiliency of ash-dominated forests by underplanting suitable tree species prior to EAB infestation and tree mortality has been applied in other areas of the state. In floodplain forests, species such as swamp white oak may be appropriate, while in ash-dominated hardwood swamps, underplanting red maple or disease-resistant strains of American elm may help retain long-term forest cover. In addition to being tolerant of shade and high water tables, these species are also projected to fare relative well under potential impacts related to long-term climate change (Iverson et al. 2008, Janowiak et al. 2014).

#### Common and glossy buckthorn

Both common buckthorn and glossy buckthorn are locally common along the Brule River corridor between CTH B and CTH FF, with particularly dense populations near the village of Brule. As tall shrub or small tree, both species of buckthorn have potential to severely disrupt the forest ecosystem by shading out native groundlayer species, inhibiting native tree regeneration. By eliminating virtually all undergrowth and exposing bare mineral soil, they also have the potential to increase soil erosion. Furthermore, the leaf litter of buckthorn is higher in nitrogen than native trees and shrubs, which alters soil nutrient cycling and creates a feedback mechanism that favors more buckthorn and other non-native invasive species.

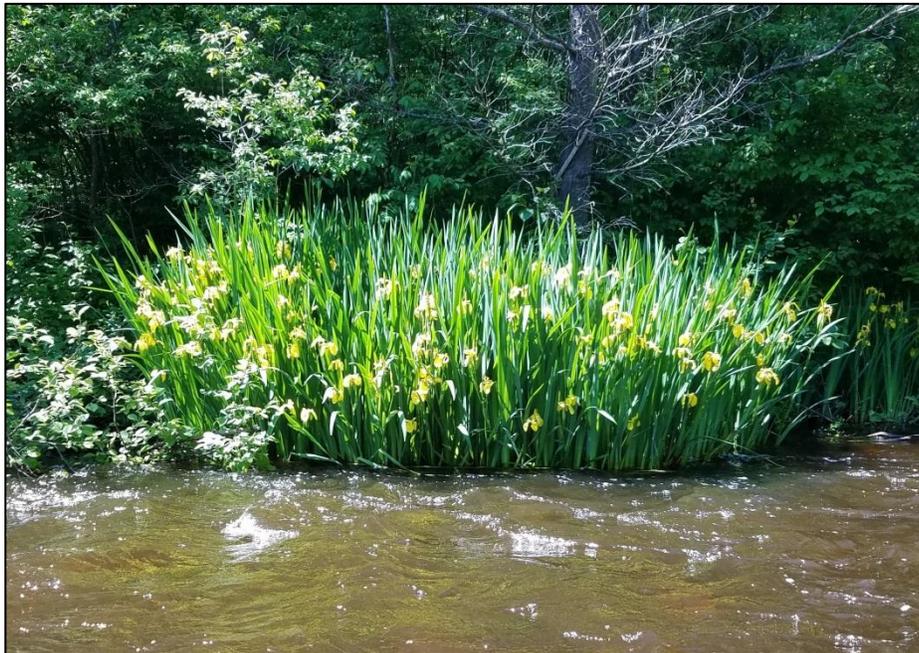
Buckthorn is a serious threat to the Brule River fishery, to high-quality recreation, to long-term forest health, and to the integrity of the entire Brule River corridor. A buckthorn control strategy should be a priority for the State Forest. Forest management operations should follow Best Management Practices

developed by the Wisconsin Council on Forestry (WDNR 2009). Additional recommendations can be found in A Field Guide to Terrestrial Invasive Plants of Wisconsin (Boos et al. 2010). In brief, a strategy should involve the following elements:

- 1) Develop a plan by making maps and setting feasible objectives;
- 2) Prevent invasions by following BMPs;
- 3) Control new invasions as early as possible;
- 4) Control invasives using manual, mechanical and chemical means;
- 5) Slow their spread when control isn't feasible;
- 6) Reduce negative impacts of invasives;
- 7) Conduct regular monitoring;
- 8) Restore degraded sites to confer resistance to new invasions.

### Yellow iris

Yellow iris (*Iris pseudacorus*) is scattered along the middle and lower Brule River, from Winnebougou downstream. Although an attractive garden plant, it forms dense clones along the riverbank and crowds out native species, including our native iris, blue flag (*Iris versicolor*). Yellow iris is on Wisconsin's list of NR40 restricted invasive species (WDNR 2015d). While widely scattered, and occasionally locally dense (nearly continuous clones for 100 feet or more), it is still manageable and should be a priority for control. Just as a purple loosestrife was the "purple plague" of wetlands, yellow iris may become a "yellow fever" of streamside habitat. Yellow iris can create extensive mats floating over deeper water, reduce habitat needed by waterfowl and fish, displace native vegetation and animals, and can impact recreation by reducing stream width by trapping sediment (Stone 2009). More research into the extent of the population and feasibility of control should be conducted.



Yellow iris is a rapidly spreading invasive species along the Brule River. Photo by Ryan O'Connor.

## Game Species and Sport Fish

*The following information was provided by WDNR wildlife and fishery managers*

The BRRSF provides good opportunities for hunting and trapping. Primary game species found throughout the property are white-tailed deer, black bear, ruffed grouse, eastern gray squirrel, and snowshoe hare. Lesser sought after game species known to be present include numerous upland furbearers such as long-tailed weasel, short-tailed weasel, fisher, red fox, gray fox, bobcat, and coyote. Upland gamebird species found here are ruffed grouse, American woodcock and less commonly wild turkey, sharp-tailed grouse and mourning doves. Waterfowl are present in modest numbers along the river, and seepage lakes in the southern portion of the state forest and more commonly in numerous wetlands and beaver ponds in the northern portion of the BRSF encompassing the clay plain. Wetlands and aquatic areas also provide habitat for river otter, muskrat, mink, raccoon, and beaver along with Wilson's snipe, sora rail, and Virginia rail.

From a fisheries perspective, the Bois Brule River supports several trout and salmon species throughout its entire 44-mile span. The most common are rainbow trout (steelhead), brown trout, brook trout, and Coho salmon, although Chinook (King) salmon and pink salmon are also present. These trout and salmon have migratory forms that spend at least part of their lives in Lake Superior and use the River for spawning and rearing. In fall 2015, 5,660 steelhead, 3,930 brown trout, and 1,680 Coho salmon were counted at the sea lamprey barrier and its companion fish passage facility. Brook trout is the only native species in the River, and the lake-run form (known as "coasters") is rare. Two hybrid trout species, splake and tiger trout, are also present in the River. Splake is a hybrid between lake trout and brook trout; most are produced in hatcheries and stocked in the lake. Tiger trout is a hybrid between brown trout and brook trout; they naturally reproduce in the River. Resident forms of brook trout, brown trout, and rainbow trout inhabit the River year-round, primarily in the reach known as the "upper river," upstream of County Highway B. They exhibit some migratory behavior, moving in and through the main channel and the tributaries particularly during their fall spawning seasons.

## Primary Sites: Site-specific Opportunities for Biodiversity Conservation

Twenty-five ecologically important sites, or “Primary Sites,” were identified within the BRRSF (Table 16 and Map E). Primary Sites are delineated because they generally encompass the best examples of 1) rare and representative natural communities, 2) documented occurrences of rare species populations, and/or 3) opportunities for ecological restoration or connections. These sites warrant high protection and/or restoration consideration during the development of the property master plan. This report is meant to be considered along with other information when identifying opportunities for various management designations during the master planning process.

A complete description of the Primary Sites can be found in Appendix E. 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 F provides a table of the rare species and high-quality natural communities currently known from these Primary Sites in the BRRSF. For a comparison of current Primary Sites with previously identified Primary Sites (WDNR 1999), see Table 17.

**Table 16.** Brule River State Forest Primary Sites.

<b>Code</b>	<b>Name</b>
BRRSF01.	Eau Claire River
BRRSF02.	Gordon Correctional Bog
BRRSF03.	Deer Print, Black Fox, Jack Pine, and Paradise Lakes Complex
BRRSF04.	Jerseth Creek and Smith-Cheney-Shoberg Lakes Complex
BRRSF05.	North Country Trail Barrens and Mott's Ravine SNA
BRRSF06.	Divide Swamp
BRRSF07.	Angel Creek and Beaupre Springs
BRRSF08.	Stone Chimney Cedar Swamp
BRRSF09.	Blue Springs – McDougal Springs
BRRSF10.	Cedar Island – Winneboujou
BRRSF11.	Mills Lake
BRRSF12.	Lake Minnesuing
BRRSF13.	Vapa Road Pines and Ponds
BRRSF14.	Willard Pines
BRRSF15.	Kurt's Deep Depression
BRRSF16.	Brule Rush Lake SNA
BRRSF17.	Devil's Hole Pines
BRRSF18.	Hoodoo Lake
BRRSF19.	CCC Miller Boreal Forest and Pines
BRRSF20.	Sugar Camp Hill
BRRSF21.	The Promontory
BRRSF22.	Lenroot Ledges
BRRSF23.	Brule River Boreal Forest SNA
BRRSF24.	Brule River Mouth Marsh and Lagoon
BRRSF25.	Bear Beach SNA and Pearson Creek Boreal Forest

**Table 17.** Comparison of 2016 Primary Sites to 1999 Primary Sites.

Site Code	Primary Site Name	1999 acres	2016 acres	Acreage Change	Comments
BRRSF01	Eau Claire River	91	63	-28	Site reduced to riverine/wetland stands.
BRRSF02	Gordon Correctional Bog	24	15	-9	Site reduced to follow wetland stands, plus small upland area of significance.
BRRSF03	Deer Print, Black Fox, Jack Pine, & Paradise Lakes	0	103	103	New site within project boundary on the Brule-St. Croix Legacy Forest Easement
BRRSF04	Jersech Creek & Smith-Cheney-Shoberg Lakes Complex	445	204	-241	Site reduced to follow wetland/lake boundaries and high-quality pine barrens. Includes former Smith Lake Primary Site.
BRRSF05	North Country Trail Barrens	2773	2857	85	Slightly expanded from 1999, includes private land within project boundary.
BRRSF06	Divide Swamp	1212	1030	-182	Site reduced slightly to most significant features.
BRRSF07	Angel Creek Swamp	1023	654	-369	~350 acres moved from Angel Creek to Stone Chimney
BRRSF08	Stone Chimney Cedar Swamp	940	1257	317	~350 acres moved from Angel Creek Swamp to Stone Chimney.
BRRSF09	Blue Springs - McDougal Springs	1047	946	-101	Site reduced slightly to most significant features. Partially on private land.
BRRSF10	Cedar Island - Winneboujou	1721	1625	-96	Within project boundary, but mostly on private land.
BRRSF11	Mills Lake	33	23	-10	Site reduced to wetland areas.
BRRSF12	Lake Minnesuing Hemlock-Hardwoods Swamp	133	243	110	Site expanded to include hemlock ravines, ephemeral ponds, and stands of maturing hardwoods.
BRRSF13	Vapa Road Pines and Ponds	109	95	-15	Site reduced to most significant features.
BRRSF14	Willard Pines	199	77	-122	Site reduced to most significant features.
BRRSF15	Kurt's Deep Depression	33	9	-24	Site reduced to most significant stand of pines, barrens, and marsh in bottom of kettle.
BRRSF16	Brule Rush Lake SNA	122	24	-99	Site reduced to lake and associated shoreline.
BRRSF17	Devils Hole Pines	53	16	-37	Site reduced to most significant stand of pines in bottom of kettle.
BRRSF18	Hoodoo Lake	72	59	-13	Site reduced to follow wetland boundaries; mostly private.
BRRSF19	CCC Miller Boreal Forest and Pines	101	83	-18	Site reduced following stand boundaries.
BRRSF20	Sugar Camp Hill	554	423	-131	Site reduced to exclude younger stands and developed land
BRRSF21	The Promontory	10	53	43	Site expanded to include greater extent of bedrock glades
BRRSF22	Lenroot Ledges	149	246	98	Site expanded to include more boreal forest along Brule River.
BRRSF23	Brule River Boreal Forest SNA	712	709	-3	Includes former Trask Creek/Weir Riffles and McNeil's Landing Primary Sites.
BRRSF24	Brule River Marsh and Lagoon	48	69	21	Site expanded to include additional riverine/estuarine wetlands upstream. Upland buffer eliminated.
BRRSF25	Bear Beach SNA and Pearson Creek Boreal Forest	1307	148	-1159	Site mostly contracted to SNA boundary. Includes former Pearson Creek Boreal Forest Primary Site.

Table 17 continued.

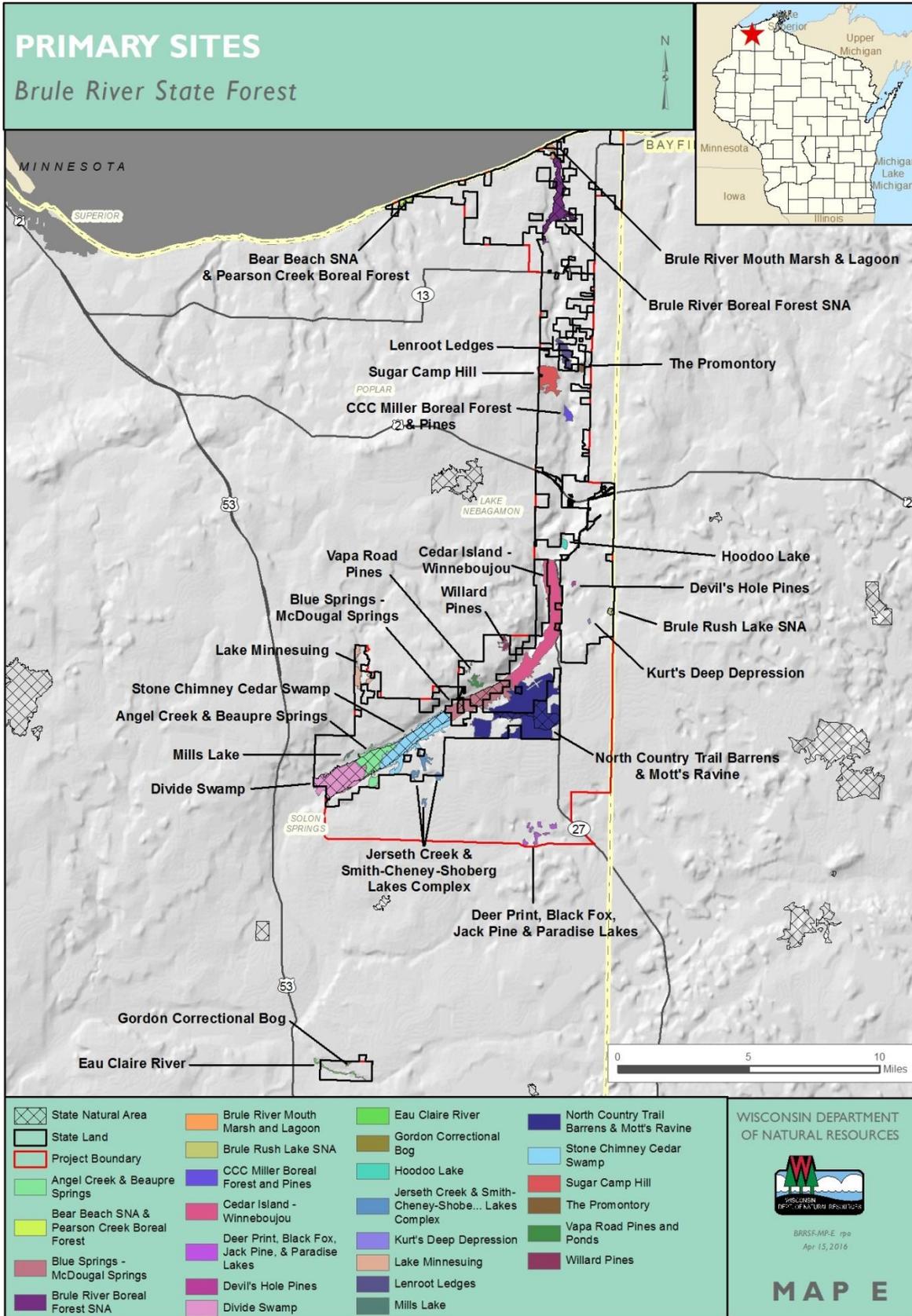
Former Primary Sites no longer deemed to be high conservation priorities:					
Site Code	Primary Site Name	1999 acres	2016 acres	Acreage Change	Comments
	Afterhours Tamaracks	22	0	-22	Site dropped, too small, fragmented, and of relatively low significance.
	Brackett's Corner	12	0	-12	Site dropped, very small and of relatively low significance.
	Buried Road Pines	13	0	-13	Site dropped, too small to be of high significance.
	Catlin Creek	0	0	0	Site dropped, not in project boundary
	Grover Lake	9	0	-9	Site dropped, not in project boundary
	Porcupine Creek Headwaters	25	0	-25	Site dropped, small, fragmented, and of relatively low significance.
	State Highway 13 Grasslands	792	0	-792	Site dropped, treated as management opportunity rather than Primary Site due to anthropogenic origins.
	<b>Total Acreage</b>	<b>13786</b>	<b>11032</b>	<b>-2755</b>	



Stone Chimney Cedar Swamp Primary Site. Photo by Eric Epstein.

# PRIMARY SITES

## Brule River State Forest



# Future Needs

This project was designed to provide a biotic inventory of the biodiversity values for the Brule River State Forest. 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 BRRSF.

- A comprehensive invasive species management plan is needed, especially for buckthorn along the Brule River corridor. This plan should include a monitoring strategy for detecting and rapidly responding to new invasive threats.
- Monitoring for Emerald Ash Borer infestation is paramount, as well as monitoring the success of any silvicultural trials or management to retain areas in forest cover, such as underplanting of other desirable tree species in ash-dominated areas.
- Continued wood turtle nest productivity monitoring and establish long-term wood turtle monitoring transects to track population trends.
- Expand small mammal surveys to inventory for rare woodland SGCN (e.g., woodland jumping mouse, northern flying squirrel, water shrew). Continue surveys of barrens and brushy grasslands for presence of Franklin's ground squirrel
- Periodic monitoring of key barrens species (sharp-tailed grouse, common nighthawk, whip-poor-will, Connecticut warbler, etc.) is recommended in the barrens area, especially to evaluate long-term effectiveness of barrens and Northern Dry Forest management.
- Continue surveys to locate and track female northern long-eared bats to identify roost locations.
- Additional surveys for terrestrial invertebrates would be beneficial. Specific taxa groups in need of additional work include:
  - Continued monitoring of the hairy-necked tiger beetle is warranted, especially in the face of higher lake levels and high recreational use of its habitat.
  - Inventory of native lady beetles, especially those found in mesic areas.
  - Surveys for bees, especially the yellow-banded bumblebee (*Bombus terricola*).
  - Inventory and monitoring of tiger beetles, especially the northern barrens tiger beetle (*Cicindela patruela*) and the boreal long-lipped tiger beetle (*Cicindela longilabris*). Spring surveys in suitable areas can sometimes be more successful than fall surveys, as fall populations tend to be smaller in northern areas.
  - Surveys for old growth forest beetles such as native longhorned beetles, jewel beetles, and a number of other groups with flight traps. This could be in conjunction when monitoring for invasive species (e.g., emerald ash borer, Asian longhorned beetle).
- Additional surveys for select species and groups of aquatic terrestrial invertebrates is warranted. Specific needs include:
  - Surveys for the alkali bluet damselfly (*Enallagma clausum*), a species recently discovered in Wisconsin and known only from a handful of sites near Lake Superior in Douglas and Bayfield Counties.
  - Surveys and monitoring for the plains emerald dragonfly (*Somatochlora ensigera*). This uncommon dragonfly is mostly restricted in Wisconsin to small riverine estuaries near Lake Superior in Douglas County.
  - Conduct general aquatic invertebrate surveys in the Brule headwaters and headwater tributary areas.

- Survey for the rare net-winged midge (*Blepharicera tenuipes* (Diptera: Blephariceridae)), known currently from Brule River at only one location.
- Inventory of winter stoneflies.
- Conduct Hilsenhoff Biotic Index (HBI) monitoring in the Brule system at periodic intervals (e.g., every five years), ideally expanding the number sites monitored, including tributary streams.
- Survey aquatic invertebrates of Ephemeral Ponds.
- Water quality monitoring, including turbidity and total suspended solids, is recommended at the Brule River mouth, and potentially at other key locations, to serve as an indicator of the health of the watershed, especially related to land use and erosion on the clay plain.
- Periodic sampling (e.g., every 10 years) and analysis is recommended for Davidson monitoring plots established at Willard Pines, Vapa Road Pines, CCC Miller Boreal Forest and Pines, Lenroot Ledges, Pearson Creek, Brule River Boreal Forest SNA, Cedar Island-Winneboujou (including Bois Brule Bluffs and Cedar Island-Winneboujou proper) and Stone Chimney Cedar Swamp. For more information, see forthcoming report from Paul Hlina and Dr. Nick Danz, UW-Superior.
- Periodic monitoring of Sugar Camp Hill and Divide Swamp (especially the black ash-dominated hardwood swamp) utilizing established timed meander survey areas is recommended in order to detect changes in ground layer species resulting from the potential spread of non-native invasives in upland forests and loss of black ash in hardwood swamps.

# 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 (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 2015d).

# Species List

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

Common Name	Scientific Name
<b>Plants</b>	
Alder-leaved Buckthorn	<i>Rhamnus alnifolia</i>
American Elm	<i>Ulmus americana</i>
Aquatic Forget-me-not	<i>Myosotis scorpioides</i>
Arrow-leaved Sweet-coltsfoot	<i>Petasites sagittatus</i>
Aspen	<i>Populus</i> spp.
Autumnal Water-starwort	<i>Callitriche hermaphroditica</i>
Autumn-olive	<i>Elaeagnus umbellata</i>
Balsam Fir	<i>Abies balsamea</i>
Balsam Poplar	<i>Populus balsamifera</i>
Balsam Willow	<i>Salix pyrifolia</i>
Basswood	<i>Tilia americana</i>
Beaked Hazelnut	<i>Corylus cornuta</i>
Bearberry	<i>Arctostaphylos uva-ursi</i>
Bell's Honeysuckle	<i>Lonicera X bella</i>
Big Bluestem	<i>Andropogon gerardii</i>
Big-leaf Lupine	<i>Lupinus polyphyllus</i>
Big-tooth Aspen	<i>Populus grandidentata</i>
Bird's-foot Trefoil	<i>Lotus corniculatus</i>
Bishop's Gout-weed	<i>Aegopodium podagraria</i>
Black Ash	<i>Fraxinus nigra</i>
Black Locust	<i>Robinia pseudoacacia</i>
Black Spruce	<i>Picea mariana</i>
Bladderworts	<i>Utricularia</i> spp.
Blue-bead-lily	<i>Clintonia borealis</i>
Bluejoint Grass	<i>Calamagrostis canadensis</i>
Bog Birch	<i>Betula pumila</i>
Bog Laurel	<i>Kalmia polifolia</i>
Bog-bean	<i>Menyanthes trifoliata</i>
Boneset	<i>Eupatorium perfoliatum</i>
Bracken Fern	<i>Pteridium aquilinum</i>
Buffalo Berry	<i>Shepherdia canadensis</i>
Bull Thistle	<i>Cirsium vulgare</i>
Bull-head pond-lily	<i>Nuphar variegata</i>
Bunchberry	<i>Cornus canadensis</i>
Bur Oak	<i>Quercus macrocarpa</i>
Burning Bush	<i>Euonymus alatus</i>
Calypso Orchid/Fairy Slipper	<i>Calypso bulbosa</i>
Canada Mayflower	<i>Maianthemum canadense</i>
Canada Thistle	<i>Cirsium arvense</i>
Canada Wild Rye	<i>Elymus canadensis</i>
Cinnamon Fern	<i>Osmunda cinnamomea</i>
Common Buckthorn	<i>Rhamnus cathartica</i>

<b>Common Name</b>	<b>Scientific Name</b>
Common Burdock	<i>Arctium minus</i>
Common Hemp-nettle	<i>Galeopsis tetrahit</i>
Common Polypody	<i>Polypodium virginianum</i>
Common Reed	<i>Phragmites australis</i>
Common Speedwell	<i>Veronica officinalis</i>
Common Spike-rush	<i>Eleocharis palustris</i>
Common St. John's-wort	<i>Hypericum perforatum</i>
Common Tansy	<i>Tanacetum vulgare</i>
Common Teasel	<i>Dipsacus fullonum</i> spp. <i>sylvestris</i>
Crack Willow	<i>Salix X fragilis</i>
Crown Vetch	<i>Coronilla varia</i>
Dame's Rocket	<i>Hesperis matronalis</i>
Dwarf Milkweed	<i>Asclepias ovalifolia</i>
Dwarf Red Raspberry	<i>Rubus pubescens</i>
Early Low Blueberry	<i>Vaccinium angustifolium</i>
Elecampane	<i>Inula helenium</i>
Emerald Ash Borer	<i>Agrilus planipennis</i>
Eurasian Water-milfoil	<i>Myriophyllum spicatum</i>
False Spiraea	<i>Sorbaria sorbifolia</i>
Few-seeded Sedge	<i>Carex oligosperma</i>
Field Forget-me-not	<i>Myosotis arvensis</i>
Fir Clubmoss	<i>Huperzia selago</i>
Flat-leaved Bladderwort	<i>Utricularia intermedia</i>
Fragrant Fern	<i>Dryopteris fragrans</i>
Fragrant Water-Lily	<i>Nymphaea odorata</i>
Garden Forget-me-not	<i>Myosotis sylvatica</i>
Garden Valerian	<i>Valeriana officinalis</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Giant Hogweed	<i>Heracleum mantegazzianum</i>
Glossy Buckthorn	<i>Frangula alnus</i>
Golden Sedge	<i>Carex aurea</i>
Graceful Sedge	<i>Carex gracillima</i>
Grape Fern	<i>Sceptridium rugulosum</i>
Greater Periwinkle	<i>Vinca minor</i>
Green Ash	<i>Fraxinus pennsylvanica</i>
Hill's oak	<i>Quercus ellipsoidalis</i>
Hoary puccoon	<i>Lithospermum canescens</i>
Hooker's Orchid	<i>Platanthera hookeri</i>
Hybrid Cattail	<i>Typha X glauca</i>
Ironwood	<i>Ostrya virginiana</i>
Jack Pine	<i>Pinus banksiana</i>
Japanese Barberry	<i>Berberis thunbergii</i>
Japanese/ Giant Knotweed	<i>Fallopia japonica</i> , <i>F. sachalinense</i>
Joe-pye-weed	<i>Eupatorium maculatum</i>
June Grass	<i>Koeleria macrantha</i>
Lapland Buttercup	<i>Ranunculus lapponicus</i>
Large-leaved aster	<i>Eurybia macrophylla</i>

<b>Common Name</b>	<b>Scientific Name</b>
Leafy Spruge	<i>Euphorbia esula</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Lesser Wintergreen	<i>Pyrola minor</i>
Little Bluestem	<i>Schizachyrium scoparium</i>
Long-awned Wood Grass	<i>Brachyelytrum aristosum</i>
Long-leaved Aster	<i>Symphotrichum robynianum</i>
Manna Grass	<i>Glyceria striata</i>
Marsh Horsetail	<i>Equisetum palustre</i>
Marsh Ragwort	<i>Tephrosia palustris</i>
Meadowsweet	<i>Spiraea alba</i>
Moneywort	<i>Lysimachia nummularia</i>
Mountain Cranberry	<i>Vaccinium vitis-idaea</i>
Mountain Fly Honeysuckle	<i>Lonicera villosa</i>
Mountain Maple	<i>Acer spicatum</i>
Naiads	<i>Najas</i> spp.
Naked miterwort	<i>Mitella nuda</i>
Narrow-leaved Cow Wheat	<i>Melampyrum lineare</i>
Narrow-leaved Woolly Sedge	<i>Carex lasiocarpa</i>
Northern Pin Oak	<i>Quercus ellipsoidalis</i>
Northern White-cedar	<i>Thuja occidentalis</i>
Northern Yellow Lady's- slipper	<i>Cypripedium parviflorum</i> var. <i>makasin</i>
Orange Daylily	<i>Heemerocallis fulva</i>
Orange Hawkweed	<i>Hieracium aurantiacum</i>
Oriental Bittersweet	<i>Celastrus orbiculata</i>
Pale Corydalis	<i>Capnoides sempervirens</i>
Paper Birch	<i>Betula papyrifera</i>
Pennsylvania Sedge	<i>Carex pensylvanica</i>
Pitcher-plant	<i>Sarracenia purpurea</i>
Pondweeds	<i>Potamogeton</i> spp.
Poverty Grass	<i>Danthonia spicata</i>
Purple Loosestrife	<i>Lythrum salicaria</i>
Purple Moor Grass	<i>Molina caerulea</i>
Queen-of-the-meadow	<i>Filipendula ulmaria</i>
Ram's-head Lady's-slipper	<i>Cypripedium arietinum</i>
Red Maple	<i>Acer rubrum</i>
Red Oak	<i>Quercus rubra</i>
Red Pine	<i>Pinus resinosa</i>
Red-osier Dogwood	<i>Cornus stolonifera</i>
Reed Canary Grass	<i>Phalaris arundinacea</i>
Reed Manna Grass	<i>Glyceria grandis</i>
Rocky Mountain Sedge	<i>Carex backii</i>
Rough Blazing Star	<i>Liatris aspera</i>
Rough-leaved Rice Grass	<i>Oryzopsis asperifolia</i>
Round-leaved Sundew	<i>Drosera rotundifolia</i>
Royal Fern	<i>Osmunda regalis</i>
Rugulose Grape-fern	<i>Sceptridium rugulosum</i>
Rusty Woodsia	<i>Woodsia ilvensis</i>

<b>Common Name</b>	<b>Scientific Name</b>
Sandbar willow	<i>Salix interior</i>
Scrub Oak	<i>Quercus ellipsoidalis</i>
Siberian Peashrub	<i>Caragana arborescens</i>
Slender Willow	<i>Salix petiolaris</i>
Small Cranberry	<i>Vaccinium oxycoccos</i>
Small Yellow Pond Lily	<i>Nuphar microphylla</i>
Sneezeweed	<i>Achillea ptarmica</i>
Speckled Alder	<i>Alnus incana</i>
Spike-rushes	<i>Eleocharis spp.</i>
Spotted Knapweed	<i>Centaurea stoebe ssp. micranthos</i>
Starflower	<i>Trientalis borealis</i>
Stiff Arrowhead	<i>Sagittaria rigida</i>
Stoneworts	<i>Nitella spp.</i>
Sugar Maple	<i>Acer saccharum</i>
Swamp Loosestrife	<i>Lysimachia thyrsiflora</i>
Swamp White Oak	<i>Quercus bicolor</i>
Sweet-fern	<i>Comptonia peregrina</i>
Tamarack	<i>Larix laricina</i>
Thimbleberry	<i>Rubus parviflorus</i>
Three-leaf Solomon's- seal	<i>Maianthemum trifolium</i>
Three-way Sedge	<i>Dulichium arundinaceum</i>
Torrey's Bulrush	<i>Schoenoplectus torreyi</i>
Trembling Aspen	<i>Populus tremuloides</i>
Tussock Sedge	<i>Carex stricta</i>
Vasey's Rush	<i>Juncus vaseyi</i>
Water Cinquefoil	<i>Comarum palustre</i>
Watercress	<i>Nasturtium officinale</i>
Water-marigold	<i>Bidens beckii</i>
Water-shield	<i>Brasenia schreberi</i>
Western Sunflower	<i>Helianthus occidentalis</i>
White Adder's-mouth	<i>Malaxis monophyllos var. brachypoda</i>
White Ash	<i>Fraxinus americana</i>
White Birch	<i>Betula papyrifera</i>
White Pine	<i>Pinus strobus</i>
White Spruce	<i>Picea glauca</i>
Wild Calla	<i>Calla palustris</i>
Wild Chervil	<i>Anthriscus sylvestris</i>
Wild Sarsaparilla	<i>Aralia nudicaulis</i>
Winterberry	<i>Ilex verticillata</i>
Wintergreen	<i>Gaultheria procumbens</i>
Wood Anemone	<i>Anemone quinquefolia</i>
Yellow Birch	<i>Betula alleghaniensis</i>
Yellow Iris	<i>Iris pseudacorus</i>
<b>Animals</b>	
A Crawling Water Beetle	<i>Haliphus canadensis</i>
A Perlodid Stonefly	<i>Isogenoides olivaceus</i>
A Predaceous Diving Beetle	<i>Hygrotus falli</i>

<b>Common Name</b>	<b>Scientific Name</b>
A Predaceous Diving Beetle	<i>Hygrotus farctus</i>
Alkali Bluet Damselfly	<i>Enallagma clausum</i>
American Bittern	<i>Botaurus lentiginosus</i>
American Eel	<i>Anguilla rostrata</i>
American Marten	<i>Martes americana</i>
American Woodcock	<i>Scolopax minor</i>
Asian Long-horned Beetle	<i>Anoplophora glabripennis</i>
Banded Mystery Snail	<i>Viviparus georgianus</i>
Beach Dune Tiger Beetle	<i>Cicindela hirticollis rhodensis</i>
Beaver	<i>Castor canadensis</i>
Big Brown Bat	<i>Eptesicus fuscus</i>
Black-backed Woodpecker	<i>Picoides arcticus</i>
Black Bear	<i>Ursus americanus</i>
Black-backed Woodpecker	<i>Picoides arcticus</i>
Blackburnian Warbler	<i>Setophaga fusca</i>
Blue-winged Teal	<i>Anas discors</i>
Bobcat	<i>Lynx rufus</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Boreal Chickadee	<i>Poecile hudsonicus</i>
Boreal Long-lipped tiger Beetle	<i>Cicindela longilabris</i>
Brook Trout	<i>Salvelinus fontinalis</i>
Brown Thrasher	<i>Toxostoma rufum</i>
Brown Trout	<i>Salmo trutta</i>
Canada Warbler	<i>Cardellina canadensis</i>
Cape May Warbler	<i>Setophaga tigrina</i>
Cerulean Warbler	<i>Setophaga cerulea</i>
Chinook (King) Salmon	<i>Oncorhynchus tshawytscha</i>
Coho Salmon	<i>Oncorhynchus kisutch</i>
Common Loon	<i>Gavia immer</i>
Common Nighthawk	<i>Chordeiles minor</i>
Common Tern	<i>Sterna hirundo</i>
Connecticut Warbler	<i>Oporornis agilis</i>
Coyote	<i>Canis latrans</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>
Eastern Meadowlark	<i>Sturnella magna</i>
Emerald Ash Borer	<i>Agrilus planipennis</i>
Evening Grosbeak	<i>Coccothraustes vespertinus</i>
Fisher	<i>Martes pennanti</i>
Forcinate Emerald Dragonfly	<i>Somatochlora forcipata</i>
Four-toed Salamander	<i>Hemidactylium scutatum</i>
Franklin's Ground Squirrel	<i>Poliocitellus franklinii</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>
Golden-winged Warbler	<i>Vermivora chrysoptera</i>
Gray Fox	<i>Urocyon cinereoargenteus</i>
Gray Jay	<i>Perisoreus canadensis</i>
Gypsy Moth	<i>Lymantria dispar</i>

