

WISCONSIN'S LAKE SUPERIOR COASTAL WETLANDS EVALUATION

**Including Other Selected Natural Features
of the Lake Superior Basin**

**A Report to the Great Lakes National Program Office
U.S. Environmental Protection Agency**

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Foreword

The Wisconsin Natural Heritage Inventory is very pleased to share this report on the biota of the Lake Superior coastal wetlands. The report represents a comprehensive effort to evaluate the coastal wetlands and to examine the Wisconsin portion of the Lake Superior Basin, to add a landscape perspective to our work. Working at this scale, it became possible to assess what features were most significant from a biodiversity point of view and how the various features functioned and were related.

This work is an important component of the effort to inventory habitat in the Lake Superior Basin called for in the 1991 Binational Program to Restore and Protect the Lake Superior Basin, of which Wisconsin is a signatory. Wisconsin's portion of the Lake Superior Basin is unique because of the red clay plain and drowned river mouths supporting coastal wetlands which are uncommon elsewhere in the basin. Consequently the habitat inventory work in Minnesota, Ontario, and Michigan for the Lake Superior Basin does not have a similar focus on coastal wetlands. The work undertaken in Wisconsin expands the knowledge base for the Lake Superior Basin.

The Lake Superior coast presents a treasure trove of biological diversity. Its unique combination of geology, soils, climate, geographic position, and glacial history have produced natural communities, plants, and animals that are truly fascinating. To quote the botanists, ecologists, and zoologists working on this project, "there's something going on here that's really different!" Understanding "what was going on" and "why" became a prime motivator and goal of the various scientists throughout the life of the project.

The basin approach used for this project was difficult to piece together, for there are few funding sources or grant opportunities for this scale of work. We found it necessary to seek funding from several different sources, using the U.S. Environmental Protection Agency grant as an anchor. Our success was due, in large part, to the awareness on the part of the various funding sources that their "piece" was contributing to a large picture that was worth painting. I believe that the piece-meal approach that we used in putting together the study is a growing pain in the path to ecosystem-based management and planning. In the future, I hope that broader geographic areas will be routinely covered in inventory projects, and that the geographic areas chosen for work will be based on ecological lines such as basins, watersheds, or ecoregions.

It is our hope that this information will prove useful to the wide range of managers who face decisions affecting the future of the ecological systems present in the Lake Superior Basin. From a Natural Heritage Inventory perspective, the information gleaned from this project will yield insight into what is rare, what is unique about this area of the state and what is not. It will also allow the DNR and others with resource management responsibilities to gauge threats to rare species and communities and to recommend actions to protect, manage, and enhance them.

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Introduction

Project Description

This report covers the results of a two-year project undertaken by the Wisconsin Department of Natural Resources (DNR) to evaluate the coastal wetlands of Wisconsin's Lake Superior shoreline. The goal of the project was to identify habitats that are most critical to protect and restore, accomplished through a comprehensive inventory and evaluation of the coastal wetlands. The project was a component of the Lake Superior Habitat Project undertaken by Wisconsin, Minnesota, and Michigan. This effort--the coastal wetlands evaluation and the habitat project--was funded by the Great Lakes National Program Office of the U.S. Environmental Protection Agency. Evaluation of the Lake Superior coastal wetlands had been identified as an important information need by DNR resource managers for many years. Federal funding allowed us to meet the need of our resource managers with the implementation of this project. The involvement of many agencies, groups, and organizations in Lake Superior habitat protection was also a project goal, including facilitation of federal-state-tribal partnerships. Within DNR, the project was a partnership effort between the Bureau of Water Resources Management and the Bureau of Endangered Resources, with other programs contributing consultation and expertise.

Need for the Evaluation

The Lake Superior shoreline is under increasing development pressures. Although there are regulatory mechanisms in place at local, state, and federal levels to protect these wetlands, in many cases the extent of protection is based upon the knowledge and documentation of the resources that may be affected by a proposed action. In many instances, knowledge and documentation of what resources are present and their functional values are very limited. Hence managers are often in a weak position to oppose or modify the incremental losses that occur with increased development. Moreover, managers and local government officials are unable to work pro-actively in early stages to direct development to sites involving lowest environmental impact. Many wetlands which have been altered or destroyed could be restored. However, there is very limited knowledge of their number, size, and location. This is important for both restoration and mitigation. The coastal wetlands evaluation was designed to address these needs.

Objectives

The primary objectives of the project were as follows:

- Identify important wetland habitats that should be protected and/or restored.
- Identify areas suitable for restoration on previously converted or degraded wetlands and explore mitigation opportunities, including restoration of functional values.
- Provide a prototype (demonstration project) on how to identify areas for protection and restoration.

- Develop a common environmental database and analytical tool to facilitate information exchange among the federal/state/local/tribal units working on Great Lakes protection.
- Transfer information gained from the project to others.

These objectives were accomplished through the following step-by-step work plan: (1) consolidation of existing data on Lake Superior coastal wetlands and development of a priority work plan for field inventory; (2) field inventory focusing on wetland communities and plants, plus other related communities and other taxa as time and budget permitted; (3) database development including a Geographic Information System; and (4) development of interpretative material for education/outreach. Work was accomplished in partnership among the DNR Bureaus of Endangered Resources and Water Resources Management, and the Northwest District Staff from Water Regulation and Zoning and Wildlife Management. Involvement of many scientists and collaboration with a host of individuals, organizations, agencies, and groups helped establish awareness of and interest in the project.

A Basin Approach

The geographic scope of the project was expanded to a basin approach so that significant features outside the Lake Superior coastal zone could be included. This expansion of the project was accomplished through additional funds, primarily a Wisconsin Coastal Management grant for inventory of lands associated with the St. Louis River Estuary, but also DNR Bureau of Forestry funds for inventory of the Brule River State Forest, and Wisconsin Department of Transportation funds for inventory of rare plants in the vicinity of the City of Superior. Additional work was conducted with funds provided by the DNR Bureau of Endangered Resources.

A basin approach was chosen because it allowed a more comprehensive evaluation of the coastal wetlands and the forces that impact them. It also allowed a more comprehensive determination of significant features because of the larger context provided by the basin. Wisconsin's approach complements the habitat evaluation activities underway in the Ontario, Michigan, and Minnesota portions of the Lake Superior Basin, coordinated under the umbrella of the Lake Superior Binational Program. This landscape level approach is a cornerstone of ecosystem management.

Project Area

The project area comprises that portion of the Lake Superior drainage basin lying within the northwestern Wisconsin counties of Douglas, Bayfield, Ashland, and Iron (**Fig. 1**). The Lake Superior shoreline forms the northern boundary of each of these counties, over a distance of approximately 156 miles (Tans 1980). Shoreline mileage of the 22 Apostle Islands (Ashland and Bayfield counties) is not included in this figure. Major streams entering Lake Superior from Wisconsin include the St. Louis, Nemadji, Amnicon, Brule, Iron, Flag, Sand, Raspberry, Kakagon, Bad, and Montreal.

For organizational purposes, the drainage basin was broken into five geographic areas, each a physiographic unit with distinctive physical and ecological attributes, conservation values, and challenges (**Fig. 2**). The five units are consistent with the Ecoregional Subsections as described in the National Hierarchical Framework of Ecological Units (ECOMAP 1993, Keys et al. 1995) (**App. A**). Additional descriptive information may be found in Albert (1995), though the units are named differently there and may be placed in other levels of his hierarchy. The Natural Divisions of Wisconsin, as mapped by Hole and Germain (1994), depict broad vegetation patterns and major soil associations for the region.

Due to the scale of the project area and the lack of readily available information at lower levels in the ecoregional hierarchy (e.g., Land Type Association), the subsection level seemed most appropriate for our purposes. Between subsections there are basic differences in geomorphic process, surface geology, lithology, and some soil characteristics, making it a potentially useful tool for designing large scale biological surveys in a heterogeneous landscape, interpreting the information gathered, and recommending conservation actions. We did not rely solely on these units, but included other relevant information from many sources.

Lake Superior Clay Plain (subsection 212Ja)

As implied by the name, much of the clay plain is level to gently undulating, with heavy red clay soils derived from glacial till and lacustrine deposits. This subsection is most extensive in Wisconsin, paralleling the shoreline from the Michigan border to Minnesota, interrupted in central Bayfield County by the rougher topography of the Bayfield Peninsula. In the vicinity of Ashland, the clay plain extends inland for almost 20 miles. From Port Wing to Superior the width generally varies from 8 to 12 miles. Streams draining into Lake Superior from the highlands to the south have cut deeply into the red clays, forming narrow, steep-walled valleys which tend to run in relatively straight, simple courses. Lakes are absent, but owing to the poor internal drainage characteristics of some clays, wetlands may occur even on the most elevated terrain. This is especially true in and around the City of Superior, where shrub swamps and wet meadows are commonly interspersed with industrial, residential, and agricultural developments. The lake has a moderating influence on the climate, greatly affecting local land use.

The most striking and ecologically significant features of the shoreline are the many coastal estuaries, occurring from the mouth of the Bad River in Ashland County west to the City of Superior. These are the result of the post-glacial tilting of the Lake Superior Basin (differential isostatic rebound), a response to glacial retreat. Most of the large coastal wetlands occur in these estuarine situations, often protected from wind, wave and ice action on the lake by well-developed sandspits. The sandspits typically support

non-vegetated beaches, grassy dunes, and xeric forests of pine (*Pinus* spp.) and oak (*Quercus* spp.). Development pressures are high at some of these sites. Wetlands of many types occupy the embayments on the landward side of these spits. Some wetland communities are restricted to the coastal zone, occurring nowhere else. Wetland communities with wider geographic distributions are found along the margins of many of the streams, and away from the coast. Elsewhere in the basin, particularly to the east in Michigan, wetlands formerly in direct contact with Lake Superior are now separated. This is also the result of basin tilting.

In Wisconsin, the coastal wetlands vary in size from a few acres to approximately 10,000 acres. Important communities include coastal fen, coastal bog, tamarack swamp, emergent marsh, submergent marsh, and interdunal wetland. Where the wetlands are not directly influenced by the dynamics of Lake Superior, long-lived woody plants requiring stable substrates may form shrub swamps, conifer swamps, or hardwood swamps. Non-forested wetland types are mostly marshes, sedge meadows, and bogs.

