A Baseline Inventory (1995-97) and Analysis of Natural Communities, Rare Plants and Animals, Aquatic Invertebrates, and other Selected Features in Preparation for State Forest Master Planning

Biotic Inventory and Analysis of the Brule River State Forest

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Introduction

Project Purpose and Objectives

This report presents the results of a three-year project (1995-97) to inventory and analyze selected biotic resources of the Bois Brule River State Forest (BRSF) and the surrounding landscape. This project was undertaken by the Natural Heritage Inventory (NHI) section of the Wisconsin Department of Natural Resources' (WDNR) Bureau of Endangered Resources in cooperation with the Bureau of Forestry to provide baseline ecological information relevant to the development of a new property Master Plan for the Forest. This inventory and analysis is one of a number of assessments undertaken to prepare for state forest master planning. The information provided in these reports will consolidate background information useful for property master planning and other applications.

The primary objectives of this project were:

- The identification and evaluation of natural communities.
- The identification and evaluation of rare plant and animal populations.
- The identification and evaluation of selected aquatic features.
- The identification of sites appropriate for the restoration of lost or declining communities or habitats.
- To highlight especially important protection, management, and restoration opportunities, including both unique and representative natural features of the Brule landscape.
- The interpretation and transfer of the information gathered to the property master planning team, and ultimately to managers, administrators, and others involved in the implementation of land use decisions on the state forest.

Future inventory and monitoring of the biotic resources of the BRSF will be ongoing and periodic, based on needs identified in the master plan. Monitoring priorities will be established in the master plan, with adjustments made to accommodate new information using the principles of adaptive management.

Background on Past Efforts

The Bois Brule River (Brule River) was the subject of a substantial research effort coordinated by the Wisconsin Academy of Sciences, Arts, and Letters in the early 1940s. This study covered hydrology, geology, vegetation, and fisheries and provided valuable baseline information for the state forest and river. Since then, scientific examinations of the area have focused on the fishery resource (e.g., Dubois and Pratt, 1994), although plant ecology (Blewett, 1976), bryophytes (Bowers, 1996), and aquatic invertebrates (DuBois, 1993) have received some attention.

Although the Wisconsin Natural Heritage Inventory had compiled records on the occurrences of plants, animals, and natural communities of the study area from these and many other sources, no comprehensive survey of rare plants and animals had been conducted on the property prior to the current study. Our ability to establish a regional context and significance for the natural features of the BRSF has been greatly enhanced by the results of other recent biological survey work in the region. These projects have included: coastal wetlands inventory of Wisconsin's Lake Superior basin; St. Louis River wetland

evaluations; City of Superior rare plant survey; Apostle Island National Lakeshore surveys (for many taxa); Northern Highland-American Legion State Forest inventory; various Chequamegon-Nicolet National Forest projects; and the statewide breeding bird atlas.

Description of Study Area

The Brule River, located in Douglas County in northwestern Wisconsin, flows north and drains into Lake Superior (Figure 1). The entire 44-mile length of the river is contained within the approximately 40,000-acre BRSF boundary, a unique situation for a stream of this size. Though many privately owned tracts occur within the forest, the vast majority of owners have a strong interest in protecting the river, its watershed, and the area's natural beauty. This situation affords an excellent opportunity to achieve desired management and protection goals throughout much of the Brule River ecosystem.

A stable flow regime and cool summer water temperatures are among the major physical factors responsible for the ability of this riparian system to sustain its renowned coldwater fishery (DuBois et al., 1994). Glacial Lake Duluth, a predecessor of Lake Superior, formerly drained to the south and southwest, and partially created the present Brule and St. Croix River valleys. This unique post-glacial history, the river's steep-walled valley, the relative absence of development, and the exceptionally rich biota make this river system unlike any other in the region.

Like the rest of northern Wisconsin, the Brule landscape was subjected to catastrophic logging, often associated with severe fire, in the latter half of the nineteenth century and sporadically into the twentieth century. These events had dramatic impacts on the lands and waters of the study area and are still apparent today. In presenting these findings, we do not intend to criticize past or present use of the land, but rather to point out or emphasize particular protection and management opportunities for the future.

Ecoregions of the BRSF

The Brule River crosses three distinct ecoregions (Bailey, 1995), each of which is briefly described below and illustrated in Figure 2. Each ecoregion demonstrates unifying attributes that we have found useful in planning and structuring our fieldwork. Among ecoregional subsections (the level in the ecoregion hierarchy we reference), there are basic differences in geomorphic process, surface geology, lithology, and some soil and vegetation characteristics. Much more detailed information on ecoregions will be included in the Northern State Forest Assessments (WDNR, in progress, 1999), particularly in the reports entitled "Regional Ecology" and the soon to be released "Community Restoration and Old-growth."

Bayfield Sand Barrens (subsection 212Ka)

The Bayfield Sand Barrens ecoregion encompasses the headwaters of both the Bois Brule and St. Croix rivers and is characterized by sandy, nutrient-poor soils, level to steeply rolling topography, and local concentrations of kettle lakes and boggy depressions. Historically, this region supported extensive pine barrens and xeric pine-oak forests. Today, plantation-grown monocultures of pine constitute the most widespread vegetative cover.

Mille Lacs Uplands (subsection 212Kb)

The Mille Lacs Uplands ecoregion occurs primarily in Minnesota, extending into Wisconsin as a “wedge” between the Bayfield Sand Barrens and the Lake Superior Clay Plain. The rolling ground moraine supports a high diversity of habitat types, but the present vegetation of the uplands is mostly aspen forest. A ridge of igneous bedrock forms the northern boundary of this ecoregion and supports one of the few relatively extensive areas of northern hardwoods forest (sugar maple, basswood, red oak, white ash) in and around the BRSF.

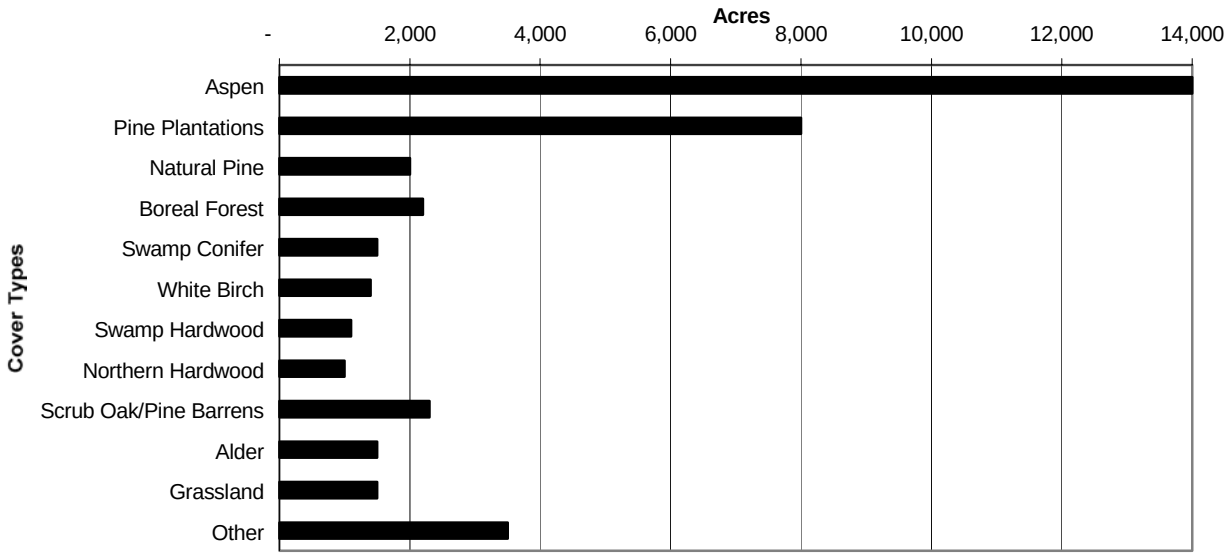
Lake Superior Clay Plain (subsection 212Ja)

Attributes of the Lake Superior Clay Plain ecoregion include level to gently sloping topography, heavy red clay soils, short steep-sided stream valleys, and a cool, moist climate moderated by the proximity of Lake Superior. This region contained Wisconsin's most extensive acreage of presettlement boreal (spruce-fir) forest. Virtually all of this forest was cut and burned, and, in most areas, aspen has replaced the boreal conifers. The present regional forest has been significantly fragmented due to the widespread conversion of forested lands to fields and pastures.

Generalized Land Cover

The boundary of the BRSF encompasses approximately 50,000 acres of land, of which roughly 10,000 acres are privately owned. The remaining 40,000 acres of public lands are vegetated primarily by aspen and pine plantation cover types, with smaller amounts of natural conifer and hardwood forests, grasslands, open water, and developed use cover types. Graph 1 depicts the acreage figures for each land cover type for state-owned lands only. Aspen and pine plantation cover types account for 55 percent of the total land area and over 70 percent of the forested lands on the state forest.

Graph 1. Land Cover Types of the BRSF



Source: Brule River State Forest Compartment Reconnaissance - December, 1998

We present these figures to give the reader a generalized overview of the study area's vegetation. Within any of these cover types, individual stands will exhibit differences in composition and in management potential.

Lands Surrounding the BRSF

Lands around the BRSF are mostly privately owned, including large tracts of industrial forest near both the headwaters and mouth of the Brule River. Small farms are common in the Lake Superior Clay Plain.

Douglas and Bayfield Counties own most public lands bordering the BRSF. The Douglas County lands, located west of the state forest, include the extensive and biologically rich "Blueberry Swamp". In addition, Douglas County lands contain one of the few relatively substantial acreages of northern hardwoods forest in the region, on the same bedrock ridge as the BRSF's "Sugar Camp Hill". Some of the state-owned lands along Highway 13 are not part of the state forest (see "State Highway 13 Grasslands" in Appendix B).

Pine plantations are very common on the sandy Bayfield County lands located to the east of the BRSF. There are some dry forest and barrens remnants on these county forest lands, but none of high ecological significance was found in the immediate vicinity of the BRSF.

Overview of Methods

Field Surveys

Reconnaissance surveys were conducted on the BRSF in 1995 by NHI ecologist Eric Epstein and botanist Dr. Emmet Judziewicz. These preliminary surveys identified those natural communities, aquatic features, and rare priority taxa warranting a more detailed inventory. Various experts conducted the detailed inventories during 1996. A limited number of surveys were conducted in 1997 to fill gaps in phenology and to more thoroughly cover some sites. Standard Natural Heritage Inventory methodology was used along with accepted protocol and procedures for the various taxa. Prior to entering the field, the following methods were used to assess the biological diversity of the BRSF. Greater details of these methods are explained in Appendix A. Detailed discussions of the field survey methods for natural communities, plants, and animals are in Appendices D, E, and F, respectively.

- Compilation of existing file information on the study area from sources both within and outside of the DNR.
- Literature review.
- Development of a target list of natural communities, rare plants and animals, waterbodies, and other significant natural features for the study area.
- Map compilation and development of a base map of the study area.
- Aerial photograph examination and interpretation.
- Original Land Survey Notes examination and interpretation.
- Interviews with experts (scientists, naturalists, land managers) knowledgeable about the study area.
- Information sharing among project participants.

- Aerial reconnaissance (fly-over).
- Analysis of information gathered and project planning.

Natural Heritage Inventory Overview

The BRSF inventory and analysis were conducted by the Wisconsin Natural Heritage Inventory program, which is part of an international network of NHI programs. The defining characteristic of this network, and the feature that unites the programs, is the use of a standard methodology for collecting, processing, and managing data on the occurrences of natural biological diversity. This network of data centers was established, and is currently coordinated by, The Nature Conservancy, an international non-profit organization.

The Natural Heritage Inventory programs focus on rare species, natural communities, and other rare elements of nature. When NHI programs are established, one of the first tasks facing the staff is to consolidate existing information on the status and location of rare elements. Before proceeding, the NHI program must determine what elements warrant "tracking" and which are more common. Similar to most states, Wisconsin biologists had a general idea of which species in the better-studied taxonomic groups (e.g., mammals, birds, and vascular plants) were rare or declining. For less-studied groups such as macroinvertebrates, the process of assembling the list of species to track and gathering the data were quite dynamic. Initially, NHI staff cast a wide net, collecting data on many species from existing sources (e.g., scientific literature, field guides, books, maps, and museum collections) as well as from direct contact with experts throughout the state. As more data were gathered, it was clear that some species were more common than originally thought and the NHI program stopped collecting data on them. Thus, the list of which elements are tracked, the NHI Working List, changes over time as species' populations change (both up and down) and as our knowledge about their status and distribution increases. This evolution continues today, with the NHI Working List typically going through several revisions a year. The current Wisconsin Natural Heritage Working List for the State of Wisconsin dated March 17, 1999 is found in Appendix G.

In general, there are two approaches to surveying biodiversity: (1) those focused on locating occurrences of particular elements, and (2) those focused on assessing the components of a particular area. The latter approach employs a "top down" analysis that begins with an assessment of the natural communities and aquatic features present, their relative quality and condition, the surrounding landscape pattern, and current land use and results in the identification of future species-oriented surveys. This approach, commonly referred to as “coarse filter-fine filter,” concentrates inventory efforts on those sites most likely to contain target species. It also allows sites to be placed in a larger, landscape context for more broad applications of ecosystem management principles.

The BRSF inventory used the top-down, coarse filter-fine filter approach. The initial analysis assessed the entire region and determined the important ecological attributes and the biological processes supporting them. Criteria to evaluate sites were established and then vegetative communities were identified and characterized. Based upon existing habitat characteristics and known habitat preferences of various rare species, sites where species-specific surveys were most appropriate were identified***. No doubt, occurrences of rare species exist that were not located through these inventories.*** However, by concentrating inventory efforts on the highest quality or otherwise suitable sites, it is most likely that the populations with the highest conservation value were located.

The NHI methodology for organizing and storing data is actually a system of three inter-related data storage techniques: structured manual information files, topographic map files, and a computer database

that integrates the various information. The computer component, known as the Biological & Conservation Data System, was developed by The Nature Conservancy for use by the Heritage Network. It is a sophisticated relational database management application built upon the Advanced Revelation application environment. Owing to the diversity and complexity of the information managed--from species taxonomy and ecosystem classification to real estate transactions--the system contains 36 database files and more than 2,000 information fields. The data in the Biological & Conservation Data System populate the NHI Geographic Information System.

Data Analysis and Site Identification

Following completion of our field work and the computerization of the collected data, the Natural Heritage Inventory conducted a staff workshop to evaluate the significance of the natural features we had surveyed from both local and statewide perspectives, and to identify those sites that encompassed the most significant features. Fred Clark of Clark Forestry, Inc. led the workshop and used techniques developed for similar evaluations in the Baraboo Hills of south central Wisconsin for The Nature Conservancy. Participants in this workshop were leaders for the NHI botany, zoology, and ecology programs, and staff from the Bureaus of Forestry, Facilities and Lands, and Science Services. The evaluations were guided by ranking factors such as: the number of populations of a rare species on the State Forest relative to the number known to occur statewide; the size of the populations on the BRSF compared to those elsewhere; the need for active management to provide for the long-term viability of rare species populations or natural communities; the extent, quality, and condition of the natural communities on the BRSF compared to those in the region; the degree to which inherent or potential ecological conditions on the planning unit (here the BRSF) increase the viability or defensibility of the rare species population or natural community; and the sensitivity of the rare species or community to management actions.

We consulted many sources to aid in the identification and prioritization of sites in and around the State Forest. Our basic references included the Bureau of Forestry's stand/compartment reconnaissance, interpretations of local and regional land cover from recent aerial photographs and satellite imagery, the original land survey notes for the region, and habitat type information newly derived from available data on landform, vegetation, and soils.

Other inventory work conducted recently in the northern and northwestern Wisconsin region (including Wisconsin's Lake Superior basin, the Apostle Islands, the Northern Highland-American Legion State Forest, the St. Louis River Estuary, and the Chequamegon-Nicolet National Forest, among others) gave us a solid basis for comparison and interpretation of the Brule River data.

Finally, individuals are encouraged to submit records for rare plants and animals that are on the NHI Working list. Additional information on how to submit data can be obtained from the WIDNR-BER in Madison, Wisconsin.

Summary of Results

The Results section summarizes the findings of this study according to sites, natural communities, rare plants, and rare animals and concludes with a discussion of the key ecological factors and processes occurring in the BRSF. Each of the groupings is summarized here but discussed in more detail in Appendices B, D, E, and F.

Certain species groups received relatively less attention that others. These include fish, mammals, non-vascular plants, and some invertebrates (especially terrestrial invertebrates). Reasons for these omissions include: (1.) insufficient existing data; (2.) too little is known about a group to interpret the information gathered within the context of a DNR property master plan; and (3.) the assumption was made that a "coarse-filter" community-focused approach to protection will conserve a significant portion of the unsurveyed taxa.

Sites

Inventory sites were identified within and around the BRSF and surveyed by NHI field biologists during 1995-97. Site files are maintained in the NHI offices in Madison, WI and include details on flora and fauna, data sheets, maps, aerial photographs, and other information.

The significance of each site was evaluated during the Ranking Workshop (see Methods section) according to condition, quality, and extent of the natural communities present; the number and size of the rare species populations; and the ecological context of these features. Many of the inventory sites were found to be of relatively low significance: they either had been greatly disturbed, supported only widespread or common species, or contained features for which much better examples occur elsewhere in northern Wisconsin. In general, these lands were pine plantation monocultures or in even-aged aspen cover.

These lands of lower significance do possess economic, recreational, and ecological values and may deserve consideration for long-term restoration or other special management designation. Their management can significantly impact surrounding lands. Therefore, management decisions for intact forest production or other intensively used sites should be considered as carefully as for the more ecologically sensitive areas. Note that the Brule River itself is a natural feature of the highest significance and one on which many of the other features included here are at least somewhat dependent.

From the Ranking Workshop, 45 sites emerged (Figure 3) that contained some feature of significance, raising their importance over the remaining sites. They include the best examples of both rare and representative natural features that were documented within and around the BRSF. The 44 sites are organized according to three categories defined below:

1. Primary sites - Selected inventory sites within the BRSF that contain the best examples of rare and representative natural features that were documented. All or significant portions of these sites should receive high protection or restoration consideration.
2. Outlying occurrences of rare species - Selected inventory sites located within the BRSF boundary that contain a rare species occurrence. These sites are generally very small and isolated from other more extensive natural features and thus may have a lower protection or restoration priority than primary sites.
3. External lands and waters - Selected inventory sites near but primarily outside of the BRSF boundary that contain the best examples of rare and representative natural features that were documented. Natural communities, rare species populations, and aquatic features are represented.

Sites categorized as external lands and waters have similar significance as primary sites, but are located outside the BRSF boundary.

Site descriptions for each of the 44 sites are found in Appendix B and organized according to the above categories. Information in Appendix B includes:

- location information,
- a site map showing occurrences of significant communities, species and aquatic features,
- a brief summary of the natural features present,
- the site's ecological significance (including a table of element occurrences), and
- management considerations.

Each site map[1] shows the site location against a background of a scanned USGS topographic quadrangle. The scale of the maps varies from 1:18,000 to 1:125,000 depending upon the size of each site and information presented (original USGS resolution is 1:24,000). Occurrences of rare or endangered species or natural communities are portrayed as dot symbols. Only those species or communities within the site or within 200 meters of the site boundary are portrayed in order to emphasize their location(s) relative to the boundary. Note that there may be more than one occurrence of one or more species or communities represented by any single "dot" (or symbol), that these symbols may overlap, and that the significance of the site is not based only on the presence of rare species occurrences. Also, the area of land the species or community occupies is frequently much larger than the dot representation.

Appendix C includes a master list of each of the 44 sites and the element occurrences that are located in or near them.

Site List and Characteristics

Table 1 is an overview of each of the 44 sites. The local and regional significance of each site is summarized and general comments are provided on management and other issues. The primary sites are arranged geographically, from the Brule headwaters north to the river's mouth at Lake Superior. Outlying occurrences of rare species and external land and water sites are listed separately after the primary sites.

[1] The maps should not be reproduced except by permission from the Bureau of Endangered Resources. These maps are for illustrative purposes only.

Table 1. Overview and Significance of Sites

Site Name (Map ID #)	Significance within BRSF	Ecoregional Significance Province/Subsection	Comments
Primary Sites			
Catlin Creek (35)	Medium/High	Medium	One rare aquatic invertebrate and 24 total invertebrate taxa present.
Porcupine Creek Headwaters (28)	Medium	Low	Unusual mixture of plants. Small site.
Brule Spillway Macrosite • Divide Swamp (23) • Angel Creek Swamp (22) • Jerseth Creek (20) • Stone Chimney Cedar Swamp (31) • Blue Springs-McDougal Springs (17) • Cedar Island - Winneboujou (15)	High for all sites	High for all sites	Unique natural features complex. Extensive site, exemplary stands of several important natural communities (e.g. Northern wet-mesic forest, Northern dry-mesic forest, alder thicket, soft springs). Very high concentration of rare species. "Macrosite" is of statewide significance for several vascular plants, natural communities, and animals.
Mills Lake (24)	High	Low	Best example of community type that is rare on forest but common, more extensive elsewhere.
Smith Lake (21)	High	Medium	Very good example of regionally representative aquatic feature. Supports rare species.
North Country Trail Barrens (18)	High	Medium/Low	Best site for globally rare community on state forest. More diverse, larger examples occur elsewhere in this ecoregion, but site is still worth protecting.
Lake Minnesuing Hemlock-Hardwoods & Swamp (25)	Medium	Low	Small, isolated, not old-growth. Notable mostly because of Hemlock presence at extreme northwestern edge of range. Very high aesthetic value to local residents.
Buried Road Pines & Ponds (26)	Medium	Low	Older, but very small and isolated, stand of dry mesic-pine forest within matrix of intensively managed forest.
Vapa Road Pines & Ponds (19)	High	Medium	Older dry-mesic forest which could be expanded, linked to the Brule Spillway corridor. Site also contains ponds, wetlands. Rare species present.

Site Name (Map ID #)	Significance within BRSF	Ecoregional Significance Province/Subsection	Comments
Willard Pines (16)	High	Medium	Older stands of dry-mesic forest that could be expanded, linked to the Brule Spillway corridor. One rare species present.
Rush Lake (13)	High	Medium	Very good example of beach community borders undeveloped seepage lake. Excellent invertebrate community is also present.
Kurt's Deep Depression (14)	Medium	Unknown	Small kettle wetland. Pond supports significant aquatic invertebrate diversity. Barrens remnants occur on south and west-facing slopes of the kettle.
Devils Hole Red Pines (12)	Medium	Low	One of the few stands of natural red pine forest in the Brule, but small, isolated, and somewhat altered.
Hoodoo Lake (11)	High	Medium/Low	Few kettle bogs occur in the state forest. This one supports several rare species. Kettle bogs are common features regionally.
Afterhours Tamaracks (10)	Low	Low	Muskeg and bog forest communities are rare on the BRSF but common regionally. Site is small, isolated.
CCC Miller Boreal Forest and Pines (9)	Medium	Medium	Fair quality second-growth boreal and pine forest communities. Could be expanded, linked to other sites.
Sugar Camp Hill (8)	High	Medium	Most extensive mesic forest on the Brule, could be connected to pine forest, boreal forest, and river corridor. Several rare species occur here.
The Promontory (34)	High	Low	Contains cliff with one rare species. Bedrock features are much better represented outside of the state forest.
Lenroot Ledges (7)	Medium	Low	Best feature is older pine-cedar forest on private lands. Several rare species present. Could be linked to sites just to south (Sugar Camp, CCC Miller).
State Highway 13 Grasslands (6)	Medium	Low	Old farmland, supports grassland birds, but contributes to fragmentation of regional forest, and there may be adverse water quality impacts. Some of the resident grassland birds are uncommon and of regional concern.

Site Name (Map ID #)	Significance within BRSF	Ecoregional Significance Province/Subsection	Comments
Lower Brule Boreal Forest & Lake Superior Shoreline Macrosite	Overall High Potential	Overall High (with restoration)	Best opportunity to protect rare Boreal Forest community on state lands. Restoration is needed in most areas. Most land in the Clay Plain ecoregion is privately owned. The regional forest is severely to moderately fragmented, with aspen now the dominant cover type.
• McNeil's Landing Boreal Forest (3)	High	Medium	
• Trask Creek-Weir Riffles Boreal Forest (2)	High	Medium	Macrosite includes diverse marsh with rare species. Mouth of river heavily used by migratory birds. Several miles of undeveloped Great Lakes shoreline also heavily used by migratory birds. Rare species are present.
• Brackett's Corner Boreal Forest (1)	Medium	Low	
• Brule River Marsh and Lagoon (32)	High	Medium	
• Bear Beach (4)	High	Medium	
• Pearson Creek Boreal Forest (5)	Medium	Low	
The Brule Annex			
• Eau Claire River (30)	High	Medium/High	A medium-sized river with very high aquatic invertebrate diversity.
• Gordon Correctional Bog (29)	High	Low	A Small but very good example of regionally common community. Rare plant present.
Outlying Element Occurrences within the BRSF			All are small, somewhat isolated sites with one or more rare species. Significance varies with population size, management potential, and defensibility of the site. Contact BER for details as needed
• Bois Brule River			
• Clevedon Road			
• Hazel Prairie Road Wetland			
• Jerseth Road Seeps			
• Lawyer Bridge Bog			
• Little Bois Brule River			
• Ranger Station Riffle			
• State Highway 13 Bridge			

Site Name (Map ID #)	Significance within BRSF	Ecoregional Significance Province/Subsection	Comments
External Lands and Waters beyond the BRSF Boundary			
• Blueberry Swamp	NA	High	Good quality, extensive stands of several natural communities, many rare species. Swamp is the headwaters area of important Brule River tributary.
• Casey Creek	NA	Low	One rare and 15 total taxa of aquatic invertebrate present on tributary of Brule.
• Grover Lake	NA	Low	High aquatic invertebrate diversity
• Nebagamon Creek	NA	Medium	Several rare species present. Important to protect stream banks and local watershed as this creek is an important tributary of the Brule.

Natural Communities

Over 90 occurrences of 20 natural community types were surveyed within the BRSF. A master list of the natural communities of the study area, brief descriptions of each type, and an assessment of the significance of each type on the property and within the region, may be found in Appendix D. The following identifies community types that present high and moderate to low protection/restoration opportunities.

High Priority Protection/Restoration/Management Opportunities

Especially good opportunities to protect and manage the communities listed below now exist on the BRSF. These community types express major ecological themes of the Brule landscape. The types identified for high priority emphasis were selected because of their outstanding condition, high significance to both rare and representative native species, or because few other opportunities to manage these types exist statewide.