<b>Common Name</b>	<b>Scientific Name</b>
Hairy-necked Tiger Beetle	<i>Cicindela hirticollis rhodensis</i>
Hemlock Woolly Adelgid	<i>Adelges tsugae</i>
Kirtland's Warbler	<i>Setophaga kirtlandii</i>
Lady Beetles	<i>Coccinellidae spp.</i>
Least Flycatcher	<i>Empidonax minimus</i>
LeConte's Sparrow	<i>Ammodramus leconteii</i>
Little Brown Bat	<i>Myotis lucifugus</i>
Long-eared Owl	<i>Asio otus</i>
Long-tailed Weasel	<i>Mustela frenata</i>
Mink	<i>Neovison vison</i>
Mink Frog	<i>Lithobates septentrionalis</i>
Mourning Warbler	<i>Geothlypis philadelphia</i>
Muskellunge	<i>Esox masquinongy</i>
Muskrat	<i>Ondatra zibethicus</i>
New Zealand Mud Snail	<i>Potamopyrgus antipodarum</i>
Non-native Earthworms	<i>Lumbricus spp.</i>
Northern Barrens Tiger Beetle	<i>Cicindela patruela</i>
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>
Northern Goshawk	<i>Accipiter gentilis</i>
Northern Harrier	<i>Circus cyaneus</i>
Northern Long-eared Bat	<i>Myotis septentrionalis</i>
Northern Pike	<i>Esox lucius</i>
Northern Saw-whet Owl	<i>Aegolius acadicus</i>
Olive-sided Flycatcher	<i>Contopus cooperi</i>
Ovenbirds	<i>Seiurus aurocapillus</i>
Pine Warbler	<i>Setophaga pinus</i>
Pink Salmon	<i>Oncorhynchus gorbushca</i>
Plains Emerald Dragonfly	<i>Somatochlora ensigera</i>
Prairie Skink	<i>Plestiodon septentrionalis</i>
Pronghorn Clubtail Dragonfly	<i>Gomphus graslinellus</i>
Purple Finch	<i>Haemorhous purpureus</i>
Raccoon	<i>Procyon lotor</i>
Rainbow Trout (Steelhead)	<i>Oncorhynchus mykiss</i>
Red Crossbill	<i>Loxia curvirostra</i>
Red Fox	<i>Vulpes vulpes</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
Red-necked Grebe	<i>Podiceps grisegena</i>
River Otter	<i>Lontra canadensis</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>
Ruffed Grouse	<i>Bonasa umbellus</i>
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>
Short-tailed Weasel	<i>Mustela erminea</i>
Silver-haired Bat	<i>Lasionycteris noctivagans</i>
Skink	<i>Scincidae spp.</i>
Smallmouth Bass	<i>Micropterus dolomieu</i>
Snowshoe Hare	<i>Lepus americanus</i>
Sora Rail	<i>Porzana carolina</i>

<b>Common Name</b>	<b>Scientific Name</b>
Splake	<i>Salvelinus namaycush X Salvelinus fontinalis</i>
Spruce Grouse	<i>Falcapennis canadensis</i>
Tiger Trout	<i>Salmo trutta X Salvelinus fontinalis</i>
Upland Sandpiper	<i>Bartramia longicauda</i>
Vesper Sparrow	<i>Poocetes gramineus</i>
Virginia Rail	<i>Rallus limicola</i>
Walleye	<i>Sander vitreus</i>
Water Shrew	<i>Sorex palustris</i>
Western Meadowlark	<i>Sturnella neglecta</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
White-winged Crossbill	<i>Loxia leucoptera</i>
Wild Turkey	<i>Meleagris gallopavo</i>
Wilson's Snipe	<i>Gallinago delicata</i>
Winter Wren	<i>Troglodytes hiemalis</i>
Wood Thrush	<i>Hylocichla mustelina</i>
Wood Turtle	<i>Glyptemys insculpta</i>
Woodland Jumping Mouse	<i>Napaeozapus insignis</i>
Yellow-banded Bumblebee	<i>Bombus terricola</i>
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>

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# Additional Resources

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

- 1. WDNR Natural Heritage Conservation Webpages for Animals, Plants, and Communities**  
Information for plants, animals, and natural communities on the Wisconsin Working List, as well as Species of Greatest Conservation Need from the Wisconsin Wildlife Action Plan. For reptiles and amphibians, information for more common species is also provided here. At this time, the level of detail available varies among species; some have detailed factsheets while others have only a short paragraph or a map. These pages will continue to evolve as more information becomes available and are the Bureau of Natural Heritage Conservation's main source of information for species and communities. [dnr.wi.gov](http://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](http://dnr.wi.gov) keyword "*working list*"
- 3. Ecological Landscapes of Wisconsin**  
Wisconsin's 16 Ecological Landscapes have unique combinations of physical and biological characteristics such as climate, geology, soils, water, or vegetation. This publication contains a chapter for each of these landscapes with detailed information about their ecology, socioeconomics, and ecological management opportunities. An additional introductory chapter compares the 16 landscapes in numerous ways, discuss Wisconsin's ecology on the statewide scale, and introduces important concepts related to ecosystem management in the state. A suite of web pages also 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](http://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](http://dnr.wi.gov) keyword "*wildlife action plan*"
  - explore Wildlife Action Plan data by County:  
[dnr.wi.gov/topic/WildlifeHabitat/county.asp](http://dnr.wi.gov/topic/WildlifeHabitat/county.asp)
  - Wildlife Action Plan Implementation: [dnr.wi.gov](http://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](http://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](http://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](http://dnr.wi.gov) keyword "*forest assessment*"

8. **Species Guidance Documents.**

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

[dnr.wi.gov](http://dnr.wi.gov) keyword "*species guidance*"

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## Appendix A

### Natural Heritage Inventory Overview and General Methodology

This biotic inventory and analysis was conducted by the Wisconsin Natural Heritage Inventory (NHI) program. The Wisconsin NHI program is part of the Wisconsin DNR's Bureau of Endangered Resources and a member of an international network of Natural Heritage programs representing all 50 states, as well as portions of Canada, Latin America, and the Caribbean. These programs share standardized methods for collecting, processing, and managing data for rare species, 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](http://www.NatureServe.org)) for locating, documenting, and ranking rare species and natural community occurrences.

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

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

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

Taxa-specific surveys can be costly and intensive and sometimes must be completed during a very narrow period of time. For example, bird surveys must be completed within 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.

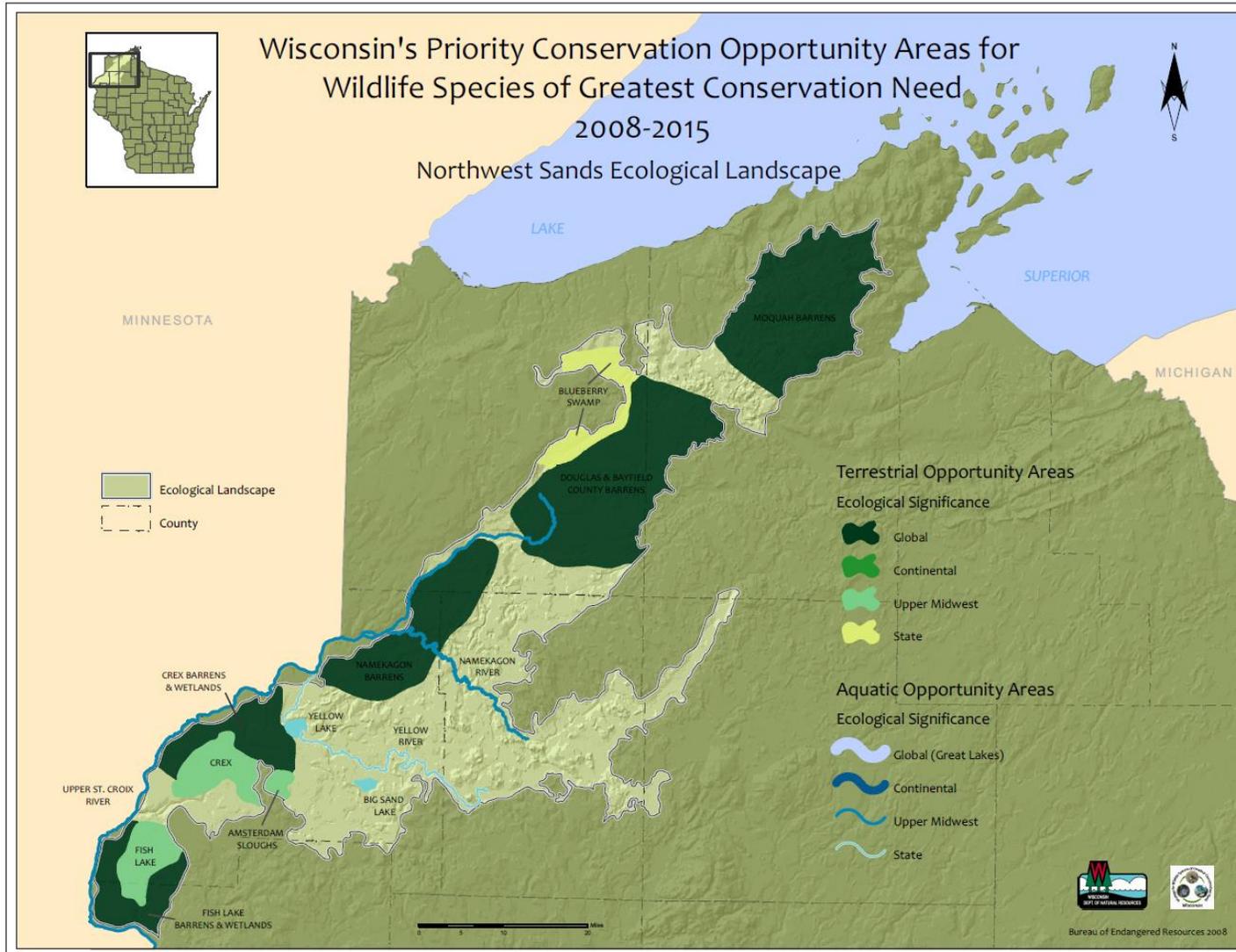
**Original Land Survey Records:** The surveyors who laid out the rectilinear Town-Range-Section grid across the state in the mid-nineteenth century recorded trees by species and size at all section corners and along section lines. Their notes also included general impressions of vegetation, soil fertility,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

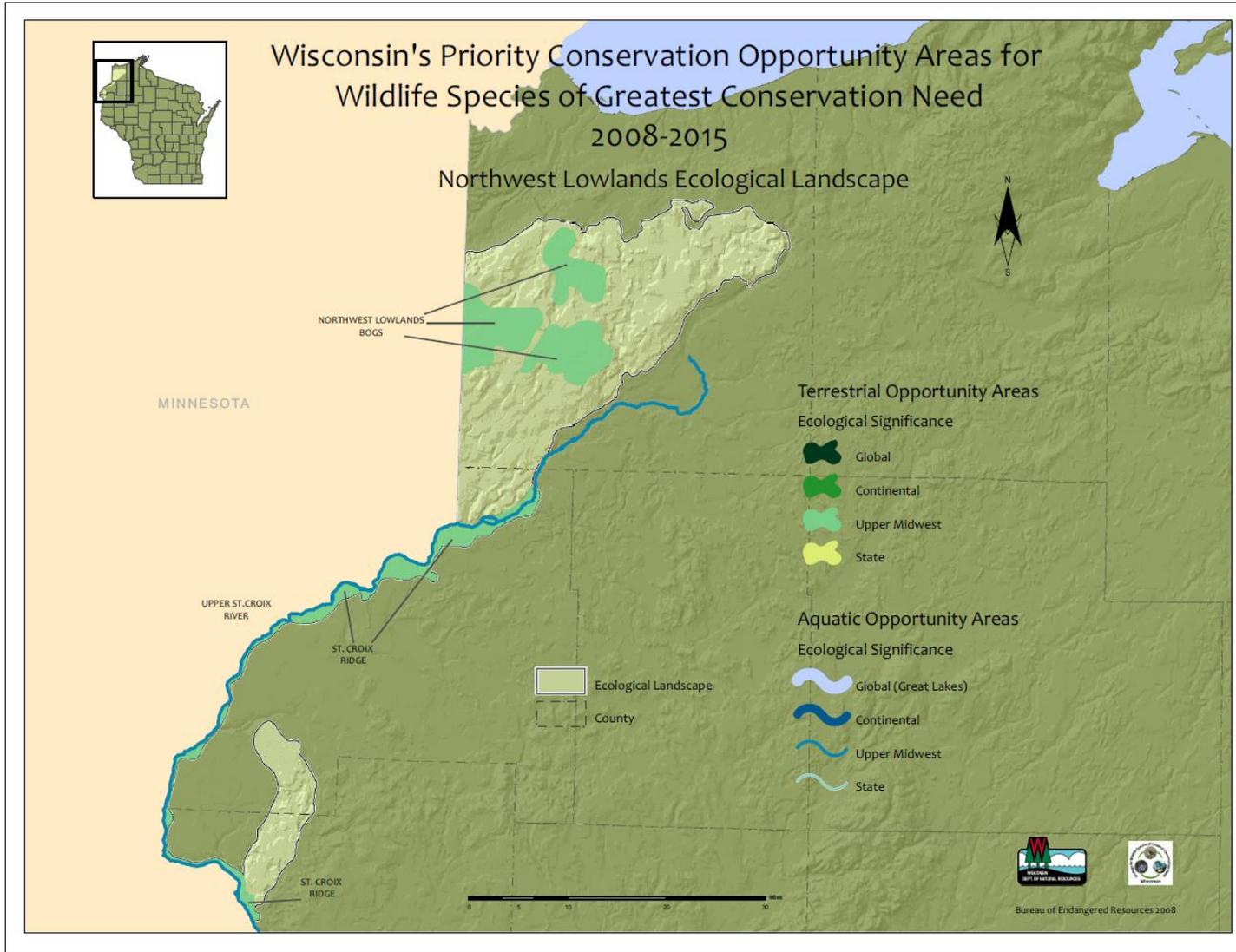
**Interviews:** Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield invaluable information.

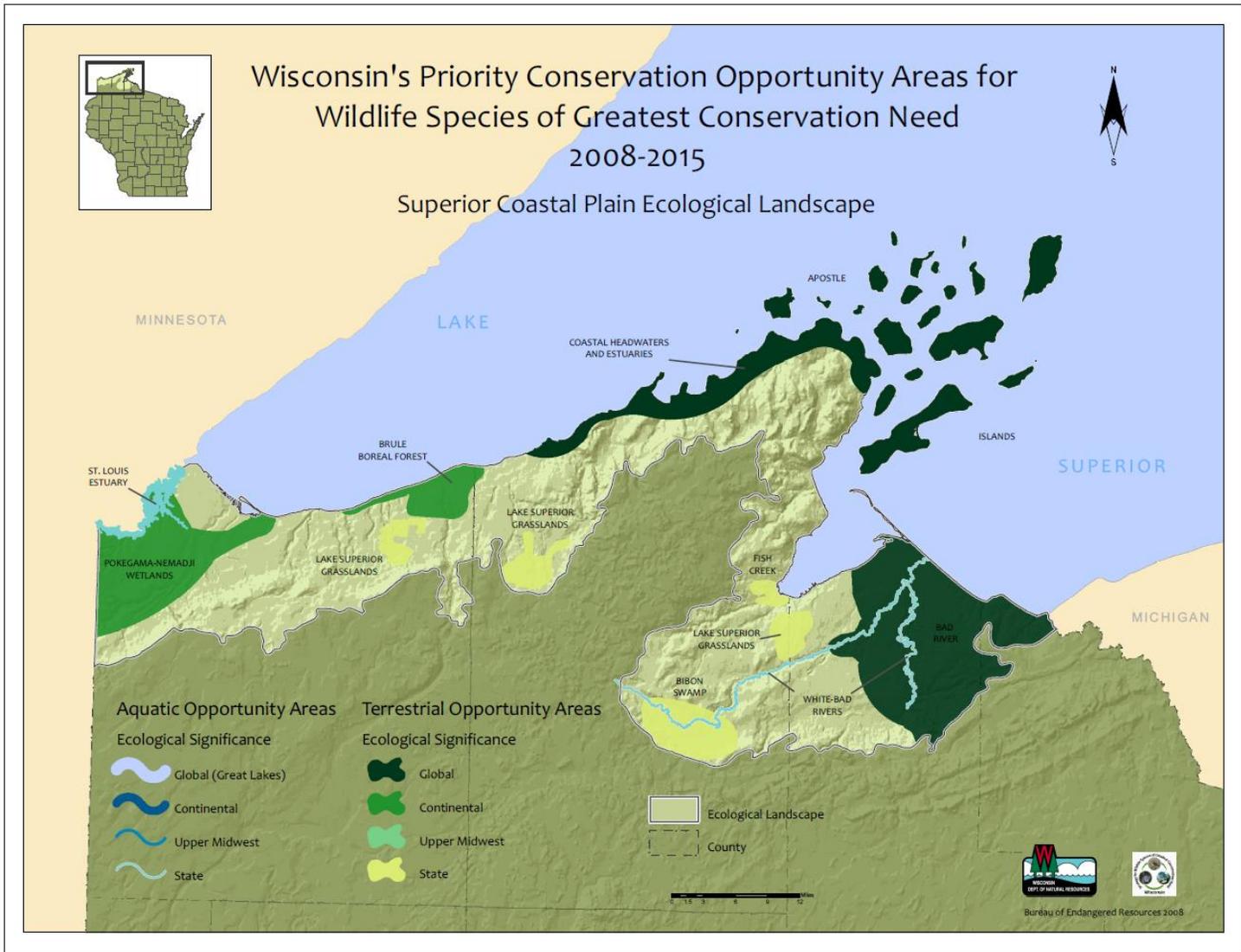
**Global Positioning Systems (GPS):** Small, portable GPS units are now a routine piece of field equipment used for virtually all NHI survey work. Collecting coordinates (waypoints) facilitates mapping and makes it easy to quickly communicate specific locations among biologists. Often waypoints are paired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









Common Name	Scientific Name	Aspen-Birch	Boreal Forest	Surrogate Grasslands	Conifer Plantation	Pine Barrens	Northern Dry Forest--young seral	Northern Dry Forest--mid-seral	Northern Dry Forest--late seral	Northern Dry-mesic--young seral	Northern Dry-mesic--mid-seral	Northern Dry-mesic--late seral	Northern Mesic Forest--young seral	Northern Mesic Forest--early seral	Northern Mesic Forest--mid seral	Northern Mesic Forest--late seral	Northern Hardwood Swamp	Northern Wet Forest	Black Spruce Swamp	Northern Tamarack Swamp	Northern Wet-mesic Forest	Alder Thicket	Emergent Marsh	Northern Sedge Meadow	Open Bog	Poor Fen	Submergent Marsh	Floating-leaved Marsh	Inland Beach	Clay Seepage Bluff	Dry Cliff	Great Lakes Dune	Great Lakes Beach	Lake Superior	Coldwater streams	Coolwater streams	Riverine Impoundment	Small Lake--Other	Spring Pond, Lake--Spring	Springs and Spring Runs (Soft)	Large Lake--shallow, soft, seepage						
Eastern whip-poor-will	<i>Antrostomus vociferus</i>					S	M	M	M	M	M																																				
Evening Grosbeak	<i>Coccothraustes vespertinus</i>		S											M	S	S																															
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	M					M			M			M				M	M		M		S																									
Grasshopper Sparrow	<i>Ammodramus savannarum</i>			S																																											
Gray Jay	<i>Perisoreus canadensis</i>																		S																												
Le Conte's Sparrow	<i>Ammodramus leconteii</i>			S																			S																								
Least Bittern	<i>Ixobrychus exilis</i>																																														
Least Flycatcher	<i>Empidonax minimus</i>	M	M				M			M	M			S	S	S	M																														
Long-eared Owl	<i>Asio otus</i>												M	M																																	
Nelson's Sparrow	<i>Ammodramus nelsoni</i>																						S			M																					
Northern Goshawk	<i>Accipiter gentilis</i>				M							M																																			
Olive-sided Flycatcher	<i>Contopus cooperi</i>		M															S	S	S	M				M	M																					
Peregrine Falcon	<i>Falco peregrinus</i>																											S																			
Piping Plover	<i>Charadrius melodus</i>																																														
Purple Martin	<i>Progne subis</i>				M																																										
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>					M																																									
Red-necked Grebe	<i>Podiceps grisegena</i>																											M	S																		
Red-shouldered Hawk	<i>Buteo lineatus</i>										M																																				
Ruby-crowned Kinglet	<i>Regulus calendula</i>		M																																												

Common Name	Scientific Name	Aspen-Birch	Boreal Forest	Surrogate Grasslands	Conifer Plantation	Pine Barrens	Northern Dry Forest--young seral	Northern Dry Forest--mid-seral	Northern Dry Forest--late seral	Northern Dry-mesic--young seral	Northern Dry-mesic--mid-seral	Northern Dry-mesic--late seral	Northern Mesic Forest--young seral	Northern Mesic Forest--early seral	Northern Mesic Forest--mid seral	Northern Mesic Forest--late seral	Northern Hardwood Swamp	Northern Wet Forest	Black Spruce Swamp	Northern Tamarack Swamp	Northern Wet-mesic Forest	Alder Thicket	Emergent Marsh	Northern Sedge Meadow	Open Bog	Poor Fen	Submergent Marsh	Floating-leaved Marsh	Inland Beach	Clay Seepage Bluff	Dry Cliff	Great Lakes Dune	Great Lakes Beach	Lake Superior	Coldwater streams	Coolwater streams	Riverine Impoundment	Small Lake--Other	Spring Pond, Lake--Spring	Springs and Spring Runs (Soft)	Large Lake--shallow, soft, seepage					
Rusty Blackbird	<i>Euphagus carolinus</i>																					M	M		M	M																				
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>			M		S																		M																						
Swainson's Thrush	<i>Catharus ustulatus</i>	M	M													M						S																								
Upland Sandpiper	<i>Bartramia longicauda</i>			S		M																																								
Vesper Sparrow	<i>Pooecetes gramineus</i>					S																																								
Wilson's Phalarope	<i>Phalaropus tricolor</i>																							S																						
Yellow Rail	<i>Coturnicops noveboracensis</i>																							S	S	S																				
<b>Fish</b>																																														
Lake Sturgeon	<i>Acipenser fulvescens</i>																																													
Least Darter	<i>Etheostoma microperca</i>																																													
Pugnose Shiner	<i>Notropis anogenus</i>																																													
Shortjaw Cisco	<i>Coregonus zenithicus</i>																																													
<b>Herps</b>																																														
Blanding's Turtle	<i>Emydoidea blandingii</i>			M		S	M																M	M			S																			
Four-toed Salamander	<i>Hemidactylium scutatum</i>	S	M										S	S	S	S	M	M	M	M	M	S	S	S	M	S	S																			
Gophersnake	<i>Pituophis catenifer</i>			M		S	M																																							
Mink Frog	<i>Lithobates septentrionalis</i>																						M	S	M	S	M	S																		
Wood Turtle	<i>Glyptemys insculpta</i>	S		M		S	S	S	M	S	S	S	S	S	S	M	M	M	M	M	M	S		M																						







Common Name	Scientific Name	Aspen-Birch	Boreal Forest	Surrogate Grasslands	Conifer Plantation	Pine Barrens	Northern Dry Forest--young seral	Northern Dry Forest--mid-seral	Northern Dry Forest--late seral	Northern Dry-mesic--young seral	Northern Dry-mesic--mid-seral	Northern Dry-mesic--late seral	Northern Mesic Forest--young seral	Northern Mesic Forest--early seral	Northern Mesic Forest--mid seral	Northern Mesic Forest--late seral	Northern Hardwood Swamp	Northern Wet Forest	Black Spruce Swamp	Northern Tamarack Swamp	Northern Wet-mesic Forest	Alder Thicket	Emergent Marsh	Northern Sedge Meadow	Open Bog	Poor Fen	Submergent Marsh	Floating-leaved Marsh	Inland Beach	Clay Seepage Bluff	Dry Cliff	Great Lakes Dune	Great Lakes Beach	Lake Superior	Coldwater streams	Coolwater streams	Riverine Impoundment	Small Lake--Other	Spring Pond, Lake--Spring	Springs and Spring Runs (Soft)	Large Lake--shallow, soft, seepage					
Forcinate Emerald	<i>Somatochlora forcipata</i>																	M	M	M					S	S														M						
Forest Locust	<i>Melanoplus islandicus</i>					M	S	S	S	M	M	M	M	M	M	M																														
Gorgone Checker Spot	<i>Chlosyne gorgone</i>					S																																								
Huckleberry Spur-throat Grasshopper	<i>Melanoplus fasciatus</i>		M																																											
Hydroporus Diving Beetle	<i>Heterosternuta pulchra</i>																																													
Indiscriminate Cuckoo Bumble Bee	<i>Bombus (Psithyrus) insularis</i>																																													
Karner Blue	<i>Lycaeides melissa samuelis</i>					S																																								
Mottled Dusky Wing	<i>Erynnis martialis</i>					S																																								
Northern Barrens Tiger Beetle	<i>Cicindela patruela patruela</i>					S	S	S	S																																					
Owl-eyed Bird Dropping Moth	<i>Cerma cora</i>					M																																								
Persius Dusky Wing	<i>Erynnis persius</i>					M																																								
Phlox Moth	<i>Schinia indiana</i>					S																																								
Pronghorn Clubtail	<i>Gomphus graslinellus</i>																																													
Robust Dubiraphian Riffle Beetle	<i>Dubiraphia robusta</i>																																													
Rocky Mountain Sprinkled Locust	<i>Chloealtis abdominalis</i>					S	M																																							

Common Name	Scientific Name	Aspen-Birch	Boreal Forest	Surrogate Grasslands	Conifer Plantation	Pine Barrens	Northern Dry Forest--young seral	Northern Dry Forest--mid-seral	Northern Dry Forest--late seral	Northern Dry-mesic--young seral	Northern Dry-mesic--mid-seral	Northern Dry-mesic--late seral	Northern Mesic Forest--young seral	Northern Mesic Forest--early seral	Northern Mesic Forest--mid seral	Northern Mesic Forest--late seral	Northern Hardwood Swamp	Northern Wet Forest	Black Spruce Swamp	Northern Tamarack Swamp	Northern Wet-mesic Forest	Alder Thicket	Emergent Marsh	Northern Sedge Meadow	Open Bog	Poor Fen	Submergent Marsh	Floating-leaved Marsh	Inland Beach	Clay Seepage Bluff	Dry Cliff	Great Lakes Dune	Great Lakes Beach	Lake Superior	Coldwater streams	Coolwater streams	Riverine Impoundment	Small Lake--Other	Spring Pond, Lake--Spring	Springs and Spring Runs (Soft)	Large Lake--shallow, soft, seepage										
Semirelict Underwing Moth	<i>Catocala semirelictica</i>	S																																																	
Speckled Rangeland Grasshopper	<i>Arphia conspersa</i>					S	M	M	M	M	M	M																																							
Spotted-winged Grasshopper	<i>Orphulella pelidna</i>																						M	M																											
Stone's Locust	<i>Melanoplus stonei</i>					S	M	M	M																																										
West Virginia White	<i>Pieris virginiensis</i>												M	M	S	S																																			
Zigzag Darner	<i>Aeshna sitchensis</i>																						M																												
<b>Plants</b>																																																			
American Shoreweed	<i>Littorella uniflora</i>																																															M			
Appalachian Clubmoss	<i>Huperzia appalachiana</i>																												M																						
Arrow-leaved Sweet-coltfoot	<i>Petasites sagittatus</i>																						M	M																											
Auricled Twayblade	<i>Listera auriculata</i>																						S																												
Autumnal Water-starwort	<i>Callitriche hermaphroditica</i>																										S																					M	M	M	M
Beautiful Sedge	<i>Carex concinna</i>	S																																																	
Bog Bluegrass	<i>Poa paludigena</i>																S																																		
Broad-leaved Twayblade	<i>Listera convallarioides</i>													S	S	S																																			
Clasping-leaf Pondweed	<i>Potamogeton perfoliatus</i>																										S																								
Downy Willow-herb	<i>Epilobium strictum</i>																						M	S				S																							
Dwarf Milkweed	<i>Asclepias ovalifolia</i>					S																																													
Fairy Slipper	<i>Calypso bulbosa</i>																					S																													



Common Name	Scientific Name	Aspen-Birch	Boreal Forest	Surrogate Grasslands	Conifer Plantation	Pine Barrens	Northern Dry Forest--young seral	Northern Dry Forest--mid-seral	Northern Dry Forest--late seral	Northern Dry-mesic--young seral	Northern Dry-mesic--mid-seral	Northern Dry-mesic--late seral	Northern Mesic Forest--young seral	Northern Mesic Forest--early seral	Northern Mesic Forest--mid seral	Northern Mesic Forest--late seral	Northern Hardwood Swamp	Northern Wet Forest	Black Spruce Swamp	Northern Tamarack Swamp	Northern Wet-mesic Forest	Alder Thicket	Emergent Marsh	Northern Sedge Meadow	Open Bog	Poor Fen	Submergent Marsh	Floating-leaved Marsh	Inland Beach	Clay Seepage Bluff	Dry Cliff	Great Lakes Dune	Great Lakes Beach	Lake Superior	Coldwater streams	Coolwater streams	Riverine Impoundment	Small Lake--Other	Spring Pond, Lake--Spring	Springs and Spring Runs (Soft)	Large Lake--shallow, soft, seepage					
Marsh Grass-of-Parnassus	<i>Parnassia palustris</i>																						M						M																	
Marsh Horsetail	<i>Equisetum palustre</i>																					S	S																							
Marsh Ragwort	<i>Senecio congestus</i>																						M					S																		
Michaux's Sedge	<i>Carex michauxiana</i>																								S		M																			
Mingan's Moonwort	<i>Botrychium minganense</i>	S												S	S	S																														
Moonwort Grape-fern	<i>Botrychium lunaria</i>	M											M	M	M	M																														
Mountain Cranberry	<i>Vaccinium vitis-idaea ssp. minus</i>	M																																												
Northern Bur-reed	<i>Sparganium glomeratum</i>																					M	M																							
Northern Oak Fern	<i>Gymnocarpium jessoense ssp. parvulum</i>																												S																	
Northwestern Sticky Aster	<i>Canadanthus modestus</i>																					S	M																							
Pale Moonwort	<i>Botrychium pallidum</i>																											S																		
Plains Ragwort	<i>Packera indecora</i>																												M																	
Ram's-head Lady's-slipper	<i>Cypripedium arietinum</i>	M																																												
Robbins' Spike-rush	<i>Eleocharis robbinsii</i>																						M	M																						
Rugulose Grape-fern	<i>Botrychium rugulosum</i>																											S																		
Russet Cotton-grass	<i>Eriophorum chamissonis</i>																								S																					

Common Name	Scientific Name	Aspen-Birch	Boreal Forest	Surrogate Grasslands	Conifer Plantation	Pine Barrens	Northern Dry Forest--young seral	Northern Dry Forest--mid-seral	Northern Dry Forest--late seral	Northern Dry-mesic--young seral	Northern Dry-mesic--mid-seral	Northern Dry-mesic--late seral	Northern Mesic Forest--young seral	Northern Mesic Forest--early seral	Northern Mesic Forest--mid seral	Northern Mesic Forest--late seral	Northern Hardwood Swamp	Northern Wet Forest	Black Spruce Swamp	Northern Tamarack Swamp	Northern Wet-mesic Forest	Alder Thicket	Emergent Marsh	Northern Sedge Meadow	Open Bog	Poor Fen	Submergent Marsh	Floating-leaved Marsh	Inland Beach	Clay Seepage Bluff	Dry Cliff	Great Lakes Dune	Great Lakes Beach	Lake Superior	Coldwater streams	Coolwater streams	Riverine Impoundment	Small Lake--Other	Spring Pond, Lake--Spring	Springs and Spring Runs (Soft)	Large Lake--shallow, soft, seepage										
Sand Violet	<i>Viola sagittata</i> var. <i>ovata</i>					S																																													
Satiny Willow	<i>Salix pellita</i>																																																		
Seaside Crowfoot	<i>Ranunculus cymbalaria</i>																						M	M																											
Shore Sedge	<i>Carex lenticularis</i>																						M																												
Slender Pondweed	<i>Stuckenia filiformis</i> ssp. <i>occidentalis</i>																																																		
Slender Spike-rush	<i>Eleocharis nitida</i>																					M	S				S																								
Small Yellow Pond Lily	<i>Nuphar microphylla</i>																							S																											
Small Yellow Water Crowfoot	<i>Ranunculus gmelini</i>																						M	S																											
Smooth Black Sedge	<i>Carex nigra</i>																							S																											
Spreading Woodfern	<i>Dryopteris expansa</i>		S											M	M	M																																			
Thread-like Naiad	<i>Najas gracillima</i>																																																		
Vasey's Rush	<i>Juncus vaseyi</i>																							S																											
Veined Meadowrue	<i>Thalictrum venulosum</i>																																																		
Woodland Cudweed	<i>Omalotheca sylvatica</i>		S																																																

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## Appendix D

### Wisconsin Natural Heritage Working List Explanation

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked and we encourage data submissions on these species. This list is meant to be dynamic - it is updated as often as new information regarding the biological status of species becomes available. See the Endangered Resources Program web site for the most recent Natural Heritage Inventory Working List (<http://dnr.wi.gov/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 proven. 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. At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
- G2 Imperiled. At high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
- G3 Vulnerable. At moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
- G4 Apparently secure. At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
- G5 Secure. At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.
- G#G# A numeric range rank (G2G3, G1G3) is used to indicate uncertainty about the exact status of an element. Ranges cannot skip more than two ranks (GU is used rather than G1G4).
- GH Possibly Extinct (species) / Eliminated (ecosystems) — Known from only historical occurrences but still some hope of rediscovery. Examples of evidence include (1) that an element has not been documented in approximately 20–40 years despite some searching and/or some evidence of significant habitat loss or degradation; (2) that an element has been searched for unsuccessfully, but not thoroughly enough to presume that it is extinct or eliminated throughout its range.
- GU Unrankable due to lack of information or to substantially conflicting information about status or trends of an element. Whenever possible, a range rank is used to delineate the range of uncertainty.
- GX Presumed Extinct (species) — Not located despite intensive searches and virtually no likelihood of rediscovery. Presumed Eliminated (natural community) — Eliminated throughout its range, due to loss of key dominant and characteristic taxa and/or elimination of the sites and ecological processes on which the type depends.
- GNR Global rank not yet assessed.