From the Village of Port Wing west to the City of Superior, in the vicinity of the City of Ashland at the head of Chequamegon Bay, and in a broken, narrow zone along the coast from the mouth of the Montreal River to the Bad River, the shoreline consists of a series of straight, low, unstable, clay bluffs which demonstrate frequent slumping. Water seeps through many of these bluffs, contributing to their instability. Narrow aprons of open sand beach may occur between the lake and the clay bluffs. These stretches of coastline are very exposed, erode easily when subjected to natural or anthropogenic disturbances, and are a source of sediment deposited in the western portion of the Lake Superior Basin. The clay bluffs are forested, mostly with early successional species such as trembling aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*). Conifers, especially balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), and white pine (*Pinus strobus*), are widespread but seldom form extensive stands.

Outcroppings of bedrock are frequent along the northern margin of the Bayfield Peninsula and on some of the Apostle Islands. Wave-sculpted sandstone cliffs rise to a height of as much as 20 meters and are prominent and ecologically significant coastal features. West of the mouth of the Montreal River in Iron County there are scattered low cliffs and sandstone ledges.

Public lands on the coast include the Apostle Islands National Lakeshore, Brule River State Forest, Big Bay State Park, several State Natural Areas, several State Fishery Areas, and a number of city and township-owned parks. The Reservations of both the Bad River and Red Cliff Bands of Lake Superior Chippewa contain extensive stretches of shoreline.

Prior to European settlement, the clay plain was mostly forested with conifers such as white spruce (*Picea glauca*), white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and white pine (*Pinus strobus*) among the dominant canopy components. Fragmentation and simplification of this forest accompanied settlement of the region by Europeans. Even-aged stands of trembling aspen (*Populus tremuloides*) have replaced the conifers in many areas.

Figure 1. Wisconsin's Lake Superior Coastal Wetlands Evaluation project area

Figure 2. Ecoregional Subsections of the Lake Superior drainage basin

The other major landform of the coastal region is the rugged Bayfield Peninsula, which rises over 500 feet above Lake Superior. The glacial tills of the peninsula include clays and sands. Sandstone bedrock is exposed along the shoreline at many locations and can also be found along the canyon walls which flank some of the streams flowing into the lake. The interior of the peninsula contains extensive areas of sandy soils and is described under "Bayfield Sand Barrens" subsection below. The ecological attributes of the Apostle Islands are more similar to the northern Bayfield Peninsula than to the level sections of clay plain.

Historically, the vegetation of both the Bayfield peninsula and the Apostle Islands was part of the vast hemlock-hardwood-white pine forest that stretched across northern Wisconsin and much of the Upper Peninsula of Michigan eastward to New England. The forest of today is composed primarily of young stands of northern hardwoods heavily dominated by sugar maple (*Acer saccharum*) and trembling aspen (*Populus tremuloides*). As on the clay plain, the importance of the coniferous species has been greatly reduced, but significant remnants remain on some of the islands and at a few locations on the northernmost parts of the peninsula.

Public lands of the clay plain include the Apostle Islands National Lakeshore, St. Louis River Streambank Protection Area, Superior Municipal Forest, Pattison State Park, Amnicon Falls State Park, Big Bay State Park, and Bayfield County Forest. Smaller but significant holdings include several State Natural Areas, State Fishery Areas, and local parks. The Reservation of the Red Cliff Band of Lake Superior Chippewa is on the northern flanks of the peninsula.

Gogebic-Penokee Iron Range (subsection 212Jb)

South of the clay plain in Iron and Ashland counties is an ancient mountain range, now reduced to a series of parallel rock ridges and domes. High gradient headwaters streams originate in this region, flowing into several major rivers (e.g., the Bad, Marengo, Montreal, and Brunsweler) which have cut through the rock en route to Lake Superior. Rocky gorges and waterfalls are present at several locations, providing habitat for rare species not occurring elsewhere in the Lake Superior drainage basin of Wisconsin.

Most of the Penokee landscape is forested with second-growth stands of sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), basswood (*Tilia americana*), and hemlock (*Tsuga canadensis*). Trembling aspen (*Populus tremuloides*) is relatively less prevalent than in many other areas of northern Wisconsin. Public ownership is significant, and includes federal, state, and county lands.

Winegar Moraines (subsection 212Jc)

Only a small portion of this end moraine system is within the Lake Superior Watershed, but it is still important within the context of this project because it contains the headwaters of several major streams, especially the Bad and White rivers. These headwaters regions include undeveloped lakes and extensive undisturbed acid peatlands which contain communities and rare species populations of high significance. The matrix vegetation of this region is second-growth northern hardwoods forest. Public lands include federal and county forests.

Bayfield Sand Barrens (subsection 212Ka)

This drouthy region of rolling glacial outwash sands stretches from the northern portion of the central Bayfield Peninsula south and west to the St. Croix River in Polk County. Major forest cover types are aspen (*Populus* spp.) and pine (*Pinus* spp.). Much of the pine is plantation-grown. An important large-scale barrens restoration project occurs within the Chequamegon National Forest. Small soft water seepage lakes and kettle wetlands are scattered throughout this region. A number of streams draining the flanks of the Bayfield Peninsula may originate in or are fed by groundwater from the sand barrens. Large areas of this subsection are contained within federal, state, and county forests.

Mille Lacs Uplands (subsection 212Kb)

This subsection occurs mostly in Minnesota. Its eastern-most extremity forms a wedge-shaped area in northwest Wisconsin between the Lake Superior Clay Plain and the Bayfield Sand Barrens. It contains large, undeveloped acid peatlands, several of which are situated on the drainage divide between the St. Croix River and Lake Superior. The Poplar, Amnicon, and Black rivers, among others, originate in these wetlands. Numerous animals characteristic of the boreal regions have been documented here. The uplands are forested, primarily with second-growth stands of northern hardwoods or aspen (*Populus* spp.). There are remnant stands of conifers. Public ownership is significant, mostly by Douglas County.

Methods

Overview of Methods

The Wisconsin Lake Superior Coastal Wetlands Evaluation began in January 1995 and ended in July 1997 when this report was submitted. It covered two field seasons, 9 study components, and 6 taxa (**Tbl. 1**). The first year of the study focused on data consolidation and initiation of field inventories. Existing data were gathered from all available sources and used to develop a needs assessment and work plan that identified priority sites for inventory. Manual files were set up for use in field inventory and consolidated data were entered into the Wisconsin Natural Heritage Inventory (NHI) database. This database follows a standard methodology used by the states and provinces surrounding Lake Superior (see description in next section). Field inventory of rare vascular plants and wetland communities was conducted throughout the 1995 field season, focusing on an area within six miles of the coast. Many of the sites visited had not previously been inventoried and much insight was gained into the nature of the coastal wetlands. Community ecology work was focused on typing (classifying) wetland communities, assessing their functional values, and assigning a priority protection rank. New inventory data were entered into the NHI database. Old records were verified and updated.

The second year of work built on work completed in 1995 and focused on obtaining additional information thus allowing a more comprehensive evaluation of the Lake Superior coastal wetlands. Significant wetland sites located elsewhere in the watershed were inventoried along with lower priority yet significant sites along the immediate coast. Faunal surveys were also undertaken, focusing on birds, terrestrial insects of special concern, and aquatic macroinvertebrates. Faunal inventories allowed the incorporation of more biodiversity elements into our evaluations and added insight into habitat and ecosystem functioning. Upon completion of field work and database development, a manual for field managers and local zoning officials will be developed. It will summarize findings of the 2-year project which can be applied to decisions related to zoning, permitting, management, and restoration.

The second year of the project included other significant areas in the basin, utilizing funding from sources other than the U.S. Environmental Protection Agency. This work included: (1) an inventory of lands associated with the St. Louis River Estuary, focusing on rare plants and natural communities; and (2) an inventory of the Brule River State Forest, which took a comprehensive look at natural communities and a spectrum of plant and animal taxa. A comprehensive inventory of rare plants in the vicinity of the City of Superior was funded in 1995 by the Wisconsin Department of Transportation.

The Lake Superior coastal region was surveyed in the late 1970s by staff of the Scientific Areas program of the DNR Bureau of Research (Tans 1980) for the purpose of identifying valuable natural features. That project confined its efforts to within approximately six miles of Lake Superior and focused on natural communities, and, to a lesser extent, rare plants. We revisited each of the sites surveyed then, and expanded the inventory to include other taxa as well as many additional sites throughout the Lake Superior Basin.

Table 1. Overview of the evaluation of Wisconsin's Lake Superior Coastal Wetlands

Year	Study Component	Taxa Covered
1995	Data consolidation and identification of priority sites for inventory.	All available
	Field inventory and evaluation of priority wetlands within 6 miles of lakeshore.	Natural communities; Rare vascular plants
	Field inventory of plants in vicinity of the City of Superior.	Rare vascular plants
	Quantitative sampling of natural communities (plot data).	Natural communities
1996	Field inventory of additional wetlands in the coastal zone plus priority wetland and upland sites in the basin interior.	Natural communities; Rare vascular plants; Lepidoptera; Birds; and Terrestrial and aquatic macroinvertebrates.
	Field inventory of St. Louis River Estuary and uplands.	" "
	Field inventory of Brule River State Forest.	" "
	Quantitative sampling of natural communities (plot data) and aerial reconnaissance surveys.	Natural communities
1997	Data management, priority site identification, and report writing.	All of the Above

Natural Heritage Inventory

The coastal wetlands evaluation was conducted by Wisconsin's 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 them, is their use of a standard methodology for collecting, processing, and managing data on the occurrences of natural biological diversity (**Fig. 3**). This network of data centers was established, and is still coordinated by, The Nature Conservancy, an international non-profit organization.

The Natural Heritage Inventory programs focus on rare species, natural communities, and other rare elements of nature. When NHI programs are established, one of the first tasks facing the staff is to consolidate existing information on the status and location of rare elements. Before proceeding, the NHI program must determine what elements warrant "tracking" and which are more common. Like the situation in most states, Wisconsin biologists had a general idea of which species in the better-studied

taxonomic groups (e.g., mammals, birds, and plants) were rare or declining. For less-studied groups such as macroinvertebrates, the process of assembling the list of which species to track and gathering the actual 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 (**App. B**).

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 land use, and then identifies where different species-oriented surveys should be conducted. 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 Lake Superior Coastal Wetlands Evaluation inventory used the top-down, coarse filter-fine filter approach. The initial analysis for the inventories began with an assessment of the entire region in which the important ecological attributes and the biological processes that support them were determined. Criteria to evaluate sites were established and then vegetative communities were identified and characterized. Based upon existing habitat characteristics and habitat preferences of different rare species, sites where species-specific surveys were most appropriate were identified. No doubt, several occurrences of rare species exist that were not located through these inventories. However, by concentrating inventory efforts on the highest quality sites, it is most likely that the populations with the highest conservation value were located.

