E. EPSTEIN

D. CREHORE

E. EPSTEIN

K KOHOUT

BIOTIC INVENTORY AND ANALYSIS OF THE NORTHERN HIGHLAND-AMERICAN LEGION STATE FOREST

A Baseline Inventory (1992-96) and Analysis of Natural Communities, Rare Plants and Animals, Aquatic Invertebrates, and Other Selected Features in Preparation for State Forest Master Planning

October 1999

Wisconsin's Natural Heritage Inventory Program
Bureau of Endangered Resources
Department of Natural Resources
P.O. Box 7921, Madison, WI 53707

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Primary Authors: Eric Epstein, William Smith, June Dobberpuhl, and Andrew Galvin

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Cover photographs: E. Epstein, D. Crehore, and K. Kohout

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Primary Authors: Eric Epstein, William Smith, June Dobberpuhl, and Andrew Galvin

Data Management: Julie Bleser

GIS/Graphics Development: Julie Bleser, Janel Pike

Report Coordination: Andrew Galvin

Contributors: This project would not have been possible without the efforts and expertise of many people. The following are those individuals who contributed to the study:

Dick Bautz – invertebrates
Julie Bleser – data management, graphics
Jim Burnham – zoology, data processing
Dr. Frank Bowers – mosses, hepatics
Cass Brewster – wood turtle
Kevin Brewster – wood turtle
Gary Casper – herpetology
Andy Clark – botany, rare plants
Matthew Christiansen – data entry
June Dobberpuhl – planning, botany
Colin Dovichin – aquatic invertebrates
Eric Epstein – planning, community ecol., birds
Andrew Galvin – report coordination, administ.
Dr. William Hilsenhoff – aquatic invertebrate taxonomy
Randy Hoffman – community ecology, botany, ornithology
Becky Isenring – administration, planning, birds
Dr. Emmet Judziewicz – botany
Tim Larsen – document review
Betty Les – administration
Susan Knight – aquatic plants
Janel Pike – GIS products
Dr. Robert Rosenfield – forest raptors
Dr. Kurt Schmude – aquatic invertebrates
Beth Simon – data handling, field assistance
Bill Smith – planning, aquatic invertebrates, forest raptors
Elizabeth Spencer – community ecology, birds
Dan Spuhler – community ecology
Wayne Steffens – aquatic invertebrates
Michelle Voss – cover design
Kristen Westad – botany, lichens, data processing
Dr. Susan Will-Wolf – lichens

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Executive Summary

Project Purpose and Objectives

This report presents the results of a multi-year project to inventory and analyze selected biotic resources of the Northern Highland-American Legion State Forest (NHAL) 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. The information from this report will be used alongside other information on the forest and its surrounding environment to support property master planning. The primary objectives of this project are:

- The identification and evaluation of natural communities, rare or otherwise significant plant and animal populations, and selected aquatic features and their associated biotic communities.
- The identification of sites appropriate for the restoration of lost or declining communities or important habitats.
- To emphasize especially important protection, management, and restoration opportunities, focusing on both unique and representative natural features of this property and the surrounding 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.

Description of Study Area

The Northern Highland-American Legion State Forest is located in northern Wisconsin in Vilas, Oneida, and Iron Counties. The NHAL is the state's largest property, with over 220,000 acres acquired to date. The entire region was glaciated, with deep deposits of outwash and moraine creating prominent landforms. The majority of the forest lies within the Northern Highlands Pitted Outwash ecoregion, characterized by thick deposits of glacial outwash, a highly significant concentration of glacial kettle lakes, springs and headwater streams, and extensive wetlands. Soils are generally sandy, with topography varying from level to rough and rolling ("pitted" outwash). Areas along the northern edge of the NHAL are within the Winegar Moraines ecoregion and are characterized by rolling topography; richer sandy loam soils; numerous lakes and springs; and many small, forested and open wetlands.

Prior to European settlement, white and red pine forests dominated most of the pitted outwash plain of the Northern Highland ecoregion (Finley, 1976). Northern hardwood forests and conifer swamps were also common and extensive peatlands occupied depressions and the headwater areas of many streams. In the Winegar Moraine ecoregion, greater concentrations of northern hardwood forests, especially sugar maple and hemlock forests, were evident (WDNR, 1999).

Today, aspen is the most extensive cover type, with smaller amounts of northern hardwood forests, pine forests, oak forests, and pine plantations. Aspen, white birch, and pine plantation cover types account for approximately 45 percent of the total state-owned land area and over 55 percent of the forested lands on the NHAL. Lowland forest (5 percent) and "marsh" (10 percent) (bog, muskeg, fen, meadow, marsh)

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

The three counties of Iron, Oneida, and Vilas contain over 20 percent of Wisconsin's inland lakes and 20 percent of the state's inland lake acreage (WLRB, 1995). The NHAL contains over 900 lakes within its boundaries, over 6 percent of Wisconsin's total number, while the NHAL land area is barely one-half of one percent of Wisconsin's total land base (WDNR, 1982). Extensive bogs, peatlands, and swamps cover about 21% of the Northern Highlands Region. The region is an important headwater area for much of Wisconsin (the Wisconsin and the Flambeau-Chippewa) because of its relatively high elevation, great infiltration capacity, and mostly forested watershed.

An additional important characteristic of the NHAL is the forest's location and proximity to surrounding public ownerships, including the Ottawa, Nicolet, and Chequamegon National Forests, the Iron, Oneida, and Vilas County forests, two state-owned flowages (Willow and Turtle-Flambeau), state wildlife areas, state trust lands, and State Natural Areas.

Summary of Results

Several hundred sites within and around the NHAL were inventoried between 1992 and 1996 for natural communities, rare plants and animals, and aquatic features. The selection of inventory sites relied on compilation of background data, including sources both inside and outside of DNR, and involved literature review, aerial photograph interpretation, Original Land Survey Notes interpretation, NHI database review, and interviews.

Sixty-five sites, some of which are grouped within 4 macrosites, are termed **Primary Sites** and generally include the best examples of both rare and representative natural features that were documented within the NHAL. Descriptions for each Primary Site are included in Appendix B in the report. Additional sites of importance have been organized within two other categories. **Isolated Occurrences of Rare Species** are scattered inventory sites located within the NHAL boundary that contain a rare species occurrence. These sites are generally small, isolated, and not associated with more extensive natural features. **Ecologically Significant Sites Outside the NHAL** are selected inventory sites near but primarily outside of the NHAL boundary that contain significant examples of rare and representative natural features.

Rare Vascular Plants

Thirty-four rare plant species were documented on the NHAL including one WI Endangered, 3 WI Threatened, and 30 WI Special Concern species. Seventy-nine percent of the rare plants documented on the NHAL grow primarily in wet habitats, illustrating the biodiversity significance of abundant high-quality lakes, streams, and wetlands in the region. Appendix E in the report provides detailed information for each of the rare plants on the NHAL.

Rare Animals

Sixty-seven species of rare animals were documented on the NHAL, including one US Endangered, one US Threatened, one WI Endangered, nine WI Threatened, and 57 WI Special Concern species. The NHAL presents a significant opportunity to provide secure habitat for a large number of forest dependent birds, including several boreal species, and many forest interior species. As with rare plants, the high number of rare aquatic animals is a reflection of the abundance of high-quality lakes, streams, and wetlands in the Northern

Highland region. The NHAL is used by 2 known wolf packs and contributes to one of the highest known regional concentrations of bald eagle, osprey, and common loon. Appendix G in the report provides detailed information on rare animals for the NHAL.

Natural Communities

Over 200 occurrences of 22 natural community types were surveyed within the NHAL. 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 of the report.

The following community types express major ecological themes of the NHAL landscape, and are of high conservation priority because of their extent, relatively outstanding condition, high significance to both rare and representative native species, or because relatively few other opportunities to conserve these types exist statewide:

- northern dry-mesic forest
- northern mesic forest
- open bog/muskeg/poor fen/black spruce swamp/tamarack swamp
- wild rice marsh
- aquatic features

Important Aquatic Features

One of the dominant attributes of the Northern Highland region is the high density of lakes and other aquatic habitats. Important aquatic communities include:

- seepage lakes
- drainage lakes
- spring lakes
- spring ponds
- small streams
- selected stretches of medium-sized streams
- wetlands

Key Issues for Consideration

Five key issues emerged from the analysis of the ecological findings. These are ordered according to a nested hierarchy of scales ranging from the regional to the local level, and are the highest priorities from the Biotic Inventory.

1. **Local, Regional, and Continental Significance -** The NHAL is an ecologically important site at local, regional, and even larger scales. It provides potential ecological connections to other properties (local and regional), large forested landscapes (regional and state), habitat for animals with landscape level habitat needs (regional and state), and habitat for migratory birds (state, multi-state, continental).
2. **Size and Context** - At over 220,000 acres, the NHAL is by far the largest state property. It is in close proximity to many other public and private conservation lands. This combination of large size and central location set the stage for the NHAL to play a defining role in the protection, management, and restoration of the area's most characteristic natural communities, including extensive forests, large peatlands, diverse lakes, headwater streams, and rare plants and animals.
3. **Content** – The NHAL contains some of Wisconsin's largest and least disturbed remnants of mature dry-mesic white pine-red pine and mesic hemlock-hardwood forest. The state forest occupies a central location within the Northern Highlands Pitted Outwash ecoregion, making up about 25 percent of the total area. The NHAL contains a high concentration of wetlands that are of regional importance.

Protection and management of these key features at suitable locations and at a variety of scales should be a key consideration.

The NHAL contains a significant variety of natural communities, rare plants and animals, and unique aquatic features. The 65 primary sites and 4 macrosites represent the best examples of rare and representative natural features documented and should be considered as high protection and/or restoration opportunities. In particular, 36 of the Primary Sites are of comparable significance to existing State Natural Areas (SNAs), and may represent ecological components that are missing or underrepresented from the existing SNAs.

4. **Diverse Array Of Aquatic Features -** The NHAL presents excellent opportunities to protect and manage important aquatic features, including seepage lakes, drainage lakes, spring lakes, spring ponds, and small and medium-size streams. The concentration of glacial kettle lakes is globally important. Some of the lake types are rare, and many rare aquatic plants and animals are present.
5. **Development Pressures -** Development pressures on privately owned lands within and around the NHAL are currently high and increasing, especially on shorelines of lakes and streams (Laas, 1996). Road densities within the forest boundary are high, compared to many other parts of northern Wisconsin (WDNR, 1999), and are likely to increase with additional development.

Ecological Considerations and Priorities for Master Planning

The Biotic Inventory report presents general and specific ecological considerations that emerged after careful scientific analysis of the ecological processes, biotic data, and existing land use for the NHAL. They are grouped according to conservation opportunities and challenges and restoration opportunities. In addition, ecological priorities are outlined and grouped in sections: natural resource management and protection, restoration, land use, monitoring, research, and future inventory.

Site Descriptions

Sites descriptions are located in Appendix B of the report and provide locational information, site descriptions, element occurrence information, site significance, and management considerations for each of the 66 Primary Sites and 4 macrosites. In addition, a site map for each primary site depicts occurrences of significant communities, species and aquatic features, and public ownership according to 1998 GIS public ownership coverages.

Introduction

Project Purpose and Objectives

This report presents the results of a multi-year project to inventory and analyze selected biotic resources of the Northern Highland-American Legion State Forest (NHAL) 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 consolidates background information useful for property master planning and other applications and is intended to be used together to develop overall recommendations for the forest.

The primary objectives of this project were:

- The identification and evaluation of natural communities.
- The identification and evaluation of rare or otherwise significant plant and animal populations.
- The identification and evaluation of selected aquatic features and their associated biotic communities.
- The identification of sites appropriate for the restoration of lost or declining communities or important habitats.
- To emphasize especially important protection, management, and restoration opportunities, focusing on both unique and representative natural features of this property and the surrounding 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 NHAL will be ongoing and periodic, based on needs identified in the master plan and possibly elsewhere, with adjustments made to accommodate new information using the principles of adaptive management.

Background on Past Efforts

The NHI has compiled records on the occurrences of rare species and intact natural community remnants throughout the state of Wisconsin, but no comprehensive inventory had been conducted for these elements on the NHAL. During 1979-80, the Scientific Areas section of the DNR's Bureau of Research conducted inventories in Vilas, Iron, and Oneida counties to locate and assess remnant natural areas. These surveys included the NHAL but were designed primarily to identify potential State Scientific Areas and were therefore more limited in scope than the present effort.

Additional surveys have been conducted on the property and within the region by various individuals, agencies, and institutions for a variety of reasons, but most of this work was limited to specific locations and/or specific taxa. All of these data, however, have been helpful to us in assessing the adequacy of the information available to enable the development of a new property master plan.

Description of Study Area

The Northern Highland-American Legion State Forest is located in northern Wisconsin in Vilas, Oneida and Iron Counties (Figure 1). The NHAL is the state's largest property, with over 220,000 acres acquired to date. The entire region was glaciated, with deep deposits of outwash and moraine creating prominent landforms. Lakes are major natural features of this landscape, with over 900 occurring within the state forest boundary alone. Small streams, and, in some areas, spring ponds are also notable aquatic features. The Northern Highlands is the headwater area of Wisconsin's two largest drainage basins, the Wisconsin and the Flambeau-Chippewa.

The soils associated with outwash landforms are primarily sands and loamy sands. Loams and sandy loams are more prevalent on the moraines. Organic wetland soils formed from acid moss, sedge, and woody peat are common throughout the forest.

The Northern Highland now occupies the heart of one of the upper Midwest's great historic pineries. The western Great Lakes region was subjected to catastrophic logging, often followed or accompanied by severe fires, during the late nineteenth and early twentieth centuries and before state ownership. Today the landscape once again features extensive forests, but in many places deciduous trees, such as trembling aspen and paper birch have replaced the pines. At some locations, second-growth northern hardwoods stands are prominent. Wetlands are well represented in this landscape, both in acreage and diversity of types. Peatlands are especially prevalent here.

Many additional public lands occur in the vicinity of the NHAL. These include national and county forests; state recreational, fishery, and wildlife properties; state trust lands; and state natural areas. Privately owned lands with high conservation significance are also found in the study area.

Ecoregions of the NHAL

Ecoregions are geographic areas of similar physical, chemical, and biological characteristics organized within a hierarchical framework. Each level of the hierarchy shares important ecological attributes such as climate, geology, landform, hydrology, soils, and vegetation. Terminology for the ecoregions presented here follows that developed by Bailey (1995), the National Hierarchical Framework of Ecological Units (NHFEU) (Avers et al., 1994), and others. Related information on the ecoregions of Wisconsin and the western Great Lakes can be found in Albert (1995) and Hole and Germain (1994).

The NHAL is located within Province 212 - Laurentian Mixed Forests and Section 212J – Southern Superior Uplands. These broad ecoregional classifications are characterized by differences in climate, geomorphic process, geologic origin, drainage, and stratigraphy. A further subdivision of these ecoregions shows the NHAL crossing two distinct sub-sections: the Winegar Moraine and the Northern Highlands Pitted Outwash (Figure 2). The subsections, described below, are characterized by basic differences in geomorphic process, surface geology, lithology, subregional climate, and some soil and vegetation characteristics. The subsections demonstrate unifying attributes that we have found useful in planning and structuring our fieldwork. We do not use the more detailed lower levels of the system

(landtype associations - LTAs) because individual delineations and descriptions had not been completed for the forest by the time this report was printed.

Northern Highlands Pitted Outwash – Subsection 212Jm

Thick deposits of glacial outwash, a highly significant concentration of soft water glacial kettle lakes, springs and headwaters streams, and extensive wetlands, characterize this ecoregion. Soils are generally sandy, with topography varying from level to rough and rolling ("pitted" outwash). Several small drumlin fields are present. Outcroppings of bedrock are extremely rare and those noted are very small. Throughout most of this region the uplands are forested. Dominant cover types at present include aspen, paper birch, plantation-grown pine (mostly red pine), and northern hardwoods. Historically, this region was renowned for its magnificent "pinery" – vast forests of large white and red pines. Mesic hemlock-hardwood forests were significant in some areas, and paper birch and aspen were at least locally common, especially where there had been recent wildfires.

Wetlands are numerous in this ecoregion, some of them very large. Most wetlands are acidic, having accumulated layers of sphagnum peat over several millennia. Open bog, muskeg, poor fens, black spruce swamp, and tamarack swamp are common peatland communities. Other wetland types are also present, including white cedar swamp, hardwood swamp, emergent and submergent marsh, fen, sedge meadow, alder thicket, shrub-carr, and small patches of floodplain forest along the major rivers.

Winegar Moraines – Subsection 212Jc

The Winegar Moraines subsection extends into the northern edge of the NHAL. Key attributes of this ecoregion include: rolling topography; extensive mesic northern hardwoods and hemlock hardwoods forests; richer, and in some areas more finely textured soils than those associated with the sandy glacial outwash area to the south; numerous lakes and springs, especially in the rough end moraine across extreme northern Vilas county; and many small, forested and open wetlands. Publicly owned portions of this ecoregion include parts of the Ottawa National Forest of the central Upper Peninsula of Michigan and the Chequamegon National Forest of northwest Wisconsin.

More detailed information on the ecoregions of northern Wisconsin is included in the DNR's Northern State Forest Assessments (1999), particularly in the reports dealing with Regional Ecology and Community Restoration and Old-growth. Information on vegetative cover, wildlife, ownership, and aquatic features is included in these documents, and is broken down by ecoregion. Ecoregion descriptions relevant to the upper Great Lakes area can also be found in Albert (1995) and Bailey (1995).

Ecoregional Scale and Distribution

The following terms are used throughout this report to describe how various ecological components (i.e. community, species) relate to ecoregions.

Scale – within a given ecoregion, natural communities will occur (or could potentially occur) at characteristic scales or a range of scales. In the text, we have used the following terms to reference community patch sizes:

- Matrix – very large, continuous, and regionally driven (climate, surface geology, disturbance regime, soils). The matrix vegetation of the Northern Highland Pitted Outwash ecoregion is dry-mesic forest, historically dominated primarily by white and red pine.
- Large patch – large, discrete, and locally driven (local landform, topography, soil conditions). NHAL examples include mesic hemlock-hardwood forest and some open bog/muskeg communities in the Northern Highland Pitted Outwash ecoregion.

- Small patch – small, discrete, very localized. NHAL examples include boreal (rich) fen, bedrock glade, and spring pond.
- Linear – discrete, continuous, driven by local and regional processes. NHAL examples include streams, beaches, and bedrock outcroppings along an escarpment.

Distribution pattern – useful terms for referring to the geographic range of natural communities or species of concern within ecoregions include:

- Restricted/endemic – occurs primarily within a single ecoregion (>=90%).
- Limited – shared within a few other ecoregions.
- Widespread – occurs in many ecoregions.
- Disjunct – occurs mainly in other ecoregions, separated by unoccupied regions.
- Peripheral – edge of natural range, main distribution occurs outside of ecoregion.

Hydrology

The Northern Highlands region was entirely affected by Pleistocene glaciation over 12,000 years ago. The area was reduced to a nearly level plain that in turn was buried under varying thicknesses of glacial outwash. This material is composed of sand and gravel derived mostly from igneous rock with some metamorphic and sedimentary rock. It is largely insoluble and non-calcareous. As a result, much of the seepage source surface waters, especially in the Northern Highlands Pitted Outwash ecoregion, are very low in dissolved nutrients. Geologically, the drift is classified as pitted outwash. Much of the Northern Highland Region was thought to be a calving area for icebergs as this is where the receding glacier broke into pieces (Black et al., 1963). These icebergs became buried in the drift and, upon melting, formed deep pits or kettles. Many of these filled with water to form the abundant lakes of the region, making the Northern Highland ecoregion one of the most concentrated lake districts in the world. Moraine landforms composed of glacial drift materials exist in the region, including the large end moraine in Vilas County (Winegar Moraines ecoregion) and several small moraines scattered throughout the region.

The three counties of Iron, Oneida, and Vilas contain over 20 percent of Wisconsin's inland lakes and 20 percent of the state's inland lake acreage (WLRB, 1995). The NHAL contains over 900 lakes within its boundaries, over 6 percent of Wisconsin's total number, while the NHAL land area is barely one-half of one percent of Wisconsin's total land base (WDNR, 1982). Extensive bogs and swamps that formed in poorly drained depressions cover about 21% of the Northern Highlands Region.

The many lakes and wetlands store surface water and release it to streams slowly over extended periods of time. Peak runoff is attenuated and high base flows are prolonged by basin and wetland storage from the shallow water table, but are reduced during long drought periods. Many of the lakes in this area are classified as sensitive to acid precipitation because of very low alkalinity. The region is an important headwater area for much of Wisconsin because of its relatively high elevation, great infiltration capacity, and mostly forested watershed.

Generalized Land Cover

The boundary of the NHAL encompasses approximately 220,000 acres of state-owned land, of which over 75 percent is covered by forested vegetation (WDNR, 1999a). Prior to European settlement, white pine and red pine forests dominated most of the pitted outwash plain of the Northern Highland ecoregion

(Finley, 1976). Northern hardwood forests and conifer swamps were also common and extensive peatlands occupied kettle depressions and the headwater areas of many streams. In the Winegar Moraine ecoregion, greater concentrations of northern hardwood forests, especially sugar maple and hemlock forests, were evident (WDNR, 1999). Figure 3 shows the distribution of forest cover types prior to European settlement (Finley, 1976).

Today, the vegetation pattern of the NHAL has changed considerably (Figure 4). Aspen is the most extensive cover type, with smaller amounts of northern hardwood forests, pine forests, oak forests, and pine plantations. Table 1 depicts the current acreage figures for each land cover type for state-owned lands only (NHAL Forest Compartment Reconnaissance, 3/2/99). Aspen, white birch, and pine plantation cover types account for approximately 45 percent of the total state-owned land area and over 55 percent of the forested lands on the NHAL. Lowland forest (5 percent) and "marsh" (10 percent) (bog, muskeg, fen, meadow, marsh) cover types remain a significant component of the NHAL. We present these figures to give the reader a generalized overview of the study area's vegetation. Within any of these broad cover types, individual stands will exhibit differences in composition and in management potential.

In addition to the change in cover type composition, a number of presettlement ecological attributes are missing from or diminished in the current NHAL forest. Old-growth forests of all communities and including remnants of the northern Wisconsin pinery are few, generally widely scattered, and of limited size. Upland conifer forest types, especially white and red pine cover types, have decreased in acreage as aspen and other cover types have increased. Road and utility corridors, residential development, and various management practices impact large patches of continuous forest cover. The attributes of old-growth, extensive upland forests, and large community patches increase landscape level diversity and accommodate functional, structural, and compositional needs of many plants and animals (Matthaie, 1993).

Figures 3 and 4 were developed using Original Vegetation and Land Use/Land Cover (LULC) GIS coverages from the Bureau of Information Management of the Wisconsin Department of Natural Resources. More detailed maps of both coverages are available and have been used in other Northern Forest Assessments. In an effort to provide a general picture of both presettlement and current vegetation for the NHAL, and to make both coverages more compatible, we employed a combination of level one and level two classifications for the LULC coverage. Generalizations, inaccuracies, and interpretation difficulties are inherent in the resultant Current Vegetation map of Figure 4.

A listing of all known vascular plants within the NHAL is included in Appendix F.

Table 1. Cover Types for State-Owned Lands in the Northern Highland-American Legion State Forest

*Forest Cover Type**	*Sub-total*	*Total*	*Percent*
Aspen		73,147	33.7%
Northern Hardwood		18,727	8.6%
▪ Hemlock-Hdwd	3,351		
▪ Red maple	272		
▪ Northern Hdwd	15,104		
Natural Pine		17,465	8.0%
▪ Jack pine - natural	2,680		
▪ White pine-natural	6,986		
▪ Red pine-natural	7,799		
Oak		15,540	7.2%
Pine plantation		13,379	6.2%
▪ Jack pine-plantation	4,364		
▪ Red pine-plantation	8,427		
▪ White pine-plantation	588		
White birch		10,801	5.0%
Lowland Conifer		9,137	4.2%
▪ Cedar	1,958		
▪ Black spruce	5,844		
▪ Swamp conifer	737		
▪ Tamarack	598		
Lowland hardwood		899	0.4%
Fir-Spruce		1,960	0.9%
Scrub Oak		1,031	0.5%
Other		8,521	3.9%
Sub-total of Forested Acres:		**170,607**	**78.7%**
Marsh		21,512	9.9%
Grassland		12,546	5.8%
▪ Upland grass	3,636		
▪ True Grasses	31		
▪ Herb vegetation	1,148		
▪ Noncomm grass	10		
▪ Lowland brush	7,484		
▪ Upland brush	217		
▪ Rock outcrops	20		
Emergent vegetation		225	0.1%
Alder		170	0.1%
Muskeg bog		76	<0.1%
Water		3,233	1.5%
Other		8,440	3.9%
Sub-total Non-forested Acres:		**46,202**	**21.3%**
TOTAL ACRES:		**216,809**	**100.0%**

Source: Northern Highland-American Legion State Forest Compartment Reconnaissance – March 2, 1999

***** Forest Reconnaissance is a coarse filter approach classifying forest cover types. The name of a cover type reflects the dominant vegetation in forest stands. Within any of these cover types, individual stands will exhibit differences in composition and in management potential.

Lands Surrounding the NHAL

The Northern Highland is situated amid, and in some cases, adjacent to, numerous other public ownerships (Figure 5). These lands include the Ottawa, Nicolet, and Chequamegon National Forests, the Iron, Oneida, and Vilas County forests, two state-owned flowages (Willow and Turtle-Flambeau), state wildlife areas, state trust lands, and state natural areas.

While management emphasis on most of these lands is focused on timber products and recreation, each property makes contributions to the maintenance of regional diversity. Many of these lands have been at least partially surveyed for rare plants and animals and unique natural communities.

Very significant natural features are also known to occur on private lands (including tribal lands) in the NHAL landscape. These have not generally been identified on the maps.

Overview of Methods

Natural Heritage Inventory Overview

The NHAL 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.

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 I.

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 NHAL 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 (BCD), 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.

Field Surveys

Reconnaissance surveys were conducted on the NHAL in 1992 by NHI ecologist Eric Epstein and Randy Hoffman. These preliminary surveys identified those natural communities, aquatic features, and rare priority taxa warranting a more detailed inventory. Various experts conducted comprehensive inventories during 1992-1995. Certain species groups received relatively less attention than others. These include fish, mammals, non-vascular plants, and some invertebrates (especially terrestrial invertebrates). Reasons include: 1. insufficient existing data; 2. too little was 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.

A limited number of surveys were conducted in 1996 to fill gaps in phenology and to more thoroughly cover some sites. Standard NHI 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 NHAL. The methods are explained in greater detail 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.

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 and the Brule River State Forest for DNR. Participants in this workshop were leaders for the NHI botany, zoology, and ecology programs. Staff from the Bureaus of Forestry, Facilities and Lands, and Science Services observed the process. 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 NHAL 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 NHAL compared to those in the region; the degree to which inherent or potential ecological conditions on the planning unit (here the NHAL) 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 Brule River 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 NHAL data.

Finally, individuals are encouraged to submit records for rare plants and animals that are on the NHI Working list. Such information is included in the NHI database on a regular basis, pending a determination of its validity. 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, important aquatic features, and rare plants and animals and concludes with a discussion of the key ecological factors and processes occurring in the NHAL. Each of the groupings is summarized here but discussed in more detail in Appendices B, D, E, and F.

Sites

Inventory sites were identified within and around the NHAL and surveyed by NHI field biologists during 1992-96. 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 the 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 sites inventoried were found to be of relatively low significance by these criteria: they either had been greatly disturbed, supported only widespread or generalist species, or contained features for which better examples occur elsewhere in northern Wisconsin. Such lands included pine plantation monocultures, even-aged aspen stands, and certain natural communities.

These lands of lower significance do possess economic, recreational, and ecological values and may also deserve consideration for long-term restoration or other special management designation depending on site potential, condition, and context. Their management can significantly impact surrounding lands. Therefore, management decisions for forest production or other intensive uses should be considered as carefully as for the more ecologically sensitive areas.

Sixty-five sites, some of which are grouped within 4 macrosites, contained some feature of significance that raised their importance over the remaining sites as determined through the Ranking Workshop. Termed Primary Sites, they generally include the best examples of both rare and representative natural features that were documented within the NHAL. The location of each Primary Site is shown on Figure 6. Additional sites of importance have been organized within two other categories: Isolated Occurrences of Rare Species and Ecologically Significant Sites Outside the NHAL. These categories are defined below and illustrated on Figure 7 and Figure 8:

1. **Primary Sites** - Selected inventory sites within the NHAL 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 and/or restoration consideration.
2. **Isolated Occurrences of Rare Species** - Scattered inventory sites located within the NHAL boundary that contain a rare species occurrence. These sites are generally small, isolated, and not associated with more extensive natural features. Protection priority will depend on the significance of each population at local and regional scales, and the feasibility of maintaining or enhancing that population (Figure 7).
3. **Ecologically Significant Sites Outside the NHAL** - Selected inventory sites near but primarily outside of the NHAL 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 in this category have similar significance to the primary sites, but

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.

are located outside of the NHAL boundary (Figure 8). A listing of the Ecologically Significant Sites Outside the NHAL is provided at the end of Appendix B.

Site descriptions for each of the 65 sites and the 4 macrosites 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, and public ownership according to 1998 GIS public ownership coverages,
- 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 1:49,000 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. The area of land the species or community occupies is frequently much larger than the dot representation. Non-DNR owned lands were obtained from a 1998 DNR GIS public lands coverage. The coverage does not represent legal ownership boundaries and may encompass errors in presentation.

Appendix C includes a master list of each of the 65 sites and the element occurrences that are located in or near them.

Site List and Characteristics

Table 2 is an overview of each of the 65 sites and the 4 macrosites. A summary of the local and regional significance of each site is provided and serves to prioritize the sites at these two landscape levels. General comments are provided on management and other issues. Full sites descriptions and management considerations are provided in Appendix B. The primary sites are arranged geographically, from the northwest corner of the NHAL to the southeast corner, and numbered to correspond with Figure 6.

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

Table 2. Overview and Significance of Sites

Site Name (Map ID #)	Significance within NHAL	Ecoregional Significance Province/Subsection	Comments
Primary Sites			
Catherine Lake Hemlock-Hardwoods (1)	High	High	Extensive, mature mesic hardwood, hemlock-hardwood forests (with patches of old-growth) on moraine; undisturbed wetlands and ponds; rare plants and animals.
Lower Manitowish River Macrosite • North Bass Lake and Hemlocks and Bog (2) • Du Page Lake and Pines (3) • Sugar Lake (Plunkett Lake) (4) • Manitowish River Wilderness Area (5) • Sandy Beach Lake and Bog (6)	High	High	Large peatland complex of open bog, muskeg, spruce-tamarack swamp, drained by lower portion of the Manitowish River. Mature stands of red pine-white pine, old-growth hemlock "islands" with white pine super canopy. Sedge meadow, and emergent marsh border the river, which supports significant aquatic life. Several undeveloped seepage lakes present, at least two of which support rare aquatic organisms. Linked to other ecologically valuable sites outside the state forest boundary. Numerous rare species.
Sherman Lake (7)	High	High	Large undeveloped seepage lake, good quality wetlands; adjacent to other highly significant features.
Toy Lake Cedar and Ash Swamp (8)	High	High	Excellent natural features complex, with highly significant, large stands of swamp conifers (cedar); swamp hardwoods, plus mature hemlock-hardwood forest with old-growth characteristics. Rare plants and animals present.
Papoose Creek Pines (9)	Medium	Medium	Maturing stands of dry to dry-mesic forest composed of jack pine, red pine, white pine. Natural stands are intermingled with plantations. Near the creek, forest has a spruce-fir component. Uncommon birds associated with extensive conifer forests present.
Rice Creek Complex (10)	High	High	Exceptional site with excellent, extensive cedar swamp, spruce swamp, emergent marsh, plus old-growth hemlock stands with white pine supercanopy, northern fens, undeveloped seepage lakes. High concentration of rare plants and animals.
Highway 51 Meadow and Pond (11)	Medium	Low	Small but good quality poor fen, large population of rare plant.
Manitowish River (12)	High	High	River is a good example of medium-sized stream; few developments; diverse aquatic biota with rare species.

Site Name (Map ID #)	Significance within NHAL	Ecoregional Significance Province/Subsection	Comments
Day Lake (13)	High	High	Large, undeveloped deep seepage lake with ultra-soft water, unusual flora.
North Creek - Trout Springs (14)	Low	Low	Managed spring and headwaters stream. Several rare plants occur in the adjoining wetlands.
Grassy Lake (15)	Medium	Low	Drained lake is a very good example of type; bordered by mosaic of undisturbed wetlands; limited development.
High Lake Spruce-Balsam Forest (16)	Low	Low	Small stand of mature, second-growth dry-mesic to mesic forest occurs at interface of end moraine and outwash landforms. Surrounding lands have good restoration potential and could provide an ecologically significant link to important features to the north and south.
Garland Creek Hemlocks (17)	Low	Low	Small, selectively cut hemlock stands, which are uncommon in local landscape. Surrounding forest is young hardwoods type.
Northeast Springs - Johnson Creek Macrosite • Johnson Lake and Barrens (18) • Johnson Creek and Pines (19)	High	High	Good examples of bracken grassland, an undisturbed drainage lake and associated wetlands, and dry forest of unusual composition. The headwaters of the Flambeau-Chippewa River system consists of a unique complex of soft water springs above Johnson Lake. Restoration potential for dry forest community.
Nixon Lake Complex (20)	High	High	Undeveloped drainage lake, outlet stream, undisturbed peatlands; support several rare species. Uplands are managed aspen, natural pine forests. Pine restoration potential.
Partridge Lake Connection (21)	Medium	Low	Lake, outlet stream, and extensive peatlands provide ecological link between Nixon Lake and the Star Lake Crescent Macrosite.
Star Lake Crescent Macrosite • Lake Alva Hemlock-Hardwoods (22) • Lake Laura - Salsich Lake (23) • Plum Lake Hemlock Forest (24)	High	High	Outstanding large complex of old-growth and mature mesic hardwood and hemlock forest; undeveloped seepage lakes, and kettle wetlands. Rare plant and animal species occur here. Hemlock reproduction is locally strong. Excellent opportunity to protect and link high quality mesic forest patches.
Wharton Lake Bog Complex (25)	Low	Low	Open bog and muskeg of good quality within intensively managed upland birch/aspen forest. Some pinery restoration potential.

Site Name (Map ID #)	Significance within NHAL	Ecoregional Significance Province/Subsection	Comments
Aurora Lake and Wetlands (26)	High	High	Excellent drainage lake, with significant wetlands of several types. Small stands of maturing pine forest. Outlet stream supports significant aquatic biota. Consider upland pine restoration.
Mary Davis Ries Bogs (27)	Medium	Medium	Small kettle bogs, representative features of the Northern Highland landscape, that support rare aquatic invertebrates.
Frank Lake and Frost Pocket (28)	Medium	Medium	Large undeveloped seepage lake; dry kettle depression that will not support forest due, apparently, to microclimatic conditions and, possibly, other factors.
Blueberry Lake (29)	Low	Low	Small kettle bog with representative flora. Rare species present.
Plum Creek (30)	Medium	Medium	Small, 4 mile long stream connecting two lakes; supports diverse aquatic biota with several rare species; minimal development, managed for game fish.
Central Highland Macrosite • Escanaba Lake Hemlocks (31) • Lost Canoe Hardwoods (32) • Stevenson Creek and Pines (33) • Allequash Lake and Pines (34) • Little John Junior Lake (35) • Benedict - Hurrah - Scaffold Lakes Complex (36) • Dry Lake and Pines (37) • Bittersweet Lakes Complex (38) • Mud Creek Springs (39) • Sweeney Lake Area (40)	High	High	This extensive site occupies the heart of the Northern Highlands Pitted Outwash ecoregion and contains excellent examples of many of the region's most representative natural communities and aquatic features. These include dry-mesic white pine-red pine-red oak forests, mesic hemlock-hardwood forests, many undeveloped lakes, (including ultra-soft water seepage lakes), and a variety of wetland communities. Some of the individual features were evaluated as among the best examples of their respective types. The key issue is that they occur within a matrix of unbroken upland forest with few plantations or intensively managed aspen stands. Restoration opportunities are excellent and linkages to other features, especially to the north and east, could easily be created. Many rare species occur here.
Trout River (41)	High	High	Hardwater stream supports exceptional aquatic biota, with high diversity, rare species.
East Ellerson Lake and Drumlin (42)	Medium	Medium	Primary site features are undeveloped drained lake and drumlin with second-growth red oak forest.
Sparkling Creek Cedars (43)	Low	Low	Cedar swamp - alder thicket drains to Trout River. Several rare species were documented, but overall condition of the forest is poor due to beaver activity, browse, historic logging.

Site Name (Map ID #)	Significance within NHAL	Ecoregional Significance Province/Subsection	Comments
Camp Lake and Pines (44)	High	High	Ultra-soft, deep seepage lake; small stand of "older-growth" white pine-red pine forest; undisturbed acid kettle bog with open bog and muskeg border. Several rare species present.
Devine Lake - Mishonogan Creek (45)	High	High	This unusual, alkaline drained lake is fed by numerous springs, and drained by an undeveloped stream. An exceptional concentration of rare plants occurs here and the aquatic biota is also significant.
Black Tern Bog (46)	Medium	Low	Small boggy kettle wetland along highway 51 contains good quality poor fen community with diverse flora. Used for educational purposes.
Vandercook Lake and Pines (47)	Medium	Medium	Mature dry-mesic forest of white and red pine, red oak, and paper birch occurs north of lake, several rare species present. Site has restoration potential.
Mann Creek Pines (48)	Low	Low	Small stand of mature, dry-mesic white pine-red pine forest borders county highway; managed peatland complex.
Trout Lake Conifer Swamp (49)	Medium	Low	Small stand of mature, wet-mesic white cedar forest adjoins Trout Lake; receives educational use. Diverse ground layer.
Trout Lake Pines (50)	Low	Low	Small linear stand of old-growth white and red pine borders good example of inland beach on Trout Lake.
Hemlock Lake (51)	Medium	Medium	Mature mesic hemlock, hemlock-hardwood forest with some old-growth attributes; undeveloped seepage lake occur on outskirts of Woodruff.
Timberlane Pines (52)	Medium	Low	Mature, older, dry-mesic forest of white and red pine was partially salvaged following recent windstorm damage. Isolated by highway 47; private developments on shoreline.
Zottle Lake (53)	Low	Low	Small, undeveloped deep seepage lake bordered by second-growth dry-mesic hardwood forest.
Tomahawk Lake Hemlocks (54)	Medium	Medium	Mesic hemlock forest with locally strong hemlock reproduction, mature dry-mesic pine-oak forest, undeveloped lake shoreline, and small kettle peatlands

Site Name (Map ID #)	Significance within NHAL	Ecoregional Significance Province/Subsection	Comments
Horsehead Lake Pine-Oak Forest (55)	Medium	Low	Mature to maturing forest of white pine-red pine-paper birch-red oak-red maple, borders undeveloped shoreline of large lake. Site is isolated by roads, other factors. Several rare animals were documented here.
Two Lakes Pine-Oak Forest (56)	Medium	Medium	Mature, dry-mesic white pine-red pine forest has old-growth characteristics and undeveloped lake shoreline. Also, small patches of older hemlock forest. Somewhat isolated by private developments, ownership pattern.
Wind Pudding Lake (57)	High	High	Unusual seepage lake with diverse basin characteristics supports rare plants and aquatic invertebrates.
Hawk Lake (58)	Low	Low	Small kettle bog complex features showy, representative bog flora. Surrounding uplands are managed; may have some restoration potential.
McNaughton Conifer Swamp (59)	Medium	Low	Large acid conifer swamp of black spruce-tamarack supports boreal bird community, representative flora. Limitations include rights-of-way crossings. Most of site is outside of forest boundary.
Rainbow Wetlands (60)	High	High	Bordering the Rainbow Flowage, this peatland complex of several thousand acres consists of open bog, muskeg, sedge meadow, and shrub-carr. Small sandy islands and ridges support jack pine, red pine forest. Rare plant and animal species occur here.
Big Swamp (61)	High	High	Large acid peatland complex of open bog, muskeg, poor fen, and sedge meadow contains undeveloped seepage lake, small islands of mature white and red pine and rare plant and animal populations.
Swanson Lake and Pines (62)	High	High	This complex of undeveloped seepage lakes and associated peatlands borders a mature dry-mesic forest of red and white pine-red oak-red maple. Many rare plants occur here.
Pickerel Lake (63)	Medium	Medium	Undeveloped drainage lake, small acreage of undisturbed wetlands, and small mature stand of red pine-white pine.
Shallow Lake (64)	High	High	Undeveloped lake contains exceptional concentration of rare species and undisturbed peatlands.

Site Name (Map ID #)	Significance within NHAL	Ecoregional Significance Province/Subsection	Comments
Stone Lake Pines (65)	Medium	Medium	Very small but intact old-growth pine "islands" within undisturbed acid peatland.

Natural Communities

Over 200 occurrences of 22 natural community types were surveyed within the NHAL. 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 section identifies conservation opportunities and priorities for each of the community types. An underlying consideration is that context is frequently a key factor to consider in planning; thus the ecological values and management/protection options for a given site should generally not be considered in terms of a single community.

High Priority Conservation Opportunities

Especially good opportunities to protect and manage the communities listed below now exist on the NHAL. These community types express major ecological themes of the NHAL landscape. They were selected because of their extent, relatively outstanding condition, high significance to both rare and representative native species, and because few other opportunities to conserve these types exist statewide.

- **northern dry-mesic forest** (white pine - red pine - red oak - red maple): Highly significant protection/restoration/management opportunities occur on the forest. Issues to address in the planning process include old-growth, patch size, fragmentation impacts, connectedness, fire ecology, and appropriate silvicultural and other methodologies.
- **northern mesic forest** (hemlock - sugar maple - yellow birch): Though not the major upland forest community on the property, excellent occurrences were documented, some with old-growth attributes, and among these are some of the largest such remnants in the northern Wisconsin landscape.
- **open bog/muskeg/poor fen/black spruce swamp/tamarack swamp** (sphagnum mosses - ericaceous shrubs - sedges - black spruce-tamarack): Extensive acreages of good quality acid peatlands occur on the Highland and some adjoining properties. These communities merit increased protection, as all of the larger sites have been somewhat altered or compromised by various developments. A number of specialized plants and animals occur only in the peatlands.
- **wild rice marsh:** No longer common throughout Wisconsin, this emergent marsh type is represented by excellent occurrences on and around the forest.
- **aquatic features**: The NHAL presents exceptional opportunities to protect and manage a diverse array of aquatic features including seepage lakes, drainage lakes, spring lakes, spring ponds, small streams, and selected stretches of medium-size streams such as the Manitowish and Wisconsin Rivers. Aquatic ecosystem protection is one of the highest conservation priorities in this region. See Appendix D for the NHI classification of lakes and streams and type definitions.

The following natural community types are widespread in northern Wisconsin, and in some cases, more common outside of the NHAL. However, excellent occurrences in terms of size, context, condition, and diversity were documented on the NHAL and these merit careful conservation attention.

- **northern wet-mesic forest** (white cedar - balsam fir): Uncommon in the NHAL, 2 exceptional, large occurrences were documented. Both are very diverse, supporting many representative and rare species.
- **northern hardwood swamp** (black ash): One large, exceptional occurrence was documented. This type is vastly underprotected in northern Wisconsin.
- **boreal fen** (rich fen): Rare on the NHAL and apparently uncommon throughout Wisconsin, several excellent stands were identified. Each is an unusually rich repository of rare plants.

- **emergent aquatic** (bulrush - bur-reed - arrowhead - pickerelweed): Widespread in the state and region, particularly good opportunities exist on the NHAL to protect shoreline marshes because of the many lakes and numerous, small low-gradient streams.
- **submergent aquatic** (pondweeds - waterweed - bladderwort): Status same as above, but often better developed in deeper water than the emergent community type. They commonly co-occur.
- **northern sedge meadow** (sedges - bluejoint grass): Widespread in the north, this herbaceous wetland community may border streams, and in a few cases, lakeshores in the NHAL. Several large high quality occurrences were documented.
- **inland beach**: Many examples, some with rare species, are located on the NHAL. As shoreline development pressures continue to increase in northcentral Wisconsin, further surveys may be warranted.
- **bracken grassland** (bracken fern - sweetfern - grasses): The origins of this type are not well understood. Several good examples occur on the forest.

Additional Protection/Restoration/Management Opportunities

The following types are also widespread, but generally don't require special conservation attention because they typically occur as inclusions in wetlands containing types listed in the high priority category above:

- **shrub-carr** (willow - dogwood shrub swamp): Occurs throughout much of Wisconsin and is more common in the south. Several large stands of good quality were documented on the NHAL.
- **alder thicket**: Very widespread and common in northern Wisconsin, often in linear stands along a stream or lake border, at the interface of forested and herbaceous wetland types, or at an upland-wetland margin.

The following community types are not well represented on the NHAL, but individual stands may be of interest because of their context, local rarity, or disjunct distribution.

- **floodplain forest** (silver maple - green ash - box elder): This deciduous wet forest community is much more prevalent further south. Small stands occur along the Wisconsin and Manitowish Rivers, sometimes associated with other ecologically important features.
- **boreal forest** (white spruce - balsam fir): Only small, often-degraded remnants of this type were found. This community is pushing its southern range limits in this ecoregion and is neither extensive nor widespread.
- **bedrock glade**: Only one, very small rock outcropping was surveyed on the Forest.
- **pine barrens** (jack pine - blueberry - prairie grasses - forbs): No stands of this globally imperiled community were documented on the NHAL. Stands previously identified as barrens are more appropriately classified as "bracken grasslands," given their previous and present vegetative cover, and the absence of a sand prairie component.

Important Aquatic Features

One of the dominant attributes of the Northern Highland region is the high density of lakes and other aquatic habitats. Appendix D contains the NHI aquatic classification system. Soft-water (MPA < 50) seepage lakes (Lake- deep/shallow, soft, seepage) are particularly well developed on the NHAL and have a wide range of sizes and depths. A special feature of the Northern Highland Region is the concentration of very soft (MPA 1-20) seepage lakes (Lake – deep, very soft, seepage). These lakes feature a unique

aquatic community characterized by a number of aquatic plants that exhibit a sterile rosette growth form carpeting the lake bottom. A number of rare invertebrates are found in these lakes as well. Large firm bottomed lakes (Lake- deep, drainage and Lake- deep, seepage) are common on the forest. An interesting feature of these lakes is that they occasionally provide habitat for animals that are typically “lotic” (stream dwelling). The NHAL offers perhaps the only opportunity to protect these large, intact, deep lakes with firm bottoms - a type facing especially strong development pressure in northern Wisconsin.