- **northern wet-mesic forest** (white cedar swamp, mixed swamp conifers): Extensive, exceptionally diverse, many rare species. Arguably, Wisconsin's exemplary occurrence occupies the Brule Spillway.
- **boreal forest** (white spruce - balsam fir): Highly significant restoration opportunity, with small, scattered mature remnants, to serve as templates and seed sources. Few alternative sites exist statewide.
- **springs and spring runs - soft:** High concentration of softwater springs and seeps, some with rare invertebrates, occurs along the upper Brule.
- **northern dry-mesic forest** (white pine - red pine - red oak): Small but significant stands of older pine forest are and were prominent on the flanks of the Brule Valley. Restoration opportunities exist, and this type could be expanded via a long-term shift in management emphasis.
- **alder thicket:** Extensive and undisturbed, especially along the upper river.
- **stream - slow, soft, cold** (upper Brule): Sluggish, soft-bottomed, and meandering, the upper Brule is fed by numerous springs and supports a significant assemblage of coldwater organisms and a diverse complex of wetland communities.
- **stream - fast, soft, cold** (portions of the middle and lower Brule): The Brule River is a unique aquatic system in the Lake Superior basin owing to its post-glacial history, the assemblages of aquatic organisms it supports, and the fact that the entire river is contained within a state forest boundary. The middle and lower river contain significant stretches of rapids and fast water.

Additional Protection/Restoration/Management Opportunities

For the following natural communities, opportunities for protection and management were judged to be somewhat lower than for those mentioned above. This was mainly due to limited acreage, present condition, or our knowledge of more extensive stands in better condition elsewhere in northern Wisconsin. Keep in mind that no single community should be evaluated solely on its individual merits, as context can be critical. Some of the types listed below occur in close association with types of greater significance and their values may be correspondingly higher.

- **pine barrens** (jack pine-prairie grasses and forbs) - limited acreage of this globally rare community occurs on the state land, but modest opportunities to maintain and expand remnants exist and should be seriously considered.
- **northern dry forest** (jack pine-Hill's oak) - Management of this type should be integrated with the barrens community. Acreage of this community has been greatly reduced statewide recently.

- **northern mesic forest** (maple-basswood, maple-hemlock) - Though very limited in extent on the BRSF, one or several of the surveyed stands merit consideration for special management designation.
- **emergent aquatic** (bur-reed - bulrush-cattail) - Widespread throughout Wisconsin but limited on the BRSF. However, some excellent stands occur in the low gradient "widenings" of the lower Spillway and at the mouth of the river. Rare plant and animal species were documented in this and the next community.
- **submergent aquatic** (pondweed-coontail) - Comments under "emergent aquatic" also apply here.
- **hardwood swamp** (black ash-red maple) - Very limited acreage, mostly on low terraces within the river corridor. Few management or use conflicts were noted. Usually within aesthetic and/or erosion control zones.
- **tamarack swamp** (tamarack-alder) - Small but good quality stands occur within the Brule Spillway and have been treated as inclusions within the white cedar-dominated “northern wet-mesic forest.”.
- **open bog** (sphagnum mosses - sedges-ericaceous shrubs) - Common and widespread throughout much of northern Wisconsin. Two small but significant examples occur on the forest.
- **muskeg** (similar to open bog, stunted black spruce-tamarack) - Common and widespread throughout northern Wisconsin and the region. Much better represented elsewhere.
- **poor fen** (sphagnum mosses-sedges) - Status uncertain in the state, but fens are probably common and widespread in the north (many of Wisconsin’s "open bog" communities would be considered "poor fen" elsewhere).
- **northern sedge meadow** (bluejoint grass-sedges) - Widespread in the north, but not well represented on the BRSF.
- **northern wet forest** (black spruce-tamarack) - Widespread in northern Wisconsin, but some important stands occur within the Brule Spillway.
- **dry cliff** - Rare on the BRSF and much better represented elsewhere.
- **Great Lakes dune** (marram grass-beach pea) - A single, very small, and rather battered occurrence is at the mouth of the river. It does function to protect a high quality marsh from excessive ice and wave action.
- **Great Lakes beach** - Though beaches on this part of Lake Superior are very dynamic entities and seldom support any permanent vegetation at all, they are important foraging and resting sites for many migratory birds. An extensive, undeveloped beach occurs west of the Brule's mouth and merits protection.
- **interior beach** - one excellent occurrence is present on the BRSF. As development pressures on lake and stream shores are increasing rapidly in many parts of northern Wisconsin, this site merits strong protection.

Rare Plants and Animals

“Rare” plant and animal species are treated here as native species known or suspected to be rare and/or declining in the state. Included are species legally designated as “Endangered” or “Threatened” by either the State of Wisconsin or the federal government, as well as species in the Department’s advisory “Special Concern” category and the U.S. Fish & Wildlife Service’s “Candidate” and “Species of Concern” lists. Rare species information for the BRSF was compiled from existing records in the BER NHI Biological Conservation Database (BCD), field inventories, and other data sources as described in Appendices E and F.

Appendix E provides detailed information and lists of rare plants for the BRSF. **Twenty** rare plant species were documented, including two WI endangered and three WI Threatened. The BRSF appears to contain the largest overall populations of Calypso orchid (fairy slipper) (*Calypso bulbosa* - WI Threatened), Lapland buttercup (*Ranunculus lapponicus* - WI Threatened), and sheathed sedge (*Carix vaginata* - WI Special Concern). Other important examples of rare plants include:

- fir clubmoss (*Lycopodium selago*) - WI SC
- autumnal water starwort (*Callitriche hermaphroditica*) - WI SC
- showy lady's slipper (*Cypripedium reginae*) - WI SC
- small yellow lady's slipper (*Cypripedium parviflorum*) - WI SC

Appendix F provides detailed information and lists of animals for the BRSF. **Thirty-two** species of rare animals were documented, including two WI Threatened and one US Threatened. Formal breeding bird surveys were conducted at 12 sites within the BRSF. Aquatic insect diversity on the main stem of the Brule River is excellent and reflects the high level of water quality in most of the river. A significant population of wood turtles (*Clemmys insculpta* - WI Threatened) is present in the Bois Brule River and some of its tributaries. The BRSF represents a significant opportunity to provide secure habitat for this species in NW Wisconsin. The same can be said for the northern goshawk (*Accipiter gentilis* – WI Special Concern) and the entire suite of "boreal" birds.

The Brule Spillway contains a concentration of softwater springs and spring fed streams, some of which support invertebrates which are very rare in WI and the eastern United States. See write-ups in Appendix F for: a predaceous diving beetle, zebra clubtail, and the two Diamesin midges. Shallow ponds with fluctuating water levels in a "barrens" landscape are fairly well represented here. Some of these are rich in, or contain rare, macroinvertebrate taxa.

Key Ecological Processes And Attributes

Within the context of the work completed for this project, the key ecological processes of high importance to the maintenance and protection of the natural features on and around the Brule River State Forest include:

1. **Hydrologic processes** - Among these are groundwater recharge, springhead discharge, and fluctuations in base level flow and water temperature. The geologic processes of erosion and sedimentation are also of significance here, as they directly impact water quality and habitat suitability.

2. **Fire**. Many of the natural communities and species found on the Brule were influenced by wild fire in the past. The impacts of long-term fire suppression are ecologically significant and need to be addressed in the future.

3. **Herbivory** - Browse pressure, especially from white-tailed deer, is currently heavy in much of the State Forest. Negative impacts on sensitive conifers are especially noticeable and significant.

4. **Natural Succession** - Older successional stages are rare on and around the State Forest, including those community types that would typically be represented by old-growth and other late successional stages in the Brule landscape. Conversely, communities characterized by a poorly developed canopy of trees and historically maintained in an open condition by fire, such as pine barrens, have also become very rare. Most have grown up into dense forests or have been planted to pine monotypes.

Besides fire, other natural disturbances that can be directly or indirectly responsible for initiating or maintaining successional processes include windthrow, ice storms, insect infestation, and flooding.

5. **Immigration and emigration** - Several native species are now absent from the Brule landscape with few opportunities to recolonize due to habitat changes, disruption of dispersal corridors, and an insufficient land base. Non-native species have invaded terrestrial, palustrine, and aquatic communities and have displaced, or threaten to displace, additional native plants and animals (examples are leafy spurge, reed canary grass, and the sea lamprey).

Key attributes of the present landscape include:

1. **Landforms** - In the region of the Brule headwaters, the predominant landform is a glacial outwash plain. Portions of this region are rolling and dotted with small kettle lakes, elsewhere the landscape is pancake flat. A rolling glacial moraine is the dominant landform of the middle portions of the Brule. An east-west trending ridge forms the northern boundary of this part of the region and is the only location in which bedrock outcroppings occur. The lower Brule flows through nearly level glacio-lacustrine deposits, dissected by short steep-walled stream valleys.

2. **Soils** - In the upper Brule landscape, the soils are mostly sands of low nutrient content. In the middle Brule the soils are a mixture of sands, loams, and silts. Along the lower Brule the soils are mostly heavy, thick, red clays.

3. **Vegetation** - Moderate to severe fragmentation, simplification, and loss of both older forest successional stages and semi-open, non-forested communities characterize the current vegetation compared to the historical condition. Aspen and plantation-grown pine (mostly red) comprise the majority of the present cover types on and around the Forest.

4. **Representative and rare species** - Population levels of some species have changed markedly in recent times in concert with habitat and land use changes (e.g. the fluctuations of sharp-tailed grouse). A few species have been entirely eliminated owing to habitat loss, persecution, or for reasons unknown. This group includes top predators (Canada lynx), large herbivores (moose and woodland caribou), and several plants (marsh ragwort, mountain cranberry).

   The reintroduction or reestablishment of some of these is very problematic because of past habitat changes, the current conditions on and around the Forest, and the needs of the individual species.

5. **Land use** - Dominant land uses are recreation, commercial forestry, and agriculture. Residential development (and associated infrastructure such as roads and utility corridors) is substantial in and around some parts of the State Forest.

Considerations and Ecological Priorities

Key Issues for Consideration

There are five key issues that are important to the ecological future of the BRSF and should be considered during master planning. These are not ordered according to importance but rather are nested within a hierarchy of scales ranging from the regional to the local level.

1. Three major ecoregions (see Figure 2) are represented within the BRSF. The lower Brule River area, part of the Lake Superior Clay Plain ecoregion, presently affords the only major opportunity to restore a conifer-dominated boreal forest on any state land throughout Wisconsin. The Bayfield Sand Barrens ecoregion contains the unique and regionally significant "Brule Spillway." The Mille Lacs Uplands ecoregion is a rolling landscape with the potential to support diverse native vegetation.

2. Activities and processes occurring beyond the State Forest boundaries influence many of the Brule River's natural features and ecological processes directly or indirectly. Examples include groundwater recharge, the primary water source for the upper Brule and its many springs and seepages; fragmentation caused by road construction, residential development, logging, agriculture and utility corridors; and increasing human population pressures via recreation and other uses, especially those which demand products or space. Progress on these fronts will require efforts that are directed at the larger landscape, by the Department as well as other entities.

3. The BRSF encompasses the entire main stem of the river within its boundary. This affords unique opportunities for the protection and management of a river of this size, a large portion of its watershed, and the associated natural processes, communities, and species.

4. Aspen and plantation-grown pine are the most abundant and dominant vegetation cover types on and around the forest. Approximately 70 percent of the state-owned forested land within the BRSF boundary is in aspen or pine plantation cover types (see Table 2 on the following page). Opportunities exist to restore the composition of the forest to something that better reflects ecosystem potential in terms of natural communities, which will increase diversity in the present landscape.

   Some recent BRSF management activities, especially in the clay plain, have favored the regeneration of the native conifers. It is highly desirable to progress toward a goal of increased conifer dominance, at least in selected areas, using a variety of methods (including "passive" prescriptions). Boreal forest and native pine forests are high priorities for restoration in the Brule landscape.

5. The "Brule Spillway" contains natural communities, aquatic features, and a concentration of rare plants and animals of exceptionally high significance. Figure 4 shows the frequency of NHI "element occurrences" (see Natural Heritage Inventory Overview) in the region of the BRSF. There is a higher density of element occurrences within the Brule Spillway than elsewhere in the BRSF or any of the surrounding areas.

   Ecologically, this site is not comparable to any other in Wisconsin, and it merits consideration for the highest level of protection. The core protection area to consider extends from the headwaters downstream to Winneboujou (roughly Highway 'B'), and from bluff top to bluff top across the Brule valley. In addition, there may be critical water recharge areas beyond the bluff tops.

General Considerations for Master Planning

A number of general considerations for master planning have emerged from the analysis of the existing ecological processes, biotic data, and land use for the BRSF. They are grouped into two categories: considerations related to conservation challenges and limitations, and restoration challenges.

Conservation Opportunities, Challenges and Limitations

1. **Size of the Property** - At approximately 42,000 acres, the BRSF is not large enough by itself to accommodate certain scale dependent species (such as the timber wolf) or landscape level attributes and processes (e.g., large scale forest interior conditions) capable of conserving all forest interior organisms and their interactions.
2. **Linear Configuration of the Property** - Much of the state forest is only two miles wide. This makes it difficult to address some of the major conservation issues of the BRSF within the property boundaries alone. Some use conflicts will be more acute because of this factor.
3. **Context of the Property** - The Brule Landscape includes industrial forest and, in the north, many farms. Roughly 20 percent of the land within the BRSF, and most of the land surrounding it, is private.
4. **Fragmented Landscapes -** In both the upper and lower sections of the property, habitat has been fragmented. The most strongly affected habitats within the study area are the forests in the north and pine barrens in the south.
5. **Existing Forest Cover** - Table 2 provides the acreage figures of cover types for state-owned lands within the BRSF. Aspen is presently the major cover type, occupying (with paper birch) approximately 50 percent of the *forested acreage on the state-owned land*. Aspen is also abundant throughout all three of the major ecoregion units within which the state forest occurs. Aspen-dominated stands have replaced most of the boreal forest of the Lake Superior Clay Plain ecoregion, which historically was conifer-dominated (see Appendix D for community descriptions). In the Brule landscape, aspen stands also now occupy many sites that formerly supported forests of pine and northern hardwoods. An aerial survey over the clay plain in mid-October of 1996 revealed clearly that aspen is dominant throughout the region, not just on the State Forest. Upland conifer forests are relatively scarce and, where present, are generally small and isolated, restricted to steep slopes, or consist of plantation monocultures.

   The emphasis on managing for aspen can, in some areas, limit options for managing or restoring certain important natural communities and/or successional stages. This, in turn, can make it difficult to successfully manage populations of certain rare or otherwise sensitive species. Related factors include the high herbivore density often associated with extensive aspen management, the creation of additional high contrast edge habitats which generally favors those herbivores (and can also create conditions favorable for nest predators and brood parasites), and an increase of the habitat fragmentation that is now so characteristic of much of this landscape.

Table 2. Cover Types for State Lands in the BRSF

Cover Type	*Acreage*	*Percent of Total*	*Percent of Sub-total*
State-owned Forested Lands			
Aspen	14,000	35%	45%
Pine Plantations	8,000	20%	26%
Natural Pine	2,000	5%	6%
Boreal Forest	2,200	6%	7%
Swamp Conifer	1,500	4%	5%
White Birch	1,400	4%	5%
Swamp Hardwood	1,100	3%	4%
Northern Hardwood	1,000	3%	3%
Sub-total of Forested Lands	*31,200*	*80%*	*101%*
State-owned Non-forested Lands			
Scrub Oak/Pine Barrens	2,300	6%	26%
Alder	1,500	4%	17%
Grassland	1,500	4%	17%
Other	3,500	9%	40%
Sub-total of Non-forested Lands	*8,800*	*23%*	*100%*
TOTALS	**40,000**	**103%**	

Source: Brule River State Forest Compartment Reconnaissance - December, 1998

6. **Pine Plantations** - Much of the land capable of supporting key native natural communities in the southern half of the state forest, such as dry forest and pine barrens, has been planted to pine monocultures. Plantation cover types now occupy ca 25% of all state-owned forested acreage on the BRSF. Consideration for the long-term restoration of diminished natural communities is key, as they have been significantly reduced not only in the vicinity of the Brule, but range-wide as well.

   A recent large-scale infestation of the jack pine budworm led to the damage or destruction, and subsequent salvage, of many thousands of acres of dry, jack pine-dominated forest in northwestern, north-central, west-central, and central Wisconsin. Most of the salvaged acres, especially on county and industry-owned lands, have already been planted or replanted, often to red pine. It is important for the state and other public land managers to develop alternative management scenarios that do not eliminate extensive patches of either pine barrens or jack pine/scrub oak forest from the landscape.

7. **Ecological Capability and Ecological Potential** - Each of the three major ecoregions (subsection level) represented on the BRSF have different ecological capabilities based on climate, glacial history, landform, soil type, disturbance history, competition, and other factors. These ecoregions also have different ecological potentials to support forest communities and species. For example, the soils of the Lake Superior Clay Plain are capable of supporting both intensively managed stands of aspen and limited agriculture (mostly pasture “grasslands”), but also have the potential to (and formerly did) support a diverse boreal conifer-hardwood forest community with complex structure. The trade-offs between forest production, biological diversity, restoration and other possibilities will need careful consideration by the master planning team. The relationships between these wide-ranging goals will vary, from complimentary to conflictual.

   Management decisions need to consider not only the ecological capability of the land, but also the management of surrounding lands. Much of the land on the BRSF is capable of supporting aspen or plantation-grown pine and has been managed accordingly. However, virtually all of the surrounding

lands have been managed in a similar manner resulting in a homogeneous and simplified regional land cover and an incomplete representation of the ecological potential of this landscape.

8. **Ownership Patterns** - Numerous private holdings occur within the state forest boundary. Because these boundaries tend to follow cultural lines rather than ecological features, several important sites are vulnerable to incompatible uses or developments.
9. **High Road Densities** - In general, areas with sandy soils or concentrations of lakes have high road densities. Where these two factors coincide, as on the Northern Highland State Forest, road densities and the related problems of fragmentation, isolation, disturbance, and development pressure can be especially high. This is also true for portions of the BRSF landscape, especially in the south.
10. **Regional Conflicts** - Many divergent interests, projects, and goals exist within the BRSF region. State and federal agencies, county and local governments, and private industry and landowners may have dissimilar goals (i.e. management goals) based upon their particular interests. Conflicts may exist, both within and outside of the BRSF boundary, that will present challenges for the future management of the BRSF landscape. Tradeoffs are common elements of any implemented management plan.
11. **Dispersed Information** - In the past, it was very difficult to pull together all of the information needed to provide a regional perspective on management opportunities and considerations for a particular property. A series of WDNR reports collectively entitled "Northern State Forest Assessments" is nearing completion and will be available in the future. These reports cover biological topics such as Biodiversity, Community Restoration and Old-growth, and Regional Ecology, as well as socio-economic issues. The information provided in these reports will consolidate background information useful for property master planning and other applications.

Restoration Challenges

In the body of this report we have highlighted ecological features of special significance within or adjacent to the BRSF boundary. Many of these features merit consideration for special protection and management because of their rarity, regional or range-wide decline, vulnerability, or because they are especially representative of this landscape. We have given emphasis to "restoration" of lost features only when the choice seemed obvious because of an absence of alternative sites (e.g., in the case of the boreal forest community), when the proximity of other significant natural features nearby made restoration seem like an especially worthwhile and reasonable objective (the Brule Spillway), or when the community to be restored is regionally rare and a land base capable of supporting it exists on the property (North Country Trail Barrens).

Important points are:

- Tried and true methods for the restoration of forest (and most other) communities do not exist. Actions will be at least somewhat experimental, with no outcomes guaranteed. It should not be assumed that leaving things alone will expedite matters, nor that this option should be ignored.
- Much of the intensively managed land dedicated to forest products (such as pine plantations) has long-term capability for the restoration of more natural vegetation. This does not imply that restoration of these lands is the best thing to do, or the most practical, or that future harvest would be prohibited. But restoration should be identified as an option and a realistic timetable for achieving goals acknowledged up front.
- At this point, the successful restoration of certain extirpated species seems unlikely. The moose, woodland caribou, and Canada lynx are among those species whose habitat needs are not met by current conditions, either on or around the state forest. The BRSF is not, by itself, large enough to maintain populations of these species. In addition, open country species with large spatial

requirements, such as the sharp-tailed grouse, will decline locally as new pine plantations mature, especially in the southern part of the Brule River drainage.

The timber wolf occurs as a resident on and around the BRSF, but maintaining packs will require a coordinated protection effort, involving various owners, to meet the management challenges presented by the state forest's small size, linear configuration, and relatively high road density. For a regional overview and recommendations for the timber wolf, see the Wisconsin Wolf Management Plan (1999).

- Goals and objectives for restoration, and methods to be used, need to be clearly defined and developed within an appropriate ecological context.

Ecological Priorities

The Bureau of Endangered Resources bases the following ecological priorities on careful analysis. They reflect assessment and inventory of the region surrounding the BRSF as well as the property itself. They are organized around a number of primary issues: management and protection, restoration, land use, and monitoring. The Department's master planning team will use these ecological priorities to develop overall recommendations for the forest, and will also consider social, economic, and other ecological needs. Research and inventory priorities are also listed, although they may be more useful in identifying follow-up actions to master planning. Site specific information and considerations are provided in the site descriptions section (see Appendix B).

BRSF Management

1. Re-examine the boundaries of the two designated State Natural Areas within the Brule Spillway to include additional features that are ecologically significant. The Brule Spillway is currently the most important site, ecologically, on the BRSF. Both of the existing State Natural Areas are small, and in neither case do the boundaries coincide with ecological or major cultural features in the area. Creating a single, large, special protection and management area within the Spillway is one option, but others may also be worthy of consideration.
2. Consider sites containing features representative of each of the forest's major ecoregions for special protection and management. The candidates should cover a broad spectrum of natural communities, rare or otherwise sensitive species populations, and aquatic features, emphasizing those that are especially well represented on the BRSF or are rare globally or regionally.
3. Consider adjusting BRSF boundaries to include additional natural features. Several important sites lie at least partially outside of the BRSF boundary and merit additional protection. Examples include: Smith Lake, Nebagamon Creek, Blueberry Creek, Blueberry Swamp, and the Lower Brule Boreal Forest. Boundary adjustments to address these needs and opportunities should be considered. Hoodoo Lake, a significant aquatic/wetland site with an interesting geologic history, is within the State Forest boundary, but all of the lands (and wetlands) along the shore are privately owned.
4. Establish a plan for protection priorities that would employ acquisition, conservation easements, and other land protection methods. This would include both lands within the current Forest boundary and, potentially, lands outside of that boundary. High ecological priorities for future protection include:
    a) key tracts for watershed protection (including, but not limited to riparian lands),
    b) any tracts within, or where land use could negatively impact, the Brule Spillway and shoreline habitats,

c) additional lands containing high quality or restorable boreal forest or pine barrens,

d) high quality aquatic features, and

e) lands that would extend Forest ownership out to the nearest road (or similar cultural feature) and maintain or create management flexibility and efficiency.

5. Provide endangered resources information to land and water managers in the field. Information on locations, sensitivities, and needs of rare species which could be impacted by habitat modification should be exchanged with managers as early as possible. Develop monitoring protocols as needed to measure the response of both target and non-target associated species/habitats to management activities. The same should be done for at least a subset of the natural communities.
6. Explore methods of reducing deer densities and/or impacts where browsing has reached problem levels.
7. Existing and potential travel/dispersal corridors for organisms sensitive to habitat fragmentation, including certain large mammals, need identification and/or protection. This should be done along both west-east and north-south axes.
8. Site specific management considerations are provided as part of the Site Descriptions in Appendix B.
9. General recommendations and management considerations for natural communities and rare species are found in Appendices D, E, and F.
10. Identify exotic/invasive species issues and develop control strategies as appropriate.

Restoration

1. Restore the boreal forest community in the Lake Superior Clay Plain ecoregion. Restoration efforts directed toward the boreal forest community of the lower Brule should not only aim to increase the conifer component of stands in that area, but also to increase stand size and age. Reforestation should be considered at appropriate locations. Given the uncertainties involved in this restoration attempt we recommend a broad, adaptive approach, which might run the gamut from "hands-off" to intensive active management.

   The prevalence of aspen in current stands should not drive the future management of those stands before the ecological impacts of doing so are better understood and alternative management opportunities have been carefully weighed.
2. Maintain larger blocks of mature, closed canopy forest in the boreal restoration zone. Clearcutting, with retention of conifers, should not be ruled out if it can be shown that progress toward increased conifer dominance is accelerated. However, this need not be the sole method of implementation. A broader landscape and community level restoration plan is recommended.
3. Investigate the feasibility of removing the dam on the Eau Claire River above Gordon. Fragmentation of stream habitat in the upper St. Croix River basin may be limiting lake sturgeon reproduction. Dam removal would also restore the ability of mussel populations to move between the St. Croix and Eau Claire Rivers and provide additional habitat for macroinvertebrates and fish.
4. The Mille Lacs Uplands ecoregion contains a high diversity of habitat types but this is not currently reflected in the present cover types. Further investigation of management options may be warranted.

Land Use

1. Land Management classifications have been established per Chapter NR44 of the Administrative Code for the Department of Natural Resources. The classifications are used in developing, revising and amending master plans. In some cases, site recommendations (provided with site descriptions in Appendix B)

suggest limitations or guidelines to land management and must be expressed in the land management classifications. BER staff will work with the Planning Team to help develop and evaluate alternatives for the state forest and appropriate surrounding areas based on the findings of this study.

2. Develop a long-term plan to address forest fragmentation. The Master Plan could recommend initiating a long-term plan to address related impacts, such as small stand size, stand isolation, an abundance of high contrast edge, and excessive browse from white-tailed deer.
3. Clarify the sources of increased runoff and sediment loads to the Brule River and its tributaries, especially in the Lake Superior clay plain. The higher percentage of open (non-forested) land north of highway 'F', and road and utility corridor maintenance activities, are among the potential sources of runoff problems.
4. Assess opportunities to work with local citizens, non-government conservation organizations, private organizations, and public agencies and land managers in the region to influence the landscape surrounding the BRSF.

Monitoring

The following suggestions comprise an initial list of monitoring needs. We realize that neither our bureau nor other programs in the Department are able to undertake these actions immediately, but we feel that it is important to identify issues now within the context of a new planning cycle. These suggestions are intended to be factored into master planning to help develop an overall monitoring plan. Final priorities should reflect the preferred alternative selected through master planning.