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

Figure 3. Methodology of the Natural Heritage Inventory

Palustrine and Terrestrial Community Surveys

An initial list of potential survey sites was developed by examining air photos, DNR wetlands maps, U.S. Geological Survey 7.5' topographic quadrangle maps, and existing DNR Bureau of Endangered Resources file information. Local naturalists, biologists, agency personnel, and others familiar with the region's communities, especially the wetlands, were interviewed. A previous "Natural Areas Inventory" of Wisconsin's Great Lakes Coast (Tans 1980) also proved useful in creating the preliminary site list. Data on lakes and streams were obtained from DNR's Surface Water Resources publications, which, while somewhat dated, are among the few region-wide comprehensive sources of information on the physical and chemical characteristics of aquatic features.

After compiling this information, the large number of potential sites to survey was prioritized. Criteria used to identify priority survey sites for inventory included size, association with significant terrestrial features, known presence of rare species, major information gaps, hydrologic linkage with previously identified significant wetlands, and urgency owing to the knowledge of an imminent threat. Surveys were conducted on both public and private lands. A number of private landowners and tribal officials from the Bad River and Red Cliff Bands of Lake Superior Chippewa were contacted to secure permission to conduct surveys where access was an issue.

Field surveys were conducted by walking transects through relatively homogeneous patches of vegetation. Evidence of disturbance was noted, and a list of all vascular plant species encountered was created. Transects were combined with "meander" surveys until the addition of new species became unduly time-consuming. Members of difficult groups were collected for later identification. Rare species were collected or vouchered with a photograph. A rough assessment of the relative abundance of each species was made. Microhabitats, such as pools, hummocks, or springs, were examined whenever possible. Community structure was described. When wetland gradients, such as changing water depth, were present, transects were also run perpendicular to the gradient to note changes in composition and structure of vegetation.

Plot data were collected at a subset of the survey sites to provide more quantitative descriptive information of the wetland communities. Vegetation of the coastal zone wetland sites could then be compared to the vegetation of the basin interior wetland sites, and other sites in the Great Lakes states.

Following the 1996 field season, the coastal zone, and the corridors of the St. Louis, Nemadji, Brule, and Bad rivers were flown in a small fixed-wing aircraft in order to obtain aerial photographs of the priority survey sites and gain a broader perspective of the ecosystem context within which those sites occur.

Botanical Surveys

Searches in 1995-96 were conducted after checking historical records for species, topographic maps and air photos, and consulting with local DNR, tribal, and other biologists for their recommendations on areas in need of survey. A target list of rare plants was compiled from these sources. In May and June 1995, nearly every town road within six miles of Lake Superior was driven at slow speeds to survey for sweet coltsfoot (*Petasites sagittatus*--an early-flowering species often found in ditches) and wetland communities that would merit further investigation later in the season. The same procedure was followed in 1996 for areas further inland in the drainage basin. Potentially interesting wetlands were walked in

June and July, basically using a meander method. Areas with higher nutrient status as indicated by the presence of white cedar (*Thuja occidentalis*), mixtures of cedar, tamarack (*Larix laricina*), and black spruce (*Picea mariana*), or open mats with "poor fen" species such as wiregrass sedge (*Carex lasiocarpa*), sweet gale (*Myrica gale*), and bog bean (*Menyanthes trifoliata*) were particularly sought after as these communities had high probabilities of harboring rare plant species. The City of Superior wetlands were unusual in that rare species grew in mixtures of ordinary sedge meadows/swamps dominated by *Carex lacustris*, tag alder (*Alnus incana*), and shrubby willows (*Salix* spp.); here the presence of open water--either in ditches or in puddles or small ponds along utility right-of-ways or even in open, undisturbed swamp--was most indicative of areas that might harbor rare plants.

Later in the season (July and August), aquatic plants in lakes, ponds, and rivers were searched via canoe. This was the best time to collect fruiting pondweeds and other submersed aquatics. In 1995, emphasis was placed on the coastal river mouth estuaries as well as the St. Louis River, while in 1996 the Bad River and inland lakes such as those in Ashland County south of the City of Mellen received more attention. Also late in the season, the majority of the Lake Superior shoreline itself was walked from Superior east to the Village of Red Cliff. Wetland ravine bottoms in streams draining into the lake were an object of surveys, particularly in the Red Cliff Reservation where the best remnant hemlock-hardwood forests were located. Wet sandstone cliff plant species on the Bayfield Peninsula were observed (and even collected) by boat during calm weather. Habitats particularly sought after and rich in rare species were mossy sandstone shelves, a meter or so above the lake, moistened by both lateral seepage from the cliffs and wave splash from Lake Superior.

Zoological Surveys

Animal inventories were conducted on the Lake Superior coastal wetlands in 1996 on the following taxa: terrestrial animals of dunes and beaches, aquatic macroinvertebrates, butterflies and skippers of peatlands, and migratory and breeding birds. The following paragraphs describe the primary reasons these elements were included in this evaluation. Details of the inventories including the scope, sites surveyed, and techniques used for each of these taxa follow this introduction.

Dune and beach habitats were selected for inventory of rare terrestrial animals because of the uniqueness of these habitats and the likelihood that they might support uncommon species. Within these habitats, inventory was focused on species and species groups on the NHI Working List. This was a highly focused approach, and was not intended to yield comprehensive data on rare terrestrial animals.

Lepidoptera inventories were conducted on acid peatlands, which are moderately frequent and widely distributed across northern Wisconsin (Curtis 1959), to clarify the status of certain species. Previous investigations of the butterfly and skipper fauna of these communities, beginning in the late 1960s (e.g., Masters 1971a, 1971b, 1972, Ferge and Kuehn 1976), uncovered a group of boreal and/or arctic taxa (*Clossiana freija*, *C. frigga*, *C. eunomia dawsonii*, *Erebia discoidalis*, *Oeneis jutta*) which reach the southern limits of their eastern North American range on these sites. The presence of such taxa in northern Wisconsin is particularly intriguing as most are absent from similar acid peatlands in the northeastern states (Opler and Krizek 1984, Opler and Malikul 1992).

Surveys of this habitat have continued to the present, but such investigations have tended to emphasize individual site fauna and the reverification of previously documented populations. In the absence of a

systematic survey of peatland sites, investigators have assumed (e.g., Kuehn 1983), owing to the relative commonness of these habitats, that many additional populations for these species likely occur in northern Wisconsin. Based upon these recommendations, the Wisconsin Department of Natural Resources Bureau of Endangered Resources (BER) has typically ranked these taxa lower than the number of documented populations would otherwise indicate. The only way to assess whether lack of collection is responsible for the paucity of records for these taxa was to conduct a systematic, regional survey of acid peatlands for butterfly and skipper taxa.

Macroinvertebrates were chosen as another animal group to focus on for several reasons. Aquatic macroinvertebrates are frequently used by the DNR as water quality indicators. They are less expensive to sample than fish and more diverse statewide than macrophytes. Although streams and other aquatic features are among the biotic communities most sensitive to ecological perturbations, they are the features least well known. A large number of streams were inventoried, chosen to represent various habitats within the 5 Ecoregional Subsections of the Lake Superior Basin (see Fig. 2). All macroinvertebrate species present at the various sampling stations were collected and identified so that the data could be used to help define community structure and to clarify what is rare. Resulting taxa diversity, unique taxa, rare taxa and pollution tolerance values were considered in characterizing aquatic features and in prioritizing protection and mitigation activities.

Migratory and breeding bird surveys were conducted to gather data on species composition, migratory flow, and breeding bird densities. Five of Wisconsin's coastal wetlands were surveyed for migratory birds. Breeding bird surveys were conducted on wetlands and inland swamps in the Lake Superior Basin and on the Lake Superior coastal wetlands situated in the Apostle Islands and adjacent coastal mainland.

Terrestrial Animals of Dunes and Beaches

Scope. Inventories for rare terrestrial animals potentially associated with Lake Superior beach and dune habitats were conducted between 29 May and 15 August 1996. Species or species groups inventoried for included: Franklin's ground squirrel (*Spermophilus franklinii*); piping plover (*Charadrius melodus*); grasshoppers and allies, especially the Lake Huron Locust (*Trimerotropis huroniana*); leafhoppers; and a beach-dune tiger beetle (*Cicindela hirticollis rhodensis*).

Site Selection. Five sample sites were chosen to represent the Wisconsin portion of the south shore of Lake Superior and ranged from Wisconsin Point on the west to Chequamegon Point on the East. Sampling was conducted on mainland sites only.

Techniques. Franklin's ground squirrel was searched for visually on all five sample sites. In addition, eight live traps were baited with peanut-butter sandwiches and placed on Chequamegon Point for 24 hours. Piping plover suitable nesting habitat was searched on 25 June and 3 July by 3-5 observers walking parallel transects. Leafhoppers were sampled on all five sites by sweeping likely host plants with standard insect nets. On Wisconsin Point and Chequamegon Point, leafhoppers were sampled by placing 12 yellow traps for 2-4 hours. Grasshoppers and tiger beetles were sampled by capture with aerial insect nets on all five sites.

Effort. Chequamegon Point was sampled at two locations in three different efforts; 25 June, 3 July and 15 August. The Sioux River Beach was sampled on 6 August. The mouth of the Bois Brule River was sampled on 29 May and Wisconsin Point was sampled on 2 July, all in 1996.

Sorting/Preservation/Taxonomy. Macroinvertebrate specimens collected were placed in 70% ethyl alcohol. Tiger beetles and most grasshoppers were subsequently pinned and dried. Most leafhoppers were sorted, dried and placed in gel capsules which were then pinned in standard insect boxes. Taxonomic determinations were made by project staff for Orthoptereans, tiger beetles, and leafhoppers (to genus). Leafhoppers were then sent to Andrew Hamilton of Agriculture Canada for species determinations.

Data Recording/Handling. Survey efforts were summarized on standard Natural Heritage Inventory Site Summary Forms. Rare taxa were further documented on NHI Animal Survey and Element Occurrence Forms. Detailed data on all specimens collected were entered into computer database files.

Aquatic Macroinvertebrates

Scope. Inventories of macroinvertebrates were conducted on 129 selected Lake Superior Basin streams and on virtually all (56) waterbodies on the Brule River State Forest. Rare taxa, exemplary or unique associations, and sites needing special management were the primary focus. The NHI Working List contains several potentially rare aquatic insects based on preliminary recommendations from specialists, although most of these are not well represented in the Biological & Conservation Data System (BCD) and refinement is needed. Mussel surveys were conducted on four Lake Superior Basin stream mouths and in Chequamegon Bay.

Site Selection. The approach taken toward evaluating aquatic features in the Lake Superior Basin was to sample streams representative of each of the five major geographic areas (previously described) for all macroinvertebrates.