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 due to a very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
- S2 Imperiled in Wisconsin due to a restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
- S3 Vulnerable in Wisconsin due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
- S4 Apparently secure in Wisconsin due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
- S5 Secure in Wisconsin due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.
- S#S# A range rank (S2S3, S1S3) is used to indicate any range of uncertainty regarding the status of the element in Wisconsin.
- SNA A state rank is not applicable because the element is not a suitable target for conservation activities, typically because it is non-native, accidental, irregular, a long-distance migrant/transitory, or the element's presence in Wisconsin is unconfirmed.
- SNR Not ranked. State conservation status not yet assessed.
- SU Unrankable due to lack of information or to substantially conflicting information about status or trends.
- SH Known from only historical records. The element may no longer be present in Wisconsin, but there is not enough evidence to state this with certainty. The SH rank is used when an element's presence has not been documented in decades despite some searching and there is evidence of significant habitat loss or degradation, or when an element has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in Wisconsin.
- SX Presumed to be extirpated from Wisconsin. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

## 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).

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## APPENDIX E

### Primary Sites within the Brule River State Forest

Twenty-five ecologically important sites were identified on the Brule River State Forest (BRRSF). These “Primary Sites” were delineated because they generally encompass the best examples of:

- 1) Rare and representative natural communities,
- 2) Documented occurrences of rare species populations, and/or
- 3) Opportunities for ecological restoration or connections.

These sites warrant high protection and/or restoration consideration during the development of the property master plan. This report is meant to be considered along with other information when identifying opportunities for various management designations during the master planning process.

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

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## **BRRSF01. EAU CLAIRE RIVER**

### ***Location***

Landtype Association: 212Ka. Bayfield Sand Barrens  
Approximate Size: 63 acres  
Ownership: WDNR

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

The Eau Claire River is a small, cool, fast, hard water stream originating in the Eau Claire Lakes east of the BRSF in Bayfield County and emptying into the St. Croix River at Gordon. The stream runs approximately 19 miles, averages 40 feet in width and drains about 23 square miles. Bottom materials are approximately equal amounts of sand, gravel and rock. A 24-foot head dam has long been located a little over a mile above the mouth of the Eau Claire River, though it is slated for removal and was in the process of being decommissioned and removed in 2016. Prior to removal, the dam maintained the 2-mile-long, 56-acre Eau Claire River Flowage.

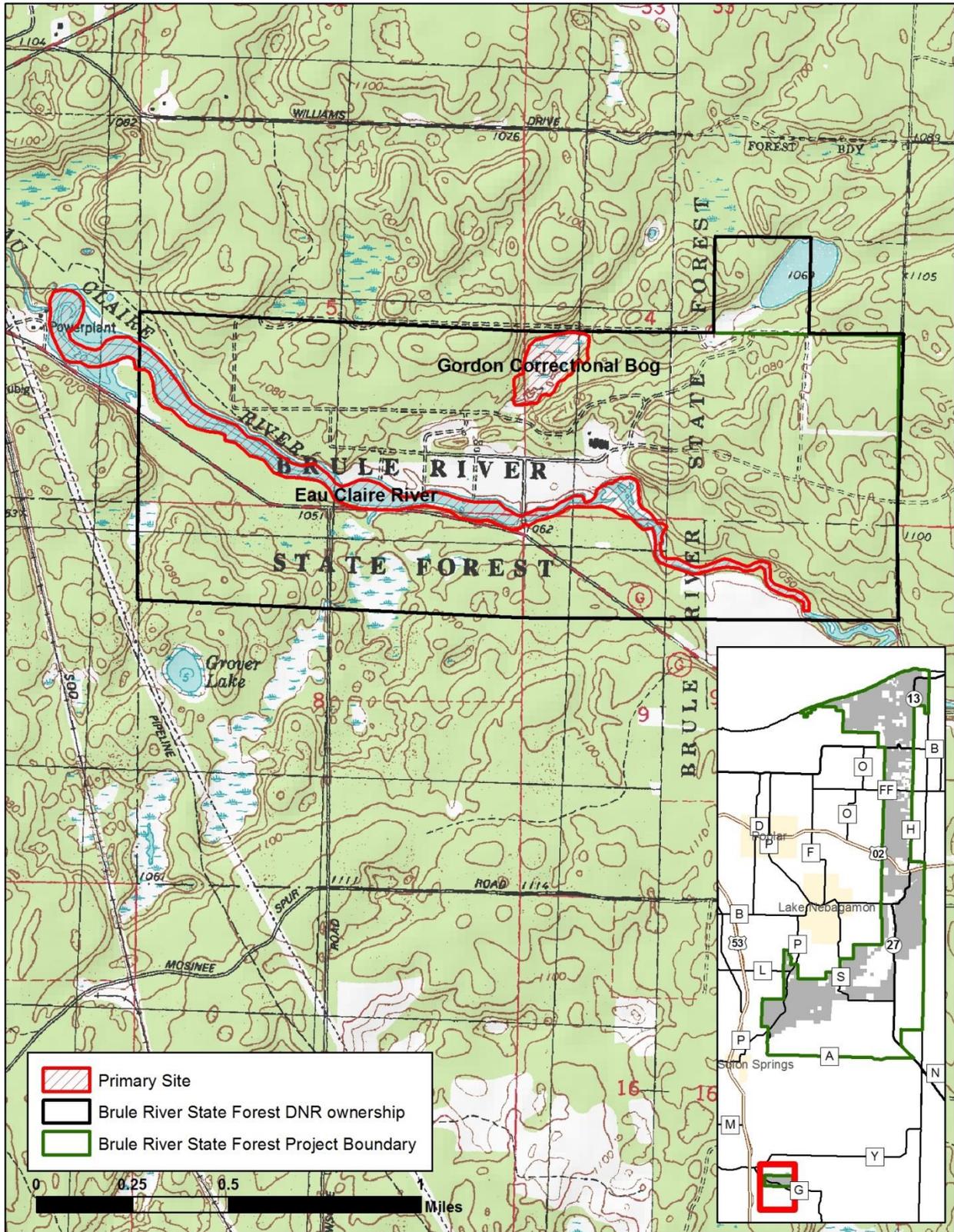
### ***Significance of Site***

The Eau Claire River was identified as having high aquatic species richness in 1993-1997 (WDNR 1999). Most of the Eau Claire River is considered Class III trout water and contains many warm water and cold water animals including fishes, mussels and aquatic insects. The number of species in the river and flowage signify a very rich aquatic system: 82 species of aquatic invertebrates (including insects and mussels) are known from the river and 31 species (18 of these not found in the river proper) are known from the flowage. In addition, the Eau Claire is a headwater tributary to the St. Croix River system, globally significant due to its diverse aquatic biota (WDNR 1999).

### ***Management Considerations***

The water source for the Eau Claire River is primarily the chain of lakes contained in the Eau Claire Lakes system. Each of the three major lakes in this system has a low dam that artificially maintains water levels. Shorelines are highly developed. The 24-foot head dam on the lower Eau Claire mentioned above alters water quality on the lower three miles of river and serves as a barrier to fish and mussel movements. Monitoring of fish and aquatic non-game species is recommended following dam removal.

The Town of Barnes has an active citizen-based group that actively monitors and protects area waters. They recently received a Clean Boats, Clean Waters grant for 2016 to monitor five public boat landings on the Upper Eau Claire, Middle Eau Claire, Lower Eau Claire, Robinson, and Island Lake.



**BRRSF01: Eau Claire River Primary Site and BRRSF02: Gordon Correctional Bog Primary Site.**

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## BRRSF02. GORDON CORRECTIONAL BOG

### **Location**

Landtype Association: 212Ka. Bayfield Sand Barrens  
Approximate Size: 14.5 acres  
Ownership: WDNR

### **Description of Site**

This small, isolated peatland occurs in a red pine (*Pinus resinosa*) plantation in the northeast portion of the Brule Annex near the Gordon Correctional Center. Located in a kettle depression in glacial outwash sands, the bog is dominated by leatherleaf (*Chamaedaphne calyculata*) and few-seeded sedge (*Carex oligosperma*) with scattered round-leaf sundew (*Drosera rotundifolia*) within a matrix of deep Sphagnum moss hummocks. Toward the center of the bog the Sphagnum layer thins and becomes flat and, along with narrow-leaved woolly sedge (*Carex lasiocarpa*), forms a quaking mat perforated by small pools of water which provide microhabitats for additional species such as white beak-rush (*Rhynchospora alba*), pod-grass (*Scheuchzeria palustris*) and carnivorous bladderworts (*Utricularia* spp.). Along the outer edges of the peatland the vegetation transitions to a narrow border of bluejoint grass (*Calamagrostis canadensis*). The south end of the site is disturbed with evidence of small amounts of past dredging as well as areas of reed canary grass (*Phalaris arundinacea*); willows are also a dominant feature of this area

### **Significance of Site**

Although small, this site represents one of the few bogs on the state forest. An interesting complement of conservative Poor Fen plant species (e.g., white beak-rush and pod-grass) is present in the central portion of the site. Overall the site is relatively pristine, with only a small area on the south end of the site disturbed in the past by minor dredging.

A small population of a rare plant was noted in 1997 and 2014 immediately adjacent to the bog in sandy uplands in and at the edge of the red pine plantation. This is the only known location for this species on the BRRSF. These sandy uplands adjacent to the bog likely supported Pine Barrens circa 1800.

### **Management Considerations**

Passive management that protects the hydrology of the wetland is the primary management need for this site. Control of reed canary grass on the south end of the site may be warranted, especially as it not widespread in the region. Two-tracks associated with the Gordon Correctional Facility run along the south end of the site. While the two-track is not a direct threat to the site in its current form, the potential exists for illegal ORV/UTV to use it for access into the edge of the wetland, which could cause sedimentation, rutting, impact hydrology, and spread invasive species.

Dwarf milkweed in the adjacent pine plantation prefers sunny, open habitats. When the stand reaches rotation age, prescriptions for harvest and replanting that minimize soil disturbance in occupied habitat will help avoid direct impacts to the species. If improved habitat is desired, consider converting a portion of the stand to open red pine forest or Pine Barrens. Historically, this species and the Pine Barrens landscape (including kettle wetlands) would have benefited from periodic fire.

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## BRRSF03. DEER PRINT, BLACK FOX, JACK PINE, AND PARADISE LAKES COMPLEX

### Location

Landtype Association: 212Ka. Bayfield Sand Barrens  
Approximate Size: 103 acres  
Ownership: Lyme Timber and other private

### Description of Site

This Primary Site consists of seven shallow soft-water seepage lakes (four named and three unnamed) with undeveloped shorelines characterized by fluctuating water levels, good-quality aquatic communities, and good examples of the Inland Beach natural community. Several of the shorelines have historic records of rare plants associated with fluctuating water levels. All lakes are within the Brule River State Forest Project Boundary and all have all or a portion of their shoreline within the Brule-St. Croix Legacy Forest easement, currently owned by the Lyme Timber Company.

Located in the Bayfield Sand Barrens, the lakes are imbedded in a landscape of jack pine (*Pinus banksiana*) plantations, remnant Pine Barrens and scattered aspen stands. A low- to fair-quality, large (600- to 700-acre) pine barrens stretches from Deer Print Lake northeast to State Highway 27. The area has a significant disturbance history: there are shallow furrows from recent logging and the area burned in the 2013 Germann Road Fire. Dead jack pine skeletons were present in places at the time of survey, with other areas salvaged. Most regeneration is from northern pin oak (*Quercus ellipsoidalis*) and bur oak (*Q. macrocarpa*) with abundant hazelnut (*Corylus* spp.) resprouts. The groundlayer is dominated by native grasses, sedges, asters, puccoons, and violets. Some orange hawkweed (*Hieracium aurantiacum*) and spotted knapweed (*Centaurea stoebe* subsp. *micranthos*) are present in the barrens, but there are few other non-native invasives.

The four named lakes (Deer Print, Black Fox, Jack Pine and Paradise) are deeper and larger in surface area than the three unnamed lakes (nicknamed for convenience Smudge, Northwest, and Northwest of Northwest Lake; see map for locations).

In general, the lakes tend to have zonal vegetation patterns typical of softwater seepage lakes that transition from uplands to Inland Beach to Emergent Marsh to Submergent Marsh (submerged and floating-leaved aquatic plants mixed with open water), though shallow lakes lack the Submergent Marsh



Black Fox Lake. *Carex lacustris* and *C. lasiocarpa* are dominant emergents in moderately deep water. Dead jack pines in the right half of the picture are a legacy of the 2014 Germann Road Fire. Photo montage by Matt Berg.

zone due to a lack of deeper water.

The lakes' shorelines are influenced by strongly fluctuating water levels that can vary by 4-6 vertical feet from year to year depending on regional and local precipitation patterns (Sather and Johannes 1972). Previous low water levels associated with a decade-long drought resulted in shoreline colonization by jack pine. In 2015, water levels were high with many seedling jack pine in several inches of standing water. While the transition from lake to upland is abrupt at Black Fox Lake, Inland Beach communities are found at the other lakes.



Dead jack pines on shoreline and in water illustrate fluctuating water levels at Deer Print Lake. Photo by Matt Berg.

Three discrete zones typify these beach communities: 1) the lower beach, frequently inundated and dominated by sedges and bluejoint grass, 2) the middle beach, damp with frequent seasonal fluctuations of water and dominated by annual grasses and sedges and other specialists, and 3) the upper beach, which is typically dry and dominated by prairie species, shrubs, and a mix of wetland species capable of thriving in seasonally dry sites (e.g., bluejoint grass, boneset, etc.).

The aquatic plant communities of these lakes have moderate diversity, most likely due to low fertility and, in some cases, as a result of extreme drought conditions in recent decades. Prominent aquatic plant groups include pondweeds (*Potamogeton* spp.), bladderworts, stoneworts (*Nitella* spp.), naiads (*Najas* spp.), watershield (*Brasenia schreberi*), and fragrant water-lily (*Nymphaea odorata*).

A number of conservative species (based on Coefficient of Conservatism; (Nichols 1999, Bernthal 2003) are present on these lakes, indicative of higher water quality and/or absence of disturbance. These include small bladderwort (*Utricularia minor*), three-way sedge (*Dulichium arundinaceum*), small waterwort (*Elatine minima*), seven-angle pipewort (*Eriocaulon aquaticum*), and Farwell's water-milfoil (*Myriophyllum farwellii*).

### **Significance of Site**

Protection of soft-water seepage lakes with undeveloped shorelines represents a major conservation opportunity in the Northwest Sands Ecological Landscape (WDNR 2015). Development pressure on lakes in this region is high because of their proximity to the Twin Cities. The lakes contain good-quality plant communities and have high water quality. A conservative stonewort (*Nitella furcata*) was also tentatively found at Jack Pine Lake (final identification pending collection of a voucher specimen).

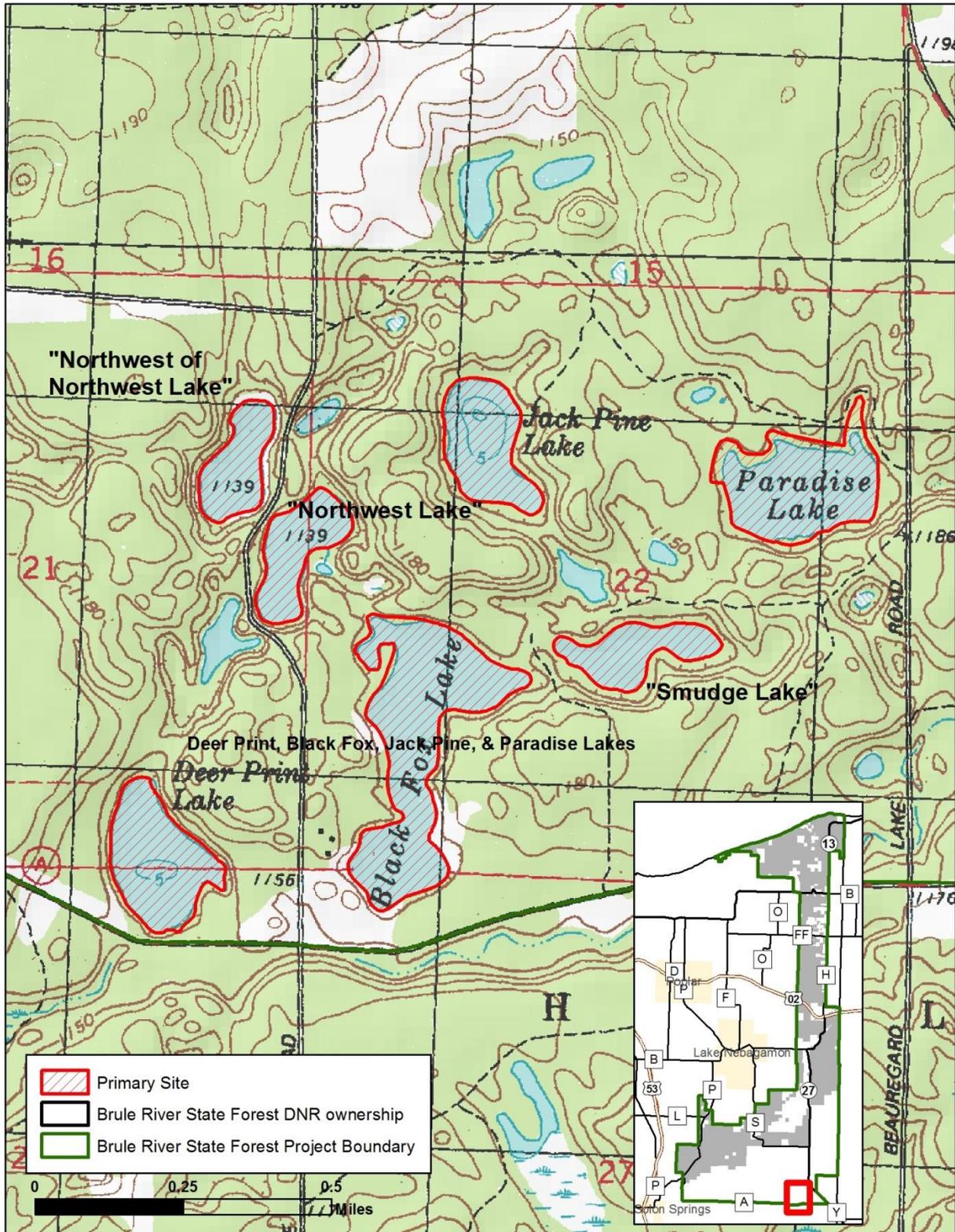
The shorelines of Deer Print Lake and, to a lesser extent Paradise Lake, harbor good examples of the Inland Beach community, which is limited to landscapes with deep sandy outwash where water levels periodically fluctuate. The Northwest Sands Ecological Landscape contains the highest opportunities in the state to conserve Inland Beach in the state (WDNR 2015). In addition, rare plants are known from these receding shorelines. Pine barrens adjacent to the lakes also support the a rare beetle ranked as globally vulnerable (G3, see Appendix F for detailed explanation of ranks).

The lakes also support nesting pied-billed grebes and sora, and shorebirds also likely utilize the Inland Beach habitats for resting and feeding during migration. This Primary Site also supported the highest densities of a rare frog on the BRRSF. This special concern species favors sedge meadow dominated by narrow-leaved woolly sedge areas at the lake edges.

Deer Print Lake and "Smudge Lake" were also identified as important conservation targets in The Nature Conservancy's Lake Conservation Portfolio (Blann and Wagner 2014).

### ***Management Considerations***

The most important management issue relating to these lakes and especially their Inland Beach communities is maintenance of hydrology within a range of variability that will sustain all of the associated native species and dynamic processes. Excessive groundwater withdrawals can have a negative impact on these lakes' hydrology. Sensitive beach areas should also be protected from clearing, livestock, heavy foot traffic, and vehicles, especially All-Terrain Vehicles, which can cause destruction of sensitive vegetation, including rare plants, and provide a vector for non-native invasive plants. One invasive, spotted knapweed, appears to be associated with boat launches and field roads at Deer Print and Paradise Lakes.



BRRSF03: Deer Print, Black Fox, Jack Pine, and Paradise Lakes Complex Primary Site.

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## BRRSF04. JERSETH CREEK AND SMITH-CHENEY-SHOBERG LAKES COMPLEX

### **Location**

Landtype Association: 212Ka. Upper Brule-St. Croix Valley and 212Ka. Bayfield Sand Barrens  
Approximate Size: 204 acres  
Ownership: WDNR (195 acres), Private (9 acres)

### **Description of Site**

Jerseth Creek is a mile-long tributary of the Bois Brule situated in an old glacial outwash channel south of Stone Chimney Cedar Swamp (see primary site BRRSF08). A narrow corridor of speckled alder (*Alnus incana* spp. *rugosa*) and large swamp conifers borders the stream. The sandy slopes above the creek support dry stands of pine and oak, some with a semi-open structure and populations of native prairie/barrens plants. One small, older stand of large, natural-origin red pine occurs just above the headwaters spring for Jerseth Creek.

Smith, Shoberg, and Cheney Lakes are soft-water seepage lakes characterized by fluctuating water levels, good-quality aquatic communities, and good examples of the Inland Beach natural community that are comparable to those described for the previous primary site. Several of the shorelines have historic records of rare plants associated with fluctuating water levels. All lakes are within the Brule River State Forest Project Boundary.

The aquatic plant communities of these lakes have moderate diversity, most likely due to low fertility and, in some cases, as a result of extreme drought conditions in recent decades. Emergent plants are one of the dominant aquatic plant forms, including common spike-rush (*Eleocharis palustris*), water bulrush (*Schoenoplectus subterminalis*), narrow-leaved woolly sedge, three-way sedge, and bluejoint grass. A seven-acre lobe on the southeastern portion of Cheney Lake also harbors a Northern Sedge Meadow. The submergent community is somewhat depauperate in these lakes, with the most common species being slender pondweed (*Potamogeton pusillus*) and common bladderwort (*Utricularia vulgaris*), a submergent species associated with acidic conditions and decaying vegetation. The presence of decomposing organic matter in all four lakes is also suggested by scattered patches of three floating-leaved species that favor such conditions, including water-shield, bull-head pond-lily (*Nuphar variegata*) and fragrant water-lily. A number of conservative species (based on Coefficient of Conservatism (Nichols 1999, Bernthal 2003) are present on these lakes, indicative of higher water quality and/or absence of disturbance. These include small bladderwort, three-way sedge, seven-angle pipewort, Oakes' pondweed (*Potamogeton oakesianus*, special concern), water bulrush, and dwarf water-milfoil (*Myriophyllum tenellum*).

### **Significance of Site**

The diversity of aquatic invertebrates in the stream is high and includes a rare beetle as well as a rare midge only known from four counties east of the Colorado River, all in Wisconsin. Both species are known from cold water, spring fed streams. In addition, several special concern rare birds associated with jack pine stands and barrens are known from the vicinity, including one area-sensitive species, illustrating the importance of the surrounding landscape to wildlife requiring large open barrens habitat.



A frog observed at Smith and Shoberg Lakes during spring 2015 surveys. Photo by Matt Berg.

Cheney Lake harbors a good example of an Inland Beach community, which is limited to landscapes with deep sandy outwash where water levels periodically fluctuate.

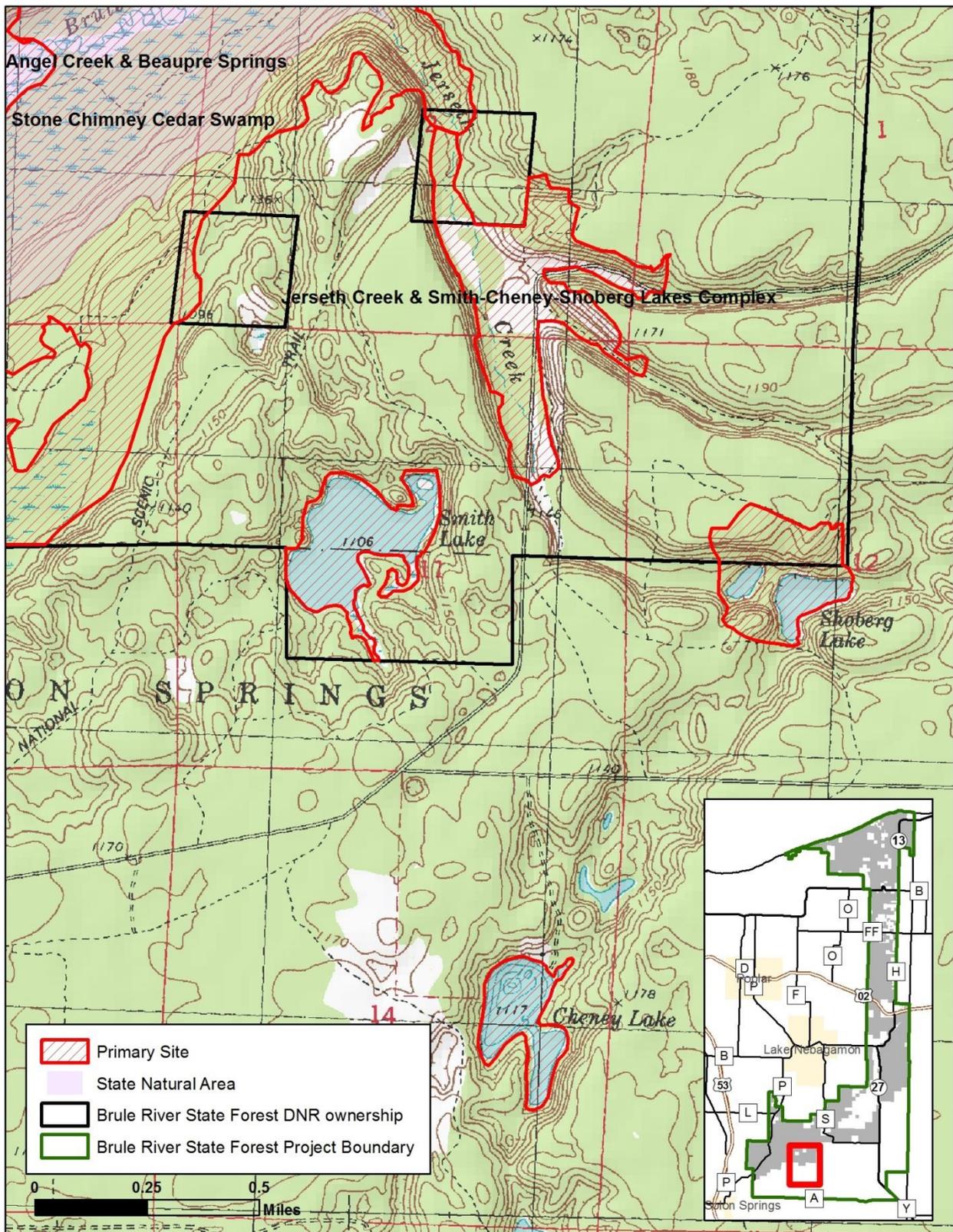
The Northwest Sands Ecological Landscape contains the highest opportunities in the state to conserve Inland Beach (WDNR 2015). In addition, a rare plant of marshes is known from Smith Lake. Historical occurrences (observed in the 1930s) of a second rare plant of sandy shorelines are also known from several lakes in the Primary Site. The site is also important for wildlife. Migrating shorebirds may rest and feed in beach habitats, while Smith Lake provides important nesting and foraging habitat for waterfowl. Extensive beds of emergent vegetation provide excellent fish and frog habitat, including a special concern species of sedge meadows dominated by narrow-leaved woolly sedge. A special concern aquatic invertebrate is also known from Smith Lake.

### **Management Considerations**

Due to its strategic location in the central portion of the Northwest Sands, this site has the potential to play an important role in increasing the size and landscape connectivity of adjacent barrens and tracts of dry forest. In particular, this site is located in an area identified in the Northwest Sands Corridor Plan as an important habitat corridor between other adjacent, large barrens complexes such as Douglas County Wildlife Area, the Bayfield Rolling Barrens, and Moquah Barrens (Reetz et al. 2012).

Small-scale opportunities to manage for Pine Barrens occur on south and west-facing slopes above the creek and its tributary valleys. Shoberg Lake and an adjacent small, unnamed seepage lake, occur at the head of the same ravine containing the headwaters of Jerseth Creek. Most of the lake acreage is just outside of the present forest boundary and it may be advisable to contact the owners regarding their interest in protection and management of these waterbodies. Water in these lakes was noted to be “very turbid” by investigators in 1996 (WDNR 1999), though no water quality issues were noted in 2015 surveys.

The most important management issue relating to the lakes and especially their Inland Beach communities is maintenance of hydrology within a range of variability that will sustain all of the associated native species and dynamic processes. Excessive groundwater withdrawals can have a negative impact on these lakes’ hydrology. Sensitive beach areas should also be monitored periodically for damage by illegal use from ATV and other vehicles, which can cause destruction of sensitive vegetation and provide a vector for non-native invasive plants. One non-native invasive plant, spotted knapweed, was found in small numbers at Cheney Lake on the beach. In addition, two other non-native invasives, reed canary grass and common forget-me-not (*Myosotis scorpioides*) were observed downstream in Jerseth Creek, just north of the Primary Site, and are likely present upstream in the creek as well.



**BRRSF04. Jerse Creek and Smith-Cheney-Shoberg Lake Complex Primary Site.**

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# BRRSF05. NORTH COUNTRY TRAIL BARRENS AND MOTT'S RAVINE SNA

## **Location**

Landtype Association: 212Ka. Upper Brule-St. Croix Valley and 212Ka. Bayfield Sand Barrens  
Approximate Size: 2857 acres  
Ownership: WDNR (1721 acres), Private (1136 acres)

## **Description of Site**

Lying just southeast of the Brule Spillway, this site is comprised of a high-elevation sand terrace and ravine, a small glacial outwash channel leading down to the spillway. The site includes Mott's Ravine SNA as well as adjacent areas with similar habitat.

Mott's Ravine SNA lies on an old glacial outwash channel and contains the full range of vegetation expected on glacial outwash: natural jack pine forest, scrubby northern pin and bur oak thickets, and small Pine Barrens remnants. Jack pine is the dominant tree, sometimes interspersed with gnarly northern pin or bur oaks. Shrubs include hazelnut, prairie willow (*Salix humilis*), and sand cherry (*Prunus pumila*). Low shrubs and herbs include bracken fern (*Pteridium aquilinum*), Pennsylvania sedge (*Carex pensylvanica*), Canada mayflower (*Maianthemum canadense*), wintergreen (*Gaultheria procumbens*), early low blueberry (*Vaccinium angustifolium*), and narrow-leaved cow wheat (*Melampyrum lineare*). Some areas contain dense stands of jack pine with nearly 100% canopy cover. Areas with more open canopy support barrens and prairie species such as big bluestem (*Andropogon gerardii*), prairie brome (*Bromus kalmii*), bearberry (*Arctostaphylos uva-ursi*), three-toothed cinquefoil (*Sibbaldiopsis tridentata*), sweet-fern (*Comptonia peregrina*), asters, blazing star (*Liatris* sp.), bird's-foot violet (*Viola pedata*), pussy-toes (*Antennaria* sp.), false-dandelion (*Krigia biflora*), puccoon (*Lithospermum* sp.), and wood lily (*Lilium philadelphicum*). Several uncommon barrens animals are also present.

Areas adjacent to Mott's Ravine SNA include a similar range of habitats from open barrens to scrub oak to jack pine forest. The primary site includes areas managed using prescribed fire as well as timber harvesting.

## **Significance of Site**

Historically, the vegetation of much of the area in the Bayfield Sand Barrens south of the Brule Spillway was Pine Barrens and pine-oak scrub with scattered patches of dry forest. Today, these community types are rare and declining throughout the western Great Lakes making their presence here very significant. Several rare or uncommon species often associated with barrens habitats were documented at this site, including a state threatened bird, three special concern birds and one special concern herptile. Least chipmunk, a barrens and lakeshore species, was also found at this site. It is a species with information needs because of suspected range contraction, possibly due to climate change. For all of these species, this site represents the best habitat identified on the Brule River State Forest. In addition, a forest-associated special concern songbird is also known from this site. This site also harbors a significant diversity of lichens, including the only known location in the state for two species, rim lichen (*Lecanora minutilla*) and dot lichen (*Micarea melanobola*) and the second known location for a third species, a *Rimularia* lichen (*Rimularia caeca*) (Wetmore 2010).

This site is particularly important in light of the management direction on nearby non-state-owned lands, especially parcels managed for timber production with minimal open habitat. The Northwest Sands Ecological Landscape is one of only three Ecological Landscapes in the state with major conservation

opportunities for pine barrens, and this site and the larger landscape that continues to the south is one of the best barrens management opportunities in this part of the Northwest Sands (WDNR 2015). The Primary Site is part of the larger Douglas and Bayfield County Barrens Conservation Opportunity Area (COA), a COA of global significance identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) - Implementation Plan (WDNR 2008).