Small streams (Stream - slow/fast, warm) originating in or connecting lakes are common on the forest, but feature few rare species. These streams, however, support excellent examples of macroinvertebrate communities dominated by filter feeding and collecting/gathering detritivores. Only portions of the Wisconsin and Manitowish Rivers represent larger non-wadeable streams (Streams- slow, hard, warm). However, these two streams feature a number of rare fish and invertebrates found nowhere else on the NHAL. Spring ponds (Spring pond) are characteristic of a small portion of the NHAL and are generally the source of the 12-13 trout streams (Stream- slow/fast, cold, soft/hard) found here.

A wide variety of wetland habitats are found on the forest including open bog, forested bog, sedge meadow, emergent and submergent aquatic plants, hardwood swamp, white cedar swamp, and fen. Protection of existing wetlands in good condition is critical to the maintenance of high water quality and sufficient water quantity. The wetlands are also necessary components of the habitats of many organisms, some of which have aquatic life stages.

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 on the U.S. Fish & Wildlife Service’s “Candidate” and “Species of Concern” lists. Rare species information for the NHAL was compiled from existing records in the BER NHI Biological Conservation Database (BCD), field inventories, and other data sources as described in Appendices E (plants) and F (animals). As a result, the dates of last observations will vary greatly between species. An older, historic record does not necessarily mean the species no longer exists on the NHAL, only that it was not encountered during the inventory completed for this report.

The full listing of rare plant and animals occurring on the NHAL is provided in Appendices E and G, respectively. A discussion of the species at each individual primary site is provided in the site descriptions in Appendix B. However, discrepancies of rare species may exist between the site narratives, site tables, and other appendices for the reasons listed on page B-1 in Appendix B.

Rare Vascular Plants

The Wisconsin Natural Heritage Database lists 34 rare plant species on the NHAL. Moor rush (*Juncus vaseyi*) is listed as Endangered in Wisconsin, and Calypso orchid (*Calypso bulbosa*), shore sedge (*Carex lenticularis*), and algae-like pondweed (*Potamogeton confervoides*) are listed as Threatened in Wisconsin; all were documented on the NHAL. Thirty additional rare plant species found on the NHAL are designated of “special concern,” meaning experts suspect a problem in their abundance or distribution, but have not yet gathered proof of threats to their survival in Wisconsin. Appendix E provides detailed information for each of the rare plants on the NHAL.

Seven of the 34 rare species grow predominantly on upland sites. The remaining species grow in wetlands (18 species) or water (9 species). This high concentration of rare plants in aquatic habitats illustrates the biodiversity significance of abundant high-quality lakes, streams, and wetlands in the Northern Highland region. Many of the high quality habitats used by rare plants at the NHAL may be vulnerable to invasion by aggressive exotic species such as purple loosestrife, reed canary grass, Eurasian water milfoil, and glossy buckthorn. Preventing the spread of these species would greatly aid the survival of rare aquatic and wetland species at NHAL.

NHAL provides excellent opportunities for assuring the viability of algae-like pondweed, shore sedge, Robbins spikerush (*Eleocharis robbinsii*), and American shoregrass (*Littorella americana*) in Wisconsin, holding the state's largest known populations and large portions of the total number of populations in the state. In addition, NHAL hosts many of Wisconsin's largest known populations of marsh willow-herb (*Epilobium palustre*), leafy white orchis (*Platanthera dilatata*), hidden-fruited bladderwort (*Utricularia geminiscapa*), purple bladderwort (*Utricularia purpurea*), and northeastern bladderwort (*Utricularia resupinata*). Excellent habitat for the above-mentioned plants occurs on the Northern Highland.

A listing of all known vascular plants within the NHAL is provided in Appendix F.

Rare bryophyte species

NHI has a draft list of rare bryophytes, but these taxa are not currently well known at a statewide level. In 1996, NHI undertook a pilot study by contracting Dr. Frank Bowers of the University of Wisconsin – Stevens Point to survey mosses and hepatics. Six sites were surveyed on the NHAL. The rare species *Mylia anomala* (a liverwort, S1, SC) was documented, as well as 4 other bryophytes that are considered rare but have not yet been added to Wisconsin's draft list of rare bryophytes. These include the mosses *Anomodon rugelii*, *Campylium radicale*, *Pseudobryum cinclidioides*, and *Ulota coarctata*.

Rare lichen species

Wisconsin's Natural Heritage Inventory has not formally adopted a list of rare lichen species. In 1996, eminent lichenologist Dr. John Thomson (UW-Madison) compiled a list of lichen species he considers rare in Wisconsin. These are species that are only known from five or fewer places in Wisconsin. In addition, Dr. Thomson highlighted a subset of rare species that show signs of decline in Wisconsin. During the summer of 1996, Dr. Will-Wolf (1996) completed a pilot study for NHI and surveyed the NHAL for lichens. Twelve species from Dr. Thomson's list were found, including two on the subset of rare species: *Hypogymnia tubulosa*, and *Icmadophila ericetorum*.

Rare Animals

Appendix G provides detailed information and lists of rare animals for the NHAL. **Sixty-seven** species of rare animals were documented on the NHAL. This includes one WI Endangered, nine WI Threatened, and 57 WI Special Concern species. Included in these 67 species are one US Endangered (timber wolf) and one US Threatened (bald eagle). The 57 WI Special Concern species found on the NHAL included 20 birds, 19 aquatic insects, 3 mussels, 4 fish, 6 terrestrial insects, 2 mammals, 2 amphibians, and 1 reptile. The NHAL presents a significant opportunity to provide secure habitat for a large number of forest dependent birds including the northern goshawk (*Accipiter gentilis* – WI Special Concern), several boreal species, and many forest interior species. As with rare plants, the high number of rare aquatic animals reflects on the abundance of high-quality lakes, streams, and wetlands in the Northern Highland Region.

Of the 67 species occurring on the NHAL, over 75 percent of the species occur in wetland and aquatic sites. Only 19 (28 percent) occur on upland sites (difference in percentages is due to species occurring in more than one habitat). Though these figures do not convey greater importance of any particular species over another, it

does provide an indication of the importance of protecting wetland and aquatic ecosystems to maintain rare animal species.

Potential timber wolf pack habitat occurs in three main areas of the Forest: 1. areas west of Manitowish Waters, especially the Manitowish River Wilderness and vicinity (~80mi2); 2. areas in the northeast part of the Forest on and adjacent to the Patridge Lake and Frank Lake Wild Areas (~90mi^2); and 3. areas on and adjacent to the Indian Creek Wild Area on the southeast side of the Forest (~35mi^2). As of 1999, a pack of 2 wolves occurs in the west part of the Forest (Miles Lake Pack), and a pack of 2 occurs on the northeast side of the Forest (Nineweb Lake Pack) (pers. Comm., Wydeven, 1999). The large public land base that the NHAL provides could prove critical for timber wolf restoration in north central Wisconsin, providing road densities are not increased substantially.

The lakes of the NHAL contribute significantly to one of the highest known regional concentrations of bald eagle, osprey, and common loon. Figure 9 shows the distribution of nesting sites for the bald eagle and osprey throughout Wisconsin and the heavy concentration of sites centered on the NHAL area. Detailed, up-to-date records for the eagle and osprey are maintained by DNR Wildlife Management staff at Rhinelander (pers. comm., Ron Eckstein, 1999). The lakes also provide habitat for some of Wisconsin's rarest aquatic invertebrates. See write-ups in Appendix G for: mottled darner, lake darner, black-tipped darner, a caddisfly, subarctic bluet, robust Dubiraphian riffle beetle, a predaceous diving beetle, and the lake emerald dragonfly. Appendix H includes a checklist of all known birds species documented within the NHAL since 1939.

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 NHAL include:

1. **Natural Disturbance** – Historically, fire was the driving force that influenced vegetation types and patterns throughout the Northern Highlands Pitted Outwash ecoregion. The impacts of long-term fire suppression have significant implications for present and future management and protection efforts. Other important natural disturbances include windthrow, ice storms, insect infestations, plant pathogens, and herbivory.
2. **Hydrology** – Lakes, streams, springs, and wetlands are natural features of the highest importance on the NHAL and surrounding landscape. Important hydrologic processes include rainfall, groundwater recharge, springhead discharge, fluctuations in base level flow, lake levels, and water temperature. The many lakes and wetlands store surface water and release it to streams slowly over extended periods of time. Peak runoff is attenuated and high base flows are prolonged by the basin and wetland storage from the shallow water table, but are reduced during long drought periods. Many of the lakes in this area are classified as sensitive to acid precipitation because of their very low alkalinity. Maintenance, and in some areas, improvement, of water quality and quantity are essential goals.
3. **Natural Succession** – Past land use practices, altered disturbance regimes, and other factors have led to the virtual elimination of older successional stages, a great reduction in several important natural cover types, and the loss of certain plant and animal species from areas they formerly inhabited.
4. **Airshed Characteristics** – We mention this because the Northern Highland Pitted Outwash ecoregion has such a high concentration of soft water lakes. These water bodies are vulnerable to acidification from certain airborne pollutants, and, should this happen, it is likely that there would be a loss or reduction of some of the more specialized and/or sensitive biota now characteristic of the Highlands' soft water lakes.

5. **Immigration/Emigration** – Because of its size and setting, the NHAL presents an excellent opportunity to maintain populations of most, if not all, of the organisms native to the region. This will necessitate careful consideration of the need to create or maintain ecological linkages across administrative boundaries, especially to the west, north, and east.

Key attributes of the present landscape include:

1. **Landforms** – All major landforms of the NHAL are of glacial origin and include uncollapsed outwash, collapsed (pitted) outwash, and end moraine. Lakes and wetlands are especially well represented in each of them. Major drainage systems are the Wisconsin and the Chippewa-Flambeau. Minor landforms include drumlins and bedrock outcroppings.
2. **Soils** – Important soil associations are primarily sands, loamy sands, and sandy loams. Loams are locally prevalent along the southern edge of the end moraine, and loamy sands or loams are common at several locations, often associated with mesic vegetation. Poorly drained organic soils predominate in low-lying areas that intersect or are near the water table.
3. **Vegetation** – Extensive forests cover most of the property and surrounding region, with dry-mesic and mesic types the most widespread. Aspen and plantation-grown pine have replaced the vast pine and hemlock-hardwood forests that historically comprised the bulk of the area's vegetation. Old-growth successional stages and large patches of mature forest are presently rare or uncommon. Conifer cover has been greatly reduced compared to its past extent. Extensive peatlands occur in portions of the region and on the forest.
4. **Representative and rare species** – Water dependent organisms, including many of high management concern such as the bald eagle, common loon and osprey are common in the region. Species associated with extensive forest are also well represented. Some wetlands and lakes are notable for their concentrations and/or large population of rare plants. Several formerly extirpated animals have recently recolonized the forest, including the timber wolf and fisher.
5. **Land use** – Primary land uses are recreation and commercial forestry. Residential growth is high and increasing, especially on lake and stream shores.

Considerations and Ecological Priorities

Key Issues for Consideration

There are 5 key issues that are important for the ecological future of the NHAL 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. **Content** – The NHAL contains some of Wisconsin's largest and least disturbed remnants of dry-mesic white pine-red pine and mesic hemlock-hardwood forest. Both types comprised the historic vegetation matrix of much of the western Great Lakes "North Woods," and a key consideration should be the protection and management of these communities at suitable locations and at a variety of scales. In particular, the NHAL formerly supported one of the Upper Midwest's greatest pineries, and could do so again. The state forest occupies the heart of the Northern Highlands Pitted Outwash ecoregion (NHAL includes almost 25 percent of the ecoregion), and is therefore especially well suited

to the protection, management, and restoration of this ecoregion's most characteristic forest communities.

Wetlands also deserve conservation emphasis on the NHAL - in particular the extensive peatlands of muskeg, bog, and fen. A diverse array of less extensive natural features are also well-represented on the state forest, including white cedar swamp, hardwood swamp, boreal (rich) fen, emergent and submergent marshes, black spruce and tamarack swamps, bracken grassland, northern dry (jack pine-red pine) forest, and northern sedge meadow.

2. **Size and Context -** At over 220,000 acres, the NHAL is by far the largest state property. It is in close proximity to many other public and private conservation lands. Thus, issues of scale and context are critical and conservation opportunities are available for the NHAL that few, if any, other state properties possess. Opportunities include large patch protection, large-scale restoration of pineries, ecological connectivity, and protection of representative ecological components of the Northern Highlands Pitted Outwash ecoregion. These opportunities could have major implications for future management.
3. **Importance of NHAL at a Variety of Scales** – The NHAL is an important ecological feature at local, regional, and even larger scales. For example, the NHAL provides connections to other properties (local and regional), large forested patches (regional and state), habitat for animals with landscape level habitat needs (regional and state), and critical habitat for both resident and migratory birds (state, multi-state, continental). To implement integrated ecosystem management, the impacts of future management activities at each of these scales should be considered.
4. **Diverse Array of Aquatic Features -** The NHAL presents exceptional opportunities to protect and manage a diverse array of aquatic features. The concentration of glacial kettle lakes within the NHAL is globally important. Some of the lake types are rare, and many rare organisms are supported by the Highland's waterbodies. Important aquatic features include seepage lakes, drainage lakes, spring lakes, spring ponds, small streams, and selected stretches of medium-size streams such as the Manitowish and Wisconsin Rivers. See Appendix D for NHI classification of lakes and streams and type definitions.
5. **Development Pressures -** Development pressures on and around the NHAL are currently high and increasing, especially on the shorelines of lakes and streams (Laas, 1996). Road densities within the forest boundary are high compared to many other parts of northern Wisconsin (WDNR, 1999), and are likely to increase with additional development. This situation lends urgency to the completion of the property master plan, as some current opportunities are unlikely to be available through another planning cycle. Boundary issues deserve especially careful scrutiny in this regard. Identification and prioritization of expansion or coordinated management opportunities should occur during the master planning process.

General Considerations for Master Planning

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

Conservation Opportunities and Challenges

1. **Ecosystem Protection** – The NHAL comprises a large portion of the Northern Highlands Pitted Outwash ecoregion. Much smaller portions are in other public ownerships, while the remainder is in private ownership. Thus, the NHAL offers a unique opportunity to protect, restore, and manage the

characteristic features of the Northern Highlands Pitted Outwash ecoregion, including extensive forest, large peatlands, and lakes. The ecosystems within the NHAL provide habitat for plants and animals of local and regional importance, including portions of 2 timber wolf pack areas; regionally high concentrations of bald eagle, osprey, and common loon; and good populations of boreal, forest interior, and area-sensitive birds.

Ideally, site protection design should accommodate natural disturbance events at a sufficient scale so that a single disturbance event would not eliminate the important elements at the site.

2. **Natural Community Protection -** Large patch protection, restoration, and management opportunities are especially important for dry-mesic (white pine-red pine) forests, mesic hemlock-hardwood forests, and large peatlands (muskeg, poor fen, open bog and black spruce/tamarack forests). Among other communities, very good examples occur on the NHAL of northern wet-mesic forest (white cedar swamp), hardwood swamp (black ash swamp), northern dry forest (jack pine-red pine), emergent aquatic (wild rice marsh), northern sedge meadow, shrub-carr, and boreal rich fen.

3. **Existing Forest Cover -** The forests of the NHAL have demonstrated remarkable recovery from the catastrophic logging and other associated major disturbances that occurred in the late nineteenth and early twentieth centuries. However, those forest communities that were formerly most widespread in the NHAL's major ecoregions (dry-mesic white pine-red pine forest in the pitted outwash, and mesic hardwood and hemlock-hardwood forest types on the moraine and to a lesser degree within the pitted outwash) have been greatly reduced in area or strongly altered in character. Individual patches of these natural communities are often isolated from one another. Aspen is currently the most common cover type on the forest, followed by northern hardwoods (mesic forests), natural pine forest, red oak forest, pine plantations, and paper birch (patches of old-growth or older upland conifer-dominated forests of over 100 hectares are now rare throughout northern Wisconsin).

4. **Integrated Site Management** - Some of the sites and features described in the previous section would benefit from management in aggregate rather than separately. An example is Rainbow Wetlands - Swanson Lake and Pines - Big Swamp, in Oneida County. Individually, each of these sites contains very good stands of natural communities that are representative of the Northern Highlands Pitted Outwash ecoregion. These communities in turn support many if not most of the plants and animals typically associated with these respective types, including a number of species that are rare. No single site contains all of the plants, animals, natural communities, and aquatic features characteristic of a northcentral Wisconsin peatland/pine forest landscape. But, by considering the three sites together, many more of these natural features are encompassed, as are large-scale processes.

5. **Boundaries -** The administrative boundaries of the Forest cross the ecological boundaries of some natural features and sites, including forests, wetlands, lakes, and streams. This issue affects lands both within and outside of (but adjacent to) the property boundary. Consideration should be given to identify and secure ecologically appropriate boundaries, through available and suitable options.

6. **High Concentration of Lakes -** The concentration of lakes on the Forest presents a highly significant conservation opportunity, certainly the highest among all state lands for lacustrine ecosystems. However, a significant proportion of the ownership around lakes within the NHAL is in private ownership. This is especially true for large lakes of over 100 acres.

7. **Conservation of Neotropical Migrant Birds –** The NHAL occurs within a band of physiographic strata that supports the highest species richness of breeding birds north of Mexico (Green, 1995). The identification, protection, and appropriate management of significant habitats for this group should be a conservation priority for large public lands in northern Wisconsin.

8. **Dams -** Dams have been constructed on the largest streams within the state forest: the Wisconsin and Manitowish Rivers. These create barriers to the dispersal and other movements of many aquatic

organisms, increase water temperatures, reduce current velocity, and influence water levels in ways that can impact aquatic life.

9. **Land Use -** Development pressures on privately owned lands are currently high and increasing in the region. This is especially true along the shorelines of lakes and streams (WDNR 1996). One consequence of accelerated shoreline development has been the loss of natural vegetation of high value to native animal species. Serious potential consequences include diminished water quality and inadvertent introduction of invasive species.

10. **Fragmentation -** Road densities on the NHAL are high compared to other parts of northern Wisconsin (WDNR(1), 1999). Habitat fragmentation and negative impacts to disturbance-sensitive species are among the management challenges that can result from this condition. As development and human population size increase, associated infrastructure will exacerbate fragmentation-related resource management issues.

11. **Management Conflicts -** Many divergent interests, projects, and goals exist within the NHAL region. State and federal agencies, tribal, county and local governments, and private industry and small landowners may have dissimilar goals (i.e. management goals) based upon their particular interests. Conflicts may exist, both within and outside of the NHAL boundary, which will present challenges for the future management of the NHAL landscape. Tradeoffs are common elements of any implemented management plan. The potential for coordinating management across administrative boundaries should be explored throughout the planning process as appropriate.

12. **Need for Monitoring –** Many controversies have arisen in recent decades regarding the ecological impacts of various management actions. There is a demonstrable need to develop or increase monitoring programs to effectively address these questions. Relevant topics include, but are certainly not limited to, sensitive species trends, changes to water quality and aquatic biota, fragmentation, identification of declining habitats, invasive species trends, and shoreline development issues.

13. **Inventory Results -** The present inventory project has identified and evaluated natural features of many kinds, including natural communities, community complexes, aquatic features, populations of both rare and representative plants and animals, and restoration opportunities that merit careful consideration during the master planning process. For specifics, see succeeding sections, the tabular site summary, and the individual site descriptions in Appendix B.

14. **Inventory Gaps -** No inventory is ever complete, and we do not imply that those taxa we did not include in this effort are unimportant (quite the contrary!). In general, we tried to fill significant information gaps and focused on those communities and taxa where the clarification of status and identification was especially important within the context of the current planning process. A great deal of information already exists, and is available to the planners and the public, for the timber resource, game and certain non-game wildlife species, and fish. Some important but relatively poorly surveyed or understood organisms (e.g., lichens and mosses) received less attention than better known groups because it would be difficult to interpret the results of even a very detailed survey for these taxa within the context of this master plan. Inventory of the NHAL will continue and information will be added on an ongoing basis to the baseline inventory developed for this report.

15. **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, and in this report, will contribute background information useful for property master planning and other applications.

Restoration Opportunities

Throughout this report we have highlighted natural features of special significance within and around the state forest. Some of these features merit consideration for special management attention based on their rarity, local, regional or range-wide decline, vulnerability, or because they are particularly representative of this landscape. We are treating “restoration” as an issue for master planning in those cases where we have identified opportunities and established need, where restoration in proximity to other natural features of significance would confer ecological benefits to that feature (or site), or when few other opportunities to achieve the restoration of a given feature exist in either the local or regional landscape. It is important to note that 1. We do not imply that restoration means a return to presettlement conditions, but rather that communities, species, structural features, microhabitats, and natural processes that are diminished in, or now absent from, the present landscape have a valuable role to play in maintaining our native ecosystems; and 2. Tried and true methods for the restoration of whole forest communities do not exist. All such actions should be regarded as at least somewhat experimental, and monitoring of the responses of vegetation, and perhaps selected species, must be an integral part of such an endeavor.

1. **Restoration Potential -** Much of the land that has been intensively managed for forest products in recent times has some potential for the restoration of lost or diminished species, structural features, successional stages, ecological connections, or other attributes. It is important to select candidate sites for restoration with respect to their size, context, and ecological appropriateness, and to identify project objectives as clearly as possible. Methods to be used in restoration should be clearly conveyed to relevant parties.
2. **The Pinery -** This report identifies a subset of sites where white and/or red pine restoration is appropriate now or in the near future. DNR's various assessment teams have identified broader areas, using a combination of existing land cover (e.g., forest reconnaissance and satellite imagery) and habitat type information, where conditions are suitable for pine restoration. What's less readily available is the identification and location of stands typed by their current canopy cover (usually aspen or paper birch or occasionally as oak) but with a strong component of pine in the understory. Pinpointing those stands with a significant understory pine will greatly increase the success of a restoration effort. Working with the Bureau of Forestry, we recommend the use of infrared aerial photography, under leaf-off conditions, over and around the most suitable areas already identified as having the best restoration opportunities.
3. **Stream Restoration -** Dams impact the biodiversity of streams, especially affecting fish, mussels, and certain aquatic insects. Removal of some dams would provide an opportunity to restore various aquatic biotic and stream functions.
4. **Wildlife Restoration -** The size of the property is adequate for most area sensitive species such as timber wolf and moose, especially if forested and roadless (or lightly roaded) corridors are maintained between the NHAL and the large public holdings surrounding. The draft timber wolf management plan identifies parts of the NHAL as primary habitat and much of the rest as secondary habitat. This primary and secondary habitat area is an island surrounded by unsuitable habitat for wolves and is critical as a connection to forested habitats in northcentral and northeastern WI.

Ecological Priorities

The Bureau of Endangered Resources bases the following ecological priorities on careful scientific analysis. They reflect assessment and inventory of the region surrounding the NHAL as well as the property itself. They are organized around a number of primary issues: management and protection, restoration, land use, and monitoring. This information was developed for the Department’s master planning team who will use these ecological priorities, along with other information, to help develop

overall recommendations for the Forest. 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 description section (Appendix B).

Primary Site Management and Protection

1. The 65 primary sites and 4 macrosites represent selected inventory sites within the NHAL that contain the best examples of rare and representative natural features that were documented. They encompass a broad array of natural communities, aquatic features, rare plant and animal populations, and restoration candidates. The following attributes may be used to help identify and prioritize these ecological priorities:
   a. Communities that are rare everywhere in the region or state.
   b. Communities and community complexes that are better represented on, and especially characteristic of, the NHAL.
   c. Successional stages of widespread forest communities that are poorly represented in the current landscape.
   d. Rare species that are represented by large, potentially viable populations, and are better represented on the NHAL than on other properties in other regions. Isolated, small, or disjunct populations of rare species should be treated on a case by case basis, and protected as deemed appropriate and feasible.
   e. Aquatic features representative of the pitted outwash and Winegar moraine ecoregions. Some of those present on the NHAL are uncommon or absent elsewhere in the state.
   f. Aquatic features that are rare throughout the state and region.
   g. Select restoration candidates with respect to need, opportunity, and especially, context. These candidates should focus on:
      - sites that link or could link now-separated patches of existing communities or aquatic features of high ecological significance.
      - sites with good potential to reduce high-contrast edge and associated negative edge impacts - sites that would increase the effective stand size of small high-quality forest patches.
      - sites that would create or enhance dispersal or travel corridors.
      - sites that could create appropriate linkages with natural features beyond the boundaries of the NHAL.
2. The local and regional significance of each primary site is summarized in Table 2 on page 17. Of the 65 primary sites, 36 sites, including all four macrosites, are ranked “high” in all of BER’s evaluation categories at both the property (local) and statewide (regional) levels. Basic ranking criteria include current quality and condition of the natural communities and aquatic features, size of the natural communities, the representation of both rare and characteristic species, context of the sites, and the degree of effective protection afforded these natural features statewide.

Catherine Lake Hemlock-Hardwoods (1)

Lower Manitowish River Macrosite

- North Bass Lake and Hemlocks and Bog (2)
- Du Page Lake and Pines (3)
- Sugar Lake (Plunkett Lake) (4)
- Manitowish River Wilderness Area (5)
- Sandy Beach Lake and Bog (6)

Sherman Lake (7)

Toy Lake Cedar and Ash Swamp (8)

Rice Creek Complex (10)

Manitowish River (12)

Day Lake (13)

Northeast Springs - Johnson Creek Macrosite

- Johnson Lake and Barrens (18)
- Johnson Creek and Pines (19)

Nixon Lake Complex (20)

Star Lake Crescent Macrosite

- Lake Alva Hemlock-Hardwoods (22)
- Lake Laura - Salsich Lake (23)
- Plum Lake Hemlock Forest (24)

Aurora Lake and Wetlands (26)

Central Highland Macrosite

- Escanaba Lake Hemlocks (31)
- Lost Canoe Hardwoods (32)
- Stevenson Creek and Pines (33)
- Allequash Lake and Pines (34)
- Little John Junior Lake (35)
- Benedict - Hurrah - Scaffold Lakes Complex (36)
- Dry Lake and Pines (37)
- Bittersweet Lakes Complex (38)
- Mud Creek Springs (39)
- Sweeney Lake Area (40)

Trout River (41)

Camp Lake and Pines (44)

Devine Lake - Mishonogan Creek (45)

Wind Pudding Lake (57)

Rainbow Wetlands (60)

Big Swamp (61)

Swanson Lake and Pines (62)

Shallow Lake (64)

It is important to note that protection and restoration opportunities for the NHAL are not and should not be limited to the sites above – rather, they provide opportunities to achieve a basic level of protection for the rare and representative species, natural communities, and aquatic features of the NHAL. The remaining 29 primary sites all support features of relatively high ecological value, but conservation opportunities are somewhat limited by stand size, adjacent land use, ownership, or some other factor. However, these 29 sites should be considered carefully for the most appropriate land use classification, as some community types do not presently occur at large scales, may be lacking older successional stages, or are represented everywhere in the Wisconsin landscape only by very small or degraded examples.

In the case of restoration sites, we expect that information will be forthcoming from the DNR's Community Restoration and Old-growth interdisciplinary team and will identify additional restoration opportunities appropriate for the NHAL.

3. 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. The 65 primary sites and 4 macrosites should be considered for an appropriate classification with the objectives of:
   - Ensuring habitat needed for rare and representative endangered resources (natural communities, aquatic features, and rare species)
   - Restoring and perpetuating native communities

   In some cases, management considerations (provided with site descriptions in Appendix B) suggest limitations, guidelines, or special responsibilities in the development of land management decisions.

4. The above 36 high significance sites are referenced in the text in Appendix B by the term "strong protective designation." This term highlights the need for strong habitat and native community protection because of their ecological values. From a BER standpoint, these 36 sites are of comparable significance

to existing SNAs, and may represent ecological components that are missing or underrepresented from the existing SNAs. Official designation and state natural areas will be determined through the master planning process and other formal review, such as Natural Areas Preservation Council (NAPC) review.

There are currently thirteen designated SNAs on the NHAL totaling 2,206 acres. A variety of natural features occur within these sites, but they are typically small and at least somewhat isolated by land uses on adjacent tracts. The largest of these, Bittersweet Lakes, is 568 acres. 275 acres of this SNA is second-growth upland forest, the rest open water and wetland. Despite the very low representation of old-growth or older forest on the SNAs statewide, the state's largest stand of old-growth occurs at Plum Lake Hemlock Forest SNA on the NHAL and totals slightly less than 200 acres. Larger old-growth stands are not known on any other state, federal, or county lands anywhere in Wisconsin.

5. Specific management and protection considerations for rare species, natural communities, and aquatic features at each site are provided in Appendix B.
6. General recommendations and management considerations for natural communities, rare plants, and rare animals are provided in Appendices D, E, and F.
7. Issues of scale and context warrant careful consideration when making future land use decisions on the NHAL. These issues should be considered for all sites identified in our report, as well as sites proposed for restoration. At some locations, restoration could create additional ecological benefit if restoration areas were extended beyond primary survey site and macrosite boundaries. Additional opportunities should be considered as they are identified or as conditions on or around the NHAL change.

NHAL Management and Protection

1. Protect large undeveloped and unmanaged lakes, as these are becoming a scarce resource in Wisconsin. The NHAL represents one of the few opportunities to preserve a meaningful number of lakes in this condition.
2. Protect existing stands of late successional and old-growth forest where appropriate and identify potential sites for old-growth restoration. At present in the NHAL landscape and throughout the remainder of Wisconsin, old-growth forests are rare, large patches of old-growth forest are nonexistent, and large patches of older, maturing, closed canopy forest are uncommon. Existing old-growth stands are generally isolated and limited to small patches. Large diameter trees, large snags, a multi-layered canopy, coarse woody debris, and certain late successional species are among the attributes that typically characterize old-growth forests. These forests support assemblages of plant and animal species, structural elements, and ecological processes not found in younger aged stands (White, 1994).

   The NHAL contains several primary late successional upland forest community types, including mesic hemlock-hardwood forests and dry-mesic to dry white and red pine forests. Examples of protection opportunities for existing old-growth mesic hemlock-hardwood stands include Catherine Lake Hemlock-Hardwoods (#1), Du Page Lake and Pines (#3), and Star Lake Crescent Macrosite (including Lake Alva Hemlock-Hardwoods (#22), Lake Laura-Salsich Lake (#23), and Plum Lake Hemlock Forest (#24), the largest known old-growth hemlock stand in the state). Examples of protection opportunities for existing old-growth dry-mesic stands include Lower Manitowish River Macrosite (including Manitowish River Wilderness Area (#5)), Central Highlands Macrosite (including Dry Lake and Pines (#37)), Two Lakes Pine-Oak Forest (#56), and Stone Lake Pines (#65). In addition to existing stands, other sites provide additional opportunities for restoration of late

successional or old-growth forests, including Camp Lake and Pines (#44), Mud Creek Springs (#39), and Vandercook Lake and Pines (#47).

3. Though still common in northern Wisconsin, peatlands have been increasingly vulnerable to certain types of development and merit additional protection. The highest protection priorities should be extended to stands that are large, functionally intact (especially the hydrology), support significant diversity, and are ecologically connected to other important natural features. Examples on the NHAL include Lower Manitowish River Macrosite (including Sandy Beach Lake and Bog (#6)), Mud Creek Springs (#39), Rainbow Wetlands (#60), and Big Swamp (#61).
4. Consider adjusting boundaries that presently impede the ability to appropriately protect and manage a given feature.
5. Establish a plan for identifying and implementing protection priorities on lands not owned by the state, including acquisition, conservation easements, cooperation and coordination with other agencies, organizations, and private individuals, and other methods. High protection priorities could include:
   a. shoreline areas
   b. key inholdings, especially where there are identified natural features of significance and the potential for incompatible use or development exists
   c. lands with high restoration potential, especially in close proximity to identified natural features of significance
   d. lands that would create ecological linkages across administrative boundaries between sites with significant natural features
6. The term “active management” encompasses activities such as timber production, site preparation, prescribed burning, trail maintenance, fish stocking, exotic species removal, and many others. For a number of sites described in Appendix B, active management is not necessary in the near future to maintain certain species or natural communities. However, depending upon changes from colonization by invasive species, successional processes, site conditions, and many other factors, some active management activities may be required in the long term.
7. Consider long term aquatic ecosystem management when developing management plans for aquatic systems. Stocking of fish species not normally present or abundant enough to provide a sustained sport fishery occurred in many of the lakes on the forest that are large and deep. Chemical treatment (eradication) of fish to change the species composition and to favor the stocked species has been conducted on relatively few NHAL lakes. These practices alter the aquatic fish community for varying lengths of time. Successful fish eradication affects all fish species including non-targeted species. Nearly all mussel species are dependent on one or more fish species to complete their life cycle and as a result could be affected by the alteration of the fish community. Some aquatic insects, including some Special Concern species, are dependent on the absence of fish in the waterbodies they breed in. At least one Special Concern species, the lake herring, is thought to have declined in part because of stocking of muskellunge, rainbow smelt, and walleye.
8. Continue to provide Endangered Resources information to land and water managers in the field. Increase the use of information on the locations, management needs, and sensitivities of rare plants and animals that could be impacted by habitat modifications.
9. Plan for unanticipated disturbance events or advances in management techniques by establishing benchmarks and applying adaptive management principles. Experimental techniques could be developed and accompanied by long-term monitoring of effects.

Restoration

Key factors to consider in all restoration projects include context, the reduction of high-contrast edge and linear stand configuration, and the benefits of creating or expanding ecological linkages between existing high quality remnants (including restoration, where feasible, across administrative boundaries).

Note that not all restoration opportunities have been identified on our "Primary Survey Site" map (Figure 6) and additional locations will also merit consideration. We recognize that not all of these sites will be the focus of restoration, that it will take years before it is feasible to proceed with some restoration activities, and that the results may be difficult to interpret for many decades.

1. Pursue the restoration of dry-mesic white pine-red pine forests at locations within the Northern Highland Pitted Outwash ecoregion. Red oak should be considered an important component of restoration efforts at some localities. Restoration at varying scales is possible, and is especially needed to address the absence of larger patches and older successional stages of this formerly widespread community. The restoration of more natural whole communities dominated by pines is perhaps most desirable at this time in areas adjoining relatively intact remnants of this forest type. At other locations, the primary considerations could include restoring certain community attributes such as increased conifer cover, increased forest patch size, larger trees, and allowing for the development of snags, coarse woody debris, and other features. Sites known to harbor invasive species (e.g., the heavy infestation of purple loosestrife in some wetlands on the Minocqua Chain of Lakes) could also be considered within the category of ecosystem restoration.

   Potential high priority restoration areas include but should not be limited to:

   a. areas around (as well as within) the "Central Highlands Macrosite"
   b. areas around (and within) the "Lower Manitowish River Macrosite"
   c. along the entire northern border of the state forest, linking primary survey sites with the extensive forests to the north
   d. areas around and between "Rainbow Wetlands," "Big Swamp," and "Swanson Lake and Pines."

2. Consider restoration opportunities for dry forest in the vicinity of the "Northeast Springs Macrosite," "Boulder Flats Plantations," and "Rainbow Wetlands." Dry forests of jack pine and/or Hill's (northern pin) oak are quite limited on the NHAL but this type is declining statewide and many stands have been converted to red pine plantations in recent years.

3. Consider the restoration of mesic hardwood and hemlock-hardwood forests in the vicinity of three important sites in the NHAL: "Star Lake Crescent Macrosite," Central Highlands Macrosite," and "Catherine Lake Hemlock-Hardwoods." Several smaller sites also contain good examples of this community but at a greatly reduced scale. Stands containing a significant amount of hemlock are vulnerable to excessive browse by white-tailed deer, and the restoration of forest types less likely to support high deer densities, where appropriate and feasible, is an important consideration for managers of such sites. Hemlock reproduction is spotty throughout the NHAL, locally strong, but overall quite poor.

4. Develop a restoration proposal for tamarack swamp communities. Some evidence has indicated that tamarack, especially stands composed of large trees, may have been significantly reduced in the region since European settlement (WDNR 1999, CROG report in progress). For the time being, adherence to a philosophy of strong wetland protection may be the best course of action.

5. A number of sites on the NHAL are currently managed intensively for timber production, yet offer a range of ecological values (and thus restoration potential) including extensive conifer cover and habitat for conifer-dependent forest-interior animals. The forests of Boulder Flats and Papoose Creek

Pines are examples of large sites currently in partial plantation cover that offer long-term restoration potential towards a natural conifer-dominated landscape.

6. Consider stream and stream bank restoration for stretches of the Wisconsin, Manitowish, and Trout Rivers. Efforts should be focused on areas known to support significant diversity of aquatic life and where negative impacts exist from past or present land use.
7. There are currently 2 wolf packs using the NHAL as part of their occupied habitat. Because of the large average size of wolf territories (ranging from 20 to 120 mi^2), no pack territory is likely to be completely contained within the forest, and some areas of suitable habitat may not be fully occupied. Linkages from the NHAL to other surrounding properties are important to maintain populations of timber wolf in the northcentral Wisconsin landscape.

Land Use

1. Develop a long-term plan to assess the impacts of development and future land use on the natural communities of the forest. Primary uses of the forest and surrounding lands include recreation, timber production, limited agriculture (cranberry and wild rice production), and residential development. Private lands within and around the state forest are experiencing increasing development pressure. All of these uses impact the natural communities of the NHAL and their long term sustainability.

Monitoring

The following suggestions comprise an initial list of monitoring needs. We realize the Department is limited in its ability 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 should be factored into master planning to help develop an overall monitoring plan. Final priorities should reflect the preferred alternative selected through master planning.

1. Identify a selected subset of rare, sensitive, highly specialized, or otherwise appropriate plant and animal species which are important in the Northern Highland landscape and design a monitoring project to measure changes over time.
2. Develop monitoring protocols to measure the responses of both target and non-target species to various management activities. The same should be done for all restoration projects and at least a subset of natural communities.
3. Develop a coarse scale monitoring protocol to measure changes over time in patch size distribution, cover type representation, successional stage representation, and development in and around the NHAL.

Research

Inventory is an ongoing endeavor, with new efforts adding information to the baseline established for this report. In general, the following research needs and information gaps will not have significant impacts on the development of a new master plan for the state forest.

1. Conduct additional research on methods of reducing browse pressure on sensitive species such as eastern hemlock and white cedar. The development of effective restoration methods for these species is an important application of such research.
2. Conduct research on the long-term impacts of fire suppression on dry and dry-mesic forest communities, bracken grasslands, and sedge meadows.

3. Establish standardized breeding bird surveys in important sites and community types throughout the NHAL.
4. Complete the descriptions of the Land Type Associations (LTAs). More detailed ecoregional information is needed to sufficiently describe and analyze the lands of the NHAL and apply this information to other data sets including rare species, community types, aquatic features, and others.

Future Inventory

1. Complete surveys on the extensive peatlands that occur north of the Manitowish River, just west of USH 51 and the village of Manitowish Waters. An aerial reconnaissance was conducted here and the vegetation appears to be in excellent condition. No immediate threats were noted.
2. Further investigate the semi-open lands north and west of Papoose Creek Pines. It is uncertain whether the vegetation structure here is due solely to past attempts at agriculture. A wetland separates this area, characterized by scattered trees and herbaceous or shrubby openings, from the old field to the west. It shouldn't be assumed that all of this land shares the same land use history without further investigation.
3. Extensive wetlands occur between White Sand and Nixon Creeks in Vilas county, T42N-R7E-secs. 21, 22, and 23. A number of small undeveloped seepage lakes (kettle bogs) are found in this area. Surveys should be conducted here prior to the implementation of management activities that would alter the vegetation structure, composition, or hydrologic function of these features.
4. Conduct additional fieldwork at Partridge Lake, Partridge Creek and wetlands, McGinnis Creek and wetlands, and the uplands between Partridge and Ballard Lakes prior to the implementation of management actions.
5. Inventory scattered wetlands not surveyed on the Forest. In general these are small, somewhat isolated sites, often within intensively managed uplands. Some of these wetlands are identified in the Primary Survey Site Description section (e.g. Wharton Lake Bog Complex).
6. Conduct additional survey at Sweeney Lake and its adjoining wetlands. We recommend that no drastic management actions occur here until such surveys are completed.
7. Conduct additional fieldwork on bryophytes and lichens throughout northern Wisconsin.
8. Conduct further surveys for the state endangered little goblin moonwort (*Botrychium mormo*) on the NHAL and determine its significance to the statewide status of this species. Though not confirmed on the NHAL, this plant was tentatively identified from a fragment collected in a mature mesic hardwood forest near Lake Laura in September of 1995. In addition, it is found in abundance just east of the Forest. Recent discoveries of this plant in other parts of the state have raised the question of the actual status of this plant in Wisconsin.
9. Identify exotic/invasive species issues relevant to the NHAL and devise management strategies as appropriate.
10. Additional inventory is needed for the Powell Marsh area, Big Swamp, and other large peatlands. These areas represent wetland types with great potential to support a number of rare species including dragonflies, butterflies, moths, and birds.
11. Conduct additional surveys of Lepidoptera (butterflies and moths). There is excellent potential on the NHAL for boreal leps because of the extensive high quality peatlands on and around the state forest. Note that a number of peatland sites were identified for careful management and protection consideration in this report. Future surveys should be done to better establish the status of boreal wetland lepidoptera in the state.

12. Conduct additional fieldwork on non-game fish and other selected aquatic organisms.

Glossary of Terms Used in This Report

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

bog - wetlands characterized by high acidity, the accumulation of sphagnum moss peat, and a group of highly specialized vascular plants that includes ericaceous shrubs (e.g., leatherleaf, bog laurel, cranberries), sedges, and insectivorous species. By the strictest definition, a bog can receive nutrients only from precipitation, and is isolated from mineral enriched groundwater by thick beds of living sphagnum mosses and partially decomposed moss peat. "Open" bogs are those lacking a dense overstory of coniferous trees. Forested, or treed, bogs support a relatively dense growth and correspondingly closed canopy of black spruce, sometimes mixed with tamarack. See "*muskeg*."

complex – used here to reference an integrated mosaic of natural communities and/or aquatic features.

cover type – Cover typing is a generalized but sometimes useful method of broadly classifying vegetation based on the single species or species group comprising a majority of the living plants (usually commercially important trees when used in a forestry context). Cover types may also reference cultural features such as cornfields or pastures ("grass"). In cases where a clear plurality of a single species is not apparent, terms have been invented to reference groups of commonly co-occurring species, such as "northern hardwoods" (see definition below), and "swamp conifers."

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."

drumlin - streamlined, teardrop shaped hills created by glacial action. The long axis parallels the direction of past glacial movement.

ecoregion – geographic units that are differentiated by climate, subsurface geology, physiography, hydrology, soils, and vegetation. These units have been defined and organized in different ways by various institutions but in this document we use the National Hierarchical Framework of Ecological Units (NHFEU). As described by Avers et al (1994), the NHFEU can provide a basis for assessing resource conditions at multiple scales. In this report we have most frequently referred to ecoregions of the "subsection" level, which are intermediate in scale within the NHFEU and typically cover areas of hundreds to thousands of square miles. In recent years the NHI has found the ecoregions of the NHFEU to be useful tools for work planning, interpreting the collected data, and communicating across political and administrative boundaries.

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

element occurrence – an individual example of an element (a natural community, a rare plant population, a 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 and muskeg. Members include well-known plants such as blueberries, cranberries, leatherleaf, Labrador tea, and bog rosemary.

exemplary – used in this report to describe aquatic communities or organismic assemblages that are especially good representatives of their respective types. Usage of the term, while somewhat subjective, entails a comparison of like entities based on their diversity, water quality characteristics, disturbance history, and values to scientific study.

fen - wetlands that receive nutrients via direct contact with mineral enriched groundwater. A "poor" fen has very low concentrations of plant nutrients and floristically resembles a bog. A "rich" fen has relatively high concentrations of nutrients, but is still characterized by the accumulation of peat (though this is likely to be primarily from the remains of plants other than sphagnum mosses, such as sedges and brown mosses). While some plants tolerate, and in fact may thrive under, a wide range of conditions, others are quite restricted and typically occupy only a narrow range of nutrient concentrations. This last group can be useful in the identification of peatland communities.

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.

habitat – references those environmental attributes necessary to provide a niche that supports the needs of a species or group of species.

habitat type – all sites capable of producing similar climax plant communities. This system uses the floristic composition of a plant community as an integrated indicator of those environmental factors that affect reproduction, growth, competition, and community development. These include soils, moisture, nutrient levels, and topography. Some professional foresters in the upper Great Lakes region have begun using this system as a forest management tool. To date, this system has been developed primarily for upland forest communities.

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).

landtype association (LTA) - this level in the ecoregional hierarchy covers areas of tens to thousands of acres. Landform, soils, and vegetation are the key factors.

lentic – pertaining to standing waters, lakes.

lotic – pertaining to flowing waters, rivers.

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

macrosite – two or more standard survey sites in close proximity, where consideration of their collective attributes is in some way related to the viability ecological values of the larger site.

matrix - used in this document to refer to the dominant land cover within which other features of the landscape are embedded.

mesic - used by ecologists to describe site conditions that are well-drained but almost never excessively dry or inundated.

moraine - landforms composed of unsorted materials deposited by glaciers. They can cover broad geographic areas of millions of acres. Topography can vary from nearly level “till” plains to rough end moraine landscapes composed of steep dry ridges interspersed with deep kettle holes. These glacial “kettles” are frequent locations for lakes and wetlands.

muskeg – similar to “open bog.” Used to describe highly acidic peatlands characterized by a sparse growth of scattered, stunted black spruce and tamarack over ericaceous shrubs, sedges, and a deep carpet of sphagnum mosses.

National Hierarchical Framework of Ecological Units (NHFEU) – a land unit classification system developed by the U.S. Forest Service and many collaborators. As described by Avers et al (1994): "The NHFEU can provide a basis for assessing resource conditions at multiple scales. Broadly defined ecological units can be used for general planning assessments of resource capability. Intermediate scale units can be used to identify areas with similar disturbance regimes. Narrowly defined land units can be used to assess specific site conditions including: distributions of terrestrial and aquatic biota; forest growth, succession, and health; and various physical conditions."