Techniques. Stream and lake macroinvertebrates were primarily sampled using a standard Wards D-frame aquatic net, and kicknetting each of the habitat types apparent at each site until new taxa were not apparent. Wood substrates were removed from the stream when possible and all macroinvertebrates were hand picked. Other methods used included bottle traps and shoreline exuviae searches. At each site, sampling effort, location, technique(s) used, habitat, instream water quality indicators, factors potentially affecting habitat quality and pollutant sources were documented. For mussel surveys, SCUBA diving, snorkeling and shoreline dead shell searches were used. Quantitative mussel sampling was done by randomly placing a square meter grid on the bottom and then removing all mussels to a depth of six inches. This procedure was repeated until 11-12 square meters per site were sampled.

Effort. Lake Superior Basin stream sampling was conducted between 21 May and 2 August 1996. Due to circumstances beyond our control, much of the sampling was done during the summer months rather than the spring/fall period more typical of stream macroinvertebrate surveys. Streams and lakes on the Brule River State Forest were sampled from 24 May to 17 July 1996. Mussel sampling was conducted on the Reservations on 30 May and 14-16 August 1996.

Sorting/Preservation/Taxonomy. Macroinvertebrate specimens collected were kept separate by habitat and placed in 70% ethyl alcohol. They were returned to the lab and sorted taxonomically to the lowest level possible and re-labeled with site and habitat codes. Specimens were then distributed to project staff for final determinations. Other aquatic organisms collected incidentally were preserved as above and representatives of all taxa are stored at the DNR Research Center, Monona, Wisconsin.

Data Recording/Handling. All aquatic macroinvertebrate survey efforts (except mussels) were summarized on a modified DNR Macroinvertebrate Field Sheet. These data were entered in a Paradox for Windows database. A separate Paradox database was established for site/species information. A third database (the Taxamaster File), maintained by Stan Szczytko of University of Wisconsin-Stevens Point, was integrated to provide basic taxonomic information. Mussel data were recorded on standard DNR Mussel Data Sheets. Rare taxa were further documented on standard NHI Animal Survey and Element Occurrence Forms.

Additional sources of macroinvertebrate data for the Lake Superior Basin were developed and utilized to enhance this effort. These included: (1) a project to complete taxonomic determinations for several hundred samples previously gathered for water quality studies on the Bad River Reservation, and (2) acquisition and computerization of DNR macroinvertebrate data sheets representing water quality sampling efforts in northwestern Wisconsin.

Butterflies and Skippers of Peatlands

Scope. A preliminary regional survey in northeastern Wisconsin during 1994 and 1995 (Howe et al. 1995) indicated that many Wisconsin acid peatland butterfly and skipper taxa were absent from apparently suitable sites. Thus, the present study was undertaken to provide a systematic butterfly and skipper survey of acid peatlands in the Lake Superior Basin of Wisconsin. This work focused on documenting: (1) the butterfly and skipper fauna of each of the three major acid peatland types (muskeg, pothole and coastal) located in the study region; (2) the regional patterns in faunal diversity; (3) the rarity and habitat requirements for members of this fauna; and (4) the most important sites in the region for conservation of this fauna.

Site Selection. Identification of high quality peatland sites was accomplished by a fly-over of the study area on 20 May 1996 in a small aircraft. Approximately 5½ hours of flight time was required to survey the entire study area at an altitude of 5000-6000 feet in north-south transects running approximately 6 miles apart. Sites representing all three peatland types were found to be easily identifiable from the air, and were marked on U.S. Geological Survey 7.5' topographic quadrangle maps. Sites previously reported to contain restricted peatland taxa in the region were identified through review of the BCD. A few additional sites were also recommended by Eric Epstein and others in the staff of the BER. While an attempt was made to inventory all accessible high-quality peatlands within the region, some high-quality sites were not inventoried due to difficulty in access. Additional populations of peatland-restricted taxa are likely to occur on these sites.

A total of 87 sites were selected for inventory. This list includes 9 sand barrens and 7 mesic forest sites which were surveyed to allow for a broader perspective on rare lepidoptera in the region. The peatlands studied included 37 muskeg, 24 pothole, and 10 coastal sites (**App. C, Tbl. 1**).

Effort. Survey sites were visited at approximately 1-2 week intervals throughout the growing season. Sites were typically visited a total of 4-6 times. Site visits were made at more frequent intervals early in the season when a number of closely-spaced emergences occur. Later in the season, when emergences are more temporally separated and when individual populations are in flight for longer periods of time, intervals between site visits increased to three weeks. Each site visit lasted for 15-90 minutes, depending upon site size. During this time, all major plant community associations within each site were surveyed, and a list made of all observed butterfly and skipper taxa.

A survey was also conducted of the Milwaukee Public Museum collections for specimens of the BER-monitored butterfly and skipper taxa which had been located within the 4-county study region. This process was deemed necessary as: (1) many county records reported in Opler (1995) are not found within the BCD, and (2) many of the BCD records are based upon unreliable sight records rather than voucher specimens. Although survey of private collections for records fell beyond the time constraints of this project, this information should be gathered as not all of the county records reported by Opler (1995) were located at the Milwaukee Public Museum, but presumably exist in these other collections (Kuehn 1983).

Data Recording/Handling. The location in longitude-latitude of each surveyed site was determined through digitization of U.S. Geological Survey 7.5' topographic quadrangle maps. The centrum, area and perimeter of each site were also calculated. The estimated latitude-longitude location of each BCD or Milwaukee Public Museum record/collection was also determined.

Cumulative species lists for each site were generated by compiling lists from all site visits, plus any additional records/collections found in the BCD or Milwaukee Public Museum. The diversity of peatland taxa was calculated for each site based upon those taxa which live within acid peatlands during their entire life cycle (*Clossiana freija*, *C. frigga saga*, *C. eunomia dawsonii*, *C. titania*, *Coenonympha inornata*, *Erebia discoidalis*, *Incisalia augustinus*, *Lycaena dorcas*, *L. epixanthe*, *Oeneis jutta*).

The distribution of all current and historical populations within the study region were mapped. These maps also plotted the location of appropriate habitats inventoried during each taxon's flight time which were not occupied.

Linear regression and Analysis of Variance were used to statistically analyze the species-area relationship in peatlands, and to compare average habitat size and species richness across peatland types. Richness patterns across the study region were estimated via distance-weighted least squares smoothing (Wilkinson 1988) of individual site richness values, and of richness values calculated within 12x12 mile square grids laid across the study region.

Migratory Birds

Scope. Field surveys for migratory birds were conducted at between 29 April and 29 May 1996. Biweekly surveys were conducted at most sites through 20 May; two additional surveys, looking primarily for shorebirds, were conducted at Fish Creek and Allouez Bay, both on 29 May.

Site Selection. Five coastal wetlands survey sites along the Lake Superior south shore between Ashland and Superior were selected. From east to west these are: Fish Creek Estuary and adjacent shoreline and near-shore portions of Chequamegon Bay; Sioux River Estuary, beach, and near-shore waters of Chequamegon Bay; Bark Bay Estuary; Port Wing Estuary and adjacent beaches and near-shore waters of Lake Superior; Allouez Bay Estuary and the associated beach and jetty of Wisconsin Point and near-shore waters of Lake Superior.

Techniques. Surveys were conducted in a systematic manner. At each site observations were made from a series of points; larger sites had more points and smaller ones had fewer. Access was to a varying degree limited at all sites. Weather information as well as starting and ending times were recorded for

each survey. All birds observed were counted; the few that could not be identified were counted as “unidentified waterfowl” or “unidentified shorebird.” Whenever possible, individual birds were counted. Rough counts by fives, tens or fifties were used to estimate large numbers of gulls and terns which were roosting or flying. Where large numbers of waterfowl were concentrated, efforts were made to not double-count birds. Equipment used in the surveys included 8x30 Nikon binoculars, 15-45x60 Nikon spotting scope, and field guides to help verify uncommon species.

Data Recording/Handling. Data were recorded in a field notebook and later transferred to data sheets. Information from the data sheets was entered into a LOTUS database for convenience of use, analysis, and graphics.

Breeding Birds: Coastal Zone Wetlands of the Apostle Islands

Scope. Field surveys were conducted between 14 June and 30 June 1996 at ten coastal wetland sites located within a 25 mile radius of the Village of Bayfield, Wisconsin. Eight sites were located on the Apostle Islands and 2 sites were located on the associated mainland shore of Bayfield County.

Site Selection. The ten sites selected include: Stockton Island Brander Bog; Stockton Island Julian Bay Bog; the adjacent Stockton Island Julian Bay-Northwest Bog; two un-named bogs, “North Bog” and “South Bog,” on Sand Island; the wetlands of the Outer Island Lagoon/Bog; the sedge meadows and bogs of Long Island Wetlands; Madeline Island Amnicon Bay Bog; the bog and wetlands at the mouth of the Sand River Estuary on the mainland; and the bog and wetlands of Sioux River Wetlands, also on the mainland.

Techniques. Sites were surveyed using the point-count method. Observation points were spaced 200 to 300 meters apart, by pacing, to provide optimal coverage of a given site within the limits of time and accessibility. The survey period was from 30 minutes before sunrise to approximately 0900; this was exceeded on two occasions when additional points were needed to meet survey objectives. All singing, calling, or observed birds within 50 and 100 meters radius were recorded on the point-count maps for 0-5 and 5-10 minute intervals. Efforts were made to avoid double-counting birds. If portions of other plant community types, such as dune or maple-hemlock forest, were within the 100 meter survey radius, birds within those communities were also counted.

Data Recording/Handling. Weather and water data were recorded at each point and rough maps detailing gross vegetation were sketched on most of the point-count data sheets. Wetlands acreage information for the six sites within the Apostle Islands National Lakeshore were from the park’s Geographic Information System. Areas of Amnicon Bay Bog and the Sioux River Wetlands were estimated from topographic maps.

Breeding Birds: Additional Coastal Zone and Basin Interior Wetlands

Scope. As we had identified more sites to survey than a single observer could complete during the short season, two biologists were hired to survey breeding birds. Additional Lake Superior Basin coastal wetlands and interior sites (predominantly peatlands) were surveyed between 1 June and 3 July 1996. Visits to sites later in the season provided additional information, though rigorous sampling was not conducted past 3 July 1996.

Techniques. The sampling methods used varied from site to site, depending on the type of habitat present. Birds were surveyed via canoe on open water and riverine sites. Point counts were conducted at sites with solid ground. Relevés were used to survey birds at sites too small for point count sampling, and late in the season when most birds were no longer singing. At several sites a combination of methods was used because more than one habitat type was present. The sampling methods are described below.