1. Establish permanent monitoring plots for vegetation types with impaired function (e.g., poor reproduction by canopy species). White cedar swamps (wet-mesic forests) and boreal forest are the highest priorities. It is important to collect baseline data as part of process toward future management. Also, consider disturbance dependent communities such as pine barrens and northern dry forest (jack pine) as priorities.
2. Re-sample historic vegetation plots (e.g., at Divide Swamp and "Brule Bog" (Blewett, 1976)) and analyze the data.
3. Design and implement a monitoring program for rare plant species such as Lapland buttercup, fairy slipper, fragrant fern, and sweet coltsfoot. Other species may be equally or more suitable.
4. Establish permanent breeding bird transects (with points). One to several of these could be canoe transects, as the conifer swamps along the upper Brule would be very difficult to access by land (this would limit coverage to only a few points in a single morning). Road transects would be efficient for portions of the lower Brule. At a minimum, conifer swamp, boreal forest, and pine forest should receive attention, but it would be desirable to include pine barrens, aspen, pine plantations and grasslands as well. Large habitat patches should be the highest priority. Integrate efforts with state or regional projects when possible.
5. Perform ongoing monitoring of Ebony bog haunter dragonfly (*Williamsonia fletcheri)* population at Hoodoo Lake.
6. Perform ongoing monitoring of aquatic macroinvertebrate communities at representative sites:
   - Bois Brule segments (as used by Dubois, 1993),
   - springs and spring runs,
   - examples of cold, cool and warm water streams,
   - Smith Lake.
7. Repeat benthic invertebrate sampling per Dubois (1993).
8. Develop monitoring component (built-in) for any restoration program (e.g. boreal forest and pine barrens).

Research

1. Re-evaluate management of sensitive vegetation types dependent on disturbance for their long-term maintenance. Examples include pine/oak forests and pine barrens. Where significant changes to a community are likely to result in a loss of valued ecological attributes (function, structure, composition), we need to carefully examine options. If fire cannot be safely or economically used, is silviculture a viable option? If so, are existing prescriptions adequate? If not, who will develop them?
2. Thoroughly explore the reintroduction of fire as a management tool, especially in the barrens landscape of the upper Brule. The implications of continued fire exclusion need to be examined. Alternative methods of maintaining open or semi-open habitats need careful assessment, as they are not risk-free, inexpensive, or likely to accomplish all desired objectives.
3. Additional research is clearly needed to develop effective methods to reduce the quantities of fine sediments reaching the river and Lake Superior. A special erosion control zone has been established by state forest staff to provide maximum protection to the fragile bluffs flanking the river. This has arrested erosion to a degree. However, where past historic damage was especially severe, such as on the lower Brule, the slumping of the red clays continues. We support previous recommendations made by DuBois (1993), including continued acquisition of riparian land, sedimentation studies, and a water quality monitoring program.
4. Determine taxonomic status of aquatic insects that are potentially very rare throughout their range:
    - *Caenis youngi*, a rarely reported mayfly, has been found in a range of habitats that suggest there may be more than one species involved.
    - A Diamesin midge (*Protanypus* sp.) collected on the Brule was not identifiable to species in the larval form. Species determination could be accomplished by rearing larvae to adults or placing emergence traps in larval habitat. Whatever species is (are) found here represent a significant range extension.

Inventory

1. The mouth of the Brule River and the Lake Superior coastal area should be more thoroughly inventoried for aquatic invertebrates, terrestrial invertebrates, and important bird use areas.
2. Identify and protect the communal or traditional wood turtle nest sites.
3. The Mille Lacs Uplands ecoregion may warrant additional survey and/or restoration consideration.

Glossary of Terms Used in This Report

aquatic macrophyte - vascular plants with special adaptations to aquatic habitats (lakes, streams, springs).

barrens - Also known as "pine barrens". A natural community characterized by sandy soils of low nutrient content, vegetation adapted to periodic wildfire, and, under a disturbance regime of wild or prescribed fire, an open structure resembling a prairie or savanna.

BRSF - the Bois Brule River State Forest

Brule Spillway - that portion of the Brule River Valley above the Highway B bridge crossing that was the outlet of glacial Lake Duluth, a predecessor of Lake Superior.

cover type – a simplistic and generalized but sometimes useful method of classifying land based on the species forming the most significant portion of the vegetation. The term may also be used to broadly describe other surface cover, e.g. “open water,” grass,” etc.

diversity - used in this report as a shortened form for biological diversity, or biodiversity. A general definition (Matthiae et al., 1993) is "the spectrum of life forms and the ecological processes that support and sustain them. Biological diversity is a complex of four interacting levels: genetic, species, community, and ecosystem."

element - elements are 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 and mussel beds. In short, an element is any biological or ecological entity upon which the Natural Heritage Inventory considers important to gather information for conservation or related purposes.

element occurrence - An individual example of an element (a natural community, rare plant population, rare animal population, or other feature tracked by the Natural Heritage Inventory program) at a specific geographic location.

ericaceous - pertaining to a family of plants, the Ericaceae, especially characteristic of highly acidic habitats such as bogs. Members include such well-known plants as blueberries, cranberries, leatherleaf, Labrador tea, and bog rosemary.

exemplary - Used in the report to describe aquatic (and occasionally other) communities or assemblages that are especially good representatives of their respective types. Usage of the term, while subjective, includes comparison of like types based on their diversity, water quality characteristics, disturbance history, and values to scientific study.

fragmentation – the breaking up of large and continuous ecosystems, communities, and habitats into smaller discontinuous areas that are surrounded by altered or disturbed lands or aquatic features.

inventory site - also "site" in text. The geographic location at which a biological survey has been conducted. These may be large or small, depending on the nature of the species or community surveyed. Boundaries may be finite and discrete (a property boundary, a single stand of a forest community), or rather arbitrary. When sites become very large (exceeding several thousand acres) and encompass complex landscapes, they are sometimes referred to as "macrosites" (see below).

macroinvertebrate - Used in the report to refer to aquatic insects and mollusks.

macrosite - see "inventory site." Two or more standard inventory sites in close proximity, where consideration of their collective attributes is in some way related to the viability and ecological values of the larger whole. Scale is usually in 1000's of acres or more.

mesic - moist, well-drained (not too wet, not too dry).

natural community - an assemblage of plants and animals, in a particular place at a particular time, interacting with one another and 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.

Natural Heritage Inventory - a system developed by the science division of The Nature Conservancy for collection, management, and use of biological, ecological, and related information. In Wisconsin, the Natural Heritage Inventory was established by action of the state legislature in 1985, after which the program was installed within the DNR's Bureau of Endangered Resources.

old-growth – used in this report to refer to forests characterized by large trees, large standing snags, abundant down wood ("coarse woody debris") on the forest floor, a complex multi-layered canopy, pit and mound microtopography ("tip-ups"), and many other attributes. Definitions can vary for specific forest community types for a variety of reasons.

State Natural Area - formally designated sites that contain outstanding examples of native biotic communities and are often the last refuges in the state for rare and endangered species of pants and animals. Areas are devoted to scientific research, the teaching of conservation biology, and especially to the preservation of their natural values and genetic diversity for future generations. The Department of Natural Resources currently administers 326 State Natural Areas encompassing more than 120,000 acres of land and water.

TNC - The Nature Conservancy, a private conservation organization responsible for developing the standardized methodology used by Natural Heritage programs. The Wisconsin Chapter has actively worked for many decades with private landowners in the Bois Brule watershed to secure conservation agreements.

xeric - characterized by excessive dryness.

References

Albert, D.A. 1995. Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: A Working Map and Classification. Gen. Tech. Rpt. NC-178. St. Paul, MN: USDA, Forest Service, North Central Forest Experiment Station. 250 pp.

Bailey, R.G. 1995. Description of the Ecoregions of the United States. Misc. Publ. 1391. USDA, Forest Service. Washington, D.C. 107 pp.

Blewett, T.C. 1976. Structure and Dynamics of the McDougal Springs Lowland Forest. M.S. Thesis, University of Wisconsin-Madison. 88 pp.

Bowers, F.D. 1996. A Study of the Bryophytes of Selected Areas in the Northern Highland-American Legion and Brule River State Forests. University of Wisconsin-Stevens Point. 13 pp.

DuBois, R.B. and D.M. Pratt. 1994. History of the Fishes of the Bois Brule River System, Wisconsin, with emphasis on the salmonids and their management. Transactions of the Wisconsin Academy of Sciences, Arts, and Letters. Volume 82, pp. 33-71.

DuBois, R.B. 1993. Aquatic Insects of the Bois Brule River System,Wisconsin. Technical Bulletin No. 185. Wisconsin Department of Natural Resources, Madison, WI. 35 pp.

Epstein, E.J., E.J. Judziewicz, and W.A. Smith. 1997. Wisconsin's Lake Superior Coastal Wetlands Evaluation. Wisconsin Department of Natural Resources, Madison, WI. 330 pp.

Faber-Landgendoen, D., D.M. Ambrose and J.F. Drake. 1994. Rare Plant Communities of the Continuous United States, An Initial Survey. The Nature Conservancy, Arlington, VA 620 pp.

Fassett, N.C. 1944. Vegetation of the Brule Basin, Past and Present. Brule River Survey: Paper No. 4. Transactions of the Wisconsin Academy of Sciences, Arts, and Letters. Vol. 36, pp.33-63.

Hadley, D.W. and J.H. Pelham comp. 1976. Glacial Deposits of Wisconsin: Sand and Gravel Resource Potential. Wisconsin Geological and Natural History Survey. Madison, WI.

Hole, F.D., M.T. Beatty, C.J. Milfred, G.B. Lee and A.J. Klingelhoets. comp. Soils of Wisconsin. Wisconsin Geological and Natural History Survey. Madison, WI.

Kotar, J., J.A. Kovach, and C.T. Locey. 1988. Field Guide to habitat types of northern Wisconsin. University of Wisconsin-Madison Department of Forestry, and Wisconsin Department of Natural Resources, Madison, WI. 220 pp.

Kotar, J., T.L. Burger, and D. Czysz. 1992. Supplement to the Field Guide to Forest Habitat Types of Northern Wisconsin: Douglas County and Northern Bayfield and Ashland Counties. Unpublished. University of Wisconsin-Madison, Department of Forestry, Madison, WI 27 pp.

LaBerge, G.L. 1994. Geology of the Lake Superior Region. Geoscience Press, Inc. Tucson, AZ. 313pp.

Martin, L.M. 1916. The physical geography of Wisconsin. University of Wisconsin Press, Madison, WI. 608 pp.

Matthiae, P. (team leader). 1993. Wisconsin's Biodiversity as a Management Issue: A Report to Department of Natural Resources Managers. DNR, Madison, WI. 180 pp.

Maycock, P.F. 1957. The phytosociology of boreal conifer-hardwood forests of the Great Lakes region. Ph.D. thesis, University of Wisconsin.

Owen, D.D. 1848. Report of a Geological Reconnaissance of the Chippewa Land District. Senate Executive Document 57: 58-61.

Sather, L.M. and S.I. Johannes. 1972. Surface Water Resources of Douglas County. Department of Natural Resources, Madison, WI. 166 pp.

Sweet, E.T. 1880. Geology of the western Lake Superior district; climate, soils and timber. In Geology of Wisconsin, Vol. 3:323-329.

The Nature Conservancy. (R. Tull, Project Manager). 1980. The Ecological Nature of the Bois Brule River Study Area. The Nature Conservancy - Madison Field Office, Madison, WI. 145 pp.

Thomson, J.W. 1945. An analysis of the vegetative cover of the Brule River (Wisconsin) watershed. Brule River Survey Report No. 8. Transactions of the Wisconsin Academy of Sciences, Arts, and Letters. Vol. 37. pp. 305-323.

Thomson, J.W. 1944. A survey of the larger aquatic plants and bank flora of the Brule River. Brule River Survey Report No. 5. Transactions of the Wisconsin Academy of Sciences, Arts, and Letters. Vol. 36, pp. 57-76.

Wisconsin Department of Natural Resources. (1999). Wisconsin's Northern State Forest Assessments. Regional Ecology. DNR. Madison, WI.

Wisconsin Department of Natural Resources. (in progress). Wisconsin's Northern State Forest Assessments. Community Restoration and Old Growth. DNR. Madison, WI.

Wisconsin Department of Natural Resources. (1999). Wisconsin Wolf Management Plan (Draft). Wisconsin Wolf Advisory Committee. DNR. Madison, WI.

Woodward, D.A. comp.1972. Landforms of Wisconsin. Wisconsin Geological and Natural History Survey. Madison, WI.

APPENDIX A

Methods of Inventory

Any step 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 Biological & Conservation Data system, housed within DNR's Natural Heritage Inventory. Other databases with potentially useful information may also be queried, such as: forest stand/compartment reconnaissance, which is available for many public agency owned lands; 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; museum/herbarium collections for various target taxa; soil surveys; and the fish distribution database (by watershed, WDNR-Research).

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 contain information on a variety of subjects relevant to the inventory of natural features and are frequently useful.

Literature Review: Field biologists involved with a given project consult basic references on the natural history and ecology of the region within which the study area is situated. This can both broaden and sharpen the focus of the investigator.

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.

Map compilation: USGS 7.5 minute topographic quadrangles serve 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.

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.

Ecoregion maps 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. As these maps evolve, they should become increasingly useful, even for relatively small, localized projects.

Geographic Information Systems (GIS) are increasing our ability to integrate spatial information on lands and waters of the state and are becoming a basic resource tool for the efficient and comprehensive planning of surveys and the analysis of their results.

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.

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. These notes also record 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.

Interviews: Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield information not available in other formats.

Analysis of Compiled Information: The compiled information is analyzed to identify inventory priorities, determine needed expertise, and develop budgets.

Meetings: Planning and coordination meetings are held with all participants to provide an overview of the project, share information, identify special equipment needs, coordinate schedules, and assign landowner contact responsibilities. Team development may be a part of this step.

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

Site Descriptions of the Brule River State Forest

Apendix C contains site descriptions for the 44 sites that contained some feature of significance that raised their importance over the remaining inventory sites. See the text for more detailed descriptions of site selection and definitions.

PRIMARY INVENTORY SITES WITHIN THE BRSF BOUNDARY

The following are the Primary Sites defined as selected inventory sites within the BRSF that contain the best examples of documented rare and representative natural features. Significant portions of these sites should receive high protection or restoration consideration. A Map ID number is included on each of the Primary Site description sheets and corresponds to specific site locations on Figure 3.

CATLIN CREEK

Map ID# 35

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Bennett
Town-Range-Section:	T46N-R12W-sec 36; T45N-R12W-sec 1; T45N-R11W-secs 6,7,18
Size:	3 acres of surface water; approx. 15 acres in site boundary

Description of Site

Catlin Creek is a 2.7 mile long, fast, small, coldwater stream with light brown color. It enters Upper St. Croix Lake which is part of the headwaters of the St. Croix River. The major tributary springs are located upstream of the state forest boundary. Substrate materials are mostly rock with large amounts of gravel and sand also present. The stream flows through wooded uplands in a mostly forested watershed. Flow extremes have been noted.

Significance of Site

Catlin Creek is considered Class I trout water from its headwaters to its confluence with Porcupine Creek, after which it is considered Class lll trout water. The fish population is varied and includes brook trout, spawning walleyes from Upper St. Croix Lake, and several minnow species. A rare caddisfly known in WI from only three sites is found here as well. Total aquatic insect diversity was 23 species (based on only one sample) which is relatively high for streams of this type in the Lake Superior basin.

Management Considerations

Management issues include shoreline modifications, water quality degradation, and water level alterations. Presence or absence of beaver dams is also a consideration. Fluctuations in flow have been extreme in the past and it would be desirable to bring these under a more natural range of variation (which still needs to be determined).

Catlin Creek

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
A BIZARRE CADDISFLY (LEPIDOSTOMA LIBUM)		SC/N	1996

PORCUPINE CREEK HEADWATERS

Map ID# 28

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Bennett
Town-Range-Section:	T45N-R11W-section 6 W1/4NE1/4; N1/2NE1/4NW1/4
Size:	approximately 25 acres are in the site boundary

Description of Site

The uppermost reaches of Porcupine Creek are forested with an interesting mix of mesic northern hardwoods and wet-mesic swamp hardwoods. Dominant canopy trees are medium-size sugar maple and black ash. Common understory plants include ostrich fern, wild sarsaparilla, lady fern, big-leaved aster, wood nettle, and marsh marigold. Very large stumps, approaching 4' in diameter, were noted in this stand.

The small creek has dark-stained water and a sandy bottom. Just downstream of this site the creek has been dammed by beaver and the adjoining forest drowned. Aquatic invertebrate sampling was conducted farther downstream on two dates.

Significance of Site

No rare species were documented here but the mix of plants is unusual.

Management Considerations

Conservation limitations include small size, isolation, and multiple ownerships. Only a small wedge of the relatively rich Mille Lacs Uplands ecoregion occurs on this part of the BRSF, bordered by the more intensively managed (for aspen and plantation-grown pine) Bayfield Sand Barrens.

Porcupine Creek Headwaters

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN MESIC FOREST		NA	1996

BRULE SPILLWAY MACROSITE

(multiple sites are grouped here)

Location

Ecoregion:	Bayfield Sand Barrens subsection
USGS 7.5' Quadrangle:	Bennett, Lake Minnesuing, Island Lake, Brule
Town-Range-Section:	T45N-R11W - parts of sections 2,3,4,8,9,10,17,18 T46N-R11W - parts of sections 25,35,36 T46N-R10W - parts of sections 3,10,15,16,20,21,19,30,31 T47N-R10W - parts of sections 27,34
Size:	approximately 6,257 acres in the macrosite boundary

Description of Site

Following the retreat of the glaciers, Lake Superior drained southwestward through what are now the Bois Brule and St. Croix River valleys. This created the long, narrow, steep-sided, relatively straight valley which exists today and possesses many unusual ecological attributes. The present Brule River originates from springs within an extensive conifer swamp near Solon Springs, and flows north to Lake Superior. (This swamp is also the headwaters area of the St. Croix River which flows south to join the Mississippi.) The upper stretches of the river are slow, with many meanders, and receive cold, clean water from numerous springs and seepages. Just above Stone's Bridge the character of the river changes: the gradient begins to steepen; the bottom materials include gravel, cobbles and boulders (rather than just organic sediments); meanders are much less frequent; and several large spring ponds feed the main stem (rather than numerous small seepages).

This "macrosite" encompasses the headwaters of the Bois Brule River, the upper portions of the river corridor, and a stretch of the middle section of the Bois Brule downstream to the Highway B bridge. Also included within the site boundary are the forested sandy slopes bordering the river and several short tributary streams.

Significance of Site

This site is of the highest ecological significance at local, regional and statewide levels. The extent and quality of the natural communities present, the aquatic features represented, and the concentration of rare plants and animals found here are not duplicated elsewhere.

Management Considerations

The sandy uplands up and out of the Bois Brule valley are generally managed for plantation-grown pine or aspen. Some of the narrow, level terraces parallel to the river below Stone's Bridge are also in short rotation cover types or plantations. Significant portions of the valley are privately owned, especially below Stone's Bridge.

Management issues and concerns listed below are for the entire Brule Spillway and not per individual site.

- protection of surface and ground water throughout the drainage basin is critical
- excessive browse is occurring on sensitive plants

- maintenance and restoration of older conifer forests on the adjacent slopes would have many benefits
- long-term fire suppression on xeric uplands and slopes has affected and will continue to affect the vegetation
- road maintenance along county highways 'P', 'S', and 'B' needs to be especially sensitive to environmental concerns
- there is a need for continued coordination and cooperation among different landowners
- maintaining the ecological integrity of this exceptional natural features complex should be a top priority in Wisconsin

Note: Because of the size of this complex, the description is broken into six sections, each keyed on a feature that appears on maps and/or may be familiar to individuals knowledgable about the Bois Brule River ecosystem.

Though the quality, condition, and significance of the individual sections (sites) described in the following pages varies, the direct linkages between them, their continuous nature, and the ecological importance of scale are over-riding and integrating factors that should receive recognition and attention in the master plan.

Brule Spillway Macrosite			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
COMMUNITIES			
ALDER THICKET		NA	1997
HARDWOOD SWAMP		NA	1996
NORTHERN DRY-MESIC FOREST		NA	1996
NORTHERN WET-MESIC FOREST		NA	1996
SPRING POND		NA	1982
SPRINGS AND SPRING RUNS, SOFT		NA	1996
STREAM--FAST, SOFT, COLD		NA	1996
SUBMERGENT AQUATIC		NA	1996
TAMARACK SWAMP		NA	1996
ANIMALS			
A CAENID MAYFLY (CAENIS YOUNGI)		SC/N	1996
A PREDACEOUS DIVING BEETLE (HYDROPORUS PSEUDOVILIS)		SC/N	1996
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1995
BLACK-TIPPED DARNER (AESHNA TUBERCULIFERA)		SC/N	1996
CAPE MAY WARBLER (DENDROICA TIGRINA)		SC/M	1997
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		SC/M	1997
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1997
NORTHERN GOSHAWK (ACCIPITER GENTILIS)		SC/M	1997
OSPREY (PANDION HALIAETUS)		THR	1996
PINE SISKIN (CARDUELIS PINUS)		SC/M	1997
PRONGHORNED CLUBTAIL (GOMPHUS GRASLINELLUS)		SC/N	1996
SKI-TAILED EMERALD (SOMATOCHLORA ELONGATA)		SC/N	1996
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1997
PLANTS			
AUTUMNAL WATER-STARWORT (CALLITRICHE HERMAPHRODITICA)		SC	1996
FAIRY SLIPPER (CALYPSO BULBOSA)		THR	1996
FIR CLUBMOSS (LYCOPODIUM SELAGO)		SC	1996
LAPLAND BUTTERCUP (RANUNCULUS LAPPONICUS)		END	1996
Brule Spillway Macrosite (cont.)			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**

LARGE WATER-STARWORT (CALLITRICHE HETEROPHYLLA)		THR	1996
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1996
MOUNTAIN CRANBERRY (VACCINIUM VITIS-IDAEA SSP MINUS)		END	1930
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1996
PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)		SC	1996
RICHARDSON SEDGE (CAREX RICHARDSONII)		SC	1996
SHEATHED SEDGE (CAREX VAGINATA)		SC	1996
SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)		SC	1996
SPARSE-FLOWERED SEDGE (CAREX TENUIFLORA)		SC	1996

DIVIDE SWAMP

Map ID# 23

(Brule Spillway Macrosite)

Location

Ecoregion:	Bayfield Sand Barrens subsection
USGS 7.5' Quadrangle:	Bennett
Town-Range-Section:	T45N-R11W-sections 4, 5,7-9,17,18
Size:	approximately 1,211 acres in the site boundary

Description of Site

This conifer swamp of mature white cedar, black spruce, and tamarack straddles a drainage divide and contains the headwaters of both the Bois Brule and St. Croix Rivers. Black ash-dominated hardwood swamp, alder thicket, springs, and spring runs are among the other natural communities present.

Significance of Site

Numerous rare plant and animal species were documented here. One of the rare plants, fir clubmoss, was not previously known in Wisconsin away from the immediate vicinity of Lake Superior. It occurs here at its only station on the BRSF.

Management Considerations

Of special interest at this site is the presence of three small rectangular forested plots near county highway 'P' which were subjected to different management treatments in the 1970's in an attempt to regenerate white cedar. This extremely important species is experiencing reproductive problems throughout most of its northern Wisconsin range and is a dominant in the species-rich conifer swamps growing throughout the Spillway.

Because this site contains the headwaters of two of Wisconsin's most important streams it merits strong protection. It is crossed by a county highway and the adjacent upland forests are intensively managed for aspen and plantation-grown pine.

Divide Swamp

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
HARDWOOD SWAMP		NA	1996
NORTHERN WET-MESIC FOREST		NA	1996
TAMARACK SWAMP		NA	1996
ANIMALS			
A CAENID MAYFLY (CAENIS YOUNGI)		SC/N	1996
A PREDACEOUS DIVING BEETLE (HYDROPORUS PSEUDOVILIS)		SC/N	1996
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1995
BLACK-TIPPED DARNER (AESHNA TUBERCULIFERA)		SC/N	1996
OSPREY (PANDION HALIAETUS)		THR	1996
PRONGHORNED CLUBTAIL (GOMPHUS GRASLINELLUS)		SC/N	1996

Divide Swamp (cont.)			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
PLANTS			
FAIRY SLIPPER (CALYPSO BULBOSA)		THR	1932
FIR CLUBMOSS (LYCOPODIUM SELAGO)		SC	1996
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE		SC	1996
MOUNTAIN CRANBERRY (VACCINIUM VITIS-IDAEA SSP MINUS)		END	1930
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1996
SHEATHED SEDGE (CAREX VAGINATA)		SC	1996
SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)		SC	1996
SPARSE-FLOWERED SEDGE (CAREX TENUIFLORA)		SC	1996

ANGEL CREEK SWAMP

Map ID# 22

(Brule Spillway Macrosite)

Location

Ecoregion:	Bayfield Sand Barrens subsection
USGS 7.5' Quadrangle:	Lake Minnesuing
Town-Range-Section:	T45N-R11W-sections 3,4,9,10
Size:	approximately 1023 acres in the site boundary

Description of Site

Angel Springs and its outlet, Angel Creek, feeds the upper reaches of the Bois Brule River, flowing through a floristically rich conifer swamp. White cedar is the dominant tree, though locally, black spruce and/or balsam fir are codominant. Canopy trees are of medium size, but little evidence of recent disturbance was noted. Only fir is reproducing, and heavy deer browse was apparent. The swamp conifers give way to an alder thicket close to the river.

Significance of Site

Angel Creek supports rare invertebrates (24 aquatic invertebrate taxa, one rare, were collected here) and rare plants. This site is contiguous with other highly significant natural features both upstream and downstream.

Management Considerations

Protect the hydrology, reduce browse pressure on white cedar, and encourage development of older, conifer-dominated forests on the adjoining slopes.

Angel Creek Swamp

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN WET-MESIC FOREST		NA	1996
ANIMALS			
SKI-TAILED EMERALD (SOMATOCHLORA ELCONGATA)		SC/N	1996
PLANTS			
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1996
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1996
SHEATHED SEDGE (CAREX VAGINATA)		SC	1996
SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)		SC	1996

JERSETH CREEK

Map ID# 20

(Brule Spillway Macrosite)

Location

Ecoregion:	Bayfield Sand Barrens subsection
USGS 7.5' Quadrangle:	Lake Minnesuing
Town-Range-Section:	T45N-R11W-sections 2,11,12
Size:	approximately 313 acres in the site boundary

Description of Site

This mile-long tributary of the Bois Brule is situated in an old glacial outwash channel. A narrow corridor of alder and large swamp conifers borders the stream. The sandy slopes above the creek support xeric 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 red pine occurs just above the headwaters spring for Jerseth Creek.

Significance of Site

The diversity of aquatic invertebrates in the stream is high and includes rare species, one of which was not previously known east of the Colorado River. Rare animals were also documented as residents of both the dry forests and the conifer swamps.

Management Considerations

Small-scale opportunities to manage for pine barrens occur on south and west-facing slopes above the creek and its tributary valleys. Shoberg Lake, actually two small undeveloped seepage lakes, occurs 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.