### **Management Considerations**

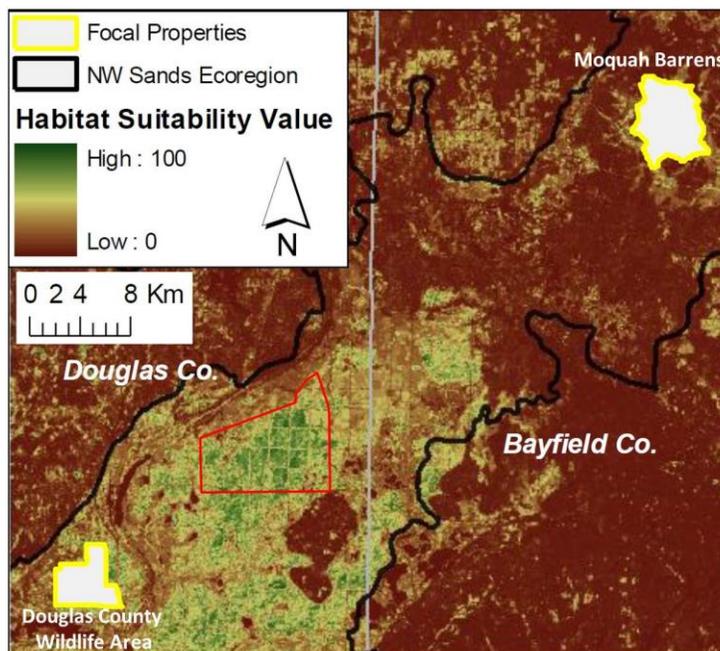
Due to its strategic location in the central portion of the Northwest Sands, this site has the potential to play an important role in increasing the size and landscape connectivity of adjacent barrens and tracts of dry forest. This area has been identified in the Northwest Sands Corridor Plan as an important habitat corridor for sharp-tailed grouse and other barrens species between other adjacent, large barrens complexes such as Douglas County Wildlife Area, the Bayfield Rolling Barrens, and Moquah Barrens (Reetz et al. 2012).

In addition, this site is located in the Douglas and Bayfield County Barrens COA. Given the statewide rarity of open barrens, the high quality nature of the barrens here, and importance in multiple conservation plans, a strong emphasis on barrens and dry forest maintenance and restoration is warranted at this site. It is important to manage for the full spectrum of barrens, including mature forest stands, as outlined in the Northwest Sands Integrated Ecosystem Management Plan, as cited in the Wisconsin Wildlife Action Plan (WAP) - Implementation Plan (WDNR 2008).

This Primary Site and the surrounding landscape is an ideal candidate for this type of planning. The Northwest Sands Corridor Plan and the Northwest Sands Integrated Ecosystem Management Plan includes identification and management of early successional core barrens areas, such as those that occur at Mott's Ravine SNA.

The WAP Implementation Plan also notes the importance of integrating planning efforts across federal, state, county, local and industrial ownership boundaries. In particular, the adjoining Brule-St. Croix Legacy Forest easement lands and Cedar Island Conservancy property both present excellent opportunities to coordinate management across property boundaries, with the joint goal of enhancing and maintaining a shifting landscape mosaic of jack pine forest/barrens representing the full spectrum of age classes and structures.

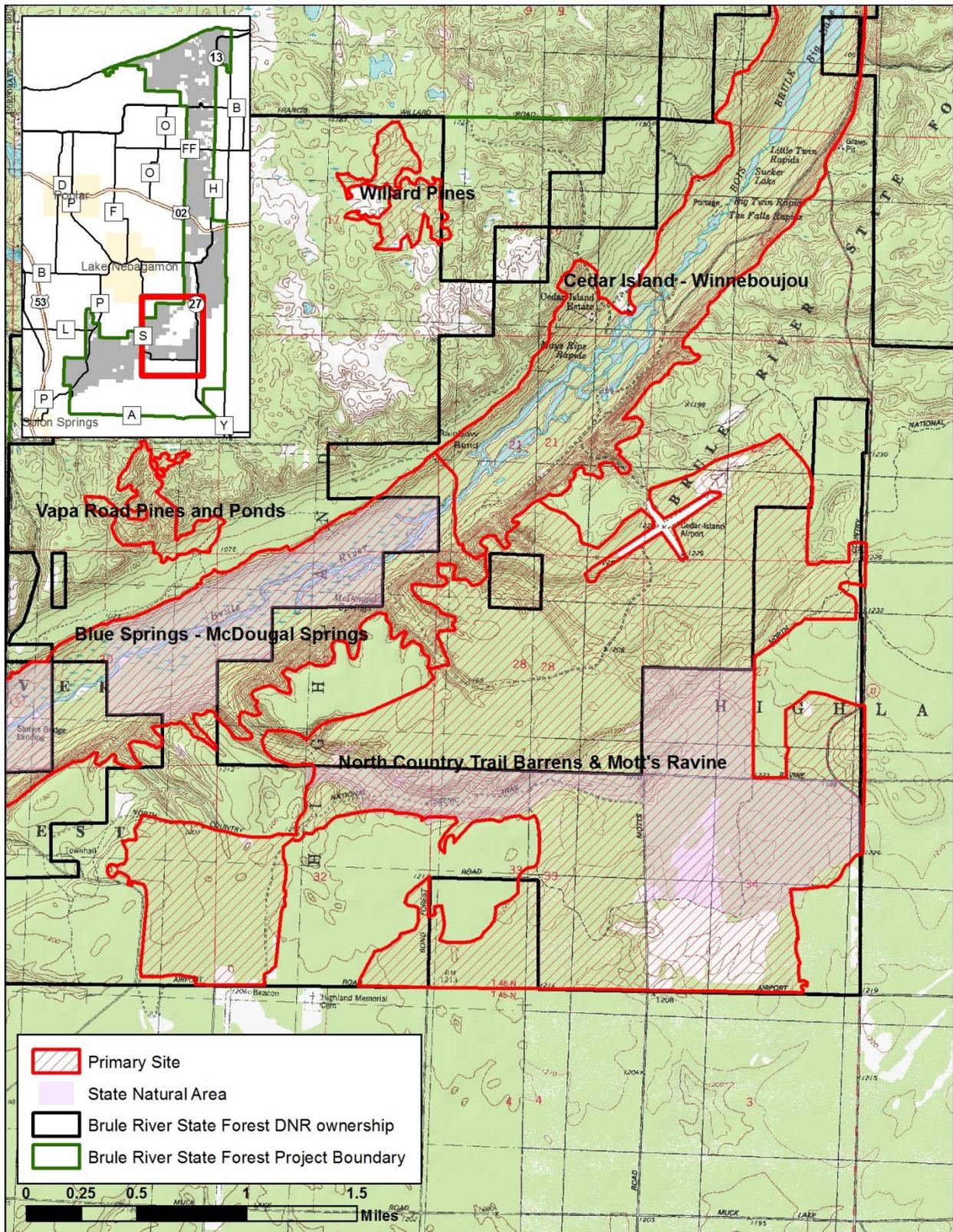
It is important to recognize that forests and barrens were dynamic in time and space as well as relative patch sizes across the regional landscape, ranging from mostly open to savanna-like forests embedded in a



Habitat suitability of corridors for sharp-tailed grouse and other barrens species between large habitat blocks at Douglas County Wildlife Area and Moquah Barrens. Approximate area outlined in red for several Primary Sites on the BRRSF including North Country Trail Barrens, Jerseeth Creek and Lakes Complex, and Deer Print Lakes Complex. Modified from Reetz et al. 2012.

larger landscape matrix of pine forests (Public Land Survey data; Radeloff et al. 1999). This natural variability was historically maintained by disturbances such as fire and infrequent catastrophic windstorms. Management that mimics or creates natural variability will maximize benefits across the landscape. This could include: 1) conducting prescribed burns with very large burn units, allowing fire to consume available fuel in a patchwork fashion as would have occurred historically; or 2) establishing rotational management units that follow ecological boundaries such as ravines or waterbodies. Ideally, these management units and rotations will be of sufficient size to provide habitat for various species, including those that need large open areas (e.g., sharp-tailed grouse), as well as those that need blocks of mature to over-mature forests (e.g., Connecticut warbler).

Managers may also find the "WDNR Barrens State Natural Area Management Guide" a helpful resource for establishing a management plan for this site (WDNR 2011).



**BRRSF05: North Country Trail Barrens and Mott's Ravine SNA Primary Site.**

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## BRRSF06. DIVIDE SWAMP

### **Location**

Landtype Association:	212Ka. Upper Brule-St. Croix Valley
Approximate Size:	1030 acres
Approximate Ownership:	WDNR (966 acres), Private (64 acres)

### **Description of Site**

This site, which straddles a drainage divide and contains the headwaters of both the Bois Brule and St. Croix Rivers, contains a diversity of wetlands including Northern Wet-mesic Forest of mature northern white-cedar (*Thuja occidentalis*), Northern Tamarack Swamp with black spruce (*Picea mariana*) and tamarack (*Larix laricina*), Hardwood Swamp dominated by black ash (*Fraxinus nigra*), Alder Thicket, and Springs and Spring Runs. The site is mostly contained within the much larger Brule Glacial Spillway SNA and is bisected by County Highway P and the North Country Trail.

A high-quality Northern Wet-mesic Forest forms the core of the swamp. White-cedar dominates the canopy with trees averaging 10-12 inches in diameter at breast height (dbh) with scattered individuals up to 20-24 inches dbh. Balsam fir (*Abies balsamea*), black ash and black spruce are also present. The shrub layer includes Labrador-tea (*Rhododendron groenlandicum*), American fly honeysuckle (*Lonicera canadensis*), and snowberry (*Symphoricarpos albus*). The herb layer comprises multiple sedges, especially slender sedge (*Carex leptalea*) and green bog sedge (*C. brunnescens*), as well as Canada mayflower and three-leaf Solomon's-seal (*Maianthemum trifolium*), while mosses are abundant with over 90% cover. Several rare plants were also observed here, including one found nowhere else on the BRRSF. Past logging is minimal, with the exception of one area just south of County Highway P in which a series of fenced plots was experimentally cut in in 1980, 35 years ago. Unfortunately, cedar regeneration failed due to rabbit browsing, and the area converted to black spruce, tamarack, and alder (Forest Recon, stand examined in 2011; C. Matula, pers. com.).

Bordering the Northern Wet-mesic Forest to the south and west is a Hardwood Swamp dominated by black ash 9-15 inches dbh, with occasional trees over 15 inches. The surface is hummocky, with numerous spring runs and pools. Canopy associates include balsam fir and white-cedar. Tall shrubs are prevalent, especially speckled alder, mountain maple (*Acer spicatum*), and alder-leaved buckthorn (*Rhamnus alnifolia*). Characteristic herbs include lady fern (*Athyrium filix-femina*), bluejoint grass, marsh marigold (*Caltha palustris*), fowl manna grass (*Glyceria striata*), sensitive fern (*Onoclea sensibilis*), and cinnamon fern (*Osmunda cinnamomea*).

Toward the southwest portion of the site, a Northern Tamarack Swamp occurs, dominated by a mature canopy of 5- to 11-inch dbh tamarack. Other tree species are occasional but account for relatively little cover, including black spruce, white-cedar, and balsam fir. Saplings are mostly black ash, with occasional fir. Tall shrubs are abundant and include speckled alder, winterberry (*Ilex verticillata*), and high-bush cranberry (*Viburnum trilobum*). Characteristic herbs include cinnamon fern, royal fern (*Osmunda regalis*), crested shield fern (*Dryopteris cristata*), marsh marigold, and many sedges as well as a dense layer of mosses.

### **Significance of Site**

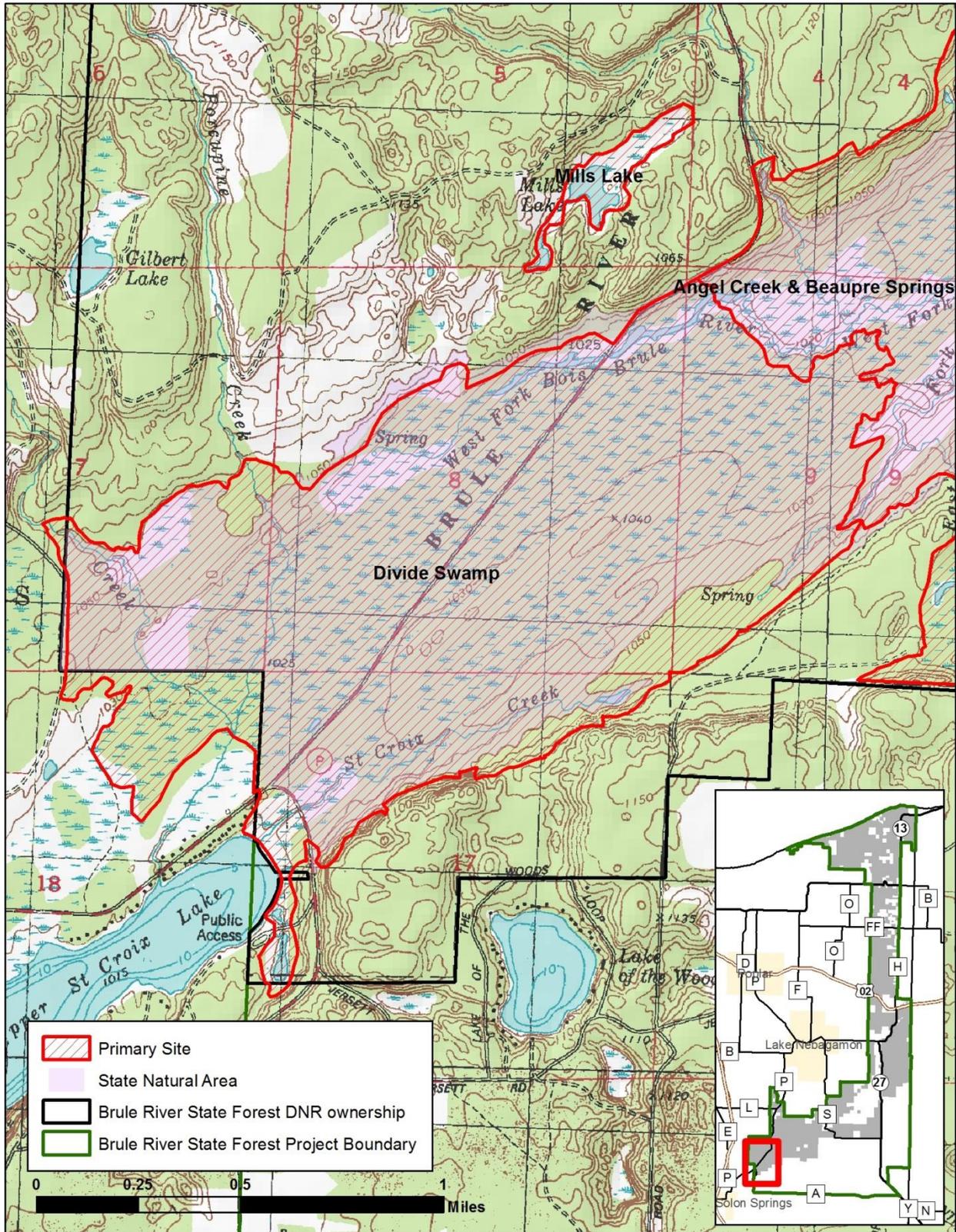
This site is part of the Brule Spillway SNA and is located within the Blueberry Swamp COA, a conservation opportunity of statewide significance identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) Implementation Plan (WDNR 2008). As noted above, the site is the headwaters of both the Brule River and the St. Croix River. The importance of the site to these two flagship river systems cannot be overstated.

Numerous rare species are also known from this site, including one state endangered plant and two special concern plants found in marshes and cedar swamps. For all three of these rare plants, this site is their only known location on the BRRSF. A special concern dragonfly associated with wetlands is also known from this site.

### **Management Considerations**

Because this site contains the headwaters of two of Wisconsin's most important rivers it merits strong continued protection. Maintaining intact hydrology is essential for both wetland and riparian systems, including minimizing erosion and sedimentation along roads and trails. The site is crossed by a county highway and the adjacent upland forests are managed for aspen and plantation-grown pine. Where logging occurs in adjacent uplands, care should be taken to follow or exceed forestry BMPs around wetland edges where streams, springs, seeps, and pools are nearby.

Numerous invasive species were reported along County Highway P in a 2006 survey (Lake Superior Research Institute (LSRI), unpublished data), including several wetland species such as purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), and reed canary grass, as well as upland species such as garden valerian (*Valeriana officinalis*), common tansy (*Tanacetum vulgare*), bull thistle (*Cirsium vulgare*), Canada thistle (*C. arvense*), spotted knapweed, and common St. John's-wort (*Hypericum perforatum*). In addition, goutweed (*Aegopodium podagraria*) was reported from the DNR boat launch on Upper St. Croix Lake off County Highway A.



**BRRSF06: Divide Swamp Primary Site.**

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## BRRSF07. ANGEL CREEK AND BEAUPRE SPRINGS

### *Location*

Landtype Association:	212Ka14 Upper Brule-St. Croix Valley and 212Ka06 Bayfield Level Barrens
Approximate Size:	654 acres
Approximate Ownership:	WDNR

### *Description of Site*

Angel Springs and its outlet, Angel Creek, feed the upper reaches of the Bois Brule River and flow through a floristically rich conifer swamp that gives way to an alder thicket close to the river. Beaupre Springs is a series of soft water Springs and Spring Runs that form the East Fork of the Brule River. Both Angel Creek and Beaupre Springs support a notably large number of rare invertebrates. The site is contiguous with other highly significant natural features both upstream and downstream, and the majority of the site (with the exception of Beaupre Springs) is encompassed in the Brule Glacial Spillway SNA.

Angel Creek originates in a spring pond on the north side of the river. While the outlet of the pond was bermed many decades ago, the creek still flows from the base of the berm through a high-quality Northern Wet-mesic Forest toward the Brule River. The forest is a moderate-sized (approximately 170-acre) white-cedar swamp, the majority of which is located on the north side of the Brule River. White-cedar averages 10 inches dbh (with a maximum of 24 inches or more), and provides 50-80% canopy cover with contributions from black spruce and sub-canopy balsam fir. Most of the regenerating trees are black ash saplings. Additional springs and forest seeps are scattered along the north edge on the north side of the river, keeping the peat saturated and forming pockets of clear, cold standing water. Dense carpets of moss cover up to 90% of the forest floor. The shrub layer is thick in places, dominated by pussy willow (*Salix discolor*), mountain maple and speckled alder. The herb layer is dominated by dwarf red raspberry (*Rubus pubescens*), wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower, three-leaf Solomon's-seal, blue-bead-lily (*Clintonia borealis*), goldthread (*Coptis trifoliata*), slender sedge, two-seeded bog sedge (*Carex disperma*) and hairy woodrush (*Luzula acuminata*). Deer browsing is apparent on red-osier dogwood (*Cornus sericea*) and there is very little cedar regeneration.

Beaupre Springs is a series of soft water Springs and Spring Runs and associated low seeps in an open sedge meadow complex that form the headwaters of the East Fork of Brule River. The area was formerly part of a beaver pond complex, but was breached as part of a restoration project over the course of 2012-2014. Scattered tamarack stumps, logs, and rarely, snags are evident around springs, a remnant of a patchy forest occupying the area prior to beaver occupation. Vegetation around the springs is distinctly zonal and sharply demarcated from an adjacent sedge meadow. Characteristic species include soft rush (*Juncus effusus*), Canadian rush (*J. canadensis*), narrow-panicle rush (*Juncus brevicaudatus*), bottlebrush sedge (*Carex hystericina*), Bebb's oval sedge (*C. bebbii*), common spike-rush, soft-stem bulrush (*Schoenoplectus tabernaemontani*), and false water-pepper (*Polygonum hydropiperoides*). Characteristic species in springs includes round-leaved monkey-flower (*Mimulus glabratus*), American speedwell (*Veronica beccabunga* var. *americana*), and paniced bulrush (*Scirpus microcarpus*). Wildlife observed includes swamp sparrow, song sparrow, common yellowthroat, sedge wren, and river otter.

### **Significance of Site**

The site is contiguous with other highly significant natural features both upstream and downstream, and the majority of the site (with the exception of Beaupre Springs) is encompassed in the Brule Glacial Spillway SNA. The site is also located within the Blueberry Swamp COA, a conservation opportunity of statewide significance identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) - Implementation Plan (WDNR 2008).

Angel Creek and Beaupre Springs were also identified as important conservation targets in The Nature Conservancy's Lake Conservation Portfolio (Blann and Wagner 2014).

Angel Creek, the East Fork of the Brule, and Beaupre Springs support several uncommon invertebrates, including aquatic beetles, dragonflies, and damselflies associated with cold water streams and springs. A total of twenty-four (24) aquatic invertebrate taxa were collected here in the mid- to late 1990s (WDNR 1999).

As the headwaters of the East Fork of the Brule River, Beaupre Springs is also highly significant to the hydrology and temperature of the river, as evidenced by the recent restoration efforts undertaken by the Brule River Sportsman Club.

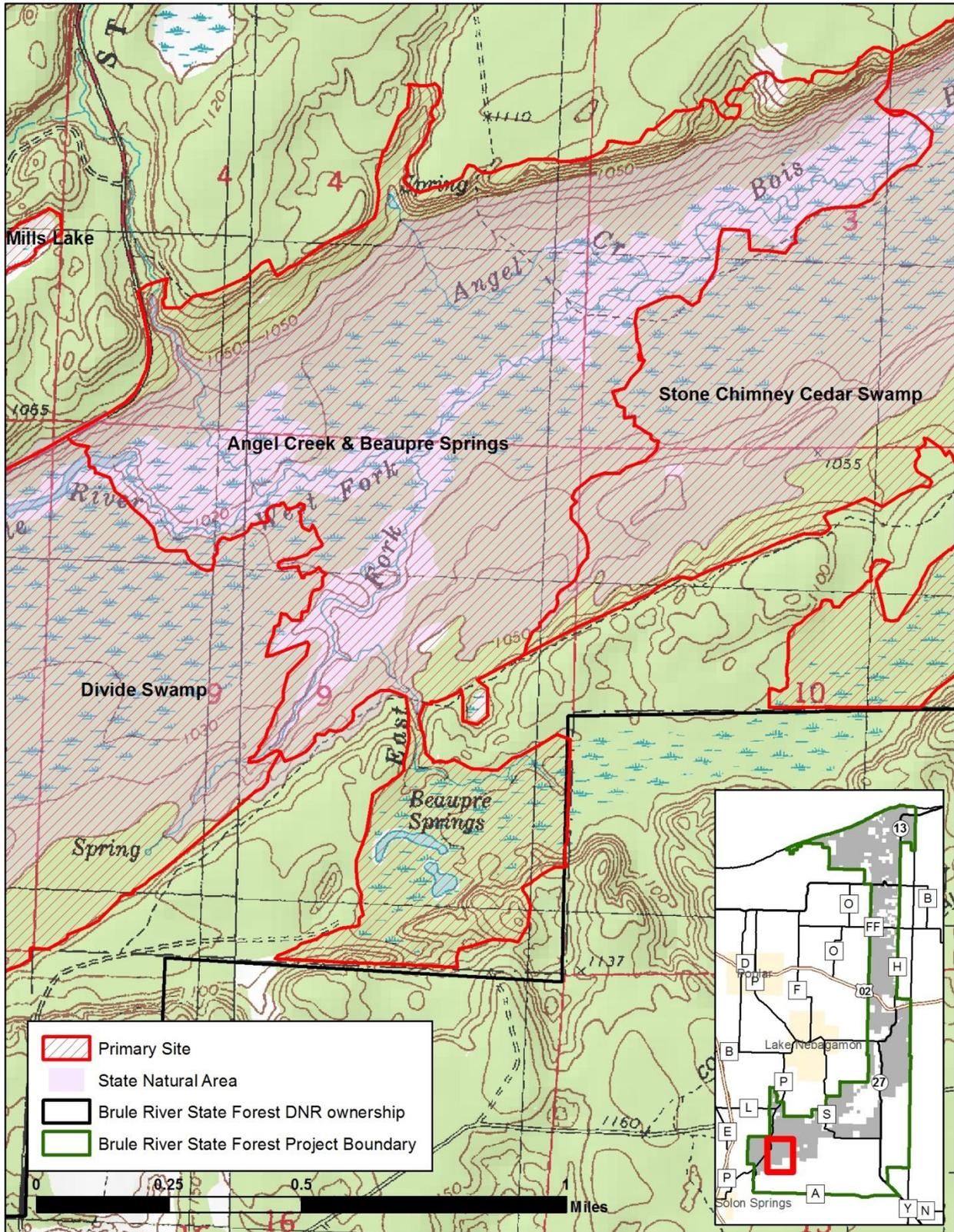
### **Management Considerations**

Continued protection of the hydrology is paramount to the site. County Highway P runs along the northwest corner of the site, and the adjacent upland forests are managed for aspen and plantation-grown pine. Where logging occurs in adjacent uplands, care should be taken to follow or exceed forestry BMPs around wetland edges where streams, springs, seeps, and pools are nearby. Passive management of the cedar swamps and other wetland conifers is also essential for their conservation.

Lack of regeneration of white-cedar remains an issue due in part to browse pressure, though small pockets of regeneration through layering may be present where small blowdowns occur. Adjacent slopes of the Brule Spillway on the north edge of the site are beginning to develop old forest characteristics in places, and could be considered as an Ecological Reference Area. Currently, the SNA boundary extends only partway up the slope. Expanding the boundary to the top of the slope would also serve to protect the hydrology of the springs and seeps, limit downslope erosion, and serve as an ecological buffer to the wetland complex in the Spillway.

The invasive species garden valerian and orange hawkweed are scattered along the upland edge of the site on the north side of the river. In the south side of the site, garden valerian is also present along a two-track road north of Rifle Range Road, as well as in a small logged opening. This species is not yet widespread in the Spillway wetlands and should be priority for control. The aquatic non-native species common forget-me-not and watercress (*Nasturtium officinale*) are also present along the Brule River, and one small colony of purple loosestrife was noted in 2006 with heavy beetle damage (LSRI, unpublished data).

Small colonies of reed canary grass and Canada thistle were noted in the Beaupre Springs area, usually near old beaver dams or on recently dewatered margins of the site. The site should be a priority for early detection and rapid response for these and other non-native invasive species, especially as the site is vulnerable to takeover where native species have not yet fully colonized the newly exposed habitat.



**BRRSF07: Angel Creek and Beaupre Springs Primary Site.**

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## BRRSF08. STONE CHIMNEY CEDAR SWAMP

### Location

Landtype Association:	212Ka14 Upper Brule-St. Croix Valley and 212Ka06 Bayfield Level Barrens
Approximate Size:	1257 acres
Approximate Ownership:	WDNR (1241 acres), Private (16 acres)

### Description of Site

Situated in the heart of the Brule Glacial Spillway SNA, Stone Chimney Cedar Swamp features one of the largest and highest quality cedar swamps in the state in conjunction with sites upstream and down. Alder Thickets and small patches of sedge meadow also occur along the Brule River, and numerous springs and seepages occur along this stretch of the river. The steep south-facing upland slopes adjoining the north side of the river corridor support Northern Dry-mesic Forest of relict red pine and white pine (*Pinus strobus*) and scattered white spruce (*Picea glauca*), while the north-facing slopes on the south side of the river have a higher proportion of Boreal Forest species. Big-tooth and trembling aspen (*Populus grandidentata*, *P. tremuloides*), paper birch (*Betula papyrifera*), red oak (*Quercus rubra*), and balsam fir also occur in the uplands. The North Country Trail bisects the southern portion of the site, which also includes the mouth of Jerseth Creek.

The Northern Wet-mesic Forests here are very high quality, with a closed to partially open canopy of white-cedar (average 10-12 inches dbh, up to 24 inches) and balsam fir over a heavy cover of mosses. The shrub layer includes Labrador-tea, American fly honeysuckle and speckled alder. Dominant herbaceous species include naked miterwort (*Mitella nuda*), Canada mayflower, three-leaf Solomon's-seal, blue-bead-lily, and starflower (*Trientalis borealis*). Several orchids, including a state threatened species, are also known from this site.

An extensive Alder Thicket occurs along the river and stretches for over 5 miles as the crow flies (approximately 15 river miles) along upper reaches of the Brule, spanning this site as well as Angel Creek and Blue Spring – McDougal Springs Primary Sites. Ranging in width from 30 yards to 300 yards, it is dominated by 6- to 10-foot-tall speckled alder. Numerous springs add diversity and hydrologic integrity. A good diversity of other shrubs are also present, along with tussock sedge (*Carex stricta*), bluejoint grass, and a variety of other species in the groundlayer. The Alder Thicket appears to be a stable community that has been self-perpetuating for over 200 years, as it was noted by explorers in the early 1800s (Bardon and Nute 1948).

The slopes of the Brule Glacial Spillway and occasional terraces support mixed quality Northern Dry-mesic Forest on southeast-facing slopes north of the river and what is best characterized as Boreal Forest on northwest-facing slopes south of the river. These slopes are moderate to steep (30-50% slope) and rise 100 vertical feet from the cedar swamp below. Quality is variable but includes scattered supercanopy red pine (avg 18-24 inches dbh, up to 32 inches), occasional white spruce (14-22 inches dbh, up to 36 inches) and sparse white pine (up to 48 inches dbh). On the south side of the river, pines are especially characteristic of ridgetops, while white spruce and large aspen dominate the ravines. Beneath the supercanopy trees, big-tooth aspen, trembling aspen, white spruce and balsam fir are common, with a subcanopy of balsam fir, red maple (*Acer rubrum*), and red oak. The groundlayer is variable, with south-facing slopes supporting species such as large-leaved aster (*Eurybia macrophylla*), bracken fern, and Pennsylvania sedge, and north-facing slopes having a high proportion of boreal indicators (Curtis 1959)

such as bunchberry (*Cornus canadensis*), blue-bead-lily, rose twisted-stalk (*Streptopus lanceolatus*), Canada mayflower and starflower.

### **Significance of Site**

This site lies in the heart of the Brule Glacial Spillway SNA and together with adjacent Primary Sites contains one of the largest and highest quality cedar swamps in the state. The site is also located within the Blueberry Swamp COA, a conservation opportunity of statewide significance identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) - Implementation Plan (WDNR 2008).

This site also represents the largest and possibly most viable population in the state for a state endangered plant as well as a special concern orchid. A state threatened orchid is also known from the site. The area also supports one of the only known nesting territories for a special concern hawk on the State Forest. Historically, a state threatened bird of forested wetlands was known to occur here too, but has not been observed in over 25 years. This site also includes one of the few known breeding areas on the State Forest for a small special concern songbird. Bryophyte diversity is also very high (67 taxa were collected in one day in the mid-1990s, including 53 mosses and 14 liverworts). This site also harbors significant lichen diversity, including one species, Elizabeth's pelt lichen (*Peltigera elisabethae*) found for the first time ever in Wisconsin in 2009 (and also found at several other locations on the BRRSF), as well as rimmed shingle lichen (*Fuscopannaria leucosticta*), known from only one other location in the state (Wetmore 2010).

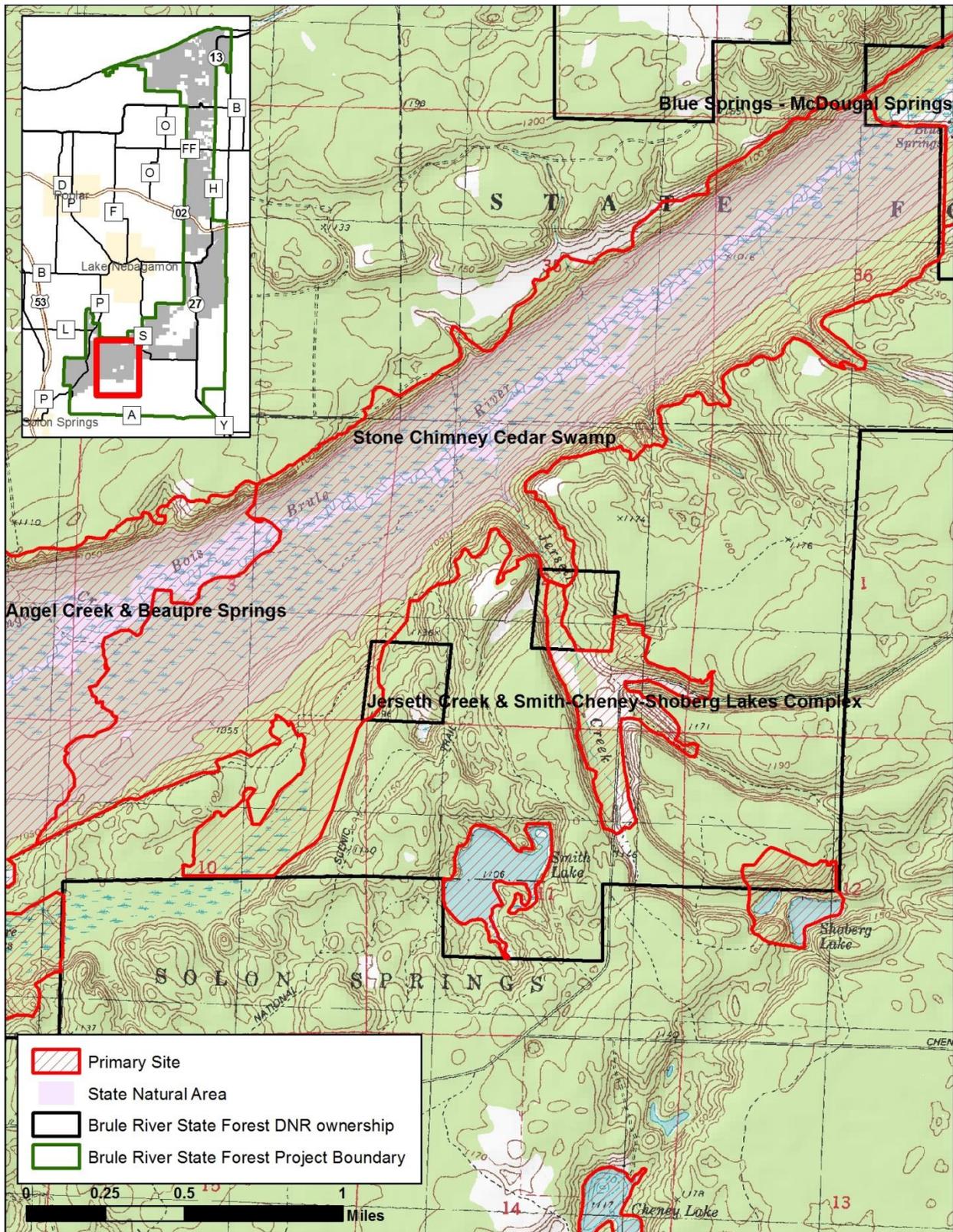
The wetlands are extensive and of excellent quality, while the uplands contain relict natural-origin red pine and white pine of fantastic sizes, along with moderate-sized white spruce. Large blocks of forests with trees of this size are rare throughout the state. In addition, both wetland and upland communities are juxtaposed in the exceptional geologic and ecological feature of the Brule Spillway. The northerly location of the spillway, local cold air sink, and presence of numerous cold water springs and seeps may make the site resistant to long-term environmental change, including climate change, potentially making it one of the best places in the state to conserve these communities and the rare species they support.