Canoe Surveys. Surveys began at approximately 0430 and usually ended no later than 1030 (with the exception of the Kakagon Slough on 1 July which lasted until 1200). Night surveys began around 0200. In all canoe surveys, a route was paddled close to shoreline throughout the open water area of the wetlands. Tapes of wetland bird species songs and calls were played at intervals during the surveys in an attempt to elicit a response. All bird species heard and seen were recorded, along with relative or actual abundance data.

Point Counts. Ten-minute, unlimited distance point counts were conducted in wetlands inaccessible via canoe. Points were located a minimum of 100 meters from a road or edge with an upland habitat type to minimize counting of individuals from other habitats, and 250 meters apart in order to minimize double-counting of individuals. Routes taken and the location of points were documented on maps. All birds heard and seen during the 10-minute counts were recorded. In addition, vegetation characteristics were noted at each site, and the most common plant species were recorded. The presence of herps was also recorded. Bird species identified between points and not present at a point, and uncommon plant species observed between points were recorded in a field notebook.

Relevés. Data on bird species presence and relative abundance levels were gathered by walking around and through portions of the wetlands. Vegetation characteristics were recorded and a preliminary vegetation list was compiled.

Boat Surveys. In the Bad River and Honest John complex some birds were observed while motoring to the desired site. These species are included in the total species reported for these sites, and the type of survey is indicated as "boat".

Data Recording/Handling. Relative abundance was assessed for each species surveyed by assigning a rank for this species at a given site. These rankings are relative to each other and to the total number of birds observed at each site. Since sampling effort was not standard across sites, it is difficult to assign exact cutoffs for each category, but in general, "rare" indicates the observation of a single individual or pair of the given species; "uncommon" is used when 2 to 3 individuals were observed at a site; "common" and "abundant" are relative to each other with the latter indicating only the most numerous species. Species observed at the Sioux River were indicated by presence or absence at the time of the survey and were ranked later, based on memory. At all other sites the species were ranked either at the time of the survey or later, based on actual abundance data. Bad weather may have influenced the results at Bad River (19 June 1996) and Odanah Swamp (17 June 1996), therefore, data from 1994 and 1995 are included in this project summary.

Results and Discussion

Palustrine and Terrestrial Community Surveys

Natural communities were surveyed throughout the Lake Superior basin of Wisconsin. In 1995, we focused on coastal zone sites. In 1996, we revisited several coastal zone sites, added the Bad River and Red Cliff Reservations, and expanded our surveys to include basin interior wetland sites. We felt it was necessary to include at least a subset of representative wetlands away from the coast in order to identify those features, if any, unique to or most characteristic of coastal communities (we wanted to be able to do the reverse as well, of course). Neither current ownership nor existing special land use designation (e.g., State Natural Area) influenced our evaluations or our choices of survey sites.

Primary goals of the community survey work were to refine the existing classification of coastal zone community types, particularly wetlands, and to assess their functional values. Communities of the basin interior were also studied as a means of comparison. We broadly categorized coastal zone communities into four classes: coastal peatlands, estuarine marshes, coastal cliffs and ledges, and terrestrial forests. Basin interior communities were also categorized into four main classes: interior peatlands, red clay flats, stream corridors, and terrestrial features. Within these categories there are specific community types, both palustrine and terrestrial. The following paragraphs describe the community classes within the coastal zone and basin interior and include specific community types that fit into each category, sites surveyed, major threats, and other comments. Note that some community types occur within both the coastal zone and the basin interior. Classification work is ongoing and will continue as new data are collected and analyzed.

Coastal Zone Communities

Coastal Peatlands. Wetland complexes characterized by the accumulation of sedge and moss peat that have developed in association with sandspits at the inundated mouths of several streams entering Lake Superior on the margins of the Bayfield peninsula, several of the Apostle Islands, and at the mouths of the Bad and Kakagon rivers. For this evaluation, priority peatland communities consisted of coastal fen, coastal bog, and tamarack swamp. Other important associated communities were interdunal wetland, alder thicket, beach, lake dune, dry boreal pine forest, and Great Lakes pine barrens. The priority sites surveyed were Port Wing, Bark Bay, Lost Creek, Sand Bay, Big Bay, Stockton Island Tombolo, Outer Island Sandspit and Lagoon, Long Island-Chequamegon Point, Bayview Beach-Sioux River Slough, Red Cliff Reservation, and Bad River Reservation.

Threats to these communities include invasive species, diminished water quality, increased development, and suppression of natural disturbance regimes.

With a few exceptions, these communities and associated landforms are unique to the coastal zone. Many rare species are restricted to the coastal peatlands and their associated features. Outer Island Sandspit and Lagoon and Long Island-Chequamegon Point are especially important migratory bird concentration

areas. Bad River Reservation contains aquatic biota of high regional significance.

Estuarine Marsh. Relatively eutrophic wetlands composed of stands of emergent, submergent, and floating-leaved aquatic macrophytes, occurring at the mouths of drowned rivers along the Lake Superior shore. Peat accumulation is minimal or absent. For this evaluation, priority communities consisted of emergent aquatic, submergent aquatic, northern sedge meadow, and boreal forest. The priority sites surveyed were St. Louis River Marshes, Oliver Marsh, Allouez Bay, Superior Municipal Forest, Nemadji River Marshes, Fish Creek Sloughs, and Bad River Reservation.

Threats to these communities include invasive species, diminished water quality, and increased development pressure.

The St. Louis River estuary sites (including St. Louis River Marshes, Oliver Marsh, and Allouez Bay) and Fish Creek Sloughs may have lost the majority of their coastal peatlands due to development and eutrophication (based on historical descriptions published in newspapers prior to the turn of century, and a few remnant fens found on the Minnesota side of the St. Louis River at Grassy Point and the foot of the Oliver bridge).

Coastal Cliffs and Ledges. Exposures of sandstone bedrock are frequent shoreline features of the northern Bayfield peninsula and also occur on some of the Apostle Islands. Cold currents, fogs, and wave spray create conditions suitable for the maintenance of populations of many specialized vascular plants which are not present in similar rocky habitats away from the coast. For this evaluation, priority communities consisted of moist cliff, dry cliff, Great Lakes rocky shore, hemlock-hardwood forest, and pine forest. The priority sites surveyed were Red Cliff Reservation, Stockton Island Tomolo, and Sand Bay.

Threats to these communities include quarrying, shoreline development, and rock climbing.

These natural communities are critical habitat for many rare plants, most of them habitat specialists and restricted to coastal environments. Many additional sites occur on the Apostle Islands and on the northern Bayfield Peninsula.

Terrestrial Forests. For this evaluation, priority communities consisted of boreal forest, dry boreal pine forest, and northern mesic (hemlock-hardwood) forest (Great Lakes shoreline variant). The priority sites surveyed were Superior Municipal Forest, Red River Breaks, Port Wing, Red Cliff Reservation, Stockton Island Tomolo, and Bad River Reservation.

Threats to these communities include logging, increased development, invasive species, and suppression of natural disturbance regimes.

In general, terrestrial forests were not a major focus of this project. Surveyed stands were, in most cases, directly associated with, or examined en route to, wetland features. In portions of the coastal zone, forest fragmentation is severe and there has been a great loss of both the coniferous component and the older successional stages. Public lands containing especially important upland forests (because of size and/or quality) within the Lake Superior basin include Apostle Islands National Lakeshore, Brule River State Forest, Chequamegon National Forest, Superior Municipal Forest, each of the county forests, and several State Natural Areas. Both the Red Cliff and Bad River Reservations also contain highly significant

terrestrial communities.

Basin Interior Communities

Interior Peatlands. Wetlands characterized by the accumulation of acid peat are widespread and locally extensive on ground moraine and outwash landforms not under the influence of coastal climate or processes. For this evaluation, priority communities consisted of black spruce swamp, open bog and muskeg, white cedar swamp, poor fen, hardwood swamp, alder thicket, shrub-carr, and northern sedge meadow. The priority sites surveyed were Black Lake Bog, Belden Swamp, Mud Lake/Ericson Creek, Brule Spillway, Divide Swamp, Sultz Swamp, Bibon Swamp, and Caroline Lake and Wetlands.

Threats to these communities include disrupted hydrology, logging, increased development, off-road vehicles, and invasive species.

Large, undisturbed acid peatlands are characteristic landscape elements within the interiors of the Mille Lacs Uplands and Winegar Moraines subsections. These wetlands provide habitat for many rare animals, several rare plants, sometimes contain lakes, and are the headwaters of some of the region's major streams. Neither the major communities nor many of the rare species found in these interior peatlands occur commonly at the coastal sites. Though generally more widespread than the coastal "obligates", it is important to represent these features in a comprehensive regional conservation effort, and priority should be given to those sites which are large, linked with priority coastal sites, among the least disturbed, or have unique attributes not represented elsewhere. The inventory of interior sites was less comprehensive than for the coastal zone and it is highly probable that valuable sites have been overlooked.

Red Clay Flats. Though red clay soils blanket much of Wisconsin's portion of the basin, in the vicinity of the City of Superior there is a concentration of shrub- and sedge-dominated wetlands on the nearly level, poorly drained clays. For this evaluation, priority communities consisted of alder thicket, shrub-carr, northern sedge meadow, and emergent aquatic. The priority sites surveyed were Pokegama-Carnegie Wetlands, Red River Breaks, and Superior Airport/Hill Avenue Wetlands/South Superior Triangle.

Threats to these communities include disruption of hydrology, increased development, invasive species, pollution, and suppression of natural disturbance regimes.

While within the rather arbitrarily defined coastal zone, the poorly drained red clay flats are not directly affected by coastal processes and so are placed here. All of the sites are in the vicinity of the City of Superior and vulnerable to a variety of disturbances. These sites are most notable for their concentrations of rare plants, some of which occur nowhere else in the drainage basin or state.

Stream Corridors. For this evaluation, priority communities consisted of white cedar swamp, hardwood swamp, floodplain forest, mesic hardwood bottoms, alder thicket, emergent aquatic, boreal forest, and northern dry-mesic forest. The priority sites surveyed include Bad River Reservation, Brule Spillway, and Nemadji River Bottoms.

Threats to these communities include disruption of hydrology, logging, increased development, and invasive species.

Several of the large streams deeply entrenched in the region's red clays possess unique attributes,

especially the Bad and Nemadji rivers. The entire length of the Brule River, including those stretches that go through the Bayfield Sand Barrens subsection, contains unique features.

Terrestrial Features. Comments for terrestrial forests under coastal zone communities also apply here. Other terrestrial communities worthy of special mention are the pine barrens remnants and their associated "grassland" biota at Micah (Chequamegon National Forest, Bayfield County), and adjacent to Brule Spillway (Brule River State Forest, Douglas County).