Jerseth Creek

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
STREAM--FAST, SOFT, COLD		NA	1996
ANIMALS			
CONNECTICUT WARBLER (OPORORNIS AGILIS)		SC/M	1996
PLANTS			
RICHARDSON SEDGE (CAREX RICHARDSONII)		SC	1996

STONE CHIMNEY CEDAR SWAMP

Map ID# 31

(Brule Spillway Macrosite)

Location

Ecoregion:	Bayfield Sand Barrens subsection
USGS 7.5' Quadrangle:	Lake Minnesuing
Town-Range-Section:	T46N-R11W-sections 35,36; T45N-R11W-sections 2,3
Size:	approximately 940 acres in the site boundary

Description of Site

This area features an extensive forest of mature swamp conifers, with white cedar generally dominant. Thickets of alder, small patches of sedge meadow, and numerous springs and seepages also occur along this stretch of the river. The steep upland slopes adjoining the river corridor support second-growth dry-mesic forest of red and white pine, aspen, paper birch, and red oak. These stands, some of them now quite mature, also contain boreal components such as white spruce and balsam fir. One site in the old growth cedar swamp was sampled for bryophytes (mosses) on one day. Sixty-seven taxa were collected with 53 mosses and 14 hepatics (liverworts). None of the taxa were considered to be “rare” or unexpected at such a site. However, our present knowledge of the distribution and status of non-vascular plants is sketchy.

Significance of Site

Many rare plant and animal species were documented here, and in general the site is especially rich in sedges and orchids. Several of the rare plants are represented by their largest, and possibly most viable, state populations. The plant communities are extensive and of excellent quality.

Management Considerations

A portion of this site, totalling 182 acres, is designated as State Natural Area No. 161 ("Upper Brule River") in the current property master plan. This boundary needs review, as it is not based on ecological features.

Stone Chimney Cedar Swamp

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
ALDER THICKET		NA	1997
NORTHERN WET-MESIC FOREST		NA	1997
ANIMALS			
CAPE MAY WARBLER (DENDROICA TIGRINA)		SC/M	1996
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1996
NORTHERN GOSHAWK (ACCIPITER GENTILIS)		SC/M	1997
OSPREY (PANDION HALIAETUS)		THR	1987
PINE SISKIN (CARDUELIS PINUS)		SC/M	1996
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1996
PLANTS			
FAIRY SLIPPER (CALYPSO BULBOSA)		THR	1996

Stone Chimney Cedar Swamp (cont.)			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
LAPLAND BUTTERCUP (RANUNCULUS LAPPONICUS)		END	1996
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE		SC	1996
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1996
PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)		SC	1996
SHEATHED SEDGE (CAREX VAGINATA)		SC	1996
SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)		SC	1996

BLUE SPRINGS - MCDOUGAL SPRINGS

Map ID# 17

(Brule Spillway Macrosite)

Location

Ecoregion:	Bayfield Sand Barrens subsection
USGS 7.5' Quadrangle:	Lake Minnesuing
Town-Range-Section:	T46N-R10W-sections 20,29,30; T46N-R11W-sections 25,36
Size:	approximately 1047 acres in the site boundary

Description of Site

Crossed by one of the few roads over the upper Bois Brule at Stone's Bridge, this stretch demonstrates a marked change in the character of the stream with respect to substrate, gradient, and channel meanders. The forest adjoining the river corridor includes stands of old-growth white cedar swamp and old-growth dry-mesic white pine-red pine forest. The pine stands occur on gravelly or sandy ridges paralleling the river channel. Several large undisturbed spring ponds occur here.

Significance of Site

At least one of the large spring ponds, McDougal Springs, supports rare aquatic invertebrates. Numerous rare plants and animals were documented in this area, and Stone's Bridge is well known to our state's active birders as a reliable location at which to observe boreal species such as the olive-sided flycatcher, Cape May warbler, gray jay, and black-backed woodpecker.

Management Considerations

Part of this area, totalling 132 acres, is designated as State Natural Area No. 160, "Bois Brule Conifer Bog", in the current property master plan. This boundary needs review. The spring seeps and spring ponds are fragile features. Inundation due to beaver impoundments has altered the hydrology of parts of this site, and some important old-growth forest has been drowned recently. Private owners are key partners in the long-term protection of this site.

Blue Springs - McDougal Springs

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN WET-MESIC FOREST		NA	1996
SPRING POND		NA	1982
SPRINGS AND SPRING RUNS, SOFT		NA	1996
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
CAPE MAY WARBLER (DENDROICA TIGRINA)		SC/M	1997
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		SC/M	1997
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1997
PINE SISKIN (CARDUELIS PINUS)		SC/M	1997
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1997
PLANTS			
FAIRY SLIPPER (CALYPSO BULBOSA)		THR	1996
LARGE WATER-STARWORT (CALLITRICHE HETEROPHYLLA)		THR	1996

Blue Springs - McDougal Springs			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1996
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1996
SHEATHED SEDGE (CAREX VAGINATA)		SC	1996
SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)		SC	1996

CEDAR ISLAND - WINNEBOUJOU

Map ID# 15

(Brule Spillway Macrosite)

Location

Ecoregion:	Bayfield Sand Barrens subsection
USGS 7.5' Quadrangle:	Lake Minnesuing, Island Lake
Town-Range-Section:	T46N-R10W-sections 3,10,15,16,21,28
Size:	approximately 1721 acres in the site boundary

Description of Site

This area, which begins just below McDougal Springs and extends north almost to the highway ‘B’ bridge, includes several stretches of the Bois Brule River that are slow, wide, and shallow. These are referenced as "lakes" on the topographic maps: "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 confers and upland pine forest.

Significance of Site

This is 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, waterweed, arrowhead, and bur-reed. Wildlife values are high with bald eagle, osprey, northern goshawk, and many neotropical migrants among the residents.

Management Considerations

The lands bordering the river are forested, with conifers generally dominant. Extensive stands of older white cedar-balsam fir swamp, 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. Development of a long-term management and protection plan for the pine forest community is key. Protection of water quality and shoreline habitats is another major consideration.

Cedar Island - Winneboujou

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1996
SUBMERGENT AQUATIC		NA	1996
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1995
PLANTS			
AUTUMNAL WATER-STARWORT (CALLITRICHE HERMAPHRODITICA)		SC	1996

MILLS LAKE

Map ID# 24

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Bennett
Town-Range-Section:	T45N-R11W-section 5 SE1/4
Size:	approximately 36 acres in the site boundary

Description of Site

This shallow, muck-bottomed, softwater seepage lake of 8 acres is bordered by a boggy open meadow that is composed primarily of sedges and leatherleaf. The shoreline and wetland margins are undeveloped. The adjoining rolling sandy uplands are intensively managed for short rotation aspen and plantation-grown conifers.

Significance of Site

No rare species were documented here, but 29 species of aquatic invertebrates were collected. The lake and associated wetlands are essentially undisturbed and 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 wet meadow bordering the lake is the best example of this community that was documented on the BRSF.

Management Considerations

Application of the Bureau of Forestry's best management practices (BMPs) to proposed activities at or near this site should be sufficient to maintain the condition and quality of the natural features here. We would recommend that clearcutting around the lake and wetland be limited and not allowed to totally isolate the wetlands from upland forest. In the long-term, the restoration of more natural pine-oak forest, or pine barrens, could be considered here.

Mills Lake

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
POOR FEN		NA	1996

SMITH LAKE

Map ID# 21

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Lake Minnesuing
Town-Range-Section:	T45N-R11W-section 11
Size:	30 acres of lake surface, approximately 131 acres in site boundary

Description of Site

Smith Lake is a shallow seepage lake with very soft water. Bottom materials include muck, sand, and gravel. The upland shoreline, is mostly forested and undeveloped. The lake supports beds of emergent, submergent, and floating-leaved aquatic vegetation. Small patches of wet meadow and leatherleaf occur along the sandy margins. Winterkill conditions prevail because of the shallow depth and lack of oxygenated inflow.

Significance of Site

This lake is especially noteworthy because of its diverse aquatic invertebrate population (39 species collected), including several rare species. Some of these are uncommon statewide. Common loons (uncommon in the BRSF) were noted on the lake during their breeding season. Seepage lakes are common in this ecoregion but few are protected and development pressures are high.

Management Considerations

The most pressing management concern is securing protected status for that portion of the lake occurring on private lands. In the past, management of the adjoining forest included aerial herbicide applications (pers. comm., J. Gallagher). Management for brush barrens, dry forest types, or a combination of these on the uplands around the lake is appropriate and complementary.

Smith Lake

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
A CAENID MAYFLY (CAENIS YOUNGI)		SC/N	1996
AMBER-WINGED SPREADWING (LESTES EURINUS)		SC/N	1996

NORTH COUNTRY TRAIL BARRENS

Map ID# 18

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Island Lake, Lake Minnesuing
Town-Range-Section:	T46N-R10W-parts of sections 27, 28, 29, 31, 32, 33, 34
Size:	approximately 2772 acres in the site

Description of Site

An old glacial outwash channel and the adjoining level sand flats are currently vegetated with red and jack pine plantations, patches of dense natural jack pine forest, scrubby Hill's and bur oak thickets, and small pine barrens remnants. Historically, the vegetation of much of this area was pine barrens and pine-oak scrub, with scattered patches of xeric forest. Prairie plants such as asters, blazing stars, puccoon, and wood lily are inter-mixed with patches of “heath” containing bearberry, sweet fern, and blueberry.

Significance of Site

These community types are rare and declining throughout the western Great Lakes, making their presence here very significant. The Bayfield Sand Barrens ecoregion contains a large share of the significant occurrences of pine barrens. This site, though not especially large, is still important, especially in light of the management direction on nearby non-state-owned lands. Rare or uncommon species often associated with barrens habitats were documented at this site, including prairie skink, upland sandpiper, Brewer's blackbird, Connecticut warbler, and Richardson's sedge.

Management Considerations

Extensive salvage of jack pine has occurred on county and industrial forest land in this area owing to an outbreak of jack pine budworm in the early-mid 1990s. Many of these salvaged stands have already been planted or replanted, often to red pine monotypes. This is true for tracts bordering highway 27 and south of highway ‘S’, as well as for some of the state lands on the north side of ‘S’.

Due to the decline of pine barrens, pine-oak scrub, and xeric forest throughout Wisconsin, it would be worth giving serious consideration to maintain the existing natural community remnants, expanding them where feasible, and developing a management plan which would both maintain barrens and dry forest types and reduce fire danger by lowering fuel load. However, for the foreseeable future, barrens and dry forest management opportunities here will be limited in scale and probably confined to state-owned lands. There is potential for management of some adjoining private lands for barrens, but this will depend on the interests of the principal owners.

Several management issues are of importance. There is relatively high potential for the establishment and spread of invasive species owing to soil disturbance associated with salvage and replanting operations. Colonies of leafy spurge and spotted knapweed, aggressive exotic plants, were noted in scraped areas along highway 27 just south of highway `S'. Also, the long-term suppression of fire from this ecosystem and the widespread planting of conifer monocultures has not only suppressed many of the native barrens species but has also led to high fuel buildup and simplified natural community structure and composition.

The dry forest end of the barrens continuum has gotten little attention from public agencies. A large acreage of this community has been lost recently in northwestern, west central, and central Wisconsin. In some areas, large-scale conversion of jack pine-"scrub oak" barrens to red pine plantations is still occurring and will result in diminished habitat for many plants and animals.

North Country Trail Barrens			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
COMMUNITIES			
NORTHERN DRY FOREST		NA	1996
PINE BARRENS		NA	1996
ANIMALS			
CONNECTICUT WARBLER (OPORORNIS AGILIS)		SC/M	1996
UPLAND SANDPIPER (BARTRAMIA LONGICAUDA)		SC/M	1996
PLANTS			
RICHARDSON SEDGE (CARES RICHARDSONII)		SC	1996

LAKE MINNESUING HEMLOCK-HARDWOODS & SWAMP

Map ID# 25

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Bennett
Town-Range-Section:	T46N-R11W-section 16 SW 1/4; section 21 W 1/4, W 1/2 SE 1/4
Size:	approximately 133 acres in the site

Description of Site

A mixed mesic forest of hardwoods and conifers occurs on rolling morainal topography to the west of Lake Minnesuing. Canopy associates in this medium-aged stand include sugar maple, basswood, red oak, red maple, and paper birch. Typical ground layer plants are beaked hazelnut, leatherwood, wild sarsaparilla, Canada mayflower, and big-leaved aster. 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 locally important. Several roads cross the site.

Shallow basins just south and west of the Lake support small medium-aged stands of hardwood swamp dominated by black ash. The lake itself is heavily developed with many homes on the shoreline.

Significance of Site

No rare species were documented here but this site is noteworthy as one of the northwestern-most stations for eastern hemlock. Mesic forests are well-represented on national and state forest lands to the east and south of the BRSF. The largest, least isolated “island” of mesic forest in the BRSF is at Sugar Camp Hill.

Management Considerations

Limited state ownership, the placement of roads, the mosaic of current vegetation cover types, and the capability of the land pose constraints on management of this site.

Lake Minnesuing Hemlock-Hardwoods Swamp

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
HARDWOOD SWAMP		NA	1996
NORTHERN MESIC FOREST		NA	1996
ANIMALS			
FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)		SC	1996
GLOYD'S BLUET (ENALLAGMA VERNALE)		SC/N	1996
PLANTS			
AUTUMNAL WATER-STARWORT (CALLITRICHE HERMAPHRODITICA)		SC	1996

BURIED ROAD PINES & PONDS

Map ID# 26

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Lake Minnesuing
Town-Range-Section:	T46N-R11W-section 21 S1/2SE1/4SE1/4section 28 N1/2NE1/4NE1/4
Size:	approximately 12 acres in the site boundary

Description of Site

The canopy of this dry-mesic forest is composed of large white and red pines. Associates and sub-canopy trees include red oak, red maple, and paper birch. A robust, dense layer of hazelnuts (both spp.) and red maple saplings comprises the shrub layer. Among the representative herbs and low shrubs are bracken fern, low sweet blueberry, Canada mayflower, rice grass, and wild sarsaparilla.

Significance of Site

No rare species were documented here. However, at present older stands of white and red pine forest are quite rare on the BRSF as they are throughout the northern Wisconsin range of the community.

Management Considerations

The major conservation limitations of this site are the small stand size, its isolation, and its context within intensively managed forest. If prescribed fire cannot be used here as a management tool, silvicultural methods will have to be employed to maintain pines as the dominant species.

This site merits consideration for "old-growth" management, or something similar, but exactly what the prescription would be and at what point in time the management actions would be implemented needs to be determined.

Buried Road Pines & Ponds

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1996

VAPA ROAD PINES & PONDS

Map ID# 19

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Lake Minnesuing
Town-Range-Section:	T46N-R10W-SE 1/4, NW 1/4 section 19
Size:	approximately 109 acres within the site boundary

Description of Site

The slopes and bottom of a dry sandy ravine adjoining the Bois Brule River corridor support a mature dry-mesic forest composed primarily of large red and white pines. Canopy associates include red oak, red maple, and paper birch. A dense shrub/sapling layer of hazelnut (both spp.) and maple saplings is present. Pine reproduction is limited. The resident birds include many species characteristic of older coniferous forests such as northern raven, pileated woodpecker, blackburnian and pine warblers, and red-breasted nuthatch.

Rough topography just across the town road and west of the pines features many small ponds and wetlands in the numerous 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

The ravine terminates at the uppermost of several terraces above and parallel to the Bois Brule River. This stand escaped the heavy cutting that occurred in virtually all stands of this community type, but scattered old stumps attest to the past use history of the site. Nevertheless, this stand remains, arguably, the best example of older white and red pine forest encountered away from the river within the BRSF boundary. The cluster of small ponds and kettle wetlands was deemed “exemplary” by aquatic researchers and deserving of strong protection. The wetlands also support at least one rare vertebrate animal. The wetland communities are common types within the region.

Management Considerations

Management issues include developing a means of dealing with long-term successional changes, and eventually, the potential loss of the pine overstory; restoring pine in adjacent stands currently supporting pole-size hardwoods with a very limited conifer component; and linking the natural upland pine forest to the forests along the river. Currently, the terraces are at least partially forested with pine plantations and aspen, and in the long-term, the feasibility of promoting more natural forests on the terraces should be considered. Encouraging the growth of a more natural pine or pine-oak forest on the adjoining uplands is a legitimate goal here. The wetlands merit strong protection.

Vapa Road Pines & Ponds

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1996
ANIMALS			
AMBER-WINGED SPREADWING (LESTES EURINUS)		SC/N	1996

WILLARD PINES

Map ID# 16

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Lake Minnesuing
Town-Range-Section:	T46N-R10W-section 16 SW1/4NW1/4 NW1/4SW1/4, section 17 E1/2NE1/4
Size:	approximately 199 acres within the site boundary

Description of Site

This dry-mesic forest is composed of large to medium size white and red pines, with red maple, red oak, and paper birch the major associates. Beaked and American hazelnuts form a dense shrub layer. Red maple is common in the sapling and small tree classes. The understory is representative for this community type, with bracken fern, low sweet blueberry, wild sarsaparilla, wild oats, and rice grass among the common species. Soils are sands, or sandy loams, and the topography is rolling. Small boggy depressions are scattered throughout the site and should be considered important, potentially fragile features.

Significance of Site

One rare amphibian was documented here. Older stands of the dry mesic forest community are presently rare throughout Wisconsin.

Management Considerations

Several episodes of past selective harvest have occurred here. The acreage of pine forest is relatively large, but the mosaic of stands includes aspen, some of which has been recently clearcut. Ownership is a mixture of public and private lands.

Important management considerations for this site include the potential for emphasizing and extending management for natural pine forest. For long-term management, it would be desirable to ecologically link the pine-dominated areas directly with the corridor of the Bois Brule River, which is less than one mile to the southeast of this site. Pine forest remnants are interspersed with aspen (and some paper birch) stands, some of them quite young. The feasibility of increasing the conifer component in the upland forest merits exploration.

Willard Pines

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1996
ANIMALS			
FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)		SC	1996

RUSH LAKE

Map ID# 13

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Island Lake
Town-Range-Section:	T46N-R10W-E 1/2 NE 1/4 section 12; SE 1/4 SE 1/4 section 01
Size:	approximately 122 acres in the site boundary

Description of Site

This slightly alkaline, softwater seepage lake of 22 acres has clear water, a sandy bottom, and a maximum depth of 9 feet. Apparently, winterkill conditions have not occurred here despite the shallow depth (Sather, 1973).

The most notable natural feature here is an undisturbed shoreline with a good example of an inland lake 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 spikerushes and bulrushes. The middle beach, with a substrate of moist sand, supports a diverse array of sedges and rushes, creeping clubmoss, purple gerardia, and several large populations of the insectivorous round-leaved sundew. The dry upper beach is vegetated with coarser plants such as grass-leaved goldenrod, boneset, Canada bluejoint grass, and red-stemmed gentian. Along the south shore of the lake, an area of spring seepages was noted.

The xeric, rolling uplands are forested with jack pine, red pine, and aspen. Much of the pine is plantation-grown. An interesting but 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

This site is exemplary for its aquatic invertebrate community. A rare mayfly was collected from the lake during aquatic invertebrate surveys. Many uncommonly collected, aquatic invertebrate taxa were documented here.

This waterbody is currently designated as a "Wild Lake" in the existing property master plan. The site also merits recognition for its ecological values, especially its well-developed beach. Seepage lakes with naturally fluctuating shorelines are common in this eco-region, but the rate of lake and shoreline development has accelerated tremendously in recent years, with many littoral habitats destroyed or damaged.

Management Considerations

Past management has included chemical treatment with butimycin and the stocking of channel catfish. There are no developments on the shoreline, which is all upland. The feasibility of eventually phasing out the pine plantations and restoring a natural xeric forest of pine and oak is worth exploring. In any case, this site should be protected from hydrologic alterations, further water quality degradation, and abuse of the shoreline and adjoining sandy slope by off-road vehicles. Future chemical treatment of the lake is not recommended.

Rush Lake			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
COMMUNITIES			
INTERIOR BEACH		NA	1996
ANIMALS			
A CAENID MAYFLY (CAENIS YOUNGI)		SC/N	1996

KURT'S DEEP DEPRESSION

Map ID# 14

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Island Lake
Town-Range-Section:	T46N-R10W sec. 12, SW4NW4
Size:	approximately 33 acres in the site boundary

Description of Site

The site is a shallow marshy pond surrounded by forest and situated in the bottom of a steep sided depression. The pond has a mostly muck and sand bottom, and water quality was judged to be excellent. A good representation of aquatic insects, particularly beetles, was found here. Undoubtedly, winterkill and fluctuating water levels are important forces. The steep slopes of the kettle are forested with jack and red pines, aspen, and oak. South-facing slopes are somewhat open and feature barrens plants including orange puccoon and western sunflower.

Significance of Site

Aquatic researchers surveying the state forest judged this site to be exemplary due to its unusual setting in a steep sided depression and its apparently intact aquatic biota. 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.

Management Considerations

Dynamics that will maintain or enahnce the forested/pine barrens communities of the watershed should be encouraged. There are no developments on the shoreline, which is all upland.

DEVILS HOLE PINES

Map ID# 12

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Brule
Town-Range-Section:	T46N-R10W-section 2 N1/2NE1/4NW1/4 T47N-R10W-section 35 W1/2SE1/4, E1/2SW1/4
Size:	approximately 52 acres in the site boundary

Description of Site

A portion of this site features a natural stand of mature, second-growth red pine on rough, sandy, collapsed glacial outwash topography. Canopy associates include white pine, red maple, paper birch, and Hill's oak over a moderately dense shrub layer of hazelnuts. Representative members of the herb/low shrub stratum include bracken fern, large-leaved aster, wintergreen, and barrens strawberry.

Significance of Site

Conservation limitations of this site include its relatively small size, isolation from other significant natural features, and history of past use. Nevertheless, it contains one of the few natural red pine forests on the BRSF and this should be a consideration when determining an appropriate land use classification for the site.

Management Considerations

The composition and structure of all 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 kettlehole. Some jack pine were removed not long ago. Forested lands bordering this site include intensively managed Hill's oak-jack pine forest, aspen stands, and pine plantations.

Use of prescribed fire is doubtfully practical at this time, but extended rotations or other prescriptions designed to promote late successional stage forests(not just big tress) should be considered.

Devils Hole Pines

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1996

HOODOO LAKE

Map ID# 11

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Brule
Town-Range-Section:	T47N-R10W-section 26 W1/2NW1/4
Size:	approximately 72 acres in the site boundary

Description of Site

This 32 acre seepage lake occupies a long abandoned channel of the Bois Brule River. Bottom materials include muck, gravel, and sand. Water color is dark brown. With a maximum depth of 13', this lake periodically experiences winterkill conditions. A narrow open bog mat of sphagnum mosses, ericaceous shrubs, and sedges borders the northwest side of the lake. Elsewhere along the shore, the wetland fringing the lake is forested with a well-developed conifer swamp of tamarack and black spruce.

Significance of Site

Hoodoo Lake is the only "kettle bog" found within the boundary of the BRSF proper (although several occur on the BRSF Annex to the south). Several noteworthy species were observed here, at least one of which, the "ebony bog haunter" (a dragonfly), is apparently very rare statewide and uncommon globally. Several of the other rare plants and animals documented occur here at their only station on the BRSF. Some of these are more widespread and better represented elsewhere in northern Wisconsin, but several of the invertebrates are uncommonly collected in this state.

Management Considerations

The shoreline of Hoodoo Lake is all in private ownership. It would be appropriate to contact the owners to apprise them of the biological significance of the lake and wetlands and explore possible conservation options.

The key to maintaining the integrity of this site is to protect water quality and hydrology. Gross physical disturbance to the bog mat and conifer swamp, or degradation of water quality, would negatively impact the habitat needed by 5 of the 6 rare species documented here.

The moat bordering Anderson Road may be very fragile. Chemical/physical impacts related to maintainence of this gravel road should be examined.

Hoodoo Lake

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
BOG COPPER (LYCAENA EPIXANTHE)		SC/N	1996
BOG FRITILLARY (BOLORIA EUNOMIA)		SC/N	1996
EBONY BOG HAUNTER (WILLIAMSONIA FLETCHERI)		SC/N	1996

Hoodoo Lake (cont.)			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
JUTTA ARCTIC (OENEIS JUTTA)		SC/N	1995
MERLIN (FALCO COLUMBARIUS)		SC/M	1996
PLANTS			
SWAMP PINK (ARETHUSA BULBOSA)		SC	1995

AFTERHOURS TAMARACKS

Map ID# 10

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Brule
Town-Range-Section:	T47N-R10W-section 22 N1/4NW1/4
Size:	approximately 22 acres in the site boundary

Description of Site

This site is an insular depression in rolling ground moraine and contains a conifer swamp of tamarack and black spruce. The boggy understory of sphagnum mosses, sedges, and ericaceous shrubs indicates acidic conditions. In portions of the site the swamp is composed of small trees, with a semi-open canopy. Elsewhere, the tamarack are larger and the canopy closed.

Significance of Site

No rare species were documented here. Acid conifer swamps are common in many parts of northern Wisconsin but are quite local and occur in small patches on the BRSF. This site contains one of the better examples of this community on the BRSF.

Management Considerations

No special management is needed or requested here beyond protection of site hydrology.

Afterhours Tamaracks

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN WET FOREST		NA	1996

CCC MILLER BOREAL FOREST & PINES

Map ID# 9

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Brule
Town-Range-Section:	T48N-R10W-section 35 W1/2NW1/4
Size:	approximately 101 acres in the site boundary

Description of Site

This east-sloping moraine on the west side of the Bois Brule River supports second-growth boreal-hardwood forest of medium size balsam fir, red maple, and trembling aspen. Associates include white spruce and white pine. Very large pine stumps were noted at scattered locations within the site. The understory is composed of species such as speckled alder, thimbleberry, wild sarsaparilla, Canada bluejoint grass, and bunchberry. 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

One rare plant species was documented here. This site is not far to the south of the mesic forests of Sugar Camp Hill, and is also within one-half mile of the Bois Brule River and thus can be connected with those two areas.

The conservation value of this site increases dramatically if it is considered along with Sugar Camp Hill, Lenroot Ledges, The Promontory, and the slopes flanking the Brule River. By doing this, a much greater representation of common and rare natural features characteristic of this part of the forest would be captured, there would be many scale-related benefits, and the likelihood of successful management would be increased. Appropriate restoration would be needed for the forested lands in-between these sites.

Management Considerations

Promoting long-lived conifers, providing for permanent canopy closure, 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 management strategy would also reduce the high contrast edge and fragmentation associated with aspen regeneration.

CCC Miller Boreal Forest and Pines

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
BOREAL FOREST		NA	1996

SUGAR CAMP HILL

Map ID# 8

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Brule, Oulu
Town-Range-Section:	T48N-R10W-section 21 SE1/4; 22 S1/2; section 27 N1/2; sec28 N1/2
Size:	approximately 554 acres in the site boundary

Description of Site

Sugar Camp Hill is part of an extensive east-west trending bedrock ridge that supports the BRSF's largest acreage of mesic forest. The closed canopy of this second-growth forest is composed primarily of pole to small sawtimber size hardwoods, with sugar maple, basswood, yellow birch, and red oak among the common trees. Sugar maple, as expected, is reproducing very well, and the shrub/sapling stratum also includes ironwood, leatherwood, and balsam fir. The herb layer is moderately rich at best, though a forested draw on the southeastern flank of the hill features a strong component of spring ephemerals and other rich site indicators, a rare association on the BRSF and in the region.