### **Management Considerations**

The exemplary complex of wetlands, Spillway slopes/ravines, and relict pine-clad terraces can serve as an Ecological Reference Area. Currently, the SNA boundary extends partway up the Spillway slope. Expanding the boundary to the top of the slope could be considered and would also serve to protect the hydrology of springs and seeps, limit downslope erosion, limit the spread of invasive species, and serve as an ecological buffer to the wetland complex in the Spillway.

Terraces adjacent to the primary site are predominantly managed aspen stands and red pine plantations. Aspen management typically involves coppicing with reserves, leaving scattered individuals of legacy pine and spruce. The juxtaposition of these stands next to the Spillway creates a hard edge and leaves the upper portion of the Spillway slope vulnerable to windthrow. In addition, legacy conifers, while more wind firm than deciduous softwoods, become vulnerable when isolated. Thought should be given to the desired future condition of both the terraces and slopes adjacent to the Spillway, striving to strike a balance between protection of the Ecological Reference Area, restoration of uncommon habitats like Northern Dry-mesic Forest and Boreal Forest, promoting wildlife habitat, and providing sustainable forest products. This is especially true for current red pine plantations approaching rotation age. A useful management question to ask might be: do opportunities exist to increase the diversity of age structure (including old trees), create a more complex forest with a multi-structured canopy, and increase tree species diversity through the gradual conversion of red pine plantations to more diverse forests?

The invasive species garden valerian is scattered along the edges of the Spillway slope and swamp as well as along portions of the North Country Trail near Jerseth Creek. Reed canary grass is also present in isolated patches along the NCT and upper reaches of Jerseth Creek. These species are not yet widespread in the Spillway wetlands and should be priorities for control. In addition, boot brushes should be installed at North Country Trail access points to reduce incidental introductions. Common buckthorn (*Rhamnus cathartica*) is rare in adjacent uplands on the north side of the river and should also be a priority for control. The aquatic non-native species common forget-me-not is also present along the Brule River and Jerseth Creek.



**BRRSF08: Stone Chimney Cedar Swamp Primary Site.**

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## BRRSF09. BLUE SPRINGS – MCDOUGAL SPRINGS

### **Location**

Landtype Association:	212Ka14 Upper Brule-St. Croix Valley
Approximate Size:	946 acres
Approximate Ownership:	WDNR (485 acres), Private (461 acres)

### **Description of Site**

Located in the northern portion of the Brule Spillway, this site contains high-quality Northern Wet-mesic Forest and large, undisturbed Spring Ponds. Crossed by one of the few roads over the upper Bois Brule at Stone's Bridge, this stretch of the river also demonstrates a marked change in the character of the stream with respect to substrate, gradient, and channel meanders, as the river transitions from meandering through Alder Thickets to flatter water bordered directly by cedar swamp.

The cedar swamp is dominated by large white-cedar (average 10 inches dbh, up to 24 inches) with mature black spruce and tamarack also common. Balsam fir is common in the subcanopy along with shrubs such as beaked hazelnut (*Corylus cornuta*), red-osier dogwood, mountain maple, speckled alder and black ash. Canada yew (*Taxus canadensis*) is occasional, though all stems were small with heavy browsing damage evident. Characteristic herbaceous species include naked miterwort, starflower, Canada mayflower and goldthread embedded in a thick layer of moss. A number of rare plants are also known from the site.

Blue Springs and McDougal Springs are the namesake Spring Ponds of the site, but numerous other springs, seeps, and small ponds also lie just off the river. These large ponds are shallow with a mucky bottom and scattered submerged woody debris. Aquatic plants are sparse but include common waterweed (*Elodea canadensis*), common water-starwort (*Callitriche palustris*) and common forget-me-not at the edges. Exposed mucky shorelines are dominated by aquatic emergents such as bald spike-rush (*Eleocharis erythropoda*), broad-leaved arrowhead (*Sagittaria latifolia*), great water dock (*Rumex britannica*), soft rush, reed manna grass (*Glyceria grandis*), and sedges. Ponds are surrounded by alder, sweet gale (*Myrica gale*), tussock sedge, and bluejoint grass.

The forest adjoining the river corridor includes stands of old-growth Northern Wet-mesic Forest and old-growth Northern Dry-mesic Forest with large pines, which occur on gravelly or sandy ridges paralleling the river channel.

### **Significance of Site**

This site lies in the northern portion of the Brule Glacial Spillway SNA and, together with adjacent Primary Sites, contains one of the largest and highest quality cedar swamps in the state, spanning over eight linear miles and nearly 1,500 acres. The site is also located within the Blueberry Swamp COA, a conservation opportunity of statewide significance identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) - Implementation Plan (WDNR 2008).

This site supports numerous rare species, including records for two special concern birds of conifer swamps. Stone's Bridge is also well known to Wisconsin birders as a reliable location at which to observe boreal species; in 2015 these included Cape May warbler, Canada warbler, golden-crowned kinglet, red-winged crossbill, and a special concern woodpecker. Two state threatened orchids are also known from

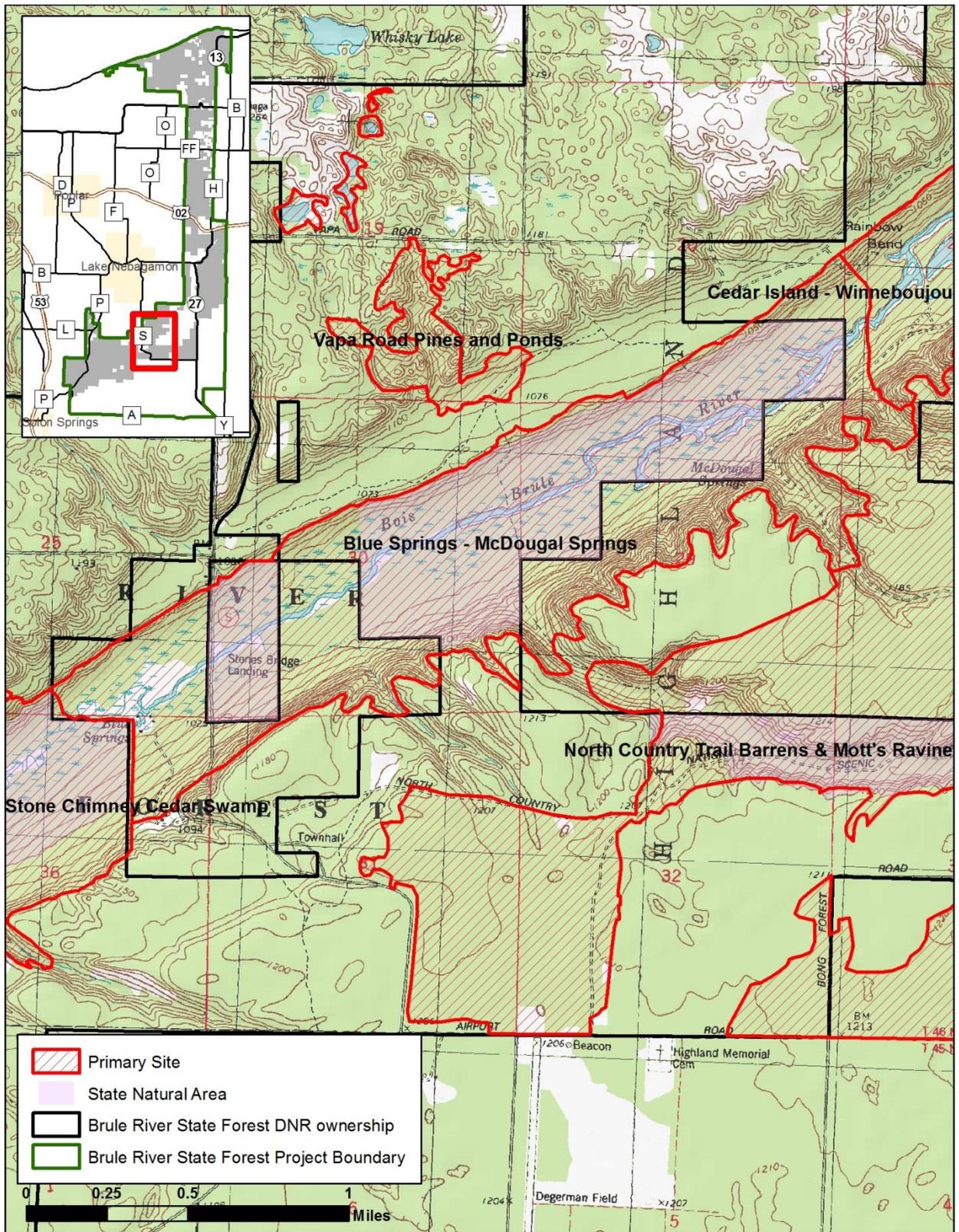
the site. The site also supports only the second known location in the state for the gold dust lichen (*Chrysothrix candelaris*) as well as Elizabeth's pelt lichen, first found in Wisconsin in 2009 and known only from the Brule River State Forest (Wetmore 2010). Spring Ponds and seeps at the site also support numerous uncommon aquatic invertebrates.

The two discrete waterbodies associated with Blue Springs and McDougal Springs were also identified as important conservation targets in The Nature Conservancy's Lake Conservation Portfolio (Blann and Wagner 2014).

### ***Management Considerations***

Protection of hydrology, including groundwater recharge areas, is crucial to the conservation of this area. In addition, Spring Ponds and seeps are fragile features. Inundation due to beaver impoundments has altered the hydrology of parts of this site in the past, and recent surveys found some Spring Pond outlets blocked. Private landowners are key partners in the long-term protection of this site, particularly large landowners as well as owners of cabins near springs, who can promote water quality by properly maintaining their septic fields and by serving as water quality monitors and advocates..

Passive management is important for continued conservation of cedar swamps and Spillway slopes. Non-native invasive species are a minor concern. None were noted in the cedar swamp, but common forget-me-not is common along the river and in some of the Springs and Spring Runs. Watercress also occurs here, particularly below Blue Spring. Numerous non-native invasive species were also noted along County Highway S in 2006, including reed canary grass, garden valerian, common tansy, bull thistle, bird's-foot trefoil (*Lotus corniculatus*), and a small colony of purple loosestrife. As the road and boat landing at Stone's Bridge Landing are one of the main potential introduction points for unwanted invaders into the high-quality wetlands, the area should be monitored vigorously on a regular basis along with appropriate control measures employed as necessary.



**BRRSF09: Blue Springs - McDougal Springs Primary Site.**

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## BRRSF10. CEDAR ISLAND – WINNEBOUJOU

### **Location**

Landtype Association:	212Ka. Upper Brule-St. Croix Valley and 212Kb. Winneboujou Glacial Thrust Hills
Approximate Size:	1625 acres
Approximate Ownership:	Private (1422 acres), WDNR (203 acres)

### **Description of Site**

This area, which begins just below McDougal Springs and extends north almost to the County Highway B bridge, includes several stretches of the Bois Brule River that are slow, wide, and shallow. These are referenced as "lakes" on some maps, including Big Lake, Lucius Lake, and Sucker Lake. Areas of relatively slack water are interspersed with stretches of fast current and significant rapids. The vegetation bordering the river includes old-growth swamp conifers and upland pine forest.

Several stands of mature Northern Dry-mesic Forest occur on this site on private land. In the oldest, least disturbed stands, white pine and red pine over 30 inches dbh form a super canopy over pole-sized paper birch, red maple, and balsam fir. Characteristic ground layer plants include wild sarsaparilla, partridgeberry (*Mitchella repens*), large-leaved aster, bunchberry, twinflower (*Linnaea borealis*), round-lobed hepatica (*Anemone americana*) and low sweet blueberry. Resident birds include pine warbler, Blackburnian warbler, red-breasted nuthatch, evening grosbeak, hermit thrush, and pileated woodpecker.

The northwestern portion of the site, including the majority of state land, supports a narrow band of high-quality Hardwood Swamp and Northern Wet-mesic Forest between Castle Road and the Brule River. Black ash trees 10-20 inches dbh form a canopy with scattered white-cedar and balsam fir, while naked miterwort, fowl manna grass, dwarf red raspberry, and feather mosses grace the groundlayer. Seepages are common, which feed small streams that drain into the Brule. Trout were noted in the small streams.

### **Significance of Site**

This site lies in the northern portion of the Brule Glacial Spillway and while not within an SNA due to predominantly private ownership, it contains qualities of an Ecological Reference Area. It is also located within the Blueberry Swamp COA, a conservation opportunity of statewide significance identified through a collaborative stakeholder process during the Wisconsin WAP - Implementation Plan (WDNR 2008).

In addition to containing some of the best examples of remnant Northern Dry-mesic Forest in northern Wisconsin, it is also one of the few sites along the Bois Brule where extensive beds of emergent, floating-leaved, and submergent aquatic macrophyte vegetation are common. Representative species include aquatic buttercups, several kinds of pondweed, common waterweed, arrowhead, and coontail, as well as a special concern aquatic plant. Wildlife values are high with bald eagle, osprey, uncommon raptors, and many neotropical migrants among the residents.

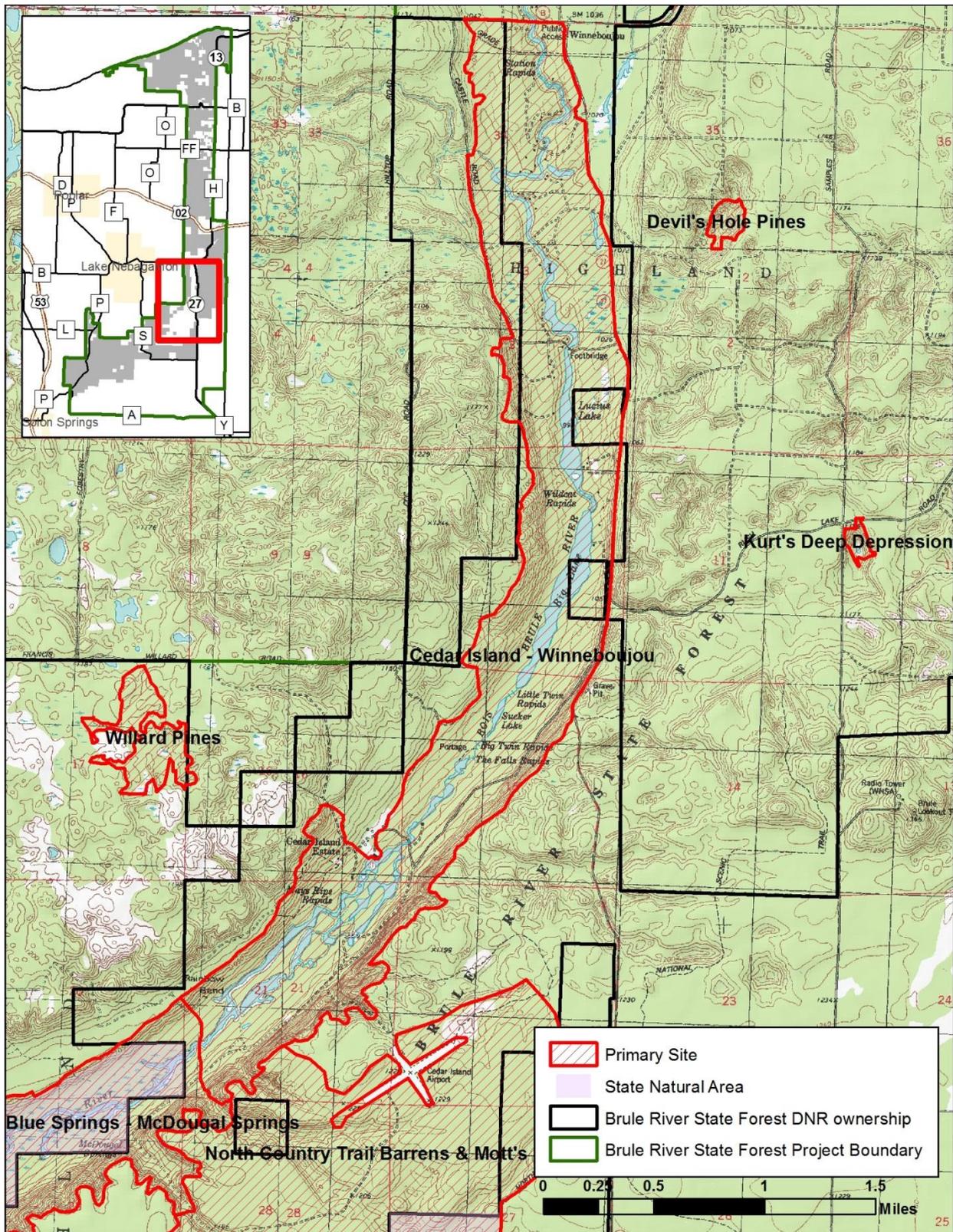
Several lakes along the Brule River corridor within this Primary Site were also identified as important conservation targets in The Nature Conservancy's Lake Conservation Portfolio (Blann and Wagner 2014). These include Big Lake and three unnamed lakes, further illustrating the site's aquatic significance.

### **Management Considerations**

The majority of this site is in private ownership with significant acreage in conservation easements. The lands bordering the river are forested, with conifers generally dominant. Extensive stands of older Northern Wet-mesic Forest and perhaps the most extensive area of old-growth and mature white and red pine forest within the river corridor, occur in this area. Scattered residences are present and much of the land fronting the river is privately owned. Protection of water quality and shoreline habitats is another major consideration, including maintenance of private septic fields to promote high water quality.

The area was not well surveyed for invasive species, but a handful of observations were made along the river, along with a 2006 study of roads and rights-of-way ( LSRI 2006, unpublished data). Two small patches of narrow-leaved cat-tail were noted just below Lake Lucius, while yellow iris (*Iris pseudacorus*) is scattered along the river from just upstream of County Highway B and north. Reed canary grass also occurs at the County Highway B bridge and downstream. A small patch of glossy buckthorn (*Frangula alnus*) was observed in 2006 near the Winneboujou Canoe Landing. Bell's honeysuckle (*Lonicera x bella*) and Canada thistle were also found here. Glossy buckthorn is particularly important to control here, as this is the most upstream locale documented for this very problematic species.

The Hardwood Swamp is threatened by Emerald Ash Borer, although portions of the site that have a relatively high diversity of associated tree species are well-positioned to at least remain in forest cover.



**BRRSF10: Cedar Island - Winneboujou Primary Site.**

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## BRRSF11. MILLS LAKE

### **Location**

Landtype Association: 212Ka14 Upper Brule-St. Croix Valley  
Approximate Size: 23 acres  
Ownership: WDNR

### **Description of Site**

This shallow, muck-bottomed, soft water seepage lake of eight acres is bordered by a Poor Fen that is composed primarily of sedges and leatherleaf. The shoreline and wetland margins are undeveloped. The adjoining rolling sandy uplands are intensively managed for aspen and plantation-grown conifers.

The Poor Fen is best developed on the northeast shore of Mills Lake and contains a quaking mat of common yellow lake sedge (*Carex utriculata*) with narrow-leaved woolly sedge (*Carex lasiocarpa*) and leatherleaf. Other characteristic plant species include three-way sedge (*Dulichium arundinaceum*), round-leaf sundew, pitcher plant (*Sarracenia purpurea*), flat-leaved bladderwort (*Utricularia intermedia*), and bogbean (*Menyanthes trifoliata*). Three low forested "islands" are embedded in the site and contain paper birch, trembling aspen, red pine, and jack pine in the canopy, with meadowsweet (*Spiraea alba*), serviceberry (*Amelanchier* sp.), sweet-fern, low sweet blueberry, and bracken fern growing below.

### **Significance of Site**

The lake and associated wetlands are essentially undisturbed. While features of this type are not rare in the sand barrens landscape, this site supports a representative complement of native plants and animals, is entirely on public land, and merits continued protection. The Poor Fen bordering the lake is the best example of this community on the BRRSF. No rare species were documented here, but 29 species of aquatic invertebrates were collected in 1996 (WDNR 1999).

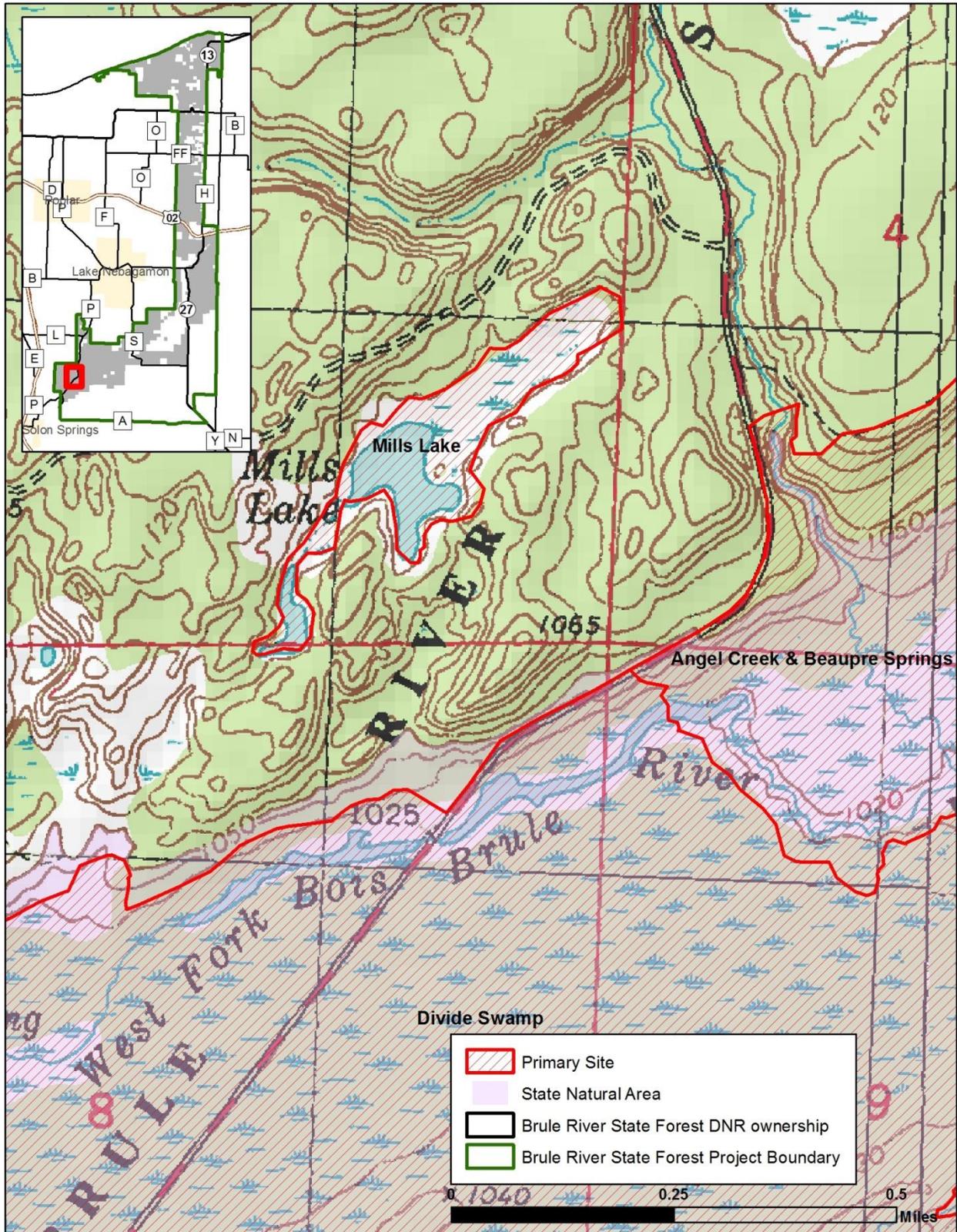
The site is also located within the Blueberry Swamp COA, a conservation opportunity of statewide significance identified through a collaborative stakeholder process during the Wisconsin WAP - Implementation Plan (WDNR 2008).

Mills Lake was also identified as an important conservation target in The Nature Conservancy's Lake Conservation Portfolio (Blann and Wagner 2014).

### **Management Considerations**

The primary management need at Mills Lake is protection of hydrology. Following water quality BMPs should be sufficient to maintain the condition and quality of the wetland. Due to the difficulty of accessing the forested island and the potential for impacting fragile wetland soils, passive management of the small islands is encouraged.

No non-native invasive species were found in the Poor Fen or at the lake margins, but given the uniqueness of the site on the forest and sensitivity to invasion by species such as glossy buckthorn, periodic monitoring is recommended. Several locations of non-native invasives species were found in adjacent uplands in 2006 along two-tracks and logging roads, including spotted knapweed and common tansy (LSRI, unpublished data).



**BRRSF11: Mills Lake Primary Site.**

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## BRRSF12. LAKE MINNESUING

### **Location**

Landtype Associations: 212Kb01 Pattison Moraines, 212Kb33 Winneboujou Glacial Thrust Hills  
Approximate Size: 215 acres  
Approximate Ownership: WDNR (192 acres), private (23 acres)

### **Description of Site**

A mixed mesic forest of hardwoods and conifers occurs on rolling morainal topography to the west of Lake Minnesuing. Canopy dominants associates in this medium-aged stand include sugar maple (*Acer saccharum*), basswood (*Tilia americana*), red oak, red maple, with occasional paper birch, yellow birch, white pine, and hemlock. Mature trees average 14-16" dbh. The understory contains many of the above species, as well as locally dense balsam fir, beaked hazelnut, and leatherwood (*Dirca palustris*). Typical ground layer plants are wild sarsaparilla, Canada mayflower, large-leaved aster, Pennsylvania sedge, pipsissewa (*Chimaphila umbellata*), and bunchberry. Where site conditions are somewhat drier the ground layer supports species such as wintergreen and blueberries.

The older, less disturbed stands are small, occurring in several disjunct, somewhat isolated patches. The adjoining forest is mostly second-growth hardwoods, with paper birch and red oak dominant. Aspen is also locally important. Several roads cross the site.

Shallow basins just south and west of the Lake support small medium-aged stands of good-quality hardwood swamp dominated by black ash mixed with occasional northern white-cedar. The lake itself is heavily developed with many homes on the shoreline. In addition, several small depressions in the forest contain Ephemeral Ponds.

### **Significance of Site**

This site is noteworthy as one of the northwestern-most stations for eastern hemlock (*Tsuga canadensis*) in Wisconsin and North America. Conservation of hemlock stands in this location is important for the conservation of the species, especially as it is threatened by a number of factors throughout much of the rest of its range, including from hemlock wooly adelgid. The isolated location of this stand may afford it some protection from this devastating forest pest.

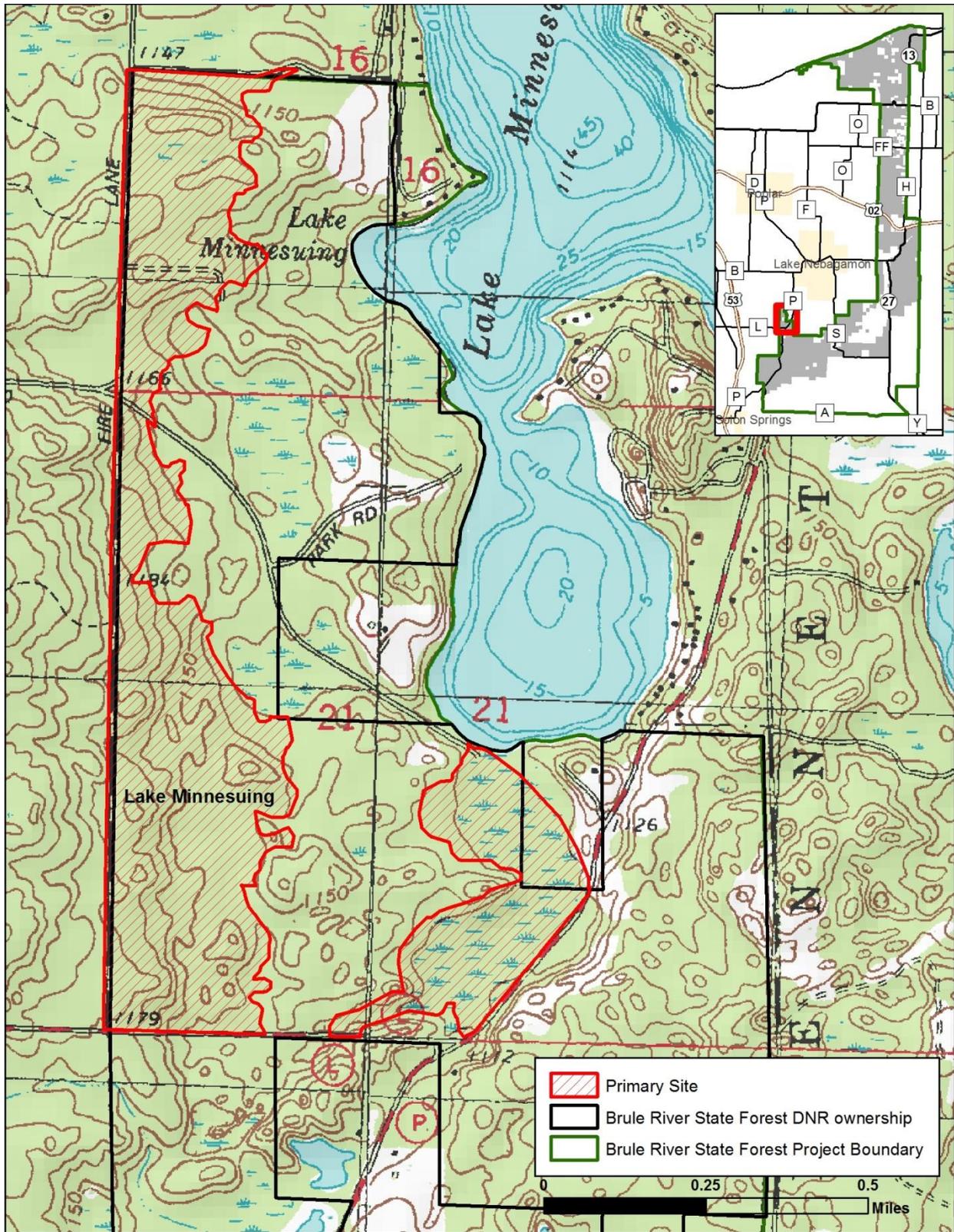
In addition, several Ephemeral Ponds are known from this site, and support a special concern amphibian found only in three other places on the BRRSF. The ponds also support locally high numbers of breeding amphibians, including wood frog, spotted salamander, and blue-spotted salamander. A rare aquatic plant has also been documented from the south end of Lake Minnesuing.

This site also harbors a significant diversity of lichens, including a rare *Caloplaca* lichen (*Caloplaca parvula*) found in only one other location in the state and Elizabeth's pelt lichen, found for the first time ever in Wisconsin on the BRRSF (and also found at several other locations on the BRRSF) (Wetmore 2010). In addition, a black ash swamp just outside of the Primary Site along Park Road also contained a species of *Biatora* lichen (*Biatora longispora*) know from only one other location in the state. Due to its contribution toward lichen conservation, this site was recommended for consideration as an Ecological Reference Area (Wetmore 2010).

### **Management Considerations**

Maintaining older age classes of hemlock should be a priority at this site. Protection of Ephemeral Ponds scattered on the moraine is also important. Ephemeral Ponds, in particular, serve as the primary breeding habitat for a suite of frogs and salamanders including wood frog, spotted salamander, and blue-spotted salamander. Many of these species also rely on large, decaying woody debris on the forest floor as adults. Management that allows for scattered large trees to develop, eventually die, fall over, and decompose on the forest floor is crucial for these amphibians, especially in the vicinity of clusters of ponds. In addition, non-native earthworms are a major threat to salamanders, as they reduce or eliminate the thick duff layers required by some species of adult salamanders (Maerz et al. 2009).

A number of non-native invasive species were documented along roads in the vicinity of this site, including reed canary grass, garden valerian, Bell's honeysuckle, hemp-nettle (*Galeopsis tetrahit*) glossy buckthorn, and Phragmites (LSRI 2006, unpublished data). Purple loosestrife is also known to occur along the margins of Lake Minnesuing. These species have potential to seriously disrupt both uplands and wetlands, including Ephemeral Ponds, and should be controlled and the site monitored for new infestations.



**BRRSF12: Lake Minnesuing Primary Site.**

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## **BRRSF13. VAPA ROAD PINES AND PONDS**

### ***Location***

Landtype Associations:	212Kb33 Winneboujou Glacial Thrust Hills, 212Ka14 Upper Brule-St. Croix Valley
Approximate Size:	95 acres
Approximate Ownership:	WDNR (94 acres), private (0.5 acres)

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

This site lies just north of the Brule Spillway and east of County Highway S. It spans both north and south of Vapa Road, with the south portion featuring a significant stand of large pines, and the northern portion of the site holding a complex of ponds and wetlands containing exemplary aquatic invertebrate communities.

Vapa Road Pines is a good-quality, approximately 50-acre Northern Dry-mesic Forest located in a north-south oriented ravine above the Brule River. The substrate is loamy sand with moderate slopes (~20%). The stand is dominated by large red and white pine (average 22-24 inches dbh, up to 36 inches) as well as smaller red oak. Most regeneration is red maple and paper birch, although white pine and red oak saplings are scattered. In general, pine reproduction is limited. Snags, an important feature of old forests, are relatively common. The shrub layer is dominated by abundant beaked hazelnut, while the groundlayer is dominated by classic dry-mesic forest species such as wild sarsaparilla, Canada mayflower, starflower, low sweet blueberry and bracken fern. Resident birds include many species characteristic of older coniferous forests such as common raven, pileated woodpecker, blackburnian and pine warblers, and red-breasted nuthatch.

Vapa Road Ponds features many small ponds and wetlands in the numerous glacial kettles that pit the surface. The wetland communities include northern sedge meadows, open bog, and alder thicket. Stand size for all types is small and the floristic diversity is relatively low.

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

Old, natural origin white pine and red pine stands are exceedingly uncommon in Wisconsin, and this stand remains one of the best examples of older white and red pine forest on state land and on the state forest. The ravine terminates at the uppermost of several terraces above and parallel to the Bois Brule River. This stand escaped the heavy cutting that historically occurred in virtually all stands of this community type in northwest Wisconsin. As the largest older red pine stand on the BRRSF at 71 acres, and one of the oldest at nearly 140 years (stand origin estimated at 1878, WDNR Forest Recon), this site has very high conservation value. A special concern and SGCN songbird is also known from the site.

The cluster of small ponds and kettle wetlands north of Vapa Road was deemed exemplary by aquatic researchers in 1996, supporting several uncommon aquatic invertebrates (WDNR 1999).