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

natural division – six major natural divisions have been delineated for the state of Wisconsin based on gross differences in vegetation, soils, and geomorphology. Recent collaborative work by the USDA Forest Service, The Nature Conservancy, the WDNR, and others has resulted in a somewhat similar but hierarchical classification system of "ecoregions."

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 an act of the state legislature in 1985, after which the program was installed within the WDNR's Bureau of Endangered Resources.

northern hardwoods –generally applied to those forests of northern Wisconsin composed primarily of hardwoods such as sugar maple, basswood, ash, and birch. It is also sometimes used to refer to forests with a significant component of red maple or red oak, or sometimes even aspen, but which lack strong representation by coniferous species. The term is also in wide usage in Michigan, northern Minnesota, and other locations that have vegetation similar to that of northern Wisconsin.

old-growth – various definitions exist, but among the points they usually share in describing old-growth attributes are large living trees, standing snags, coarse woody debris, pit and mound microtopography, and complex multi-layered canopies. Old-growth stages of many forest types were formerly common and/or widespread in northern Wisconsin but are now very rare (Frelich, 1995).

outwash - composed of materials sorted and deposited by glacial meltwaters. The resulting topography can be a level plain ("uncollapsed") or very hilly ("collapsed" or "pitted"). Pitted outwash may contain numerous lakes, which originated when blocks of ice stranded by a receding glacier were buried within outwash deposits. As the ice melted, depressions were created that filled with water. This is the most extensive landform found on the NH-AL SF.

peat – organic deposits consisting of the partially decomposed remains of plants, which accumulate over time more rapidly than decomposition processes can break them down. Peat may be derived from the remains of mosses, sedges, or woody plants.

peatland –wetlands characterized by the gradual accumulation of peat, the partially decomposed remains of plants. Open bog, muskeg, black spruce swamp, tamarack swamp and poor fen are among the common peatland communities on the NH-AL SF.

pinery - because pine played such an important role in the European settlement of northern Wisconsin, those areas that supported extensive forests of white and red pine were called "pineries" by nineteenth century European settlers and loggers. The area now occupied by the Northern Highland State Forest was the heart of one of the upper Midwest's most notable pineries.

Pleistocene – in the geologists parlance, "the first epoch of the Quaternary Period." In more common usage, the Ice Age. The topography, soils, and drainage patterns of the Northern Highland landscape were strongly influenced by glaciation, which last occurred in this area approximately 12,000 years ago.

poletimber – a forestry term referring to living trees of at least 5” d.b.h., but less than 9” d.b.h. for softwoods such as aspen and pine, or less than 11” d.b.h. for hardwoods such as sugar maple, yellow birch, or ash.

Potential pack habitat – areas that have greater than a 50 percent probability of being settled by wolf packs (Mladenoff et al., 1995). Such habitat would be heavily forested, have few people, and have a density of improved roads of <0.7 mi/mi2. Winter pack wolf territories on the average cover 50 mi2, but can range from 20 – 120 mi2.

rare– used in this report to refer to native species and natural communities known or suspected to be rare and/or declining in the state (included on NHI’s “Working List”). 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 on the U.S. Fish & Wildlife Service’s “Candidate” and “Species of Concern” lists.

restoration – used in this report to refer to the re-establishment of a natural community, habitat, species population, or other ecological attribute, that has been eliminated or greatly reduced on a given property or landscape. Many factors, sociological as well as ecological, must be weighed when making a decision to engage in a restoration project.

sawtimber – a forestry term referring to living trees of at least 9” d.b.h. for softwoods such as aspen or pine, or of at least 11” d.b.h. for hardwoods such as sugar maple, yellow birch, or ash.

site – see “survey site.”

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.

sterile rosette – used to reference a distinctive and highly specialized flora found primarily in lakes with extremely soft, circumneutral water, and firm substrates. Examples of the plants comprising this group include American shoregrass, water lobelia, quillworts (*Isoetes* spp.), pipewort, and brown-fruit rush (*Juncus pelocarpus*).

survey site – The geographic location at which a biological survey or evaluation has been conducted. Survey sites may be large or small, depending on the nature of the species or community surveyed and other factors. The boundaries of a survey site may be finite and discrete (a property boundary, the margins of a single stand of a natural community, or even the limits of a rare plant population) or rather arbitrary. When sites become very large (exceeding several thousand acres) and encompass complex landscapes they may be referenced as “macrosites.”

Subsection – This is a level in the NHFEU that is intermediate in scale. Subsections are characterized by distinctive glacial landforms (e.g., outwash or moraine), soils, and broadly, by vegetation. Two ecoregional subsections, the Northern Highlands Pitted Outwash and the Winegar Moraines, are represented on the NH-AL SF.

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.

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Appendix B

Primary Site Descriptions of the Northern Highland - American Legion State Forest

Appendix B contains site descriptions, site significance, and management considerations for the 65 primary sites and 4 macrosites containing some natural feature that raised their importance over the remaining inventory sites analyzed for this report. Refer to the main body of the report for a more detailed discussion of site selection and definitions (Summary of Results). A listing of the Ecologically Significant Sites Outside the NHAL Boundary is located at the end of the Appendix B. Specific management considerations for individual plant and animal species are provided in Appendices E and F.

Each primary site description is organized in three sections:

Site Description: describes the existing natural features, surrounding land uses, and some of the past management activities.

Site Significance: describes the important natural features and why they are of significance. Significance can include important natural communities or successional stages, rare species, existing land use designations and overall significance at both the local and regional levels.

Management Considerations: describes the management to protect, maintain and enhance the important features of the site. Development of these considerations included:

- identifying those processes or actions needed to maintain the integrity of ecosystems and ecosystem complexes and rare species present.
- identifying potential impacts from natural disturbances, human use, and development pressure.
- highlighting the importance of selecting the most appropriate land use classification or designation for each site via the master planning process. All of the 65 sites represent priority areas that should be given a management classification that would ensure habitat needed for endangered resources and restore and perpetuate native communities. A subset of 36 sites (p. 30) has greater significance than the remaining 29 sites and are identified in this appendix by the statement "should be considered for strong protective designation." These 36 sites are of comparable significance to existing SNAs, and may represent ecological components that are missing or underrepresented from the existing SNAs.

Within each site description, discrepancies may exist between the rare species mentioned in the site narratives and those listed in the site tables. For example, a site narrative may mention the presence of a rare plant or animal, but the species is not included in the site table. This can occur for the following reasons:

1. Certain rare plants and animals are disturbance sensitive or vulnerable to exploitation and these records were deleted from the table and/or descriptions.
2. Locations of some species, particularly animals, may be generalized in the NHI database and did not always show up within our site survey polygon boundaries. An example includes those species with high mobility (i.e. timber wolf).
3. Specimen identification can be a lengthy process, especially for some of the difficult invertebrates that must be handled by outside experts. A lag time may occur in completely processing these records.

The boundaries for non-DNR owned lands were obtained from a 1998 DNR GIS public lands coverage. The coverage does not represent legal ownership boundaries and may encompass errors in presentation.

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1. CATHERINE LAKE HEMLOCK-HARDWOODS

Ecoregion:	Winegar Moraines
USGS 7.5' Quadrangle:	Winchester
Town-Range-Section:	T43N-R4E-secs. 1, 2, 11, 12
Size:	967 acres

Site Description

Rolling glacial moraine topography is forested with mature stands of mesic hardwoods and hemlock-hardwoods. The dominant trees are sugar maple, hemlock, yellow birch, and basswood. Supercanopy white pine are present in some areas. The older and least disturbed stands exhibit, or are developing, old-growth structural characteristics including large diameter trees, large snags, a multi-layered canopy, coarse woody debris, and pit and mound microtopography. Most, if not all, of the site's upland forests have been selectively logged in the past. In some stands the past cutting was very light, but the reproduction of sugar maple is generally outpacing that of both hemlock and yellow birch at this time.

Associated with the extensive upland forests are five small undeveloped lakes, a complex of wetland communities including open bog, black spruce swamp, emergent marsh, sedge meadow and alder thicket, and several miles of undeveloped lake and stream shoreline. The mesic forests of the Winegar Moraine are similar to but somewhat richer than those found on the much more extensive glacial outwash landform to the south.

Site Significance

This site supports the most significant natural community complex identified to date on state-owned lands in this ecoregion. Older stands of mesic forest are currently rare in northern Wisconsin's present landscape (including on national and county forest lands) and protection of this site would fill an important gap in both the state and federal systems of natural community protection.

Among the rare species documented here are several birds and plants. The state record "big tree" yellow birch is found here. This site should provide secure habitat for all of them if managed and protected appropriately.

Management Considerations

All or a significant portion of this site should be considered for strong protective designation in the forest master plan. The natural communities occurring here are not well represented in protected areas in the Wisconsin portion of this ecoregion. The older successional stages of mesic hardwood forest, in particular, are virtually absent from protected, publicly owned lands anywhere in northern Wisconsin. Continued natural succession would provide for the development and maintenance of old-growth conditions.

The lakes are small (largest is 33 acres), soft, shallow, muck-bottomed, and receive most of their water from groundwater seepage. One of the lakes has hard water. These lakes have apparently not been stocked, chemically treated, or otherwise altered.

CATHERINE LAKE HEMLOCK-HARDWOODS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN MESIC FOREST		NA	1994
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
BLACK-BACKED WOODPECKER (PICOIDES ARCTICUS)		SC/M	1994
BLACK-THROATED BLUE WARBLER (DENDROICA CAERULESCENS)		SC/M	1994
CAPE MAY WARBLER (DENDROICA TIGRINA)		SC/M	1993
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1994
SWAINSON'S THRUSH (CATHARUS USTULATUS)		SC/M	1994
PLANTS			
ALGAE-LIKE PONDWEED (POTAMOGETON CONFERVOIDES)		THR	1994
GIANT RATTLESNAKE-PLANTAIN (GOODYERA OBLONGIFOLIA)		SC	1996
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1996

M1. LOWER MANITOWISH RIVER MACROSITE

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5' Quadrangle:	Winchester, Mercer, Wilson Lake, Powell
Town-Range-Section:	T42N-R4E-secs. 1-4, 8-10, 13-24, 26-35
	T43N-R4E-secs. 14, 22-23, 25-27, 33-36
Size:	23,151 acres

Survey Sites contained within this macrosite include:

- North Bass Lake Hemlocks and Bog
- Du Page Lake and Pines
- Sugar Lake (Plunkett Lake)
- Manitowish River Wilderness Area
  - Frog Lake and Pines
  - Manitowish River Pines
  - Manitowish-Bear River Wetlands
- Sandy Lake Beach and Bog

Site Description

This large complex of wetlands, lakes, streams, and forests occurs in the northwestern corner of the NHAL. Important natural communities and aquatic features of this area include: mature stands of dry-mesic forest (with white and red pines the dominant canopy species); mesic hemlock-hardwood forests, including several small stands in old-growth, late successional stages; a small stand of late successional white cedar (Manitowish River Cedars); extensive acid peatlands of open bog, muskeg, and black spruce swamp; a variety of undeveloped seepage lakes of low to moderate fertility, and; the lower portions of the Manitowish River, a medium-size slow, warm, hardwater stream that is highly significant to aquatic biota and is flanked by a diverse mosaic of wetland communities including emergent and submergent marshes, northern sedge meadow, shrub swamp, and floodplain forest.

Site Significance

This macrosite contains relatively few developments other than roads and adjoins other public lands to the west, most notably the Turtle-Flambeau Flowage and Boot Lake Wildlife Area. The NHAL's sole designated Wilderness Area (6,358 acres) is within the macrosite perimeter. Other significant conservation lands in the vicinity include the Park Falls District of the Chequamegon National Forest, portions of the Lac du Flambeau Ojibwa Reservation, and the Bass Lake Preserve of The Nature Conservancy (a private conservation organization). Adjacent ecologically significant sites also occur within the state forest on the moraine just to the north, such as "Catherine Lake Hemlock-Hardwoods" (see site description).

The forested areas are integral parts of a large relatively natural landscape. The wetlands and the river itself are of very high significance due to their size, quality, content, context, and linkage to other features downstream. Vast undeveloped peatlands and extensive forests of mature red and white pine are among the Northern Highland's most important and characteristic natural features.

Management Considerations

Opportunities for management at a large scale and across administrative boundaries should be emphasized. The essential ecological integrity and unity of this area should be recognized and maintained. Each site has specific management considerations relevant to their individual circumstances.

To make the description and analysis of this large area more manageable, we have divided it into several of its major components, each of which will be described in the following pages.

LOWER MANITOWISH RIVER MACROSITE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
4 EMERGENT AQUATIC		NA	1992
2 LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1992
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1989
2 LAKE--SHALLOW, SOFT, SEEPAGE		NA	1992
LAKE--SOFT BOG		NA	1995
LAKE--UNIQUE		NA	1995
3 NORTHERN DRY-MESIC FOREST		NA	1995
2 NORTHERN MESIC FOREST		NA	1994
2 NORTHERN SEDGE MEADOW		NA	1990
NORTHERN WET FOREST		NA	1994
NORTHERN WET-MESIC FOREST		NA	1992
3 OPEN BOG		NA	1994
SHRUB-CARR		NA	1980
SPRING LAKE		NA	1981
STREAM--FAST, HARD, WARM		NA	1999
STREAM--SLOW, HARD, WARM		NA	1999
ANIMALS			
3 BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1983
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		SC/M	1981
GREATER REDHORSE (MOXOSTOMA VALENCIENNESI)		THR	1981
LAKE DARNER (AESHNA EREMITA)		SC/N	1981
9 OSPREY (PANDION HALIAETUS)		THR	1994
PUGNOSE SHINER (NOTROPIS ANOGENUS)		THR	1992
ROUND PIGTOE (PLEUROBEMA SINTOXIA)		SC/H	1994
SPLENDID CLUBTAIL (GOMPHURUS LINEATIFRONS)		SC/N	1994
SWAINSON'S THRUSH (CATHARUS USTULATUS)		SC/M	1991
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1997
PLANTS			
ALGAE-LIKE PONDWEED (POTAMOGETON CONFERVOIDES)		THR	1994
COMMON BOG ARROW-GRASS (TRIGLOCHIN MARITIMUM)		SC	1996
FARWELL'S WATER-MILFOIL (MYRIOPHYLLUM FARWELLII)		SC	1994
LARGE ROUNDLEAF ORCHID (PLATANTHERA ORBICULATA)		SC	1994
2 MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1996
2 NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1996
PALE SEDGE (CAREX PALLESCENS VAR NEOGAEA)		SC	1936
2 PURPLE BLADDERWORT (UTRICULARIA PURPUREA)		SC	1996
2 SWAMP-PINK (ARETHUSA BULBOSA)		SC	1996

2. NORTH BASS LAKE HEMLOCKS AND BOG

(Lower Manitowish River Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Winchester
Town-Range-Section:	T43N-R4E-secs. 22, 23, 14
Size:	1,119 acres

Site Description

North Bass Lake, an undeveloped, 180 acre, shallow, soft water seepage lake, is situated within an extensive muskeg of sphagnum mosses, ericaceous shrubs, and stunted black spruce and tamarack. Several other undeveloped seepage lakes occur nearby and within the same basin. The uplands have generally been managed for timber products, but there is an older stand of hemlock-hardwoods to the west of North Bass Lake that retains the compositional and many of the structural features of an old-growth stand. Selective cutting has occurred here recently.

Site Significance

The major communities at this site are in good condition and some ecological linkages with other natural features in the landscape have been retained. Rare plants and animals have been documented here. The wetlands are actually part of a much larger complex that extends south of the county highway all the way to the Manitowish River. See the "Du Page Lake" site description for additional information.

Management Considerations

This site should be considered for strong protective designation, including the lakes, peatlands, and adjoining wetlands that could be degraded by diminished water quality or unnatural water level fluctuations. It should be pointed out that all of the major peatland complexes within the NHAL boundary have been altered in some way, usually by the construction of dikes and ditches and sometimes accompanied by the commercial cultivation of cranberries or wild rice. This site is no exception, though it is somewhat isolated from unnatural disturbances by its location at the northern edge of this large wetland. The wetlands to the south of county highway "J", southeast of South Bass Lake, have been significantly altered by an extensive ditch system.

Commercial logging within the hemlock-hardwood forest appears to have increased sugar maple and decreased the more sensitive and regionally diminished species such as yellow birch and hemlock. This site provides a good opportunity for restoration of old-growth hemlock-hardwood forest.

NORTH BASS LAKE HEMLOCKS AND BOG			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
EMERGENT AQUATIC		NA	1980
LAKE--SHALLOW, SOFT, SEEPAGE		NA	1994
NORTHERN MESIC FOREST		NA	1994
OPEN BOG		NA	1994
ANIMALS			
OSPREY (PANDION HALIAETUS)		THR	1992
PLANTS			
SWAMP PINK (ARETHUSA BULBOSA)		SC	1995

3. DU PAGE LAKE AND PINES

(Lower Manitowish River Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Winchester
Town-Range-Section:	T43N-R4E-secs. 25, 26, 27, 33, 34, 35, 36. T42N-R4E-secs. 1, 2, 3, 4.
Size:	3,936 acres

Site Description

Du Page Lake is situated within a vast peatland complex of several thousand acres north of the Manitowish River. While the predominant vegetation is open bog, muskeg, and black spruce swamp, there are scattered small patches of old-growth hemlock-hardwood forest , “islands” of old-growth pine, and at least eight undeveloped lakes.

Thirty-two acre Du Page Lake is deep, with very soft water, and has a bottom of muck and sand with patches of gravel. Several stands of old-growth hemlock-hardwood forest occur on the east side of the lake, and are especially noteworthy as they contain a "supercanopy" of very large white and red pine. The wetlands are generally boggy, with a deep carpet of sphagnum mosses supporting ericaceous shrubs including cranberry, bog laurel, leatherleaf, sedges, and insectivorous plants. Stunted black spruce and tamarack are scattered throughout the wetland, in a few places forming a closed bog forest composed of denser growths of larger spruce.

Site Significance

Old-growth forest is rare throughout Wisconsin, and the remnants here, though small, are important examples of this forest successional stage. The peatlands are, for the most part, in excellent condition, excepting the area southeast of South Bass Lake which has been developed for “wild rice” culture. Rare plants and animals were documented in all of the primary natural communities surveyed, and in the lake itself.

Management Considerations

This site harbors valuable natural features and should be considered for strong protective designation. In the past, a portion of this site had been proposed for "Scientific Area" designation (the forerunner of the present State Natural Area program). Establishing an appropriate buffer around the existing old-growth forest and prohibiting commercial timber harvest at the site and buffer would help protect the important ecological features of this site.

Du Page Lake is a small oligotrophic lake, which is potentially very sensitive to adverse water quality impacts. The needs of nesting birds, such as common loon and osprey, and rare aquatic plant species should be considered when weighing the acceptability of management activities and various uses.

Most lakes in Wisconsin are experiencing heavy development. The ecological components of this site cannot absorb heavy or even moderate use by large powerboats or personal watercraft. Maintaining the undeveloped character of the lakes in this area by limiting motorized access would provide an opportunity to protect a natural lake and adjoining wetland community. Monitoring of the types and levels of uses here should be a priority, and if specific problems are identified, appropriate steps taken to reduce or eliminate them.

DU PAGE LAKE AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1992
LAKE--SHALLOW, SOFT, SEEPAGE		NA	1981
NORTHERN MESIC FOREST		NA	1992
OPEN BOG		NA	1996
ANIMALS			
OSPREY (PANDION HALIAETUS)		THR	1992
PLANTS			
ALGAE-LIKE PONDWEED (POTAMOGETON CONFERVOIDES)		THR	1983
COMMON BOG ARROW-GRASS (TRIGLOCHIN MARITIMUM)		SC	1936
LARGE ROUNDLEAF ORCHID (PLATANTHERA ORBICULATA)		SC	1996
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1996
SWAMP PINK (ARETHUSA BULBOSA)		SC	1996

4. SUGAR LAKE (PLUNKETT LAKE)

(Lower Manitowish River Macrosite)

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5’ Quadrangle:	Winchester
Town-Range-Section:	T42N-R4E-secs. 3, 10.
Size:	52 acres

Site Description

This waterbody is a 48 acre spring lake and moderately fertile with light brown water. The lake has a maximum depth of 35 feet and a bottom composed of rubble, sand, gravel, and muck. The poorly defined outlet drains southwestward to the Manitowish River. Aquatic vegetation is generally sparse. White and yellow water lilies, pondweeds, and water horsetail are among the plant species present. Freshwater sponges are common in this lake.

The uplands are forested with nondescript stands of northern hardwoods. Paper birch, red maple, and trembling aspen are the primary canopy species. Some white pine and hemlock exist on the north and west shores of the lake.

Busy US highway 51 is located less than a quarter mile to the south of the lake. An improved access road and boat landing facilitate additional recreational uses.

Site Significance

This is an uncommon lake type with an undeveloped shoreline in public ownership.

Management Considerations

This site should be considered for strong protective designation because of the rare aquatic communities. Increases in recreational use due to the proximity to US highway 51 and the improvement of the access road could degrade the important aquatic communities that exist here.

SUGAR LAKE (PLUNKETT LAKE)			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
EMERGENT AQUATIC		NA	1981
SPRING LAKE		NA	1995

5. MANITOWISH RIVER WILDERNESS AREA

(Lower Manitowish River Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Mercer, Wilson Lake, Powell
Town-Range-Section:	T42N-R4E-portions of secs. 7-9, 16-21, 27-33.
Size:	6,324 acres

Three previously separate survey sites (Frog Lake and Pines State Natural Area, Manitowish River Pines, and Manitowish-Flambeau-Bear River Wetlands) were combined here to emphasize the intact mosaic of natural community patches contained within the Wilderness Area:

Site Description

The Wilderness Area contains a diverse mosaic of natural communities and aquatic features. Among the most important of these are: scattered stands of old-growth to mature dry-mesic forest dominated by large to medium-size (9-15" d.b.h., 15"+ d.b.h.) red and white pines (some of these stands occur on small upland "islands" surrounded by wetlands); a five mile, undeveloped stretch of the lower Manitowish River; a slow, warm, medium-size hardwater stream; an undeveloped, deep, softwater seepage lake with a diverse aquatic flora; and extensive undisturbed peatlands of open bog/muskeg, northern sedge meadow, and black spruce swamp.

Other communities are also represented at a variety of scales but generally are of good quality. The communities include alder thicket, shrub-carr, northern wet-mesic forest (white cedar swamp) and, in small patches along the Manitowish, the regionally rare floodplain forest. Beds of emergent, submergent, and floating-leaved aquatic macrophytes exist at many locations along the river.

Away from the influence of the relatively nutrient-rich river water, the wetlands are boggier, with a sphagnum moss substrate supporting sedges, ericaceous shrubs, insectivorous plants, scattered, often stunted, black spruce and tamarack, and, rarely, closed black spruce forests.

Additional aquatic features of note are a one mile stretch of the Bear River and a two mile stretch of the upper Flambeau River.

Red pine plantations and second-growth forest composed of pole-size hardwoods such as paper birch, trembling aspen, and red maple, also occur on uplands within the Wilderness Area.

Site Significance

Intact stands of older pine forest are rare in this landscape and throughout the remainder of Wisconsin. This site, and nearby areas where pines remain the dominant forest tree species, could serve as the nucleus of one of the major dry-mesic to dry conifer forest conservation and restoration areas in northern Wisconsin.

Rare aquatic plants and animals occur in the lake and in the Manitowish River. The wetlands and older pine forests also support rare species. An excellent representation of the biota characteristic of the communities of the Northern Highlands Pitted Outwash ecoregion is present. A key consideration for this site, beyond the high quality and diverse interactive mosaic of natural communities and aquatic features present, is its size and linkage to other sites.

Management Considerations

The Manitowish River Wilderness Area contains some of the best examples of the natural features representative of this ecoregion. Though this site is currently designated “Wilderness,” it is nevertheless important to develop a site management plan that will effectively address the long-term maintenance of the natural communities, aquatic systems, and sensitive biota occurring there. Barring the intervention of a natural disturbance such as wildfire, successional processes may eventually result in a radical shift in dominant plant species. Natural disturbances may not occur at a scale or frequency adequate to maintain or aid in the restoration of the pine-dominated (or other) ecosystems, even though this site is considered “large”.

In this case, pine appears to be succeeding to hardwoods. Development of a plan appropriate to the type of features present and the site’s land use classification (i.e. Wilderness Area, State Natural Area) should be a priority. There is great opportunity to conduct applied research in a wilderness and State Natural Area context due to the presence, on and near the site, of: undisturbed old-growth and mature forest patches; younger, recently managed pine forest; more disturbed, second-growth stands of pole hardwoods (on sites that formerly supported pine forests); and pine plantations. Such research should result in needed solutions to the management issues identified here. The findings of the research could also be useful for the same or similar issues at other sites on and around the NHAL, particularly where restoration is being considered.

Protection and management of pine forests in a variety of block sizes and in all successional stages is one of the highest priorities for both this ecoregion and property. Small stand size imposes conservation limitations on the older pine stands within the site. But, the opportunity for significant expansion of the older stands, both within and beyond the site boundaries, is feasible and is an important management consideration.

The river, lake, and wetlands all ranked very highly in our evaluations. No immediate threats were identified, but periodic monitoring for the presence of troublesome invasive species should be a consideration here.

There are major opportunities to create and maintain ecological connections beyond the site boundaries. The Turtle-Flambeau Flowage, Boot Lake State Wild life Area, The Nature Conservancy's Bass Lake Preserve, and the Park Falls District of the Chequamegon-Nicolet National Forest all contain highly significant natural features, and are located just to the southwest of the Manitowish Wilderness. Extensive peatlands of good quality, several undeveloped lakes, and pockets of relatively undisturbed white pine-red pine and hemlock-hardwoods forest (some of them old-growth) occur to the east and north.

In 1992, the Natural Areas program of WDNR’s Bureau of Endangered Resources conducted baseline vegetation sampling in the pine forest community at Frog Lake. These data should prove useful for future monitoring projects on the NHAL. Extending such a program to include additional forest stands and aquatic features and wetlands should receive due consideration by the planning team.

MANITOWISH RIVER WILDERNESS AREA			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
EMERGENT AQUATIC		NA	1983
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1991
NORTHERN DRY-MESIC FOREST		NA	1991
NORTHERN SEDGE MEADOW		NA	1991
STREAM--FAST, HARD, WARM		NA	1991
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1995
LAKE DARNER (AESHNA EREMITA)		SC/N	1991
SWAINSON'S THRUSH (CATHARUS USTULATUS)		SC/M	1991
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1991
PLANTS			
FARWELL'S WATER-MILFOIL (MYRIOPHYLLUM FARWELLII)		SC	1994
NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1994
PURPLE BLADDERWORT (UTRICULARIA PURPUREA)		SC	1994
SWAMP PINK (ARETHUSA BULBOSA)		SC	1995

6. SANDY BEACH LAKE AND BOG

(Lower Manitowish River Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Powell, Winchester, Wilson Lake
Town-Range-Section:	T42N-R4E-portions of secs. 13-16, 21-24, 26-28
Size:	3,088 acres

Site Description

This site features a large acreage of the vast peatlands found within the lower drainage of the Manitowish River. The wetlands are peaty, acidic, and mostly of the muskeg, open bog, and black spruce swamp communities. The resident birdlife includes palm warbler, Lincoln's sparrow, purple finch, and northern harrier. There are also more minerotrophic wetland types present, including shrub swamp (both alder thicket and willow/dogwood swamp) and sedge meadow, most frequently occurring in the vicinity of streams draining the site, such as Lost Creek and Little Bear Creek.

The 112 acre seepage lake has a maximum depth of 7 feet, a mostly sandy bottom, and circumneutral water. There is a non-navigable outlet that flows to Bear Creek. Aquatic vegetation is moderately dense and composed of native species such as pond lilies, pondweeds, water lobelia, and bulrushes. The rare purple bladderwort, a carnivorous species, also occurs here.

Site Significance

These wetlands are highly significant because of their size, quality, lack of development, and association with other valuable natural features.

Although relatively few rare species were documented here during our brief surveys, the wetlands provide breeding areas for habitat specialists as well as for some area sensitive species. Sandy Beach Lake supports several rare aquatic plant species and it is possible that these might be sensitive to water quality changes as well as mechanical disturbance as they are not widely distributed in Wisconsin lakes.

Management Considerations

This site should be considered for strong protective designation. Peatlands are of particular importance, with priorities extended to stands that are large, functionally intact, support significant diversity, and are ecologically connected to other important natural features. The primary management need for the wetlands of this site is to protect and monitor hydrologic function, especially any actions that might disrupt drainage patterns, alter ground or surface water chemistry, or fragment the natural community mosaic. An abandoned railroad grade and a gated dike road cross the wetland and should be investigated further to determine the affect on hydrology.

Sandy Beach Lake has several developments, including a small campground, boat landing, and picnic area. Impacts should be minimized to avoid negative water quality impacts, disturbance to the aquatic macrophyte beds, or the inadvertent introduction of invasive species.

SANDY BEACH LAKE AND BOG			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
EMERGENT AQUATIC		NA	1981
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1994
OPEN BOG		NA	1994
SHRUB-CARR		NA	1981
ANIMALS			
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		SC/M	1994
OSPREY (PANDION HALIAETUS)		THR	1992
PLANTS			
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1996
NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1996
PURPLE BLADDERWORT (UTRICULARIA PURPUREA)		SC	1996

7. SHERMAN LAKE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Powell
Town-Range-Section:	T42N-R4E-sec. 36 T42N-R5E-sec. 31
Size:	400 acres

Site Description

This 123 acre deep, softwater, seepage lake is situated in sandy outwash at the edge of Powell Marsh, a large acid peatland. The lake bottom is composed mostly of sand. Aquatic vegetation is generally sparse, though beds of emergents occur in narrow bands along and parallel to the shoreline. Representative species include pickerel weed, yellow pond lily, bulrushes, spikerushes, and water horsetail. "Sterile rosette" species such as pipewort and water lobelia are also present. There are no developments on this lake.

The lake is bordered by a large, ditched muskeg to the east and south. Uplands to the north and west support second-growth stands of rather nondescript mesic to dry-mesic forest, composed of paper birch, red maple, and bigtooth aspen. Several small stands of swamp conifers are also present.

Site Significance

Sherman Lake is immediately adjacent to and partially within Powell Marsh State Wildlife Area. The lake and its immediate surroundings are undeveloped. Several rare plants and animals are resident in or near the lake.

Management Considerations

The protection level for this site should remain high, focusing on hydrology, water quality, and aquatic life. Currently, the aquatic community is in very good condition and sensitive species are present. This lake could be considered for "benchmark" status, as it offers a good opportunity to maintain a high quality aquatic community unimpacted by development.

SHERMAN LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
EMERGENT AQUATIC		NA	1994
LAKE--DEEP, SOFT, SEEPAGE		NA	1994
OPEN BOG		NA	1994
ANIMALS			
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1994

8. TOY LAKE CEDAR AND ASH SWAMP

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Winchester
Town-Range-Section:	T43N-R5E-secs. 19, 20, 29-33 T43N-R4E-secs. 25, 36
Size:	3,473 acres

Site Description

This large wetland complex of hardwood swamp, white cedar swamp, and alder thicket surrounds a basin containing a shallow, drained lake with dense emergent aquatic and wet meadow vegetation. Within this wetland site are scattered upland "islands" or ridges that support stands of mature hemlock-hardwoods. Some of the islands feature numerous large-diameter white spruce and an occasional supercanopy white pine.

The hardwood swamp community is dominated by black ash, with yellow birch, red maple, and an occasional conifer (usually balsam fir or white cedar) among the typical associates. A wide array of size and age classes is present, and ash is reproducing well in all of them.

The white cedar-dominated conifer swamps are generally mature, floristically diverse, and extensive, especially to the north and east of Toy Lake. Several small streamlets were noted within the cedar swamp, apparently arising from springs or seepages and draining toward Toy Lake.

Site Significance

Both white cedar and ash swamps are uncommon in this ecoregion, and are especially so at a large scale (hundreds to thousands of acres). The community mosaic here affords a rare opportunity to maintain extensive, relatively intact examples of representative northern Wisconsin communities and their associated biota. Because fragmentation is relatively low in the local landscape, it should also be possible to protect the ecological processes, species interactions, and environmental gradients important in north woods ecosystems. Very few sites in northcentral Wisconsin protect cedar or ash swamps at any scale. Black ash swamps, in particular, are very poorly represented in special management areas.

Many uncommon species were recorded here, with boreal birds being especially well represented.

Management Considerations

Toy Lake Cedar and Ash Swamp should be considered for strong protective designation because of the large size of the site, the large stand size of the major communities, the overall good quality and condition of all communities represented, and the high number of rare and uncommon species.

Portions of the site are privately owned. Browse pressure on white cedar is high and the feeding of deer locally may be exacerbating the situation. Beaver have created several small impoundments, drowning patches of alder and ash. Future construction of roads, snowmobile trails and other corridors across this site may impact site hydrology and increase fragmentation.

TOY LAKE CEDAR AND ASH SWAMP			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
BOREAL FOREST		NA	1993
HARDWOOD SWAMP		NA	1993
NORTHERN WET-MESIC FOREST		NA	1993
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
BIRD ROOKERY		SC	1993
BLACK-BACKED WOODPECKER (PICOIDES ARCTICUS)		SC/M	1993
BOG FRITILLARY (BOLORIA EUNOMIA)		SC/N	1993
BOREAL CHICKADEE (POECILE HUDSONICUS)		SC/M	1993
CAPE MAY WARBLER (DENDROICA TIGRINA)		SC/M	1993
FRIGGA FRITILLARY (BOLORIA FRIGGA)		SC/N	1993
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1993
OSPREY (PANDION HALIAETUS)		THR	1992
SPRUCE GROUSE (FALCIPENNIS CANADENSIS)		THR	1993
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1996
PLANTS			
CHILEAN SWEET CICELY (OSMORHIZA CHILENSIS)		SC	1993
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1993
NORTHERN BOG SEDGE (CAREX GYNOCRATES)		SC	1993
VARIEGATED HORSETAIL (EQUISETUM VARIEGATUM)		SC	1993

9. PAPOOSE CREEK PINES

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Papoose Lake
Town-Range-Section:	T42N-R5E-secs. 2, 3
Size:	695 acres

Site Description

The nearly level outwash sands bordering Papoose Creek support an extensive conifer forest dominated by pines. The more mature stands surveyed were composed of varying mixtures of medium size/age red pine and white pine, with jack pine present and locally important. Associates include red oak, red maple, and paper birch. Near Papoose Creek, some of the stands contain a boreal component including white spruce and balsam fir.

The land use history of this site includes past fire and logging. Red pine plantations are now scattered throughout this site. Some semi-open, barrens-like stands occur on the north side of the creek and are the likely result of past agriculture attempts (pers.comm., Ralph Hewitt, 1996).

Site Significance

The NHAL presently occupies what had been the heart of one of Wisconsin’s greatest pineries. Now the natural pine stands are scattered, generally composed of medium age or younger trees, and large acreages have been converted to plantation monocultures or aspen cover types. The Papoose Creek site has retained dominance by native conifers, a key landscape consideration at the community level and critical for certain uncommon or restricted wildlife species (evening grosbeak, pine siskin, red crossbill, and others were all noted here during their breeding seasons) that now have a patchy distribution across the northern Wisconsin landscape.

Management Considerations

This site could be considered as a nucleus for expanded pinery management via a combination of protection, stand conversion (deciduous species to conifers, conifer plantations to more natural and diverse pine or pine-oak forests), extended rotations, and other forms of active and passive management. Maintaining the existing conifer cover, and expanding where feasible and deemed appropriate, should be a priority consideration. A substantial portion of the state-owned forested land to the south is also pine-dominated and should also be considered when evaluating management options for this site.

Further investigation of the openings north of Papoose Creek is recommended.

PAPOOSE CREEK PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1992
ANIMALS			
BULLFROG (RANA CATESBEIANA)		SC/H	1996

10. RICE CREEK COMPLEX

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Presque Isle, Papoose Lake
Town-Range-Section:	T43N-R6E-secs. 27, 28, 33, 34
Size:	1,445 acres

Site Description

This site features a two-mile stretch of Rice Creek, embedded within a large, diverse, conifer swamp of white cedar, balsam fir, black spruce, and tamarack. Several stands of old-growth hemlock-hardwoods are present, each retaining a supercanopy of huge white pine (> 25” d.b.h.). Other significant attributes of this site include open bog and muskeg, a small stand of older, upland white cedar, several undeveloped, softwater seepage lakes, and two small northern fens of exceptionally high floristic diversity.

The stream supports lush, extensive beds of both emergent and submergent aquatic vegetation. The lakes have not been surveyed in detail but are undeveloped, and have no known history of manipulation.

Site Significance

The Rice Creek Complex contains excellent stands of both common and rare natural communities and aquatic features, supports a high concentration of rare plants and animals, and is large enough to maintain most, if not all, of the ecological processes and functions necessary for long-term maintenance.

The significance of this site within the forest and the surrounding region is extremely high.

Management Considerations

This site should be considered for strong protective designation for the ecological values stated above and should receive an appropriate management designation. No actions are needed to maintain the natural communities present, but browse pressure (deer and hare) is high and should be monitored. There are some contextual challenges, as much of the upland acreage around the site has been managed for aspen regeneration. Alternative management options should be identified and considered for the adjoining aspen-birch stands.

Beaver activity on Rice Creek should be monitored. Excessive damming by beavers has caused the inundation and loss of some swamp conifers. On the other hand, the dams provide needed protection to the fragile aquatic beds and from the use of powerboats and personal watercraft on the creek.

RICE CREEK COMPLEX			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
BOREAL RICH FEN		NA	1995
EMERGENT AQUATIC		NA	1992
LAKE--DEEP, SOFT, SEEPAGE		NA	1997
NORTHERN MESIC FOREST		NA	1997
NORTHERN WET-MESIC FOREST		NA	1994

RICE CREEK COMPLEX			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
BOG COPPER (LYCAENA EPIXANTHE)		SC/N	1995
BULLFROG (RANA CATESBEIANA)		SC/H	1996
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1995
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1995
PLANTS			
COMMON BOG ARROW-GRASS (TRIGLOCHIN MARITIMUM)		SC	1995
DOWNY WILLOW-HERB (EPILOBIUM STRICTUM)		SC	1995
LEAFY WHITE ORCHIS (PLATANTHERA DILATATA)		SC	1995
PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)		SC	1994
SHOWY LADY'S-SLIPPER (CYPRIPEDIUM REGINAE)		SC	1995
SWAMP PINK (ARETHUSA BULBOSA)		SC	1995

11. HIGHWAY 51 MEADOW AND POND

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Manitowish Lake
Town-Range-Section:	T42N-R6E-secs. 29, 32
Size:	53 acres

Site Description

A small glacial kettle hole in the level outwash sands along US Highway 51 contains an acid, peaty meadow surrounding a small seepage pond. The surrounding uplands support a managed xeric forest of jack pine, red pine, and aspen.

Site Significance

The wetland and aquatic communities appear to be in good condition and the pond contains a very large population of a rare plant. Peatlands, large or small, are not adequately protected within or around the NHAL.

Management Considerations

The primary management consideration is to protect aspects of site hydrology, especially water quality and water levels. Proximity of a heavily traveled highway could make this problematic over the long-term. Logging activities and road maintenance should be especially sensitive to the important resources of this site.

HIGHWAY 51 MEADOW AND POND			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
POOR FEN		NA	1994
PLANTS			
HIDDEN-FRUITED BLADDERWORT (UTRICULARIA GEMINISCAPA)		SC	1994

12. MANITOWISH RIVER

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Quadrangle: Manitowish Lake, Boulder Junction
Town-Range-Section:	T42N-R6E-secs. 20-24, 26-29
Size:	390 acres

Site Description

This portion of the Manitowish River begins at the outlet of Boulder Lake and ends at the inlet to Island Lake. The river averages 55 feet in width, has a maximum depth of 4 feet, and is of medium fertility. Flow velocity ranges from slow to moderate and sand and gravel are the primary bottom materials.

The river is bordered by various types of wetlands and second-growth dry-mesic forest. The river flows southwest, eventually joining the Bear River in Iron County to form the Flambeau River. There are several dams on the Manitowish, including a dam with a 10 feet head at the outlet of Boulder Lake which alters the river's natural flow regime.

Site Significance

The diversity of aquatic insects, fish, and mussels is high and several rare species were documented. The intact watershed and the stream's connection to other important aquatic features and wetland communities downstream make this section of the Manitowish River significant to the forest and the region.

Management Considerations

This site should be considered for strong protective designation because of the rare species and important aquatic features. Dam management should be reviewed to ensure that operation minimizes negative impacts to the aquatic ecosystem.

MANITOWISH RIVER			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
GREEN-FACED CLUBTAIL (GOMPHUS VIRIDIFRONS)		SC/N	1997
ROUND PIGTOE (PLEUROBEMA SINTOXIA)		SC/H	1997
SKILLET CLUBTAIL (GOMPHURUS VENTRICOSUS)		SC/N	1997
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1994

13. DAY LAKE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Boulder Junction
Town-Range-Section:	T41N-R6E-secs. 1, 2
Size:	117 acres (lake only); 235 acres (total)

Site Description

A glacial kettle depression contains a 117-acre seepage lake with exceptionally soft, clear water. The lake is situated in pitted sandy outwash, with surrounding landforms that appear to be drumlins. An unusual, specialized aquatic flora composed mostly of species from the "sterile rosette" group is present. At least one of the species dwelling in the lake is rare. The surrounding uplands (there are essentially no adjoining wetlands) are intensively managed for aspen regeneration, though a 400 feet no-cut zone has been established around the lake for aesthetic purposes. Past management of Day Lake includes chemical treatment at least once in the past.

Site Significance

Day lake is designated as both "State Natural Area" and "Wild Lake" in the existing property master plan. This waterbody is a very good example of a deep, very soft seepage lake and has very limited developments around it. The lake type is best represented in the Northern Highlands Outwash ecoregion and thus offers the best opportunities for conservation and protection.

Management Considerations

This site should be considered for strong protective designation, and thus existing designations should not be changed. Surrounding land uses should be reviewed to determine the impacts on the important natural resources at this site. The no-cut zone should also be reviewed for benefits to water quality. The prominence of surrounding uplands highlights the need to consider protection of the lake’s water quality in all upland designations and actions.

"Airshed" concerns could at some point become critical here, as lakes of this type are highly vulnerable to acidification owing to their poor natural buffering. Chemical treatment and other management that alters the aquatic community should be carefully reviewed for impact.

DAY LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1995
ANIMALS			
BULLFROG (RANA CATESBEIANA)		SC/H	1989
CYRANO DARNER (NASIAESCHNA PENTACANTHA)		SC/N	1994
PLANTS			
AMERICAN SHORE-GRASS (LITTORELLA AMERICANA)		SC	1995

14. NORTH CREEK - TROUT SPRINGS

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5’ Quadrangle:	Boulder Junction
Town-Range-Section:	T42N-R7E-secs. 30 NE1/4; N2SE1/4; E1/2SW1/4 29 SW1/4NW1/4; NW1/4SW1/4
Size:	357 acres

Site Description

The natural features at this site consist of a complex of springs and spring ponds, and associated wetlands of open sedge meadow, marsh, and shrub swamp. The pond outlets converge to form North Creek, which drains southward to Trout Lake. Although this site has a history of trout management, the stream borders have remained in natural vegetative cover.

Site Significance

The open wetlands support at least two rare plant species, both of "Special Concern" in Wisconsin.

Management Considerations

Management should continue to recognize the overall ecological value of the site. Maintaining the stream borders in natural vegetative cover will aid in protecting the existing natural communities and rare plant species.

NORTH CREEK - TROUT SPRINGS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN WET FOREST		NA	1981
SPRING POND		NA	1993
SPRINGS AND SPRING RUNS, HARD		NA	1993
STREAM--SLOW, SOFT, COLD		NA	1993
PLANTS			
ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1993
SHEATHED SEDGE (CAREX VAGINATA)		SC	1993

15. GRASSY LAKE

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5' Quadrangle:	Tenderfoot Lake
Town-Range-Section:	T42N-R7E-sec. 3
Size:	388 acres

Site Description

This 220 acre, infertile, spring-fed drainage lake has a maximum depth of 4 feet. Muck is the primary bottom material, with sand present in some areas. Submergent, floating-leaved plants and emergent aquatic plants are abundant in portions of the lake basin. Representative species include white water lily, water shield, pickerel weed, waterweed, and pondweeds (*Potamogeton* spp.). The lake receives water via overland flow, groundwater seepage, and from a small stream that drains a spring pond to the northwest. "Winterkill" conditions can occur here because of the lake's shallow depth and the limited inflow of oxygenated water.

The lake is bordered on three sides by a diverse mosaic of wetland communities, including sedge meadow, shrub-carr, alder thicket, muskeg, and black spruce-tamarack swamp. Among the common shoreline plants are sweet gale, marsh cinquefoil, marsh fern, blue flag iris, broadleaf cattail, water horehound, Canada bluejoint grass, swamp milkweed, and sedges (*Carex* spp.). Shrubby areas are composed mostly of speckled alder, bog birch, meadowsweet, and leatherleaf.

The adjacent uplands are forested with second-growth stands of white and red pine, red oak, paper birch, and aspens.

Though lakeside development is limited, a town road runs very close to the east shore and there is a single house on privately-owned land west of the lake. A small parking area to the east of the lake provides access for users.

Site Significance

"Softwater drainage lake" is a rare lake type in the classification presently used by the NHI. Grassy Lake is significant because of because of its large size, extensive adjoining wetlands, and minimal developments.

At least one rare animal resides at this site.

Management Considerations

Management activities should emphasize water quality protection as a priority. Maintaining the existing aquatic communities would have positive ecological benefits to the existing rare plants and animals.

The Vilas County Surface Water Resources publication (1963) mentions an "aquatic weed problem" at this lake. No evidence of such a problem was noted during our 1994 survey or by earlier researchers in 1980. Additional information on the management history of Grassy Lake is needed. The current aquatic flora is composed of native species characteristic of this lake type in northcentral Wisconsin and the beds of aquatic vegetation provide important habitat for many birds, herptiles, and aquatic invertebrates.