Small outcroppings of basalt occur at scattered locations on the upper north and east-facing slopes, and small perched wetlands provide microhabitats for additional species. These wetlands are forested, generally with a canopy of black ash and/or red maple, and the understory includes sedges, ferns, touch-me-nots and other plants adapted to seasonally moist or inundated conditions.

Significance of Site

This is the largest, least isolated stand of mesic forest on the Bois Brule River. Several noteworthy animals were documented here, such as black-throated blue warbler, Cooper's hawk (active nest), and Red-shouldered Hawk (probably not breeding, but a one year old bird still in immature plumage was noted soaring over the site during June, calling vigorously).

Management Considerations

Mesic hardwoods of similar composition and condition also occur on lands just to the west of the forest boundary, which are in part owned by Douglas County. To the east of Sugar Camp Hill, the slopes drop toward the Bois Brule River, and the forest cover is more aspen-dominated. There are also some second-growth boreal stands with a strong spruce-fir component. Allowing these stands to revert to either longer lived conifers or hardwoods is worthy of consideration, as this would mitigate (or at least not exacerbate) the effects of the serious forest fragmentation on the clay plain immediately north of Sugar Camp Hill. This would also provide a permanent forested connection to the narrow forested corridor along the Bois Brule.

An old growth designation for all or a portion of this site is worth consideration and would certainly be ecologically appropriate. Similar stands of older pine forest are scarce or absent in the local landscape, and uncommon statewide.

Linkage of this site with “CCC Miller Boreal Forest and Pines” (southeast), “Lenroot Ledges” (northeast), and the Brule River (east) via establishment of a permanent forest canopy in which long-lived species are promoted is desirable.

Sugar Camp Hill			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
COMMUNITIES			
NORTHERN MESIC FOREST		NA	1996
ANIMALS			
BLACK-THROATED BLUE WARBLER (DENDROICA CAERULESCENS)		SC/M	1996
CERULEAN WARBLER (DENDROICA CERULEA)		THR	1996
PLANTS			
LARGE ROUNDLEAF ORCHID (PLATANTHERA ORBICULATA)		SC	1996

THE PROMONTORY

Map ID# 34

Location

Ecoregion: Mille Lacs Uplands

USGS 7.5' Quadrangle: Brule, Oulu

Town-Range-Section: T48N-R10W-sec. 23 SE1/4 SW1/4 NE1/4; NW1/4 SE1/4

Size: 1acre (essentially a linear feature), approximately 9 acres in the site boundary

Description of Site

Along the east-west ridge of igneous bedrock just to the south of the Lake Superior clay plain is a series of low, igneous cliffs that support a distinctive flora.

Significance of Site

Cliffs are rare features on the BRSF. Regionally, they are well-represented along the northern edge of the Bayfield peninsula, on several of the Apostle Islands, and in association with the Penokee Range in Iron and Ashland counties. This cliff, though small, does support a state threatened plant species.

Management Considerations

Management of a utility corridor which bisects the site is a potential concern. Injudicious use of herbicides could potentially have a negative impact on the cliff flora.

The Promontory

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
DRY CLIFF		NA	1996
PLANTS			
FRAGRANT FERN (DRYOPTERIS FRAGRANS VAR REMOTIUSCULA)		SC	1996

LENROOT LEDGES

Map ID# 7

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T48N-R10W -section 22 E½ NE¼; - section 23 W½ NW¼
Size:	approximately 148 acres in the site boundary

Description of Site

This site borders the Bois Brule River, at the southern edge of the Lake Superior Clay Plain just below Sugar Camp Hill. The terraces along the river and the adjoining slopes support an interesting mixed forest of large red and white pines, with white cedar, balsam fir, white spruce, and paper birch also represented in the canopy. Saplings are mostly fir and spruce. Thimbleberry is the dominant shrub, with twinflower, bluebead lily, and rosy twisted stalk among the common groundlayer associates. Resident birds include pine, blackburnian, and northern parula warblers, golden-crowned kinglet, solitary vireo, and hermit thrush.

Significance of Site

This site contains one of the few stands of older, conifer-dominated forests along this stretch of the Bois Brule. The composition is unusual, and the stand could serve as a template for future restoration efforts in the vicinity. Several rare plant populations were documented here.

Management Considerations

Site ownership is a mixture of both state and private lands, with the most mature, best developed conifer forest privately owned. Excessive deer browse is a problem here, as it is at many sites on the highly fragmented Lake Superior clay plain. The small size and the presence of open land to the north and west are additional conservation limitations for this site. However, an agreement of some sort is desirable to protect the features here.

Connection to “Sugar Camp Hill” just to the southwest via establishment of a closed canopy forest in which long-lived species are promoted is desirable here.

Lenroot ledges

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
BOREAL FOREST		NA	1995
PLANTS			
MARSH RAGWORT (SENECIO CONGESTUS)		SC	1897
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1931
SHOWY LADY'S-SLIPPER (CYPRIPEDIUM REGINAE)		SC	1996

STATE HIGHWAY 13 GRASSLANDS

Map ID# 6

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T49N-R10W-sections 33, 34, 35
Size:	approximately 791 acres in the site boundary

Description of Site

The nearly level landscape of the Lake Superior Clay Plain was formerly almost entirely forested, but the climatic influence of the lake made this region more suitable for agriculture than many other parts of northern Wisconsin. Extensive clearing of the forests and an emphasis on hay and pasture rather than row crops has created suitable conditions for many grassland birds, including species showing significant population declines statewide, regionwide, or rangewide.

Significance of Site

Among the uncommon birds noted here during the breeding season were sharp-tailed grouse, upland sandpiper, northern harrier, bobolink, blue-winged teal, and American bittern.

Management Considerations

The amount of former agricultural land within the state forest proper is quite limited, but there may be potential for working with private landowners in this semi-open, fragmented landscape to benefit at least some of these declining bird species. If this is pursued, the focus should be on the consolidation of existing open lands, especially those which are large and/or now idled. The best opportunities to accomplish this are to the east and west of the state forest boundary.

Care must be exercised to avoid compromising the opportunities to manage and restore a significant acreage of native conifer-dominated boreal forest, especially to the north of this site. The BRSF, alone among state lands, offers this boreal forest option, while there are many alternative sites throughout the state suitable for grassland management.

State Highway 13 Grasslands

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
AMERICAN BITTERN (BOTAURUS LENTIGINOSUS)		SC/M	1996
NORTHERN HARRIER (CIRCUS CYANEUS)		SC/M	1996
SHARP-TAILED GROUSE (PEDIOECETES PHASIANELLUS)		SC/M	1996
UPLAND SANDPIPER (BARTRAMIA LONGICAUDA)		SC/M	1996

LOWER BRULE BOREAL FOREST & LAKE SUPERIOR SHORELINE MACROSITE

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T49N-R10W - parts of sections 2,3,9,10,11,14,15,17,18,22,23,26,27 T49N-R11W - parts of sections 12,22,23
Size:	approximately 5508 acres in the macrosite boundary

Description of Site

Prior to the settlement of this region by Europeans, the Lake Superior clay plain was primarily forested with conifers such as white spruce, balsam fir, white pine, and white cedar as the most prominent species. Deciduous species such as red maple, balsam poplar, trembling aspen, and paper birch were also present, and sometimes common, in these stands. However, they did not achieve the dominance over the conifers, which they now hold.

On the BRSF, the current cover type on most of the uplands above the river valley is trembling aspen, but many of these stands have a significant component of white spruce, balsam fir, and occasionally white pine in the understory. On the steep, red clay slopes bordering the Bois Brule and its tributaries, there are remnant stands of older boreal forest. These forests may be the best indication of what the pre-settlement forests had been like and may provide a model for restoration activities. Many of these stands are currently in a special erosion control zone, but heavy deer browse and continued slumping of the less stable clay slopes will pose challenges for stewards of this landscape well into the future.

Low terraces adjoining the Bois Brule River support stands of swamp hardwoods (black ash, balsam poplar, and red maple dominant), boreal forest, and occasionally, small patches of ephemeral-rich mesic forest. At the mouth of the river, there is a small lagoon and emergent marsh complex. A narrow zone of shrubs (mostly speckled alder) occupies a natural levee between the river and the lagoon-marsh. A small dune and unvegetated beach separate the lagoon from the waters of Lake Superior. The beaches at the mouth of the Bois Brule occasionally get heavy use by waterbirds, especially gulls and terns.

Extensive stretches of undeveloped Lake Superior shoreline are found east and west of the mouth of the Bois Brule River. Much of this is unvegetated sand beach, but there are numerous slumps of red clay, some falling directly into the lake. The present upland vegetation behind the beach and above the low clay bluffs generally consists of rather open stands of trembling aspen, often with a dense and robust shrub layer of speckled alder. A few remnant stands of boreal conifers occur (e.g., near the mouth of Pearson Creek, west of the Bois Brule), but the forests of this area were severely damaged in the past by heavy logging and intense fire. There is little humus left in the upper layers of the red clay soils. The hydrology of the area may have been altered by the past removal of the forest cover and subsequent “swamping” (this could account for the great increase in alder noted by area historians).

Significance of the Macrosite

This site offers the best opportunity to protect, manage, and restore a conifer-dominated boreal forest on state forest lands. The following site attributes contributed to this conclusion: A number

of remnant stands of older spruce-fir forest are present; there are aspen stands with a strong component of boreal conifers in the understory; contiguous forest cover is greater than elsewhere on the clay plain, at least on public lands; the steep slopes along the Bois Brule and its tributaries are in a special erosion control zone and not subject to or suitable for commercial harvest; severely disturbed stands are available for experimental methods of restoration; additional features of ecological value occur within the site boundaries, such as oxbow marshes, hardwood swamps, and the marsh and lagoon near the Bois Brule's mouth; and the site is linked to a long, undeveloped stretch of Lake Superior shoreline.

The strong potential for restoration of a boreal conifer forest, the undeveloped Lake Superior shoreline, and the lower Bois Brule River are highly significant management and protection opportunities.

On several visits to this area during June of 1996, over 100 common and up to 20 Caspian terns (both state endangered) were noted resting on the beach and/or fishing just offshore. Though these species do not nest here, they use the site frequently. Use of this area by other migrating birds is high. Several rare plants and animals were documented here, including one state threatened plant and one state threatened reptile.

Management Considerations

There are also constraints and challenges. Deer browse on shrubs and saplings is extremely heavy in this area. Extensive use of the clay plain for agriculture, current forest management practices, and the checkerboard ownership pattern of the region limit restoration and management opportunities to only a few moderately-sized (100s to 1000s of acres) sites within this landscape. Remnant boreal stands also occur within the city of Superior's Municipal Forest, on the reservation of the Bad River Band of Lake Superior Ojibwa east of Ashland, and, though the remnants are very disturbed, in the rough country south of Superior along the St. Louis River. Very small remnants occur on several of the Apostle Islands.

Note: Because this area is large and complex, we have broken it into several parts to make description and evaluation more manageable. Keep in mind, though, that the proximity of these sites to one another and the types of natural features they support provide cumulative benefits beyond those which might be derived from any single site.

Lower Brule Boreal Forest & Lake Superior Macrosite			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
COMMUNITIES			
BOREAL FOREST		NA	1996
EMERGENT AQUATIC		NA	1996
ANIMALS			
AMERICAN BITTERN (BOTAURUS LENTIGINOSUS)		SC/M	1995
AMERICAN EEL (ANGUILLA ROSTRATA)		SC/N	1986
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1995
WOOD TURTLE (CLEMMYS INSCULPTA)		THR	1996
PLANTS			
ARROW-LEAVED SWEET-COLTSFOOT (PETASITES SAGITTATUS)		THR	1996
PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)		SC	1996
VASEY RUSH (JUNCUS VASEYI)		SC	1995

MCNEIL'S LANDING BOREAL FOREST

Map ID# 3

(Lower Brule Macrosite)

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T49N-R10W-section 27 W1/2NW1/4
Size:	approximately 86 acres in the site boundary

Description of Site

This deep, steep-sided clay ravine is forested with large white spruce and white pine, with balsam poplar, red maple, and balsam fir among the associates. A small, apparently perennial, stream drains the ravine and joins the Bois Brule River several hundred meters below McNeil's Landing. The lower portion of the ravine is crossed by a gravel road, and to the north, the forest is more disturbed, with aspen and paper birch more prevalent than the boreal conifers.

The clay flats above the ravine had been cleared for agricultural purposes in the past. These fields are now reverting to forest, and in some areas a substantial component of white spruce and white pine occurs among the colonizing trees.

Significance of Site

This stand represents one of the most mature conifer-dominated boreal forest remnants on the Bois Brule River.

Management Considerations

No active management is necessary to maintain this community. The old fields above the ravine are slowly being colonized by spruce, pine and other native species.

McNeil's Landing Boreal Forest

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
BOREAL FOREST		NA	1995

TRASK CREEK - WEIR RIFFLES BOREAL FOREST

Map ID# 2

(Lower Brule Macrosite)

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T49N-R10W-section 22 W1/2NW1/4; section 15 E1/2; section 10 W1/2SE1/4
Size:	approximately 625 acres in the site boundary

Description of Site

Clay slopes along the Bois Brule River support boreal forest in various stages of recovery. The most mature stands are composed of large white pine, white spruce, balsam fir, balsam poplar, with an occasional white cedar. Younger stands are generally aspen dominated. Paper birch is also sometimes a significant component of the more disturbed stands. Terraces along this stretch of river support swamp hardwood stands, composed of black ash and red maple, alder thicket, and stands of emergent marsh in old abandoned oxbows.

The level areas above and away from the river valley are generally more disturbed, with aspen and birch dominant. Many of these stands, however, have an understory of boreal conifers. Old fields in this area are being slowly invaded by spruce, fir, white pine, and alder.

A number of the more mature aspen-dominated stands have been harvested recently. Conifers are generally left uncut, but the stands seldom retain even 20% canopy cover following removal of the aspen, and often much less than that. Past disturbances to the heavy level clays have seemingly altered the hydrology of some areas and lead to a loss of forest cover and the present dominance of alder, or sometimes lake sedge and Canada bluejoint grass.

Significance of Site

Rare plants and animals inhabit this site, which also contains significant stands of boreal conifers, hardwood swamp, and marsh.

Management Considerations

Experimental conifer regeneration might be considered here though it is doubtful that silvicultural methods alone will achieve this. Deer browse is heavy, and the dense mats of bluejoint grass may also be inhibiting tree reproduction. 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 and rutting when the ground is not frozen.

Trask Creek - Weir Riffles Boreal Forest			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
COMMUNITIES			
BOREAL FOREST		NA	1996
ANIMALS			
Trask Creek - Weir Riffles Boreal Forest			

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
WOOD TURTLE (CLEMMYS INSCULPTA)		THR	1996
PLANTS			
ARROW-LEAVED SWEET-COLTSFOOT (PETASITES SAGITTATUS)		THR	1996
PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)		SC	1996

BRACKETT'S CORNER BOREAL FOREST

Map ID# 1

(Lower Brule Macrosite)

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T49N-R10W-secion 2 W ½ SE ¼
Size:	approximately 12 acres in the site boundary

Description of Site

The clay slopes flanking a small unnamed stream less than a quarter mile south of Lake Superior are vegetated with boreal conifers, predominantly white spruce and balsam fir. Aspen has been harvested from adjacent stands in recent years, but a strong component of young conifers exists as residual growth.

Significance of Site

This stand should be considered as an example of a maturing boreal conifer forest, now scarce on the landscape. Restoration of this now regionally rare community type warrants consideration. A variety of techniques, including but not limited to silvicultural methods, should be tried experimentally in this effort.

Management Considerations

Mature stands of boreal conifers are scarce on the current landscape and merit extra protection efforts until the type is substantially increased and successional processes are better understood.

Brackett's Corner			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
COMMUNITIES			
BOREAL FOREST		NA	1996

BRULE RIVER MARSH & LAGOON

Map ID# 32

(Lower Brule Macrosite)

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T49N-R10W-section NW ¼
Size:	approximately 48 acres in the site boundary

Description of Site

At the mouth of the Bois Brule River there is a sand spit, with an unvegetated 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, wild calla and many others. No invasive plants were observed in the marsh proper, though a few non-invasive weeds were noted in the wet shrub thicket on the berm (a natural levee) between the marsh and the lower river.

Significance of Site

The adjacent beach is used by many waterbirds. As many as 100 state-endangered common terns and lesser numbers of the state-endangered Caspian tern were seen resting at the mouth of the Bois Brule on several occasions during the 1996 field season. Common terns foraged over the marsh and lagoon as well as over the waters of Lake Superior. American bittern and northern harrier were also noted using the marsh in 1996.

Though larger wetlands occur elsewhere on the Great Lakes coasts, this site contains the largest marsh on the BRSF, and it is the largest coastal wetland between the city of Superior and the village of Port Wing. The flora is diverse and several rare animal species use the marsh.

Management Considerations

No active management is needed at this time, although the site should receive continued protection. Periodic monitoring for invasive species (there were none noted) is recommended.

Brule River Marsh and Lagoon

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
EMERGENT AQUATIC		NA	1996

BEAR BEACH

Map ID# 4

(Lower Brule Macrosite)

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T49N-R11W-section 22
Size:	approximately 1222 acres in the site boundary

Description of Site

The primary features of interest here are several extensive stretches of undeveloped beach along the Lake Superior shore, west of the Brule River mouth. The beaches are composed mostly of sand, and are unvegetated due to their exposure to wave and ice action. Locally, there are small pockets of cobblestones and driftwood "gardens".

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.

Significance of Site

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 was common on the beach and in the adjacent thickets. As development pressures on shoreline habitats are high and increasing in northern Wisconsin, this site merits protection in an undeveloped state.

Management Considerations

This site was severely damaged 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. The uplands need strong protection from any activities that might increase erosion, such as road construction and logging. Until a proven, cost-effective method of reintroducing or facilitating the spread of long-lived conifers into the forested portions of the site is developed, it might be best to leave it alone.

Bear Beach			
Common Name (Scientific Name)	**Federal Status**	**State Status**	**Observation Date**
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1995

PEARSON CREEK BOREAL FOREST

Map ID# 5

(Lower Brule Macrosite)

Location

Ecoregion:	Lake Superior Clay Plain
USGS 7.5' Quadrangle:	Oulu
Town-Range-Section:	T49N-R11W-section 22
Size:	approximately 84 acres in the site boundary

Description of Site

Steep slopes bordering the lower stretches of Pearson Creek support small stands of mature conifers such as white spruce, white pine, and balsam fir. The adjoining forest is heavily aspen-dominated.

Significance of Site

This part of the Lake Superior shoreline was badly damaged by past land uses which removed virtually all of the forest cover and destabilized the soil. Mature stands of boreal conifers are typically small, scattered, and somewhat isolated, and those on public lands merit strong protection, at least until this forest type can be substantially increased in acreage.

Management Considerations

All land management activities on the clay plain need to be designed and implemented with great care to avoid soil erosion and negative water quality impacts to Lake Superior. This stand, along with several other remnants in the vicinity, could perhaps serve as a model for the type of forest that is best adapted to regional conditions.

Pearson Creek Boreal Forest

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
BOREAL FOREST		NA	1996

THE BRULE ANNEX

The Bois Brule River State Forest Annex is a disjunct administrative unit of the BRSF, situated 10 miles south of the Brule River headwaters, just to the southeast of the village of Gordon. It contains a correctional facility, extensive red pine plantations, and is drained by the Eau Claire River.

The Annex is wholly within the drainage of the St. Croix River and contained within the Bayfield Sand Barrens ecoregion.

The Brule Annex

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1996
COMMUNITIES			
OPEN BOG		NA	1996
PLANTS			
DWARF MILKWEED (ASCLEPIAS OVALIFOLIA)		THR	1996

EAU CLAIRE RIVER

Map ID# 30

(The Brule Annex)

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Gordon, Chittamo
Town-Range-Section:	T43N-R11W-sections 4-6,8,9 (on State Forest only)
Size:	65 acres (Surface area including that contained in state forest boundary); approximately 90 acres in the site boundary

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 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 is located a little over a mile above the mouth, creating the 2 mile long, 56 acre Eau Claire River Flowage located almost entirely within state forest ownership.

Significance of Site

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.

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. A 24-foot head dam on the lower Eau Claire alters water quality on the lower three miles of river and serve as a barrier to fish and mussel movements. Impacts of dam removal should be considered here.

Eau Claire River

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1996

GORDON CORRECTIONAL BOG

Map ID# 29

(The Brule Annex)

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Gordon
Town-Range-Section:	T43N-R11W-section 4 NW1/4SW1/4; section 5 SE1/4NE1/4SE1/4
Size:	approximately 24 acres in the site boundary

Description of Site

This small, undisturbed kettle bog occupies a depression in glacial outwash sands. A representative complement of ericaceous shrubs, sedges, and insectivorous plants occur within a matrix of deep sphagnum moss hummocks. Toward the center of the bog the sphagnum mat is thin and nearly level, perforated by small pools of water which provide microhabitats for additional species such as beak rushes and carnivorous bladderworts.

Significance of Site

The sandy uplands bordering the bog formerly supported pine barrens vegetation but are now planted to red pine. A small population of the state-threatened oval-leaved milkweed was noted at the edge of the plantation, immediately adjacent to the bog.

Management Considerations

Though uncommon on the BRSF, kettle bogs are relatively common features in many parts of northern Wisconsin, including the local landscape beyond the forest boundaries. This site is small and within a plantation landscape, but it contains a good example of a representative natural community in the sand barrens ecoregion and care should be taken to maintain the site in its present condition.

Gordon Correctional Bog

Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
OPEN BOG		NA	1996
PLANTS			
DWARF MILKWEED (ASCLEPIAS OVALIFOLIA)		THR	1996

OUTLYING ELEMENT OCCURRENCES WITHIN THE BRSF BOUNDARY

The following sites are the Outlying Element Occurrences and are defined as selected inventory sites located within the BRSF boundary and containing a rare species or community occurrence. These sites are generally very small and isolated from other more significant natural features and thus usually have a lower protection or restoration priority than primary sites. Recommendations for these sites should follow the specific element recommendations found in Appendices E, F, and G.

Site Name Common Name (Scientific Name)	Federal Status	State Status	Observation Date
Bois Brule River			
ANIMALS			
AMERICAN EEL (ANGUILLA ROSTRATA)		SC/N	1986
LAKE HERRING (COREGONUS ARTEDI)		SC/N	9999
WOOD TURTLE (CLEMMYS INSCULPTA)		THR	1990
PLANTS			
SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)		SC	1913
Clevedon Road			
PLANTS			
ARROW-LEAVED SWEET-COLTSFOOT (PETASITES SAGITTATUS)		THR	1996
VASEY RUSH (JUNCUS VASEYI)		SC	1995
Hazel Prairie Road Wetland			
ANIMALS			
FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)		SC	1996
Jerseth Road Seeps			
COMMUNITIES			
SPRINGS AND SPRING RUNS, SOFT		NA	1996
Lawyer Bridge Bog			
ANIMALS			
FORCIPATE EMERALD (SOMATOCHLORA FORCIPATA)		SC/N	1996
KENNEDY'S EMERALD (SOMATOCHLORA KENNEDYI)		SC/N	1996
Little Bois Brule River			
PLANTS			
AUTUMNAL WATER-STARWORT (CALLITRICHE HERMAPHRODITICA)		SC	1996
Ranger Station Riffle			
ANIMALS			
A BRACHYCENTRID CADDISFLY (BRACHYCENTRUS LATERALIS)		SC/N	1983
State Highway 13 Bridge			
ANIMALS			
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1989
PLANTS			
SHOWY LADY'S-SLIPPER (CYPRIPEDIUM REGINAE)		SC	1996

EXTERNAL LANDS AND WATERS BEYOND THE BRSF BOUNDARY

The following are External Lands and Waters sites and are defined as selected inventory sites near but primarily outside of the BRSF boundary that contain the best examples of rare and representative natural features. Natural communities, rare species populations, and aquatic features are represented. Sites categorized as external lands and waters have similar significance as primary sites, but are located outside the BRSF boundary. Element occurrences are specifically listed for these sites, but may be obtained from the BER.

BLUEBERRY SWAMP

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Lake Nebagamon
Town-Range-Section:	T47N-R11W-sections 12-16,21-24; T47N-R10W-sections 18,19
Size:	Undetermined at this time

Description of Site

This vast swamp occupies a drainage divide west of the BRSF. There is a direct hydrologic connection to the Bois Brule River, as the swamp is the headwaters area of Blueberry Creek, which flows to Nebagamon Creek, which in turn flows into the Bois Brule. The Blueberry Creek headwaters swamp is minerotrophic, with extensive stands of mature black ash forest, as well as areas dominated by white cedar. To the west of the drainage divide, the wetland is less minerotrophic, and the vegetation mosaic includes acidic open bog, muskeg, and black spruce-tamarack forest communities.

Significance of Site

A number of rare plant and animal species were documented at this site during a recent wetland inventory project within Wisconsin's Lake Superior watershed (Epstein et al., 1997). The forest communities are extensive and generally of very good quality. The hardwood swamp, in particular, is among the top examples of that community in northern Wisconsin.

Management Considerations

Douglas County owns much of this site and some of the adjoining land as well. A contact with the county forest administrator to explore conservation possibilities is needed. Key private landowners should be contacted as well. Further investigation is needed.

CASEY CREEK

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Brule
Town-Range-Section:	T47N-R10W-secs 2 & 3
Size:	1 acre (essentially a linear feature)

Description of Site

Casey Creek is a 4-mile long, high-gradient, first order tributary of the Bois Brule River, entering that stream just north of U.S. Highway 2. Substrate materials include sand (43%), gravel (40%), rock (12%), and muck (5%). The watershed is mostly forested, though there is some cleared land in the upper reaches of this stream.

Significance of Site

Casey Creek is considered Class Ia trout water, with rainbow and brown trout being the most abundant trout species. Rare aquatic invertebrates occur in this stream.

Management Considerations

Management issues include removal of beaver dams and reducing damaging stream flow fluctuations.

GROVER LAKE

Location

Ecoregion:	Bayfield Sand Barrens
USGS 7.5' Quadrangle:	Gordon
Town-Range-Section:	T43N-R11W-section 8 SW1/4NW1/4
Size:	approximately 9 acres in the site boundary

Description of Site

This small softwater seepage lake was judged to have excellent water quality. Bottom materials include sand, gravel, muck, and vegetative debris. The water is clear, and there are no developments on the shoreline.

Significance of Site

This site supports high aquatic invertebrate diversity, though no rare species were collected. Small kettle lakes of this type are numerous in the local landscape.

Management Considerations

The dry sandy uplands still support a few pine barrens remnants, but much of the area has been planted to red pine monotypes. Protection of site hydrology and shoreline area is key.