Palustrine Community Descriptions

Below are described all of the specific palustrine community types found in either the coastal zone or the basin interior. Aquatic community types are listed first, then herbaceous wetland, followed by shrub wetland, and finally forest wetland community types. Terrestrial community types found during this evaluation are not described, namely: beach, lake dune, boreal forest, dry boreal pine forest, Great Lakes pine barrens, pine forest, dry cliff, Great Lakes rocky shore, moist cliff, hemlock-hardwood forest, northern-mesic forest (Great Lakes shoreline variant), northern dry-mesic forest, and mesic hardwood bottoms. These terrestrial communities, although intimately related to the Lake Superior Basin wetlands and the ecology of the region, are not included in this report due to study and time constraints.

Submergent Aquatic. This aquatic plant community occurs in bodies of permanent water, usually where there is some protection from excessive wave action and strong currents. Characteristic species include waterweed (*Elodea canadensis*), coontail (*Ceratophyllum demersum*), water milfoils (*Myriophyllum exalbescens*, and *M. verticillatum*), wild celery (*Vallisneria americana*), water marigold (*Megalodonta beckii*), naiad (*Najas flexilis*), mare's-tail (*Hippuris vulgaris*), common bladderwort (*Utricularia macrorhiza*), and many pondweeds, especially *Potamogeton amplifolius*, *P. epihydrus*, *P. natans*, *P. richardsonii*, and *P. zosteriformis*. Rooted, floating-leaved, aquatic macrophytes often occur with this group in shallower waters. Most common among these are water shield (*Brasenia schreberi*), yellow water lily (*Nuphar variegatum*), and white water lily (*Nymphaea tuberosa*). Some members of the bur-reed genus *Sparganium* also form beds of floating leaves. Some biologists separate the floating from the submerged beds, but there is often considerable spatial overlap between them so they have been treated together here.

Rare and uncommon species of submergent aquatic communities are lake cress (*Armoracia lacustris*), a water milfoil (*Myriophyllum alterniflorum*), and small yellow water lily (*Nuphar microphyllum*).

Emergent Aquatic. The aquatic plant community is best developed in shallow, protected, usually permanent waters. Most of the dominant plants are tall and erect with narrow leaves. Frequently a single species will form a zone within an emergent marsh, often correlated with water depth. Cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), bur-reeds (*Sparganium* spp.), arrowheads (*Sagittaria* spp.), spike rushes (*Eleocharis* spp.) and water plantain (*Alisma plantago-aquatica*) are important members of this community. Unrooted floating-leaved species such as the duckweeds (*Lemna minor*, *L. trisulca*, *Spirodela polyrrhiza*), and several submergent aquatic macrophytes may occur among the stems of the emergents. Emergent marshes are important to many nesting and migratory waterbirds, mammals, invertebrates, and fish.

Coastal Fen (Sedge Fen). This herbaceous (sedge-dominated) wetland community occurs in coastal areas on the margins of shallow lagoons, which are protected from wind, wave, and ice action on Lake

Superior by sandspits. Woolly sedge (*Carex lasiocarpa*) is usually the primary mat component. Typical associates are twig rush (*Cladium mariscoides*), buck bean (*Menyanthes trifoliata*), sweet gale (*Myrica gale*), pitcher plant (*Sarracenia purpurea*), bladderworts (*Utricularia cornuta*, *U. intermedia*, *U. minor*), cotton-grass (*Scirpus hudsonianus*), intermediate sundew (*Drosera intermedia*), water horsetail (*Equisetum fluviatile*), marsh muhly (*Muhlenbergia glomerata*), and white beak-rush (*Rhynchospora alba*).

Floristically, these communities appear intermediate to rich and poor fens as described in both Michigan (Crum 1988) and Minnesota (Wright et al. 1992). The rich fen indicators of the Minnesota peatlands and eastern Wisconsin such as grass-of-Parnassus (*Parnassia glauca*), false asphodel (*Tofieldia glutinosa*), linear-leaved sundew (*Drosera linearis*), beaked spike rush (*Eleocharis rostellata*), and the sedge *Carex sterilis*, are absent from these coastal fens.

Rare and uncommon plants of coastal fens include coast sedge (*Carex exilis*), livid sedge (*C. livida*), Michaux's sedge (*C. michauxiana*), bog arrow grass (*Triglochin maritimum*), English sundew (*Drosera anglica*), tall white bog orchid (*Platanthera dilatata*), and sooty beak-rush (*Rhynchospora fusca*). Several rare birds also occur in the sedge mats, including yellow rail and LeConte's sparrow.

Coastal Bog (Poor Fen). The coastal bog is also considered an herbaceous wetland community. The surface layer of this weakly minerotrophic open peatland community, which occurs as a part of the coastal sandspit-lagoon complexes, is comprised of *Sphagnum* mosses. The mats are typically quite firm and may be "grounded" along the margins of the uplands adjoining the wetland complexes. At larger sites, the coastal bogs grade into a sedge fen community toward the open lagoon waters and to tamarack swamp toward the uplands. Characteristic plants associated with the sphagnum mats are a number of ericaceous shrubs and sedges, particularly leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), small cranberry (*Vaccinium oxycoccos*), large cranberry (*Vaccinium macrocarpon*), woolly sedge (*Carex lasiocarpa*), few-seeded sedge (*C. oligosperma*), mud sedge (*C. limosa*), a sedge (*C. chordorrhiza*), white beak-rush (*Rhynchospora alba*), and tawny cotton-grass (*Eriophorum virginicum*). Shrub components of this type often include bog birch (*Betula pumila*), speckled alder (*Alnus incana*), and bog willow (*Salix pedicellaris*).

Other typical species include pitcher plant (*Sarracenia purpurea*), buck bean (*Menyanthes trifoliata*), scheuchzeria (*Scheuchzeria palustris*), sweet gale (*Myrica gale*), rose pogonia (*Pogonia ophioglossoides*), grass pink (*Calopogon tuberosus*), and club-spur orchid (*Platanthera clavellata*). Floristically, the coastal bogs closely resemble the "poor fens" and "sphagnum lawns" of the upper Great Lakes region, and they should perhaps be treated as a subtype of that community.

Among the rare plants found in the coastal bogs are dragon's mouth orchid (*Arethusa bulbosa*), Michaux's sedge (*Carex michauxiana*), sooty beak-rush (*Rhynchospora fusca*), *Carex tenuiflora*, and yellow star grass (*Xyris montana*). Rare animals include birds, such as northern harrier and American bittern, and a number of boreal lepidoptera.

Open Bog. This peatland type herbaceous wetland community is dominated by deep layers of *Sphagnum* mosses which isolate the other members of the community from the influence of nutrient-rich groundwater or runoff. There is often a pronounced hummock-hollow microtopography. Ericaceous shrubs, sedges, and stunted, scattered black spruce (*Picea mariana*) are the most characteristic vascular plants. Among the ericads the most important species are typically leatherleaf (*Chamaedaphne*

calyculata), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), and small cranberry (*Vaccinium oxycoccos*). Sedges with a tolerance for these ombrotrophic peatlands include the carices *Carex oligosperma*, *C. pauciflora*, and *C. paupercula*, and the cotton-grasses *Eriophorum angustifolium*, *E. spissum*, and *E. virginicum*. Round-leaved sundew (*Drosera rotundifolia*) is among the few other vascular plants frequently found in the open bogs. In the "muskeg" phase, the community structurally resembles a savanna owing to the scattered, often stunted, black spruce and tamarack.

Bogs occur mostly in poorly drained depressions in glacial till and in isolated kettles within end moraines or outwash. Scale and landscape context of this community often differs markedly within different landforms. Within the project area, the largest bogs occur in the Mille Lacs Uplands and Winegar Moraines subsections. Rare species found in the bogs include a number of birds and butterflies of boreal affinity.

Northern Sedge Meadow. Two distinct types of sedge meadow, another herbaceous wetland community, are currently recognized within the Lake Superior Basin. The first is found along the margins of low gradient streams and drainage lakes. Dominants are often tussock sedge (*Carex stricta*) and bluejoint grass (*Calamagrostis canadensis*). Associates include swamp milkweed (*Asclepias incarnata*), spotted joe-pye-weed (*Eupatorium maculatum*), blue flag (*Iris versicolor*), yellow loosestrife (*Lysimachia terrestris*), marsh St. Johnswort (*Triadenum fraseri*), marsh bellwort (*Campanula aparinoides*), water horehound (*Lycopus uniflorus*), paniced aster (*Aster simplex*), purple meadow rue (*Thalictrum dasycarpum*) and the sedges *Carex comosa*, *C. diandra*, and *C. canescens*. This type is found throughout most of the project area, though the stands are often small.

The other type tends to occur more in insular depressions, especially in the vicinity of northwestern Douglas County. The usual dominants are broad-leaved sedges, usually lake sedge (*Carex lacustris*), sometimes with beaked sedge (*Carex rostrata*). Associates include bluejoint grass (*Calamagrostis canadensis*), fringed brome (*Bromus ciliatus*), flat-topped aster (*Aster umbellatus*), rough bedstraw (*Galium asprellum*), spotted touch-me-not (*Impatiens biflora*), spotted joe-pye-weed (*Eupatorium maculatum*), water horehound (*Lycopus uniflorus*), blue flag (*Iris versicolor*), late goldenrod (*Solidago gigantea*), and other sedges. Several rare plants were found in this community, including sweet coltsfoot (*Petasites sagittatus*), Vasey's rush (*Juncus vaseyi*), and New England violet (*Viola novae-angliae*). Encroachment by woody shrubs appears to be occurring at many locations, especially for the broad-leaved type.

Interdunal Wetland. This herbaceous wetland community is extremely rare, occurring only within dune systems of the Great Lakes. As there are fewer than five occurrences known in the western Lake Superior Basin, and they are quite a distance from one another, it is difficult to characterize them floristically. Graminoids are prominent at all sites, including shore rush (*Juncus balticus*) and the sedge *Carex viridula*. Other species found at some, but not all sites, are woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), and nodding ladies' tresses (*Spiranthes cernua*).

At some sites, this community may be ephemeral. At least one site has been known for many decades, and is being encroached on by woody species and invaded by exotics. A great number of rare species were documented in the interdunal wetlands, including marsh grass-of-Parnassus (*Parnassia palustris*), small purple bladderwort (*Utricularia resupinata*), Robbins spike rush (*Eleocharis robbinsii*), sooty beak-rush (*Rhynchospora fusca*), shore sedge (*Carex lenticularis*), and variegated horsetail (*Equisetum variegatum*). An old borrow pit on one of the coastal barrier spits has been colonized by several of these

rare plants and also held the first Wisconsin record for juniper clubmoss (*Lycopodium sabinaefolium*).