GRASSY LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1994
NORTHERN SEDGE MEADOW		NA	1994
NORTHERN WET FOREST		NA	1994
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1983

16. HIGH LAKE SPRUCE-BALSAM STATE NATURAL AREA

Ecoregion:	Winegar Moraines
USGS 7.5’ Quadrangle:	Tenderfoot Lake
Town-Range-Section:	T43N-R7E-sec. 35, NE 1/4 NE 1/4
Size:	49 acres

Site Description

This site was established as a "State Scientific Area" (now State Natural Area) in the early 1950s to represent the boreal forest (spruce-fir) community. An infestation of spruce budworm in the 1980s eliminated virtually all of the white spruce, and the forest now resembles other second-growth dry-mesic to mesic forests in the area. Previous disturbances have included logging, windthrow, and severe fire.

Site Significance

The existing forest can no longer be viewed as representative of the boreal forest community. However, the site’s primary values include its strategic location at the very northern edge of the NHAL and its contribution to a continuous forest cover between the Forest and surrounding properties. Ecologically significant sites in the vicinity include privately-owned lands to the north and, beyond that, the Ottawa National Forest.

Management Considerations

No active management is necessary here at this time and the current designation should be maintained. If better examples of the boreal forest type are located in the future, they should be considered for strong protective designation. This forest could serve as a potential baseline at which to document the behavior of boreal species that reach their southern range limits in this ecoregion. At present it appears that the dominance of boreal species occurs chiefly in transitional or successional stages.

There are several important contextual issues which extend far beyond the perimeter of this rather isolated 40 acre site. The first involves the management of lands surrounding a site within an existing special management designation. The second involves the protection of continuous forest canopy across administrative boundaries. Broader consideration of the conservation opportunities available both within and beyond the boundaries of the State Natural Area or the State Forest would be a useful component of future management plans for this area. Working with other conservation organizations and private landowners to achieve management beyond individual properties is an important goal.

There is a substantial acreage of recently thinned, natural pine forest to the south and west. These stands were not surveyed because of the disturbance to the natural systems caused by the recent thinning and the priorities of the inventory. However, this area does provide important opportunities for long-term restoration of an extensive conifer forest, including an old-growth component.

HIGH LAKE SPRUCE-BALSAM FOREST			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1994

17. GARLAND CREEK HEMLOCKS

Ecoregion:	Northern Highlands Pitted Outwash.
USGS 7.5’ Quadrangle:	Thousand Island Lake
Town-Range-Section:	T43N-R8E-sec. 34 SE1/4SW1/4
Size:	43 acres

Site Description

This site features rolling topography and contains three small disjunct stands of older hemlock forest within a matrix of intensively managed younger aspen, paper birch and sugar maple stands. The hemlock remnants have a history of management via selective logging.

Site Significance

The northern mesic community type and the late successional stage that exist at this site are not well represented in the local landscape.

Management Considerations

The hemlock stands are very open and park-like. Hemlock reproduction is virtually non-existent. Although this site does not contain large patches of high quality hemlock forest, this cover type was formerly much more widespread in this region and existing remnants should be maintained. Reducing the separation and isolation of the disjunct hemlock forest patches should be a consideration when making management decisions.

GARLAND CREEK HEMLOCKS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN MESIC FOREST		NA	1992

M2. NORTHEAST SPRINGS-JOHNSON CREEK MACROSITE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Star Lake, Thousand Island Lake
Town-Range-Section:	T42N-R8E
Size:	3,376 acres

Survey Sites contained within this macrosite include:

- Johnson Lake and Barrens
- Johnson Creek and Pines

Site Description

This macrosite is located in the northeastern corner of the NHAL and contains an unusual concentration of softwater springs, spring-fed headwaters streams, and associated wetland communities. A series of at least four distinct soft water spring complexes occurs near the interface of the Winegar Moraine and Northern Highland Pitted Outwash ecoregions. The four complexes – Garland, Goodyear, Salsich, and Siphon Springs – each feature one to several spring ponds. Their outlet streams flow in a generally westerly direction for one to three miles before joining Johnson Creek, which in turn joins other small streams.

Fisheries management has focused on the trout fishery. Salsich Creek has been stocked twice. The rolling sands of the surrounding uplands are forested but are generally managed intensively for aspen, plantation-grown red pine, and jack pine.

Site Significance

One of the two ponds at Goodyear Springs had been previously designated as a State Natural Area. The concentration of soft water spring ponds at Goodyear Springs is unusual and replicated in few, if any, other locations in the state. Several rare animals, primarily birds of boreal affinity, have been documented as residents of this site.

Management Considerations

The SNA designation would be more effective if it encompassed a broader array of the natural communities representative of this unique landscape, including dry forest (especially in areas with substantial amounts of jack and red pine, balsam fir, or other upland conifers), lowland conifer swamp, shrub swamp, sedge meadow, an additional spring complex, and some length of stream.

the development of a larger block of conifer forest around one or several of the spring and stream complexes would benefit several of the uncommon species resident at this site, such as the boreal birds. More extensive stands of upland coniferous or mixed forest communities (especially balsam fir, and jack and/or red pine) and lowland coniferous types (black spruce and tamarack) would enhance conditions for spruce grouse, gray jay, boreal chickadee and others, by providing more ample habitat of higher quality.

The identification of areas to maintain in a more open condition is also warranted in this part of the NHAL, as only Johnson Lake Barrens SNA and several small wildlife openings are currently managed to maintain an open bracken grassland habitat.

NORTHEAST SPRINGS - JOHNSON CREEK MACROSITE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
ALDER THICKET		NA	1984
BRACKEN GRASSLAND		NA	1990
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1991
2 NORTHERN DRY FOREST		NA	1988
4 NORTHERN SEDGE MEADOW		NA	1983
3 NORTHERN WET FOREST		NA	1982
OPEN BOG		NA	1977
2 SPRING POND		NA	1983
3 STREAM--FAST, HARD, COLD		NA	1982
STREAM--SLOW, SOFT, COLD		NA	1994
ANIMALS			
CONNECTICUT WARBLER (OPORORNIS AGILIS)		SC/M	1983
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1985
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1994
PLANTS			
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1995

18. JOHNSON LAKE AND BARRENS

(Northeast Springs-Johnson Creek Macrosite)

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5’ Quadrangle:	Tenderfoot Lake
Town-Range-Section:	T42N-R8E-secs 8, 9
Size:	271 acres

Site Description

This site is situated on a droughty, sandy outwash plain, and a portion of it has been managed by the use of controlled fire and cutting to promote an open community (bracken grassland) of sweetfern, blueberries, bracken fern, and barrens strawberry. Scattered jack pine and northern pin oak occur amid the openings, with thickets of aspen saplings common along the edges.

Johnson Lake is a shallow, undeveloped drainage lake fed by Garland Creek. The lake is ringed by a wet meadow composed of wire-leaved sedges, patches of open bog, and boggy conifer swamp. The outlet stream (Johnson Creek) and the uplands to the west of the lake also contain ecologically valuable natural features (see "Johnson Creek and Pines"). Johnson Lake has been stocked at least twice in the past.

Site Significance

This site is a designated State Natural Area. It is managed with prescribed fire to restore and maintain the bracken grassland community, and to afford a high level of protection to an undeveloped drainage lake and adjoining wetland. Several rare animals occur here and the lake supports an uncommon plant.

Management Considerations

This site should be considered for strong protective designation. Expanding the open early successional areas would enlarge the bracken grassland community and provide habitat for rare species. Additional protection should be considered for the dry forest (jack pine-red pine-black spruce) to the west, as this community is very poorly represented in special management areas in northcentral Wisconsin, as well as elsewhere within its range. Future stocking of the lake should be carefully reviewed for impact to the aquatic community.

See next site, “Johnson Creek and Pines”.

JOHNSON LAKE AND BARRENS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
BRACKEN GRASSLAND		NA	1995
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1995
NORTHERN SEDGE MEADOW		NA	1995
NORTHERN WET FOREST		NA	1995
STREAM--FAST, HARD, COLD		NA	1995
ANIMALS			
CONNECTICUT WARBLER (OPORORNIS AGILIS)		SC/M	1990
PLANTS			
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1995

19. JOHNSON CREEK AND PINES

(Northeast Springs-Johnson Creek Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Tenderfoot Lake
Town-Range-Section:	T42N-R8E-sec. 8 SW 1/4
Size:	394 acres

Site Description

Infertile, rolling outwash sands support a mature dry forest of jack pine, red pine, and black spruce. The understory is composed of bracken fern, blueberries, wintergreen, and barrens strawberry, among others. Some recently harvested stands exhibit very strong jack pine reproduction. Scattered groves and individuals of larger jack and red pine are interspersed with dense thickets of sapling jack pine and herb/low shrub dominated openings.

The hilly landscape is pocked with glacial kettle holes, some of which hold lakes, others containing boggy wetlands. To the south is Johnson Creek, the outlet stream of Johnson Lake, which collects waters from the many spring-fed streams to the northeast. Johnson Creek is bordered by shrub swamp, sedge meadow, and boggy stands of swamp conifers. Lush, within-stream stands of submergent and emergent aquatic macrophytes are significant in some stretches.

Site Significance

This site contains one of the better-developed stands of mature dry conifer forest within the NHAL. The composition of this forest is unusual, especially with regard to the high proportion of black spruce in both the canopy and understory. This site's proximity to Johnson Lake Barrens SNA is advantageous. Expanded, complementary management at Johnson Creek and Pines would significantly broaden the benefits derived from the maintenance and management of the existing SNA.

Much of the forest in this part of the Highland is presently in an aspen covertype.

Several rare birds have been documented in and around this site. Most are species that typically inhabit stands of dense conifers, and one is associated with the open wetland communities along Johnson Creek.

Management Considerations

This site should be considered for strong protective designation. Fire suppression has been a major ecological factor throughout the ecoregion, but this site adjoins another (Johnson Lake Barrens SNA) that is managed with prescribed fire to maintain open or savanna-like conditions. Extension of this fire regime, or judicious use of some other method designed to maintain the community (not just the covertype), should also be considered here. This would better represent the gradient of vegetation structures characteristic of communities on droughty, nutrient-poor sites, reduce high-contrast edge, and provide habitat for uncommon and/or declining species.

The Johnson Lake Barrens SNA at the Johnson Creek and Pines site should also be managed for various stages of xeric forest as well, emphasizing, at the other end of the xeric continuum, dense stands of mature conifers.

At least some of the best quality dry forest is on private land. The owners should be contacted to inform them of the ecological values of the site, and to assess their intentions for management of the property.

JOHNSON CREEK AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY FOREST		NA	1994
ANIMALS			
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1994

20. NIXON LAKE COMPLEX

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	White Sand Lake
Town-Range-Section:	T42N-R8E-secs. 19, 30; T42N-R7E-secs 23, 24, 25
Size:	1,042 acres

Site Description

The primary natural features of this site include: Nixon Lake, an undeveloped, hardwater drainage lake; Nixon Creek, a free-flowing stream from the outlet of Nixon Lake downstream to a dammed stretch of the Manitowish River; extensive wet meadow (both "poor fen" and tussock meadow) and shrub swamp; and acid conifer swamp and muskeg of black spruce and tamarack.

The uplands support dry to dry-mesic forest vegetation, much of which was recently cut. Major covertypes include white pine, jack pine, trembling aspen, and paper birch. Several small soft water seepage lakes occur in the vicinity of this site and should be included in the complex if further investigation so warrants.

Site Significance

The aquatic features and adjoining wetlands are extensive, in excellent shape, and support rare species. Neither drainage lakes nor wet meadows are well represented in areas with habitat or native community protection designations (such as an SNA) on the NHAL.

Management Considerations

This site should be considered for strong protective designation to ensure long-term maintenance of its wetland and aquatic communities. Periodic monitoring for the presence of invasive species is desirable. Future surveys for breeding birds and boreal Lepidoptera would provide a better understanding of their distribution and use of these habitats in the region.

On the uplands, the continued and expanded management of both dry-mesic and dry pine-dominated forests would provide representative examples of these community types and benefit associated plant and animals species. Future surveys of the entire site for breeding birds would provide a better understanding of habitat needs and sensitivities.

Largescale ecological linkages upstream (ESE) to the Partridge Lake and Lake Alva sites, and downstream (N and W) to the Manitowish River, would provide additional protection to important natural communities and create or maintain migration and travel corridors for various animals.

NIXON LAKE COMPLEX			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1994
NORTHERN DRY FOREST		NA	1992
NORTHERN SEDGE MEADOW		NA	1994
PLANTS			
PRICKLY HORNWORT (CERATOPHYLLUM ECHINATUM)		SC	1996
VASEY'S PONDWEED (POTAMOGETON VASEYI)		SC	1996

21 PARTRIDGE LAKE CONNECTION

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5' Quadrangle:	White Sand Lake, Star Lake
Town-Range-Section:	T42N-R8E-secs. 28, 29, 32, 33
Size:	2,146 acres

Site Description

This site consists primarily of Partridge Lake and the adjoining uplands to the east and south, the lake's outlet stream (Partridge Creek) and its associated wetlands, and McGinnis Creek and its associated wetlands. Portions of this site are wild, undeveloped, and difficult to access. However, forest management has been intensive in some areas, especially northwest of Partridge Lake, north of McGinnis Creek, and southwest of Partridge Creek. Ballard and Partridge Lakes have been stocked many times.

Site Significance

This is one of the few primary sites that contain significant stands of mature, densely stocked black spruce forest. It also occupies a strategic location between Lake Alva Hemlock-Hardwoods and the Star Lake Crescent to the southeast, and Nixon Lake Wetlands Complex to the west.

Management Considerations

Continuing only limited management on this site would benefit the upland and wetland communities found at this site. Additional surveys of the lowlands, shorelines and aquatic features are desirable before specific management decisions are made. Future stocking of the lakes should be carefully reviewed for impact to the aquatic community.

PARTRIDGE LAKE CONNECTION			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
OSPREY (PANDION HALIAETUS)		THR	1992

M3. STAR LAKE CRESCENT MACROSITE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Star Lake, White Sand Lake
Town-Range-Section:	T42N-R8E-secs. 27, 28, 34, 35. T41N-R8E-secs. 1, 2, 11-14, 21-24
Size:	6,012 acres

Survey Sites contained within this macrosite include:

- Lake Alva Hemlock-Hardwoods
- Lake Laura-Salsich Lake
- Plum Lake Hemlock Forest

Site Description

This part of the NHAL features one of the more extensive acreages of mesic forest in the region and is especially notable for its concentration of stands in or approaching old-growth condition. The most abundant canopy trees are hemlock, sugar maple, and yellow birch, with scattered white (rarely red) pine, white cedar, red maple, and paper birch. Typically, sugar maple demonstrates the most vigorous reproduction, but locally there are dense patches of hemlock saplings. Site conditions are not rich in this area, and consequently the understory is most often represented by plants such as Canada mayflower, wood anemone, starflower, big-leaved aster, leatherwood, club mosses, and wood ferns.

Among the additional features of importance in this forested landscape are kettle wetlands consisting of black spruce and tamarack swamp, muskeg, open bog, and emergent aquatic marsh. Several undeveloped lakes are also worthy of mention.

Site Significance

This macrosite encompasses one of the largest areas of old-growth to mature mesic forest in northcentral Wisconsin. One of the sites, "Plum Lake Hemlock Forest", may be the largest stand of old-growth hemlock in the state.

Management Considerations

Excellent potential exists to develop and maintain connections between the three primary survey sites, and to increase stand size and reduce or prevent the development of high-contrast edge. Additional ecological connections to the northwest (via the "Partridge Lake Connection)", south ("Wharton Lake Bog Complex"), and west ("Aurora Lake and Wetlands") are possible and should be considered carefully as this is one of the few state properties on which management at a large (landscape) scale is feasible.

Potential management constraints include the presence of several roads and the current ownership pattern. The NHAL boundary passes through Lake Laura, with private lands on the east shore.

Deer browse is very heavy in some areas and is one of the major factors limiting the widespread reproduction of hemlock, and possibly, other browse-sensitive upland plants.

Both Lake Laura-Salsich Lake and Lake Alva Hemlock-Hardwoods should be considered for strong protective designation, emphasizing the protection and maintenance of an extensive, mature, mesic forest ecosystem, along with associated populations of both rare and representative species, and aquatic features.

STAR LAKE CRESENT MACROSITE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
2 LAKE--DEEP, SOFT, SEEPAGE		NA	1994
NORTHERN DRY-MESIC FOREST		NA	1981
5 NORTHERN MESIC FOREST		NA	1996
NORTHERN SEDGE MEADOW		NA	1981
ANIMALS			
2 BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
2 BLACK-THROATED BLUE WARBLER (DENDROICA CAERULESCENS		SC/M	1996
BLACK-TIPPED DARNER (AESHNA TUBERCULIFERA)		SC/N	1962
2 BULL FROG (RANA CATESBEIANA)		SC/H	1994
CERULEAN WARBLER (DENDROICA CERULEA)		THR	1996
LAKE DARNER (AESHNA EREMITA)		SC/N	1994
LAKE EMERALD (SOMATOCHLORA CINGULATA)		SC/N	1994
PINE SISKIN (CARDUELIS PINUS)		SC/M	1996
2 RED-SHOULDERED HAWK (BUTEO LINEATUS)		THR	1980
SUBARCTIC BLUET (COENAGRION INTERROGATUM)		SC/N	1967
2 SWAINSON'S THRUSH (CATHARUS USTULATUS)		SC/M	1992
PLANTS			
LARGE ROUNDLEAF ORCHID (PLATANTHERA ORBICULATA)		SC	1901
SHORE SEDGE (CAREX LENTICULARIS)		THR	1996

22. LAKE ALVA HEMLOCK-HARDWOODS

(Star Lake Crescent Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Star Lake
Town-Range-Section:	T42N-R8E-secs. 27, 28
Size:	424 acres

Site Description

The rolling topography south of Lake Alva features a stand of old-growth mesic forest composed of hemlock, yellow birch, and sugar maple. Very large, very old trees are present, including scattered supercanopy white pine. Yellow birch is present and reproducing. There is evidence of several past episodes of light selective cutting, which have apparently accelerated succession toward greater dominance by maple. Apart from that, the stand is intact, has high canopy cover, and has relatively high ecological integrity.

The lake is undeveloped. Adjoining wetlands, while of small acreage, are diverse in kind and include an open leatherleaf bog, shrub swamp, and an acid conifer swamp of black spruce and tamarack. Around a small pond just to the east of the main lake basin there is a stand of hemlock-white cedar-yellow birch, in which hemlock is reproducing very well.

Past management activities have include selective logging of the hemlock-hardwood forest and the stocking of Lake Alva with game fish.

Site Significance

Old-growth forest remnants, even of the most common and widespread communities, are now rare in northern Wisconsin. Though not large, this site features one of the better old-growth hemlock-hardwood stands in the northcentral portion of the state. The lake and adjoining wetlands are undisturbed and add considerable diversity and significance to the site. This site is a crucial component in a constellation of sites, which in aggregate afford the opportunity to manage a mesic forest complex at a large (landscape) scale.

Several rare animal species are resident here.

Management Considerations

This site merits strong protective designation, and the surrounding forests, especially to the south and east, should be managed compatibly by maintaining high canopy cover, retaining or promoting large trees and snags, etc.. No active management is needed at this time to perpetuate these communities, but monitoring the reproduction of hemlock and yellow birch is desirable. An important consideration is the linkage of this site, via active and passive management, with the large Lake Laura complex to the southeast, and to Partridge Lake, McGinnis Creek, Nixon Lake, and Nixon Creek to the west-northwest.

LAKE ALVA HEMLOCK-HARDWOODS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, SOFT, SEEPAGE		NA	1992

LAKE ALVA HEMLOCK-HARDWOODS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
NORTHERN MESIC FOREST		NA	1992
ANIMALS			
PINE SISKIN (CARDUELIS PINUS)		SC/M	1996
RED-SHOULDERED HAWK (BUTEO LINEATUS)		THR	1980

23. LAKE LAURA-SALSICH LAKE

(Star Lake Crescent Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Star Lake
Town-Range-Section:	T41N-R8E-secs. 1, 2, 11-14, 23, 24
Size:	2,580 acres

Site Description

Rolling glacial outwash terrain near the eastern edge of the State Forest is vegetated with an extensive mesic forest that includes old-growth stands as well as mature stands that now possess or are developing some old-growth attributes. Canopy dominance varies from almost pure conifer (hemlock, with some white pine) to pure hardwood (sugar maple, yellow birch, and basswood). Reproduction is primarily by sugar maple, but locally balsam fir is an important sapling or small tree, and hemlock and yellow birch are doing well near Salsich Lake.

The understory is very representative for the mesic forests of this ecoregion: the rich beds of spring ephemerals, so characteristic of mesic stands on richer, siltier soils, are absent here.

The landscape is pitted with glacial kettle holes that contain softwater seepage lakes or boggy wetlands. Among these, Salsich Lake is the most significant because of its size, lack of development, relatively light use history, and diverse aquatic biota. Lake Laura has been stocked with fish at least once, and there are several private cabins on the east shore, east of the State Forest boundary.

Site Significance

This site is large, contains excellent examples of mature mesic forest with a variety of cover types, and at least one exceptional softwater seepage lake (Salsich Lake) is present.

The older successional stages of mesic hardwood forests are poorly represented anywhere in Wisconsin. To date, few have been included in both state and federal special management areas that afford a high level of protection to natural communities.

Numerous rare species, both terrestrial and aquatic, were documented at this site.

Management Considerations

No active management is necessary to perpetuate the natural features occurring here. Monitoring the reproductive success of browse sensitive species such as hemlock and yellow birch is desirable. Current developments are few, and potentially intrusive activities have been handled well by State Forest staff. Linking this site with other sites, including Lake Alva to the northwest and Plum Lake Hemlocks to the southwest, would provide added protection and possible expansion of the natural communities and rare species populations present at this site.

The Lake Laura-Salsich Lake site provides an especially important opportunity for the protection of extensive high quality, older mesic forest, ecologically significant and sensitive aquatic features, undisturbed wetland communities, and rare and representative species preferring these conditions. Future stocking of the lakes should be carefully reviewed for impact to the aquatic community.

LAKE LAURA - SALSICH LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, SOFT, SEEPAGE		NA	1994
NORTHERN MESIC FOREST		NA	1996
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
BLACK-THROATED BLUE WARBLER (DENDROICA CAERULESCENS)		SC/M	1996
BULLFROG (RANA CATESBEIANA)		SC/H	1994
CERULEAN WARBLER (DENDROICA CERULEA)		THR	1996
LAKE DARNER (AESHNA EREMITA)		SC/N	1994
LAKE EMERALD (SOMATOCHLORA CINGULATA)		SC/N	1994
SWAINSON'S THRUSH (CATHARUS USTULATUS)		SC/M	1992
PLANTS			
SHORE SEDGE (CAREX LENTICULARIS)		THR	1996

24. PLUM LAKE HEMLOCK FOREST

(Star Lake Crescent Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Star Lake, White Sand Lake
Town-Range-Section:	T41N-R8E-secs. 21, 22
Size:	650 acres

Site Description

This site features an older forest of hemlock and associated hardwoods, primarily yellow birch and sugar maple, on rolling outwash topography bordering Star and Plum Lakes. The older stands are in, or are approaching, old-growth condition. The understories of these stands are open and park-like.

The current stand originated in the early 1800s, possibly due to wildfire, and was selectively logged for large white pine in the 1880s. High use by deer in winter has been a factor in limiting reproduction by hemlock.

Several small stands of acid swamp conifers (black spruce and tamarack) occur on the margins of the upland areas.

Site Significance

This site includes the Plum Lake Hemlock Forest State Natural Area and, at present, harbors one of the largest stands (possibly the largest) of old-growth hemlock-hardwood forest in Wisconsin. However, at less that 100 hectares, it is still quite small.

Several rare animal species have been documented here in recent years.

Management Considerations

This site should be considered for strong protective designation. The existing State Natural Area designation is appropriate - extending the designation to include all or parts of the Lake Laura and Lake Alva sites (the "Star Lake Crescent") would increase the site's protection by reducing edge effects and better accommodating natural disturbance events. An excellent opportunity exists to functionally expand the size of this forest, due to the proximity of similar patches of older mesic forest to the north and northeast, which are within a matrix of extensive but much younger, second-growth forest. The expansion of the forest will support the more distinctive plants, animals, and natural processes associated with this ecosystem type. No active management is necessary to perpetuate the mesic forest community, but monitoring the reproductive success of browse-sensitive species, especially eastern hemlock, is desirable. Current regeneration of this species is extremely localized.

The development of a comprehensive plan to expand the size of the older closed canopy forest here and to link it to similar older remnants to the northeast (see Lake Laura and Lake Alva site descriptions) would enhance the long-term sustainability of this community type.

PLUM LAKE HEMLOCK FOREST			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN MESIC FOREST		NA	1988
ANIMALS			
BLACK-THROATED BLUE WARBLER (DENDROICA CAERULESCENS)		SC/M	1980
BULLFROG (RANA CATESBEIANA)		SC/H	1985
SWAINSON'S THRUSH (CATHARUS USTULATUS)		SC/M	1980
PLANTS			
LARGE ROUNDLEAF ORCHID (PLATANTHERA ORBICULATA)		SC	1901

25. WHARTON LAKE BOG COMPLEX

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5' Quadrangle:	Star Lake, St. Germain
Town-Range-Section:	T41N-R8E-secs. 24, 25, 26, 35, 36. T40N-R8E-secs. 1, 2.
Size:	1,920 acres

Site Description

Rough pitted outwash terrain contains a large complex of kettle bogs, seepage lakes, and wetlands within an upland matrix of intensively managed young aspen forest. The limited survey work conducted here (due to the young age of the upland forest) revealed that the wetlands are of the acid peatland type, a mosaic of open bog, muskeg, and black spruce-tamarack swamp. Sphagnum mosses, ericaceous shrubs, sedges, and insectivorous plants are among the important community members.

Much of the upland forest consists of very young, dense stands of trembling aspen, especially south of Wharton Lake Road. To the north of Wharton Lake Road, white and red pines are important species. Although logging has occurred in many of these stands recently, there is an opportunity to increase both the pine component and overall canopy cover in the foreseeable future.

Site Significance

Important attributes of this site include the extensive acreage of undisturbed peatlands, the numerous undeveloped small seepage lakes, and the opportunity to conduct pinery restoration north and west of Wharton Lake.

Management Considerations

Minimal survey work was done here because the majority of the upland forest was so young. The wetlands and lakes appear essentially undisturbed and should remain that way to protect the community and provide time for more thorough surveys.

The area north and west of Wharton Lake does include selectively cut dry-mesic forest with a significant component of large white pine. This area provides an opportunity for some sort of pinery restoration. The highly significant Lake Laura-Salsich Lake site is just to the north, and Plum Lake Hemlock Forest is not far to the west. Though these other sites occur on a different LTA (Landtype Association) with generally more mesic conditions, both of them could benefit from the local reduction of high contrast edge, an increase in conifer canopy cover, and an overall increase in contiguous forest block size.

WHARTON LAKE BOG COMPLEX			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
OPEN BOG		NA	1996
ANIMALS			
OSPREY (PANDION HALIAETUS)		THR	1992

26. AURORA LAKE AND WETLANDS

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	White Sand Lake
Town-Range-Section:	T41N-R8E-secs. 18, 19
Size:	822 acres

Site Description

The primary natural features at this site include an undeveloped, shallow, hard water drainage lake; Aurora Creek, the lake's outlet stream; extensive stands of emergent aquatic vegetation, wet meadow and bog; several small stands of acid swamp conifers (black spruce and tamarack); and second-growth stands of mature red and white pine forest on the adjacent uplands. Aurora Lake has been stocked four times in the past.

Site Significance

The lake and a portion of the adjoining wetlands are within a designated State Natural Area. The aquatic features and associated wetlands are in excellent condition and represent their respective communities well. We support continued, and potentially, expanded protection for this site as it contains features that have been identified as protection priorities for this ecoregion.

Several rare plant and animal species dwell within the confines of Aurora Lake and Wetlands.

Management Considerations

This site should be considered for strong protective designation. Expanding the boundary of the SNA to include other important ecological features would enhance the site's protection. The features include all of the wetlands bordering the lake and stream, the length of the stream south to Razorback Road, and at least some of the adjoining upland forest, which is recovering and has redeveloped some of the attributes of a mature dry to dry-mesic pine forest community.

A long-term management plan for the maintenance and expansion of the pine forests, including an evaluation of the use of prescribed fire, is appropriate here.

The source of water for Aurora Lake is Bear Springs, a modified spring pond approximately 1 mile north of the lake. A review of existing management plans for both areas would be timely and could potentially head off any existing or future conflicts. Future stocking of the lake should be carefully reviewed for impact to the aquatic community.

Additional protection would be provided if the planning process for this site is extended to include Frank Lake, a large undeveloped seepage lake just to the northwest of Aurora Lake, and the two small kettle bogs, "Mary Davis Ries Bogs" to the west. Also, the extensive hemlock-hardwood forest at Plum Lake is a short distance to the east.

No active management is needed for the lake, stream, or wetlands, but periodic monitoring to check for the presence of invasive species or inappropriate uses is needed.

AURORA LAKE AND WETLANDS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1999
NORTHERN DRY-MESIC FOREST		NA	1999
NORTHERN WET FOREST		NA	1999
OPEN BOG		NA	1999
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
BULLFROG (RANA CATESBEIANA)		SC/H	1994
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		SC/M	1994
SUBARCTIC BLUET (COENAGRION INTERROGATUM)		SC/N	1967
PLANTS			
SWAMP PINK (ARETHUSA BULBOSA)		SC	1994

27. MARY DAVIS RIES BOGS

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	White Sand Lake
Town-Range-Section:	T41N-R7E-sec. 24 NE1/4NE1/4; T41N-R8E-sec. 19 NW1/4NW1/4
Size:	77 acres

Site Description

Rough pitted glacial outwash between Frank and Aurora Lakes contains several steep-sided depressions. The deepest of these contains two small kettle bogs, each consisting of a small open pond bordered by a mat of sphagnum mosses, sedges and ericaceous shrubs. The surrounding forests are managed forests composed mostly of aspen, paper birch, and, to the south, young pine plantations.

Site Significance

Each of the kettle bogs supports rare aquatic invertebrates.

Management Considerations

The access road to Frank Lake passes over a narrow isthmus between the two bogs. Protection of site hydrology is critical. Any activities that would alter water chemistry or change water levels should be avoided until the impacts can be evaluated.

MARY DAVIS RIES BOGS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
BLACK-TIPPED DARNER (AESHNA TUBERCULIFERA)		SC/N	1991
CITRINE FORKTAIL (ISCHNURA HASTATA)		SC/N	1962

28. FRANK LAKE AND FROST POCKET

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	White Sand lake
Town-Range-Section:	T41N-R7E-sec. 13 E1/4; T41N-R8E-sec. 18 W1/2
Size:	338 acres

Site Description

Frank Lake is a 141 acre undeveloped soft water seepage lake with slightly alkaline, clear water of high transparency. Sand is the primary bottom material, with rock, gravel, and muck also present. The rolling sandy uplands are forested with second-growth stands of dry-mesic northern hardwoods (paper birch, aspen, red maple, red oak). The lake has been stocked twice in the past.

Less than a quarter mile north of Frank Lake is an open, 18-acre dry depression that apparently will not support a forest community because of periodic growing season frosts. Heavy frost damage (die-back) on this year's growth was evident in late June on some of the conifers (white pine and white spruce) planted in and on the margins of the "frost pocket". The vegetation is composed mostly of herbs and low shrubs, with non-native species being very common. The natives include blueberries, bracken fern, Kalm's brome grass, lousewort, rice grass, and dense sods of Penn sedge. Among the exotics, orange hawkweed, ox-eye daisy, Canada bluegrass, and sheep sorrel were typical.

Site Significance

Lakes of this type and size are currently under very heavy development pressure throughout northern Wisconsin. Frost pockets are poorly understood and are of potentially high research value.

Management Considerations

This waterbody is a designated Wild Lake in the current property master plan. Minimizing additional development on or around the lake would help to maintain the current character of the aquatic community. Any management of the lake should emphasize the maintenance of the aquatic community. Future stocking of the lake should be carefully reviewed for impact to the aquatic community.

The frost pocket should be considered for special management designation. While this is not necessarily the best site to consider for such recognition, it is one of the large ones.

There are contextual considerations here, as other significant sites occur just to the southeast (Aurora Lake), south (Mary Davis Ries Bogs), and a short distance to the west (Blueberry Lake, Central Highlands Macrosite).

FRANK LAKE AND FROST POCKET			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
BRACKEN GRASSLAND		NA	1992
LAKE--DEEP, SOFT, SEEPAGE		NA	NA

29. BLUEBERRY LAKE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	White Sand Lake
Town-Range-Section:	T41N-R7E-sec. 23
Size:	89 acres

Site Description

Blueberry Lake is a small, infertile seepage lake within a deep kettle depression in pitted glacial outwash. The 12 acre lake is 27 feet deep and has a mostly muck bottom. The lake is bordered on the northwest and northeast by an open bog mat composed of sphagnum mosses, sedges, ericaceous shrubs, and insectivorous plants. Small black spruce and tamarack are scattered within the mat. The adjoining uplands support second growth stands of dry-mesic forest consisting of paper birch, red oak, maples, balsam fir, and some white and red pines. Extensive plantations occur to the east and north.

Just to the south is a second small kettle bog ("Blueberry Junior"), which has only an acre or two of open water surrounded on all sides by open bog, muskeg, and acid conifer swamp communities. Chemical treatment was proposed for Blueberry Lake twenty years ago but we are not aware that this ever occurred.

Site Significance

This site is known for its diverse and showy flora. A number of research projects have used Blueberry Lake as a study site. This site contains small but good representatives of several wetland communities characteristic of this ecoregion.

Management Considerations

Because of the site's close proximity to Big Muskellunge Lake Road, the impact of recreational uses on the vegetation should be studied. If chemical treatment is proposed in the future, the potential impacts should be reviewed carefully.

BLUEBERRY LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, SOFT, SEEPAGE		NA	1980
OPEN BOG		NA	1980
PLANTS			
HIDDEN-FRUITED BLADDERWORT (UTRICULARIA GEMINISCAPA)		SC	1985
SWAMP PINK (ARETHUSA BULBOSA)		SC	1959

30. PLUM CREEK

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Sayner
Town-Range-Section:	T40N-R8E-secs. 6, 7, 18; T41N-R8E-sec. 31.
Size:	144 acres

Site Description

Plum Creek flows southward from Plum Lake to Big St. Germain Lake, a distance of 4.7 miles. Average width is 18 feet, the water is clear with moderate fertility, and the bottom materials are mostly sand and gravel. The channel is confined within a steep-sided and rather straight valley, running through an almost level sandy outwash plain. The uplands are mostly forested, with xeric community types (including pine plantations) predominant.

Site Significance

Plum Creek is a very good example of a stream type that is common on the NHAL - a small, cool to warmwater stream, originating in a large lake and flowing to another lake.

The stream supports a diverse macroinvertebrate fauna, which includes rare species. One of these is globally rare.

Management Considerations

Protection of stream hydrology and water quality is paramount to maintaining the aquatic community and rare species at this site. The stream is managed for trout (both native and exotic species) and extensive bank modifications have been made in some areas to improve the sport fishery. Impacts of these modifications on the native aquatic invertebrate community are uncertain.

Potential sources of water quality degradation are the two county highway crossings and the campground at Plum Lake.

PLUM CREEK			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
SPLENDID CLUBTAIL (GOMPHURUS LINEATIFRONS)		SC/N	1994
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1994

M4. CENTRAL HIGHLAND MACROSITE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	White Sand Lake, Boulder Junction, Woodruff, Sayner, Lake Tomahawk
Town-Range-Section:	T39N-R7E-secs. 3, 4, 9, 10, 12, 13, 15, 16, 21-24, 26, 27, portions of 1, 2, 11, 14; T39N-R8E-secs. 6, 7; T40N-R6E sec. 7; T40N-R7E secs. 3, 6, 7, 10-13, 17-21, 27-29, 34, portions of 4, 5, 8, 9, 14-16, 22-26, 35, 36; T40N-R8E secs. 18, 19, 30, 31; T41N-R7E secs. 1, 2, 4, 5, 8, 10-17, 20-23, 27-29, 31, 32, 34, 35, portions of 3, 9, 33.
Size:	28,091 acres

Survey Sites contained within this macrosite include:

- Escanaba Lake Hemlocks
- Lost Canoe Hardwoods
- Stevension Creek and Pines
- Allequash Lake and Pines
- Little John Junior Lake
- Benedict-Hurrah-Scaffold Lakes Complex
- Dry Lake and Pines
- Bittersweet Lakes Complex
- Mud Creek Springs
- Sweeney Lake Area

Site Description

This "macrosite" occupies the heart of the Northern Highland, stretching from Lost Canoe Lake on the north to Sweeney Lake on the south. Terrain is generally rolling, with many kettle lakes, spring ponds, and wetlands. The uplands are almost entirely forested, with both mesic and dry-mesic communities well represented. Though the entire area was cut over and much of it burned during the catastrophic logging of the late nineteenth and early twentieth centuries, most stands have retained an approximation of the natural composition for these forest types in this ecoregion and many of them are mature and developing old-growth structural characteristics.

Rough, sandy outwash topography supports extensive managed forests of white and red pine, hemlock-hardwoods, northern hardwoods, aspen and paper birch, plus numerous kettle wetlands containing open bog, poor fen, muskeg, black spruce swamp, tamarack swamp, alder thicket, and spring pond communities.

Site Significance

At a large scale (over 1000 acres), this is one of the more ecologically intact forested portions of the NHAL. Stands of intensively managed aspen and plantation-grown pine are relatively scarce here. Many of the existing stands of dry-mesic (white pine-red pine) and mesic forest ("northern hardwoods" of sugar maple-yellow birch-basswood and hemlock) now possess or are developing old-growth attributes. At present, old-growth forests are rare, large patches of older forest are nonexistent, and large patches of older maturing forest are uncommon.

Management Considerations

This complex of sites affords one of the best opportunities on state lands for largescale ecosystem management and protection. Options for management include enhancement of present conditions by increasing forest block size, increasing stand age, and, where appropriate and feasible, increasing the coniferous component of the existing stands.

Opportunities to create ecological linkages with the forests of the Upper Peninsula of Michigan are important landscape level considerations.

The oligotrophic seepage lakes found here are highly vulnerable to degradation due to acidification if local or regional air quality deteriorates.

CENTRAL HIGHLANDS MACROSITE				
	Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES				
	EMERGENT AQUATIC		NA	1992
5	LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1992
	LAKE--SHALLOW, HARD, SEEPAGE		NA	1980
2	LAKE--SHALLOW, SOFT, DRAINAGE		NA	1995
	LAKE--SHALLOW, SOFT, SEEPAGE		NA	1996
6	NORTHERN DRY-MESIC FOREST		NA	1996
5	NORTHERN MESIC FOREST		NA	1995
2	NORTHERN SEDGE MEADOW		NA	1996
2	OPEN BOG		NA	1996
2	POOR FEN		NA	1996
	SPRING POND		NA	1977
	STREAM--FAST, HARD, COLD		NA	1977
	SUBMERGENT AQUATIC		NA	1992
ANIMALS				
	A CADDISFLY (BANKSIOLA DOSSURIA)			1994
7	BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1997
	BANDED KILLIFISH (FUNDULUS DIAPHANUS)		SC/N	1975
	BLACK TERN (CHLIDONIAS NIGER)		SC/M	1992
2	BLACK-TIPPED DARNER (AESHNA TUBERCULIFERA)		SC/N	1994
	BULL FROG (RANA CATESBEIANA)		SC/H	1986
	CERULEAN WARBLER (DENDROICA CERULEA)		THR	1988
	CYRANO DARNER (NASIAESCHNA PENTACANTHA)		SC/N	1994
	FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)		SC/N	1996
	LAKE DARNER (AESHNA EREMITA)		SC/N	1991
	LONG-EARED OWL (ASIO OTUS)		SC/M	1988
3	MOTTLED DARNER (AESHNA CLEPSYDRA)		SC/N	1994
	NORTHERN RINGNECK SNAKE (DIADOPHIS PUNCTATUS EDWARDSII)		SC/N	1996
7	OSPREY (PANDION HALIAETUS)		THR	1992
PLANTS				
3	AMERICAN SHORE-GRASS (LITTORELLA AMERICANA)		SC	1995
4	NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1996
	PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)		SC	1957
3	ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1996
	SHORE SEDGE (CAREX LENTICULARIS)		THR	1995

31. ESCANABA LAKE HEMLOCKS

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	White Sand Lake
Town-Range-Section:	T41N-R7E-sec. 2
Size:	308 acres

Site Description

A steep-sided knob on the southeast side of Escanaba Lake supports a stand of old-growth mesic forest dominated by large hemlock. Canopy associates include yellow birch, paper birch, red maple, and rarely, sugar maple. Scattered supercanopy white pine are present. The understory is generally open and park-like, composed mostly of Canada mayflower, wood ferns, and clubmosses. Thickets of balsam fir saplings and mountain maple occupy canopy gaps. Hemlock saplings are rare and those present have been browsed by deer.

A boggy conifer swamp composed of small to pole-size tamarack and black spruce borders the hemlock stand on three sides. Escanaba Lake, a very scenic waterbody with minimal developments and a long history of fisheries research, is the western border of this site. Common loon, bald eagle, and osprey were noted on or around the lake during the 1992 field season.

Site Significance

This site was established as a State Natural Area to recognize a small stand of old-growth mesic forest and an adjoining conifer swamp. Old-growth stands of the widespread mesic forest community are now very rare in the Wisconsin landscape, and the extent of hemlock has diminished greatly.

Several rare animals have been documented here.

Management Considerations

This site should be considered for strong protective designation. No active management is needed to perpetuate the communities present at this time, however, there is little or no reproduction by the dominant trees, hemlock and yellow birch. The very small size (ca 25 acres) and isolation of the old-growth stand is a concern and may be a serious viability limitation. Uplands to the east and south should be considered for restoration.

ESCANABA LAKE HEMLOCKS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN MESIC FOREST		NA	1992

32. LOST CANOE HARDWOODS

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	White Sand Lake
Town-Range-Section:	T42N-R7E-secs. 34, 35; T41N-R7E-secs. 2, 3
Size:	504 acres

Site Description

The isthmus between Lost Canoe, Escanaba, and Pallette Lakes contains a mature second-growth forest of red oak, red maple, paper birch, and sugar maple. Large white pines are common, scattered throughout the site, and beginning to form a supercanopy. Several small kettle depressions hold boggy wetlands and/or small ponds.

Pallette Lake is entirely undeveloped (though it has been stocked 13 times), Escanaba has only a boat access and DNR Fish Research facility, and Lost Canoe has limited private developments on its north side.

Site Significance

Little or no tree harvest has occurred on the isthmus since the initial cutover, hence the forest there exhibits more characteristics of an older stand than is common in the NHAL at this time. Older oak-pine forests are uncommon throughout northern Wisconsin and this site features a very good example of a mature "recovered" dry-mesic northern hardwoods forest.

The lakes and nearby patches of older conifer forest support rare species.

Management Considerations

This site should be considered for strong protective designation due to contextual attributes. The three lakes are, for the most part, undeveloped or have experienced only light development. Escanaba Lake State Natural Area protects a small stand of old-growth hemlock-hardwood forest and conifer swamp on the east side of Escanaba Lake. Stevenson Springs, a biologically interesting complex of wetlands and managed pine forest, is just to the west of Pallette Lake. Rare species occur in several of these communities and would benefit from additional protection and compatible management.

As present land uses emphasize aesthetics and relatively passive forms of recreation, strong protective designation would be appropriate to further promote, protect, interpret, and recognize the natural features found here.

LOST CANOE HARDWOODS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1992
NORTHERN DRY-MESIC FOREST		NA	1992

33. STEVENSON CREEK AND PINES

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	White Sand Lake, Boulder Junction
Town-Range-Section:	T41N-R7E-secs. 3 W1/2, 4 NE1/4 T42N-R7E-sec34 SW1/4, 33 E1/2SE1/4
Size:	189 acres

Site Description

Stevenson Creek originates from the base of rolling sandy ridges just west of Pallette Lake and flows west two miles into Trout Lake. A water control structure has partially impounded the uppermost portions of the creek, which is bordered by an extensive floating mat of wire-leaved sedges. The open waters support an emergent marsh of very good quality composed mostly of wild rice, yellow water lily, bur-reed, and pondweeds.

The uplands support second-growth dry-mesic forests composed of white pine, red maple, paper birch, and red pine. Some of these stands had been cut recently, but pines remain dominant.

Site Significance

The wetland communities are of very good quality, and wire-leaved sedge mats are uncommon in the region. The upland forests, though second-growth and recently thinned, remain dominated by pine and should stay that way.

Management Considerations

This site should be considered for strong protective designation. It is an interesting, fairly remote complex that would benefit by maintaining the present management regime. The pine forest could benefit from longer rotations to complement the significant natural features just to the east (Lost Canoe Hardwoods, Escanaba Lake).

STEVENSON CREEK AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
POOR FEN		NA	1994

34. ALLEQUASH LAKE AND PINES

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Boulder Junction
Town-Range-Section:	T41N-R7E-secs. 16, 17, 20, 21.
Size:	1,055 acres

Site Description

This site is centered on the shallow south basin of Allequash Lake, a large drainage lake located five miles south of Boulder Junction. This basin supports lush, diverse beds of emergent, submergent, and floating-leaved aquatic vegetation. Among the birds nesting in the aquatic beds and on the margins of the lake are several rare species. The lake itself (at least the deep north basin) is managed for game fish and has been stocked many times. The only development on the lake is a boat landing, which periodically receives heavy use.

The shoreline is primarily upland and forested with mature second-growth stands of white pine, red oak, red maple, paper birch, balsam fir, and sugar maple. More mesic patches of forest also occur, perhaps being best developed on the south side of the basin where hemlock is dominant, and yellow birch and sugar maple make up the remainder of the canopy. Stands vary in structure and quality, but in those exhibiting the best recovery from past logging, large trees and some snags are present and a pine supercanopy is developing.

Site Significance

The aquatic communities are exceptional and support a diverse complement of native species including several that are quite rare. The forest around the south basin of Allequash Lake is mature and developing the characteristics of later successional stage forests such as large trees, standing snags, coarse woody debris, and in some areas, a white pine supercanopy. Adjoining and nearby forests possess few of these attributes.

Management Considerations

This site is entirely within the Frank Lake Wild Area but should be considered for additional recognition and a greater level of protection based on its ecological attributes. The lake basin and aquatic communities should be monitored periodically for the presence of introduced invasive species. Future stocking of the lake should be carefully reviewed for impact to the aquatic community.