NEBAGAMON CREEK

Location

Ecoregion:	Mille Lacs Uplands
USGS 7.5' Quadrangle:	Brule, Lake Nebagamon
Town-Range-Section:	T47N-R10W-section 27 S½NW¼ and west of the BRSF, parts of sections 21,20,28, 29,30,31,36
Size:	linear feature, undetermined size

Description of Site

This stream originates at the outlet of Lake Nebagamon and flows east-northeast about 4 miles to the Bois Brule River. Stretches of the creek below the Highway 'B' bridge crossing are considered Class IIa trout water (with the exotic rainbow trout the most common of the three trout species present). The bottom materials are diverse and include boulders, rubble, gravel, and sand.

Significance of Site

The aquatic biota includes several rare invertebrates and one rare reptile. This stream is an important tributary of the Bois Brule and warrants a high level of protection for that reason alone.

Blueberry Creek, a high-gradient, cold water tributary of Nebagamon Creek, originates in a large, ecologically important swamp west of the BRSF. Protection of the entire length of Blueberry Creek should be a priority.

Management Considerations

Management challenges relevant to the protection of Nebagamon Creek include reducing damaging flow extremes (possibly related to the extensive acreage of open land adjoining the stream, near Lake Nebagamon), and water quality impacts related to the intensive development around the lake.

APPENDIX C

Master List of Sites and Element Occurrences

SITE NAME / COMMON NAME (SCIENTIFIC NAME)		YEAR	TAXA GROUP
AFTERHOURS WET FOREST			
NORTHERN WET FOREST		1996	COMMUNITY
ANGEL CREEK SWAMP			
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		1996	PLANT
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		1996	PLANT
NORTHERN WET-MESIC FOREST		1996	COMMUNITY
SHEATHED SEDGE (CAREX VAGINATA)		1996	PLANT
SKI-TAILED EMERALD (SOMATOCHLORA ELCONGATA)		1996	DRAGONFLY
SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)		1996	PLANT
BEAR BEACH			
	2 BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	1995	BIRD
BLUE SPRINGS - MCDOUGAL SPRINGS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)		1992	BIRD
CAPE MAY WARBLER (DENDROICA TIGRINA)		1997	BIRD
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		1997	BIRD
FAIRY SLIPPER (CALYPSO BULBOSA)		1996	PLANT
GRAY JAY (PERISOREUS CANADENSIS)		1997	BIRD
LARGE WATER-STARWORT (CALLITRICHE HETEROPHYLLA)		1996	PLANT
	3 MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)	1996	PLANT
	2 NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)	1996	PLANT
NORTHERN WET-MESIC FOREST		1996	COMMUNITY
PINE SISKIN (CARDUELIS PINUS)		1997	BIRD
	3 SHEATHED SEDGE (CAREX VAGINATA)	1996	PLANT
	2 SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)	1996	PLANT
SPRING POND		1982	COMMUNITY
SPRINGS AND SPRING RUNS, SOFT		1996	COMMUNITY
	2 YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)	1997	BIRD
BOIS BRULE RIVER			
AMERICAN EEL (ANGUILLA ROSTRATA)		1986	FISH
LAKE HERRING (COREGONUS ARTEDI)		UNKNOWN	FISH
SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)		1913	PLANT
	3 WOOD TURTLE (CLEMMYS INSCULPTA)	1996	TURTLE
BRACKETT'S CORNER			
BOREAL FOREST		1996	COMMUNITY
BRULE RIVER MARSH AND LAGOON			
EMERGENT AQUATIC		1996	COMMUNITY
BRULE SPILLWAY			
ALDER THICKET		1997	COMMUNITY
BURIED ROAD PINES			
NORTHERN DRY-MESIC FOREST		1996	COMMUNITY
CASEY CREEK			
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		1996	DRAGONFLY
CATLIN CREEK			
A BIZARRE CADDISFLY (LEPIDOSTOMA LIBUM)		1996	CADDISFLY
CCC MILLER BOREAL FOREST AND PINES			
BOREAL FOREST		1996	COMMUNITY
CEDAR ISLAND - WINNEBOUJOU			
	2 AUTUMNAL WATER-STARWORT (CALLITRICHE HERMAPHRODITICA)	1996	PLANT

SITE NAME	COMMON NAME (SCIENTIFIC NAME)	YEAR	TAXA GROUP
2	BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	1995	BIRD
2	NORTHERN DRY-MESIC FOREST	1996	COMMUNITY
	SUBMERGENT AQUATIC	1996	COMMUNITY
CLEVEDON ROAD			
	ARROW-LEAVED SWEET-COLTSFOOT (PETASITES SAGITTATUS)	1996	PLANT
	VASEY RUSH (JUNCUS VASEYI)	1995	PLANT
DEVILS HOLE PINES			
	NORTHERN DRY-MESIC FOREST	1996	COMMUNITY
DIVIDE SWAMP			
	A CAENID MAYFLY (CAENIS YOUNGI)	1996	MAYFLY
	A PREDACEOUS DIVING BEETLE (HYDROPORUS PSEUDOVILIS)	1996	BEETLE
	BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	1995	BIRD
	BLACK-TIPPED DARNER (AESHNA TUBERCULIFERA)	1996	DRAGONFLY
	FAIRY SLIPPER (CALYPSO BULBOSA)	1932	PLANT
	FIR CLUBMOSS (LYCOPODIUM SELAGO)	1996	PLANT
	HARDWOOD SWAMP	1996	COMMUNITY
3	MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)	1996	PLANT
	MOUNTAIN CRANBERRY (VACCINIUM VITIS-IDAEA SSP MINUS)	1930	PLANT
3	NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)	1996	PLANT
	NORTHERN WET-MESIC FOREST	1996	COMMUNITY
	OSPREY (PANDION HALIAETUS)	1996	BIRD
	PRONGHORNED CLUBTAIL (GOMPHUS GRASLINELLUS)	1996	DRAGONFLY
3	SHEATHED SEDGE (CAREX VAGINATA)	1996	PLANT
	SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)	1996	PLANT
2	SPARSE-FLOWERED SEDGE (CAREX TENUIFLORA)	1996	PLANT
	TAMARACK SWAMP	1996	COMMUNITY
EAU CLAIRE RIVER			
	ZEBRA CLUBTAIL (STYLURUS SCUDDERI)	1996	DRAGONFLY
GORDON CORRECTIONAL BOG			
	DWARF MILKWEED (ASCLEPIAS OVALIFOLIA)	1996	PLANT
	OPEN BOG	1996	COMMUNITY
GROVER LAKE			
	LAKE--SHALLOW, SOFT, SEEPAGE	1996	COMMUNITY
HAZEL PRAIRIE ROAD WETLAND			
	FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)	1996	SALAMANDER
HOODOO LAKE			
	BOG COPPER (LYCAENA EPIXANTHE)	1996	BUTTERFLY
	BOG FRITILLARY (BOLORIA EUNOMIA)	1996	BUTTERFLY
	EBONY BOG HAUNTER (WILLIAMSONIA FLETCHERI)	1996	DRAGONFLY
	JUTTA ARCTIC (OENEIS JUTTA)	1995	BUTTERFLY
	MERLIN (FALCO COLUMBARIUS)	1996	BIRD
	SWAMP PINK (ARETHUSA BULBOSA)	1995	PLANT
JERSETH CREEK			
	CONNECTICUT WARBLER (OPORORNIS AGILIS)	1996	BIRD
	RICHARDSON SEDGE (CAREX RICHARDSONII)	1996	PLANT
	STREAM--FAST, SOFT, COLD	1996	COMMUNITY
JERSETH ROAD SEEPS			
	SPRINGS AND SPRING RUNS, SOFT	1996	COMMUNITY
LAKE MINNESUING HEMLOCK - HARDWOODS SWAMP			
	AUTUMNAL WATER-STARWORT (CALLITRICHE HERMAPHRODITICA)	1996	PLANT
	FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)	1996	SALAMANDER
	GLOYD'S BLUET (ENALLAGMA VERNALE)	1996	DRAGONFLY
	HARDWOOD SWAMP	1996	COMMUNITY
	NORTHERN MESIC FOREST	1996	COMMUNITY
LAKE MINNESUING WETLAND DRAINAGE			
	FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)	1996	SALAMANDER

SITE NAME	COMMON NAME (SCIENTIFIC NAME)	YEAR	TAXA GROUP
LENROOT LEDGES			
	BOREAL FOREST	1995	COMMUNITY
	MARSH RAGWORT (SENECIO CONGESTUS)	1897	PLANT
	NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)	1931	PLANT
	SHOWY LADY'S-SLIPPER (CYPRIPEDIUM REGINAE)	1996	PLANT
LITTLE BOIS BRULE RIVER			
	AUTUMNAL WATER-STARWORT (CALLITRICHE HERMAPHRODITICA)	1996	PLANT
MCNEIL'S LANDING BOREAL FOREST			
	BOREAL FOREST	1996	COMMUNITY
MILLS LAKE			
	POOR FEN	1996	COMMUNITY
NEBAGAMON CREEK			
	ZEBRA CLUBTAIL (STYLURUS SCUDDERI)	1996	DRAGONFLY
NORTH COUNTRY TRAIL BARRENS			
	CONNECTICUT WARBLER (OPORORNIS AGILIS)	1996	BIRD
	NORTHERN DRY FOREST	1996	COMMUNITY
	PINE BARRENS	1996	COMMUNITY
	RICHARDSON SEDGE (CAREX RICHARDSONII)	1996	PLANT
	UPLAND SANDPIPER (BARTRAMIA LONGICAUDA)	1996	BIRD
PORCUPINE CREEK HEADWATERS			
	NORTHERN MESIC FOREST	1996	COMMUNITY
RANGER STATION RIFFLE			
	A BRACHYCENTRID CADDISFLY (BRACHYCENTRUS LATERALIS)	1983	CADDISFLY
RUSH LAKE			
	A CAENID MAYFLY (CAENIS YOUNGI)	1996	MAYFLY
	INTERIOR BEACH	1996	COMMUNITY
SMITH LAKE			
	A CAENID MAYFLY (CAENIS YOUNGI)	1996	MAYFLY
	AMBER-WINGED SPREADWING (LESTES EURINUS)	1996	DRAGONFLY
STATE HIGHWAY 13 GRASSLANDS			
	AMERICAN BITTERN (BOTAURUS LENTIGINOSUS)	1996	BIRD
	NORTHERN HARRIER (CIRCUS CYANEUS)	1996	BIRD
	SHARP-TAILED GROUSE (PEDIOECETES PHASIANELLUS)	1996	BIRD
	UPLAND SANDPIPER (BARTRAMIA LONGICAUDA)	1996	BIRD
STATE HIGHWAY 13 BRIDGE			
2	SHOWY LADY'S-SLIPPER (CYPRIPEDIUM REGINAE)	1996	PLANT
	ZEBRA CLUBTAIL (STYLURUS SCUDDERI)	1989	DRAGONFLY
STONE CHIMNEY CEDAR SWAMP			
2	CAPE MAY WARBLER (DENDROICA TIGRINA)	1996	BIRD
3	FAIRY SLIPPER (CALYPSO BULBOSA)	1996	PLANT
	GRAY JAY (PERISOREUS CANADENSIS)	1996	BIRD
2	LAPLAND BUTTERCUP (RANUNCULUS LAPPONICUS)	1996	PLANT
3	MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)	1996	PLANT
3	NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)	1996	PLANT
	NORTHERN GOSHAWK (ACCIPITER GENTILIS)	1997	BIRD
	OSPREY (PANDION HALIAETUS)	1987	BIRD
	PINE SISKIN (CARDUELIS PINUS)	1996	BIRD
	PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)	1996	PLANT
3	SHEATHED SEDGE (CAREX VAGINATA)	1996	PLANT
4	SMALL YELLOW LADY'S-SLIPPER (CYPRIPEDIUM PARVIFLORUM)	1996	PLANT
	YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)	1996	BIRD
SUGAR CAMP HILL			
	BLACK-THROATED BLUE WARBLER (DENDROICA CAERULESCENS)	1996	BIRD
	CERULEAN WARBLER (DENDROICA CERULEA)	1996	BIRD
	LARGE ROUNDLEAF ORCHID (PLATANTHERA ORBICULATA)	1996	PLANT
	NORTHERN MESIC FOREST	1996	COMMUNITY

SITE NAME	COMMON NAME (SCIENTIFIC NAME)	YEAR	TAXA GROUP
THE PROMONTORY			
	DRY CLIFF	1996	COMMUNITY
	FRAGRANT FERN (DRYOPTERIS FRAGRANS VAR REMOTIUSCULA)	1996	PLANT
TRASK CREEK - WEIR RIFFLES BOREAL FOREST			
	ARROW-LEAVED SWEET-COLTSFOOT (PETASITES SAGITTATUS)	1996	PLANT
	BOREAL FOREST	1996	COMMUNITY
2	PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)	1996	PLANT
VAPA ROAD PINES AND PONDS			
	AMBER-WINGED SPREADWING (LESTES EURINUS)	1996	DRAGONFLY
	NORTHERN DRY-MESIC FOREST	1996	COMMUNITY
WILLARD PINES			
	FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)	1996	SALAMANDER
	NORTHERN DRY-MESIC FOREST	1996	COMMUNITY
NO SITE NAME			
	AMERICAN BITTERN (BOTAURUS LENTIGINOSUS)	1995	BIRD
	BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	1995	BIRD
	OSPREY (PANDION HALIAETUS)	1996	BIRD

APPENDIX D

Natural Communities of the Brule River State Forest

Field Survey Methods

Inventory and evaluation of the natural communities, habitats, and other significant attributes of a given study area are helpful in focusing future surveys for plants, birds, herptiles, and other taxa. The information gleaned from the community surveys can assist planners by identifying needed expertise, prioritizing the skills most needed, and cutting costs. These surveys also provide the basic assessment of the study area's diversity and significance at the community or "coarse-filter" level.

Evaluation of a natural community is based on the field biologist's assessment of the quality, condition, size, and context of an area using standard criteria. Other factors that are noted and evaluated include imminent and long-term threats, management needs and priorities, and defensibility of the community and the site within which it is contained.

Plot sampling is generally conducted when more detailed quantitative information is required for the purposes of description, comparison, or classification. However, this method is not a major part of standard natural community inventory in Wisconsin at this time because it is time consuming and a great deal of historic data already exists on plant communities. Many standard methods are available for use, and descriptions of these may be found various field manuals, scientific papers, and agency or institutional publications.

The general approach for a natural community inventory is outlined below.

- Use air photos, reconnaissance data, and cover types to identify a relatively homogeneous forest stand and establish a transect designed to cover a substantial portion of the community, ensuring that the interior of the stand is adequately surveyed.
- "Meanders", in conjunction with topographic maps and air photos, can be used to document variability and microhabitats within the community, such as rock outcrops, springs and seepages, ephemeral ponds, tip-up mounds, and differing slopes and exposures.
- For very wet sites and aquatic communities, a canoe or small power boat may be needed.
- Document all plant species encountered, assigning relative abundance codes to each. Collect or obtain photo documentation of unidentified species as necessary. Note dominant species and estimate their relative cover in each vegetative stratum, noting reproductive success of important canopy species.
- Record changes due to edge effects, recent disturbances, or environmental gradients that alter or otherwise affect the composition and structure of the community,.
- Document structural attributes of the community, including estimates of tree size, distribution of size/age classes, microtopography, coarse woody debris, snags, patch size, and patch mosaic.
- Record evidence of disturbance, whether natural or anthropogenic, recent or in the distant past. Specific examples include grazing, logging, fire, mining/quarrying, grading, placement of fill, presence of roads or other rights-of-way, exotic species, dumping, use of chemical agents, ditching, diking, draining, erosion, and sedimentation. The severity of impact and degree of recovery or potential for recovery are estimated when possible. Edge attributes and impacts are also estimated.
- The community's potential to support rare or otherwise significant plants and animals is assessed, based on the condition of the site, the information previously compiled, and the experience of the observer.

- Our surveys of forest communities focused on mature stands, and included those with old-growth attributes whenever we could find them. This was because older stands of closed canopy forest represent more natural conditions for some types (there are exceptions) and they are uncommon in our present landscape. Old-growth stands are rare. Intensively managed forest types such as pine plantations and aspen were not ignored, but such stands are now common and widespread throughout Wisconsin. In our experience, such types seldom support rare species (at least in part because these younger intensively managed forests are common and widespread, associated species tend to follow suit).

The following nomenclature is used by the Natural Heritage Inventory of the Bureau of Endangered Resources in its working list of natural communities (WDNR-BER, 1998) for the state of Wisconsin. Vegetation that does not fall readily into the types described below, such as agricultural land, pasture, old fields, pine plantations, and aspen stands, is referenced by dominant plant cover or land use.

Forest Communities

Northern Dry Forest: This forest community is associated with sites featuring coarse-textured soils of low fertility. It can also occur where bedrock is at or near the surface and the soil mantle is very thin. Glacial outwash sands and Great Lakes sand spits are the landforms on which this community most frequently develops in northwestern Wisconsin.

Common canopy dominants are jack pine and Hill's oak, sometimes mixed with bur oak and/or red pine. 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.

The potential to manage for this type is high on the southern half of the BRSF, but much of the acreage capable of supporting dry forest is currently in monotypic plantations of red or jack pine. Restoration is therefore not a short-term proposition. Where feasible, it would be most beneficial to manage for dry forest as part of a continuum of xeric communities encompassing dense closed forests, semi-open woodland or savanna, brush, and open barrens. Patch size, connectivity, and patch configuration would all need to be determined on a site specific basis within a context of the overall goals and objectives of restoration.

Dense, mature stands of jack pine are favored habitats for uncommon species such as the Connecticut warbler (WI SC). See "Pine Barrens" for related information.

Sites: North Country Trail Barrens; Devil's Hole Red Pines.

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. Fire, at infrequent intervals (several centuries), was the primary disturbance factor responsible for regenerating stands.

This natural community has declined greatly because of the conversion of pine forests to plantation monocultures or short rotation aspen. Stands exceeding economic rotation age are rare statewide.

On the BRSF, there are several small to medium size remnants (10s to 100s of acres). 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; 3) and in the broken, sandy terrain north and west of the river, east of highway ‘S’.

The BRSF is an important property at which to represent the older successional stages of this community because of the quality and context of the remnants there, and because of its statewide decline. A plan is needed to allow for the expansion of the existing acreage of older pine forest and to develop effective and acceptable methods of addressing successional changes.

Species of management interest associated with this community within the BRSF include bald eagle, osprey, northern goshawk, evening grosbeak, red crossbill, pine warbler, pileated woodpecker, and large roundleaf orchid.

Sites: Brule Spillway (Blue Springs-McDougal Springs; Cedar Island-Winneboujou; Stone's Chimney Cedars); Vapa Road Pines; Willard Pines; Lenroot Ledges; Buried Road Pines.

Northern Mesic Forest: The mesic forests of sugar maple, yellow birch, hemlock, and their associates comprised the matrix vegetation of much of northern Wisconsin in the past. The BRSF is near the western and northern range limits for the community type and several of the dominant trees. In the present landscape, this community (actually a complex of several to many associations of varying distinctiveness depending on which vegetation classification one uses and whether one has a predilection to be a "lumper" or "splitter") is still the most abundant type in northern Wisconsin.

All stands of mesic forest on the BRSF are second-growth, but little recent timber harvest has occurred at the sites surveyed and described in this report. No active management is needed to perpetuate this community under normal circumstances. The Sugar Camp Hill site contains the most extensive acreage of mesic forest on the BRSF, and is directly connected to the forested corridor along the Brule River to the east. This site includes important microhabitats such as low igneous cliffs and small perched wetlands.

Several animals of management interest were documented in the mesic forests of the BRSF, mostly at the Sugar Camp Hill site. These included black-throated blue warbler and Cooper's hawk. A red-shouldered hawk (WI Thr) in immature plumage was observed in June soaring above Sugar Camp Hill while calling vigorously, but no direct evidence of breeding was noted.

Sites: Sugar Camp Hill; Lake Minnesuing Hemlock-Hardwoods.

Northern Wet-mesic Forest: The conifer swamps of the "Brule Bog" had been justly recognized for their beauty and biological importance by past investigators (Thomson, 1944). Our recent surveys reaffirmed these impressions but also revealed the presence of many previously undocumented rare plants and animals. The conifer swamps of the upper Brule are generally mature, with some stands in or approaching old-growth condition.

Cedar swamps are widespread in northern Wisconsin, especially in association with glacial moraines. From the headwaters downstream to Winneboujou, stands of mature white cedar, balsam fir, tamarack, black spruce, and black ash border the river. The forest understory is floristically rich, especially in orchids and sedges. Numerous springs and seepages feed the Brule and its tributaries.

Major management issues include the protection of site hydrology, the role played by fire in maintaining the adjoining pine forests of the Spillway, and especially, the poor reproductive success of white cedar, the dominant tree species. Silvicultural methods have thus far been unsuccessful in regenerating cedar and it is clear that other techniques should be tried.

This community supports a high concentration of rare or otherwise important species, perhaps rivaled in northwestern WI only by the estuarine fens and sandscapes found on the northern edge of the Bayfield peninsula, on several of the Apostle islands, and at the mouths of the Bad and Kakagon Rivers in Ashland County. Species include lapland buttercup, fairy slipper, small yellow lady's slipper, Hudson Bay gooseberry, sheathed sedge, olive-sided flycatcher, Cape May warbler, black-backed woodpecker, and gray jay.

Sites: Brule Spillway (Divide Swamp, Angel Creek Swamp, Stone's Chimney Swamp, Blue Springs-McDougal Springs; Cedar Island-Winneboujou).

Northern Wet Forest: Conifer swamps of black spruce and tamarack are widespread in northern Wisconsin and can occupy areas of up to several thousand acres. Two distinct natural communities have been recently split out from this complex: the highly acidic **Black Spruce Swamp**, with an understory of sphagnum mosses, ericaceous shrubs, and sedges; and the more minerotrophic **Tamarack Swamp**, in which species such as speckled alder, skunk cabbage, and marsh marigold may be prominent.

Within the BRSF this community is relatively rare. Stands are small and, when away from the river corridor, often isolated. The best examples of this community are within the Brule Spillway, where they are treated as inclusions within the matrix forest of white cedar and fir.

Species of management interest include yellow-bellied flycatcher, Cape May warbler, olive-sided flycatcher, sparse-flowered sedge, and fir clubmoss.

Sites: Brule Spillway (Divide Swamp, Jerseth Creek, Blue Springs-McDougal Springs); Afterhours Tamaracks.

Boreal Forest: The circumboreal forests of spruce and fir occur across parts of Canada, Alaska, the former Soviet Union, and the Scandinavian countries. In northern Wisconsin they were historically most extensive and best developed near the Great Lakes, especially on the clay plain in Douglas, Bayfield, and Ashland counties. Here, the trees most often mentioned, in order of abundance, were, "spruce, fir, birch, pine, aspen, white cedar, tamarack, ash, and red maple, over an understory of alder, hazel, and (probably) mountain maple" (Fassett, 1944).

The BRSF contains by far the largest acreage of state land suitable for the protection, restoration, and management of this now severely diminished community. Among the major management issues are severe overbrowse on conifers (excepting only white spruce), severe to moderate forest fragmentation, checkerboard ownership patterns, and the absence of a proven method for the restoration of long-lived conifers to sites with the potential to support this community. Alterations of the area’s hydrology, past damage to soils, and competition from present vegetation may also be problems to surmount.

Species of management interest noted in the boreal forests along the lower Brule include the wood turtle, sweet coltsfoot, magnolia warbler, and white-winged crossbill.

Sites: Lower Brule Boreal Forest (McNeil's Landing, Trask Creek-Weir Riffles, Brackett's Corner, Pearson Creek), CCC Miller Boreal Forest and Pines.

Northern Hardwood Swamp: "Swamp hardwoods" are generally composed of trees such as black ash, green ash, red maple, American elm, and yellow birch. In the vicinity of the Great Lakes, balsam poplar is sometimes an important component.

This community is widespread in northern Wisconsin but rare within the BRSF. 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.

Management issues primarily involve the protection of site hydrology.

Sites: Brule Spillway (Divide Swamp, Blue Springs-McDougal Springs, Cedar Island-Winneboujou); Lower Brule Boreal Forest (Trask Creek-Weir Riffles).

Savanna Communities

Pine Barrens: This community was historically widespread in northwestern Wisconsin but has declined greatly due to the general suppression of fire and the conversion of barrens vegetation to monotypic pine plantations.

Characteristic barrens structure features scattered trees, usually jack pine, red pine, or Hill's oak, amid openings supporting a diverse flora typical of sandy prairies. "Heaths" of plants such as blueberries, sweetfern, and bearberry may also be prominent.

Though the acreage of pine barrens on the BRSF is small, and the potential for expansion in the short term limited by ownership and present land uses on and around the forest, the few existing remnants support a vulnerable and declining biota and should not be lost. Species of interest include dwarf milkweed, wood lily, upland sandpiper, and prairie skink.

Sites: North Country Trail Barrens; Jerseth Creek.

Shrub Communities

Alder Thicket: Wet thickets of tall shrubs in northern Wisconsin are usually dominated by speckled alder. Associates may include other shrubs such as red-osier dogwood, winterberry, bog holly, and willows, and herbs such as marsh marigold, skunk cabbage, and canada bluejoint grass. Evidence of groundwater seepage is often present. Soils are often partially decomposed mucks.

The BRSF contains one of most extensive and best-situated stands of this often overlooked community along the upper Brule from the headwaters springs downstream beyond Stone's Bridge. Thickets of alder are also presently common on the heavy red clays near Lake Superior, where a combination of past catastrophic logging, severe fire, loss of humus, and altered hydrology allowed wetland plants to replace the region's boreal forests in some areas.

The alder thicket is and has been an integral and important component of the vegetation mosaic of the upper Brule. As described by the geologist Sweet (1880), "...in the northern part of T.45N., R.11W., the exceedingly sluggish stream winds through dense cedar, tamarac (sic) and alder swamps, for a distance of eight or ten miles." Even earlier, the geologist Owen (1848) stated: "The Brule meanders through a series of cedar swamps, separating into several channels, the main one being sixty or seventy yards wide.... the river now very soon contracts its dimensions to a mere creek, just wide enough to float a canoe between the bushes that overhang its banks."

Special care needs to be exercised when contemplating the removal of alder from streambanks for habitat improvement projects, as this may be followed by the development of dense monotypic stands of the very invasive reed canary grass and a significant reduction in local diversity.

Species of special management interest on the BRSF include the wood turtle (WI Thr). Several additional rare species associated with alder thickets were documented just beyond the Forest's boundaries: eared twayblade (a WI End orchid) and lesser wintergreen (also WI End).

Sites: Brule Spillway (throughout), scattered locations in the Lower Brule Boreal Forest.

Open Bog: Deep layers of sphagnum mosses form the acidic substrate which supports a specialized flora including sedges, ericaceous shrubs (e.g., leatherleaf, bog laurel, cranberry), and insectivorous plants.

Though common in many parts of northern Wisconsin, the open bog is poorly represented within the BRSF.