Wet Sand Flats. Found only on the Chequamegon Bay side of the former gap between Long Island and Chequamegon Point, this herbaceous wetland community has developed within the past two decades. The wetter, more open areas are dominated by short sedges (*Carex* spp., *Scirpus* spp.) and rushes (*Juncus* spp.). Slightly drier sands support thickets of willows (*Salix exigua*, *Salix* spp.) and speckled alder (*Alnus incana*), and many sapling green ash (*Fraxinus pennsylvanica*), cottonwood (*Populus deltoides*), balsam poplar (*P. balsamifera*), and box elder (*Acer negundo*).

Because of its short tenure and rapidly changing structure and composition, it's difficult to make any recommendations except to continue efforts to control the serious infestation of purple loosestrife (*Lythrum salicaria*) now established. The stand should also be visited periodically by skilled biologists as unusual numbers of interesting waifs have appeared here.

Alder Thicket. This tall shrub wetland community is dominated by speckled alder (*Alnus incana*). Common sites include stream and lake margins, the interface between open and forested wetland communities, the interface between open wetlands and upland communities, and depressions where there is movement of groundwater through the soil. Common associates include marsh marigold (*Caltha palustris*), black currant (*Ribes americanum*), crested shield fern (*Dryopteris cristata*), spotted touch-me-not (*Impatiens biflora*), rough bedstraw (*Galium asprellum*), sensitive fern (*Onoclea sensibilis*), horsetails (*Equisetum* spp.), and arrow-leaved tearthumb (*Polygonum sagittatum*). Rare species occurring in alder thickets include auricled twayblade (*Listera auriculata*), sweet coltsfoot (*Petasites sagittatus*), small shinleaf (*Pyrola minor*), and the wood turtle (*Clemmys insculpta*).

Shrub-carr. Willows (*Salix* spp.) are the dominant plants in this tall shrub wetland community. Important species include slender willow (*Salix gracilis*), pussy willow (*S. discolor*), balsam willow (*S. pyrifolia*), and autumn willow (*S. serissima*). Other common shrubs, which may be co-dominant in some stands, are meadowsweet (*Spiraea alba*), red-osier dogwood (*Cornus stolonifera*), nannyberry (*Viburnum lentago*), and speckled alder (*Alnus incana*). Representative herbs are bluejoint grass (*Calamagrostis canadensis*), spotted touch-me-not (*Impatiens biflora*), sensitive fern (*Onoclea sensibilis*), water horehound (*Lycopus uniflorus*), and purple meadow rue (*Thalictrum dasycarpum*).

Tamarack Swamp. This forest wetland community, a weakly minerotrophic conifer swamp, is dominated by tamarack (*Larix laricina*). The shrub/sapling layer is often well-developed, composed of black ash (*Fraxinus nigra*), speckled alder (*Alnus incana*), and other tall shrubs. The groundlayer is often mossy, though genera other than *Sphagnum* may be most important. Characteristic low shrubs and herbs include smooth white violet (*Viola pallens*), Labrador tea (*Ledum groenlandicum*), goldthread (*Coptis trifolia*), three-leaved false Solomon's seal (*Smilacina trifolia*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), sensitive fern (*Onoclea sensibilis*), twinflower (*Linnaea borealis*), small bishop's cap (*Mitella nuda*), and many sedges such as *Carex crinita*, *C. disperma*, *C. leptalea*, and *C. stipata*.

This is a one-generation forest type, as the tamarack (*Larix laricina*) cannot reproduce under its own shade. It is also the most common forested wetland in the coastal zone. Rare species found in tamarack swamps include the sedges *Carex tenuiflora* and *C. vaginata*, fly honeysuckle (*Lonicera involucrata*), showy lady's slipper (*Cypripedium reginae*), and yellow-bellied flycatcher.

Black Spruce Swamp. This forest wetland community occurs primarily in acid peatlands of insular

basins. Black Spruce (*Picea mariana*) is the dominant tree. Canopy associates include tamarack (*Larix laricina*) and occasionally balsam fir (*Abies balsamea*). A level mat of *Sphagnum* mosses covers the surface and provides a substrate upon which a characteristic set of understory plants grows. Among these are Labrador tea (*Ledum groenlandicum*), three-leaved false Solomon's seal (*Smilacina trifolia*), creeping snowberry (*Gaultheria hispidula*), three-seeded sedge (*Carex trisperma*), and moccasin flower (*Cypripedium acaule*). Windthrow gaps are often common in mature stands, and these contain thickets of spruce or tamarack saplings. As the sphagnum peat accumulates, the canopy may break up and a very acid muskeg will result.

Black spruce swamp and tamarack swamp have previously been treated as "northern wet forest", as described by Curtis (1959). We have recognized two types based on compositional differences and the diverging successional pathways demonstrated by these communities. Rare species include many boreal birds and lepidoptera.

White Cedar Swamp (Northern Wet-mesic Forest). This forest wetland community (wet-mesic conifer forest) is dominated by white cedar (*Thuja occidentalis*), often in association with balsam fir (*Abies balsamea*), black spruce (*Picea mariana*), tamarack (*Larix laricina*), and black ash (*Fraxinus nigra*). White cedar mixed with hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*) is not treated as "white cedar swamp". Canopy gaps are frequently occupied by fir or ash saplings. Young cedar seldom reach the sapling stage. The tall shrub layer is typically well-developed, composed primarily of mountain maple (*Acer spicatum*), speckled alder (*Alnus incana*), and elder buckthorn (*Rhamnus alnifolia*). Common herbs/low shrubs include bluebead lily (*Clintonia borealis*), twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), dwarf raspberry (*Rubus pubescens*), small bishop's cap (*Mitella nuda*), many sedges, and a lush cover of bryophytes. Orchids may be especially well-represented in this forest community.

Springs and spring runs are present in many cedar forests, often containing spotted touch-me-not (*Impatiens biflora*), golden saxifrage (*Chrysosplenium americanum*), and swamp saxifrage (*Saxifraga pennsylvanica*), as well as aquatic mosses. The presence of mineral-rich groundwater is a given in this community.

Concern for the cedar swamps is warranted as reproduction of cedar is severely suppressed in the presence of high deer densities. Silvicultural experiments have not succeeded in addressing this issue. Among the many rare inhabitants of this type are fairy slipper (*Calypso bulbosa*), Lapland buttercup (*Ranunculus lapponicus*), northern black currant (*Ribes hudsonianum*), and sheathed sedge (*Carex vaginata*).

Hardwood Swamp. The hardwood swamp can also be considered a forest wetland community. These deciduous lowland forests situated on wet to wet-mesic mineral or muck substrates outside of active floodplains are often dominated by black ash (*Fraxinus nigra*). Canopy associates may include red maple (*Acer rubrum*), green ash (*F. pennsylvanica*), American elm (*Ulmus americana*), white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and yellow birch (*Betula alleghaniensis*). However, black ash not infrequently occurs in almost pure stands, and is often well represented as a sapling or small tree. A dense tall shrub layer of speckled alder (*Alnus incana*) and winterberry (*Ilex verticillata*) is commonly present. Seasonal pools are features of many stands.

Among the characteristic groundlayer plants are marsh marigold (*Caltha palustris*), swamp saxifrage

(*Saxifraga pensylvanica*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), water horehound (*Lycopus uniflorus*), skunk cabbage (*Symplocarpus foetidus*), mint (*Mentha arvensis*), fowl manna grass (*Glyceria striata*), and many sedges.

Floodplain Forest. Confined to the floodplains of large streams, this forest wetland community is rare in the Lake Superior Basin. Canopy trees include silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), box elder (*A. negundo*), and occasionally bur oak (*Quercus macrocarpa*). The primary disturbance dynamic affecting this community is flooding, which occurs in the spring after the ice goes out and the snow melts, and after heavy rains. The understories are often quite open, supporting ostrich fern (*Matteucia struthiopteris*), wood nettle (*Laportea canadensis*), green-headed coneflower (*Rudbeckia laciniata*), swollen sedge (*Carex intumescens*), Gray's sedge (*C. grayii*), and Tuckerman's sedge (*C. tuckermanii*).

Botanical Surveys

About 250 specimens of rare plants were vouchered, identified, labelled, and deposited at the University of Wisconsin-Madison Herbarium during the course of this survey, with most verified by Ted Cochrane, one of the curators at that institution. Altogether, approximately 200 sites were surveyed, over 1,000 miles of roads were searched at least once by car at slow speeds, and several hundred miles were walked on foot. See **Table 2** for a list of rare plants found during this study.

1995 Field Season Results

In 1995, emphasis was placed on wetlands within six miles of the coast, plus the area around the City of Superior. Three new populations of sweet coltsfoot (*Petasites sagittatus*) were found in the Brule River area, and several more just south of the City of Superior, during surveys conducted along town roads in late May. In June and July, bog floras were in full bloom and all accessible coastal bogs were visited at least twice. Port Wing, Bark Bay, Lost Creek, Sand River, Bayview Beach, Big Bay, and Amnicon Bay all had impressive mats with floras of state significance. In addition to rare species historically known to be present, several new stations for *Carex livida* (Threatened) and *C. tenuiflora* and *Triglochin maritimum* (both Special Concern) were found in these bogs. The most significant find was *Lonicera involucrata* at Port Wing tamarack swamp. The species, previously known only from 1897 collections in the same area, had recently been reclassified as extirpated in Wisconsin. The conifer swamp at the east end of Allouez Bay, City of Superior, may have been a bog in the past but the conifers are nearly all dead and no rare plants were found there.

Failure to relocate several species (*Drosera anglica*, *D. linearis*, *Listera auriculata*, and *Senecio congestus*) at historical sites in coastal bogs and marshes is cause for concern. Perhaps, as at Port Wing, logging drive activities (involving construction of small check dams and stream channelization) and, more recently, release of treated sewage effluent has negatively impacted these species. The new population of *Drosera anglica* discovered on the Bad River Slough in 1994 may be the only extant Wisconsin site, while the robust, not-easy-to-overlook marsh ragwort (*Senecio congestus*) has not been seen in Wisconsin since 1960 and may be extirpated.