In the long-term, development of a management methodology and plan is desirable for the dry-mesic forest at this site (and elsewhere on the NHAL) to ensure that important community components are not lost. This includes, but is not limited to, canopy species such as white pine and red oak. Because similar stands in the vicinity of this site have been logged recently, often with a substantial reduction in canopy cover (e.g., well over 50% in stands just to the east of this site), it is important to maintain existing stands of older closed canopy forest in this area. This will provide structural features that are relatively scarce in the local landscape, provide forest interior conditions for those species that require them, and complement the highly significant wetlands and aquatic features also present at this site.

ALLEQUASH LAKE AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
EMERGENT AQUATIC		NA	1992
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1992
NORTHERN DRY-MESIC FOREST		NA	1994
NORTHERN MESIC FOREST		NA	1994
SUBMERGENT AQUATIC		NA	1992
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
BLACK TERN (CHLIDONIAS NIGER)		SC/M	1992
BULLFROG (RANA CATESBEIANA)		SC/H	1986
OSPREY (PANDION HALIAETUS)		THR	1992

35. LITTLE JOHN JUNIOR LAKE

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Boulder Junction
Town-Range-Section:	T41N-R7E-sec. 29 NE1/4NE1/4, 28NW1/4NW1/4
Size:	49 acres

Site Description

Little John Junior is a deep seepage lake of extremely low fertility. The bottom materials are mostly sand and gravel, that in some areas occur under a very thin layer of organic sediments. No developments are present, but the lake was chemically treated and then stocked in the past in an attempt to improve the sport fishery.

Site Significance

Deep, ultra-soft, hard-bottomed seepage lakes are better represented on the NHAL than anywhere else in the state or region. Rare plants and animals, some with unusual adaptations to the extreme conditions exhibited by these waterbodies, occur here, and are significant occurrences for the forest and the region.

Management Considerations

Little John Junior should be considered for strong protective designation to ensure the maintenance of its highly significant biological values. Deep seepage lake types are highly vulnerable to development because of their firm bottoms, clear soft water, low density of aquatic vegetation, and high aesthetic qualities. As they are so poorly buffered naturally, they are also at high risk of acidification and degradation should air quality deteriorate further. Chemical treatment and other management that alters the aquatic community should be carefully reviewed for impact.

No developments are present on the shoreline at this time but a road does occur just to the north of the lake. Increased access has the potential to negatively impact the aquatic communities of this lake.

LITTLE JOHN JUNIOR LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1995
ANIMALS			
BLACK-TIPPED DARNER (AESHNA TUBERCULIFERA)		SC/N	1966
LAKE DARNER (AESHNA EREMITA)		SC/N	1991
MOTTLED DARNER (AESHNA CLEPSYDRA)		SC/N	1991
PLANTS			
AMERICAN SHORE-GRASS (LITTORELLA AMERICANA)		SC	1995
NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1995
ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1975

36. BENEDICT-HURRAH-SCAFFOLD LAKES COMPLEX

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Woodruff, Sayner
Town-Range-Section:	T40N-R7E-secs. 7, 8, 9, 17
Size:	2,438 acres

Site Description

Rough pitted outwash terrain is covered by extensive second-growth forest composed mostly of hardwoods. Site conditions vary from mesic to dry-mesic, with small, scattered wet pockets. The canopy dominants include sugar maple, paper birch, yellow birch, red oak, and red maple. Conifers are uncommon, though white pine is present in a few areas and small balsam fir occur throughout the site. Though most of the trees are of poletimber or small sawtimber size, scattered individuals exceeding 20" d.b.h. are present, including some very large yellow birches. A small "island" of old-growth hemlock-spruce-fir occurs near Scaffold Lake.

The site includes seven small, undeveloped soft water seepage lakes, the largest among them being Benedict Lake at 26 acres. Two of the lakes are deep and possess firm bottoms. The others are soft-bottomed.

Site Significance

The mesic forest community is widespread throughout northern Wisconsin, though in the Northern Highland landscape it does not comprise the matrix vegetation as it does on the richer soils of the ecoregions to the east, west, and north. Missing attributes for this type in the present landscape include older successional stages, large patch sizes, and a significant component of conifers. Dry-mesic site conditions are also present and very old, well-rotted pine stumps are scattered in various locations within the site.

This site is large, has relatively few roads, and does not include a significant acreage of intensively managed cover types (little or no aspen or plantation-grown pine occurs here). The existing forest cover includes scattered large trees and a few snags, and the lakes and wetlands are undeveloped and essentially undisturbed. A few very small pockets of old-growth conifer forest are present. Sites with similar or compatible attributes occur to the east and southeast.

Rare plants were documented in aquatic and wetland habitats at this site, and one rare herptile was captured here in the mid-1980s (species not included in the site table-see page B-1).

Management Considerations

This site should be considered for strong protective designation because of the significance described above . This and nearby sites cluster well, and collectively would seem to be a logical choice for considering some sort of big block management. This could entail favoring the maintenance or development of high canopy closure and old-growth structural characteristics, increased conifer cover, and affording a high level of protection to the wetlands and aquatic features. An important consideration is to coordinate management here with that of sites to the east and north. See **Dry Lake and Pines, Bittersweet Lakes, Central Highlands Macrosite**.

BENEDICT - HURRAH - SCAFFOLD LAKES COMPLEX			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--SHALLOW, SOFT, SEEPAGE		NA	1996
NORTHERN SEDGE MEADOW		NA	1980
OPEN BOG		NA	1992
NORTHERN MESIC FOREST		NA	1992
PLANTS			
ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1996

37. DRY LAKE AND PINES (AKA LUCIUS BAY PINES)

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Woodruff, Sayner
Town-Range-Section:	T40N-7E-sec. 21, 20
Size:	863 acres

Site Description

The rolling sandy terrain between Lucius Bay of Big Arbor Vitae Lake and Dry Lake is forested with stands of large white and red pines. Canopy associates include red oak, red maple, and paper birch. Balsam fir saplings are abundant, and the shrub layer consists of beaked hazelnut and hardwood saplings. Old-growth characteristics are developing in this stand.

The site includes three lakes including a 106 acre shallow drainage lake and a 44 acre shallow seepage lake.

Site Significance

This is the oldest known white pine stand on the NHAL. Other significant natural features, including mesic and dry-mesic forests, undeveloped lakes, springs, and a stream, occur immediately to the east and northwest of this site.

Several rare animals were documented here.

Management Considerations

This site is within a large complex of natural features that should receive consideration for strong protective designation. In addition to the individual stands of older conifer forest and undeveloped lakes in the vicinity, the extensive, relatively unfragmented forest and the absence of plantation-grown pine and short rotation aspen is important. This is one of the few areas on the State Forest that presently offers an opportunity to protect and manage a forested landscape at a largescale. See **Bittersweet Lakes** and **Benedict-Hurrah-Scaffold Lake Complex** for additional information.

DRY LAKE AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1993
ANIMALS			
CYRANO DARNER (NASIAESCHNA PENTACANTHA)		SC/N	1994
MOTTLED DARNER (AESHNA CLEPSYDRA)		SC/N	1994
OSPREY (PANDION HALIAETUS)		THR	1992

38. BITTERSWEET LAKES COMPLEX

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Sayner
Town-Range-Section:	T40N-R7E-secs. 15, 16, 22, 21
Size:	1,672 acres

Site Description

The rough pitted outwash topography of this site contains several deep, softwater seepage lakes within an extensive matrix of dry-mesic to mesic forest. The lakes are undeveloped, with clear water of extremely low fertility. The aquatic flora includes many members of the highly specialized "sterile rosette" group, which includes several rare species. Past management of the lakes has included stocking: 15 times at Bittersweet and twice at Prong. Catch and release regulations apply to these lakes. There are no known records of stocking at Smith or Oberlin Lakes

Although the forest is mostly second-growth, composed of species such as red oak, red maple, paper birch, and balsam fir, there are older stands of hemlock-hardwoods and white pine-red pine to the north and west of the lakes. Excellent reproduction of hemlock was noted in several areas.

Site Significance

This site includes the Bittersweet Lakes State Natural Area and encompasses excellent examples of deep softwater seepage lakes, mesic hemlock-hardwood forest, and dry-mesic white pine-red pine forest. In aggregate, these major features, along with the others present, represent this portion of the Northern Highlands landscape very well.

A number of rare species occur at this site, in both terrestrial and aquatic habitats.

Management Considerations

The Bittersweet Lakes Complex should be considered for strong protective designation. This site could serve as a core to a suite of natural features highly representative of this ecoregion, surrounded by lands and waters managed under complementary regimes to derive benefits of scale and landscape level diversity. The NHAL is one of very few state properties for which this potential exists, because of its size, the kinds of natural features it contains, and its context.

The expansion of the existing State Natural Area boundary to the north, south, and west would incorporate and protect older stands of hemlock-hardwoods, white pine-red pine forest, significant aquatic features, and rare species habitat.

The forest immediately to the east has been cut recently, but a number of large white pine were retained, providing a management focus opportunity in the future. A bit farther to the east is an important pine forest-wetland complex (**Mud Creek Springs**) and much of the surrounding forest to the north and south of this site could be considered for pinery restoration.

Future stocking of the lakes should be carefully reviewed for impact to the aquatic community.

BITTERSWEET LAKES COMPLEX			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1992
NORTHERN DRY-MESIC FOREST		NA	1992
NORTHERN MESIC FOREST		NA	1992
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
BLACK-THROATED BLUE WARBLER (DENDROICA CAERULESCENS)		SC/M	1992
CERULEAN WARBLER (DENDROICA CERULEA)		THR	1988
LONG-EARED OWL (ASIO OTUS)		SC/M	1988
PLANTS			
AMERICAN SHORE-GRASS (LITTORELLA AMERICANA)		SC	1975
NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1996

39. MUD CREEK SPRINGS

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Sayner
Town-Range-Section:	T40N-R7E-secs. 23 E1/2, 24 W1/2, 25 NW1/4, 26 NE1/4
Size:	979 acres

Site Description

A spring pond at the base of a steeply-sloping sandy outwash landform is the headwaters of Mud Creek, which flows eastward through a large boggy peatland to Big St. Germain Lake.

The peatland contains very good stands of forested bog (black spruce-tamarack swamp), muskeg, open bog, and poor fen communities. Deep basins in the nearby outwash in the southwestern corner of the site contain excellent kettle bogs (e.g., "Butterfly Lake"). The uplands around the wetlands support second-growth forest. To the north and west young aspen stands are prominent, but to the east, and on small upland "islands" within the peatland there are some older stands of red and white pines.

Site Significance

This is one of the better representative wetland complexes within the State Forest, offering an opportunity to protect a continuum of good quality acid peatland communities along with small stands of older pine forest. There are logical opportunities to link this site to others, especially to the west. This could be done by promoting longer-lived conifers (and hardwoods such as red oak) where appropriate, and insuring that the wetlands and older pine stands are not isolated by the intensive management of intervening stands.

Management Considerations

This site should be considered for strong protective designation. Protecting the wetlands from hydrologic disruption and the introduction of invasive species would maintain this important wetland complex. Older stands of pine-dominated forest would benefit from community type-based management rather than cover type management. A significant portion of these forests should be considered for old-growth or other native community classification. The more intensively managed forest to the west (mostly dense stands of young trembling aspen with scattered large white pine) has the potential to provide an eventual increase in conifer cover through extended rotation, and should be viewed as an important component in a landscape scale forest management plan.

MUD CREEK SPRINGS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1996
NORTHERN SEDGE MEADOW		NA	1996
OPEN BOG		NA	1996
POOR FEN		NA	1996

40. SWEENEY LAKE AREA

(Central Highlands Macrosite)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Lake Tomahawk
Town-Range-Section:	T39N-R7E-secs. 14, 15, 22, 23.
Size:	328 acres

Site Description

The major natural features of this site are a large undeveloped drainage lake, a small stand of old-growth hemlock forest, and a complex of small bog ponds with adjoining open bog and black spruce swamp communities. Part of the hemlock stand was heavily damaged by a severe windstorm recently.

Sweeney Lake has a maximum depth of 18 feet, bottom materials of sand, rubble, and gravel, and clear, soft, water of moderate transparency. No developments are present on the shore with the exception of a parking area and boat launch. Two small headwater streams enter the lake on its southwest side. The outlet, Sweeney Creek, flows from the northeast side of the lake eastward to Gilmore Lake and the Wisconsin River. The lake has been stocked on numerous occasions (at least 27).

The wetlands have not been surveyed in detail. A Great Blue Heron rookery formerly existed northeast of Sweeney Lake but has been abandoned.

Site Significance

Lakes, especially large lakes in this part of Wisconsin, are currently under heavy development pressure. This site provides a unique opportunity to maintain a large lake aquatic community without development. More detailed surveys should be done at this site to identify the wetland types present and the potential for rare species.

Management Considerations

The surrounding landscape is extensively forested with second-growth stands of pine and northern hardwoods. The feasibility of largescale management and restoration of older, conifer-dominated, or mixed conifer-hardwood forests seems feasible here. The present vegetation in the local landscape contains a relatively limited acreage of highly disturbed, intensively managed aspen, paper birch, or plantation-grown pine. The site may qualify for special protective designation because of the aquatic community type and the lack of development.

Future stocking of the lake should be carefully reviewed for impact to the aquatic community.

SWEENEY LAKE AREA			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1995
NORTHERN MESIC FOREST		NA	1995
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992

41. TROUT RIVER

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Boulder Junction, Manitowish Lake
Town-Range-Section:	T41N-R6E-secs. 14-16, 21, 22
Size:	185 acres

Site Description

The Trout River is a slow, warm, alkaline stream with clear water of high fertility that flows west and north from its source at Trout Lake, eventually joining the Manitowish River west of the state forest boundary. The Trout averages 30 feet in width and has a maximum depth of 3 feet. Bottom materials are mostly sand and gravel and the current moderate to fast, though there are wide, slow stretches where muck is the primary substrate. Patches of aquatic vegetation are common in the lower reaches. Portions of the shoreline are in private ownership, including a golf course.

The fauna may be characterized as "cool" to "warmwater" in nature.

Site Significance

The aquatic life of this stream is rich in insects, fish, and mussels and among these are many rare species.

Management Considerations

This stream should be considered for strong protective designation. Changes to the current water quality characteristics would negatively impact the rare aquatic animals found here. Surrounding land uses (including non-state owned lands) should be evaluated for potential impacts.

TROUT RIVER			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
BANDED KILLIFISH (FUNDULUS DIAPHANUS)		SC/N	1985
GREATER REDHORSE (MOXOSTOMA VALENCIENNESI)		THR	1984
LEAST DARTER (ETHEOSTOMA MICROPERCA)		SC/N	1985
LONGEAR SUNFISH (LEPOMIS MEGALOTIS)		THR	1993
PUGNOSE SHINER (NOTROPIS ANOGENUS)		THR	1985
ROUND PIGTOE (PLEUROBEMA SINTOXIA)		SC/H	1997
SPLENDID CLUBTAIL (GOMPHURUS LINEATIFRONS)		SC/N	1997

42. EAST ELLERSON LAKE AND DRUMLIN

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Manitowish Lake, Boulder Junction
Town-Range-Section:	T41N-R6E-sec. 28 W1/2, SW1/4NE1/4, NW1/4SE1/4
Size:	136 (lake only); 641 acres (total)

Site Description

East Ellerson Lake, a deep, soft, drained lake, features clear water and a mostly sand bottom. Aquatic vegetation is generally sparse, and includes specialized plants from the "sterile rosette" group including water lobelia, quillwort, and pipewort. The small outlet stream flows north to the Trout River.

The shoreline is primarily upland, forested with second-growth dry-mesic forest of paper birch, bigtooth aspen, and red maple. White and red pine are dominant locally. Small stands of boggy wetlands are present along portions of the lakeshore.

To the northeast of the lake is a forested drumlin supporting a second-growth stand of medium-size red oak. Associates are paper birch, red maple, and bigtooth aspen, with an occasional white or red pine. The site was probably pine-dominated historically, but some of the oaks appeared to originate as stump sprouts, so it’s likely that oak has been an important component of this forest here for a long time.

A small, unnamed, undeveloped seepage lake occupies a hollow between the "drumlin" and East Ellerson Lake.

Site Significance

Large undeveloped lakes are scarce and becoming increasingly so. East Ellerson is an excellent, apparently undisturbed example of a lake type that is commoner in the Northern Highland landscape than anywhere else in the state.

The forested drumlin is a good site at which to focus on either oak management or pine restoration.

Several rare animals are documented residents at this.

Management Considerations

Maintaining the hydrology and water quality is essential to protect the important features of this site. Several outstanding aquatic features, all representing very different lake and stream types, are in close proximity: East Ellerson Lake; Camp Lake; Devine Lake; and the Trout River. Though the uplands between these waterbodies are and have been intensively managed (mostly for aspen), it is worth weighing the additional ecological benefits that might be derived from considering the lakes collectively. Forest management that would promote longer-lived species (oak and pine) is an appropriate consideration for this site. Relatively few sites were identified that offer short-term potential for protection and management of older oak forest.

EAST ELLERSON LAKE AND DRUMLIN			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1992
NORTHERN DRY-MESIC FOREST		NA	1995
ANIMALS			
A CAENID MAYFLY (CAENIS YOUNGI)		SC/N	1994
CYRANO DARNER (NASIAESCHNA PENTACANTHA)		SC/N	1994

43. SPARKLING CREEK CEDARS

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Boulder Junction
Town-Range-Section:	T41N-R6E-sec. 27 NE1/4
Size:	65 acres

Site Description

Sparkling Creek is a tiny, spring-fed tributary of the Trout River that originates in and drains a forested wetland composed mostly of northern white cedar, and locally, black ash. Canopy associates include black spruce, paper birch, and an occasional hemlock or white spruce. The canopy is quite open, and the gaps are typically filled with dense thickets of tall shrubs, especially speckled alder and red-osier dogwood. Many small pools are present.

The uplands around the swamp forest are intensively managed for aspen.

Site Significance

The swamp forest is not in good condition owing to past and present disturbances, but it is important as it feeds the Trout River, a stream of very high ecological significance. Sparkling Creek Cedars also supports several rare plant and animal species.

Management Considerations

Many of the trees in the center of the swamp are dead or stressed, apparently due to inundation caused by the presence of beaver dams on the creek. Deer browse is very heavy on species such as mountain maple, dogwoods, and ash saplings, and white cedar is not successfully reproducing beyond the seedling stage. Sites containing features of greater ecological significance occur just to the north, south, and west.

SPARKLING CREEK CEDARS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN WET-MESIC FOREST		NA	1994
ANIMALS			
BLACK-BACKED WOODPECKER (PICOIDES ARCTICUS)		SC/M	1992
BOREAL CHICKADEE (POECILE HUDSONICUS)		SC/M	1992
PLANTS			
NORTHERN BOG SEDGE (CAREX GYNOCRATES)		SC	1992

44. CAMP LAKE AND PINES

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Woodruff, Boulder Junction
Town-Range-Section:	T41N-R6E-secs. 27 S1/2, 26 SW1/4SW1/4
Size:	258 acres

Site Description

This site features two glacial kettle lakes separated by a narrow isthmus forested with large white and red pines. The pine forest, though small in extent, is mature and shows little evidence of recent disturbance. Old-growth structural characteristics are beginning to appear.

Camp Lake is a deep seepage lake with extremely soft, clear water and a sand and gravel bottom. The flora includes a number of plants which have special adaptations to the highly oligotrophic conditions. Both the lake type and the unusual flora associated with it are better represented in this ecoregion than elsewhere in the state. Camp Lake is entirely bordered by a forested upland shoreline.

Just to the east is a small unnamed lake. This waterbody is also a seepage lake, but shallow and with a muck bottom. Acid, semi-open peatlands of muskeg and open bog surround this lake.

Site Significance

The lakes and wetlands are undisturbed and are excellent representatives of common types in the Northern Highland landscape. The dry-mesic pine forest community, while small, is mature and developing the characteristics of an old-growth stand. These characteristics are currently very rare for this forest type throughout northern Wisconsin. The close proximity of two strongly contrasting waterbodies affords an unusual opportunity for certain types of protection, research and education.

The lakes support several rare plant species, and the adjacent forest provides habitat for rare birds.

Management Considerations

Camp Lake and Pines should be considered for strong protective designation to protect the site from future development and potentially adverse impacts to water quality and sensitive species. Management activities should eliminate or minimize negative impacts to water quality, natural communities, and rare species populations located here.

Camp Lake, with its ultra-soft water, is highly vulnerable to acidification if regional air quality was to deteriorate.

Managing to increase both the amount and the age of pines and other conifers in the forest surrounding the site is a worthwhile consideration. The small stand of existing older forest between the lakes may eventually require intervention of some sort to ensure its perpetuation. Diversifying tree composition in the immediate vicinity of the lakes (primarily aspen) would help assure the continuation of the pine-dominated community should it be subject to a severe disturbance event.

CAMP LAKE AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1993
NORTHERN DRY-MESIC FOREST		NA	1993
PLANTS			
HIDDEN-FRUITED BLADDERWORT (UTRICULARIA GEMINISCAPA)		SC	1994
NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1994

45. DEVINE LAKE - MISHONOGAN CREEK

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Woodruff
Town-Range-Section:	T40N-R6E-secs. 3 W1/2NW1/4, 4 N1/2NE1/4 T41N-R6E-secs. 33 SE1/4SE1/4, 34 S1/2SW1/4, SW1/4SE1/4
Size:	1,453 acres

Site Description

This shallow undeveloped lake is fed by numerous alkaline springs. The springs flow through a diverse mosaic of herbaceous, shrub, and forested wetlands which fill the basin around the lake and are especially prominent on the north and east sides. The flora of this wetland complex is exceptional.

Mishonogan Creek, the lake's outlet stream, is bordered by alder thicket, muskeg, small stands of white cedar, and patches of boggy black spruce-tamarack swamp. The invertebrate life of this stream is significant in its diversity and representativeness.

A small island in the lake is forested with second-growth dry-mesic hardwoods (paper birch, red maple), plus white pine and balsam fir. Aspen dominates the rolling uplands around the site, though there is some potential to manage for greater forest diversity because of the presence of remnant conifers (fir, white and red pine, white spruce).

Site Significance

This site a unique complex of alkaline spring lakes and associated wetlands that are especially rare in this ecoregion. The opportunity to protect a significant portion of the undeveloped outlet stream is also unusual.

This site supports many rare species, some of them represented by large populations. The critical habitats include both open and forested wetlands, shrub swamp, springs, and the lake's outlet stream.

Management Considerations

This site should be considered for strong protective designation with an emphasis on protecting site hydrology and water quality. The impacts on this site from clearcutting throughout the watershed are unknown at this time. All upland management actions should be evaluated to determine the impacts to the rare springs and associated wetlands.

Two other important sites featuring aquatic communities occur approximately 1 mile to the north. Options to manage for longer-lived species, especially conifers, in the vicinity of and between these sites, merit thorough exploration.

DEVINE LAKE - MISHONOGAN CREEK			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN SEDGE MEADOW		NA	1993
NORTHERN WET FOREST		NA	1993
SPRING LAKE		NA	1995
ANIMALS			
AMERICAN BITTERN (BOTAURUS LENTIGINOSUS)		SC/M	1993
AMERICAN BLACK DUCK (ANAS RUBRIPES)		SC/M	1993
BOG COPPER (LYCAENA EPIXANTHE)		SC/N	1995
BOREAL CHICKADEE (POECILE HUDSONICUS)		SC/M	1993
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		SC/M	1993
LE CONTE'S SPARROW (AMMODRAMUS LECONTEII)		SC/M	1993
OSPREY (PANDION HALIAETUS)		THR	1992
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1993
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1994
PLANTS			
COMMON BOG ARROW-GRASS (TRIGLOCHIN MARITIMUM)		SC	1995
LEAFY WHITE ORCHIS (PLATANTHERA DILATATA)		SC	1995
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1995
SHEATHED SEDGE (CAREX VAGINATA)		SC	1993
SPARSE-FLOWERED SEDGE (CAREX TENUIFLORA)		SC	1993
SWAMP PINK (ARETHUSA BULBOSA)		SC	1995

46. BLACK TERN BOG

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Woodruff
Town-Range-Section:	T40N-R6E-sec. 12 NE1/4NE1/4
Size:	28 acres

Site Description

This glacial kettle depression contains two small ponds bordered by a quaking mat of sphagnum mosses, sedges, and ericaceous shrubs. The rich flora includes insectivorous species, orchids, and at least three rare plants. The water chemistry, and the composition and structure of the vegetation, indicate that this wetland community is more appropriately classified as a poor fen than a bog.

One rare invertebrate has been documented at the site. A colony of black terns was present until the mid-1980s, but that species has not bred here since then.

The uplands surrounding the complex are forested with nondescript stands of second or third growth aspen and paper birch.

Site Significance

Black Tern Bog was established as a State Natural Area in 1967. Along with several of the other SNAs in the vicinity, it has been used extensively as a teaching and research site by University of Wisconsin botanists and plant ecologists. Though small, the site contains a very good example of a glacial kettle wetland with better than average plant diversity.

Management Considerations

Conservation values at this site are somewhat compromised by small stand size and the immediate proximity of heavily-used US Highway 51. Protection of the water chemistry and hydrology are high priorities and efforts need to be made to ensure that transportation planners and road maintenance crews are aware of the ecological value and sensitivity of these wetlands. Continued use as an educational site is appropriate here.

BLACK TERN BOG			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
POOR FEN		NA	1995
ANIMALS			
A CADDISFLY (BANKSIOLA DOSSURIA)		SC/N	1983
BLACK TERN (CHLIDONIAS NIGER)		SC/M	1978
PLANTS			
HIDDEN-FRUITED BLADDERWORT (UTRICULARIA GEMINISCAPA)		SC	1995
ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1995
SWAMP PINK (ARETHUSA BULBOSA)		SC	1972

47. VANDERCOOK LAKE AND PINES

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Woodruff
Town-Range-Section:	T41N-R6E-sec. 36 SE1/4, SE1/4NE1/4; T41N-R7E-sec. 31 SW1/4
Size:	119 acres

Site Description

Rolling sands north of Vandercook Lake support a mature forest of large white and red pines. Associates include red and sugar maples, red oak, and balsam fir. White pine seedlings and small saplings are locally common, but in general, hardwood and fir reproduction is prevalent. This site has a variable cutting history, with no recent activity in the best-developed patches. The surrounding forest is younger, composed mostly of pole-size red maple and paper birch, with scattered red oak and white pine.

The south half of the lake is ringed with dwellings. The lake was stocked once in the past.

Site Significance

Historically the most widespread forest type in this landscape, mature stands of white and red pine are now much less extensive and almost always composed of relatively young trees.

Management Considerations

This site could serve as an appropriate nucleus for pinery restoration in the adjoining forest, especially to the east and south. Pine should be emphasized and featured when making future management decisions. Establishment of an old-growth core area would maintain or permit the development of a limited successional stage and to maintain or increase four-toed salamander habitat. Protection of this site will maintain the potentially largest four-toed salamander preserve in the Great Lakes region.

VANDERCOOK LAKE AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1994
ANIMALS			
FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)		SC/N	1996
PLANTS			
NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1976
SHORE SEDGE (CAREX LENTICULARIS)		THR	1995

48. MANN CREEK PINES

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5’ Quadrangle:	Boulder Junction
Town-Range-Section:	T41N-R7E-sec. 30 SW1/4
Size:	17 acres

Site Description

The uplands just east of Mann Creek support a mature dry-mesic forest dominated by large to medium-size red pine. Among the canopy associates are white pine, red oak, and paper birch. Balsam fir is abundant in the sapling layer. Typical understory plants include bracken fern, blueberries, wintergreen, and barrens strawberry.

Mann Creek is impounded, creating a small flowage bordered by small patches of emergent marsh and sedge meadow, and more extensive stands of muskeg and black spruce swamp.

Site Significance

Mature, intact stands of pine-dominated dry-mesic forest are uncommon on the NHAL at the present time.

Management Considerations

The major conservation limitations of this site are the small acreage of upland forest present and its location next to a heavily used county highway. In addition, the pine forest was at least partially thinned recently, somewhat reducing its natural values.

MANN CREEK PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1994
ANIMALS			
WATER SHREW (SOREX PALUSTRIS)		SC/N	1946

49. TROUT LAKE CONIFER SWAMP

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Boulder Junction
Town-Range-Section:	T41N-R7E-sec. 19 SE1/4SE1/4
Size:	26 acres

Site Description

This site consists of a small, steep-sided wet depression located at the southeastern corner of Trout Lake. The major plant community is a mature wet-mesic forest dominated by medium-size white cedar, with balsam fir and black ash among the important associates. Cedar reproduction is currently poor. The herbaceous flora is diverse, and includes a rich array of mosses, sedges, orchids, and other plants.

The resident birds include a representative subset of the species typically found in the regional lowland conifer forests during the breeding season. One rare invertebrate is known from this site.

The adjoining uplands are vegetated with second-growth stands of dry-mesic forest composed of bigtooth aspen, paper birch, red oak, red maple, and balsam fir.

The site is crossed by an old, abandoned railroad grade. Several homes are located on the nearby shore of Trout Lake. County highways “M” and “N” are just to the east and south of the site, respectively.

Site Significance

Trout Lake Conifer Swamp was established as a State Natural Area in 1953 and has a long history of use by University of Wisconsin plant ecology and botany classes. The UW maintains a research and teaching facility on the south shore of Trout Lake, just to the west of the site.

Cedar swamps are uncommon in this ecoregion and this site contains a good, albeit small, example.

Management Considerations

The major conservation limitations of this site are its small size, isolation, and vulnerability to excessive browse. Despite these shortcomings, the site does contain a floristically rich cedar swamp, and is well suited for its intended educational use. No changes from the present situation are suggested but the browse sensitivity of white cedar should be considered when making management decisions for the adjacent upland forests.

TROUT LAKE CONIFER SWAMP			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN WET-MESIC FOREST		NA	1991

50. TROUT LAKE PINES

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Boulder Junction
Town-Range-Section:	T41 N-R7E-secs. 7, 8
Size:	67 acres

Site Description

A remnant stand of very old, huge white and red pines occurs on the south side of Trout Point, a mile long peninsula on the east side of Trout Lake that partially separates that lake into two major basins. Associates include red oak and red maple, the latter being dominant in the sapling stratum. A dense layer of beaked hazelnut is prominent, especially on the flat top of the peninsula. The old-growth stand occupies a very narrow strip, often less than 100’ wide, and is bordered by a second-growth hardwood-dominated forest on the north, pine plantations on the east, and Trout Lake to the south and west.

An extensive undeveloped sand beach runs along the south edge of the point. UW-Madison plant ecologist John Curtis and his colleagues studied the beach a half century ago. The data collected contributed to the section on “inland” (i.e., not on the Great Lakes) beaches and were incorporated into his seminal work, “Vegetation of Wisconsin” (1959). The beach and adjoining offshore area are of additional scientific interest and value because they support an invertebrate fauna containing many species more characteristic of “lotic” (flowing) habitats.

Site Significance

Stands of the dry-mesic forest community in or approaching old-growth successional stages are extremely rare in the present-day forest. The conservation values of the pine forest are limited because of small size and linear configuration. The natural composition and structure of the forest have been altered by past cutting, the long-term suppression of wildfire, and recreational use.

At least two rare animal species are resident at this site (NHI field notes, 1992).

Management Considerations

Aesthetics may be a greater concern here than pine forest ecology, as the site is small and isolated and receives fairly heavy use by visitors. Trout Lake is well known for its scenic qualities. Eventually, the impacts of fire suppression may necessitate evaluating the difficulties inherent in maintaining pine communities on certain sites using silvicultural methods alone.

The beach and adjacent littoral zone would benefit from continued or expanded protection. Note that on the site map, the boundary does not extend far enough to the east to encompass the entire beach.

TROUT LAKE PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1992

51. HEMLOCK LAKE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Hazelhurst, Woodruff
Town-Range-Section:	T39N-R7E-secs. 7, 8, 17, 18.
Size:	473 acres

Site Description

This site is 2 miles southeast of Woodruff, just off of STH 47. The natural features include stands of older mesic hemlock-hardwoods, dry-mesic white pine-red pine forest, several wetland communities, and four small, undeveloped seepage lakes. Hemlock Lake has been stocked at least seven times in the past.

Site Significance

Older forests, especially conifer-dominated stands, are relatively rare in the NHAL and the surrounding region today. Several rare animals inhabit the site and at least two rare plants occur in Hemlock Lake.

Management Considerations

A forested portion of the site adjoining both sides of STH 47 suffered heavy wind damage recently and has been salvaged (logged). Additional logging has been proposed for undamaged but mature stands of natural pine forest along and just west of STH 47 (see **Timberlane Pines #52**). Contextually, it is desirable to maintain and enhance stands of older conifer-dominated forest to meet the habitat needs or preferences of species dependent on these covertypes while accommodating natural disturbance events. The existing road system, however, along with other development, limit the conservation opportunities at both Hemlock Lake and Timberland Pines.

Future stocking of the lake should be carefully reviewed for impact to the aquatic community.

A trail system accommodates educational and recreational use of the site by hikers and cross-country skiers.

HEMLOCK LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN MESIC FOREST		NA	1997
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1976
OSPREY (PANDION HALIAETUS)		THR	1992
PLANTS			
PURPLE BLADDERWORT (UTRICULARIA PURPUREA)		SC	1995
ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1995

52. TIMBERLANE PINES

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5’ Quadrangle:	Hazelhurst
Town-Range-Section:	T39N-R7E-sec.18
Size:	144 acres

Site Description

A mature dry-mesic forest dominated by large white and red pines occupies a good portion of a sandy, gently rolling peninsula between Mid and Minocqua Lakes. Associated trees include red maple, red oak, bigtooth aspen, black cherry, and paper birch. Balsam fir saplings are common throughout the site, with sapling white pine locally prevalent in canopy gaps. The groundlayer consists of beaked hazelnut, bracken fern, blueberries, wintergreen, barrens strawberry and others. The stand south of Timberlane Road and west of state highway 47 is intact. To the north of Timberlane Road, heavy salvage logging occurred following severe damage caused by a recent windstorm.

Site Significance

Mature, conifer-dominated stands of this forest community, once the most characteristic type of this ecoregion, are presently uncommon. Old-growth stands are almost nonexistent. This property has a key role to play in the representation of all successional stages and appropriate patch sizes of dry-mesic white and red pine forest in Wisconsin.

Management Considerations

Small stand size and isolation are the major factors limiting the ecological value of this site. Nevertheless, the site should be considered for some protective designation because of the high importance of this community in the Northern Highlands landscape and the overall good quality of the remnant pine forest.

TIMBERLANE PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1994
OPEN BOG		NA	1982

53. ZOTTLE LAKE

Ecoregion:	Northern Highland Pitted Outwash
USGS 7.5’ Quadrangle:	Lake Tomahawk
Town-Range-Section:	T39N-R7E-sec. 34
Size:	44 acres

Site Description

This 30 acre, 38 feet deep, soft water seepage lake has clear alkaline water and a firm sand bottom. In some areas there is a thin layer of organic material overlying the sand. The aquatic flora consists mostly of highly specialized species from the “sterile rosette” group, such as water lobelia, pipewort, quillwort, and the rush, *Juncus pelocarpus*.

The shoreline is almost entirely upland, and the second –growth forest around the lake is mostly of hardwoods, with paper birch dominant.

Site Significance

This site contains a good example of one of the important lake types (a highly oligotrophic seepage lake with a hard bottom) in this ecoregion.

Management Considerations

Protection should be relatively easy as state ownership encompasses the entire shoreline. Present use levels do not appear to be causing problems, but water quality must be protected to maintain the rare community. Lakes of this type are vulnerable to acidification if regional air quality declines.

ZOTTLE LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1993

54. TOMAHAWK LAKE HEMLOCKS

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Lake Tomahawk, Hazelhurst
Town-Range-Section:	T38N-R7E-sec. 4 NW1/4, NE1/4SW1/4
Size:	220 acres

Site Description

This site encompasses an upland peninsula on the southeast side of Tomahawk Lake. A diverse representation of older mesic forest is present. The cover types represented include hemlock, mixed hemlock-hardwoods, and hardwood stands composed mostly of yellow birch, sugar maple, and red oak. A few supercanopy white pine are present, and white pine saplings are common on a steep southwest-facing slope under paper birch-sugar maple pole timber. Hemlock reproduction is excellent at several locations within this site.

Other features at this site include small stands of open bog and black spruce swamp, a bog pond (small, deep, soft water), and approximately one mile of undeveloped lake shoreline.

Site Significance

Evidence of past logging was evident throughout the site, but recent harvest has been minimal. There is a high potential to do significant research on hemlock reproduction here, if the forest management and disturbance history can be worked out in sufficient detail. Protection of this site warrants serious consideration, as older stands of mesic forest, particularly those in which hemlock is successfully reproducing, are rare in this part of the Northern Highland.

Management Considerations

State ownership here is limited and protection of the natural communities and lake shoreline will require cooperation among the various landowners and stakeholders.

TOMAHAWK LAKE HEMLOCKS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN MESIC FOREST		NA	1992

55. HORSEHEAD LAKE PINE-OAK FOREST

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Lake Tomahawk
Town-Range-Section:	T38N-R7E-secs. 11, 10
Size:	226 acres

Site Description

The pitted glacial outwash landform supports second-growth dry-mesic forest of white and red pines, red oak, red maple, and paper birch. Parts of this site are forested with relatively pure stands of pole-size hardwoods. The robust shrub layer is composed of hazelnuts and maple-leaved viburnum. White pine is reproducing well locally.

Site Significance

This forest type was historically prevalent over a large portion of this ecoregion. Presently, stands dominated by large pines are scattered throughout the state forest, often separated by other covertypes or plantations. Acreages of the pine remnants are typically small.

The herb layer is relatively diverse for this forest type, containing some "southern" elements as well as the species more characteristic of this region.

Management Considerations

This site is isolated, with roads on three sides and a lake on the fourth. This poses limitations for strong protective status. Extended rotations and an increased pine component would help maintain and expand the northern dry-mesic communities here.

HORSEHEAD LAKE PINE-OAK FOREST			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1998
ANIMALS			
CERULEAN WARBLER (DENDROICA CERULEA)		THR	1992
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		SC/M	1992

56. TWO LAKES PINE-OAK FOREST

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Lake Tomahawk
Town-Range-Section:	T38N-R7E-secs. 16, 15
Size:	181 acres

Site Description

Gently rolling, sandy terrain bordered by three kettle lakes is forested with mature stands of white and red pines and red oak. The oldest, least disturbed stands are developing old-growth structural characteristics, including a supercanopy of very large pines. In most areas tree reproduction is strongest by red and sugar maples, and balsam fir, but locally, sapling white pine are common. The moderate to dense shrub layer is composed of beaked hazel and maple-leaved viburnum. Blueberries, bracken fern, wintergreen, wild sarsaparilla, and rice grass are common herbs/low shrubs throughout the site.

Within this site there are small stands of mature mesic forest composed of large hemlock, yellow birch, basswood, and sugar maple, as well as several boggy kettle wetlands.

Site Significance

Older successional stands of the formerly prevalent white pine-red pine forest community are now rare throughout Wisconsin.

Management Considerations

The site is not large, and private lands on and near the lakeshores continue to be developed. Management options are somewhat limited as the site is becoming increasingly isolated.

TWO LAKES PINE-OAK FOREST			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1998

57. WIND PUDDING LAKE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Hazelhurst, Lake Tomahawk
Town-Range-Section:	T38N-R7E-secs. 20, 21, 28,29
Size:	410 acres

Site Description

This large, softwater seepage lake contains several basins, each with distinctive characteristics. The shallow, muck-bottomed areas support dense growths of aquatic vegetation, which in turn support rare plant and animal life. The southeastern basin is deep, with sand and gravel the predominant bottom materials. A well-developed "sterile rosette" flora occurs here, with several of these plants either rare or quite restricted in range in Wisconsin. Wind Pudding Lake has been stocked at least eight times.

A good representation of waterbirds (both residents and migrants) was noted.

The uplands are forested with second and third growth stands of aspen, paper birch, and red oak. A few scattered red and white pines are present. The rough pitted outwash terrain is pocked with deep, steep-sided depressions, several of which contain small ponds (at least periodically).

The westernmost basin is developed with several homes on and near the shoreline.

Site Significance

The lake is a designated State Natural Area, and was initially recommended for special protection because of its high quality wetland communities, unusual flora, and rare species.

Management Considerations

This site should maintain its strong protective designation. However, there have been past attempts to dredge a channel to connect the west basin with the remainder of the lake. This activity should be prohibited to protect the eastern portion of the lake containing intact stands of sensitive wetland vegetation, and supporting a number of rare species. Minimizing future development would help to maintain the important natural communities of this site.

Future stocking of the lake should be carefully reviewed for impact to the aquatic community. Damage to the beds of aquatic vegetation is likely if the use of motorized watercraft were to increase. There is also the possibility of introducing invasive species to the site.

There is a 400 feet no-cut zone around that part of the lake with protective designation. However, much of the upland beyond this zone has been recently logged. A portion of the no-cut zone was cut, in a salvage operation following windstorm damage in the mid-1980s.

WIND PUDDING LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1995
NORTHERN DRY-MESIC FOREST		NA	1979

WIND PUDDING LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
ANIMALS			
MOTTLED DARNER (AESHNA CLEPSYDRA)		SC/N	1994
PLANTS			
FARWELL'S WATER-MILFOIL (MYRIOPHYLLUM FARWELLII)		SC	1994
HIDDEN-FRUITED BLADDERWORT (UTRICULARIA GEMINISCAPA)		SC	1994
PURPLE BLADDERWORT (UTRICULARIA PURPUREA)		SC	1995
ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1978

58. HAWK LAKE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Lake Tomahawk
Town-Range-Section:	T38N-R7E-sec.23
Size:	19 acres

Site Description

Hawk Lake is a 10 acre kettle bog situated in pitted glacial outwash. A small bay on the northwest side of the lake features an undisturbed but very narrow open mat of sphagnum mosses, ericaceous shrubs, sedges, and insectivorous plants. Away from the lake shore the open mat grades into a muskeg and acid conifer swamp with black spruce and tamarack prominent. Much of the shoreline is upland.

The uplands are forested with second-growth, managed stands of white and red pines, red oak, red maple and paper birch.

Site Significance

The site contains a small but representative example of a widespread northern Wisconsin wetland community. At least one rare plant species occurs here.

Management Considerations

No special management should be necessary to afford the wetlands an adequate level of protection. The compartment reconnaissance indicates a relatively high concentration of pine in the vicinity of Hawk Lake, though aspen stands and pine plantations break up the natural pine forest somewhat. Additional survey work in the uplands is desirable here.

HAWK LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
OPEN BOG		NA	1996
PLANTS			
SWAMP PINK (ARETHUSA BULBOSA)		SC	1996

59. MCNAUGHTON CONIFER SWAMP

Ecoregion:	Northern Highlands Pitted outwash
USGS 7.5' Quadrangle:	McNaughton Conifer Swamp
Town-Range-Section:	T38N-R7E-secs. 25, 36; T38N-R7E-sec. 31 T37N-R7E-sec. 1; T37N-R8E-sec. 6
Size:	409 acres

Site Description

McNaughton Swamp contains a large bog forest dominated by black spruce, with tamarack as the major canopy associate. Minor associates include white cedar, black ash, balsam fir, red maple, and paper birch. The understory in the undisturbed interior areas is composed mostly of ericaceous shrubs and sedges over sphagnum mosses. The Wisconsin River is just to the east of the site.

Boreal animals such as Gray Jay and Boreal Chickadee are resident here, and further investigation would likely identify others from this group.

The site is bisected by STH 47, a busy thoroughfare connecting Rhinelander with Woodruff-Minocqua. An abandoned railroad right-of-way also crosses the site. There have been some apparent changes to site hydrology, with minor ponding on the up slope sides of these corridors, and diversion of water away from the down slope sides. Given that the wetlands here are still, for the most part, intact, it would be useful to monitor further changes in the vegetation.

Site Significance

This site contains one of the larger, potentially more viable, stands of black spruce forest in the region. The primary conservation drawbacks are the impacts of several major rights-of-way on site hydrology, the fragmentation caused by those rights-of-way, and the relatively complex ownership pattern. A relatively small portion of this site is within the state forest boundary.

Management Considerations

Given the complex ownership pattern of this site, an integrated management plan would provide needed additional field survey, a more thorough regional analysis, and more effective protection to the important natural resources existing here. Current management of the state-owned portion of the site should continue to protect the area from any additional adverse impacts.

MCNAUGHTON CONIFER SWAMP			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN WET FOREST		NA	1993
ANIMALS			
BOREAL CHICKADEE (POECILE HUDSONICUS)		SC/M	1993
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1992

60. RAINBOW WETLANDS

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Dam Lake, Lake Tomahawk
Town-Range-Section:	T39N-R8E-secs. 21, 22, 27, 28
Size:	2,536 acres

Site Description

South and east of the Rainbow Flowage, an impounded stretch of the Wisconsin River, there is a large peatland of sedge meadow, shrub swamp, open bog, and muskeg. Low sandy ridges and "islands" within this wetland support a dry forest composed mostly of jack and red pines.

The wetlands closest to the flowage are floristically rich and comprise a complicated mosaic of shrub thicket (willows, bog birch, alder) and sedge-dominated openings. The flora includes a number of species that were seldom (in a few cases, never) encountered in other northcentral Wisconsin wetlands.

To the northeast, the wetland is more acidic, composed mostly of bog species, with a thick base of sphagnum mosses providing the substrate upon which sedges, ericaceous shrubs, and stunted black spruce and tamarack grow. Unusually large populations of rush aster and bog goldenrod were noted. A small, deep seepage lake with very soft water and a muck bottom is present on the southeast edge of the site.

The nearly level sandy uplands bordering the site are forested with pines and aspen. Some of the pine is plantation grown, but there are some good quality, though small, natural stands of pine on the narrow sand ridges within the bog-meadow complex.

Site Significance

This site contains one of the largest peatlands on the State Forest. The diverse community mosaic includes uncommon as well as representative types, and the flora follows suit. Additional protection for peatlands is warranted beyond what has been extended to them thus far in this ecoregion.

Several rare species were documented here.

Management Considerations

This site should be considered for strong protective designation. Protection of site hydrology and water quality are key to maintaining the important communities and rare species at this site. The impacts of fluctuating water levels on the site’s natural communities are unknown but should receive additional study. Management of the flowage does not appear to have affected the interior of the wetland and negative impacts to the western fringe have not been identified. Periodic wetland monitoring would identify the presence of invasive species.