The major management considerations relate to protection of site hydrology and water quality. Changes in water levels and excess nutrient loading can have serious negative impacts to bog ecosystems.

Species of special management interest inhabiting this community within the state forest include the ebony bog haunter (a globally rare dragonfly), dragon's mouth orchid, and the bog fritillary (a butterfly).

Sites: Hoodoo Lake, Gordon Correctional Bog.

Muskeg: This acid, sphagnum moss-dominated wetland community is closely related to the open bog but is structurally more complex, with scattered, stunted black spruce or tamarack achieving up to 50% cover. The flora is composed mostly of a specialized group of sedges, ericaceous shrubs (e.g., leatherleaf, cranberry, bog rosemary), and insectivorous plants.

This wetland type is common in northern Wisconsin but rare on the BRSF.

Several stands were examined within the Brule Annex, but they were all small and the type is much better represented outside of the BRSF boundaries.

Sites: Brule Annex (not mapped).

Herbaceous Communities

Emergent Aquatic: The emergent marshes occupy bodies of shallow, often permanent, water where there is protection from excessive wave action and strong currents. Many of the dominants, such as cattails, bulrushes, and bur-reeds, are erect and robust, with a grasslike form. Other familiar plants include arrowheads and pickerel weed.

Beds of emergent marsh are widely distributed throughout the state and region. On the BRSF they are uncommon, but significant stands of good quality occur at several of the "widenings" in the middle reaches of the Brule, and in the lagoon at the river's mouth.

The primary management considerations involve maintaining water quality and appropriate flow regimes, and monitoring for invasive species. The latter are not presently a problem on the Brule. Several birds of management interest were documented within marsh habitats here: the American bittern (SC), and the blue-winged teal (SC). Common terns (WI End) were observed foraging in the marsh at the Brule mouth on several occasions.

Sites: Lower Brule Boreal Forest (Brule River Marsh and Lagoon); Brule Spillway (Cedar Island - Winneboujou [Big Lake]).

Submergent Aquatic: Beds of submergent aquatic vegetation occupy sites similar to the emergent stands, though water depth is typically greater. Important plants include the pondweeds, coontail, waterweed, and the water-milfoils. Because of spatial overlap, we have included stands of floating leaved aquatics (such as water lilies and watershield) with the submerged beds.

This community occurs in suitable sites state and region-wide. On the BRSF the stands occupy somewhat different niches in the same sites supporting emergent aquatic vegetation.

Management considerations are similar to those listed above for the emergent aquatics. Several rare members of this community were documented on the Brule: large water starwort (WI Thr) and autumnal water starwort (SC).

Sites: Lower Brule Boreal Forest (Brule River Marsh and Lagoon); Brule Spillway (Cedar Island - Winneboujou [Big Lake]).

Northern Sedge Meadow: As indicated by the name, this wetland community occurs north of Wisconsin's climatic tension zone and is dominated by the grass-like plants of the sedge family. Distribution is wide in the northern parts of Wisconsin, although this "community" is definitely underclassified. Additional field sampling and analysis of wet meadow vegetation is needed.

On the BRSF, this community is uncommon and occurs primarily along the upper Brule corridor in very small patches of no more than a few acres that are too wet to support woody species and are.

No special management is needed to maintain the meadows along the river. Maintaining the natural hydrologic regime is the greatest challenge. In a few areas on the poorly drained red clays near Lake Superior, sedge meadows (and alder thickets) have developed on formerly forested lands due to hydrologic alteration and /or soil damage associated with past land use.

Sites: Brule Spillway (Stone Chimney Cedars, Blue Springs - McDougal Springs).

Poor Fen: This community combines elements of open bog and sedge meadow. Narrow leaved sedges (“wire-grass”) are the usual dominants, but sphagnum mosses and shrubs such as bog birch or leatherleaf are also often important. Poor fen is distributed across northern Wisconsin. However, the status is poorly determined since this community has only recently been recognized as an entity here.

This community was recorded at two locations on the BRSF.

The most significant management needs are related to the protection of site hydrology, preventing an influx of sediment or increased nutrient load.

Sites: Mills Lake, Gordon Correctional Bog.

Primary Communities

Great Lakes Dune: Restricted to the immediate coastline of the Great Lakes, these dune systems support a specialized biota which includes a number of regional endemics. The dominant plants in the early stages of dune stabilization are usually marram grass and beach pea.

On the BRSF this community is represented only by a small, low dune at the mouth of the Brule River.

No rare species were documented on the dunes of the state forest.

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. As this site is quite dynamic, the dune offers the rich marsh at the river's mouth protection from Lake Superior storm events. In addition, the river mouth is an important resting area for migratory gulls, terns, and shorebirds (among others), and merits protection.

Use of this area by humans is seasonally high and needs to be monitored for impacts to the vegetation.

Sites: Lower Brule Boreal Forest (Brule River Marsh).

Great Lakes Beach: Sand beaches of Wisconsin's Lake Superior coast are characteristically un-vegetated. 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.

Approximately eight miles of Lake Superior shoreline are within the boundary of the BRSF. A significant portion of this is undeveloped beach.

The mouth of the Brule is easily accessed from roads and receives heavy use from visitors. The stretch of undeveloped beach from the Brule's mouth west to Pearson Creek is remote and is of value to disturbance-sensitive wildlife.

Sites: Lower Brule Boreal Forest ("Bear Beach").

Inland Beach: Beaches of sand or gravel occur as shoreline features on lakes where natural fluctuations in water levels allow the colonization by and persistence of a specialized biota. Shoreline development pressures are now extremely high in northern Wisconsin, and many natural beaches are being or will be destroyed or damaged.

"Inland" beaches are rare on the Brule but Rush Lake, near the eastern boundary of the forest, is ringed with a very fine example that supports a diverse flora and demonstrates the "zonation" (related to water depth/moisture levels) that is often characteristic of this community.

Sandy shorelines are attractive places at which humans practice many forms of recreation, including some, such as ATV use or horseback riding, that can greatly damage fragile features such as this. The littoral areas of Rush Lake merit strong protection.

Sites: Rush Lake.

Dry Cliff: Cliffs are vertical exposures of bedrock, which can support a specialized flora. Dry cliffs receive all of their moisture from precipitation, rather than from internal pore seepage or wave spray. Statewide, cliffs are most prevalent in southwest Wisconsin's driftless area and along the shores of the Great Lakes. They are very local elsewhere.

On the BRSF dry cliffs are associated with the east-west bedrock ridge separating the Mille Lacs Uplands ecoregion from the Lake Superior Clay Plain.

Fragrant fern (WI Thr) occurs on a basalt cliff within the BRSF.

Sites: The Promontory, Sugar Camp Hill.

Alkaline Clay Seep: These are "micro-communities" associated with semi-stabilized clay bluffs bordering shorelines in the Lake Superior Clay Plain and along Lake Michigan in southeastern Wisconsin. If the eroding clays are too destabilized, the flora tends to be composed only of weedy generalists, or the clay may be devoid of all vegetation. If the clays are stable, a forest similar in composition to the forests prevalent throughout the local landscape is typically present.

This community is not well developed on the BRSF, but small patches, covering only a fraction of an acre, were documented on the clay slopes along the Brule River near Lake Superior. One rare and several uncommon plants (such as golden sedge and buffalo berry) occur in this community on the Forest.

These features are easily damaged by erosion and are likely to have a very delicate water balance as well. Within the BRSF, the slopes harboring this community are all within a special erosion control zone and are not subject to commercial logging or other activities that might threaten them. The restoration of slopes seriously damaged and destabilized by reckless actions in the past is a subject that needs more attention, especially on the Brule, Bad, Nemadji, St. Louis, and Amnicon Rivers.

Sites: Lower Brule Boreal Forest (Trask Creek - Weir Riffles).

APPENDIX E

Rare Vascular Plants of the Brule River State Forest

Field Survey Methods

A number of activities occur prior to the field season. First, all information on occurrences of state and federally listed rare vascular plants reported from the BRSF and surrounding area was obtained from the BER NHI Biological Conservation Database (BCD) and referenced to a set of USGS topographic quadrangles covering the area. Second, staff visited the University of Wisconsin-Madison Herbarium to become acquainted with unfamiliar or difficult to identify species. In some cases, herbarium specimens were photocopied and used as field references. At the herbarium, the draft "Flora of Wisconsin" was consulted to gain information on rare species likely to occur in the State Forest (for BRSF).

Third, staff visited DNR field offices. DNR personnel familiar with plant occurrences and ecological communities were consulted and queried about areas that would benefit from more intensive field surveys. This included sites identified as survey priorities by the NHI ecologist. In addition, forest compartment maps and air photographs maintained at these offices were consulted.

Finally, staff consulted with local college personnel and amateur naturalists knowledgeable of rare plant populations and unusual plant communities.

During the course of the field season, specific plant communities of interest may be surveyed several times for potential rare species. Initial visits of terrestrial habitat were often made in May in order to detect the spring ephemeral flora, followed by later visits in June and July during the major part of the flowering season. Surveys of aquatic areas were usually conducted in July and August when floating and submerged species were most likely to be in flower/fruit. Later blooming species, including asters and goldenrods, were searched for in August and September.

In some areas, drive-by surveys on every town and forest road in the area have proven valuable, particularly for rare species occurring along roadsides. This involves searching for those natural community sites most likely to contain rare plants. Surveys by bicycle were useful in areas with hard-packed, clay forest lanes, as were others using all-terrain vehicles (ATVs) in sandy barrens. Small water craft, such as canoes or a jon boat, were used to conduct surveys of lakes and larger streams. In shallow water areas up to 3 meters water depth, surveys were conducted using a mask and snorkel, which allowed for the use of long handled rakes and nets to collect aquatic plant specimens.

The methods used to search for rare plants were variable depending upon several factors, including maneuverability by the biologists within the habitat and the number of individuals conducting the survey. Some surveys, especially aquatic surveys or those involving fairly nondescript species, were done in a systematic fashion, often searching a habitat intensively along closely-spaced transect lines. Other surveys, where only one biologist was able to search an area and/or the potential habitat was reasonably consistent throughout, relied on the "meander" technique. In either case, the judgment and past field experience of the biologist is critical in intensive field surveys, especially in areas that are often typified by subtle habitat differences.

When potential rare species are discovered, data is recorded on standard NHI field forms. If population size permits, and if there is a question of identification, a voucher specimen is collected for later identification, verification, and deposition at the Madison herbarium. In cases where a particularly rare species is found and/or population size is small, a diagnostic photograph may substitute plant collection.

It is essential to realize that no survey can be completely comprehensive. For instance, it is impossible to search every square meter of habitat in difficult terrain when several hundred, or even thousand, hectares of similar habitat exist. Examples include a sedge or other small, nondescript species occurring in a vast white cedar or black spruce swamp. Certainly, time and other logistical constraints prevent a thorough search of every such habitat.

In addition, many rare plant species, such as grape-ferns and orchids, may exist as short-lived, above-ground plants which do not appear reliably every year. These, and other limitations not discussed here, must be taken account when evaluating rare plant occurrences at any given site.

Typically, new and interesting sites are discovered throughout the course of the field season. Often these sites have had no survey coverage for seasons earlier than the initial visit. For example, a fine hardwood forest stand "discovered" in August may have spring ephemerals that have died back and are not evident at the time of the survey. Therefore, follow-up surveys of such sites are recommended for the spring or summer of the coming year. This is strong justification for thorough botanical surveys taking more than one field season since there are always significant plant sites which are missed during the first year of survey.

*Note: Pilot surveys were completed in 1996 to sample and describe bryological communities. These surveys covered selected sites in the Brule River for bryophytes. Bower’s surveys were conducted on only one site, Stone Chimney, and were not as complete as the surveys for vascular plants.

Rare Plants List

Swamp-pink or Dragon's-mouth-orchid (Arethusa bulbosa) - Special Concern, S3/G4

A beautiful orchid with single brilliant, rose-purple flower. No obvious leaves at flowering, species endemic to boreal and north-temperate parts of eastern North America.

Habitat: open bogs and floating mats, often around lakes and in peaty, acidic sedge meadows; also in partial canopy gaps in coniferous swamps; in all cases on deep sphagnum moss substrate.

No statewide inventory has been done for this species, but with many records in Wisconsin, it possibly is secure here and may warrant deletion from the NHI working list. Recent records from NE and NW WI. The state's largest populations are along the shore of Lake Superior in Bayfield and Ashland Counties in areas of extensive bogs, both along the mainland and on the Apostle Islands.

One rather small colony is known at Hoodoo Lake.

Autumnal water-starwort (*Callitriche hermaphroditica*) - Special Concern, S2/G5

This wide-ranging boreal species has been reported from 13 sites in Wisconsin, eight of those from recent years. Of those eight, four of them are located within the BRSF. Although many of the existing reports have incomplete population data, it appears that the state's largest population may occur at the Little Bois Brule River.

As for most aquatic species, little is known about the particular habitat needs of this species. The following are thought to be general threats: dams (flood streams and create lakes); erosion of upland areas; stream channelization; bank stabilization though placement of riprap, etc.; and changes in water level, especially the lowering of it.

Large water-starwort (Callitriche heterophylla) - Threatened, S2/G5

Awaiting verification of specimen identification.

Fairy slipper, calypso orchid (*Calypso bulbosa*) - Threatened, S2/G5

This wide-ranging boreal species is known from forested conifer swamps, specifically cedar swamps, in northern WI. The species appears to be highly dependent upon the quality of its habitat, and its status in WI is thought to be quite tenuous. While the observation that calypso has been reported from about 40 sites in the State suggests that it may not be terribly rare, it should be noted that 11 of those occurrences are historical, two are known to be extirpated, and at least 21 have very small populations. A state survey for this species is recommended.

Sites: Several colonies have been reported. Collectively, those that occur in the Brule River Macrosite compose the largest known population in the State and should definitely receive protection.

Richarson sedge (*Carex richarsonii)* - Special Concern, S3/G4

Wisconsin is in the central portion of the species' range. Most WI reports are from dry hill prairies in the southern portion of state and, more recently, in barrens habitat in northwest WI. This includes two sites in the BRSF, with a very large population at the North Country Trail Barrens site. This species is probably overlooked due to its very early flowering date, and the evidence suggests that it may be fairly tolerant of disturbance. For these reasons, special conservation measures are not recommended (but be aware that virtually all of its habitat in NW WI has been planted to red pine) specifically for this species.

Sparse-flowered sedge (*Carex tenuiflora*) - Special Concern, S3/G5

Wisconsin is in the southern portion of the range of this boreal species which inhabits bogs and conifer swamps. Although most the reported populations are from the eastern part of WI, a significant number of recent records are from northwest WI. These include several large and extensive populations in the Lake Superior area. At the BRSF, several substantial colonies have been located at Divide Swamp (Brule Spillway macrosite).

Sheathed sedge (*Carex vaginata*) - Special Concern, S1/G5

The range of this North American boreal species extends into white cedar swamps in northern WI. Its habitat consists of conifer swamps, fenny bogs, and alder thickets. The BRSF has a significant concentration, with 10 reported EOs. These include very large colonies reported at Blue Springs, Stone

Chimney, Divide Swamp, Jerseth Creek Swamp, and McDougal Springs (all in the Brule Spillway Macrosite).

The largest threat appears to be habitat loss due to logging or water level changes, including beaver dams or drawdown.

Purple clematis (*Clematis occidentalis*) - Special Concern, S3/G5

This species is known from rocky woods and streambanks in SE Canada and NE U.S. Little is known about its status in WI, although it has been reported from scattered localities across the northern part of the state. It was found at several localities in the BRSF. Each represented a small colony, although at least one in the Brule Spillway Macrosite occurs at a high quality habitat.

Small yellow lady's-slipper (*Cypripedium parviflorum*) - Special Concern, S2S3/G5

Range-wide distribution is not reliably known because of taxonomic questions. Some authorities considered the small yellow to be a mere variety of the more common large yellow. Currently reported from northern portion of eastern U.S. in several habitats, particularly in limy areas: Tamarack swamps and woods in the southern portions of the range and white cedar swamps in the north, open, wet meadows, and fens or wet prairies.

In Wisconsin, the small yellow has been reported from over 70 locations, mostly in the southeast portion of the state. However, 40 of these records are historical and its current status is unknown. The most recent sightings were recorded in cedar swamps and other limy areas in northwest WI.

Although there is a lack of data on the size and quality of EOs in the state, populations are generally reported to be small in size where data exist. In contrast, the collective population at the BRSF is one of the largest known in the state, including a very good colony in the Brule River macrosite. Because of its statewide significance, habitat at the BRSF that supports this species should be protected.

Potential threats include any activity which disrupts canopy or water regime of habitat, deer browse, and collection by orchid fanciers.

Showy lady's-slipper (*Cypripedium reginae*) - Special Concern, S2S3/G4

The main portion of the range is in southeast Canada and the northeastern U.S. Its habitat includes swamps, fens, and occasionally open wetlands and wet woods. While it has been reported from nearly 100 sites located throughout WI, with concentrations near Lake Michigan, about 50 percent of those records are historical. The most recent reports are from the northeastern part of the state. The species has been reported only a few times from northwest WI, including 3 colonies found in the BRSF. The largest of these is moderate in size, while the other two are smaller.

This species is particularly vulnerable to deer browse and collection by people.

Fragrant fern (*Dryopteris fragrans*) - Special Concern, S2/G4T?

The fragrant fern is a wide-ranging northern species. Most WI records (notable exception is from the Wisconsin Dells area) are from northwest WI, particularly in Bayfield and Douglas Counties. One rather marginal occurrence has been located in the BRSF.

The inaccessibility of the habitat currently offers some protection. However, it is vulnerable to collection because of its aromatic fragrance. Also, climbing on cliffs where it grows can disturb plants.

Marsh willow-herb (*Epilobium palustre*) - Special Concern, S2/G5

This boreal species of low, wet ground has been reported from about 30 localities in northeast, northwest, and west-central WI. Several of these are historical stations whose current status is unknown.

Ten of the 30 stations are on the BRSF. Divide Swamp has a significantly large population, but the others are small. However, if they are combined, as probably should be done for those located immediately adjacent to the river, the total population becomes significant in size. These EOs occur in high quality habitat at the Brule Spillway Macrosite.

Vasey rush (Juncus vaseyi) - Special Concern, S3/G5?

The rather small, roadside colony found in the area stands in contrast to the large populations near the City of Superior.

Fir clubmoss (*Lycopodium selago*) - Special Concern, S1/G5

Excluding mountainous areas in the SE U.S., this circumboreal species is at the southern edge of its range in WI, where it has been reported from six stations along the Lake Superior Coast (as early as 1977).

As part of the current survey, it was found at an inland site for the first time in WI on the Brule Spillway Macrosite. Only one small-medium size colony was seen. It is difficult to compare this with the size of other reported colonies in WI, because in some cases the colony was not quantified or its size was measured in a different way.

Protection of fir clubmoss at Divide Swamp is recommended. However, given the potential transient nature of a given colony of the species, adequate protection will probably require the implementation of active management more so than for most other species. Other concerns of possible habitat loss at the site must be addressed.

Arrow-leaved sweet-coltsfoot (*Petasites sagittatus*) - State Threatened, S2/G5

This plant of wet places occurs in western Canada as far south as the northern U.S. and as far east as WI. EOs here are concentrated in Bayfield and Douglas Counties, from which about 25 colonies have been reported. Two sites have been reported from the Brule River area, a small-medium size colony along Brule River Road and a second somewhat larger one along Clevedon Road.

Large roundleaf orchid (*Platanthera orbiculata*) - Special Concern, S2S3/G5?

This species occurs throughout Canada and much of the northern and mountainous U.S. It inhabits dry to wet conifer forest, conifer hardwood forest, hardwood forest, and swamp forest. In WI, most of the recent

reports are from along Lake Superior and Door County. Inland reports are almost entirely historical. Only one very small colony was seen on the BRSF at Sugar Camp Hill.

Lapland buttercup (*Ranunculus lapponicus*) - State Endangered, S1/G5

This species ranges across the subarctic and boreal regions of North America and Europe, occurring in wet woods. It is very rare south of the Canadian border, with the bulk of U.S. historical locations apparently occurring in Minnesota. The Lapland buttercup was first reported in Wisconsin in 1994 on private land during a survey for another species. It was found at two locations on the BRSF, both within the Brule Spillway Macrosite and including populations of good size. Each colony is larger in size than the original one occurring on private land.

Northern black currant (*Ribes hudsonianum*) - Special Concern, S3/G5,

Northern black currant is a swamp species which occurs throughout Canada, ranging south to northern areas of the western U.S. and east to the western Great Lakes region as far south as Iowa. File records indicate that the species is fairly widespread in northern WI.

It seems to be well-established in the BRSF, particularly at the Brule Spillway Macrosite where substantial colonies occur.

Marsh ragwort (*Senecio congestus*) - Special Concern, SH/G5

The one historical EO on the property was not relocated.

Mountain cranberry (*Vaccinium vitis-ideai*) - State Endangered

The one historical EO on the property was not relocated.

APPENDIX F

Rare Animals of the Brule River State Forest

Aquatic Invertebrates

Field Survey Methods
The general approach for aquatic invertebrates was to sample representative waterbodies at least once during the study to gain a rudimentary picture of macro-invertebrate diversity. Selection of the sampled waterbodies was based on an attempt to represent the basic aquatic community types present on the forest and within each LTA. Additional searches were conducted in habitats likely to contain rare species or unusual communities. The mainstem of the Bois Brule River was not sampled because a recent comprehensive survey of aquatic insects was conducted by DuBois, 1993.

Sampling for general macro-invertebrates is best conducted in spring and fall. However, due to time constraints in this study, much of the sampling was conducted in the summer months and resulted in lower numbers of sampled taxa. Macro-invertebrate diversity reported in this study should be considered in a relative rather than an absolute sense.

Previous workers have reported low to nonexistent mussel fauna on the Bois Brule River (T. Doolittle, pers. comm.). Reconnaissance surveys also found no mussels on the Bois Brule River and, as a result, no further mussel surveys were conducted for this study.

- Kick sweeping technique: Stream and lake macroinvertebrates were sampled using a standard Wards D-frame aquatic net and dislodging specimens upstream of the net by disturbing the substrate with the foot. This was repeated in each of the habitat types apparent at each site until new taxa were not apparent. Wood substrates were removed from the stream when possible and all macroinvertebrates were hand-picked. Specimens are placed in 70% ethyl alcohol and labeled with date and location.

- Dragonfly exuviae: Measured lengths of shoreline adjacent to Waterbodies are sampled for odonate exuviae (cast off skins left behind by emerging adults) at the appropriate time of year. Ideally, sample effort in total is at least 50’ in length and includes at least a 20’ sample adjacent to each of the aquatic habitats represented. All exuviae found are placed in 70% alcohol and labeled appropriately.

- Data recording: At each site, sampling effort, location, technique(s) used, habitat, instream water quality indicators, factors potentially affecting habitat quality, and pollutant sources were documented.

- Odonata adults: Adult dragonflies are captured with aerial insect nets and placed in glassine envelopes with date and location recorded. Preservation is accomplished by placing the specimens in acetone for several hours, then drying. Specimens are then placed in clear plastic envelopes along with a 3X5 index card on which pertinent data is recorded.

A future document will contain information on the classification of aquatic features. The Nature Conservancy (TNC), a private conservation organization that works nationwide and beyond, is

developing a lake and stream classification for use across the North American continent. If this project is completed in a timely fashion and proves to be a useful tool for applications such as the status determination of aquatic features and master planning, it will be added to future iterations of this report.

Birds

Field Survey Methods
For species that sing from established territories, the following standard methods are among those most frequently used by BER program biologists. These surveys are typically conducted during early morning hours in the month of June, although they can be run in late May in extreme southern Wisconsin and extended into early July in the far north.

These methods are designed to be repeatable and provide a baseline on the presence and relative abundance of resident birds at a given survey site. Whenever possible, a standardized survey is set up that can be replicated. The method(s) selected may vary with the site's size, topography, staff availability, target species, existence of previous survey data, and, most importantly, the kind of information needed. When other ornithological work is occurring in or near the study area, our methodology may be adjusted to assure standardization and to facilitate the use and interpretation of the data.

- Walk 5: Stand 5 Counts - In this method the observer selects a transect (or follows a previously established route) through the area to be surveyed and alternates walking periods of 5 minutes with stops of 5 minutes. Generally, the 5 minute walking periods are sufficient to ensure that individual birds are not recorded more than once. Observations of birds detected at each stand point may be recorded separately from those individuals encountered while walking between points, but a basic objective is to document as many birds present at a site as possible, so all birds detected are recorded. This method may be easily modified to incorporate some of the advantages of point counts.

- Point counts: Observation points are located within the area to be surveyed at intervals that eliminate or minimize the potential of double counting individuals. Depending on the objective of the survey, points may be located randomly or along transects designed to give the most thorough coverage of the site. The points may also be located along existing trail systems to facilitate repetition. Numerous variations of this method exist, usually differing with the period of observation at each point and/or the distance from the observer at which birds are detected (fixed, variable, or infinite radius points).

- Road transects: This method follows the protocol established by the US Fish and Wildlife Service for their continent-wide Breeding Bird Survey. Transects are set up along roads with stops at one half mile intervals from which observations are made for three minutes. The major advantage of this method is that large areas can be covered in a single morning.

- Canoe surveys: These surveys are designed primarily to cover wetland sites and species not accessible by foot or automobile. Routes are recorded on 7.5' topographic quadrangles and/or air photos to establish observation points which can be relocated during subsequent surveys. Standard 5 or 10 minute point counts may be used at these observation points in conjunction with canoe surveys.

Other methods are necessary for species that do not sing or otherwise advertise territories during June mornings. These include aerial nest surveys, lek counts, use of tape-recorded calls, and nocturnal surveys, among others.

Projects designed to determine population density, nest productivity, habitat affinity, or food habits use different, often more rigorous methodologies.

A study to determine the status of forest dependent raptors was initiated and included sample plots located on the Brule River State Forest and elsewhere. Only about 15 square miles of the state forest were surveyed as a result. Contact the NHI Section Chief for more information about this study.

Herps

Field Survey Methods
General surveys for amphibians and reptiles were not conducted. Rather, rare species with potential significant habitat on the Brule River State Forest were singled out for targeted searches. The only species systematically searched for was the four-toed salamander, for which a new survey methodology was available. Recent observations of wood turtles and other rare herp species were compiled, but no systematic searches were made.

- Four-toed Salamanders: The searching strategy employed was to locate nest sites because of the unique habitat requirements for this part of the life cycle. Potential breeding sites were pre-selected based on (1) absence of fish, (2) presence of enough moss to form vertical walls over water, (3) enough water to support larval development from early June through late August, (4) lack of extensive conifer forest canopy cover, and (5) predominant hardwood canopy in the direct drainage basin of the wetland. Then, in appropriate wetlands, nest searches were made starting the second week of June. Edges of standing or running water were examined for likely nest sites, i.e. moss at least 1.5 in. thick and situated such that larvae when they hatch can wiggle into the water. Once a site is found the moss is carefully peeled back or parted to expose potential nests without destroying them. Wetlands were systematically searched by walking shorelines and or walking transects across them. Effort was recorded as the amount of time spent.