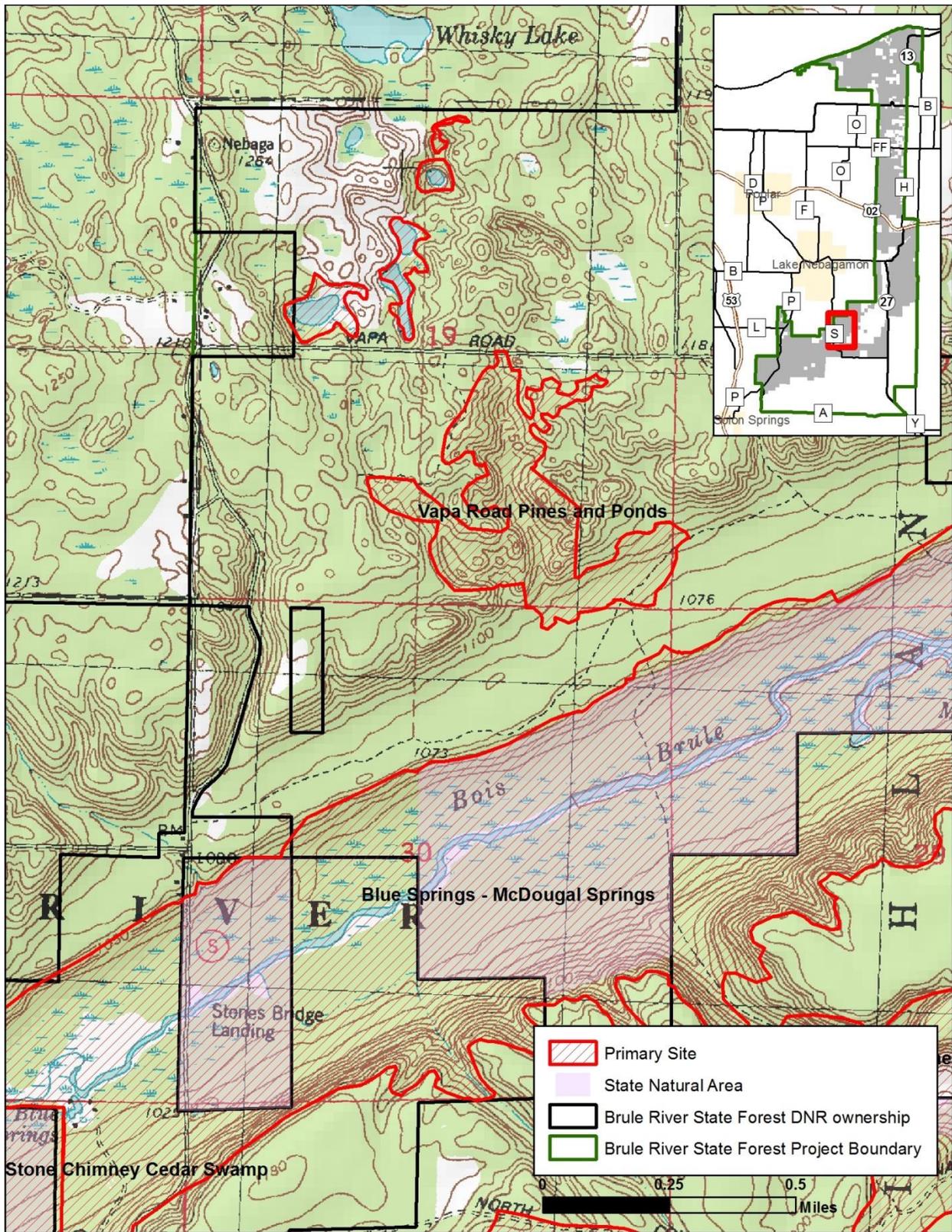
This site is partially within the Blueberry Swamp COA, a conservation opportunity of statewide significance identified through a collaborative stakeholder process during the Wisconsin WAP Implementation Plan (WDNR 2008).

### **Management Considerations**

Maintaining older age classes of natural red pine should be a priority at this site. Tyrrell et al. (1998) noted that the average stand age for older red pine ranged up to 250 years across eastern North America, with a maximum age of individual trees over 300 years. At the same time, the lack of natural red pine regeneration is a concern, and techniques that promote red pine regeneration (fire, timber harvest, deer exclosures, etc.) could be pursued in nearby areas. In adjacent stands to the east, a harvest was conducted in 2014 to encourage red pine regeneration using innovative silvicultural techniques. The result of this management should be monitored, as encouraging the growth of natural-origin pine and pine-oak forest on uplands adjacent to the Primary Site and to the Spillway is a legitimate goal and if successful could be applied elsewhere. However, encouraging natural red pine regeneration should be balanced with maintaining uncommon older age classes to ensure the full range of age class diversity is maintained, including very old, large trees.

The wetlands north of Vapa Road also merit strong protection. Following water quality BMPs for forestry operations should help protect these important areas for aquatic life.

No non-native invasive species problems were observed across the site other than Kentucky bluegrass (*Poa pratensis*). However, scattered invasives were noted along Vapa Road and County Highway S, including reed canary grass, common tansy, and spotted knapweed (LSRI 2006, unpublished data). Reed canary grass could become a problem in the high-quality wetland if allowed to spread, and spotted knapweed and tansy could interfere with tree regeneration if they reach high densities in open areas. Controlling existing infestations prior to harvest (including at road edges near stand entry points) and following invasive species BMPs during timber operations will be important to minimizing spread into the forest.



**BRRSF13: Vapa Road Pines and Ponds Primary Site.**

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## **BRRSF14. WILLARD PINES**

### **Location**

Landtype Associations: 212Kb33 Winneboujou Glacial Thrust Hills  
Approximate Size: 78 acres  
Approximate Ownership: WDNR (75 acres), private (3 acres)

### **Description of Site**

Willard Pines is a good quality Northern Dry-mesic Forest in the Winneboujou Glacial Thrust Hills LTA, located north of the Brule Spillway and just south of Francis Willard Road. Soils are loamy sands with rolling topography.

This dry-mesic forest is mostly closed canopy and composed of large- to medium-sized red pine and white pine (up to 30 inches dbh) with occasional large red oak (up to 16 inches dbh). The stand is at least 165 years old, with the origin of some trees dating to 1850 (WDNR Forest Recon). The subcanopy is primarily red maple with some red oak and trembling aspen. Red maple is also common in the sapling and small tree classes; there is little if any red pine regeneration. Beaked hazelnut forms a locally dense shrub layer, while the ground layer is comprised of typical dry-mesic species, with bracken fern, low sweet blueberry, wild sarsaparilla, large-leaved aster, and rough-leaved rice grass (*Oryzopsis asperifolia*) among the common species. A number of ephemeral ponds area also scattered throughout Willard Pines.

The immediate landscape comprises mostly upland forest punctuated by small pockets of Poor Fen, Open Bog, and Black Spruce Swamp. Much of the forest surrounding Willard Pines is composed of young aspen although pine-dominated stands are also present.

### **Significance of Site**

This site is one of the oldest examples of natural origin red pine stands on the BRRSF. Stands older than 150 years are exceptionally rare in Wisconsin and throughout the entire upper Great Lakes region, as few areas escaped the cutover. In addition, this is one of the largest stands of older red pine on the BRRSF, at over 60 acres. Only Vapa Road Pines is slightly larger in size, though it is slightly younger in age.

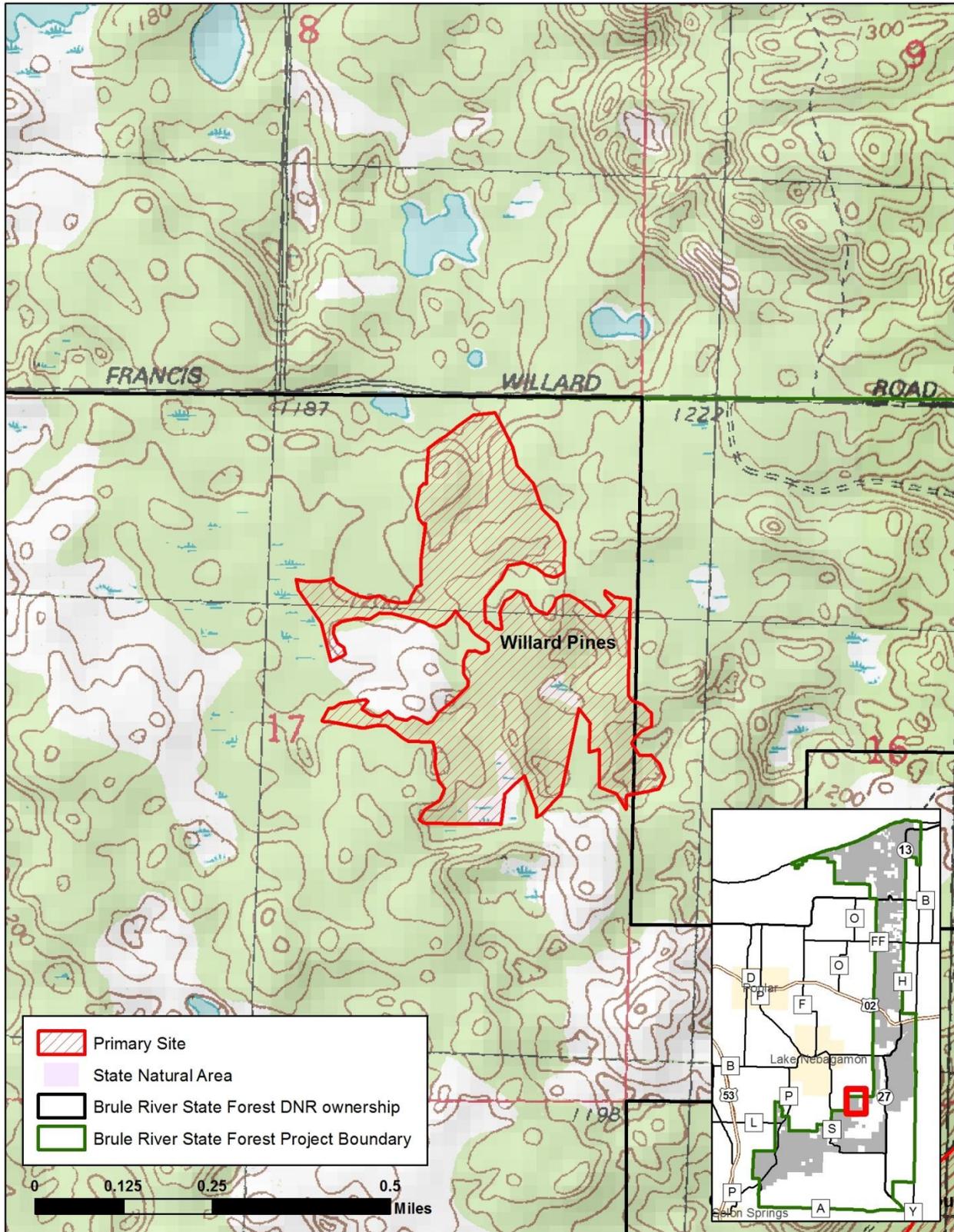
Ephemeral ponds are also uncommon on the Brule, and are important breeding areas for amphibians. Ponds in the vicinity of this Primary Site support a special concern amphibian, found in only three other locations of the forest. Several SGCN birds are also known from the site, including veery, black-billed cuckoo and two special concern species.

### **Management Considerations**

Maintaining older age classes of natural red pine should be a priority at this site. Tyrrell et al. (1998) noted that the average stand age for older red pine ranged up to 250 years across eastern North America, with a maximum age of individual trees over 300 years. At the same time, pine regeneration is lacking and the sapling layer is dominated by red maple. Over the long term, management such as thinning undesirable saplings and subcanopy trees combined with prescribed fire might be beneficial for pine and oak regeneration. Increasing the pine and oak component in adjacent stands would also be beneficial from a landscape perspective. However, encouraging natural red pine regeneration should be balanced with maintaining uncommon older age classes to ensure the full range of age class diversity is maintained, including very large, old trees.

Protecting the hydrology of ephemeral ponds, especially during timber operations, is crucial for their conservation. In addition, leaving a buffer around ponds, avoiding the crushing of partially decomposed downed wood, and leaving legacy trees and snags for future downed wood will benefit both rare and common amphibians.

Invasive plants were sparse in the site, with only Kentucky bluegrass and common buttercup (*Ranunculus acris*) observed. Several invasives were observed along Francis Willard Road, including common tansy, spotted knapweed, and a single patch of garden valerian (LSRI 2006, unpublished data). Controlling existing infestations prior to harvest (including at road edges near stand entry points) and following invasive species BMPs during timber operations will be important to minimizing spread into the forest.



**BRRSF14: Willard Pines Primary Site.**

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## BRRSF15. KURT'S DEEP DEPRESSION

### **Location**

Landtype Associations: 212Ka14 Upper Brule-St. Croix Valley  
Approximate Size: 9 acres  
Ownership: WDNR

### **Description of Site**

The site is a shallow marshy pond surrounded by forest and barrens, situated in the bottom of a steep-sided depression. The pond is semi-permanent with a firm muck and sand bottom and is shallow (in 2015, it contained 4-6 inches of water). Vegetation in the pond included sedge meadow species such as hairy-leaved lake sedge (*Carex atherodes*), rattlesnake manna grass (*Glyceria canadensis*), wool-grass (*Scirpus cyperinus*), tussock sedge, bluejoint grass, Canada thistle, common dewberry (*Rubus flagellaris*) and common goldenrod (*Solidago canadensis*).

In previous surveys during the mid-1990s, water quality was judged to be excellent, with a good representation of aquatic insects, particularly beetles (WDNR1999). Undoubtedly, winterkill and fluctuating water levels are important forces that may influence water quality and aquatic biota.

The steep slopes of the kettle are forested with sapling-size to 8-inch-dbh jack pine and trembling aspen, and scattered pole-sized red pine over American hazelnut (*Corylus americana*). South-facing slopes are somewhat open and feature barrens plants including hoary puccoon (*Lithospermum canescens*) and western sunflower (*Helianthus occidentalis*). Adjacent uplands are mostly jack and red pine plantations, including several recently harvested jack pine stands with barrens-like characteristics.

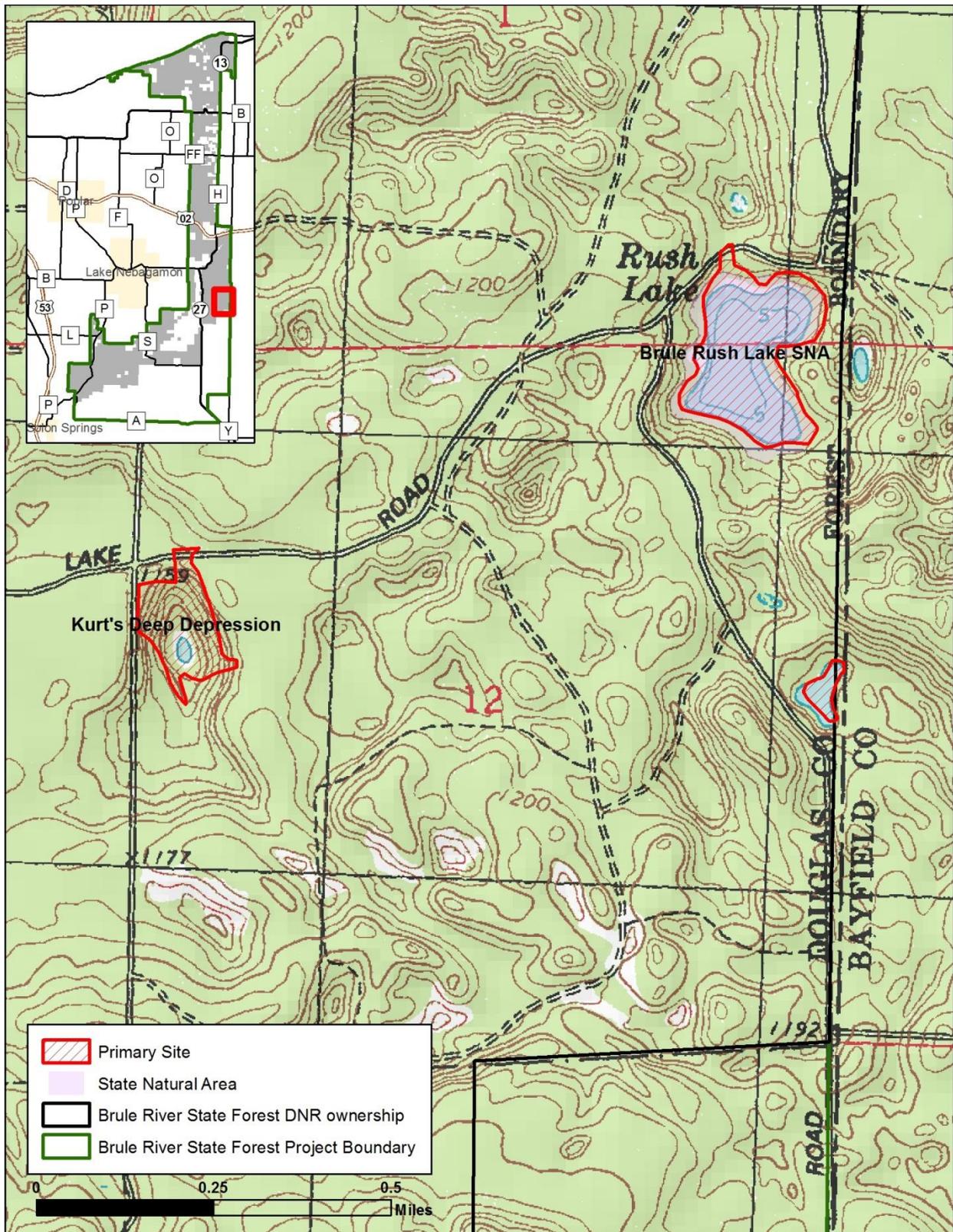
### **Significance of Site**

While no rare species were found, this site was deemed to be exemplary as an aquatic feature in the mid-1990s due to its unusual setting in a steep sided depression and its apparently intact aquatic biota (WDNR 1999). Seepage lakes with naturally fluctuating shorelines are common in this ecoregion, but the rate of lake and shoreline developments has accelerated tremendously in recent years, with many littoral habitats destroyed or damaged.

This Primary Site is part of the larger Douglas and Bayfield County Barrens COA, a COA of global significance for barrens conservation and pine barrens restoration potential as identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) - Implementation Plan (WDNR 2008).

### **Management Considerations**

Protecting the waterbody from sedimentation and invasive plants are the primary management concerns. Following water quality BMPs and avoiding harvesting on steep slopes should help conserve this site. In addition, protecting the wetland and adjacent slopes from illegal ATV/UTV use is important. From a larger landscape perspective, management that maintains or enhances pine barrens could also be encouraged.



**BRRSF15: Kurt's Deep Depression Primary Site and BRRSF16: Brule Rush Lake SNA Primary Site.**

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## BRRSF16. BRULE RUSH LAKE SNA

### Location

Landtype Associations: 212Ka14 Upper Brule-St. Croix Valley  
Approximate Size: 24 acres  
Ownership: WDNR

### Description of Site

This site includes both Rush Lake and a smaller, unnamed lake approximately a quarter mile to the south. Rush Lake is a slightly alkaline, 22-acre soft water seepage lake and has clear water, a sandy bottom, and a maximum depth of nine feet. Apparently, winterkill conditions have not occurred here despite the shallow depth (Sather and Johannes 1972). Inundated willow trees and jack pines around the periphery illustrate the effect of a decade-long drought and resulting prolonged low water levels, followed by several recent years of higher annual precipitation.

The most notable natural feature here is an undisturbed shoreline with a good example of an Inland Beach. The lake experiences significant natural water level fluctuations which have kept the littoral zone open and allowed colonization by several distinct floristic associations. The inundated zone is composed mostly of hard-stem bulrush (*Schoenoplectus acutus*, the rush in “Rush Lake”), lake sedge and broad-leaved woolly sedge (*Carex pellita*). The middle beach, with a substrate of moist sand, supports a diverse array of sedges and rushes, including narrow-leaved woolly sedge and cotton-grass (*Eriophorum* sp.). In 1996, club-moss (*Lycopodium* sp.) and several large populations of the insectivorous round-leaved sundew were also observed in this zone. The dry upper beach is vegetated with grass-leaved goldenrod (*Euthamia graminifolia*), boneset, bluejoint grass, red-stemmed gentian (*Gentiana rubricaulis*), and grasses such as little bluestem (*Schizachyrium scoparium*), big bluestem, and poverty oats (*Danthonia spicata*). Along the south shore of the lake an area of spring seepages was noted.

An extensive ring of emergent vegetation blankets the majority of the shoreline, with abundant hard-stem bulrush and lesser amounts of lake sedge and common yellow lake sedge (*Carex lacustris* and *C. utriculata*). Submergent plants represent a significant component of the lake flora, though their diversity is low, with variable-leaved pondweed (*Potamogeton gramineus*) representing the dominant submergent, and large-leaved pondweed (*P. amplifolius*), slender pondweed and submersed beds of needle spike-rush (*Eleocharis acicularis*) serving as co-dominants. Floating-leaved species comprise a minor component of the lake's flora, with bull-head pond-lily representing the most common floating species.

The dry, rolling uplands are forested with jack pine, red pine, and aspen. Much of the pine is plantation-grown. A very small stand of older natural white pine-red pine forest occurs on the northeast-facing slope of a deep but dry kettle depression approximately one-half mile south of the lake.

### Significance of Site

Protection of soft-water seepage lakes with undeveloped shorelines represents a major conservation opportunity in the Northwest Sands Ecological Landscape (WDNR 2015). Development pressure on lakes in this region is high because of their proximity to the Twin Cities. The lakes contain good-quality plant communities and have high water quality.

Rush Lake harbors a good example of an Inland Beach community, which is limited to landscapes with deep sandy outwash where water levels periodically fluctuate. The Northwest Sands Ecological Landscape contains the highest opportunities in the state to conserve Inland Beach (WDNR 2015). Migrating shorebirds may also rest and feed in beach habitats. Mink frog was detected at this lake during 2015 surveys. This special concern species favors sedge meadows dominated by narrow-leaved woolly sedge (*Carex lasiocarpa*). The rich sedge community and high percentage of open water provide excellent habitat for a variety of odonates.



The racket-tailed emerald (*Dorocordulia libera*) is one of a number of odonates found at Rush Lake. Photo by Matt Berg.

This site is also exemplary for its aquatic invertebrate community. A special concern aquatic beetle was collected from Rush Lake during aquatic invertebrate surveys in 1996, while another rare aquatic beetle was documented from the small pond on the Douglas/Bayfield County line south of Rush Lake. Many additional uncommon, though not necessarily rare, aquatic invertebrate taxa were also documented at this site.

This Primary Site is also part of the larger Douglas and Bayfield County Barrens COA, a COA of global significance for barrens conservation and pine barrens restoration potential as identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) Implementation Plan (WDNR 2008).

### ***Management Considerations***

The most important management issue relating to these lakes and especially their Inland Beach communities is maintenance of hydrology within a range of variability that will sustain all of the associated native species and dynamic processes. Excessive groundwater withdrawals can have a negative impact on these lakes' hydrology. Sensitive beach areas should also be protected from clearing, livestock, heavy foot traffic, and vehicles, especially All-Terrain Vehicles, which can cause destruction of sensitive vegetation and provide a vector for non-native invasive plants. Two small patches of reed canary grass occur at the north end of the lake just west of the boat launch. Spotted knapweed is common at the boat launch area.

Past lake management has included chemical treatment with butimycin, a non-selective aquatic pesticide, and the stocking of channel catfish. Future chemical treatment of the lake is not recommended due to the presence of rare aquatic invertebrates. There are no developments on the shoreline, which is all upland. The feasibility of eventually phasing out the pine plantations and restoring a natural dry forest of pine and oak is worth exploring.

Dense brush and tree shade are threatening the Inland Beach areas at the north and west shorelines. Impact of the canoe landing on immediate shoreline is minimal, although there is some erosion from the road down to the landing.

This waterbody is currently designated as a "Wild Lake" in the existing property master plan and the area is also designated as a State Natural Area. This site is referred to as Brule Rush Lake SNA to distinguish it from Rush Lake SNA, which is located in Winnebago County.

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## **BRRSF17. DEVIL'S HOLE PINES**

### ***Location***

Landtype Associations: 212Ka14 Upper Brule-St. Croix Valley  
Approximate Size: 16 acres  
Ownership: WDNR

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

A portion of this site features a small stand of mature red and white pine on rough, sandy, collapsed glacial outwash topography. Canopy associates include red maple, paper birch, and northern pin oak over a moderately dense shrub layer of hazelnut. Representative members of the herb/low shrub stratum include bracken fern, large-leaved aster, wintergreen, and barren-strawberry (*Geum fragarioides*).

Forested lands bordering this site include intensively managed northern pin oak-jack pine forest, aspen stands, and pine plantations.

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

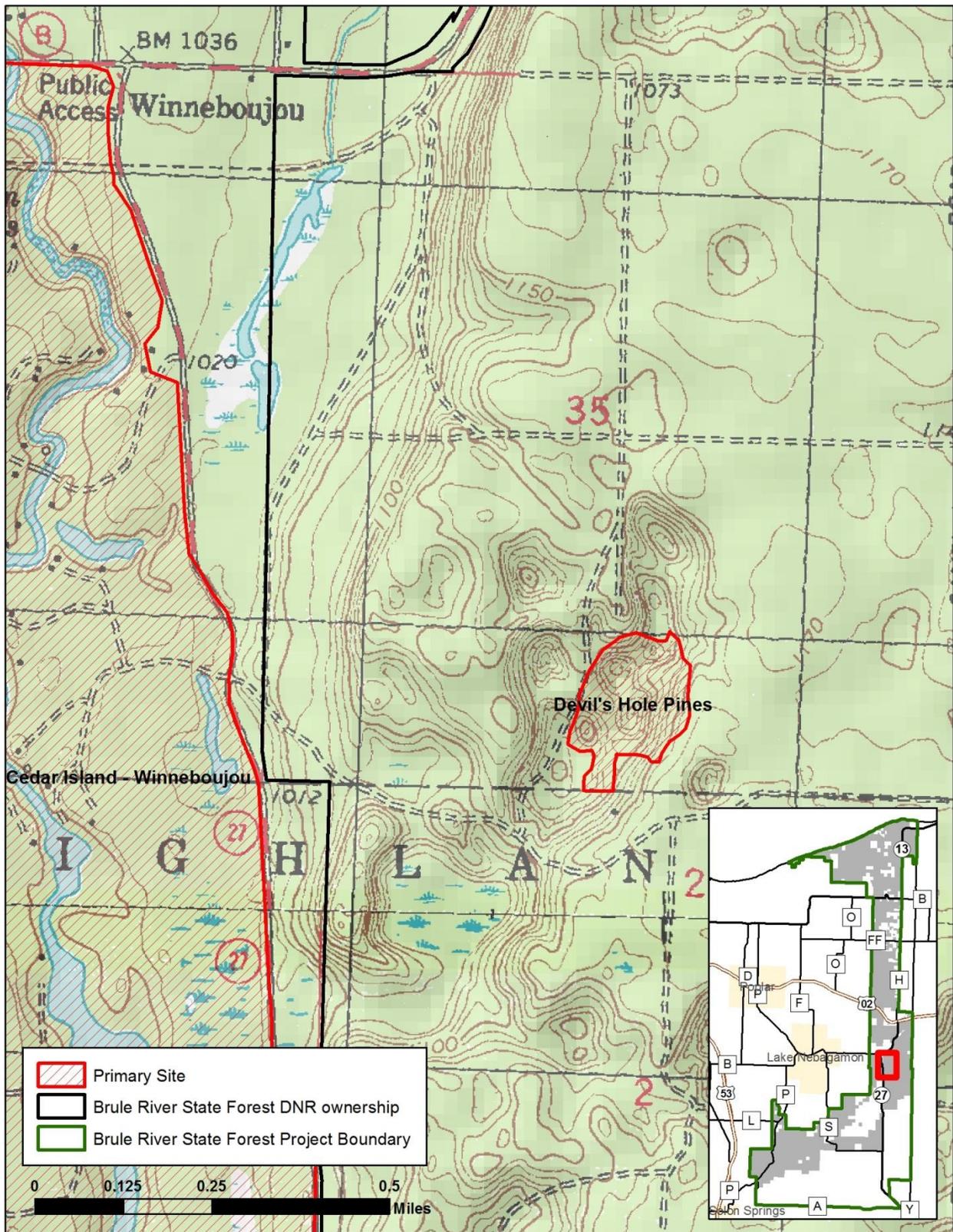
Although this site is small, it contains one of the few natural red pine stands on the state forest. Year of origin of the oldest red pine stand was estimated at 1855 (Forest Recon, stand examined in 2011). Stands older than 150 years are exceptionally rare in Wisconsin and throughout the entire upper Great Lakes region, as few areas escaped the cutover.

This Primary Site is also part of the larger Douglas and Bayfield County Barrens COA, a COA of global significance for barrens conservation and pine barrens restoration potential as identified through a collaborative stakeholder process during the Wisconsin Wildlife Action Plan (WAP) - Implementation Plan (WDNR 2008).

### ***Management Considerations***

The composition and structure of portions of this site have been affected by past logging episodes. The best developed stand, with large red pine dominating the canopy and a very representative understory for the type, is on the steep west-facing slope of a deep kettle hole.

Maintaining the structure and composition of the stand of large pine is desirable. In addition, restoration of a red pine component in adjacent stands would be beneficial from a landscape perspective, with the large pines potentially serving as a seed source. Historically, fire was an important ecological process in this landscape and was instrumental in creating and maintaining dry-mesic forests. If the use of prescribed fire remains impractical, however, prescriptions that mimic the variable intensity and severity of fire could be considered. Overall, this site ranks as a much lower priority for conservation and restoration than the larger sites at Vapa Road and Willard Road. However the small scale of this site might make it a good candidate for experimental management, which, if successful, could be applied elsewhere.



**BRRSF17: Devil's Hole Pines Primary Site.**

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## BRRSF18. HOODOO LAKE

### **Location**

Landtype Associations: 212Ka14 Upper Brule-St. Croix Valley  
Approximate Size: 59 acres  
Approximate Ownership: WDNR (7 acres), Private (52 acres)

### **Description of Site**

This 32-acre seepage lake lies adjacent to Anderson Road and occupies a long abandoned channel of the Bois Brule River, which lies just half a mile to the west. Bottom materials include muck, gravel, and sand. Water color is dark brown. With a maximum depth of 13 feet, this lake periodically experiences winterkill conditions. The lake supports surprisingly few plant species at generally low densities. In water adjacent to the upland forest, sand and gravel sediments support a few highly sensitive “isoetid,” or turf-forming aquatic plant species. An Open Bog mat of sphagnum mosses, leatherleaf, and sedges borders the west side of the lake, and ranges from 50 to 100 yards wide before giving way to tamarack and black spruce on the lake shoreline. A small zone of Poor Fen is also present on the southwest end of the bog, containing common yellow lake sedge (*Carex utriculata*), narrow-leaved woolly sedge (*Carex lasiocarpa*), and few-seeded sedge (*Carex oligosperma*). To the east the lake is fringed by a narrow band of tamarack and black spruce before meeting adjacent uplands.

Anderson Road runs along the west side of the lake, buffered from the wetland by a narrow strip of Northern Dry-mesic Forest with 16-inch dbh trees of red oak, trembling aspen, bigtooth aspen, red maple, red pine, and white pine. This gives some protection to the bog mat and lake from runoff from road.

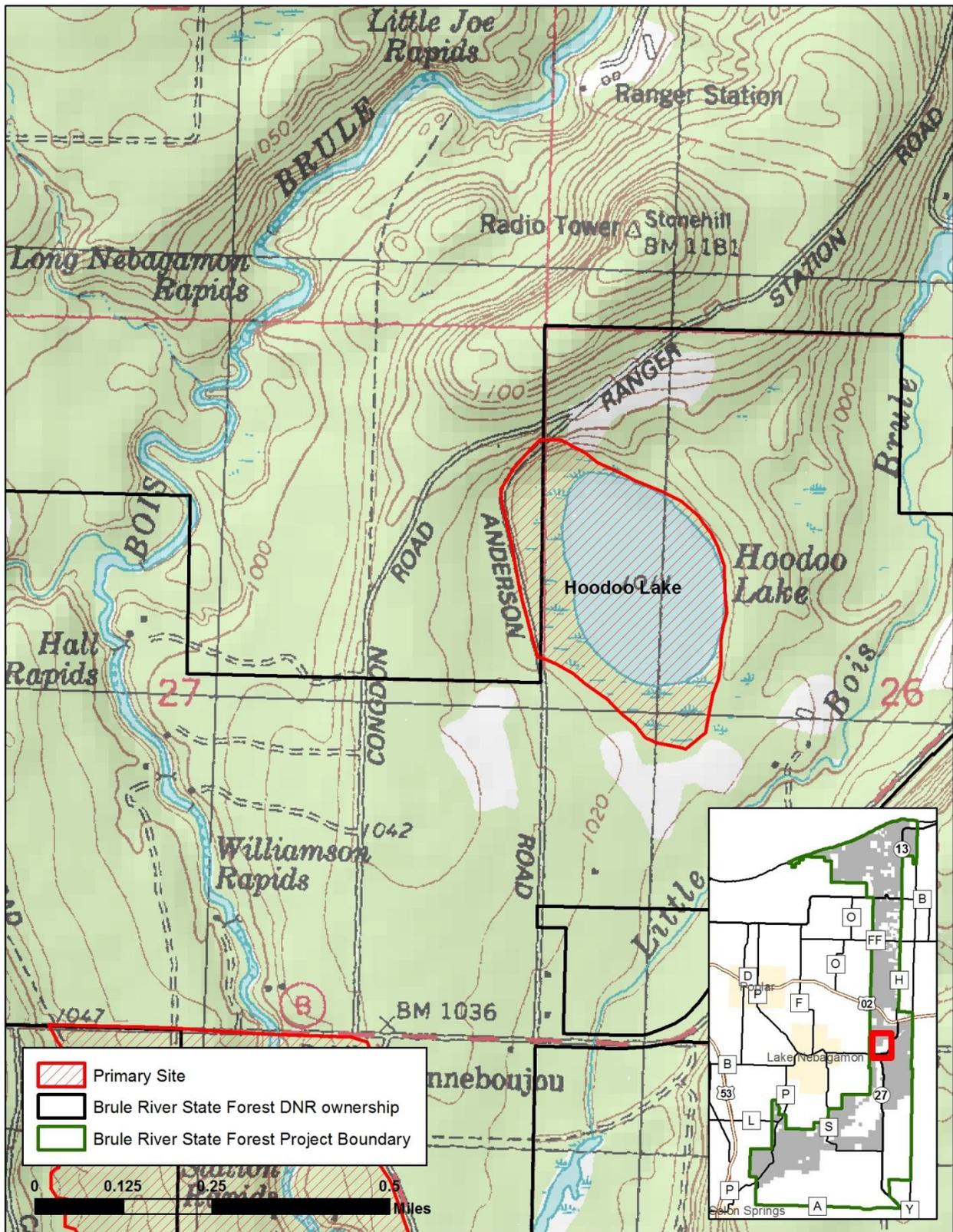
### **Significance of Site**

Hoodoo Lake is the one of the only kettle bogs found on the state forest. Several odonates uncommon on the state forest occur here. In addition, a breeding bufflehead was confirmed at this site in 2015. This species is only known to breed at one other site in the state and was not confirmed as a breeder in Wisconsin until within the past five years.