Though peatland protection deserves emphasis here, the uplands do present an opportunity to manage and/or restore xeric conifer forests. The many waterbodies and wetlands in the local landscape, and their ability to serve as fire breaks, potentially increase the feasibility of fire management.

RAINBOW WETLANDS			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY FOREST		NA	1993
NORTHERN SEDGE MEADOW		NA	1993
OPEN BOG		NA	1993
ANIMALS			
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1992
NORTHERN HARRIER (CIRCUS CYANEUS)		SC/M	1993
OSPREY (PANDION HALIAETUS)		THR	1992
PLANTS			
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1995
SHEATHED SEDGE (CAREX VAGINATA)		SC	1995

61. BIG SWAMP

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Dam Lake
Town-Range-Section:	T39N-R8E-portions of secs. 34-36; T38N-R8E-portions of secs. 1-3, 10-13; T38N-R9E-portions of secs. 6, 7.
Size:	4,592 acres

Site Description

This vast peatland complex harbors extensive stands of muskeg, open bog, poor fen and sedge meadow and an undeveloped seepage lake. Small but significant stands of mature white and red pine forest are also present. Thickets of alder-dominated shrub swamp occur along the wetland margins.

Site Significance

Acid peatlands are common and extensive in the Northern Highlands ecoregion. Big Swamp is one of the largest and least disturbed examples on the State Forest, and should be capable of supporting viable populations of most if not all of the resident plants and animals. The diverse natural community mosaic encompasses wetlands, uplands, and aquatic features and constitutes an excellent example of a representative Northern Highlands Pitted Outwash landscape.

Several rare plant and animal species have been documented here (some species not included in the site table-see page B-1).

Management Considerations

This site should be considered for strong protective designation. Wetlands in the northernmost portions of the site have been destroyed or altered by commercial developments. Future monitoring would identify any related future adverse impacts. Merging this site with the next (Swanson Lake and Pines) should be considered for management purposes. They adjoin one another and there are ecological benefits to be achieved due to the addition of species (some of them rare) and natural communities, and the increase in scale.

BIG SWAMP			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN SEDGE MEADOW		NA	1982
OPEN BOG		NA	1993
PLANTS			
SWAMP PINK (ARETHUSA BULBOSA)		SC	1993

62. SWANSON LAKE AND PINES

Ecoregion:	Northern Highlands Pitted outwash
USGS 7.5' Quadrangle:	Dam Lake
Town-Range-Section:	T38N-R8E-secs. 3, 4 E1/4.
Size:	504 acres

Site Description

This site includes 3 softwater seepage lakes, muskeg, alder thicket, and dry-mesic forest of pine and oak.

The lakes are small (22, 10, and 1.4 acres), undeveloped, and support unusual aquatic life. The wetlands are of the acid peatland group, and include bog forest of black spruce and tamarack, semi-open muskeg to the north of Swanson Lake, and alder thicket along Muskellunge Creek, the site's eastern boundary.

The dry-mesic forest is second-growth but mature, composed of large to medium-size red pine, red oak, paper birch, red maple and white pine. Tree reproduction is primarily by red maple, with white pine and balsam fir saplings also noted. The moderately dense shrub layer consists mostly of beaked hazelnut. Adjoining upland stands have been clear-cut and are dominated by aspen.

Site Significance

This site contains one of the American Legion's better second-growth pine forests in that this site, unlike most others in this part of the NHAL, is less isolated by roads, plantations, residences, checkerboard ownership, or other factors. The immediate context of the upland forest includes extensive undisturbed wetlands of several types and highly significant aquatic features, which are additional benefits.

The lake supports several rare plant species.

Management Considerations

This site should be considered for strong protective designation. Because of the remote location and prevalence of wetlands at this site, management of the pine-oak forest with prescribed fire may be feasible and practical. However, until such management prescriptions are possible, the entire site, including the uplands, should be protected. The area of consideration should include Big Swamp, a vast, important peatland just to the east of Swanson Lake and Muskellunge Creek.

Managing the existing aspen stands towards greater representation of long-lived species (such as red and white pines and red oak) would provide a larger, more viable block of this forest community. Aspen is abundant throughout this landscape and mature pine-oak forest is now relatively uncommon.

SWANSON LAKE AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1993
LAKE--SHALLOW, SOFT, SEEPAGE		NA	1995
NORTHERN DRY-MESIC FOREST		NA	1993

SWANSON LAKE AND PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
PLANTS			
ALGAE-LIKE PONDWEED (POTAMOGETON CONFERVOIDES)		THR	1995
FARWELL'S WATER-MILFOIL (MYRIOPHYLLUM FARWELLII)		SC	1995
HIDDEN-FRUITED BLADDERWORT (UTRICULARIA GEMINISCAPA)		SC	1995
PURPLE BLADDERWORT (UTRICULARIA PURPUREA)		SC	1995

63. PICKEREL LAKE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Dam Lake
Town-Range-Section:	T38N-R8E-sec. 13
Size:	206 acres

Site Description

This site contains an undeveloped 59 acre drainage lake, several wetland communities, and a small stand of dry-mesic red and white pine forest. The lake's maximum depth is 5 feet, the bottom materials are primarily muck and sand, and the soft, light brown water has low transparency. Aquatic vegetation is moderate in density, and includes emergent, submergent, and floating-leaved species. Representative among these are watershield, white water lily, spikerushes, bur-reeds, and several pondweeds. Indian Creek, a small headwaters stream, enters the southeast side of Pickerel Lake and exits on the northeast. Above Pickerel Lake, Indian Creek was not navigable at the time of our field survey.

The wetlands bordering the lake include sedge meadow, shrub swamp, and boggy, semi-open stands of black spruce and tamarack. These communities are essentially undisturbed but they are not extensive. The mature pine forest east of the lake is very small but has not been cut recently.

Site Significance

Development pressures are extremely high on lakes in northcentral Wisconsin. This site contains a very good example of a regionally representative but threatened aquatic ecosystem.

Management Considerations

The site is vulnerable to incompatible developments since some of the shoreline around Pickerel Lake is privately owned. Various options should be explored to protect this aquatic community.

PICKEREL LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1994

64. SHALLOW LAKE

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5' Quadrangle:	Dam Lake
Town-Range-Section:	T38N-R8E-secs. 22, 15.
Size:	128 acres

Site Description

This small, undeveloped, muck-bottomed seepage lake resides in a glacial kettle and is bordered on three sides by boggy conifer swamp and muskeg. A small stand of mature pine forest occurs east of the lake.

Site Significance

This waterbody has dense and diverse aquatic plant life and is especially notable for its concentration of rare species. Several of the rare plant populations are very large.

Lakes of this type are fairly common and are very representative features of the ecoregion. This site is especially important because of the opportunity to protect both representative and rare features.

Management Considerations

Shallow Lake and its surrounding wetlands and uplands should be considered for strong protective designation. The state does not own all of the land around the lake and the owners of the private tract should be contacted regarding the site's biological values and to explore mutual conservation interests and options.

SHALLOW LAKE			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
LAKE--SHALLOW, SOFT, SEEPAGE		NA	1994
SUBMERGENT AQUATIC		NA	1994
PLANTS			
ALGAE-LIKE PONDWEED (POTAMOGETON CONFERVOIDES)		THR	1994
HIDDEN-FRUITED BLADDERWORT (UTRICULARIA GEMINISCAPA)		SC	1994
NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1994
PURPLE BLADDERWORT (UTRICULARIA PURPUREA)		SC	1994
ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1994
WATER-THREAD PONDWEED (POTAMOGETON CAPILLACEUS)		SC	1994

65. STONE LAKE PINES

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Dam Lake
Town-Range-Section:	T38N-R9E-secs. 17 SW1/4, 20 NW1/4.
Size:	262 acres

Site Description

The primary feature of this site is a string of small upland "islands" within a boggy peatland that support remnant stands of old-growth xeric forest dominated by red pine. A few white pine are also present. The island edges are vegetated with dense growths of small balsam fir, black spruce, and an occasional white spruce. Very old snags charred by fire attest to the origin of these stands.

The surrounding peatlands are undisturbed, composed of a thick layer of sphagnum mosses which support a typical assemblage of sedges, ericaceous shrubs, and bog birch. Black spruce and tamarack are scattered throughout the wetland, with the trees occasionally reaching a density and stature approaching that of a closed forest.

Site Significance

The pine islands and adjoining peatlands are within a designated State Natural Area, selected to protect one of the very few locations in Wisconsin containing stands of old-growth pine forest. Though small patches of forest have certain conservation limitations, the scale represented by those occurring here is part of the natural range this community type exhibits naturally. This was true historically as well as at present.

Management Considerations

The major conservation limitation of the site is the very small stand size of the upland pine forest. In aggregate, the 4 or 5 pine islands total less than 15 acres. The feasibility of increasing the size of the older forest needs examination. There are stands of managed white and red pine-dominated forest in the area, (e.g., to the north on the "mainland"). The SNA perimeter does not follow any ecological boundaries and should be reviewed for adequacy. A burn plan for the site should be considered, although the pine stands are not presently in danger of succeeding to something else.

STONE LAKE PINES			
Common Name (Scientific Name)	Federal Status	State Status	Observation Date
COMMUNITIES			
NORTHERN DRY-MESIC FOREST		NA	1993
OPEN BOG		NA	1993

BOULDER FLATS PLANTATIONS (not represented on the site map)

Ecoregion:	Northern Highlands Pitted Outwash
USGS 7.5’ Quadrangle:	Boulder Junction
Town-Range-Section:	T42N-R7E-secs. 17-21, 28, 29
Size:	Indeterminate due to recent salvage.

Site Description

The sandy, nearly level glacial outwash deposits south and west of the village of Boulder Junction are forested primarily with plantations of red and jack pines. While not of "natural " origin, this concentration of extensive conifer cover is important to many wildlife species dependent in some way upon coniferous ecosystems. Evening grosbeaks, pine siskins, red crossbills, solitary vireos, and gray jays were all found inhabiting this site during their respective nesting seasons. Most often these species were observed in "dirty" stands (those with scattered oak or red maple, thickets of shrubs or small fir, snags) that had some structural diversity, and more often in jack pine than in red pine.

Some of the older plantations are developing diverse structures, and are maintaining or have developed a groundlayer component very similar to what would be expected in natural stands (however, in general, this is an uncommon situation in plantations and plantation landscapes).

Site Significance

The extent of conifer cover is the site’s primary feature of significance, which is prominent here but has diminished greatly in many other parts of northern Wisconsin. Recent management actions at this site (see section below) have altered stand structure but may have many positive benefits in the future as high conifer cover is maintained and the sites natural qualities increase.

Management Considerations

This site is a plantation-dominated landscape that is not included as a primary site because it is actively managed for timber production. However, it is a large site and provides important ecological values including extensive conifer cover and habitat for conifer-dependent forest-interior animals. Restoration of this site would create a large patch of natural conifer-dominated landscape with many ecological benefits.

Considerable harvest of older jack pine plantations has occurred in recent years, due both to an infestation of jack pine budworm which killed or damaged some trees, and an increasing threat of fire as trees died and the fuel load built up. In the areas recently harvested, scattered conifer stands of natural origin were retained, as were some hardwoods (mostly oaks, red maple, and cherries). The future forests should more closely resemble "natural" stands, and will still be conifer dominated.

Monitoring of the groundlayer vegetation through several rotations of plantations is worth consideration. Ideally, such a project would include both managed and unmanaged pine stands of natural origin to better understand the factors responsible for retaining the “desirable” native plant species (e.g., trailing arbutus, pipsissewa, moccasin flower, shinleaf, cow-wheat, blueberries, wintergreen, et al).

Local residents and business people are aware of the wildfire danger created by the heavy build-up of fuel at this site. Because of this, the Boulder Flats may be an unlikely choice for the implementation of a prescribed fire management plan at this time. This option should not be dismissed out of hand, however, and should receive further consideration elsewhere on the state forest.

ECOLOGICALLY SIGNIFICANT SITES OUTSIDE OF THE NHAL BOUNDARY

The following list of sites briefly describes significant natural features outside of the existing NHAL boundary. The sites are identified on Figure 8 in the main body of the report. While many of the sites are on public lands, some are privately owned and require permission to visit. We urge that private landowner's rights be respected at all times. We have omitted mention of several sites because of the lack of recent survey data or landowner sensitivity.

1. **Van Vliet Hemlocks** (Vilas Co.) – Good quality older growth hemlock-hardwoods forest and undisturbed kettle bogs are the primary features of this site.
2. **Crab Lake Hemlocks** (Vilas Co.) – Small stands of old-growth hemlock-hardwoods, wetlands, and shoreline that include rare species.
3. **Dunn Lake Pines** (Vilas Co.) – This State Natural Area straddles an undeveloped and remote stretch of the East Branch of the Presque Isle River, which flows through a stand of old-growth hemlock-hardwoods sporting a supercanopy of huge white pine.
4. **Border Lakes Landscape** * (Vilas Co.) – The area between the northern boundary of the NHAL, the Michigan-Wisconsin line, and the Ottawa National Forest features extensive stands of hemlock-hardwoods and many lakes.
5. **Palmer Lake State Trust Lands** (Vilas Co.) – This site contains managed old-growth hemlock-hardwood forest, undisturbed wetlands, and extensive frontage on Palmer Lake and the Ontonagon River.
6. **Deerpath Lake Peatlands** (Vilas Co.) – An extensive undisturbed peatland of open bog and poor fen occurs on this State Trust Land northeast of the State Forest. Small patches of old-growth hemlock forest occur on low ridges around and within the wetland.
7. **Sylvania Recreation Area** (State of Michigan) – Extensive tract of old-growth hemlock-hardwood forest in Upper Michigan's Ottawa National Forest.
8. **One Stone Lake Hemlocks** (Oneida Co.) – Fine stand of old-growth hemlock forest.
9. **Rice Lake and Thunder Lake Marsh** (Oneida Co.) – This shallow softwater drainage lake features good stands of emergent marsh and is bordered by extensive peatlands.
10. **Munninghoff Marsh** * (Oneida Co.) – This stretch of the Wisconsin River contains an extensive marsh of very good quality and supports a diverse macroinvertebrate fauna and several rare birds.
11. **Long Lake Hemlocks** (Oneida Co.) – Located just south of the NHAL border, this site supports a fine stand of old-growth mesic forest dominated by eastern hemlock.
12. **Gobler Lake** (Oneida Co.) – An undeveloped seepage lake just south of the Willow flowage is within an extensive, undeveloped, high quality acid peatland complex.
13. **Willow Flowage Recreation Area** (Oneida Co.) – The Willow Flowage is a large impoundment on the Tomahawk and Willow Rivers several miles south of the NHAL boundary. The adjacent uplands have been
14. **Tomahawk River Pines** (Oneida Co.) – This State Natural Area was purchased by the WDNR from the State Board of Commissioners of Public Lands (the "State Trust Lands" program, formerly within the Wisconsin Department of Justice). Natural features include several small but undisturbed stands

of old-growth red and white pine forest, and extensive wetlands of sedge meadow, shrub swamp, conifer swamp, and emergent marsh along the Tomahawk River.

15. **Kemp's Point Hemlocks** (Oneida Co.) – Also owned the University of Wisconsin, the grounds of the Kemp Station Research facility include a small stand of old-growth hemlock forest on the shore of Tomahawk Lake.
16. **Finnerud Pine Forest** (Oneida Co.) - Owned by the University of Wisconsin, this tract is a designated State Natural Area and contains a fine stand of old-growth to mature dry-mesic forest of red and white pines, red oak, red maple, and paper birch.
17. **Squirrel River Pines** (Oneida Co.) – This State Natural on the Squirrel River was selected primarily for its stand of mature red pine forest and wetlands bordering an undeveloped stretch of the Squirrel River.
18. **Patterson Hemlocks** (Oneida Co.) – This tract was purchased by the WDNR from the Patterson family to secure long-term protection for a stand of old-growth hemlock-yellow birch-sugar maple forest. This is one of very few old-growth mesic forest remnants in Wisconsin that includes a white pine supercanopy.
19. **Powell Marsh –** This large acid peatland complex (it's a marsh in name only) adjoins the State Forest. It is managed by the WDNR for wildlife, especially waterfowl.
20. **Bass Lake Preserve** (Iron Co.) – This privately owned conservation area protects an undeveloped lake, several small stands of older hemlock forest, and substantial wetland acreage.
21. **Goose and Reimer Lakes** (Iron Co.) – This extensive undeveloped peatland demonstrates some patterning, contains several seepage lakes, and support many rare species.
22. **Turtle Flambeau Flowage** (Iron Co.) – This recent WDNR acquisition adjoins the western edge of the State Forest. It features a large impoundment on the Flambeau River and is used primarily for recreation. Eagles, ospreys, and loons are among the many kinds of wildlife resident here.
23. **Chequamegon National Forest - Park Falls District** (Vilas - Price Cos.) – The northeastern corner of the Park Falls District of the Chequamegon National Forest contains a high concentration of mature to old-growth forest remnants, most of them conifer dominated or co-dominated, with high linkage potential to state lands.
24. **Hewitt Lake Track** (Iron Co.) – Hewitt is the largest in a complex of lakes northwest of the NHAL.

Appendix D

Natural Communities of the Northern Highland – American Legion State Forest

All natural community types are tracked by Wisconsin's NHI (cite NHI Working List). For rare communities or successional stages, as many stands of a given type as we can locate and make time for are surveyed. The information collected is then incorporated into the NHI database. For more common and widespread communities, the survey criteria are more restrictive, and include stand size, context, disturbance history, rare or declining seral stages or cover types, and potential to support rare or otherwise sensitive species.

There is no single standardized classification scheme for biotic communities so we have tried to maintain consistency with those types recognized on the NHI's natural community working list. In some cases we have referenced other classifications in the text, such as habitat types or cover types, that are in relatively wide usage by other groups.

COMMON NAME (SCIENTIFIC NAME)	FEDERAL STATUS	STATE STATUS	OBSERVATION DATE
ALDER THICKET		NA	1982
BLACK SPRUCE SWAMP		NA	1999
BOREAL FOREST		NA	1993
BOREAL RICH FEN		NA	1995
BRACKEN GRASSLAND		NA	1995
EMERGENT AQUATIC		NA	1994
EMERGENT AQUATIC – WILD RICE		NA	1999
EPHEMERAL POND		NA	1996
FLOODPLAIN FOREST		NA	1996
HARDWOOD SWAMP		NA	1993
INLAND BEACH		NA	1996
LAKE--DEEP, SOFT, SEEPAGE		NA	1997
LAKE--DEEP, VERY SOFT, SEEPAGE		NA	1995
LAKE--SHALLOW, SOFT, DRAINAGE		NA	1999
LAKE--SHALLOW, SOFT, SEEPAGE		NA	1996
MUSKEG		NA	1999
NORTHERN DRY FOREST		NA	1994
NORTHERN DRY-MESIC FOREST		NA	1999
NORTHERN MESIC FOREST		NA	1997
NORTHERN SEDGE MEADOW		NA	1996
NORTHERN WET FOREST		NA	1999
NORTHERN WET-MESIC FOREST		NA	1994
OPEN BOG		NA	1999
POOR FEN		NA	1996
SHRUB-CARR		NA	1981
SPRING LAKE		NA	1995

COMMON NAME (SCIENTIFIC NAME)	FEDERAL STATUS	STATE STATUS	OBSERVATION DATE
SPRING POND		NA	1993
SPRINGS AND SPRING RUNS, HARD		NA	1993
STREAM--FAST, HARD, COLD		NA	1995
STREAM--FAST, HARD, WARM		NA	1991
STREAM--SLOW, SOFT, COLD		NA	1993
STREAM—SLOW, WARM, HARD		NA	1999
SUBMERGENT AQUATIC		NA	1994
TAMARACK SWAMP		NA	1999
*Several additional aquatic community types are present on the NHAL and currently undergoing classification revision			

Forest Communities

Forest communities are dominated by trees, with canopy closure typically exceeding 50%. We endeavored to survey representative examples of all forest community types naturally occurring on the Northern Highland, focusing on larger stands, later successional stages, and less isolated patches. For all upland forest types in northern Wisconsin, older successional stages are now rare, and large patches of relatively homogeneous older forest are virtually absent.

Tree species associated with natural or anthropogenic disturbances and early successional stages such as trembling aspen, paper birch, and pin cherry, though historically present in the northern highland landscape, have increased greatly in abundance since the catastrophic logging episodes of the late-nineteenth and early twentieth centuries. Several other tree species have apparently also increased since the initial logging, including red maple and red oak. Monotypic plantations of red (and sometimes jack) pine have replaced vast acreages of the forest communities native to the region.

For all upland forest types in northern Wisconsin, older successional stages are now rare and large patches of relatively homogeneous forest are scarce or absent.

For additional information on forest communities of northern Wisconsin see Curtis (1959) and Kotar et al (1988).

Northern Dry Forest: Occurs on coarse textured sands, of very low nutrient content. Jack pine, red pine, and Hill's (or northern pin) oak are the characteristic dominants. Catastrophic fire at relatively short intervals (10-100 years) was historically responsible for initiating and regenerating stands.

Jack pine was a relatively minor component of the presettlement forests of the Northern Highland. A number of stands were converted to plantations, usually of red pine. Others have been converted to aspen.

Natural stands are not presently common on the NH-AL SF, but could be restored, managed and protected at several sites. As a natural community, this type has experienced a major statewide decline in acreage in recent years owing to a serious outbreak of jack pine budworm, the subsequent salvage of dead or dying trees, and the replanting of affected stands to red pine monocultures.

Inventory Sites: Johnson Creek Pines, Nixon Creek and Wetlands, Papoose Creek Pines, Rainbow Wetlands, Boulder Flats.

Northern Dry-mesic Forest: Somewhat richer and moister than the "dry" forests, this community was typically composed of white and red pines, with red oak, red maple, bigtooth and trembling aspens, paper birch, and balsam fir among the important associates.

This community comprised the matrix vegetation of the northern highlands pitted outwash ecoregion prior to European settlement.

In the past this region supported one of Wisconsin's greatest "pineries", and despite over a century of development, remains, arguably, the best location in the state at which to practice the largescale restoration, management, and protection of this community. Remnant stands are widespread and common, but old-growth successional stages and large contiguous patches of more than a few hundred acres are now rare. Vast acreages of former white and red pine forest have been converted to stands of aspen, paper birch, and plantation-grown red pine.

Inventory Sites: Manitowish River Wilderness Area, Stone Lake Pines, Bittersweet Lakes Complex, Stevenson Springs, Dry Lake Pines, Mud Creek Springs, Border Creek Springs, Swanson Lake and Pines, Horsehead Lake, Two Lakes Pines, Camp Lake, Allequash Lake, Lost Canoe Hardwoods, Trout Lake Pines.

Northern Mesic Forest: Forests of sugar maple, yellow birch, and hemlock covered over ten million acres of northern Wisconsin in the mid-nineteenth century. Because of the combined influences of sandy soils and periodic wildfire, the Northern Highlands region was vegetated primarily with drier forest types in which pines were often dominant. The major exception occurred in the forests of the Winegar Moraine ecoregion, on the northern fringes of the NH-AL SF, which were composed primarily of mesic species. Smaller, but significant patches of mesic forest occurred to the west of Powell Marsh and in the vicinity of Star and Plum Lakes.

Inventory Sites: Bittersweet Lakes Complex, Plum Lake Hemlock Forest, Lake Laura-Salsich Lake, Lake Alva Hemlock-Hardwoods, Catherine Lake Hemlock-Hardwoods, North Bass Lake Hemlocks, Rice Creek Complex, Toy Lake.

Boreal Forest: Mature stands of this circumboreal community are composed of white spruce and balsam fir, with admixtures of balsam poplar, paper birch, white pine, trembling aspen, and white cedar. This type (actually a complex of types) is not well represented in our state but was formerly extensive in the Lake Superior clay plain of northwestern Wisconsin. Under current climatic and edaphic conditions away from the Great Lakes, dominance by “boreal” species seems to be a temporary condition.

Inventory Sites: We documented no representative stands of boreal forest of more than a few acres on the NH-AL SF. The few remnants surveyed may be transitional to other, more widespread communities.

Northern Wet-mesic Forest: This lowland forest community is dominated by white cedar, often mixed with balsam fir, black ash, tamarack, and black spruce. Hemlock, yellow birch, and red maple may be locally important. The understory flora may be particularly diverse, and some stands are notable for the number of rarities they support.

This type is generally not as common on the Northern Highland as it is elsewhere in northern Wisconsin (e.g., the Chequamegon-Nicolet National Forest) but several exceptional occurrences were found here. There is concern among many scientists, land managers, and conservationists for the long-term viability of this community, as the dominant tree, white cedar, is a preferred browse species of the white-tailed deer. Cedar reproduction was poor in all inventoried stands of wet-mesic forest on the NH-AL SF. This holds true for the vast majority of white cedar stands we have surveyed elsewhere in northern Wisconsin as well.

Inventory Sites: Toy Lake, Rice Creek Complex, Trout Lake Conifer Swamp. Minor occurrences were documented at Seed Lake, Manitowish River Pines, and several other locations.

Northern Wet Forest: This type was previously used to classify acid conifer swamps composed of black spruce and/or tamarack. The Natural Heritage Inventory has split this type into two distinct communities, "**Black Spruce Swamp**" and "**Tamarack Swamp**". See descriptions below for additional information.

Black Spruce Swamp: The canopy of this nutrient-poor swamp conifer community is composed primarily of black spruce. The usual substrate is acid peat, and the groundlayer associates are very similar to those found in bog/muskeg communities but include more shade tolerant species. Among the typical understory plants are sphagnum spp. mosses, ericaceous shrubs (especially Labrador tea), three-leaved false Solomon's seal, creeping snowberry, and three-seeded sedge.

Inventory Sites: Rice Creek Complex, Manitowish River Pines, Lake Alva Hemlock-Hardwoods, Partridge Lake Connection.

Tamarack Swamp: Tamarack swamps typically occur on less acidic substrates and are floristically richer than the black spruce swamps. The influence of mineral-enriched groundwater is suggested by the presence of plants such as speckled alder, marsh marigold, Canada bluejoint grass, woodland horsetail, and dwarf raspberry, and a correspondingly diminished presence of sphagnum mosses and ericaceous shrubs. A recent, detailed re-examination of the vegetation as described in Wisconsin's original land survey in the mid-nineteenth century indicated that stands of large tamarack were formerly more common in the Northern Highland landscape than they are today.

Inventory Sites: Devine Lake.

Hardwood Swamp: Black ash is the canopy dominant in this nutrient-rich lowland forest community. Associates may include red maple, American elm, white cedar, and balsam fir, but nearly pure stands of ash are common in some areas. The tall shrub layer is usually well developed, composed of speckled alder, red-osier dogwood, mountain maple, native honeysuckles, and sapling ash. The herb layer can be quite diverse, supporting many sedges, grasses, and forbs. Swamp saxifrage, marsh marigold, and skunk cabbage are among the typical herbaceous representatives.

Though relatively rare in this ecoregion, one outstanding, diverse, extensive occurrence was documented. Because black ash swamps have only recently been recognized as a natural community type by the Natural Heritage Inventory, they are very poorly represented in special management areas to which a high level of protection has been granted.

Inventory Sites: Toy Lake. Small pockets of this type can occur on upland sites with impeded drainage owing to local soil conditions.

Floodplain Forest: Silver maple, green ash, box elder, and bur oak (or a bur X swamp white oak hybrid) are the trees most often found in this type in northern Wisconsin. The understory supports species such as tall coneflower, sensitive fern, Canada bluejoint grass, and a group of robust sedges.

Characteristic of the floodplains of the major rivers of southern Wisconsin where this community is much more extensive and diverse, in the Northern Highlands this is a minor type. Here it is found only in small stands within the floodplains of the region’s two largest rivers, the Wisconsin and Manitowish.

Inventory Sites: Manitowish River Pines, Wisconsin River.

Savanna Communities

Savannas are characterized by a scattered growth of trees interspersed with openings composed of herbs and shrubs. In northern Wisconsin, most of the savannas are classified as **Pine Barrens,** and consist of scattered

jack pine (and sometimes Hill's or bur oaks) with an understory of grasses and forbs usually associated with prairies. We found no stands of the Pine Barrens community on the NH-AL SF. See "**Bracken Grassland**" in the section on Herbaceous Communities.

Shrub Communities

Alder Thicket: Wet thickets of speckled alder are common across northern Wisconsin, where they often border sluggish streams and also occur along lakeshores.

This widespread community is a component of the vegetation mosaic of many of the NH-AL SF survey sites containing wetlands, but no stands of alder have been singled out for special conservation attention.

Inventory Sites: Northeast Springs Macrosite, Lower Manitowish River Macrosite, Plum Creek.

Shrub-carr: This wet shrub community is composed mostly of willows and red-osier dogwood. Though more characteristic of southern Wisconsin, shrub-carr occurs statewide. It is not especially common on the Northern Highland, but several large occurrences were documented.

Inventory Sites: Lower Manitowish River Macrosite, Rainbow Wetlands.

Open Bog (Muskeg): Deep layers of sphagnum mosses form the highly acidic substrate of this widespread community. Though the mosses are the real dominants, the more commonly recognized plants include a highly adapted group of ericaceous shrubs (cranberries, leatherleaf, bog laurel, bog rosemary), sedges, and insectivorous plants. Scattered, stunted individuals of black spruce and tamarack are also characteristic of bogs. "Muskeg" is the term often applied to bogs exhibiting this sparse growth of small (but not necessarily young) swamp conifers.

The animals inhabiting open bog/muskeg also include many specialists, some of which reach the extreme southern limits of their ranges in northern Wisconsin. Examples are birds such as the Lincoln's Sparrow and Palm Warbler, and butterflies such as the Jutta arctic and bog fritillary.

This community type is widespread and very well represented on the NH-AL SF, and should be a priority for management and protection. It should be noted that all large occurrences of open bog/muskeg have been somewhat compromised by various developments, including road and utility crossings, cranberry bed construction, wild rice cultivation, and hydrologic alterations due to ditching and diking.

Inventory Sites: Lower Manitowish River Macrosite, Powell Marsh, Big Swamp, Rainbow Wetlands, Swanson Lake and Pines, Rice Creek Complex, Mud Creek Springs, Camp Lake, Bittersweet Lakes, Nixon Creek, Northeast Springs Macrosite.

Herbaceous Communities

Bracken Grassland: Non-forested natural communities are rare on the uplands of the NH-AL SF, and are quite restricted in acreage. The flora consists mostly of herbs, such as sedges and grasses, and low shrubs such as blueberries and sweetfern. Exotic species are a significant component of many stands. Typical examples of these include quack grass, oxeye daisy, sheep sorrel, and orange hawkweed.

Several of the surveyed stands were at least partially within frost pockets, and it was evident that growing season frosts have played an important role in keeping encroaching woody vegetation at bay. One site is kept in a relatively open condition by the use of prescribed fire.

Inventory Sites: Johnson Lake Barrens, Allequash Lake, Frank Lake and Frost Pocket.

Northern Sedge Meadow: This minerotrophic herbaceous wetland is widespread in northern Wisconsin. Dominant species include tussock sedge (*Carex stricta*) and other sedges, and Canada bluejoint grass. Among the characteristic associates are swamp milkweed, spotted joe-pye-weed, blue flag (Iris), marsh fern, swamp loosestrife, and marsh bellwort. A shrub component is often present, with willows, speckled alder, and sweet gale common.

This type is somewhat of an ecological grab-bag, and additional sampling and classification work remains to be done.

Several large, diverse, or otherwise important occurrences were documented in the course of our fieldwork

Inventory Sites: Devine Lake, Lower Manitowish River Macrosite, Rainbow Wetlands, Nixon Creek and Wetlands, Stevenson Creek and Pines.

Poor Fen: This herbaceous peatland type is similar in composition to the open bog but differs in its higher floristic diversity, lower groundwater acidity, and microtopography. Sphagnum mosses are extensive in the poor fen, but they don't generally occur in thick blankets with pronounced hummock-hollow microtopography. Besides the typical bog ericads and sedges, the flora may include many additional sedge species, bog goldenrod, rush aster, several orchids, and bladderworts.

Among the animals found in this type are familiar species such as Sandhill Crane and Sedge Wren, as well as uncommon specialists such as the Le Conte's Sparrow and Yellow Rail.

This wetland type has been added to the Wisconsin community working list recently, so our understanding of its distribution is preliminary. It is apparently widespread in the northern part of the state. Occurrences are seldom encountered in isolation, but usually occur in mosaics composed of several wetland communities.

Inventory Sites: Black Tern Bog, Boulder Flats Meadow, Stevenson Springs and Wetlands.

Boreal (Rich) Fen: This herbaceous peatland community is dominated by sedges, usually of the "wire-leaved" type. A basal layer of mosses, when present, is not composed primarily of the highly acidic members of the Sphagnum genus. This community is typically diverse, and capable of supporting rare, specialized species. Dominant/characteristic plants include woolly sedge, alpine cotton-grass, twig rush, sage willow, marsh timothy, and common bog arrow grass.

This community has only recently been accorded recognition as an entity in Wisconsin. Formerly it was lumped with open bog or northern sedge meadow. Though its range and status here are imperfectly known at present, this is at best an uncommon community that frequently supports rare plants and animals.

The known occurrences on the NH-AL SF are few in number and small in area, but highly significant because of the rare species they support and their association with other natural communities.

Inventory Sites: Rice Creek Complex.

Emergent Aquatic: Emergent marshes occupy areas of relatively shallow standing water where there is protection from strong currents, and excessive wind and wave action. Many of the dominants, including cattails, bur-reeds, bulrushes, and spike-rushes, are tall, robust, plants with a grass-like form.

The stands of emergents in deeper water may overlap or be interspersed with stands of floating-leaved species such as white and yellow water lilies and water shield.

Inventory Sites: Johnson Creek and Pines, Rainbow Wetlands, Manitowish River Wilderness Area.

Wild Rice Marsh: Because of the biological and cultural interest in wild rice beds, NHI are recognizing emergent marshes dominated by wild rice (*Zizania aquatica*) as a community type. Some exceptionally good examples, among the state's finest, occur within and just outside of the NH-AL SF.

Inventory Sites: Allequash Lake, Aurora Lake, Rice Creek Complex.

Submergent Aquatic: Beds of submergent aquatic vegetation occupy sites similar to those supporting emergent aquatic stands but the water depth is typically greater. Representative species include pondweeds, coontail, waterweed, and the water-milfoils. There is often spatial overlap with beds of floating-leaved species such as the water lilies and water shield, as well as with emergents.

Inventory Sites: Allequash Lake, Aurora Lake, Bittersweet Lakes, Frog Lake and Pines, Johnson Lake Barrens, Rice Creek Complex, Swanson Lake and Pines.

Ephemeral Pond (vernal pond) – small seasonally flooded basins typically holding water in the spring following snow melt, then dry up during the summer. Vegetation is quite variable, but often includes knowtweeds (*Polygonum* spp.), sedges (especially *Carex* spp.), and beggar's ticks (*Bidens* spp.). These temporary ponds provide critical breeding habitat for frogs, salamanders, and invertebrates.

Inventory Sites: Lake Laura-Salsich Lake, Catherine Lake Hemlock-Hardwoods.

Primary Communities

These communities develop directly on unvegetated geologic substrates. Two types are recognized on the NH-AL SF.

Inland Beach: Beaches of sand or gravel occur on the margins of certain lakes where the natural fluctuations in water levels permit the establishment and persistence of a specialized flora. Sedges and rushes are among the typical plants colonizing such habitats. With shoreline development pressures presently very high in the Northern Highland landscape, many natural beaches are experiencing or becoming increasingly vulnerable to damage or destruction.

Despite the high concentration of lakes on the NH-AL SF we documented few examples of well-developed inland beach communities here. We did identify several rare species populations dependent on NH-AL SF beaches.

Inventory Sites: Big Muskellunge Lake, Trout Lake.

Bedrock Glade: Outcroppings of bedrock that do not form cliffs (vertical faces) and are sparsely vegetated with pioneering lichens, mosses, and vascular plants are termed "bedrock glades". Exposures of bedrock are very rare on the NH-AL SF and those identified to date do not appear to be highly biologically significant.

Inventory Sites: Lower Manitowish River Macrosite.

Aquatic Features Classification

This group includes lakes, streams, and springs. During 1999 the NHI will be working with The Nature Conservancy, a private conservation organization, to further refine and standardize our present classification of aquatic features. Following the completion of this project, our abilities to both identify ecologically significant aquatic "types", and to prioritize conservation actions, should be significantly enhanced.

The aquatic classification currently used by NHI is based on a limited group of chemical and physical parameters. This classification was developed in the 1970s by J. Magnuson (UW-Limnology), Bill Threinen (DNR - Fish Management), and Joe Ball (DNR - Water Resources), for use by the State Scientific Areas program. Attributes such as stream order, lake size and basin morphology, substrate, etc. were not used in this version but may in the future. TNC has been working on a lake and stream classification for several years, and a pilot program may be initiated with them this fall to attempt a more detailed classification of Wisconsin waterbodies. **Bolded** terms represent factors used in the Wisconsin Natural Heritage Inventory classification.

I. LAKES: Lentic systems 10 acres or larger (standing water)

A. Water Source

1. **Seepage Lake -** Groundwater infiltration, overland flow, and precipitation are the primary water sources. These are essentially landlocked waterbodies.
2. **Drainage Lake -** The primary source of water is stream-borne, via an inlet, plus those sources listed under seepage types. Water leaves the system via an outlet stream.
3. **Spring Lake -** Springs contribute substantially to lake volume. Surface features such as spring runs or spring ponds may discharge waters directly into a spring lake, or the springs may discharge from beneath the lake's surface. An outlet stream is usually present.

B. Thermal Stratification

1. **Deep Lake -** In these lakes a thermocline develops during the summer and winter. In the spring and fall this zone of marked temperature difference breaks down, allowing for the mixing of bottom and surface waters and a redistribution of oxygen and nutrients.
2. **Shallow Lake -** These lakes do not stratify thermally, and can become oxygen depleted as the water warms and decomposition exceeds primary production. This can also occur during the winter when ice and snow cover the surface, inhibiting photosynthesis. "Freezeout" conditions may then prevail.
3. **Meromictic Lake -** These are very deep lakes (often over 20 meters) with an exposed surface area of no more than a few hectares. Thermal and chemical stratification is permanent, or mixing of surface and deep waters very limited.

C. Chemical Attributes

1. **Alkalinity -** Often used as a measure of productivity for a water body.
   a. **Hard** water - Total alkalinity equals or exceeds 50 ppm.
   b. **Soft** water - Total alkalinity is less than 50 ppm.
2. Other chemical characteristics sometimes used for classifying lakes: pH, conductance, size, basin morphology

D. Miscellaneous Attributes

1. Shoreline configuration
2. Size

II. STREAMS: Lotic systems (flowing water)

A. **Gradient** - correlates roughly with substrate particle size, and to a degree, types of organisms that can stand up to high current velocity.

1. **Fast** - Gradient exceeds 20'/mile
2. **Slow** - Gradient is less than 20'/mile

B. **Temperature** - Correlates roughly with ability of stream to support aquatic biota needing high levels of dissolved oxygen to sustain themselves.

1. **Warm** - average summer temperature exceeds 24 degrees Celsius.
2. **Cold** - average summer temperature is below 24 degrees Celsius.

C. Chemical Attributes

1. **Alkalinity**
   a. **Hard** water - Total alkalinity equals or exceeds 50 ppm.
   b. **Soft** water - Total alkalinity is less than 50 ppm.
2. Other chemical characteristics sometimes used for classifying streams: pH, conductance

D. Miscellaneous Attributes

1. Stream order
2. Channel configuration
3. Stream flow (cfs)

The aquatic types recognized currently by the NHI are:

Ephemeral Pond (vernal pond) – <10 acres, shallow, water dries up most years.

Lake - deep, hard, drainage
Lake - deep, hard, seepage
Lake - deep, soft, drainage
Lake - deep, soft, seepage
Lake - deep, very soft, seepage
Lake - hard bog
Lake - meromictic
Lake - oxbow
Lake - shallow, hard, drainage
Lake - shallow, hard, seepage
Lake - shallow, soft, drainage
Lake - shallow, soft, seepage
Lake - shallow, very hard, drainage (marl)
Lake - soft bog
Lake - unique

Spring Lake
Spring Pond (< 10 acres)
Springs and spring runs - hard (tot. alk. > 50 ppm.)
Springs and spring runs - soft (tot. alk. < 50ppm.)

Stream - fast, hard, cold
Stream - fast, hard, warm
Stream - fast, soft, cold
Stream - fast, soft, warm
Stream - slow, hard, cold
Stream - slow, soft, warm
Stream - slow, soft, cold
Stream - slow, hard, warm

Appendix E

Rare Vascular Plants of the Northern Highland – American Legion State Forest

This appendix lists each of the rare plant species known to occur on the NHAL and provides information on the conservation status and species management. The Wisconsin Natural Heritage Database lists 34 rare plant species on the NHAL. Moor rush (*Juncus vaseyi*) is listed as Endangered in Wisconsin, and Calypso orchid (*Calypso bulbosa*), shore sedge (*Carex lenticularis*), and algae-like pondweed (*Potamogeton confervoides*) are listed as threatened in Wisconsin; all were documented on the NHAL. Thirty additional rare plant species found on the NHAL are designated of "special concern," meaning experts suspect a problem in their abundance or distribution, but have not yet gathered proof of threats to their survival in Wisconsin.

Seven of the 34 rare species grow predominantly on upland sites. The remaining species grow in wetlands (18 species) or water (9 species). This high concentration of rare plants in aquatic habitats illustrates the biodiversity significance of abundant high-quality lakes, streams, and wetlands in the Northern Highland region. Many of the high quality habitats used by rare plants at the NHAL may be vulnerable to invasion by aggressive exotic species such as purple loosestrife, reed canary grass, Eurasian water milfoil, and glossy buckthorn. Preventing the spread of these species would greatly aid the survival of rare aquatic and wetland species at NHAL.

COMMON NAME (SCIENTIFIC NAME)	FEDERAL STATUS	STATE STATUS	OBSERVATION DATE
ADDER'S-TONGUE (OPHIOGLOSSUM VULGATUM)		SC	1995
ALGAE-LIKE PONDWEED (POTAMOGETON CONFERVOIDES)		THR	1995
AMERICAN SHORE-GRASS (LITTORELLA AMERICANA)		SC	1995
CALYPSO ORCHID/FAIRY SLIPPER (CALYPSO BULBOSA)		THR	1992
CAPITATE SPIKERUSH (ELEOCHARIS OLIVACEA)		SC	1929
CHILEAN SWEET CICELY (OSMORHIZA CHILENSIS)		SC	1993
COMMON BOG ARROW-GRASS (TRIGLOCHIN MARITIMUM)		SC	1995
DOWNY WILLOW-HERB (EPILOBIUM STRICTUM)		SC	1995
FARWELL'S WATER-MILFOIL (MYRIOPHYLLUM FARWELLII)		SC	1995
GIANT RATTLESNAKE-PLANTAIN (GOODYERA OBLONGIFOLIA)		SC	1996
HIDDEN-FRUITED BLADDERWORT (UTRICULARIA GEMINISCAPA)		SC	1995
HOOKER ORCHIS (PLATANTHERA HOOKERI)		SC	1893
LARGE ROUNDLEAF ORCHID (PLATANTHERA ORBICULATA)		SC	1996
LEAFY WHITE ORCHIS (PLATANTHERA DILATATA)		SC	1995
MARSH WILLOW-HERB (EPILOBIUM PALUSTRE)		SC	1996
NORTHEASTERN BLADDERWORT (UTRICULARIA RESUPINATA)		SC	1997
NORTHERN BLACK CURRANT (RIBES HUDSONIANUM)		SC	1996
NORTHERN BOG SEDGE (CAREX GYNOCRATES)		SC	1993
PRICKLY HORNWORT (CERATOPHYLLUM ECHINATUM)		SC	1996

COMMON NAME (SCIENTIFIC NAME)	FEDERAL STATUS	STATE STATUS	OBSERVATION DATE
PURPLE BLADDERWORT (UTRICULARIA PURPUREA)		SC	1996
PURPLE CLEMATIS (CLEMATIS OCCIDENTALIS)		SC	1994
ROBBINS SPIKERUSH (ELEOCHARIS ROBBINSII)		SC	1996
SHEATHED SEDGE (CAREX VAGINATA)		SC	1995
SHORE SEDGE (CAREX LENTICULARIS)		THR	1996
SHOWY LADY'S-SLIPPER (CYPRIPEDIUM REGINAE)		SC	1995
SPARSE-FLOWERED SEDGE (CAREX TENUIFLORA)		SC	1993
SWAMP PINK (ARETHUSA BULBOSA)		SC	1996
VARIEGATED HORSETAIL (EQUISETUM VARIEGATUM)		SC	1993
VASEY'S PONDWEED (POTAMOGETON VASEYI)		SC	1996
WATER-THREAD PONDWEED (POTAMOGETON CAPILLACEUS)		SC	1994

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 NHAL 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 NHAL).

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.

The aquatic botanist, Susan Knight, used a small jon boat to survey lakes, usually spending most of one day at each site. Aquatic plants were surveyed to a depth of 3 meters by hanging over the edge of the boat and using a long-handled rake and net. Plants were identified in the field or brought back to the lab where reference keys and a dissecting microscope were used. At the end of the season, two days were spent at

the State Herbarium (at UW-Madison) identifying difficult members of *Potamogeton*, *Utricularia* and *Ceratophyllum*. Vouchers were collected of all of the rare aquatic plant species and have been deposited at the State Herbarium.

Various methods were used to search for rare plants. The method chosen depended upon the biologists' ability to maneuver through the habitat and the number of individuals conducting a given survey. Some surveys, especially those done in aquatic areas or by more than one individual searching for a 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 involved is critical in areas of intensive field surveys 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 UW-Madison herbarium. In some cases, where a particularly rare species is found and/or population size is small, a diagnostic photograph may substitute for plant collection.

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, (e.g. looking for a sedge or other small species occurring in a vast white cedar swamp). Logistical constraints prevent a thorough search of all potential habitat.

In addition, many rare plant species, such as grape-ferns and orchids, may exist as short-lived, above-ground plants which do not reliably appear every year. These, and other limitations not discussed here, must be into 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 usually 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 point is worth stressing as the justification for thorough botanical surveys taking more than one field season since there are always significant plant sites that are missed during the first year of survey.