- Miscellaneous rare herps (including wood turtles): Incidental sightings were compiled by coordinating with other field inventory staff, interviewing Brule River State Forest staff, and accessing a study titled Wood Turtle Survey on the Brule River State Forest by Lisa Grudzinski, 1993. Complete details of the herp surveys work are contained in a 1996 report by Gary Casper titled Research Report - Four-toed Salamander Survey: Brule River State Forest and in a 1996 memo from Gary Casper reporting on incidental herp sittings in the Brule River State Forest. Contact the NHI Section Chief for access to these reports.

Rare Animals List

Four-toed Salamander (*Hemidactylium scutatum)* - Special Concern, SU/G5

Brief Description: A small brown to rich red-brown terrestrial salamander with the underside porcelain white with irregular black flecks. Four rather than five toes on the hind feet distinguish this from all other terrestrial WI salamanders.

Distribution: Found in the eastern United States and southeastern Canada.

Habitat: Requires moist, mature, usually deciduous forest with high quality leaf litter and an abundance of downed wood in advanced stages of decomposition. These forests must also contain appropriate breeding sites, which are typically woodland ponds or seeps with abundant mosses. Nesting habitat is usually in sphagnum moss mounds directly adjacent to shallow, cool, fresh water.

State Records: There are about 40 records for the state, but most of those from southern WI are old and need to be verified. As a result, this species was recently added to the NHI Working List as status undetermined. Most recent records are from inventories conducted for state forest masterplans in the NW, NE and WC parts of the state. The recent discovery of their breeding habitat has resulted in many of these new records.

BRSF Records: Four EO's from BRSF. Half of the wetlands surveyed on the forest had four-toed salamanders. These were in the southwest portion of the forest. However, these wetlands were not randomly selected. Habitat on the BRSF is generally very limited.

Conservation concerns: Timber harvesting practices resulting in increased light and decreased humidity, canopy openings or reduced downed wood, wetland modification (draining, impoundment, dredging), or alteration of water quality.

American Bittern (Botaurus lentinginosus*)* - Special Concern, S3B,SZN

Brief Description: A stocky medium sized heron with a black neck stripe and outer wing blackish in flight.

Distribution: Found in the eastern United States.

Habitat: Marshy reedy lakes, wet meadows, and sedge meadows.

State Records: Occurs statewide, but local in the southwest, and declining in the southeast. Declining steadily overall in past 15 years. Most recent records are from inventories conducted for state forest masterplans in the NW, NE and WC parts of the state.

BRSF Records: Rare on the BRSF. Both records are from the lower river. May be found on upper river wetlands but is hard to detect. Habitat on the BRSF is generally limited.

Conservation concerns: Shoreline development, wetland alteration, disturbance, recreational boating, or alteration of water quality.

Osprey (Pandion haliaetus) - Threatened, S3S4B,SZN

Brief Description: A nearly eagle sized bird of prey with dark back and white undersides. Head white with dark line through eye.

Distribution: Nearly cosmopolitan. In eastern U.S. generally northern or coastal.

Habitat: Sites with large area of clear surface water. Typically in forested lake complexes or along larger streams in WI.

State Records: Nesting population restricted to northern third of the state with scattered out-liers in the west and central portions.

BRSF Records: Three nest sites are known.

Conservation concerns: Logging , shoreline development, wetland alteration, disturbance due to recreational boating, alteration of water quality, and toxic compounds.

Bald Eagle (Haliaeetus leucocephalus) - Special Concern, S2N,S3S4B; Federally Threatened

Brief Description: A very large bird of prey with dark back and undersides. Head white or dark in immature. Adults unmistakable with snowy white heads and tails.

Distribution: North American in distribution. In eastern U.S. generally northern or coastal.

Habitat: Sites with large area of clear surface water. Typically in forested lake complexes or along larger streams in WI.

State Records: Nesting population concentrated in northern third of the state with scattered outliers in the western, southern and central portions.

BRSF Records: Seven nest records are known.

Conservation concerns: Logging , shoreline development, wetland alteration, disturbance due to recreational boating, alteration of water quality, or toxic compounds.

Northern Harrier (Circus cyaneus*)* - Special Concern, S2N,S3B

Brief Description: A medium sized bird of prey pale-gray to brown to cinnamon in color, always with a white patch on rump.

Distribution: Holarctic.

Habitat: Forages in open habitats. Nests on ground on hummocks in large treeless areas such as meadows, shrub carrs, grasslands, sedge meadows, tall marsh, etc.

State Records: In WI statewide, but rare in heavily forested or plowed landscapes. Rare in the south.

BRSF Records: Rare on the BRSF. Both records from the lower river. May be found on upper river wetlands but is hard to detect. Habitat on the BRSF is generally limited.

Conservation concerns: Succession of grasslands, activities that disturb the ground during the nesting season, activities that concentrate ground predators, wetland alteration, or direct disturbance.

Northern Goshawk (Accipiter gentilis) - Special Concern, S2N,S2S3B; Federally under review for listing

Brief Description: Large gray to brown hawk with pale stripe over eye.

Distribution: Circumboreal.

Habitat: Locally remote tracts of forest. These are typically hardwood, hardwood/conifer, or upland conifer stands and have not been recently managed. Nests in young stands are rare. Good numbers of prey animals such as medium-sized birds and mammals near nesting areas are required as well. Doesn't do well in areas dominated by red-tailed hawks or great-horned owls.

State Records: Wisconsin status uncertain. Reportedly declining in the NE. Nests typically reported from northern third of the state. Several nests known from central WI. A few locations have been recently reported from east central WI as well. A study by WDNR is currently underway to determine nesting density in WI.

BRSF Records: One nest known from the BRSF and no more than a few others are likely to be present.

Conservation concerns: Logging, including clear cutting, thinning, and selective harvesting; increased accessibility to humans due to road building; trails, etc.

Merlin (Falco columbarius) - Special Concern, S3B,S2N

Brief Description: Small falcon with no rufous in tail or back.

Distribution: Circumboreal.

Habitat Open areas with high densities of small birds. In WI, it is a frequent nester along the south shore of Lake Superior. Occasional nester on larger interior lakes or other open habitats in the northern third of the state. They typically nest in old crow nests found in thick conifer stands. Recently has expanded its nesting range to the south for unknown reasons.

State Records: Recently has expanded its nesting range to the south for unknown reasons. Over 30 nesting sites have been reported in recent years in Wisconsin.

BRSF Records: At least one next is known from the BRSF and a few more are likely.

Conservation concerns: Logging of potential nest sites (shoreline conifer stands).

Sharp-tailed Grouse (*Pedioecetes phasianellus*) - Special Concern, S2B,S2N

Brief Description: Large pale speckled brown grouse with a short pointed tail.

Distribution: Alaska, Canada, and northwest to north central United States.

Habitat: Old burns, abandoned farms, frost pockets, off-site aspen, open bogs and large clear cuts.

State Records: Formerly the common prairie grouse of southern and central WI. Now restricted to about a dozen counties in NW WI and a few counties in central WI. The bulk of WI's populations are reliant on maintenance of open habitats, some in areas that want to be forested, these being mostly managed wildlife areas.

BRSF Records: A few birds were documented in old field habitats on the clay plain.

Conservation concerns: Succession, overhunting? Limited management opportunities on BRSF exist through restoration of barrens habitat on the sand barrens. Large areas (>5,000 acres) are needed to maintain viable populations. On the clay plain, the benefits of maintaining open grasslands must be weighed against the benefits of reforestation.

Upland Sandpiper (*Bartramia longicauda*) - Special Concern, S2B,SZN

Brief Description: A large brown sandpiper with a short bill and small head, thin neck and long tail.

Distribution: Northern half of U.S. and portions of southern Canada.

Habitat: Open grasslands, old fields, golf courses, airports.

State Records: Low numbers everywhere in WI except the east-central portion where it is more common.

BRSF Records: Scattered locations in grassland/old field habitat on the Lake Superior Clay Plain, plus a few birds hanging on in the sand barrens.

Conservation Concerns: Succession, farming or management practices that result in seasonal disturbance of nesting habitat. Management opportunities exist by restoration of barrens habitat in the sand barrens, and by maintaining permanent grass on the clay plain. Opportunities in either case are limited in the forest, and in the latter case, need to be carefully weighed against the benefits of reforestation. This is an area-sensitive species.

Yellow-bellied Flycatcher (*Empidonax flaviventris*) - Special Concern, S2B,SZN

Brief Description: The decidedly yellowish underparts from throat to belly separate this northern flycatcher from all other eastern U.S. flycatchers.

Distribution: Northeastern U.S. and Canada.

Habitat: Extensive black spruce, tamarack, and white cedar swamps.

State Records: Largely restricted to the northern fifth of the state with occasional breeding season observations elsewhere.

BRSF Records: BRSF populations maybe among the best in the state. Three recent records are known from the BRSF.

Conservation Concerns: Canopy opening, fragmentation, logging of nest sites. Altered wetland conifer reproduction resulting from high deer densities, wetland alterations, etc. Practices that result in seasonal disturbance of nesting habitat.

Gray Jay (*Perisorius canadensis*) - Special Concern, S3B,SZN

Brief Description: A large fluffy gray bird of the northern woods. Larger than a robin with a black patch across the back of the head and a white forehead.

Distribution: Boreal forests of North America.

Habitat: Boreal forests of spruce and fir. Also uses white cedar. Uncommon in pines and hardwoods.

State Records: Uncommon and largely restricted to the northern fifth of the state with occasional breeding season observations elsewhere.

BRSF Records: BRSF populations regionally important. Two breeding records are known from the BRSF.

Conservation Concerns: Conversion of spruce/fir/cedar dominated forests to hardwoods. Management practices that result in seasonal disturbance of nesting habitat.

Cape May Warbler (*Dendroica tigrina*) - Special Concern, S3B,SZN

Brief Description: A small songbird with breeding males recognized by chestnut cheek patches, yellow underneath, with striped with black.

Distribution: Canada and northeastern U.S.

Habitat: Boreal forests of spruce, fir, tamarack, and occasionally white cedar.

State Records: Uncommon and largely restricted to the northern two tiers of counties.

BRSF Records: BRSF populations regionally important with extensive high quality habitat present. Three breeding records are known from the BRSF.

Conservation Concerns: Canopy opening, fragmentation, logging of nest sites. Altered wetland conifer reproduction resulting from high deer densities, wetland alterations, etc. Conversion of spruce/fir/cedar

dominated forests to hardwoods. Management practices that result in seasonal disturbance of nesting habitat.

Black -throated Blue Warbler (*Dendroica caerulescens*) - Special Concern, S3B,SZN

Brief Description: A small songbird with breeding males recognized by blue-gray upper parts, black throat and sides, and white belly.

Distribution: Eastern North America.

Habitat: Northern mesic forests of sugar maple, white pine, yellow birch, and hemlock.

State Records: Uncommon and largely restricted to the northern tier of counties plus a population in Menominee County.

BRSF Records: Mesic forest habitat is rare in the BRSF. Only one breeding record known, so far.

Conservation Concerns: Canopy opening, fragmentation, logging of nest sites. Altered hemlock reproduction resulting from high deer densities. Management practices that result in seasonal disturbance of nesting habitat.

Cerulean Warbler (*Dendroica caerulescens*) - Special Concern, S2S3B,SZN

Brief Description: A small songbird with breeding males recognized by blue back, white undersides and a narrow dark neck stripe.

Distribution: Eastern U.S.

Habitat: Large stands of mesic hardwoods and floodplain forest.

State Records: Uncommon and largely restricted to the southern two thirds of the state with occasional breeding season records in the northern third. Has been expanding its range northward.

BRSF Records: Habitat on BRSF uncommon. Only one breeding season record is known from the BRSF.

Conservation Concerns: Canopy opening, fragmentation, logging of nest sites. Management practices that result in seasonal disturbance of nesting habitat.

Connecticut Warbler (*Oporornis agilis*) - Special Concern, S3B,SZN

Brief Description: A small songbird with breeding males recognized by gray hood, yellow and olive body, and a white eye ring.

Distribution: South central Canada and north central U.S.

Habitat: Jack-pine forests.

State Records: Uncommon and largely restricted to the northern tiers of counties with an outlier in central Wisconsin. Several breeding season records are known so far.

BRSF Records: BRSF populations are moderately important with fairly extensive habitat present.

Conservation Concerns: Harvesting/salvaging jack pine has reduced the area of suitable habitat available for this bird. Management practices that result in seasonal disturbance of nesting habitat or habitat fragmentation.

Pine Siskin (*Carduelis pinus*) - Special Concern, S1B,SZN

Brief Description: A small, dark, heavily streaked finch with a deeply notched tail and sharp bill.

Distribution: Southern Canada to northern Mexico.

Habitat: Conifer swamps, boreal forests, and residential areas.

State Records: Breeds statewide with most of population in northern two tiers of counties and in SE WI.

BRSF Records: BRSF populations regionally important with extensive secure habitat present. Two breeding records are known from the BRSF.

Conservation Concerns: Canopy opening, fragmentation, logging of nest sites. Altered wetland conifer reproduction resulting from high deer densities, wetland alterations, etc. Conversion of spruce/fir/cedar dominated forests to hardwoods. Management practices that result in seasonal disturbance of nesting habitat.

Evening Grosbeak (*Coccothraustes vespertinus*) - Special Concern, S2B,SZN

Brief Description: A chunky starling sized finch with a very large pale bill and large white wing patches.

Distribution: Canada and northcentral to northeastern U.S.

Habitat: Boreal forests of spruce, and fir or sometimes pine.

State Records: Largely restricted to the northern three tiers of counties.

BRSF Records: BRSF populations regionally important with extensive secure habitat present. Only one breeding record is known so far from the BRSF.

Conservation Concerns: Canopy opening, fragmentation, logging of nest sites. Conversion of spruce/fir/cedar dominated forests to hardwoods. Management practices that result in seasonal disturbance of nesting habitat.

American Eel (*Anguilla rostrata*) - Special Concern, S3

Brief Description: An elongate, almost snakelike fish with a protruding lower jaw.

Distribution: Breeds in the Atlantic Ocean. Females migrate up tributary systems as far west as western Lake Superior tributaries.

Habitat: Large streams and lakes, preferring muddy bottoms and still waters.

State Records: Uncommon to rare in the Mississippi River and tributaries. Considered an oddity in the Great Lakes tributaries of WI.

BRSF Records: BRSF populations probably of little biological significance but presence here is interesting. They are known to be the larval hosts of several fresh water mussels, none of which are present on the BRSF however. There is one collection record from the BRSF.

Conservation Concerns: Fish toxicants, migration barriers such as dams.

Wood Turtle (*Clemmys insculpta*) - Threatened, S3

Brief Description: A medium sized semiterrestrial turtle with the upper shell sculptured into concentric ridges and grooves similar in appearance to wood grain.

Distribution: Canada, north central and northeastern U.S.

Habitat: Restricted to forested areas along fast moving streams. Nests in nearby open sand or gravel.

State Records: Essentially statewide. Rare in the southwest and east-central portions, absent in the southeast.

BRSF Records: Good quality secure habitat present on middle and lower Brule River. Also found on tributaries of the Brule River.

Conservation Concerns: Lack of secure nesting habitat. Road kills. Harvesting for pet trade and or human consumption. Water quality degradation. Disturbance of nesting areas during incubation period. High densities of mammalian nest predators. Management opportunities might include protection of traditionally used nest sites.

A predaceous diving beetle (*Hydroporus pseudovilis*) - Special Concern, S1S2

Brief Description: An aquatic beetle with an oval, streamlined body. Species level identification requires an expert. Scientific name was recently changed to *Sanfilippodytes pseudovilis*.

Distribution: Global Range - Restricted to Illinois, Michigan and Wisconsin.

Habitat: Depositional areas of small streams and springs with predominantly sand and gravel substrate.

State Records: Only known from two small tributaries to Lake Superior in Bayfield County and one spring in Douglas County.

BRSF Records: Occurrence on BRSF very significant. A few more sites are possible in the forest.

Conservation Concerns: Activities that alter natural hydrological or biological properties of the known site, water quality degradation.

A caenid mayfly (*Caenis youngi*) - Special Concern, G3/SU

Brief Description: A mayfly which can be identified only by a taxonomist familiar with aquatic insects. The wide range of habitats reported suggests there may be more than one species associated with this name.

Distribution: Global Range - Apparently restricted (G3) to Iowa, Michigan, Minnesota, Montana, Wyoming, Alberta, and Wisconsin.

Habitat: Lakes or ponds with at least a portion sandy bottomed. Also from small slow moving streams with sand bottoms.

State Records: Only known from seven sites in WI, four in the BRSF, the other three in Vilas and Oneida counties.

BRSF Records: Occurrence on BRSF very significant. A few more sites are possible in the forest.

Conservation Concerns: Activities that alter natural hydrological or biological properties of the known sites. Water quality degradation.

Bog copper (*Lycaena epxanthe*) - Special Concern, S2S3

Brief Description: A small butterfly with upper side purple iridescent in males, mouse gray brown in females, underside pale tan or white and hindwing with tiny black spots and a zigzag red-orange border.

Distribution: Global Range - Great Lake area of U.S. and Canada and NE U.S.

Habitat: Open bogs with cranberry and other ericaceous components.

State Records: Known from 32 sites in WI, two of which is in the BRSF.

BRSF Records: Occurrence on BRSF is probably not very significant as limited habitat is available.

Conservation Concerns: Activities that alter natural hydrological or biological properties of the known site.

Bog fritillary (*Boloria eunomia*) - Special Concern, S3

Brief Description: A fritillary butterfly with a nonmetallic white pattern on the undersides, with a submarginal row of white spots outlined in black.

Distribution: Global Range - Canada, Alaska, western montane and northern most portions of U.S.

Habitat: Open bogs with cranberry and other ericaceous components.

State Records: Known from 44 sites in WI, one of which is in the BRSF.

BRSF Records: Occurrence on BRSF is probably not very significant as limited habitat is available.

Conservation Concerns: Activities that alter natural hydrological or biological properties of the known site.

Pronghorn clubtail (*Phanogomphus graslinellus*) - Special Concern, S2

Brief Description: A medium sized dragonfly strongly marked with black and yellow. End of abdomen moderately expanded in males.

Distribution: Global Range - From NW to SE Canada, western, and Midwestern U.S.

Habitat: Slow portions of streams, large lakes. Also known from ponds.

State Records: Known from only three sites in WI, one of which is historical in the SE part of the state. Factors limiting distribution in WI are not known.

BRSF Records: In the BRSF occurs in Upper St Croix Lake. Occurrence on BRSF is probably not very significant as limited habitat is available.

Conservation Concerns: Shoreline modifications, water quality degradation.

Black-tipped darner (*Aeshna tuberculifera*) - Special Concern, S3

Brief Description: A large deep blue dragonfly with abdominal segment 10 black.

Distribution: Global Range - Canada, northcentral and northeastern U.S.

Habitat: Shallow densely vegetated ponds, including acid bog ponds, peaty acidic lakes, possibly streams.

State Records: Adults have been collected rarely but widely in northern and central to south-central WI. Factors limiting distribution in WI are not known.

BRSF Records: Only three breeding sites are known including one in the BRSF. BRSF is at least moderately significant as so few breeding sites are known. Limited additional habitat is available on the forest.

Conservation Concerns: Fish stocking, shoreline modifications, water quality degradation, water level alterations.

Ski-tailed Emerald (*Somatochlora elongata*) - Special Concern, S2S3

Brief Description: A medium sized blackish damselfly with emerald green eyes and light yellowish markings on the thorax.

Distribution: Global Range - Eastern Canada and United States.

Habitat: Forest streams with intermittent rapids, outlets of lakes and ponds.

State Records: Known from nine WI counties, mostly the northern forested counties with a pocket in Jackson Co. and a historical record from Milwaukee Co. Factors limiting distribution in WI are not known.

BRSF Records: Additional habitat is available on the forest.

Conservation Concerns: Shoreline modifications, water quality degradation, water level alterations.

Ebony Bog Haunter (*Williamsonia fletcheri*) - Special Concern, S2

Brief Description: A tiny black dragonfly with emerald green eyes and whitish rings on the first few abdominal segments.

Distribution: Global Range - Central and Eastern Canada, Northeastern and Northcentral United States.

Habitat: Shallow, Sphagnum filled pools including bog moats. Bog lakes deep enough for fish are probably not good habitat. At the BRSF sites larvae were found in the shallow moat at the edge of the bog mat but could not be found in the bog lake in the center of the mat.

State Records: Now known from five WI counties, mostly the northern forested counties with a pocket in Jackson and Juneau CO's. This species is very difficult to detect with standard surveys. All of the known breeding sites (4) are the result of recent state forest inventories. These factors make it likely that many more sites are present. Factors limiting distribution in WI are not known.

BRSF Records: Only limited additional habitat is available on the BRSF.

Conservation Concerns: Shoreline modifications, water quality degradation, water level alterations, road maintenance.

Amber-winged Spreadwing (*Lestes eurinus*) - Special Concern, S3

Brief Description: A large damselfly, metallic green in color with strongly flavescent wings, which are spread open while perched.

Distribution: Global Range - Central and Eastern Canada, Eastern and Central United States.

Habitat: Sphagnum bordered lakes and pools, and temporary ponds with little vegetation.

State Records: Now known from nine WI counties scattered in all but the SW portion of the state. Factors limiting distribution in WI are not known.

BRSF Records: Additional sites are likely in the BRSF.

Conservation Concerns: Shoreline modifications, water quality degradation, water level alterations.

Zebra Clubtail (*Stylurus scudderi*) - Special Concern, S3

Brief Description: A large black and yellow dragonfly with end of abdomen widely expanded in males. Yellow rings on black abdomen distinguish it from other large Clubtails.

Distribution: Global Range - Eastern Canada and United States.

Habitat: Cool sandy streams (trout streams) in forested habitats.

State Records: Known from thirteen WI counties in the heavily forested northern part of the state with a pocket in Jackson County. Factors limiting distribution in WI are not known.

BRSF Records: Four streams in the BRSF are known to have zebra Clubtails and more are likely.

Conservation Concerns: Shoreline modifications, water quality degradation, water level alterations.

A Bizarre Caddisfly (*Lepidostoma libum*) - Special Concern, S1?

Brief Description: An aquatic insect distinguishable only by specialists. Larvae in the family containing this species are known by their construction of four-sided cases made of quadrate shaped pieces of plant material.

Distribution: Global Range -

Habitat: Small cool streams.

State Records: Known from three NW WI counties in streams tributary to Lake Superior, one of which is found on the BRSF. Factors limiting distribution in WI are not known.

BRSF Records:

Conservation Concerns: Shoreline modifications, water quality degradation, water level alterations.

A Diamesin Midge (*Pseudodiamesa pertinax*) - Special Concern, S1?

Brief Description: This midge is identifiable only by taxonomists familiar with this group of aquatic insects.

Distribution: Global Range - Western North America and WI

Habitat: Very shallow soft headwater springs and small spring-fed creeks. They were found on rocks and in gravel. They also were found in wood around the spring hole at east McDougal Springs. At Jerseth Creek they were found in the gelatinous plant/silt matter on the streambed.

State Records: Previously only known from west of the Great Plains with the recent discovery in WI representing a significant range extension. Factors limiting distribution in WI are not known.

BRSF Records: Five waterbodies in or near the BRSF represent this species' known range in WI. The BRSF population has to be considered very important for this species' conservation in the Midwest.

Conservation Concerns: Shoreline modifications, water quality degradation, water level alterations.

A Diamesin Midge (*Protanypus* sp.) - Special Concern, S1?

Brief Description: This midge is identifiable only by taxonomists familiar with this group of aquatic insects. Larvae found in the BRSF were not identifiable to species, but four of the five North American species are found only in the Pacific Northwest and the fifth species is known from N.W.T. and Ontario. A reliable report of Protanypus larvae was discovered recently documenting this genus in deeper water of Lake Superior in the vicinity of the Apostle Islands.

Habitat: Reported from oligotrophic lakes. The recently found inland sites in WI were in very shallow soft headwater springs and small spring-fed creeks. They were found on rocks and in gravel. They also were found in wood around the spring hole at west McDougal Springs.

State Records: The recent discovery in inland waters of WI represents a significant range extension. Factors limiting distribution in WI are not known.

BRSF Records: Four waterbodies in or near the BRSF represent this species known range in WI away from Lake Superior. The BRSF population has to be considered very important for this species' conservation in the Midwest.

Conservation Concerns: Shoreline modifications, water quality degradation, water level alterations.

APPENDIX G

Wisconsin Natural Heritage 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. 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 constantly changing as new information regarding the biological status of species becomes available. The Natural Heritage Program welcomes your input on any aspect of this list. Wisconsin's extirpated species list is at the end. **Changes from the previous list (01/98) are bolded.**

Key

ELCODE: Unique 10 digit code for each element (plant, animal, or natural community).

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. Refer to the Rank Definition Sheet.

State Rank: State element rank. Refer to the Rank Definition Sheet.

US Status: Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened; LELT = listed endangered in part of its range, threatened in another part; PE = proposed endangered; PT = proposed threatened; PEPT = proposed endangered in part of its range threatened in another; E(S/A), T(S/A) = Treat as endangered (E) or threatened (T) due to similarity of appearance.

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 level of protection currently follows: SC/P = fully protected; SC/N = no laws regulating use, possession, or harvesting; SC/H= take regulated by establishment of open closed seasons; SC/FL = federally protected as endangered or threatened, but not so designated by WDNR; SC/M = fully protected by federal and state laws under the Migratory Bird Act.

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

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Global & State Element Rank Definitions

Global Element Ranks:

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

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

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

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

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

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

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

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

G? = Not ranked.

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

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

State Element Ranks

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

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

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

S4 = Apparently secure in Wisconsin, with many occurrences.

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

SA = Accidental (occurring only once or a few times) or casual (occurring more regularly although not every year); a few of these species (typically long-distance migrants such as

some birds and butterflies) may have even bred on one or more of the occasions when they were recorded.

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

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

SN = Regularly occurring, usually migratory and typically nonbreeding species for which no significant or effective habitat conservation measures can be taken in Wisconsin. This category includes migratory birds and bats which do not breed in Wisconsin but pass through twice a year or may remain in the winter (or, in a few cases, the summer) and certain lepidoptera which regularly migrate to Wisconsin where they reproduce, but then completely die out every year with no return migration. Species in this category are so widely and unreliably distributed during migration or in winter that no small set of sites could be set aside with the hope of significantly furthering their conservation.

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

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

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

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

SX = Apparently extirpated from the state.

State Ranking Of Long-Distance Migrant Animals:

Ranking long distance aerial migrant animals presents special problems relating to the fact that their nonbreeding 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 nonbreeding (N) status of the taxon in question (e.g. S2B,S5N).

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