This site is within the Blueberry Swamp COA, a conservation opportunity of statewide significance identified through a collaborative stakeholder process during the Wisconsin WAP Implementation Plan (WDNR 2008).

### **Management Considerations**

The shoreline of Hoodoo Lake is entirely within private ownership and should be respected as private property. Only a small portion of bog mat and adjacent uplands is owned by the DNR. Nevertheless, a key to maintaining the integrity of this site is to protect water quality and hydrology, especially during forestry operations or road maintenance activities on adjacent state land. Care should be taken to follow water quality BMPs, prevent erosion, and monitor for invasive species that could spread along the road to the bog, especially reed canary grass, purple loosestrife, Phragmites, and glossy buckthorn.



**BRRSF18: Hoodoo Lake Primary Site.**

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## BRRSF19. CCC MILLER BOREAL FOREST AND PINES

### **Location**

Landtype Associations: 212Ya01 Douglas Lake-Modified Till Plain  
Approximate Size: 83 acres  
Ownership: WDNR

### **Description of Site**

The CCC Miller Boreal Forest falls within a lobe of the Superior Coastal Plain Ecological Landscape just north of the outlet of Glacial Lake Duluth into the Brule spillway. Because it was once covered by the glacial lake, the site sits on sandy clay soils sloping gently (5%) eastward toward the Brule River which flows north through an east-west bedrock ridge (the Copper Range, which also underlies Sugar Camp Hill and The Promontory) to Lake Superior.

This site is a mostly balsam fir-dominated forest with widely scattered large pines. Heavy logging occurred in the early 20th century, leaving a low abundance of boreal elements. In addition to balsam fir, dominant species include red maple, sugar maple and basswood. Very large white pine (living), white spruce (snags) and white-cedar are present but uncommon and not regenerating. Overall, large trees (over 12 inches dbh) are uncommon. The shrub and sapling layer is dominated by American fly honeysuckle and young balsam fir. The groundlayer is dominated by Canada mayflower, long-stalk sedge (*Carex pedunculata*) and wood millet (*Milium effusum*). The boreal stand grades into northern hardwoods to the north, but is bordered by aspen (sometimes with a strong fir-spruce component in the understory) elsewhere.

### **Significance of Site**

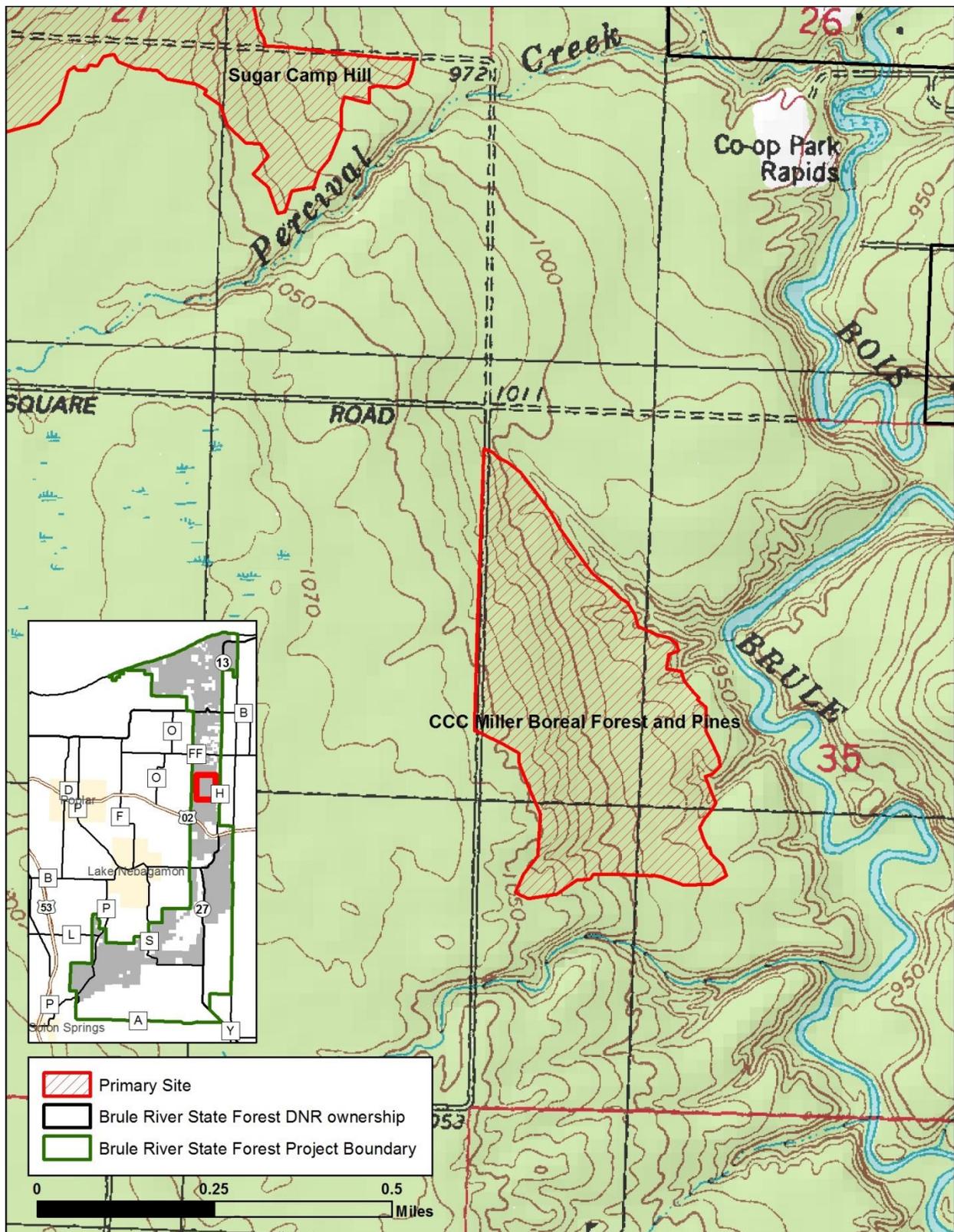
The primary significance of this site lies in its proximity to nearby sites, including Sugar Camp Hill, Lenroot Ledges, The Promontory, and the slopes flanking the Brule River. The river, in particular, lies only 100 yards to the east, and the site could serve as a corridor from the river to Sugar Camp Hill and beyond for wildlife requiring boreal habitat and large trees, both of which are rare on the landscape. Although the habitat in between these areas is not currently particularly high-quality, conservation planning at a larger scale that incorporates the full range of common and rare natural features characteristic of this part of the forest would be advantageous to species requiring larger blocks of upland habitat.

A rare herptile is known in very good numbers from the adjacent Brule River corridor, and portions of the site could be used for foraging activities. A special concern and SGCN bird is also known from the site. In addition, a second special concern bird was historically found (last observed in 1990) immediately adjacent to the site.

### **Management Considerations**

Promoting or planting long-lived conifers and connecting these stands with the forests along the Bois Brule River to the east and on Sugar Camp Hill to the north would provide a large block of diverse, mature forest communities. This would also reduce the "islanding" effect that can occur when small conservation areas are surrounded by intensively managed aspen.

Non-native invasive species include common buckthorn, but are currently uncommon and accounted for <1% of total cover in a plot survey. Garden valerian is present on the adjacent road but not in the forest.



**BRRSF19: CCC Miller Boreal Forest Primary Site.**

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## BRRSF20. SUGAR CAMP HILL

### **Location**

Landtype Associations: 212Ya01 Douglas Lake-Modified Till Plain  
Approximate Size: 456 acres  
Ownership: WDNR (445 acres), private (11 acres)

### **Description of Site**

Sugar Camp Hill features the BRRSF's largest acreage of northern mesic forest, occurring on a locally prominent basaltic bedrock ridge associated with the Copper (Douglas) Range. The site also features small north-facing cliffs, ephemeral ponds, and numerous micro-drainages that add to habitat diversity. A fire tower is located on the summit of the hill, accessed by a two track, and from a small circular parking area, a trail leads to an impressive overlook of the Superior Clay Plain to the north, lying approximately 400 vertical feet below the summit.

The forest is moderate in quality and dominated by sugar maple, red oak, red maple and basswood, with scattered individuals of white ash (*Fraxinus americana*) and yellow birch (*Betula alleghaniensis*); trees average 12 inches dbh, with scattered individuals up to 21 inches. Tree regeneration is dominated by sugar maple and red maple, as well as ironwood (*Ostrya virginiana*) and balsam fir. The variable aspect and slope position associated with the hill adds to compositional diversity, with north-facing slopes more mesic, east-facing slopes (toward the Brule River) somewhat boreal, and south-facing slopes somewhat drier. The groundlayer is diverse due to numerous wet microhabitats but has a disturbed appearance overall, with signs of earthworm invasion, minimal duff layer, and high amounts of weedy plants such as orange hawkweed and common speedwell (*Veronica officinalis*). Coarse woody debris, a crucial component of mesic hardwoods valued by amphibians and other wildlife, is modest but lacking in the number of large logs that are present. At least two substantial Ephemeral Ponds were noted, along with a wide variety of other smaller seasonal wetlands. These areas are forested, generally with a canopy of black ash and/or red maple, and the understory includes sedges, ferns, touch-me-not (*Impatiens* sp.) and other plants adapted to seasonally moist or inundated conditions.

Characteristic bird species at the site include a special concern hawk and songbird, as well as Cooper's hawk, broad-winged hawk, ovenbird, rose-breasted grosbeak, scarlet tanager, black-and-white warbler, black-throated green warbler, American robin, and common raven.

### **Significance of Site**

This is the largest stand of northern mesic forest along the Brule River across all ownerships. Several noteworthy animals were documented here, including several SGCN birds. In addition, a nesting Cooper's hawk was documented. In addition, this site was one of only a handful of upland locations to support Cape May warbler, which prefers mature conifers (especially spruce, but also balsam fir) in a forested setting. The site also supports wood thrush, which is near its northern global range limit and prefers mature trees over 50 feet tall, a moderate understory of saplings and shrubs, and large blocks of closed canopy hardwood forests due to vulnerability to nest parasitism by brown-headed cowbirds. A state threatened songbird was also documented from this site in 1996, though no evidence was found in 2015 or 2016. Finally, a special concern mammal of northern forests was also found here in 2015, one of only two areas on the BRRSF known to support this species. The site of the Lake Superior clay plain overlook also supports a small population of a rare sedge.

The context of the site is also significant, with Boreal Forest remnants lying less than half a mile to the northeast at Lenroot Ledges and just to the SE at CCC Miller Boreal Forest and Pines.

Ephemeral Ponds at the site support good populations of obligate pond breeders, including wood frog, spotted salamander, and blue-spotted salamander. Good habitat also occurs for four-toed salamander, especially in shallow ponds with raised beds of Sphagnum in or on the margins of the pond.

### **Management Considerations**

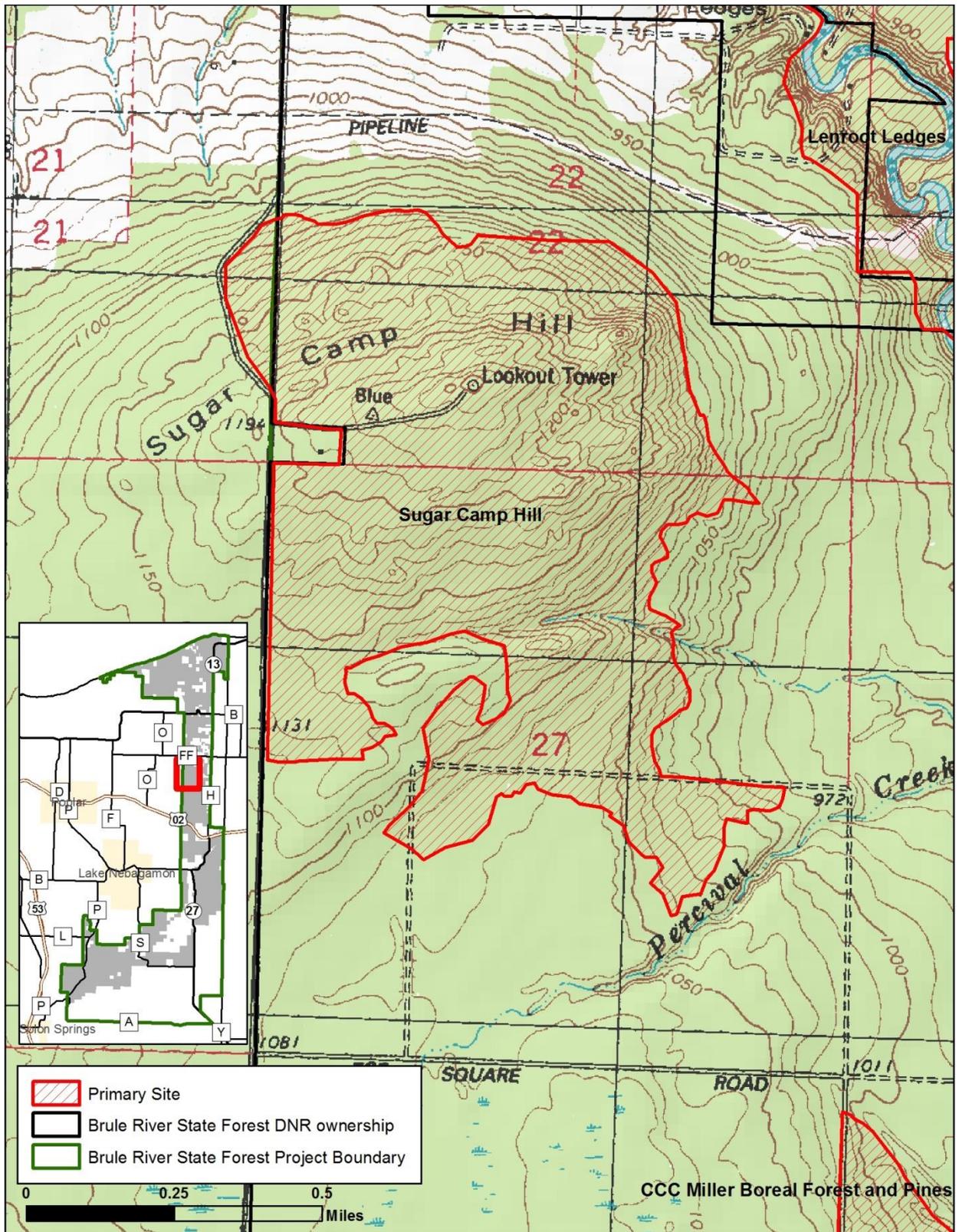
In the 2002 Brule River SF Master Plan, the site was designated as a Native Community Management Area. Although the site will likely never be exceptionally rich from a floristic standpoint, maintaining a high canopy cover is desirable, especially for forest interior birds which require large blocks of mature forest and are uncommon elsewhere on the forest. Maintaining and promoting high structural diversity in the forest, including scattered large trees, mature conifers, and a variety of subcanopy species will also benefit these species. As noted previously, linking this site with adjacent Primary Sites (especially CCC Miller and Lenroot Ledges, as well as the Brule River) by encouraging older forest, scattered large trees, and high canopy cover in the intervening forest would also be beneficial.

High levels of deer browsing were noted, particularly on oak and ash seedlings and saplings. In some areas, browsing levels appeared to be contributing to regeneration failure of these species. Depending on management goals, deer browsing may need to be controlled. Some areas are currently dominated by oak, and while many stakeholders highlight the importance of maintaining oak on the landscape, it is important to recognize that the conditions that led to the current dominance of oak on mesic sites, namely high fire frequency and exceptionally low deer numbers (and, in some areas, widespread grazing), no longer exist on the landscape. If oak is deemed to be part of a desired future condition, management strategies must overcome these present realities.

Ephemeral Ponds are uncommon on the BRRSF and serve as the exclusive breeding habitat on the property for a suite of frogs and salamanders including wood frog, spotted salamander, and blue-spotted salamander. Many of these species also rely on large, decaying woody debris on the forest floor as adults. Management that allows for scattered large trees to develop, eventually die, fall over, and decompose on the forest floor is crucial for these amphibians, especially in the vicinity of clusters of Ephemeral Ponds.

Non-native invasive species are surprisingly common in the forest, accounting for more than 5% of the herbaceous groundcover, particularly the clonal mat-forming species orange hawkweed and common speedwell, as well as garden valerian, garden forget-me-not (*Myosotis sylvatica*), common buttercup, and king devil (*Hieracium caespitosum*). Although several of these plants are not on official lists of invasive species, they were among the most common species in the groundlayer, appeared to be persisting and spreading, and fit the definition of ecologically invasive.

The success of invasive species has been linked to invasive earthworms, which eliminate the duff layer and provide newly exposed bare mineral soil for invaders to colonize. It is unknown whether these invasives have the potential to interfere with tree regeneration, though it seems plausible that areas with dense colonies of mat-forming species would create unacceptably high levels of competition for tree seedlings. Controlling existing infestations prior to harvest (including at road edges near stand entry points) and following invasive species BMPs during timber operations will be important to minimizing spread within the forest.



**BRRSF20: Sugar Camp Hill Primary Site.**

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## BRRSF21. THE PROMONTORY

### **Location**

Landtype Associations: 212Ya01 Douglas Lake-Modified Till Plain, 212Ka08 Oula Washed Moraine

Approximate Size: 53 acres

Ownership: WDNR (44 acres), private (9 acres)

### **Description of Site**

This site features an igneous rock outcropping, locally known as Waino Rock, associated with the Copper (Douglas) Range. It supports Bedrock Glade and Northern Dry Forest overlooking the Brule River Valley and Sugar Camp Hill to the west.

The Bedrock Glade is dominated by mature but sometimes stunted red pine, red oak, red maple, and paper birch. Dry-site shrubs such as northern bush-honeysuckle (*Diervilla lonicera*) and low sweet blueberry can also be found in abundance. Classic dry ferns such as common polypody (*Polypodium virginianum*) and rusty woodsia (*Woodsia ilvensis*) dominate the groundlayer and exposed rock faces along with reindeer lichen and pale corydalis (*Capnoides sempervirens*). Restricted to rocky, shallow soil, the Bedrock Glade community is a unique occurrence on the BRRSF. The site is surrounded by good quality oak and pine forests. A utility corridor also bisects the site, running directly over the rock face and through the glade complex. A second utility corridor is located just north of the site. Unfortunately, these corridors are dominated by the non-native invasive plants bird's-foot trefoil and crown vetch (*Securigera varia*).

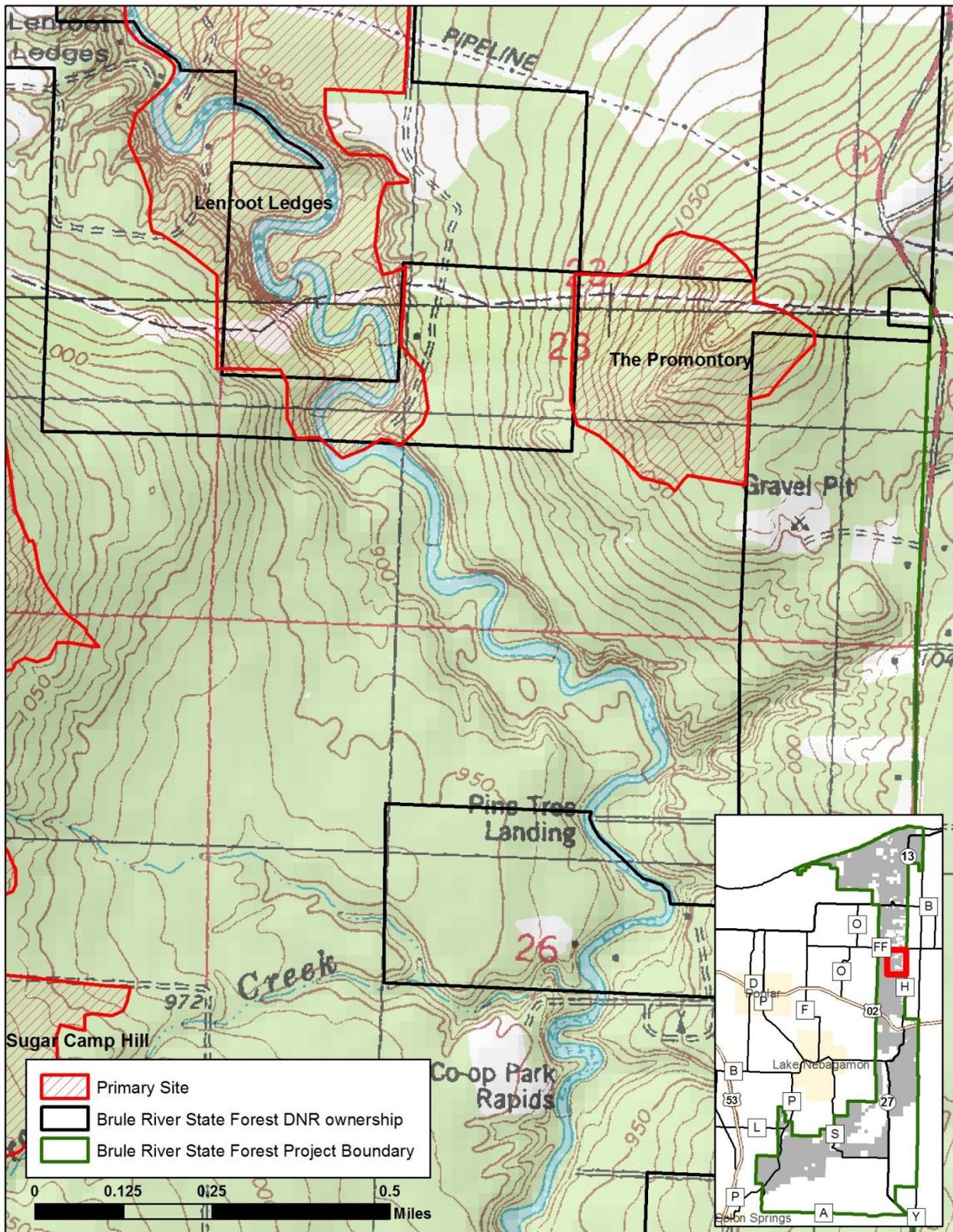
### **Significance of Site**

Bedrock Glade is a rare feature on the BRRSF. Though relatively small, the site supports a special concern sedge known from only one other place on the state forest and found in only six other locations statewide over the past 50 years. This site also harbors a significant diversity of lichens, including the only known location in the state for map lichen (*Rhizocarpon badioatrum*) and the second known location for three other species: elf ear lichen (*Normandina pulchella*), peppered rocktripe lichen (*Umbilicaria deusta*), and grizzled rocktripe lichen (*U. vellea*) (Wetmore 2010). Due to its significant contribution toward lichen conservation in the state, it was recommended for consideration as an Ecological Reference Area (Wetmore 2010).

### **Management Considerations**

Maintaining a partial tree canopy, especially older and larger trees in the Bedrock Glade and on the rock faces will benefit the site. Forest management should consider the abundance of invasives in adjacent areas, high edge and associated deer browse, and extremely shallow soils. Some recently harvested areas adjacent to the site were nearly completely dominated by non-native invasives with very high levels of browse on red oak stump sprouts.

The utility corridors are dominated by invasive species, the most problematic being bird's-foot trefoil which has already invaded portions of the glade. Crown vetch is also present in the rights-of-way, though it is currently less problematic in the high-quality bedrock outcrops. Careful and persistent control of these species is crucial for the long-term conservation value of the site, though care should be taken to avoid herbiciding rare species. The site would benefit from a long-term restoration plan of the utility corridors that eliminates the source of invasive species and encourages native graminoids and wildflowers. Given the sensitivity of the site to invasive plants and the hiking trail leading to the Waino Rock overlook, regular monitoring of the site for unwanted species is also warranted.



**BRRSF21: The Promontory Primary Site.**

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## BRRSF22. LENROOT LEDGES

### **Location**

Landtype Associations:	212Ya01 Douglas Lake-Modified Till Plain
Approximate Size:	246 acres
Approximate Ownership:	WDNR (159 acres), private (87 acres)

### **Description of Site**

This site is located along the Brule River at the southern edge of the Lake Superior Clay Plain just below Sugar Camp Hill. Named for the rapids associated with where the Brule river crosses an outcropping of the Douglas Range, the site also straddles County Highway FF. The terraces along the river and the adjoining slopes support Boreal Forest as well as small but significant stands of Northern Dry-mesic Forest featuring large red and white pines. Boreal Forests are dominated by trembling aspen, scattered supercanopy white pine, white spruce, and occasional northern white-cedar, with a subcanopy of balsam fir, sugar maple, and red maple. Saplings are mostly fir and spruce. Thimbleberry (*Rubus parviflorus*) is the dominant shrub, with large-leaved aster and bunchberry among the common groundlayer associates. Invasive plants are also common, especially garden valerian, garden forget-me-not and king devil. Resident birds include pine warbler, Blackburnian warbler, northern parula warbler, golden-crowned kinglet, and hermit thrush.

### **Significance of Site**

This site contains one of the best examples of forests dominated by mature pine and boreal conifers along the Brule River. Supercanopy pines associated with this site can be clearly seen from the Sugar Camp Hill clay plain overlook. The composition is unusual, but likely representative of the historical river terrace forests and could serve as an ecological reference for river corridor restoration in this portion of the watershed. Together with the Brule River Boreal Forest SNA, this site supports the majority of the known Blackburnian warbler populations on the BRRSF. This species requires mature coniferous forest with high canopy cover consisting of spruce, balsam fir, or hemlock and prefers tall trees. In addition, this site was one of only a handful of upland locations to support Cape May warbler, which prefers mature conifers (especially spruce, but also balsam fir) in a forested setting.

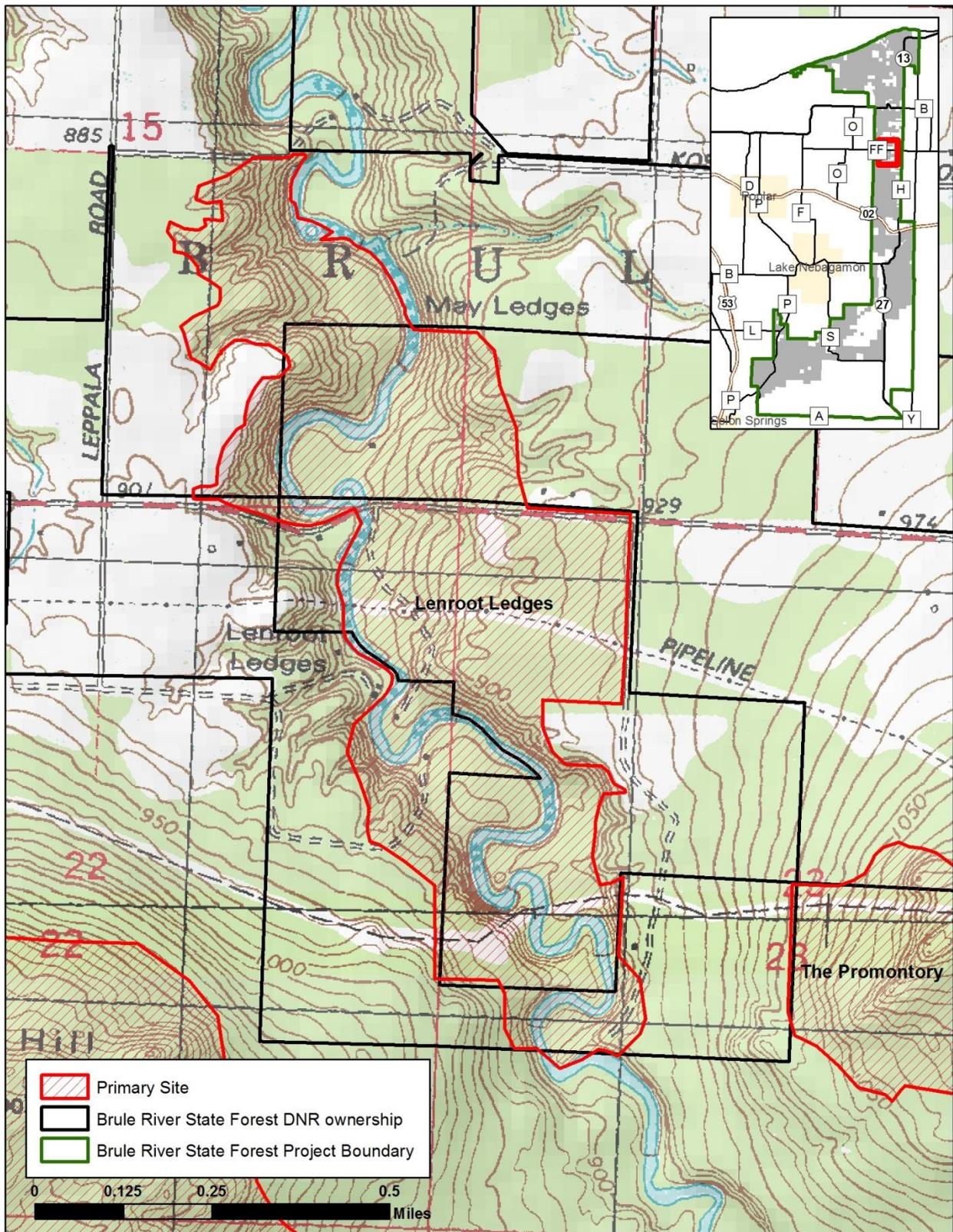
On the aquatic side, this site is also important for a rare herptile that uses both the river edge for basking as well as the adjacent uplands for nesting and foraging. A special concern aquatic invertebrate has also been documented from the Brule River at this site.

### **Management Considerations**

Maintaining a mature canopy of conifers is important for conserving this site. Opportunities for larger scale conservation exist with the potential to connect this site to Sugar Camp Hill and CCC Miller Boreal Forest and Pines just to the southwest by promoting longer-lived conifers and more complex vertical forest structure. Deer densities are also very high at Lenroot Ledges in winter and may impact forest regeneration.

This site is fragmented by County Highway FF and two pipeline corridors. In addition, portions of the site are in private ownership. Invasive species are a concern, with numerous species documented along roads, two-tracks, and the river itself. These include Bell's honeysuckle, reed canary grass, common tansy, garden valerian, Canada thistle, bull thistle, burdock (*Arctium minus*), king devil, and garden forget-me-not. Major problem areas were along Lenroot Road and associated two-tracks, County Highway FF and Koski Road leading down to the river. In addition, common buckthorn (*Rhamnus cathartica*) is known upstream, becoming dense near Brule.

Monitoring and control of this species is a must to prevent the infestation from spreading into this high-quality site.



**BRRSF22: Lenroot Ledges Primary Site.**

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## BRRSF23. BRULE RIVER BOREAL FOREST SNA

### **Location**

Landtype Associations: 212Ya01 Douglas Lake-Modified Till Plain  
Approximate Size: 709 acres  
Approximate Ownership: WDNR (662 acres), private (47 acres)

### **Description of Site**

Situated along the steep slopes and terraces bordering the lower Brule River north of State Highway 13 is a boreal forest in various stages of recovery from past logging. The most mature stands, including a steep-sided ravine along a tributary to the Brule near McNeil's Landing, feature large white pine, white spruce, trembling aspen, balsam fir, balsam poplar (*Populus balsamifera*), and occasionally northern white-cedar on the slopes. White spruce is reproducing well. Younger stands (more common on level areas above and away from the river) are generally dominated by aspen and paper birch, often with an understory of boreal conifers. Shrubs include alder, northern bush honeysuckle, and round-leaved dogwood (*Cornus rugosa*). Characteristic herbs are large-leaved aster, wild sarsaparilla, twinflower, bracken fern, wild strawberry (*Fragaria virginiana*), starflower, and bunchberry. Noteworthy plants found within the boreal forest include buffalo berry (*Shepherdia canadensis*) and purple clematis (*Clematis occidentalis*). Terraces along this stretch of river support swamp hardwood stands composed of black ash and red maple, alder thicket, and sedges bordering the river. Eroding clay bluffs also occur along the edges and slopes of the Brule River and tributary streams. Old fields in this area are being slowly invaded by spruce, fir, white pine, and alder. Resident birds include black-throated green warbler, Blackburnian warbler, Nashville warbler, Canada warbler, mourning warbler, ovenbird, and hermit thrush.

### **Significance of Site**

This site contains the best example of mature conifer-dominated clay plain boreal forest along the Brule River. In addition to warranting continued conservation, the site serves as an Ecological Reference Area for boreal forest restoration in this portion of the watershed. This site is also particularly important for boreal songbirds. This site is also a hotspot for Blackburnian warbler. While not rare, this species is indicative of mature coniferous forest with high canopy cover consisting of spruce, balsam fir, or hemlock and is found both here and at Lenroot Ledges. A special concern gamebird is also found here. A special concern small mammal was also found in good numbers at this site. It is a species with information needs because of suspected declining trends due to inter-specific competition with a more ubiquitous related species. Mature Boreal Forest at the northern portion of the site has also been identified as a Migratory Bird Concentration Area, providing crucial stopover habitat for migrating songbirds as they prepare to make their way to the north shore of Lake Superior.

This site also supports a state threatened herptile as well as a state-threatened rare plant associated with northern wetlands. In addition, a special concern dragonfly is known from the McNeil's Landing area. Finally, this site also harbors the first known collections in the state for a Biatropsis lichen (*Biatropsis usnearum*) and the trabeculate brown-shield lichen (*Melanelia trabeculata*) (Wetmore 2010).