Rare Vascular Plant Descriptions

The following is a description of each of the rare plants found on the NHAL, including status, consevation concern, and species management. The dates of last observations will vary greatly between species. An older, historic record does not necessarily mean the species no longer exists on the NHAL, only that it was not encountered during the inventory completed for this report. Each of the plants in this Appendix is accompanied by the Wisconsin protection status and a ranking code denoting its rarity in Wisconsin and throughout its range. These ranks are defined on the first pages of the Wisconsin Natural Heritage Working List (Appendix I). In addition, each NHAL rare plant population is ranked according to the significance of its contribution to a given species' success in Wisconsin and their sensitivity to land management practices or disturbance. These criteria were recommended to the Heritage staff by Clark Forestry, Inc., which used them in the Baraboo Hills (see methodology in main body of report). The significance and sensitivity ranks can range from A to C. A-level significance applies to species for which NHAL is very important to survival in Wisconsin. B applies to moderate significance, and C

describes species for which NHAL is not very important. A-level sensitivity refers to a species that has a high sensitivity to disturbance. For example, a species with the rank B/A is moderately dependent on NHAL for its persistence in Wisconsin, and is highly sensitive to land use disturbances.

Moor rush or bog rush (*Juncus stygius*) – WI Endangered, S1G5

Grows in patches around the boreal region of the globe, reaching as far south as New England, NY, MN, and WI. A documented population at Black Tern Bog is only Wisconsin's second verified occurrence of this species. The first known population, in Florence County, grows with sundews, pitcher plants, bog arrow-grass, bog clubmoss, dragon's-mouth orchids, and yellow-eyed grass. Outside of WI, bog rush also grows in marshes, shallow pools, and boggy meadows. The Black Tern Bog population appears to be small, but may include a larger, overlooked group of plants.

Conservation concerns: The calcareous bog mat depends on gentle groundwater flow from adjacent uplands. Bog rush would be sensitive to large water level fluctuations, severe timber removal from adjacent slopes, or pesticide drift.

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

This is a beautiful orchid with a single brilliant, rose-purple flower and no obvious leaves at flowering time. It is endemic to boreal and north-temperate parts of eastern North America. It's habitat is 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 there are many records in Wisconsin, it is possibly secure here and may warrant deletion from the NHI working list. Recent records are from northeastern and northwestern Wisconsin. Our largest populations are from along the shore of Lake Superior in areas of extensive bogs in Bayfield and Ashland Counties, both along mainland and in Apostle Islands.

This species grows at 9 sites on NHAL. All but one are small to moderate in size. The best example is Little Fox Lake with a fairly large population (hundreds of stems). Others are: North Bass Lake - small; Devine Lake-small; Manitowish River-moderate; Rice Creek Fen-small-moderate; DuPage Lake -small; Big Swamp-small; Aurora Lake-small; Little Fox Lake-medium-large (falls outside primary survey sites); and Hawk Lake-small.

Conservation Concerns: out right habitat destruction, wetland drainage or other change to water level, exotics invasion.

Fairy slipper, calypso orchid (*Calypso bulbosa*) - State Threatened, S2/G5, Rank C/B

This wide-ranging boreal species is known from forested conifer swamps, specifically cedar swamps, in northern Wisconsin. Calypso appears to be highly dependent upon the quality of its habitat and its status in Wisconsin is thought to be quite tenuous. While reports of Calypso from about 40 sites in the State suggest 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 should be done. Because there is so little acreage of cedar swamp on NHAL, Calypso's habitat is marginal there. The one documented population, at Seed Lake Cedars, falls outside primary survey sites.

Conservation Concerns: vulnerable to habitat changes, including water level increase or decrease and logging. This showy flower captivates orchid poachers, and is often their victim. In Wisconsin, it prefers cold, dark areas. It is reported to be sensitive to the warmer, drier conditions that result from removing nearby canopy.

Shore sedge (*Carex lenticularis*) - State Threatened, S1/G5, Rank A/B

This is a boreal species of wet shore lines ranging south to far northern Wisconsin. Up until a few years ago, botanists thought shore sedge was very rare in Wisconsin. A number of populations were discovered on the Apostle Islands and the Bayfield peninsula in recent years. NHAL provides the only other known Wisconsin habitat for this species. At Vandercook Lake, shore sedge is very rare, covering a square yard. Lake Laura hosts a very small colony of about 20 plants.

The largest known population of shore sedge in Wisconsin grows in two patches on the shore of Big Muskellunge Lake. A colony along the north side stretches along roughly 1 mile of gravelly sandy shoreline. This lake falls outside any primary survey site, but the significance of this population warrants protection of this habitat. Shore sedge would be sensitive to recreational development such as docks, rip-rap, beach filling, dredging, or mowing. It is a robust plant that probably wouldn't be bothered by wakes produced by normal boating traffic.

Conservation Concerns: shore line development, road expansion, increased lake levels.

Pale sedge (*Carex pallescens*) - Special Concern, S1/G5T/Q (should be at least S2, possibly S3), Rank C/C

Known from a variety of moist, open habitats in the northeastern United States, pale sedge often grows in somewhat disturbed areas. It is fairly widespread in northern Wisconsin, and only marginal in NHAL.

Conservation Concerns: unknown.

Northern bog sedge (*Carex gynocrates*) - Special Concern, S2/G5, Rank B/B

Boreal species occurring at a few sites in northern Wisconsin. A large population at Toy Lake in the NHAL needs verification as does a smaller population reported elsewhere on that property.

Conservation Concerns: wetland flooding or draining.

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

Wisconsin falls in the southern portion of this boreal species' range of bogs and conifer swamps. Although most of our populations are reported from the northeastern part of Wisconsin, a significant number of recent records are from northwest Wisconsin. Apparently of marginal occurrence in the NHAL, this species was first collected from Lost Lake (near Sayner, outside of primary survey sites) in 1902 and was reported in 1993 at Devine Lake (record needs verification). There are good populations of this species elsewhere in the state.

Conservation Concerns: wetland flooding or draining.

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

This wide-ranging polar sedge reaches into several areas of northern Wisconsin. Its habitats include conifer swamps, fenny bogs and alder thickets. Although large populations have been reported from northwestern Wisconsin, the few reported NHAL populations have consisted of only a few plants each. In addition, one record is historic and too vague to relocate and two of the others need verification. At the present time, the NHAL occurrences appear to be only marginal to the species' overall presence in Wisconsin.

Conservation Concerns: wetland flooding or draining, interruptions in groundwater flow.

Prickly hornwort (*Ceratophyllum echinatum*) - Special Concern S2/G4?, Rank C/B

Found in quiet waters throughout much of North America, there is uncertainty about the status of this species; it may be truly rare or merely under-reported because of its similarity to the common coontail (*C.*

demersum). While it has been collected in northern and central Wisconsin, most of those collections are historical. A moderate sized population persists at Nixon Creek. Prickly hornwort was historically documented at Flora Lake, which does not fall within a primary survey site.

Conservation Concerns: apparently very sensitive to decreases in water quality.

Flodman's thistle (*Cirsium flodmanii*) – Special Concern S2/G5, Rank C/B

Flodman's thistle grows in prairies, plains and dry meadows through the northern Great Plains and rarely reaches as far east as New York. One 1958 collection documents a population of unknown size from an open field near Manitowish. Dominated by forests and lakes and outside its core historic range, NHAL does not present good opportunities for the protection of Flodman's thistle.

Conservation Concerns: needs open canopy.

Purple clematis (*Clematis occidentalis*), Special Concern, S3/G5, Rank C/B

This species is known from rocky woods and stream banks in southeastern Canada and northeastern United States. It has been collected in scattered localities across northern Wisconsin, and reported from 5 stations on the NHAL. Two of these occur at the high quality Rice Creek Complex. Three historic populations fall outside of primary survey sites, at Edith Lake, Katherine Lake – Tigertail Point, and near Tomahawk Lake.

Conservation Concerns: This species enjoys partial canopy, although it persists in full canopy. Selective winter logging in its habitat may benefit the population. Harvesting during the growing season may destroy the roots and eliminate the population. Do not eliminate the surrounding shrub layer, which clematis climbs.

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

The main portion of this species' range occurs in southeastern Canada and the northeastern U.S. where it grows in semi-open, calcareous swamps, fens, and occasionally in open wetlands and wet woods. While it has been reported from nearly 100 sites located throughout Wisconsin (concentrated near Lake Michigan), about one-half of those records are historical. Most recent reports are from the northeastern part of the state. Although the showy lady's-slipper has been reported from only one location on the NHAL (Rice Creek Fen), the population there is significant because it is one of the state's largest populations. It is also in high quality habitat.

Conservation Concerns: Showy lady's-slipper is quite susceptible to deer damage and collection in addition to the usual threats to wetland habitats.

Capitate spikerush (*Eleocharis olivacea*), Special Concern, S2/G5, No rank

Historical collection from 1 site in NHAL (Trout Lake), not relocated.

Robbins spikerush (*Eleocharis robbinsii*), Special Concern, S3/G4G5, Rank A/B

This species ranges from along the Atlantic coast inland to the western Great Lakes. Its habitat consists of sandy-mucky shorelines and marshy bogs; it grows as an emergent aquatic plant in shallow lakes and ponds. There are a few records of this species in the northwestern and east-central parts of the state. However, most of the occurrences of Robbins spikerush are from Oneida and Vilas counties. The NHAL has the largest populations in the state, including 10 sites. Very large populations live at Hemlock Lake; Benedict Lake, Lake 33-7, Wind Pudding Lake and Shallow Lake. Black Tern Bog; Erickson Lake, and Rainbow Flowage (river mile 375) support medium-sized populations. Reports from Little John Junior Lake and North Creek - Trout Springs do not specify population size. The substantial populations at Lake 33-7 and the Rainbow Flowage do not fall within primary survey sites. The importance of NHAL

habitats to this species' success in Wisconsin warrants special consideration in management decisions. The fact that most of the lakes where it grows are completely undeveloped suggests that it may be sensitive to some aspects of development.

Conservation Concerns: prevent draining, or dredging wetlands, impounding and other extreme changes in water level; avoid mowing, filling or dredging shore habitats; avoid increased turbidity from heavy boat traffic.

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

This boreal species of low, wet ground has been reported from scattered localities throughout the state, concentrating in northwestern and northeastern Wisconsin. Five occurrences are known from the NHAL, including 2 very large, robust populations (Devine Lake, Rainbow Wetlands). Smaller populations were reported from Johnson Lake, Sandy Beach Lake and DuPage Lake.

Conservation Concerns: wetland drainage and other changes in water level

Downy willow-herb (*Epilobium strictum*), Special Concern, S2S3/G5?, Rank C/C

This flower of bogs and swamps grows in the eastern U.S. and adjacent Canada. It is known from 19 Wisconsin sites. Most are in southeastern counties, but some are scattered in northern counties. Only one small colony has been found in NHAL, where it is in exceptionally high quality habitat (Rice Creek Complex).

Conservation Concerns: wetland destruction, flooding.

Variegated horsetail (*Equisetum variegatum*), Special Concern, S3/G5, No rank

A small colony of this species was reported from Toy Lake, but needs verification.

Giant rattlesnake-plantain (*Goodyera oblongifolia*), Special Concern, SU/G5, No rank

An upland orchid of coniferous or deciduous forests, this species grows in southeastern Canada, around the northern Great Lakes, and in the western cordillera. Though historically known from Door, Florence and Iron Counties, all the giant rattlesnake-plantains collected in Wisconsin in the last 40 years are from the Apostle Islands and adjacent Bayfield peninsula. In the NHAL, only 1 plant was found at Catherine Lake Hemlock Hardwoods.

Conservation Concerns: should not be subjected to fully open canopy, nor trampling during growing season.

American shoregrass (*Littorella americana= L. uniflora*), Special Concern, S2/G5, Rank A/B

This aquatic plant grows a rosette of leaves that lie on the bottom of clear lakes. It is believed to flower only in years of low water, when its stalk can reach the surface. In North America, it is restricted to southeastern Canada and to northern NY, MN and Wisconsin. All of Wisconsin's known extant sites of this species are in Vilas and adjacent northeast Forest counties. Very few other populations have ever been reported from other parts of state. Wisconsin's largest populations are in Day and Little John Jr. lakes. A moderate colony is known from Firefly Lake, and an historical report from Trout Lake. Only two other American shoregrass populations have been verified in Wisconsin outside of NHAL in the past 30 years, and they were precariously small populations.

Conservation Concerns: Probably very sensitive to water quality changes, not only in chemistry but also in sediment levels (maintain water clarity).

Farwell's water-milfoil (*Myriophyllum farwellii*), Special Concern, S2/G5, Rank B/B

This aquatic species ranges from southeastern Canada south to NY and as far west as Minnesota. It has grown in scattered locations throughout much of Wisconsin, except the southwestern counties. Three small to moderate-sized populations occur in the NHAL (Wind Pudding Lake, Frog Lake, Lake 3-7) in high quality habitat with other listed species.

Conservation Concerns: Probably needs very clear, low nutrient water, and is sensitive to water chemistry changes.

Adder's-tongue (*Ophioglossum vulgatum*), Special Concern, S3/G5, Rank C/C

This circumboreal wetland plant has been reported about 30 times in Wisconsin, mostly from the southern 2/3 of the state. It generally prefers grassy edges of marshes and ponds. Its current status cannot be reliably assessed without field inventory since most of the records are historical. One small colony was found on NHAL in high quality habitat at Rainbow Wetlands, outside any primary survey site.

Conservation Concerns: Rise in water level could flood habitat; lowering could allow encroachment of shrubs that might result in too much shade.

Chilean sweet cicely (*Osmorhiza chilensis*), Special Concern, S3/G5, No rank

Heretofore, this species was only known from near Lakes Superior and Michigan. The presence of a very small colony at Toy Lake, on the NHAL, needs to be verified.

American ginseng (*Panax quinquefolius*), Special Concern, S4G4, Rank C/B

This species of the eastern U.S. and southeastern Canada inhabits mesic hardwood forest and occasionally conifer -hardwood forest. On the NHAL, a small colony has been found at the North Bass Lake Forest.

Conservation Concerns: The biggest threat to this species has been widespread and persistent removal of its roots for sale as an herbal medicine. Avoid bringing public attention to its location.

Leafy white orchis (*Platanthera dilatata*), Special Concern, S3/G5, Rank A/B

This wide-ranging orchid species is found in spring-fed bogs, fens, shorelines and semi-open conifer swamps. There are about 30 records of this species in Wisconsin, mostly from northeastern counties. Many of them are historical and haven't been verified in recent years. This species has been located at three sites on NHAL. Devine Lake and Rice Creek Fen appear to support the state's largest populations by far. Together, they constitute half of the vigorous leafy white orchis sites known in Wisconsin. In 1923, it was recorded near the confluence of the Wisconsin and Eagle Rivers, outside any primary survey site.

Conservation Concerns: wetland flooding or draining, disruption of ground water flow.

Hooker orchis (*Platanthera hookeri*), Special Concern, S3/G5, No rank

Pioneering Wisconsin botanist L. S. Cheney collected this species at “Doherty Lake, near Tomahawk Lake, near Clear Lake” in 1893. This location falls outside of any primary survey site, and was not verified in our inventory.

Large roundleaf orchid (*Platanthera orbiculata*), Special Concern, S2S3/G5?, Rank C/B

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. Most recent reports of the species are from along Lake Superior and Lake Michigan in Door County. Inland reports are almost

entirely historical. There are two historical reports in the NHAL. Our inventory was unable to relocate either population. One plant was seen at a new location - North Bass Lake Forest.

Conservation Concerns: maintain appropriate habitat.

Water-thread pondweed (*Potamogeton capillaceus*), Special Concern, SU/G?, Rank B/B

This species, mainly of the Atlantic coastal plain, is found scattered at inland sites west to central Minnesota. It has been reported from a handful of soft water lakes and ponds in Juneau and Wood counties in central Wisconsin. In addition, two very small colonies were found in the course of this study, on Shallow and Shannon lakes. The latter falls outside any primary survey site.

Conservation Concerns: maintain lake levels, water chemistry, minimal sediment load.

Algae-like pondweed (*Potamogeton confervoides*), State Threatened, S1/G3G4, Rank A/B

Occurring in southeastern Canada and northeastern U.S., this is a submerged aquatic species of soft water lakes and ponds. The NHAL appears to be a stronghold for this species, with 4 known populations (Catherine Lake, Lake 3-7, Shallow Lake and Swanson Lake). Lake 3-7 and Shallow Lake each have very large populations, probably the largest in the state. The population at Swanson Lake is also substantial. Other than the NHAL, this species is known to be extant at 2 sites in northern Wisconsin, one of which occurs within the bounds of the proposed Crandon Mine. The few historical records are from northern and central Wisconsin. The close proximity of the NHAL populations to one another probably enhances their vigor and long term viability, whereas the other Wisconsin populations appear to be isolated.

Conservation Concerns: lake levels, water chemistry, sediment loads.

Vasey's pondweed (*Potamogeton vaseyi*), Special Concern, S2?4, Rank B/B

This submerged aquatic species of southeastern Canada and the northeastern U.S. inhabits soft water lakes and ponds and quiet areas along rivers. Little is known about the species. It has been verified from central and northern Wisconsin. sites. Of the 18 populations statewide, 11 are historic and at least two others have not been updated for over 20 years.

Vasey's pondweed is known from one site on the NHAL (Nixon Creek) where a moderate size population occurs in good quality habitat.

Conservation Concerns: lake levels, water chemistry, sediment loads.

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

Northern black currant grows in cool swamps, often in association with white cedar. It occurs throughout Canada, ranging to northern parts of western U.S. and the western Great Lakes region as far south as Iowa. File records indicate that the species is widespread in northern Wisconsin. It has been reported from 4 or 5 small populations in the NHAL in several high quality areas that have other, more significant natural qualities. These include Dunn Lake Pines, Catherine Lake Hemlock Hardwoods and Toy Lake (population needs verification). Historically, northern black currant also grew near Trout Lake (1961) and High Lake(1940), outside any primary survey site.

Conservation Concerns: wetland destruction.

Common bog arrow-grass (*Triglochin maritimum*), Special Concern, S3/G5, Rank B/B

This circumboreal species ranges south into the northeastern U.S. It is found in fens, marshes and bogs. Many of the sites occur in southeastern Wisconsin and are protected on fens. However, probably 50% of

these occurrence records are based on historical data. Farther north, the species occurs along Lake Michigan and Lake Superior and inland in the northeastern counties.

The latter includes the NHAL where 3 populations have been reported, one historic. A small colony occurs at Devine Lake. A very large, robust population, perhaps the state's largest, occurs at Rice Creek Fen in excellent quality habitat.

Conservation Concerns: avoid large water level changes and changes in water quality; protect ground water recharge areas.

Hidden-fruited bladderwort (*Utricularia geminiscapa*), Special Concern, S3/G4G5, Rank B/B

This submerged aquatic plant ranges from southeastern Canada to the northeastern U.S. as far south as eastern VA and PA and west to Wisconsin. It typically inhabits soft water lakes and ponds. Like the other bladderworts, it eats insects by ingesting and dissolving them in small bladders. It has been reported from 56 sites in Wisconsin, with 36 of those verified in the last 20 years. It has been reported from 14 different sites in the NHAL, six of which fall outside primary survey sites (indicated below with *italics*). Several populations were recorded in the 1970's and 1980's without assessments of their size. Because of time limitations, field surveys did not cover the entire property in 1995-96. Thus, for some sites, the species has only been reported as present at the site. Such records are generally from the 1980s, one from 1973. These include *5-15 Lake*, Little Blueberry Lake bog, Blueberry Lake, *Trilby Lake*, *Elizabeth Lake*, *Trout Bog*, and *Ted's Bog*. We have quantitative data on population size and habitat characteristics have for Black Tern Bog, Boulder Flats Pond, Camp Lake, Lake 3-7, Shallow Lake, *Shannon Lake*, Swanson Lake and Wind Pudding Lake. Very large and robust populations (probably the largest in the State) occur at Lake 3-7 and Swanson Lake.

Conservation Concerns: extreme changes in lake levels, water chemistry, sediment loads, shore development.

Purple bladderwort (*Utricularia purpurea*), Special Concern, S3/G5, Rank A/B

This submerged aquatic plant occurs in southeast Canada and the eastern U.S. in soft water lakes and ponds. In Wisconsin, it has been collected in about 25 sites, mostly in the northern part of the state. Half of those records have been verified in the last 20 years. The area of the NHAL appears to have Wisconsin's greatest concentration of purple bladderwort, with a total of 8 sites, including all of the largest populations. Very large, excellent quality populations are found at Hemlock Lake, Cedar Lake, Frog Lake and Shallow Lake. Slightly smaller, but also quite substantial populations live at Wind Pudding Lake, Sandy Beach Lake, Swanson Lake and Lake 3-7.

Conservation Concerns: maintain lake levels, water chemistry, minimal sediment loads.

Northeastern bladderwort (*Utricularia resupinata*), Special Concern, S2S3/G4, Rank B/B

Similar to other *Utricularia* species, northeastern bladderwort is found in southeastern Canada and the eastern United States. It inhabits the edges of lakes and ponds where its' stems grow just beneath the surface of muddy, sandy substrate at or near the shoreline. In Wisconsin, northeastern bladderwort has been recorded from scattered northern counties, but many of the records are historical. It is reported from 13 sites on NHAL. Five of those lie outside any primary survey site, and are noted below with *italics*. Very large and robust populations live at *Big Gibson Lake*, Oberlin Lake, Sandy Beach Lake, Little John Jr. Lake, *Lake 3-7*, Camp Lake, Prong Lake, Frog Lake and Shallow Lake. Large and substantial populations have been reported at White Sand Lake and *a small nameless lake in section 25 of T. 41 N, R. 6 E*. Small colonies have been found at *White Sand Lake* and Pallette Lake. It is also documented from *Vandercook* and Camp Lakes.

Conservation Concerns: lake levels, water chemistry, sediment loads, shore development.

Rare lichen species

Wisconsin's Natural Heritage Inventory has not formally adopted a list of rare lichen species. In 1996, eminent lichenologist Dr. John Thomson compiled a list of species he considers rare in Wisconsin. These are species that are only known from five or fewer places in Wisconsin. To screen out species that may be more common than they appear, Dr. Thomson only included members of genera that he considered well-studied in Wisconsin. Dr. Will-Wolf found twelve species from this list at NHAL. Dr. Thomson also highlighted a subset of rare species that show signs of decline in Wisconsin. Two of these species grow at NHAL: *Hypogymnia tubulosa* and *Icmadophila ericetorum*.

Each of the six lichen sampling sites presented between 57 and 84 species. Species compositions between stands varied quite a bit. One way to describe this is to look at "unique" species and "common" species of this survey. "Unique" is defined here as occurring in only one or two of the six sites. "Common" species occurred on five or six of the sites. Of the 159 species found in the whole survey, a larger portion were "unique" (36%) than were "common" (18%). This suggests that it is hard to protect all of the lichen species by just protecting a few important stands. On the contrary, each of the stands made unique contributions to the lichen flora.

Of the six survey sites, Lake Alva Hemlock Hardwoods and Trout Lake Conifer Swamp hosted the largest number of "unique" species. Just the "unique" portion of their site floras accounts for 32 species (20%) of the NHAL-wide lichen list. Will-Wolf found 84 lichen species at Trout Lake Conifer Swamp, making it the most species-rich stand in her survey, and accounting for 53% of NHAL's known lichen species. Lake Alva was the only site to host nitrogen-fixing lichens, which are associated with old forests.

One of Will-Wolf's research objectives was to compare the lichen composition in stands of varying management history. She found that stands that had received less intensive management were characterized by higher levels of non-"common" species than the more heavily managed stands. The "unique" species on less-managed stands include the two rare and declining species listed above, and the distinctive nitrogen-fixing species.

Rare bryophyte species

Dr. Frank Bowers of University of Wisconsin – Stevens Point surveyed the mosses and hepatics at 6 sites on NHAL in 1996. Between these 6 sites and one on the Brule River State Forest, he found 134 moss taxa and 33 hepatic taxa. He found between 22 and 89 bryophyte species at each site, including *Mylia anomala* (a liverwort, S1, SC). Dr. Bowers found 4 other bryophytes that he considers rare although they have not yet been added to Wisconsin's under-tended draft list of rare bryophytes. These include the mosses *Anomodon rugelii*, *Campylium radicale*, *Pseudobryum cinclidioides*, and *Ulota coarctata*.

APPENDIX F

Vascular Plants for the Northern Highland – American Legion State Forest, Wisconsin

There are a total of about 725 vascular plant species recorded from the Northern Highlands – American Legion State Forest, or about 30% of Wisconsin's total flora. The State Forest is particularly rich in aquatic species. The following is a list of the vascular plants known from the Northern Highlands – American Legion State Forest in Vilas, Oneida, and Iron Counties, Wisconsin. The list was compiled from the following sources:

- The template for the list is the "Checklist of the Vascular Plants of Wisconsin," (in press) by M.A. Wetter, T.S. Cochrane, M.R. Black, H.H. Iltis, and P.E. Berry. These authors, in turn, base their nomenclature upon J.T. Kartesz (1994), "A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland."
- Field work completed from 1996-1997 by Wisconsin Department of Natural Resources (WDNR) biologists, primarily Eric J. Epstein and Andy Clark. The data from this field work include mostly sight records, although some species were collected and deposited at the University of Wisconsin-Madison herbarium.
- Records of rare species from the BCD, Natural Heritage Inventory data, WDNR.
- Manuscript dot distribution maps of the University of Wisconsin, Department of Botany, including relatively recent maps of about 1,500 species.
- Online dot distribution maps of the University of Wisconsin, Department of Botany Website (www.wisc.edu/herbarium). As of 10 August 1999, there were approximately 550 species mapped statewide. (All species should be mapped by 2001).

APPENDIX G

Rare Animals of the Northern Highland-American Legion State Forest

This appendix lists each of the rare animal species known to occur on the NHAL and provides information on the conservation status and species management. The Wisconsin Natural Heritage Database lists 67 rare animal species on the NHAL. This includes one WI Endangered, nine WI Threatened, and 57 WI Special Concern species. Also included in these 67 species are one US Endangered (timber wolf) and one US Threatened (bald eagle). The 57 WI Special Concern species found on the NHAL included 20 birds, 18 aquatic insects, 7 terrestrial insects, 4 fish, 3 mussels, 2 mammals, 2 amphibians, and 1 reptile.

Of the 67 species occurring on the NHAL, over 75 percent of the species occur in wetland and aquatic sites. Only 19 (28 percent) occur on upland sites (differences in percentages is due to species occurring in more than one habitat). Though these figures do not convey greater importance of any particular species over another, it does provide and indication of the importance of protecting wetland and aquatic ecosystems to maintain rare animal species.

COMMON NAME (SCIENTIFIC NAME)	FEDERAL STATUS	STATE STATUS	OBSERV. DATE	GROUP
BULLFROG (RANA CATESBEIANA)		SC/H	1996	AMPHIBIAN
FOUR-TOED SALAMANDER (HEMIDACTYLIUM SCUTATUM)		SC/N	1996	AMPHIBIAN
AMERICAN BITTERN (BOTAURUS LENTIGINOSUS)		SC/M	1993	BIRD
AMERICAN BLACK DUCK (ANAS RUBRIPES)		SC/M	1993	BIRD
BALD EAGLE (HALIAEETUS LEUCOCEPHALUS)	LTNL	SC/FL	1997	BIRD
BLACK TERN (CHLIDONIAS NIGER)		SC/M	1992	BIRD
BLACK-BACKED WOODPECKER (PICOIDES ARCTICUS)		SC/M	1994	BIRD
BLACK-THROATED BLUE WARBLER (DENDROICA CAERULESCENS)		SC/M	1996	BIRD
BOREAL CHICKADEE (POECILE HUDSONICUS)		SC/M	1993	BIRD
CAPE MAY WARBLER (DENDROICA TIGRINA)		SC/M	1993	BIRD
CERULEAN WARBLER (DENDROICA CERULEA)		THR	1996	BIRD
CONNECTICUT WARBLER (OPORORNIS AGILIS)		SC/M	1990	BIRD
EVENING GROSBEAK (COCCOTHRAUSTES VESPERTINUS)		SC/M	1994	BIRD
GRAY JAY (PERISOREUS CANADENSIS)		SC/M	1995	BIRD
LE CONTE'S SPARROW (AMMODRAMUS LECONTEII)		SC/M	1993	BIRD
LONG-EARED OWL (ASIO OTUS)		SC/M	1988	BIRD
MERLIN (FALCO COLUMBARIUS)		SC/M	1969	BIRD
NORTHERN GOSHAWK (ACCIPITER GENTILIS)		SC/M	1997	BIRD
NORTHERN HARRIER (CIRCUS CYANEUS)		SC/M	1993	BIRD
OSPREY (PANDION HALIAETUS)		THR	1997	BIRD
PINE SISKIN (CARDUELIS PINUS)		SC/M	1996	BIRD
RED-SHOULDERED HAWK (BUTEO LINEATUS)		THR	1981	BIRD
SHARP-TAILED SPARROW (AMMODRAMUS NELSONI)		SC/M	1992	BIRD
SPRUCE GROUSE (FALCIPENNIS CANADENSIS)		THR	1993	BIRD
SWAINSON'S THRUSH (CATHARUS USTULATUS)		SC/M	1994	BIRD

COMMON NAME (SCIENTIFIC NAME)	FEDERAL STATUS	STATE STATUS	OBSERV. DATE	GROUP
YELLOW RAIL (COTURNICOPS NOVEBORACENSIS)		THR	1988	BIRD
YELLOW-BELLIED FLYCATCHER (EMPIDONAX FLAVIVENTRIS)		SC/M	1996	BIRD
BANDED KILLIFISH (FUNDULUS DIAPHANUS)		SC/N	1985	FISH
GREATER REDHORSE (MOXOSTOMA VALENCIENNESI)		THR	1990	FISH
LAKE HERRING (COREGONUS ARTEDI)		SC/N	1967	FISH
LEAST DARTER (ETHEOSTOMA MICROPERCA)		SC/N	1985	FISH
LONGEAR SUNFISH (LEPOMIS MEGALOTIS)		THR	1993	FISH
PUGNOSE MINNOW (OPSOPOEODUS EMILIAE)		SC/N	1907	FISH
PUGNOSE SHINER (NOTROPIS ANOGENUS)		THR	1990	FISH
A CADDISFLY (BANKSIOLA DOSSURIA)		SC/N	1983	INVERTEBRATE
A CAENID MAYFLY (CAENIS YOUNGI)		SC/N	1994	INVERTEBRATE
A PREDACEOUS DIVING BEETLE(LIOPOREUS TRIANGULARIS)		SC/N	1994	INVERTEBRATE
BLACK-TIPPED DARNER (AESHNA TUBERCULIFERA)		SC/N	1994	INVERTEBRATE
BOG COPPER (LYCAENA EPIXANTHE)		SC/N	1995	INVERTEBRATE
BOG FRITILLARY (BOLORIA EUNOMIA)		SC/N	1993	INVERTEBRATE
CITRINE FORKTAIL (ISCHNURA HASTATA)		SC/N	1962	INVERTEBRATE
CYRANO DARNER (NASIAESCHNA PENTACANTHA)		SC/N	1994	INVERTEBRATE
ELFIN SKIMMER (NANNOTHEMIS BELLA)		SC/N	1966	INVERTEBRATE
FORCIPATE EMERALD (SOMATOCHLORA FORCIPATA)		SC/N	1964	INVERTEBRATE
FREIJA FRITILLARY (BOLORIA FREIJA)		SC/N	1996	INVERTEBRATE
FRIGGA FRITILLARY (BOLORIA FRIGGA)		SC/N	1993	INVERTEBRATE
GREEN-FACED CLUBTAIL (GOMPHUS VIRIDIFRONS)		SC/N	1997	INVERTEBRATE
JUTTA ARCTIC (OENEIS JUTTA)		SC/N	1995	INVERTEBRATE
KENNEDY'S EMERALD (SOMATOCHLORA KENNEDYI)		SC/N	1965	INVERTEBRATE
LAKE DARNER (AESHNA EREMITA)		SC/N	1994	INVERTEBRATE
LAKE EMERALD (SOMATOCHLORA CINGULATA)		SC/N	1994	INVERTEBRATE
MOTTLED DARNER (AESHNA CLEPSYDRA)		SC/N	1994	INVERTEBRATE
RED-DISKED ALPINE (EREBIA DISCOIDALIS)		SC/N	1996	INVERTEBRATE
ROBUST DUBIRAPHIAN RIFFLE BEETLE (DUBIRAPHIA ROBUSTA)		SC/N	1994	INVERTEBRATE
SKILLET CLUBTAIL (GOMPHURUS VENTRICOSUS)		SC/N	1997	INVERTEBRATE
SKI-TAILED EMERALD (SOMATOCHLORA ELONGATA)		SC/N	1994	INVERTEBRATE
SPLENDID CLUBTAIL (GOMPHURUS LINEATIFRONS)		SC/N	1997	INVERTEBRATE
SUBARCTIC BLUET (COENAGRION INTERROGATUM)		SC/N	1967	INVERTEBRATE
ZEBRA CLUBTAIL (STYLURUS SCUDDERI)		SC/N	1994	INVERTEBRATE
LYNX (LYNX CANADENSIS)		SC/P	1972	MAMMAL
TIMBER WOLF (CANIS LUPUS)	LELTXN	END	1999	MAMMAL
WATER SHREW (SOREX PALUSTRIS)		SC/N	1946	MAMMAL
EASTERN FLOATER (ANODONTA CATARACTA)		SC/H	1990	MUSSEL
ELKTOE (ALASMIDONTA MARGINATA)		SC/H	1976	MUSSEL
ROUND PIGTOE (PLEUROBEMA SINTOXIA)		SC/H	1997	MUSSEL
NORTHERN RINGNECK SNAKE (DIADOPHIS PUNCTATUS EDWARDSII)		SC/N	1996	REPTILE
WOOD TURTLE (CLEMMYS INSCULPTA)		THR	1998	REPTILE

Methodology

Animal survey work was completed over the field seasons of 1992 through 1996. NHI zoologist Bill Smith surveyed dragonflies from 1993 to 1995. Mussel surveys were coordinated by David Heath and conducted during the summer of 1994. Dr. Kurt Schmude of the Lake Superior Research Institute was contracted to do basic surveys of aquatic insects on representative habitats on the forest in 1994 and 1995. Kevin and Cass Brewster completed wood turtle surveys in 1996 and Gary Casper completed 4-toed salamander surveys in 1996. Breeding bird surveys were conducted by Eric Epstein, Becky Isenring, and Randy Hoffman in 1992 through 1995. A study to determine nesting density of northern goshawks and other forest dependent raptors in WI was initiated in 1996. Fifteen square mile randomly located study plots were surveyed for all nesting raptors. One such study plot was located on the NHAL. This work was done under contract by Dr. Robert Rosenfield.

Aquatic Invertebrates

Due to the large number of lakes within the NHAL, only selected waterbodies, 9 percent of the total, were sampled. Additional data were compiled from WDNR Biomonitoring Program samples. 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. Waterbodies to be sampled were chosen based on an attempt to represent the basic aquatic community types present on the forest and in each LTA. Additional searches were conducted in habitats likely to contain rare species or unusual communities.

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 resulting in lower numbers of taxa being found. Macro-invertebrate diversity reported in this study should be considered in a relative rather than an absolute sense. An attempt was made to sample stoneflies immediately after the ice was out when many species are detectable. Difficult access at this time of year and the unpredictable timing of ice break-up limited our success.

- 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 are hand-picked. Specimens are placed in 70% ethyl alcohol and labeled with date and location. Surveys were conducted primarily by Dr. Kurt Schmude of the Lake Superior Research Institute in 1994 and 1995.
- Dragonfly surveys: 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.
- 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. Dragonfly surveys were conducted by William A. Smith et al. from 1993 to 1995.
- 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.

- Mussel:Diversity: Major streams were sampled in representative segments by divers collecting lots of 20 live mussels until no new species were found in six consecutive lots. Data was tallied in the field and the mussels returned upon completion of each site.

Birds

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 especially, 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.

For species that do not sing or otherwise advertise territories during June mornings, other methods are necessary. 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 NHAL State Forest and elsewhere. Only about 15 sq. mi. of the state forest were surveyed as a result. Contact the NHI Section Chief for more information about this study.

Herps

General surveys for amphibians and reptiles were not conducted. Rather, rare species with potential significant habitat on the NHAL State Forest were singled out for targeted searches. The only species systematically searched for were the four-toed salamander for which a new survey methodology was available, and the wood turtle. See Brewster and Brewster (1996) for a detailed description of wood turtle methodology and Casper (1996).

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.

Rare Animals List

Each of the animals listed below is accompanied by the Wisconsin protection status and a ranking code denoting its rarity in Wisconsin and throughout its range. These ranks are defined on the first pages of the Wisconsin Natural Heritage Working List (Appendix H). In addition, each NHAL rare animal population is ranked according to the significance of its contribution to a given species' success in Wisconsin and their sensitivity to land management practices or disturbance. These criteria were recommended to the Heritage staff by Clark Forestry, Inc., which used them in the Baraboo Hills (see methodology in main body of report). The significance and sensitivity ranks can range from A to C. A-level significance applies to species for which NHAL is very important to survival in Wisconsin. B applies to moderate significance, and C describes species for which NHAL is not very important. A-level sensitivity refers to a species that has a high sensitivity to disturbance. For example, a species with the rank B/A is moderately dependent on NHAL for its persistence in Wisconsin, and is highly sensitive to land use disturbances.

BIRDS

Northern Goshawk (*Accipiter gentilis*) - Special Concern, S2N, S2S3B; Rank B/A

Brief Description: Large gray (adult) to brown (immature) 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 are 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.

NHAL Records: There are five known breeding records from the NHAL.

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

Le Conte's Sparrow (*Ammodramus leconteii*) – Special Concern, S2B, SZN, Rank B/B

Brief Description: A smaller sparrow with a bright eyebrow stripe, and with breast stripes confined to the sides.

Distribution: Breeding habitat extends from the northern part of the upper Midwest through a large part of Canada.

Habitat: Weedy prairie marshes, sedge meadows, tall grasses, weedy hayfields.

State Records: Large majorities of records are confined to the northern third of the state. Verified records are few, but the species is not detected efficiently during surveys as its singing periods are short and song does not carry well.

NHAL Records: There is only one known confirmed record of this species from the 1990s in the NHAL.

Conservation Concerns: Water level fluctuations, wetland draining, mowing, and burning.

Sharp-tailed Sparrow (*Ammodramus nelsoni*) – Special Concern, S1B, SZN, Rank C/C

Brief Description: An average size sparrow with a deep ochre-yellow of the face, which surrounds a gray ear patch.

Distribution: Majority of breeding records are in the Canadian prairies and coastal plains of the northeast United States.

Habitat: Marshes and muskegs.

State Records: Six records from NW WI, one from Northcentral WI

NHAL Records: Species known from one location in the NHAL in the 1980s and early 1990s.

Conservation Concerns: Water level fluctuations, wetland draining.

American Black Duck (*Anas rubripes*) – Special Concern, S2N, S3B, Rank B/B

Brief Description: A large dark marsh duck with white wing bars. Similar in appearance to a dark hen Mallard (Anas platyrhynchos.)

Distribution: Breeding range is from northeastern U.S. through the upper Midwest, up into northern Canada.

Habitat: Marshes and most permanent open water habitats.

State Records: Ranges throughout the state, but verified nests are not well documented.

NHAL Records: Only one breeding season record from the NHAL has been confirmed in the 1990s.

Conservation Concerns: Genetic swamping from the closely related Mallard (*Anas platyrhynchos*).

Long-eared Owl (*Asio otus*) – Special Concern, S2S3B, SZN, Rank B/B

Brief Description: A crow sized owl with long ear tufts. Undersides streaked lengthwise, not horizontally.

Distribution: From northern Canada down through south-central and southwestern U.S. in North America, also in Eurasia and northern Africa.

Habitat: Conifers, thickets, and woodlands. Very secretive.

State Records: Ranges throughout the state, but verified nests are few.

NHAL Records: One breeding season record, from the late 1980s, is known from the NHAL.

Conservation Concerns: Uncertain.

American Bittern (*Botaurus lentinginosus)* - Special Concern, S3B, SZN, Rank C/B

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

Distribution: Eastern and central 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.

NHAL Records: One breeding season record in the 1990s is known from the NHAL.

Conservation Concerns: shoreline development, wetland alteration, disturbance, recreational boating, or alteration of water quality.

Red-shouldered Hawk (*Buteo lineatus*) – Threatened, S1N, S3S4B, Rank C/B

Brief Description: A large hawk with rufous shoulders. Calls frequently on nesting territory.

Distribution: Eastern and central U.S. and southeastern Canada.

Habitat: Woodlands, wooded rivers, and timbered swamps.

State Records: Occurs statewide.

NHAL Records: Four breeding season records, all from the early 1980s, are known from the NHAL.

Conservation Concerns: Fragmentation of large forest blocks, stand thinning, lack of needed structural components.

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

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.

NHAL Records: One breeding season record, from the mid-1990s, is known from the NHAL.

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.

Swainson's Thrush (*Catharus ustulatus*) - Special Concern, S2B, SZN, Rank B/B

Brief Description: A gray-brown spotted thrush with a buffy eye-ring.

Distribution: Breeds in Canada and northern parts of the upper Midwest and northeastern U.S.

Habitat: Spruce and maple dominated forests.

State Records: Wisconsin is along the edge of this species range. Restricted to the northern two tiers of counties in the state. Less than ten breeding records have been verified in the 1990s.

NHAL Records: Almost half the known state records from the 1990s are from the NHAL.

Conservation Concerns: Habitat fragmentation, reduced conifer cover, conversion of forests to plantations.

Black Tern (*Chlidonias niger*) - Special Concern, S3B, SZN, Rank B/B

Brief Description: A small tern with a black body.

Distribution: Breeds from the northern U.S. up through middle Canada.

Habitat: Freshwater marshes and lakes.

State Records: Status is currently being assessed.

NHAL Records: One small colony occurs on the NHAL, another near Minocqua.

Conservation Concerns: Water level manipulations, nest predation.

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

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.

NHAL Records: Two known breeding season records have been confirmed on the NHAL in the 1990s.

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

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

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

Distribution: Canada and north-central 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.

NHAL Records: Over half the confirmed breeding season records in the 1990s are from the NHAL.

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.

Yellow Rail (*Coturnicops noveboracensis*) – Threatened, S1B, SZN, Rank B/C

Brief Description: A small buff colored rail with a short greenish bill. A white wing patch is visible in flight.

Distribution: Breeds locally from the northern central U.S. through Canada.
Habitat: Extensive grassy freshwater marshes and meadows with little shrub encroachment.

State Records: Known from eleven counties since 1935. Probably less than fifty breeding pairs now, primarily on 4 WDNR managed sites. Breeding difficult to document.
NHAL Records: The species has been documented three times on the NHAL in the 1980s. Breeding was not confirmed.

Conservation Concerns: Small population size and isolation. Threats to current and potential habitat, especially fragmentation, succession, and impoundment.

Black -throated Blue Warbler (*Dendroica caerulescens*) – Special Concern, S3B, SZN, Rank B/B

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

Distribution: Eastern and central 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.

NHAL Records: The species has been documented three times in the 1980s and 1990s.

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 cerulea*) - Threatened, S2S3B, SZN, Rank C/C

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

Distribution: Eastern and central United States.

Habitat: Large stands of mature 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.

NHAL Records: The species has been documented three times in the 1980s and 1990s.

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

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

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

Distribution: Canada, northeastern and far northern United States.

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

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

NHAL Records: The species has been documented two times in the 1990s.

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.

Yellow-bellied Flycatcher (*Empidonax flaviventris*) - Special Concern, S2B, SZN, Rank C/B

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

Distribution: Northeastern and far north central 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.

NHAL Records: The species has been documented five times in the 1990s on the NHAL.

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.

Spruce Grouse (*Falcipennis canadensis*) – Threatened, S1S2B, S1S2N, Rank B/A

Brief Description: A dusky grouse. Males have a black breast and a red skin comb above the eyes. Females are thickly barred. Both sexes have a rusty band on the tip of the tail.

Distribution: Canada and far northern U.S.

Habitat: Conifer forests, muskegs, etc.

State Records: Restricted to the northern third of the state. Observations are infrequent.

NHAL Records: This species as only been documented once in the 1990s on the NHAL.

Conservation Concerns: Misidentification by hunters, loss of conifer forests.

Merlin (*Falco columbarius*) - Special Concern, S3B, S2N, Rank B/B

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.

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

NHAL Records: Species has only been documented once, in 1969.

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

Bald Eagle (*Haliaeetus leucocephalus*) - Special Concern, S2N, S3S4B; Federally Threatened, Rank A/A

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.

NHAL Records: Fifty-eight nest sites have been documented in the 1980s and 1990s.

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

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

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. Approximately ten breeding season records are known so far.

NHAL Records: The species has been documented only once in the 1990s.

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 for habitat fragmentation.

Osprey (*Pandion haliaetus*) - Threatened, S3S4B, SZN, Rank A/A

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 outliers in the west and central portions.

NHAL Records: Seventy-nine nest sites have been documented in the 1980s and 1990s.

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

Gray Jay (*Perisorius canadensis*) - Special Concern, S3B, SZN, Rank C/B

Brief Description: A large, fluffy gray jay 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.

NHAL Records: Approximately one-third of the known breeding records in the 1980s and 1990s are from the NHAL.

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

Black-backed Woodpecker (*Picoides arcticus*) – Special Concern, S2B, SZN, Rank B/B

Brief Description: A medium sized woodpecker with solid black back and barred sides. Males have yellow caps.

Distribution: Far northern north central and northeastern U.S. and Canada.

Habitat: Fir and spruce boreal forests, tamarack bogs, jack pine forests.

State Records: Year round resident of the northern third tier of counties. Can be found occasionally throughout the state, but largely absent from the driftless area.

NHAL Records: The species has been documented three times in the 1990s in the NHAL.

Conservation Concerns: Uncertain.

Boreal Chickadee (*Poecile hudsonicus*) – Special Concern, S3B, SZN, Rank B/B

Brief Description: Similar to the abundant black-capped chickadee, but with a dull brown cap and rich brown flanks.

Distribution: Far northern north-central and northeastern U.S. and Canada.

Habitat: Conifer forests.

State Records: Year round resident of the northern third tier of counties. About a dozen breeding records have been verified in the 1990s.

NHAL Records: One-third of the known breeding records in the 1990s are from the NHAL.

Conservation Concerns: Unknown.

INVERTEBRATES

Mottled Darner (*Aeshna clepsydra*) – Special Concern, S2, Rank A/A

Brief Description: A large blue-gray dragonfly with a cross-striped greenish face and an exceedingly complicated pattern of stripes on the thorax. Thorax completely patterned in brown and blue.

Distribution: Ontario Canada, northeastern U.S., and the upper Midwest.

Habitat: Reed-bordered lakes, deep sterile lakes.

State Records: Collected from seven sites in four counties in the 1990s.

NHAL Records: Collected from six sites on the NHAL in the 1990s.

Conservation Concerns: Specialized ecological/habitat requirements, possibly sensitive to water quality.

Lake Darner (*Aeshna eremita*) – Special Concern, S3, Rank B/A

Brief Description: A very large striking blue dragonfly with a black line across face.

Distribution: Canada, Northeastern U.S., the northernmost tier of states in the U.S, and perhaps higher elevations south along the Rockies.

Habitat: Bog or marsh bordered ponds and lakes.

State Records: Collected from eleven sites in eight counties the 1980s and 1990s.

NHAL Records: Collected from three sites on the NHAL in 1990s.

Conservation Concerns: Shoreline modifications.

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

Brief Description: A large deep blue dragonfly with abdominal segment 10 (the last segment) black

Distribution: Canada, north-central 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.

NHAL Records: There are five known records from the NHAL.

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

A Caddisfly (*Banksiola dossuria*) – Special Concern, SU, Rank B/C

Brief Description: An aquatic insect recognizable only by taxonomic specialists.

Distribution: Southeastern Canada and Eastern U.S.

Habitat: Bogs, marshes, ponds, sluggish streams, on shore vegetation.

State Records:

NHAL Records: Collected from two sites on the NHAL in 1980s and 1990s.

Conservation Concerns: Uncertain. WI is at western edge of range.

Bog Fritillary (*Boloria eunomia*) - Special Concern, S3, Rank C/B

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

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

Habitat: Open bogs with cranberry and other ericaceous components.

State Records: Known from forty-six sites in seven Wisconsin counties in the 1980s and 1990s. Previously collected in one additional county in the 1970s. All collections have been made in far northern Wisconsin.

NHAL Records: Only known from one site on the NHAL.

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

Freija Fritillary (*Boloria freija*) – Special Concern, S2, Rank B/B

Brief Description: Above, tawny-orange with strong black pattern of spots and bands. Below, black zig-zag pattern on the hind wing.

Distribution: Canada, northern Great Lakes region, and isolated populations in the Rockies. Also distributed in northern Eurasia.

Habitat: Open leatherleaf bogs, margins of black spruce bogs, and jackpine forests.

State Records: Known from twenty-four sites in ten counties in the 1980s and 1990s. Previously collected in three additional counties in the 1970s. All collections have been made in far northern Wisconsin.

NHAL Records: Only known from 1 site on the NHAL.

Conservation Concerns: Gypsy moth control measures.

Frigga Fritillary (*Boloria frigga*) – Special Concern, S2, Rank A/B

Brief Description: Above, orange with black bars and spots. Forewing apex pointed, not squared off. Below, basal off-white patch on hind wing.

Distribution: Holarctic. In North America: south to the northern Great Lakes region, and isolated populations in the western montane.

Habitat: Sphagnum and sedge bogs.

State Records: Known from nine sites in six counties in the 1980s and 1990s.

NHAL Records: Only known from one site on the NHAL.

Conservation Concerns: Destruction of peatland habitats. Gypsy moth control measures.

A Caenid Mayfly (*Caenis youngi*) - Special Concern, SU, Rank B/B

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 nine sites in Wisconsin.

NHAL Records: Known from one site within the NHAL.

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

Subarctic Bluet (*Coenagrion interrogatum*) – Special Concern, S2, Rank A/B

Brief Description: A small damselfly. Males are pale blue to almost turqoise, postocular spots are not confluent. Females, head and thorax similar to males, abdomen blue dorsally to tan laterally.

Distribution: Canada, New England, and some northern Midwest and western states.

Habitat: Cold swamps, open bogs, and fens, especially those with abundant marshes.

State Records: Known from three sites in Vilas County in 1967.

NHAL Records: Collected from three sites on the NHAL in 1967.

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

Robust Dubiraphian Riffle Beetle (*Dubiraphia robusta*) – Special Concern, S2, Rank B/B

Brief Description: An aquatic beetle

Distribution: WI, MN, ND, Manitoba

Habitat: Lives on submerged wood and rock over sand bottom in lakes or slow streams.

State Records: Few scattered records. Apparently a habitat specialist.

NHAL Records: Collected from one site on the NHAL in 1994.

Conservation Concerns: Uncertain.

Red-disked Alpine (*Erebia discoidalis*) – Special Concern, S2, Rank B/C

Brief Description: Lacks eyespots. Large chestnut red patch on forewing. Underside of hindwing gray-brown.

Distribution: Holarctic. In North America south to the northern Great Lakes region and far northern Montana.

Habitat: Sphagnum and spruce bogs.

State Records: Known from five sites in four counties in the 1990s, all from far northern Wisconsin.

NHAL Records: Only one record is known from the NHAL.

Conservation Concerns: Wetland degradation by off-road vehicles. Gypsy moth control measures.

Splendid Clubtail (*Gomphurus lineatifrons*) – Special Concern, S3, Rank C/B

Brief Description: A large black and yellow dragonfly with a prominent club at the end of the abdomen that is narrow than the thorax. No yellow spot on top of club.

Distribution: Centered in the Midwest, extending to some of the northern Southern states, western northeastern states, and Mid-Atlantic States.

Habitat: Medium to large fast-flowing streams with good water quality.

State Records: Collected from about thirty waterbodies in twenty counties.

NHAL Records: Collected from eight sites on the NHAL.

Conservation Concerns: Increased sedimentation, impoundments.

Skillet Clubtail (*Gomphurus ventricosus*) – Special Concern, S3, Rank C/B

Brief Description: A medium-sized black and yellow dragonfly with a prominent flattened. Yellow spot on top of club.

Distribution: Canada, northeastern U.S., northern Midwest, and some Mid-Atlantic States.

Habitat: Relatively clean medium-large streams with at least moderate current; large lakes.

State Records: Collected from twenty-eight waterbodies in twenty-one counties.

NHAL Records: Collected from one site on the NHAL.

Conservation Concerns: Increased sedimentation, impoundments.

Green-faced Clubtail (*Gomphus viridifrons*) – Special Concern, S3, Rank C/B

Brief Description: A small dark dragonfly marked with green with abdomen black on top of segments 8-10. Lacks heavy black face striping, especially along face seam.

Distribution: Midwest, some of the northern Southern states, and western Northeastern states.

Habitat: Rapid medium-large streams with good water quality.

State Records: Collected from thirty-five sites in twenty-seven counties.

NHAL Records: Collected from two sites on the NHAL.

Conservation Concerns: Increased sedimentation, impoundments.

Citrine Forktail (*Ischnura hastata*) – Special Concern, S2, Rank A/B

Brief Description: A very small damselfly. Males are distinctive with a bright yellow abdomen. Females are very difficult to distinguish from other members of the genus in the field.

Distribution: A very wide ranging species. Found in Canada, throughout the U.S., the Antilles, Central America, and South America.

Habitat: Dense emergent vegetation along pond margins or near seepage areas and backwaters of sluggish streams. Often found where there is little standing water.

State Records: Only known from three sites in Wisconsin.

NHAL Records: Collected from one site on the NHAL in 1962.

Conservation Concerns: Uncertain.

A Predacious Diving Beetle (*Lioporeus triangularis*) – Special Concern, SU, Rank B/B

Brief Description: An aquatic beetle

Distribution: Southeastern U.S. and WI

Habitat: A big river species that lives on wood and under banks over a sand bottom.

State Records: Collected from five sites in four counties

NHAL Records: Collected from one site on the NHAL in 1994.

Conservation Concerns: Uncertain.

Bog copper (*Lycaena epixanthe*) - Special Concern, S2S3, Rank C/B

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 northeastern U.S.

Habitat: Open bogs with cranberry and other ericaceous components.

State Records: Known from thirty-seven sites in WI.

NHAL Records: Collected at two sites in the 1990s on NHAL.

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

Elfin Skimmer (*Nannothemis bella*) - Special Concern, S3, Rank B/A

Brief Description: A delicate little (ca 2cm) clear-winged dragonfly. Appearance changes with age. Small thorax, thinly clad with rather long whitish hairs. Legs black.

Distribution: Ontario and Quebec Canada, Alaska, and the eastern half of the U.S.

Habitat: Fens and floating sphagnum bogs.

State Records: Collected from seven sites in Wisconsin.

NHAL Records: Collected from one site on the NHAL in the 1960s.

Conservation Concerns: Uncertain.

Cyrano Darner (*Nasiaeschna pentacantha*) - Special Concern, S3, Rank B/B

Brief Description: A large bluish dragonfly with an elongate face. Smallish thorax, brown, brightly marked with blue. Abdomen long, tapering regularly from segment two to the end.

Distribution: Ontario and Quebec Canada, Alaska, and the eastern half of the U.S.

Habitat: Swampy streams, lake coves and ponds with roots or branches in water, or with abundant emergent annual vegetation.

State Records: Collected from ten waterbodies in ten counties in Wisconsin.

NHAL Records: Collected from five waterbodies on the NHAL in the 1990s.

Conservation Concerns: Shoreline modification.

Jutta Arctic (*Oeneis jutta*) - Special Concern, S3, Rank

Brief Description: Variable. Above, gray-brown. Both wings with yellow-orange submarginal band (usually interrupted). Variable number of small eyespots, more on forewing than hindwing.

Distribution: Holarctic. In North America the northern Great Lakes region, and south along the western montane region.

Habitat: Black spruce – sphagnum bogs.

State Records: Known from thirty-five sites in the 1990s, all but one from eleven far northern Wisconsin counties.

NHAL Records: Only one record is known from the NHAL.

Conservation Concerns: Water level alterations. Gypsy moth control measures.

Lake Emerald (*Somatochlora cingulata*) - Special Concern, S1, Rank A/A

Brief Description: A black medium sized dragonfly with emerald green eyes and with a conspicuous white-ringed abdomen. Triangles of yellow on each side of bronzy green-capped frons nearly meet.

Distribution: Canada and a few northern U.S. states in the Midwest and Northeast.

Habitat: Rocky lake points. Ponds and small boggy-bordered lakes farther north.

State Records: Only known from one site is Wisconsin.

NHAL Records: Collected from one site on the NHAL in 1993 and 1994.

Conservation Concerns: Water quality degradation, water level alterations, shoreline modification, fish stocking, and habitat modifications to promote game fish populations.

Ski-tailed Emerald (*Somatochlora elongata*) - Special Concern, S2S3, Rank C/B

Brief Description: A medium sized blackish dragonfly 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.

NHAL Records: Known from two sites on the NHAL.

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

Forcipate Emerald (*Somatochlora forcipata*) - Special Concern, S2S3, Rank B/B

Brief Description: A medium sized darkly colored dragonfly with metallic reflections. Thick growth of brownish hairs cover thorax. Ale stripes of sides appear as two conspicuous, similar, roundish-oval spots of pale yellow.

Distribution: Canada, New England, and some northern Midwest states.

Habitat: Small spring fed woodland streams and pools.

State Records: Only collected from three counties in Wisconsin. There have been collections from nine sites in two counties in the 1980s and 1990s.

NHAL Records: Collected from one waterbody on the NHAL in 1964.

Conservation Concerns: Water level fluctuations.

Kennedy's Emerald (*Somatochlora kennedyi*) - Special Concern, S3, Rank B/B

Brief Description: A medium-sized dark dragonfly with emerald green eyes in adult males. Pale stripes on sides ill defined and wide. Legs black, paler basally. Abdomen long and stout. Front of thorax metallic green, with bluish reflections, at either side of which are areas of dull yellow.

Distribution: Canada, New England, and some northern Midwest states.

Habitat: Slow streams through open bogs or marshes. Sedge meadows.

State Records: Collected from seventeen sites in nine counties.

NHAL Records: Collected from one waterbody on the NHAL in 1965.

Conservation Concerns: Water level fluctuations.

Zebra Clubtail (*Stylurus scudderi*) - Special Concern, S3, Rank C/B

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.

NHAL Records: Known from five waterbodies on the NHAL in the 1990s.

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

FISH

Lake Herring (*Coregonus artedii*) - Special Concern, S3, Rank X

Brief Description: An 11-15" fish weighing up to 2 pounds. Silvery with pink to purple iridescence. Almost round in cross-section, elliptical in lateral view.

Distribution: Canada and the Great Lakes region of the U.S.

Habitat: Deep inland lakes, the Great Lakes.

State Records: Lake Michigan, Lake Superior, and large lakes in the northern third tier of counties and eastern half of the state.

NHAL Records: There are four known records from the NHAL.

Conservation Concerns: Populations subject to large fluctuations. General decline attributed to increased predation by introduced muskellunge, rainbow smelt, and walleye.

Least Darter (*Etheostoma microperca*) - Special Concern, S3, Rank B/A

Brief Description: Adults 1.5-2" in length, compressed laterally. Olive -brown back and sides with scattered dark brown specks and zigzag markings, series of small dusky blotches on sides and four short dusky bars radiating from the eye.

Distribution: Great Lakes region, Mississippi River valley as far south as Oklahoma.

Habitat: Weedy portions of lakes and clear streams with sluggish flow.

State Records: Scattered records throughout the state, generally avoids the unglaciated region, and not reported since 1935 from the Lake Superior drainage basin. Bulk of records in southeastern Wisconsin and the Wolf River system.

NHAL Records: Only one occurrence known from the NHAL.

Conservation Concerns: Statewide abundance trends uncertain. Appears to have recently disappeared from several Rock County locations. This species is relatively sensitive to environmental perturbations such as watershed and shoreline development.

Banded Killifish (*Fundulus diaphanus*) - Special Concern, S3?, Rank X

Brief Description: Adults between 2-2.5". Body is light olive on the back and sides and yellow-white below with 12 - 20 narrow vertical bars on the body.

Distribution: Northeastern U.S. and far southeastern Canada. Great Lakes region west to eastern North and South Dakota.

Habitat: Shoal waters and estuaries of large lakes. Quiet backwaters and sections of slow current in medium to large streams. Prefers open broad, sandy shallows during the warm season.

State Records: All modern records from the eastern half of Wisconsin.

NHAL Records: There are three known collections from the NHAL.

Conservation Concerns: Species declining in southern Wisconsin, and has been extirpated at several sites. Shoreline development and modification of littoral-zone habitats are probably major factors.

Longear Sunfish (*Lepomis megalotis*) - Threatened, S2, Rank B/B

Brief Description: Thin, deep-bodied sunfish. Opercular "ear flap" flexible and much elongated in adults. Black olive to rusty brown, sides lighter, breast and belly yellow to orange red. Back and sides with specks of yellow, orange, emerald and blue.

Distribution: A broad swath from western New England southwest to the Mexican border. Populations in the western Great Lakes regions are apparently isolated.

Habitat: Prefer clear, shallow, moderately warm, still water of streams, rivers or lakes over rubble, gravel and sand with moderate aquatic vegetation.

State Records: Occurs in three widely separated population centers, in southeastern, east-central, and northwestern Wisconsin. Populations in former strongholds in southeastern Wisconsin appear to be declining. Specimens have been found in other river systems, but they are infrequently collected, and are often Lepomis sp. hybrids.

NHAL Records: There is only one known collection from the NHAL.

Conservation Concerns: Hybridization in small populations is a concern. They are intolerant to turbid water from heavy agriculture within their range. They resemble other sunfish; they are often caught and kept by young anglers.

Greater Redhorse (*Moxostoma valenciennesi*) - Threatened, S2S3, Rank C/B

Brief Description: Largest of the redhorses (*Moxostoma spp.*). Somewhat compressed body, red tail, rows of dark spots on back and sides, large mouth and full lips. Back brown olive, sides golden, belly whitish. Adult size: 18 inches.

Distribution: Great Lakes region of the U.S. and Canada.

Habitat: Clear waters of small to large sized rivers, reservoirs and large lakes at depths of less than 3 feet (1m) over sand, gravel or boulders.

State Records: Widely scattered records from the Mississippi River and Lake Michigan drainage basins. Recent records from southeastern Wisconsin in the Illinois River drainage.

NHAL Records: There are three known collections from the NHAL.

Conservation Concerns: Sensitive to chemical pollutants and turbidity. Carp control programs may also be a threat.

Pugnose Shiner (*Notropis anogenus*) - Threatened, S2S3, Rank C/A

Brief Description: Slender, fragile minnow with small and almost vertical upturned mouth, giving a distinctive pugnose appearance. Large eyes. Silvery with yellow cast dorsally, sides and belly silvery. Lead-colored lateral stripe extending from a small dark spot on base of tail, along sides and through eye. Adult length: 1.8 inches.

Distribution: Great Lakes region of the U.S west to eastern North Dakota.

Habitat: Prefer clear, weedy shoals of glacial lakes and streams of low gradient over sand, mud, gravel or marl. Characteristic vegetation includes pondweed, water milfoil, elodea, eelgrass, coontail, bullrush and filamentous algae.

State Records: Majority of records from far northwestern Wisconsin and southeastern Wisconsin. Apparently extirpated from the Rock River drainage. Recently found in the Manitowish River system.

NHAL Records: There are three known collections from the NHAL.

Conservation Concerns: Loss of littoral zone macrophyte communities and lakeshore development.

Pugnose Minnow (*Opsopoeodus emiliae*) - Special Concern, S3?, Rank C/A

Brief Description: Adults 2.5” in length. Body color is straw-brown dorsally changing to silvery-yellow on the sides and belly, body is crosshatched in appearance, very blunt snout which is rounded in appearance with small mouth that is nearly vertical.

Distribution: Southeastern U.S. west to eastern Texas, north, following the Mississippi River Valley to central Wisconsin.

Habitat: Pugnose minnows prefer clear, vegetated water, where there is sluggish current. Backwater sloughs, lowland lakes, and connecting streams along the Mississippi flood plain offer ideal habitat.

State Records: Two widely separated population centers within the Mississippi River drainage basin. Found in backwaters of the Mississippi River, within the Red Cedar system of Dunn and Washburn Counties, and isolated areas of the southernmost tier of counties.

NHAL Records: There is only one known collection from the NHAL.

Conservation Concerns: Appears to be intolerant of excessive turbidity and siltation.

REPTILES & AMPHIBIANS

Wood Turtle (*Clemmys insculpta*) - Threatened, S3, Rank C/A

Brief Description: A medium sized semi-terrestrial 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.

NHAL Records: There are only three known records from the NHAL.

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.

Northern Ringneck Snake (*Diadophis punctatus edwardsii*) - Special Concern, S3?, Rank B/B

Brief Description: Adults are 12-15" long. A slender snake with a yellow, cream, or orange neck ring and bright yellow, orange, or occasionally red belly. The underside is free of markings or may be marked with an irregular row of black spots. Spots are more common where this subspecies intergrades with the prairie ringneck snake (*Diadophis punctatus arnyi*). The neck ring may be interrupted, obscure, or occasionally absent.

Distribution: This subspecies ranges from far southeastern Canada and northeastern U.S. west to northeastern Minnesota and south to northern Alabama.

Habitat: Northern Ringneck Snakes prefer to live in moist areas in forests, grasslands, cut over areas, rocky wooded hillsides, or ledges along streams. They are most often seen under flat rocks, logs, or the loose bark of dead trees. They are believed to be highly fossorial.

State Records: Specimens verified from twenty-six counties, distributed mainly above the tension zone. Populations from the southern central and southeastern counties are believed to be extirpated. This subspecies apparently does not extend into the driftless area.

NHAL Records: There is only one known collection from the NHAL.

Conservation Concerns: Uncertain.

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

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 fresh cool water.

State Records: There are about forty records for the state from twenty-two counties, 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.

NHAL Records: There are three known collections from the NHAL.

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.

Bullfrog (*Rana catesbeiana*) - Special Concern, S3S4, Rank C/B

Brief Description: Largest North American frog. Plain or nearly plain green above, or with a netlike pattern of gray or brown on a green background. No dorsolateral ridges on trunk.

Distribution: Eastern and central North America. Introduced widely outside their range.

Habitat: A wide variety of wetlands and vegetated edges of open water bodies.

State Records: Widely distributed and scattered throughout the state in appropriate habitat. Widely introduced outside its range, and it is difficult to distinguish natural populations from introduced ones.

NHAL Records: There are more than a dozen known records from the NHAL.

Conservation Concerns: Uncertain.

MAMMALS

Timber Wolf (*Canis lupus*) - Endangered, S1, Rank B/A

Brief Description: They have silvery gray-brown backs, light tan underparts, and bushy tails. In winter, their fur becomes darker on the neck, shoulders, and rump. They are approximately twice as large as a coyote.

Distribution: Currently distributed throughout Canada and Alaska, extends south into Minnesota, Michigan, Wisconsin, Montana, Idaho, and Washington.

Habitat: Remote, contiguous, mixed forest blocks. Large conifer swamps often serve as rendezvous sites probably because of availability of dense cover and nearness to water sources.

State Records: As of 1998 there were 47 packs known to inhabit 16 northwest, north-central, and central Wisconsin counties.

NHAL Records: 2-3 packs are known to inhabit the NHAL.

Conservation Concerns: Poaching, mistaken identification by hunters, disease, collision with motor vehicles.

Lynx (*Lynx canadensis*) - Special Concern, SA, Rank B/B

Brief Description: The Canada lynx is a medium-sized cat, similar to the bobcat, but appears somewhat larger. It has longer legs and very large well-furred paws, impressive adaptations for maneuvering through deep winter snow. It also has long tufts on the ears and a short, black-tipped tail.

Distribution: Found throughout Canada and Alaska. It is also be found in some northern regions of the United States, including western Montana and nearby parts of Idaho and Washington, stretching down

through the western montane. Some have also been located in New England, the Great Lakes region, and other states bordering Canada.

Habitat: Mature, dense forests and swamps are preferred. They are also found in more open forests and rocky areas, or tundras.

State Records: Considered a non-breeding accidental wanderer.

NHAL Records:

Conservation Concerns: Could easily be mistaken for the more common bobcat (*Lynx rufus*) by hunters, and traps set for bobcats could accidentally kill individuals.

Water Shrew (*Sorex palustris*) - Special Concern, S2, Rank B/B

Brief Description: A large (3-3.5") blackish-grey shrew, with underside paler, sometimes silvery. Stiff hairs along the sides of the feet distinguish from other midwest shrews.

Distribution: Northern U.S. and Canada. Extends south in the U.S. along the Rockies and the Appalachian Mountains.

Habitat: Marshes, bogs, and cold, small streams with cover along the banks.

State Records: Not common anywhere within range. Collected infrequently in the northern third tier of counties.

NHAL Records: There is only one known collection from the NHAL.

Conservation Concerns: Sensitive to water quality changes.

MUSSELS

Elktoe (*Alasmidonta marginata*) - Special Concern, S4, Rank C/B

Brief Description: Shell elongate, triangular, inflated, and relatively thin. Anterior end rounded, posterior end sharply angled, ending in a blunt, squared point. Posterior ridge sharply angled and prominent, posterior slope broad, flat, and covered with fine ridges. Periostracum yellowish green or bright green with numerous rays and dark green spots present. Posterior slope often lighter than rest of shell. Length to 4 inches (10.2cm).

Distribution: In the U.S. it is distributed in the Ohio-Mississippi River and Susquehanna River systems. In Canada it is in the Great Lakes – St. Lawrence system from Lake Huron to the Ottawa River.

Habitat: Medium-sized streams in gravel or mixed sand and gravel.

State Records: Known from twenty-five waterbodies in Wisconsin. Only common in St. Croix River.

NHAL Records: Known from two sites on the NHAL.

Conservation Concerns: Increased sedimentation, impoundment.

Eastern Floater (*Anodonta cataracta*) - Special Concern, SU, Rank B/B

Brief Description: Elliptical, roundly pointed posteriorly, inflated, thing, fragile, and with inflated beaks that project above the hinge line. Surface smooth except for low concentric wrinkles and green rests.

Distribution: Northeastern North America to the Midwest.

Habitat: Ponds, lakes, and streams of various widths down to small brooks. Most abundant on mud, but also occurs on sand, and less frequently on gravel.

State Records: Only known from one waterbody in Wisconsin.

NHAL Records: The only known population, last seen in 1990, is from the NHAL.

Conservation Concerns: Inventory incomplete, fist host unknown.

Round Pigtoe (*Pleurobema sintoxia*) - Special Concern, S3, Rank C/B

Brief Description: Shell moderately thick, round, and compressed (medium-sized rivers) to inflated (large rivers). Anterior end rounded, posterior end rounded to bluntly pointed. Periostracum greenish brown, light brown, or reddish brown in juveniles, becoming chestnut or dark brown in adults, with faint green rays visible near the beaks in some shells. Length to 4 inches (10.2 cm).

Distribution: Found throughout most of the Mississippi – Missouri river systems in the U.S. Found in Lake Erie, and tributaries of Lake Erie and Lake St. Clair in southwestern Ontario.

Habitat: Medium to large rivers in mud, sand, or gravel.

State Records: Known from twenty-four waterbodies in Wisconsin

NHAL Records: Known from four waterbodies on the NHAL.

Conservation Concerns: Increased sedimentation, impoundment.

APPENDIX H

A Checklist of Birds of the Northern Highland-American Legion State Forest

The following list includes all known bird species documented since 1939. Species abundance varies annually due to many conditions. Relative abundance represents the average year. Probabilities of sighting a particular species depends on several factors. For instance, Common Loons are readily observed if they are nesting on a lake. However, the chance of seeing a Common Loon is averaged out for all lakes as fairly common. Observability also plays a significant role in whether or not an observer may see a particular bird. An example is the comparative populations of Great Blue Herons and Soras. Great Blue Herons are often observed along streams, lakeshores, or flying about, but their relative abundance is much less than Soras which are seldom seen due to their secretive behavior. Species abundance is listed in each of four different seasons. Abundance is defined as follows:

A = Abundant – Numerous and easily found in appropriate habitat.

C = Common – Should be found with little search effort in appropriate habitat.

F = Fairly Common – Should be found with moderate search effort in appropriate habitat. Birds can be missed due to weather or poor timing of searches.

U = Uncommon – May be found with considerable search effort in appropriate habitat. Obtaining a thorough understanding of their habits is necessary for most successful encounters.

R = Rare – Only observed once or twice every one to five or more years.

* = Accidental – Records exist, but the chance of observation is virtually nil.

The abundance of birds is on a seasonal basis as follows:

Sp = March through May

S = June and July

F = August through November

W = December through February

✔	Bird	Sp	S	F	W	Habitat
	Red-throated Loon	r		r		Large Lakes
	Common Loon	f	f	f		Medium and Large Lakes
	Pied-billed Grebe	u	u	r		Shallow lakes and marshes, Powell Marsh
	Horned Grebe	u		u		Large Lakes
	Red-necked Grebe	r				Large Lakes
	Western Grebe			*		Accidental
	American White Pelican			*		Accidental
	Double-crested Cormorant	r	r	r		Large Lakes and Flowages
	American Bittern	u	u	r		Marshes and sedge meadows
	Least Bittern		r			Occasional at Powell Marsh
	Great Blue Heron	c	c	c		Lakes, streams, and flowages
	Great Egret			r		Powell Marsh
	Cattle Egret	r	r	r		Fields and marshes
	Green-backed Heron	u	u	r		Streams and backwaters
	Black-crowned Night Heron			r		Marshes
	White-faced Ibis			*		Old record from Powell Marsh
	Trumpeter Swan	r	r	r		Endangered Species being reintroduced
	Tundra Swan	u		u		Large marshes and sedge meadows
	Mute Swan	r	r	r	u	European escape, winters on Manitowish River
	Greater White-fronted Goose			*		Powell Marsh
	Snow Goose	u		r		Primarily Powell Marsh
	Brant			*		Old record from Vilas County
	Canada Goose	c	f	c	r	Increasing - lakes, wetlands, beaver ponds
	Wood Duck	c	c	f		Beaver ponds and streams
	Green-winged Teal	u	r	u		Ponds and shallow marshes
	American Black Duck	u	u	u	r	Shallow marshes and streams
	Mallard	a	c	a	r	Lakes, wetlands, and parks
	Northern Pintail	u	r	r		Powell Marsh and other large wetlands
	Blue-winged Teal	f	f	f		Ponds, marshes, and streams
	Northern Shoveler	u	r	r		Powell Marsh and other large wetlands
	Gadwall	u	r	r		Most observation at Powell Marsh
	American Widgeon	r	r	r		Often observed with diving ducks on large lakes
	Canvasback	r	r	r		Large lakes and deep marshes
	Redhead	r	r	r		Large lakes and deep marshes
	Ring-necked duck	c	u	c		Large marshes and bog lakes
	Greater Scaup	u		u		Migrant on larger lakes
	Lesser Scaup	c	r	c	r	Large marshes and bog lakes
	Oldsquaw			r		Rare fall visitor to large lakes
	Surf Scoter			r		Rare fall visitor to large lakes
	White-winged Scoter			r		Rare fall visitor to large lakes
	Common Goldeneye	c	r	c	u	Winters on any open water
	Bufflehead	c	r	c		Large lakes and marshes
	Hooded Merganser	f	u	u		Small lakes, beaver ponds, and streams
	Common Merganser	c	u	u	r	Large lakes and large rivers
	Red-breasted Merganser	u	r	u		Large lakes
	Ruddy Duck	r		r		Occasional at Powell Marsh

✔	Bird	Sp	S	F	W	Habitat
	Turkey Vulture	r	r	r		Usually seen soaring or at roadside kills
	Osprey	u	u	u		Most large lakes, common on Rainbow Flowage
	Mississippi Kite			*		Accidental
	Bald Eagle	u	f	u	u	Most large lakes, common on Rainbow Flowage
	Northern Harrier	u	u	r		Open sedge meadows and grasslands
	Sharp-shinned Hawk	u	u	u	r	Forest clearings, edges, and gaps
	Cooper's Hawk	u	u	u	r	Forest clearings, edges, and gaps
	Northern Goshawk	r	r	r	u	Old-growth mixed forest, late successional forest
	Red-shouldered Hawk	r	r	r		Old-growth hemlock/hardwood forest, floodplain forest
	Broad-winged Hawk	c	c	c		Extensive forests
	Red-tailed Hawk	c	f	c	r	Open lands, sedge meadows, recently logged areas
	Golden Eagle	r			r	Open lands, especially Powell Marsh
	American Kestrel	c	c	c	r	Open lands, roadsides, forest edges
	Merlin	r	r	r		Extensive bogs, large undeveloped lake shores
	Peregrine Falcon	r		r		Rare migrant
	Gyrfalcon				r	Extensive open areas
	Ring-necked pheasant	*	*	*	*	Agricultural lands
	Spruce Grouse	r	r	r	r	Extensive bog areas, extensive jack pine areas
	Ruffed Grouse	c	c	c	c	Aspen, alder, early successional forests
	Greater Prairie Chicken	*	*	*	*	Widespread after exploitive logging era, now extirpated
	Sharp-tailed Grouse	r	r	r	r	A few remain at Powell Marsh and in pine barrens
	Yellow Rail	r	r			Regular at Powell Marsh, but difficult to find
	Virginia Rail	u	u	u		Dense cattail/bulrush areas, sedge meadows, alder thickets
	Sora	f	f	u		Dense cattail and bulrush areas, sedge meadows
	American Coot	u	u	u		Deepwater marshes, wild rice lakes in fall
	Sandhill Crane	u	u	r		Extensive sedge meadows and bogs
	Black-bellied Plover	r	r	r		Shortgrass areas and mudflats
	Lesser Golden Plover	r	r	r		Shortgrass areas and mudflats
	Semipalmated Plover	u	r	r		Mudflats
	Killdeer	c	c	c		Mudflats and open areas, especially agricultural land
	Greater Yellowlegs	f	u	u		Mudflats and sedge meadows, esp. Powell and Rainbow Flowage
	Lesser Yellowlegs	f	u	u		Mudflats and sedge meadows, esp. Powell and Rainbow Flowage
	Willet			r		Mudflats and sedge meadows
	Spotted Sandpiper	f	f	u		Lakeshores and rocky streams
	Upland Sandpiper	r	r			Open areas near Sugar Camp
	Semipalmated Sandpiper	r	r	r		Mudflats
	Least Sandpiper	u	r	r		Mudflats and sedge meadows, esp. Powell and Rainbow Flowage
	White-rumped Sandpiper	r	r	r		Mudflats
	Baird's Sandpiper	r	r	r		Shortgrass areas and mudflats
	Pectoral Sandpiper	u	r	r		Mudflats and sedge meadows
	Dunlin	u	r	r		Mudflats and sedge meadows
	Short-billed Dowitcher	r	r	r		Mudflats
	Long-billed Dowitcher	r	r	r		Mudflats
	Common Snipe	f	f	u		Sedge meadows, bogs, and marshes
	American Woodcock	f	f	u		Aspen woods, alder thickets, early successional forest
	Wilson's Phalarope	r	r	r		Sedge meadows, Powell Marsh

✔	Bird	Sp	S	F	W	Habitat
	Red-necked Phalarope			r		Powell Marsh
	Bonaparte's Gull	r		r		Large lakes and mudflats
	Ring-billed Gull	c	c	c	r	Large lakes, parks, golf courses
	Herring Gull	u	r	r		Large lakes, parks, landfills
	Glaucous Gull			*		Accidental
	Caspian Tern	u	r	r		Large lakes
	Common Tern	r	r	r		Large lakes
	Forster's Tern	r	r	r		Large marshed and lakes
	Black Tern	r	u	r		Large marshes, bogs, and shallow lakes--very local
	Rock Dove	f	f	f	f	Developed areas and around buildings
	Mourning Dove	u	u	u	r	Open areas, forest edges, early successional forest, towns
	Black-billed Cuckoo	f	f	u		Forest edges, roadsides. Feeds on caterpillars
	Yellow-billed Cuckoo	r	r			Forest edges, roadsides. Feeds on caterpillars
	Common Barn Owl	*			*	Accidental
	Great Horned Owl	f	f	f	f	Broken forest lands, forest edges near open areas
	Snowy Owl				r	Open areas
	Northern Hawk-Owl				*	Accidental
	Barred Owl	f	f	f	f	Old-growth hemlock/hardwood forest, extensive mature forest
	Great Gray Owl	r	r	r	r	Extensive bog lands near Manitowish
	Long-eared Owl	r	r	r	r	Extensive mature pine/fir forests
	Short-eared Owl	r	r	r	r	Large open areas. Has nested at Powell Marsh
	Boreal Owl				r	Accidental
	Saw-whet Owl	u	u	u	r	Extensive conifer wetlands, mature aspen/fir forest
	Common Nighthawk	u	f	f		Open country, dry forests, meadows, towns
	Whip-Poor-Will	f	f	f		Upland forest
	Chimney Swift	u	u	u		Old-growth forests, developed areas
	Ruby-throated hummingbird	f	f	u		Riparian edges, forest gaps, herbaceous meadows, feeders
	Belted Kingfisher	f	f	u	r	Forages on rivers and lakes, nests in banks
	Red-headed Woodpecker	r	r	r		Oaks, esp. scattered trees in open country
	Red-bellied Woodpecker	r	r	r	r	Oak forests, floodplain forests
	Yellow-bellied Sapsucker	f	f	f		Hemlocks, aspen, birches and most other forests
	Downy Woodpecker	c	c	c	c	Young, especially riparian, forests
	Hairy Woodpecker	c	c	c	c	Mature forests
	Three-toed Woodpecker	r	r	r	r	Irregular in spruce, fir, tamarack forests
	Black-backed Woodpecker	u	u	u	u	Old-growth hemlock, spruce/fir forests, areas of dead conifer
	Northern Flicker	c	c	c		Open country and forest edges. Feeds on ants.
	Pileated Woodpecker	u	u	u	u	Old-growth forests and mature forests
	Olive-sided Flycatcher	u	u	u		Conifer lined stream courses and large conifer bogs
	Eastern Wood-Pewee	c	c	c		Mature forests, pole-sized forests, old-growth forests
	Yellow-bellied Flycatcher	f	u	f		Old-growth and mature cedar swamps and spruce bogs
	Alder Flycatcher	c	f	u		Alder and willow lined streams, and early succession areas
	Least Flycatcher	c	c	c		Mature forests, pole-sized forests, old-growth forests
	Eastern Phoebe	u	u	u		Bridges, buildings, and cliffs, usually near water
	Great Crested Flycatcher	c	c	c		Mature pine-oak forests, old-growth conifers
	Western Kingbird	*	*	*		Accidental
	Eastern Kingbird	c	c	c		Open country, forest edges, and open bogs

✔	Bird	Sp	S	F	W	Habitat
	Horned Lark	u	r	u	r	Open country with sparse vegetation
	Purple Martin	f	u	f		Formerly old-growth forest, now only in Martin houses--declining
	Tree Swallow	a	c	a		Nests in cavities near lakes, streams, and open areas
	Northern Rough-winged Swallow	f	u	f		Nests in banks and cliffs near open country
	Bank Swallow	f	f	f		Nests in banks near open country
	Cliff Swallow	c	c	c		Cliffs and buildings usually near water
	Barn Swallow	c	c	c		Buildings near open country
	Gray Jay	u	u	u	u	Mature spruce, fir, and pine forest, occasional in plantations
	Blue Jay	a	c	a	c	Ubiquitous
	American Crow	c	c	c	f	Ubiquitous
	Common Raven	f	f	f	f	Most forested habitats
	Black-capped Chickadee	a	a	a	a	All forested and shrub habitats
	Boreal Chickadee	u	u	u	u	Mature, large conifer bogs and muskeg
	Tufted Titmouse	*				Accidental
	Red-breasted Nuthatch	c	c	c	c	Conifer forests
	White-breasted Nuthatch	c	c	c	c	Deciduous forest, mature conifer forests
	Brown Creeper	f	r	f	r	Old-growth forests, cedar swamps, and mature forests
	Carolina Wren				*	Accidental
	House Wren	f	f	f		Developed areas, shrubby open country, forest edges & gaps
	Winter Wren	f	f	u		Cedar swamps, conifer bogs, hemlock stands
	Sedge Wren	f	f	f		Sedge meadows, open bogs, old fields with dense grasses
	Marsh Wren	u	u	u		Cattails, bulrushes
	Golden-crowned Kinglet	f	f	f	r	Mature conifer swamps and bogs, old-growth hemlock
	Ruby-crowned Kinglet	f	r	f		Mature upland spruce/fir forests
	Eastern Bluebird	f	u	f		Open areas with scattered trees, young regenerating forests
	Veery	c	c	c		Old-growth hardwoods, mature hardwood / conifers, alders
	Gray-cheeked Thrush	f		f		Migrant only in many different forest types
	Swainson's Thrush	a	u	a		Old-growth hemlock/hardwoods, mature upland conifers
	Hermit Thrush	c	c	c		Found in nearly every forest type, most numerous in dry conifer
	Wood Thrush	u	r	u		Old-growth hardwoods, mature hardwoods
	American Robin	a	a	a		Ubiquitous
	Varied Thrush				*	Accidental
	Gray Catbird	c	c	c		Alder/Willow thickets, forest edges, brushy areas
	Northern Mockingbird	*				Accidental
	Brown Thrasher	f	f	u		Forest edges, open brushy areas
	Water Pipit	r		r		Mudflats, short grass areas such as golf courses
	Bohemian Waxwing				u	Variable - depend on winter fruits
	Cedar Waxwing	c	c	u	r	Variable - most often found in conifer bogs and along rivers
	Northern Shrike	u		u	u	Perches in or near open areas
	Loggerhead Shrike		*			Accidental
	European Starling	c	c	c	c	Developed areas, farms, and near buildings
	Solitary Vireo	f	f	u		Conifer bogs, cedar swamps, and areas with dense fir understory
	Yellow Throated Vireo	u	u	r		Mature hardwoods, especially stands with a large oak component
	Warbling Vireo	f	f	u		Trees adjacent to streams and lakes, ash swamps
	Philadelphia Vireo	u	r	f		Areas with dense brush such as stream borders and forest gaps
	Red-eyed Vireo	a	a	a		All forests except very yourng stands

✔	Bird	Sp	S	F	W	Habitat
	Blue-winged Warbler	*				Accidental
	Golden-winged Warbler	u	u	u		Young aspen stands, stream borders, large forest gaps
	Tennessee Warbler	c	r	c		Aspen, birch, and, during migration, hardwoods
	Orange-crowned Warbler	u		u		Migrant only, found in shrubby areas
	Nashville Warbler	a	a	c		The most common warbler in conifer bogs and cedar swamps
	Norther Parula	u	u	u		Mature conifer bogs, cedar swamps, and old-growth hemlock
	Yellow Warbler	c	c	r		Alder/willow thickets, dense bog birch, dense upland brush
	Chestnut-sided Warbler	a	a	c		Young aspen stands, oak forest with dense understory, gaps
	Magnolia Warbler	c	f	f		Mature spruce/fir forest and areas with dense fir understory
	Cape May Warbler	c	r	f		Mature spruce/fir forest, large black spruce, cedar swamp
	Black -throated Blue Warbler	u	u	r		Old-growth and mature hardwoods with a dense understory
	Yellow-rumped Warbler	a	c	a		Conifer bogs, cedar swamps, pine plantations, upland spruce/fir
	Black-throated Green Warbler	c	c	f		Old-growth hemlock/hardwoods, mature hardwoods, mature pine
	Blackburnian Warbler	f	u	f		Old-growth hemlock, old-growth pines, cedar & spruce swamps
	Pine Warbler	u	f	u		Canopy of mature pines usually over 50 years old
	Palm Warbler	c	f	c		Black spruce muskeg, and large conifer bogs
	Bay-breasted Warbler	u		f		Migrant in conifer forests
	Blackpoll Warbler	f		f		Migrant in conifer and oak forests
	Cerulean Warbler	r	r	r		Large mature oak forest with an intact canopy
	Black and White Warbler	c	f	f		Many mature forests, most common in cedar & tamarack swamps
	American Redstart	c	u	c		Ash swamps, floodplain forest, old-growth hardwoods, aspen
	Ovenbird	a	a	c		Found in all forests pole size or larger
	Northern Waterthrush	f	u	u		Wet conifer swamps, ash swamps, alder thickets
	Connecticut Warbler	f	f	r		Jack pine barrens/forest, large conifer bogs
	Mourning Warbler	f	f	f		Brushy stream borders, moist forest gaps, young aspen
	Common Yellowthroat	c	c	c		Alder thickets, brushy wetlands, moist upland brush
	Wilson's Warbler	f	*	f		Migrant found in brushy areas
	Canada Warbler	f	u	f		Cedar swamps, conifer bogs, dense forest gaps, young aspen
	Scarlet Tanager	f	f	f		Mature hardwoods, especially stands with a large oak component
	Northern Cardinal	r	r	r	r	Developed areas, deciduous forest, forest edges
	Rose-breasted Grosbeak	c	c	c		Deciduous forest of all ages
	Indigo Bunting	c	c	c		Forest edges, canopy gaps, young aspen
	Painted Bunting	*				Accidental
	Dickcissel	r	r			Old fields
	Rufous-sided Towhee	f	f	u		Jack pine barrens, young pine and aspen, forest edges
	American Tree Sparrow	a		a	u	Open areas and feeders
	Chipping Sparrow	c	c	c		Upland coniferous forest, developed areas
	Clay-colored Sparrow	u	u	u		Jack pine barrens, young pine plantations, brushy old fields
	Field Sparrow	r	r	r		Young pine plantations and brushy old fields
	Vesper Sparrow	u	u	u		Young pine plantations and brushy old fields
	Savannah Sparrow	u	f	u		Powell Marsh, sedge meadows, leatherleaf bogs, old fields
	Grasshopper Sparrow	r	r	r		Open grassy areas
	LeConte's Sparrow	u	f	r		Powell Marsh, wiregrass meadows near Manitowish Waters
	Sharp-tailed Sparrow	r	r			Powell Marsh
	Fox Sparrow	c		c		Migrant along forest edges and brushy areas
	Song Sparrow	a	a	c	r	Brushy wetlands, sedge meadows, alder thickets

✔	Bird	Sp	S	F	W	Habitat
	Lincoln's Sparrow	f	f	f		Black spruce muskeg, dense streamside alder and willow
	Swamp Sparrow	f	f	u		Brushy wetlands, sedge meadows, alder thickets
	White-throated Sparrow	a	c	a		Pole to mature upland forest, mature conifer swamps, alders
	White-crowned Sparrow	u		u		Migrant in brushy areas
	Dark-eyed Junco	c	f	c	r	Breeds in mature spruce/fir forests
	Lapland Longspur	r		r		Open areas
	Snow Bunting			u	u	Open areas
	Bobolink	f	f	u		Powell Marsh and other wet meadows with scattered brush
	Red-winged Blackbird	a	a	a		Any wet or moist open area
	Eastern Meadowlark	u	u	r		Open grassy areas
	Western Meadowlark	r	r	r		Open grassy areas
	Yellow-headed Blackbird	r	r			Primarily found at Powell Marsh
	Rusty Blackbird	c		c		Migrant in brushy wetlands
	Brewer's Blackbird	f	f	r		Sparse open areas
	Common Grackle	a	a	a		Wet open areas and forest edges
	Brown-headed Cowbird	c	c	c		Open areas, forest edges, and forest gaps
	Orchard Oriole		*			Accidental
	Northern Oriole	c	f	c		Deciduous forest and developed areas
	Pine Grosbeak				u	Coniferous forests
	Purple Finch	c	u	f	r	Stream borders, ash swamps, cedar swamps, and aspen/birch
	House Finch	r	r	r	r	Increasing in developed areas
	Red Crossbill	u	u	u	u	Irregular in conifer forests, especially red & white pine
	White-winged Crossbill	u	u	u	u	Irregular in conifer forests, especially spruce & hemlock
	Common Redpoll	u		u	u	Irregular, feeds on birch and alder catkins
	Hoary Redpoll				*	To be looked for in flocks of Common Redpoll
	Pine Siskin	f	u	f	u	Conifer forests
	American Goldfinch	c	c	c	u	Conifer forests
	Evening Grosbeak	u	u	f	f	Coniferous and mixed forests
	House Sparrow	c	c	c	c	Developed areas

APPENDIX I

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 <u>before</u> they become threatened or endangered.

Wisconsin Natural Heritage Program, Bureau of Endangered Resources, DNR, Box 7921, Madison, WI 53707 03/17/99 jmb

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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