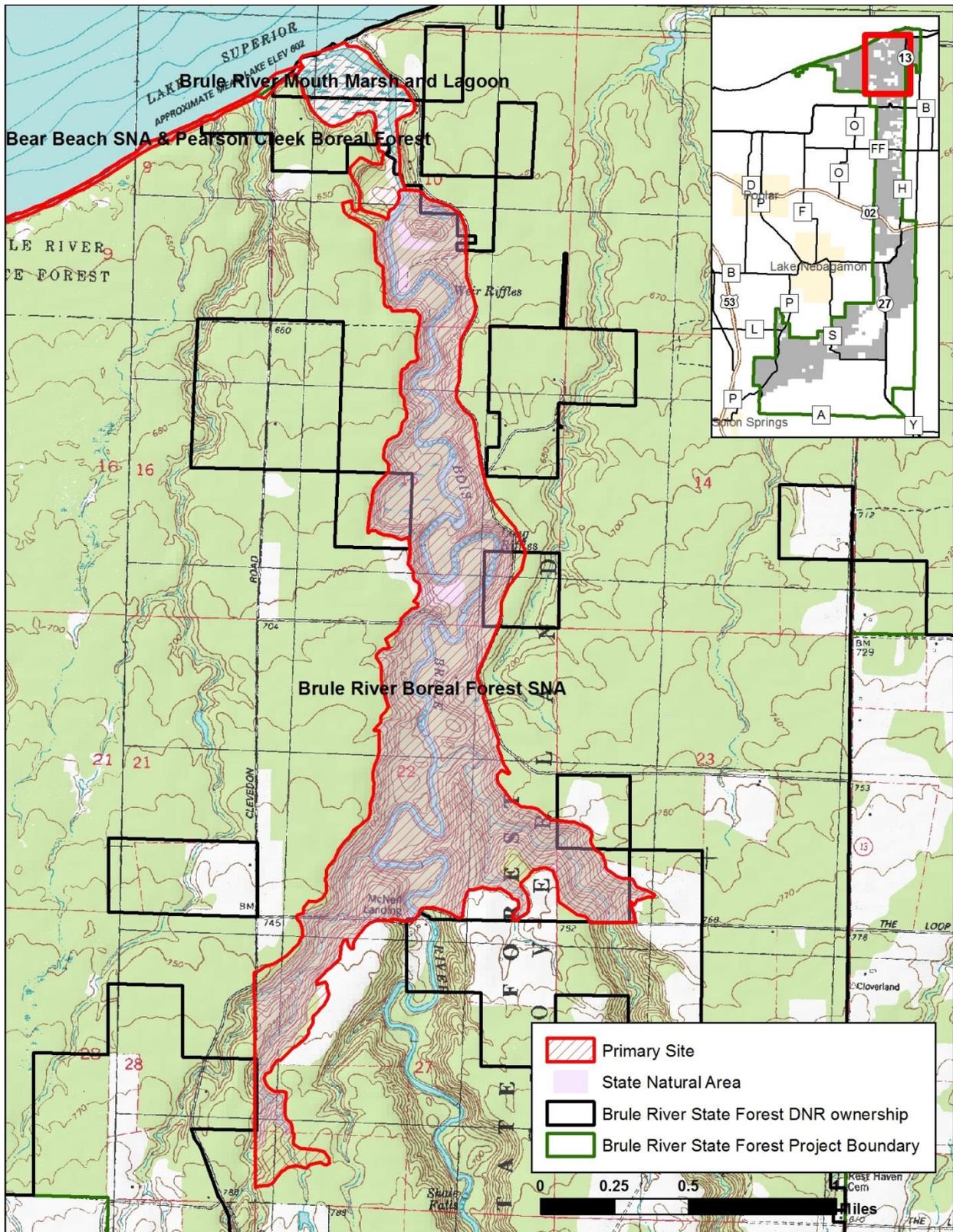
### **Management Considerations**

Maintaining mature conifers is important here and long term management that transitions early successional stands to boreal conifers could also be considered. While species such as white spruce are projected to be vulnerable to climate change in many areas of northern Wisconsin (Janowiak et al. 2014),

this site could serve as a refuge for this and other vulnerable species given its proximity to Lake Superior and to the river corridor, which acts to moderate extremes in local climate.

Experimental conifer regeneration might be considered in some areas of the site, though silvicultural methods alone may not fully achieve those goals due to heavy deer browse and locally dense mats of bluejoint grass. Frozen ground restrictions on logging operations here may sometimes be ineffective, as deep lake-effect snows may insulate the ground, at least locally. The clay soils are very susceptible to compaction, rutting and erosion when the ground is not frozen.

Several invasive species are known from the Brule River Boreal Forest and vicinity. Yellow iris occurs in sparse patches along the Brule River. Garden valerian and common tansy occur on woodland edges, while Bell's honeysuckle was found on either side of McNeil's Landing bridge (LSRI 2006, unpublished data). Canada thistle and bull thistle are also known from numerous road edges, and reed canary grass is known in the vicinity and likely occurs in scattered pockets along the river. Controlling existing infestations, especially at popular access points, will be important to minimizing spread within the site. In addition, common buckthorn is known upstream of the site, and is particularly problematic around and just downstream of Brule. Monitoring and control of this species is a must to prevent the infestation from spreading into this high-quality site.



**BRRSF23: Brule River Boreal Forest SNA Primary Site.**

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## BRRSF24. BRULE RIVER MOUTH MARSH AND LAGOON

### **Location**

Landtype Associations: 212Ya01 Douglas Lake-Modified Till Plain  
Approximate Size: 69 acres  
Approximate Ownership: WDNR (52 acres), private (17 acres)

### **Description of Site**

At the mouth of the Bois Brule River there is a sand spit with a sparsely vegetated beach and small dune system, which separates the waters of Lake Superior from a 35-acre lagoon and marsh complex west of the main channel. The marsh surrounding the lagoon is composed of sedges, bulrushes, bur-reeds, water cinquefoil (*Comarum palustre*), wild calla (*Calla palustris*) and many other wetland plants. A submergent marsh zone of diverse aquatics also exists, dominated by bull-head pond-lily, common spike-rush, stiff arrowhead (*Sagittaria rigida*), water-marigold (*Bidens beckii*), five species of bur-reed and eight species of pondweeds, including several conservative species.

This site is considered a freshwater estuary due to the influence of Lake Superior, including short-term water level changes and related mixing of lake and river water due to seiches and other wind events. It was surveyed intensively by LSRI in 2011 and 2012 as part of the Great Lakes Coastal Wetlands Monitoring Consortium project.

### **Significance of Site**

This site ranks as one of the higher quality estuarine complexes on the south shore of Lake Superior, after only Bark Bay and Lost Creek (LSRI, unpublished data, not including the St. Louis River and Bad River). The beach and river mouth are part of a Migratory Bird Concentration Area and are used by many birds during migration, including several state-endangered waterbirds and rare marsh birds and raptors. The north-south orientation of the northern stretch of the Bois Brule and its proximity to Lake Superior which acts as a natural barrier to migrating birds funnels large numbers of individuals through this corridor. Wetlands provide ideal foraging areas for migrants looking to load up on insects for the remainder of their journey. A special concern marsh bird also occurs in the marsh associated with the lagoon. The low dunes and beach also provide habitat for a state endangered beetle. Finally, the lagoon and lower portion of the Brule River support a rare fish relative as well as uncommon odonates.

As a wetland near the mouth of the Brule catchment, this site serves as a barometer for the health of the watershed. In particular, the degree of sedimentation is closely related to the percentage of open lands, including hayfields and young forest, upstream (Verry et al. 1983, Jereczek et al. 2011).

### **Management Considerations**

Non-native invasive species seem to be increasing in the marsh, with a marked increase observed in percent cover of both narrow-leaf cat-tail (*Typha angustifolia*) and hybrid cat-tail (*T. x glauca*) over a one-year timespan (LSRI 2012, unpublished data). While total cover was still low in 2012, this is cause for concern and may signal changes in the watershed related to an increase in nutrient loading and sedimentation.

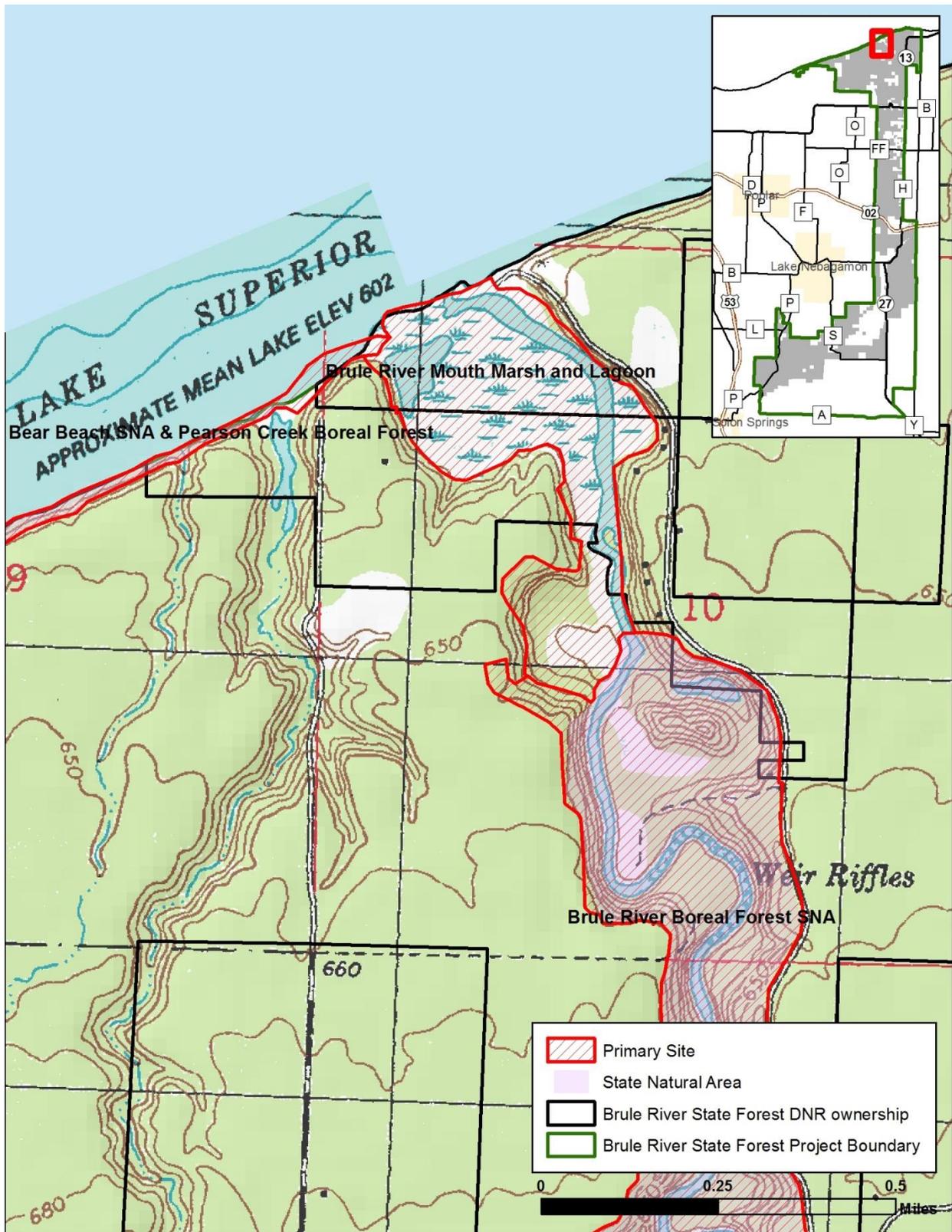
Management of invasive species is crucial for the long-term health of this site. Cat-tails facilitate a transformation of marshes toward higher cat-tail densities by altering the nutrient status of the

substrate, aggressively spreading via rhizomes, producing dense thatch, and generally outcompeting native sedges and rushes. Nutrient loading and sedimentation exacerbate this problem. Aggressive control of cat-tails may be warranted. In addition, the BRRSF may want to consider partnering with citizen-based monitoring programs to track nutrients and sediments at various points in the watershed, including at the river mouth.

The health of the marsh and lagoon is directly related to upstream landuse and management in the watershed. Forest managers should also consider recommendations outlined in *Managing Woodlands on Lake Superior's Red Clay Plain: Slowing the Flow of Runoff to protect the flagship Brule fishery and river ecosystem that supports it* (WDNR2007).



Low dunes and beach at the mouth of the Brule River, with clay sediment visible in Lake Superior. Photo by Ryan O'Connor, WDNR (taken in 2010).



**BRRSF24: Brule River Mouth Marsh and Lagoon Primary Site.**

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## **BRRSF25. BEAR BEACH SNA AND PEARSON CREEK BOREAL FOREST**

### ***Location***

Landtype Associations: 212Ya01 Douglas Lake-Modified Till Plain  
Approximate Size: 148 acres  
Approximate Ownership: WDNR, with portions of shoreline above the Ordinary High-water Mark in private ownership

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

Bear Beach SNA stretches 6.5 miles from the Brule River mouth to west of Pearson Creek and contains extensive stretches of undeveloped beach along the Lake Superior shore. The beaches are mostly sandy, and are unvegetated due to their exposure to wave and ice action. Locally, there are small pockets of cobblestones and driftwood. The site also includes slumping clay banks that contain uncommon combinations of plants and animals. The erosion of the clay banks here is a partially natural process, and the site will continue to change over time. The uplands above the beach are vegetated with speckled alder and a rather open forest of trembling aspen. Scattered white spruce, white pine, and balsam fir are present but not common. Paper birch is locally dominant, especially on bluffs bordering the lower reaches of some of the small tributary streams flowing directly into Lake Superior. Several of these streams terminate in small estuarine lagoons at the lake.

Pearson Creek is a small, fair-quality Boreal Forest on the Superior clay plain immediately adjacent to Lake Superior. The canopy is 30-70% closed and composed mainly of aspen and white spruce that averages 16 inches in dbh (with a maximum of an impressive 33 inches). Snags are scattered and relatively frequent, a good sign of increasing structural diversity and future coarse woody debris on the forest floor for wildlife species. The groundlayer is dominated by bluejoint grass, thimbleberry, large-leaved aster, and wild sarsaparilla. Notable is the significant amount of spruce regeneration. There were a number of invasive species present on the site, although all were uncommon to occasional. A portion of the site that appears to occasionally hold water is dominated by black ash.

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

Bear Beach is one of the largest stretches of undeveloped shoreline in state of Wisconsin ownership on the mainland of Lake Superior. During migration periods this area is used for foraging and resting by terns, shorebirds, gulls, snow buntings, water pipits and others, sometimes in substantial numbers. Bear sign has been observed on the beach and in the adjacent thickets. As development pressures on shoreline habitats are high and increasing in northern Wisconsin, this site merits continued protection in an undeveloped state. The low dunes and beach also provide habitat for a state endangered beetle. This is one of only a handful of known sites in the state for this species, and in the mid-2000s was the largest known population west of the Apostle Islands (Steffens 2014)

Pearson Creek represents one of the few remaining stands of modest quality Boreal Forest outside of the Brule River corridor. Though small, it can serve as a potential model for the recovery of boreal conifers as well as a seed source for adjacent areas. The lower reaches of the creek also support a special concern dragonfly.

### ***Management Considerations***

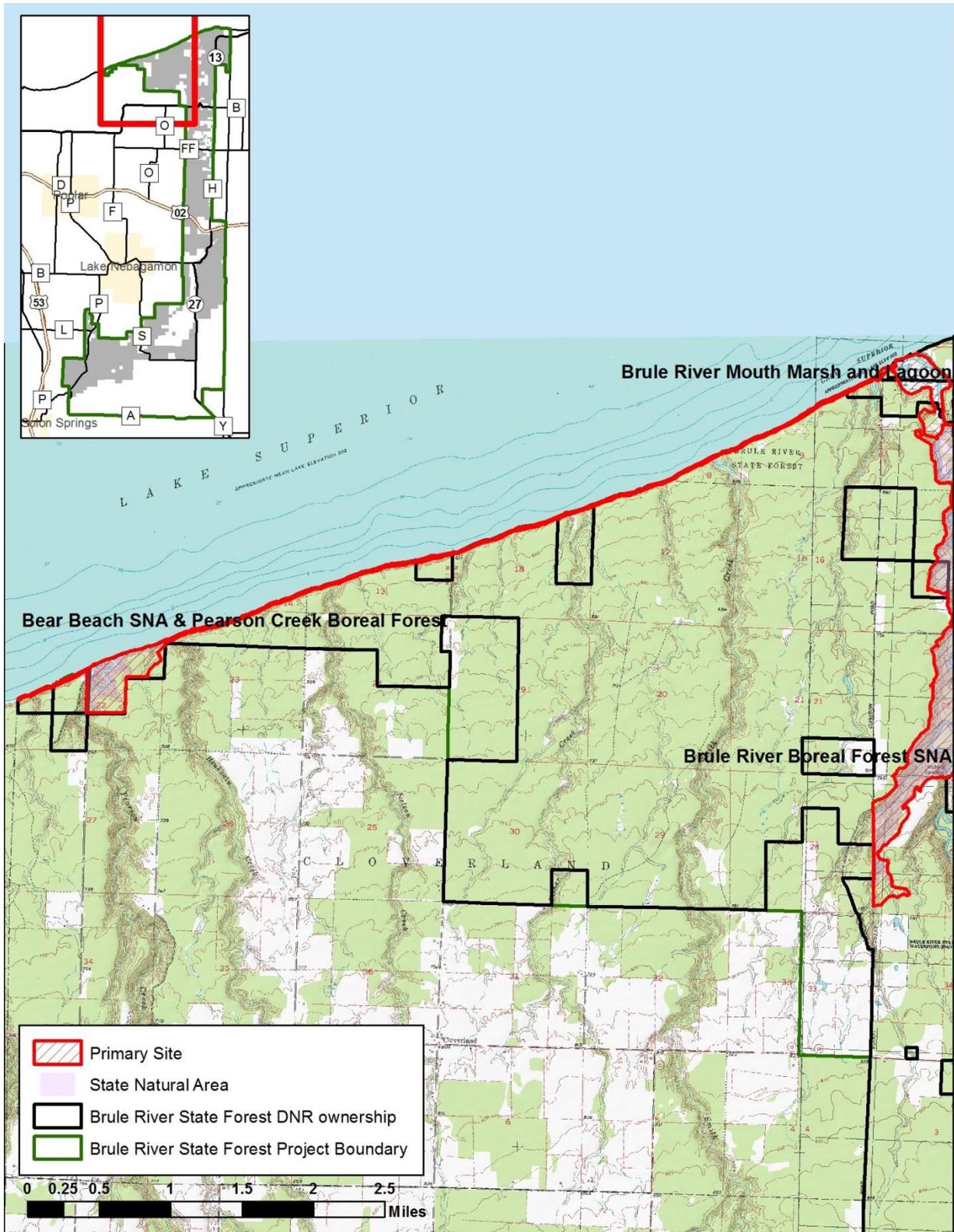
The uplands in and adjacent to this site have been highly altered by past land use activities. Some of the slopes above the shoreline are unstable, with noticeable seepages. In a few areas raw, eroding slumps are depositing clay sediments directly onto the beach or into the lake waters. While this is partially a natural process, historical forest clearing has exacerbated the problem.

Existing water quality BMPs should be evaluated to determine if they are sufficient for preventing erosion of clay bluffs along Lake Superior and associated tributary ravines. For stands that are actively managed, consider recommendations outlined in *Managing Woodlands on Lake Superior's Red Clay Plain: Slowing the Flow of Runoff* to protect the flagship Brule fishery and river ecosystem that supports it (WDNR2007). In particular, seepage along sand lenses embedded in the clay can create slippage zones prone to slumping. Removal of the tree canopy may alter evapotranspiration rates and lead to higher infiltration, which could increase the risk of bank failure. In addition, clay soils are at a high risk of compaction during forest management activities, and areas with disturbed ground are at a high risk of erosion.

A number of invasive species are present at Pearson Creek, though all are uncommon to occasional with low cover values. These include hedge-nettle, burdock, garden valerian, reed canary grass, and Canada thistle. Finally, the beach along the mouth of Pearson Creek is used as an informal campground, which may present issues related to trash, erosion, and invasive species introductions.



Bear Beach Primary Site west of Brule River mouth, off Clevedon Road. Photo by Wayne P. Steffens.



**BRRSF25: Bear Beach SNA Primary Site.**

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## LIST OF SPECIES REFERRED TO BY COMMON NAME

<b>Plants</b>	
a <i>Biatora</i> lichen	<i>Biatora longispora</i>
a <i>Biatoropsis</i> lichen	<i>Biatoropsis usnearum</i>
a <i>Caloplaca</i> lichen	<i>Caloplaca parvula</i>
a <i>Rimularia</i> lichen	<i>Rimularia caeca</i>
alder-leaved buckthorn	<i>Rhamnus alnifolia</i>
American fly honeysuckle	<i>Lonicera canadensis</i>
American hazelnut	<i>Corylus americana</i>
American speedwell	<i>Veronica beccabunga</i> var. <i>americana</i>
bald spike-rush	<i>Eleocharis erythropoda</i>
balsam fir	<i>Abies balsamea</i>
balsam poplar	<i>Populus balsamifera</i>
barren-strawberry	<i>Geum fragarioides</i>
basswood	<i>Tilia americana</i>
beaked hazelnut	<i>Corylus cornuta</i>
bearberry	<i>Arctostaphylos uva-ursi</i>
Bebb's oval sedge	<i>Carex bebbii</i>
Bell's honeysuckle	<i>Lonicera x bella</i>
big bluestem	<i>Andropogon gerardii</i>
big-leaved aster	<i>Eurybia macrophylla</i>
big-tooth aspen	<i>Populus grandidentata</i>
bird's-foot trefoil	<i>Lotus corniculatus</i>
bird's-foot violet	<i>Viola pedata</i>
black ash	<i>Fraxinus nigra</i>
black spruce	<i>Picea mariana</i>
bladderworts	<i>Utricularia</i> spp.
blazing star	<i>Liatris</i> sp.
blue-bead-lily	<i>Clintonia borealis</i>
bluejoint grass	<i>Calamagrostis canadensis</i>
bogbean	<i>Menyanthes trifoliata</i>
bottlebrush sedge	<i>Carex hystericina</i>
bracken fern	<i>Pteridium aquilinum</i>
bristly sedge	<i>Carex comosa</i>
broad-leaved arrowhead	<i>Sagittaria latifolia</i>
broad-leaved wooly sedge	<i>Carex pellita</i>
buffalo berry	<i>Shepherdia canadensis</i>
bull thistle	<i>Cirsium vulgare</i>
bull-head pond-lily	<i>Nuphar variegata</i>
bunchberry	<i>Cornus canadensis</i>
bur oak	<i>Quercus macrocarpa</i>
burdock	<i>Arctium minus</i>
bur-reed	<i>Sparganium</i> sp.
Canada mayflower	<i>Maianthemum canadense</i>
Canada thistle	<i>Cirsium arvense</i>

<b>Plants</b>	
Canada yew	<i>Taxus canadensis</i>
Canadian rush	<i>Juncus canadensis</i>
chestnut sedge	<i>Carex castanea</i>
cinnamon fern	<i>Osmunda cinnamomea</i>
club-moss	<i>Lycopodium</i> sp.
common bladderwort	<i>Utricularia vulgaris</i>
common buckthorn	<i>Rhamnus cathartica</i>
common buttercup	<i>Ranunculus acris</i>
common dewberry	<i>Rubus flagellaris</i>
common forget-me-not	<i>Myosotis scorpioides</i>
common goldenrod	<i>Solidago canadensis</i>
common polypody	<i>Polypodium virginianum</i>
common reed	<i>Phragmites australis</i>
common speedwell	<i>Veronica officinalis</i>
common spike-rush	<i>Eleocharis palustris</i>
common St. John's-wort	<i>Hypericum perforatum</i>
common tansy	<i>Tanacetum vulgare</i>
common water-starwort	<i>Callitriche palustris</i>
common waterweed	<i>Elodea canadensis</i>
common yellow lake sedge	<i>Carex utriculata</i>
cotton-grass	<i>Eriophorum</i> sp.
crested shield fern	<i>Dryopteris cristata</i>
crown vetch	<i>Securigera varia</i>
dot lichen	<i>Micarea melanobola</i>
dwarf red raspberry	<i>Rubus pubescens</i>
dwarf water-milfoil	<i>Myriophyllum tenellum</i>
early low blueberry	<i>Vaccinium angustifolium</i>
eastern hemlock	<i>Tsuga canadensis</i>
elf-ear lichen	<i>Normandina pulchella</i>
Elizabeth's pelt lichen	<i>Peltigera elisabethae</i>
false water-pepper	<i>Polygonum hydropiperoides</i>
false-dandelion	<i>Krigia biflora</i>
Farwell's water-milfoil	<i>Myriophyllum farwellii</i>
few-seeded sedge	<i>Carex oligosperma</i>
garden forget-me-not	<i>Myosotis sylvatica</i>
flat-leaved bladderwort	<i>Utricularia intermedia</i>
fowl manna grass	<i>Glyceria striata</i>
fragrant water-lily	<i>Nymphaea odorata</i>
garden valerian	<i>Valeriana officinalis</i>
glossy buckthorn	<i>Frangula alnus</i>
gold dust lichen	<i>Chrysothrix candelaris</i>
goldthread	<i>Coptis trifolia</i>
goutweed	<i>Aegopodium podagraria</i>
grass-leaved goldenrod	<i>Euthamia graminifolia</i>
great water dock	<i>Rumex britannica</i>
green bog sedge	<i>Carex brunnescens</i>
grizzled rocktripe lichen	<i>Umbilicaria vellea</i>

<b>Plants</b>	
hairy woodrush	<i>Luzula acuminata</i>
hairy-leaved lake sedge	<i>Carex atherodes</i>
hard-stem bulrush	<i>Schoenoplectus acutus</i>
hazelnut	<i>Corylus</i> sp.
hemp-nettle	<i>Galeopsis tetrahit</i>
high-bush cranberry	<i>Viburnum trilobum</i>
hoary puccoon	<i>Lithospermum canescens</i>
hybrid cat-tail	<i>Typha x glauca</i>
ironwood	<i>Ostrya virginiana</i>
jack pine	<i>Pinus banksiana</i>
Kentucky bluegrass	<i>Poa pratensis</i>
king devil	<i>Hieracium caespitosum</i>
Labrador-tea	<i>Rhododendron groenlandicum</i>
lady fern	<i>Athyrium filix-femina</i>
lake sedge	<i>Carex lacustris</i>
large-leaved pondweed	<i>Potamogeton amplifolius</i>
leatherleaf	<i>Chamaedaphne calyculata</i>
leatherwood	<i>Dirca palustris</i>
little bluestem	<i>Schizachyrium scoparium</i>
long-stalk sedge	<i>Carex pedunculata</i>
map lichen	<i>Rhizocarpon badioatrum</i>
marsh marigold	<i>Caltha palustris</i>
meadowsweet	<i>Spiraea alba</i>
Michigan lily	<i>Lilium michiganense</i>
mountain maple	<i>Acer spicatum</i>
naiads	<i>Najas</i> spp.
naked miterwort	<i>Mitella nuda</i>
narrow-leaf cat-tail	<i>Typha angustifolia</i>
narrow-leaved cow wheat	<i>Melampyrum lineare</i>
narrow-leaved woolly sedge	<i>Carex lasiocarpa</i>
narrow-panicle rush	<i>Juncus brevicaudatus</i>
needle spike-rush	<i>Eleocharis acicularis</i>
northern bush-honeysuckle	<i>Diervilla lonicera</i>
northern pin oak	<i>Quercus ellipsoidalis</i>
Oakes' pondweed	<i>Potamogeton oakesianus</i>
orange hawkweed	<i>Hieracium aurantiacum</i>
pale corydalis	<i>Capnoides sempervirens</i>
panicled bulrush	<i>Scirpus microcarpus</i>
paper birch	<i>Betula papyrifera</i>
partridgeberry	<i>Mitchella repens</i>
Pennsylvania sedge	<i>Carex pennsylvanica</i>
peppered rocktripe lichen	<i>Umbilicaria deusta</i>
pitcher plant	<i>Sarracenia purpurea</i>
pod-grass	<i>Scheuchzeria palustris</i>
pondweeds	<i>Potamogeton</i> spp.
poverty oats	<i>Danthonia spicata</i>
prairie brome	<i>Bromus kalmii</i>

<b>Plants</b>	
prairie willow	<i>Salix humilis</i>
puccoon	<i>Lithospermum</i> sp.
purple clematis	<i>Clematis occidentalis</i>
purple loosestrife	<i>Lythrum salicaria</i>
pussy willow	<i>Salix discolor</i>
pussy-toes	<i>Antennaria</i> sp.
rattlesnake manna grass	<i>Glyceria canadensis</i>
red maple	<i>Acer rubrum</i>
red oak	<i>Quercus rubra</i>
red pine	<i>Pinus resinosa</i>
red-osier dogwood	<i>Cornus sericea</i>
reed canary grass	<i>Phalaris arundinacea</i>
reed manna grass	<i>Glyceria grandis</i>
rim lichen	<i>Lecanora minutella</i>
rimmed shingle lichen	<i>Fuscopannaria leucosticta</i>
rose twisted-stalk	<i>Streptopus lanceolatus</i>
rough-leaved rice grass	<i>Oryzopsis asperifolia</i>
round-leaf sundew	<i>Drosera rotundifolia</i>
round-leaved dogwood	<i>Cornus rugosa</i>
round-leaved monkey-flower	<i>Mimulus glabratus</i>
round-lobed hepatica	<i>Anemone americana</i>
royal fern	<i>Osmunda regalis</i>
rusty woodsia	<i>Woodsia ilvensis</i>
sand cherry	<i>Prunus pumila</i>
sensitive fern	<i>Onoclea sensibilis</i>
serviceberry	<i>Amelanchier</i> sp.
seven-angle pipewort	<i>Eriocaulon aquaticum</i>
Siberian iris	<i>Iris sibirica</i>
slender pondweed	<i>Potamogeton pusillus</i>
slender sedge	<i>Carex leptalea</i>
small bladderwort	<i>Utricularia minor</i>
small waterwort	<i>Elatine minima</i>
sneezewort	<i>Achillea ptarmica</i>
snowberry	<i>Symphoricarpos albus</i>
soft rush	<i>Juncus effusus</i>
soft-stem bulrush	<i>Schoenoplectus tabernaemontani</i>
speckled alder	<i>Alnus incana</i> spp. <i>rugosa</i>
spotted knapweed	<i>Centaurea stoebe</i> subsp. <i>micranthos</i>
Sprengel's sedge	<i>Carex sprengelii</i>
starflower	<i>Trientalis borealis</i>
stiff arrowhead	<i>Sagittaria rigida</i>
stoneworts	<i>Nitella</i> spp.
sugar maple	<i>Acer saccharum</i>
sweet gale	<i>Myrica gale</i>
sweet-fern	<i>Comptonia peregrina</i>
tamarack	<i>Larix laricina</i>
thimbleberry	<i>Rubus parviflorus</i>

<b>Plants</b>	
three-leaf Solomon's-seal	<i>Maianthemum trifolium</i>
three-toothed cinquefoil	<i>Sibbaldiopsis tridentata</i>
three-way sedge	<i>Dulichium arundinaceum</i>
touch-me-not	<i>Impatiens</i> sp.
trabeculate brown-shield lichen	<i>Melanelia trabeculata</i>
trembling aspen	<i>Populus tremuloides</i>
tussock sedge	<i>Carex stricta</i>
twinflower	<i>Linnaea borealis</i>
two-seeded bog sedge	<i>Carex disperma</i>
variable-leaved pondweed	<i>Potamogeton gramineus</i>
water bulrush	<i>Schoenoplectus subterminalis</i>
water cinquefoil	<i>Comarum palustre</i>
watercress	<i>Nasturtium officinale</i>
water-marigold	<i>Bidens beckii</i>
water-shield	<i>Brasenia schreberi</i>
western sunflower	<i>Helianthus occidentalis</i>
white ash	<i>Fraxinus americana</i>
white beak-rush	<i>Rhynchospora alba</i>
white pine	<i>Pinus strobus</i>
white spruce	<i>Picea glauca</i>
white-cedar	<i>Thuja occidentalis</i>
wild calla	<i>Calla palustris</i>
wild sarsaparilla	<i>Aralia nudicaulis</i>
wild strawberry	<i>Fragaria virginiana</i>
willows	<i>Salix</i> spp.
winterberry	<i>Ilex verticillata</i>
wintergreen	<i>Gaultheria procumbens</i>
wood lily	<i>Lilium philadelphicum</i>
wood millet	<i>Milium effusum</i>
wool-grass	<i>Scirpus cyperinus</i>
yellow birch	<i>Betula alleghaniensis</i>

<b>Animals</b>	
American Robin	<i>Turdus migratorius</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Black-and-white Warbler	<i>Mniotilta varia</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Blackburnian Warbler	<i>Setophaga fusca</i>
Black-throated Green Warbler	<i>Setophaga virens</i>
Blue-spotted Salamander	<i>Ambystoma laterale</i>
Broad-winged Hawk	<i>Buteo platypterus</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Bufflehead	<i>Bucephala albeola</i>
Canada Warbler	<i>Cardellina canadensis</i>
Cape May Warbler	<i>Setophaga tigrina</i>
Common Raven	<i>Corvus corax</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Deer Mouse	<i>Peromyscus maniculatus</i>
Evening Grosbeak	<i>Coccothraustes vespertinus</i>
Four-toed Salamander	<i>Hemidactylum scutatum</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>
Hermit Thrush	<i>Catharus guttatus</i>
Mourning Warbler	<i>Geothlypis philadelphia</i>
Nashville Warbler	<i>Leiothlypis ruficapilla</i>
Northern Parula	<i>Setophaga americana</i>
Osprey	<i>Pandion haliaetus</i>
Ovenbird	<i>Seiurus aurocapilla</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>
Pileated Woodpecker	<i>Hylatomus pileatus</i>
Pine Warbler	<i>Setophaga pinus</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
Red-winged Crossbill	<i>Loxia curvirostra</i>
River Otter	<i>Lontra canadensis</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Sedge Wren	<i>Cistothorus platensis</i>
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>
Song Sparrow	<i>Melospiza melodia</i>
Sora	<i>Porzana carolina</i>
Spotted Salamander	<i>Ambystoma maculatum</i>
Swamp Sparrow	<i>Melospiza georgiana</i>
Veery	<i>Catharus fuscescens</i>
White-footed Mouse	<i>Peromyscus leucopus</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
Wood Frog	<i>Lithobates sylvaticus</i>
Wood Thrush	<i>Hylocichla mustelina</i>