Table 2. Rare plants found during the Lake Superior Coastal Wetland Evaluation

<i>Arethusa bulbosa</i>	<i>Juncus vaseyi</i>
<i>Armoracia lacustris</i>	<i>Listera auriculata</i>
<i>Asclepias ovalifolia</i>	<i>Listera convallarioides</i>
<i>Asplenium trichomanes*</i>	<i>Lonicera involucrata</i>
<i>Astragalus alpinus</i>	<i>Lycopodium selago</i>
<i>Botrychium lanceolatum*</i>	<i>Lycopodium sabinaefolium</i>
<i>Botrychium simplex</i>	<i>Myriophyllum alterniflorum</i>
<i>Callitriche hermaphroditica</i>	<i>Nuphar microphyllum</i>
<i>Callitriche heterophylla</i>	<i>Ophioglossum vulgatum</i>
<i>Calypso bulbosa</i>	<i>Orobanche uniflora*</i>
<i>Cardamine pratensis*</i>	<i>Osmorhiza chilensis</i>
<i>Carex capillaris</i>	<i>Parnassia palustris</i>
<i>Carex concinna</i>	<i>Petasites sagittatus</i>
<i>Carex exilis</i>	<i>Pinguicula vulgaris</i>
<i>Carex lenticularis</i>	<i>Platanthera flava var herbiola</i>
<i>Carex livida var radicaulis</i>	<i>Platanthera hookeri</i>
<i>Carex pallescens var neogaea</i>	<i>Platanthera orbiculata</i>
<i>Carex richardsonii</i>	<i>Polystichum braunii</i>
<i>Carex tenuiflora</i>	<i>Potamogeton confervoides</i>
<i>Ceratophyllum echinatum*</i>	<i>Primula mistassinica</i>
<i>Clematis occidentalis*</i>	<i>Pyrola minor</i>
<i>Cypripedium arietinum</i>	<i>Ranunculus cymbalaria</i>
<i>Cypripedium parviflorum</i>	<i>Ranunculus gmelinii var hookeri</i>
<i>Cypripedium reginae</i>	<i>Ranunculus lapponicus</i>
<i>Deschampsia flexuosa</i>	<i>Rhynchospora fusca</i>
<i>Drosera anglica</i>	<i>Ribes hudsonianum</i>
<i>Dryopteris fragrans var remotiuscula</i>	<i>Salix planifolia</i>
<i>Eleocharis nitida</i>	<i>Sparganium glomeratum</i>
<i>Eleocharis robbinsii</i>	<i>Streptopus amplexifolius</i>
<i>Epilobium palustre</i>	<i>Triglochin maritimum</i>
<i>Equisetum palustre</i>	<i>Trisetum spicatum</i>
<i>Equisetum variegatum</i>	<i>Utricularia resupinata</i>
<i>Eriophorum chamissonis</i>	<i>Vaccinium vitis-idaea</i>
<i>Gymnocarpium jessoense subsp. parvula*</i>	<i>Viola novae-angliae</i>
	<i>Woodsia oregana</i>

* These rare plants were found in the Lake Superior Basin but are not mentioned in the text as they occur on non-priority sites as defined in this evaluation.

Smaller, estuarine-type river- or creek-mouth wetlands were also surveyed, some such as the Cranberry and Iron rivers several times, but few rare plants were found in this habitat. In early August, the coastline from Wisconsin Point in the City of Superior to the mouth of the Iron River was walked and no significant rare plant populations were found, nor at the mouths of streams such as the Amnicon, Middle, and Poplar rivers. In general, lakeside clay bluffs suffered from heavy slumping and stabilized parts were covered by dense thickets of tag alder (*Alnus incana*). However, lakeside sandstone bluffs from the Village of Herbster and east yielded new stations for the threatened grass *Trisetum spicatum* and a new station for the Wisconsin Endangered mountain-cranberry (*Vaccinium vitis-idaea*) on the Squaw Bay Cliffs within the Apostle Islands National Lakeshore.

Throughout the 1995 season, but especially in August and September, the wetlands in the vicinity of the City of Superior were surveyed. The Pokegama-Carnegie Wetlands, southwest of the city, turned out to have significant populations of all the rare species found at the Superior Airport site, namely *Petasites sagittatus*, *Sparganium glomeratum*, *Eleocharis nitida*, *Ranunculus gmelinii*, and *Juncus vaseyi*. All of these species were found at one to several other sites in the vicinity of the City of Superior, mainly in roadside and railyard ditches. In the city, *P. sagittatus* appears to be suffering from hybridization with the common *P. palmatus*, perhaps induced by habitat disturbance. *Sparganium glomeratum*, *Eleocharis nitida*, and *Ranunculus gmelinii* are all more common than previously thought, but still deserve at least threatened status. On the other hand, the rush *Juncus vaseyi* turned out to be so widespread that the upgrade to threatened status is not recommended. New England violet (*Viola novae-angliae*) also turned out to be widespread in the City of Superior area, evidence in support of its de-listing. The threatened seaside crowfoot (*Ranunculus cymbalaria*) was locally common on salted curbside lawns and sidewalk margins in the city, and these non-native populations do not merit protection.

1996 Field Season Results

The emphasis in 1996 was to survey wetlands in the Bad River and Red Cliff Reservations as well as those sites greater than 6 miles from Lake Superior. In May, rich mesic deciduous river bottoms along the Bad, White, and Nemadji rivers were surveyed for spring ephemerals. The Nemadji River proved to have very rich ephemeral displays including *Isopyrum biternatum*, but no rare species. The Bad River within the Bad River Reservation had a number of southern disjuncts including showy orchis (*Galearis spectabilis*), several sedges (*Carex plantaginea*, *C. hirtifolia*, *C. woodii*), false mermaid (*Floerkea proserpinacoides*), and the ferns *Athyrium thelypteroides* and *Dryopteris goldiana*. The bluffs along the river had a number of uncommon species including three lady's-slippers (*Cypripedium arietinum*, *C. parviflorum*, and *C. reginae*). A coastal fen with abundant *Carex livida* and *Triglochin maritimum* was also surveyed.

The Red Cliff Reservation had a number of high quality remnant hemlock/sugar maple/yellow birch/white cedar forests that ranked among the finest along the Wisconsin mainland shoreline, and small ravines that cut through them to Lake Superior harbored significant new populations of rare species such as *Listera convallarioides*, *Osmorhiza chilensis*, and *Streptopus amplexifolius* that are otherwise common only on the Apostle Islands. The last-named species appears to be affected by deer browsing and is nearly gone from the Penokee Range area, where many sites were known in the 1920s and 1930s. *Calypso bulbosa* (now known only from the Brule River State Forest in the drainage) and perhaps *Mertensia paniculata* (apparently now gone from the Bayfield Peninsula) may also be impacted by deer, although this is more speculative.

The shaded, seeping, mossy sandstone ledges at the tip of the Bayfield Peninsula had a number of rare species including new populations of narrow false oats (*Trisetum spicatum*), bird's-eye primrose (*Primula mistassinica*), the largest state populations of fir clubmoss (*Lycopodium selago*), and additional populations of the Endangered mountain-cranberry (*Vaccinium vitis-idaea*), which were also found in a black spruce swamp near the City of Mellen. Farther west, Roman Point, Squaw Point, and the Squaw Bay Cliffs were also found to harbor some of these boreal species.

Several species of Special Concern proved to have numerous additional sites, especially round-leaved orchid (*Platanthera orbiculata*) and tufted hairgrass (*Deschampsia flexuosa*). Both are fairly common in sandy areas of the interior Bayfield Peninsula.

Although they are upland plants that were not specifically searched for, the rarity of climbing fumitory (*Adlumia fungosa*) and large-flowered ground cherry (*Leucophysalis grandiflora*), both obligate fire-adapted species, is cause for some concern. The ground cherry is known from five historical sites in the drainage, plus a 1992 sight record from northwestern Bayfield County that may be the only observation of the species in Wisconsin in the last fifty years. Yet there is hope for these species, as they are known to persist for decades in soil seedbanks.

Ditches with bedrock near the surface south of the City of Mellen along State Trunk Highways 13 and 77 between Mellen and Hurley had several rare species including tubercled orchid (*Platanthera flava* var. *herbiola*). In this habitat, pale sedge (*Carex pallescens*) was common and iris-leaved rush (*Juncus ensifolius*, a probable exotic) occasional.

Farther inland, the threatened cliff ferns *Dryopteris fragrans* and *Polystichum braunii* were found in a large number of new stations in the Gogebic-Penokee Range. One disappointment was the lack of open rocks and pine forests in the range; the expected Wisconsin sites for northern Michigan specialties such as *Collinsia parviflora*, *Polystichum lonchitis*, *Saxifraga virginensis*, and *Polygonum douglasii* were not found.

In July, project staff worked in the drainage divide conifer swamps on the southern edge of the drainage basin and made two significant discoveries: (1) the relocation of lesser wintergreen (*Pyrola minor*), a species previously known from a single 1897 coastal collection in alder/tamarack/other conifer swamps, a neglected community type in which rare plants were unexpected; and (2) the first five Wisconsin records for tawny cotton-grass (*Eriophorum virginicum*), in bogs and boggy ditches, usually those with a thick, very wet, open sphagnum mat and a relative absence of other sedges and ericads. The purple-flowered dwarf raspberry (*Rubus acaulis*), a distinctive "boreal fen" species that is found scattered throughout the northern one-third of Minnesota and across northern Michigan, was targeted but not found.

Tawny cotton-grass (*Eriophorum virginicum*), along with marsh grass-of-Parnassus (*Parnassia palustris*-found at an additional site in interior Bayfield County) and marsh ragwort (*Senecio congestus*-not found in the 1995-96 survey and perhaps extirpated) are all rare in Wisconsin but occur throughout northern and central Minnesota and even in coniferless eastern North Dakota. This common distribution pattern suggests that they are not bog obligates but may be expected in calcareous prairie pothole-like marshes and swamps in northwestern Wisconsin counties such as Burnett, Sawyer, Polk, Barron, and St. Croix which have an abundance of lakes.

Many of the cliffs and bogs of the Apostle Islands were revisited in 1995-96, partly with the hope of finding boreal taxa that might have been missed during 1990-92 surveys, and with better search images following extensive field work on Isle Royale in 1994. Some of the forests, cliffs, and sandstone splash pools on the islands seemed like ideal habitat for ubiquitous Isle Royale species such as *Selaginella selaginoides*, *Geocaulon lividum*, *Euphrasia arctica*, *Carex atratifomis*, *C. media*, *Poa alpina*, and *Sagina nodosa*. Several of these species also extend south along the Minnesota shoreline nearly to the City of Duluth. However, none were found on the Apostle Islands. Several new sites for grape-ferns (one population of *Ophioglossum vulgatum* and three of *Botrychium simplex*) were found near coastal island rock splash pools that were thoroughly searched in 1991-92, thus illustrating the ephemeral nature of these ferns.

Rare Plant Species Descriptions

The following section consists of descriptions and distributional summaries of 103 rare vascular plant species found in Wisconsin's Lake Superior drainage basin. The data were compiled during 1995-96 surveys of the entire drainage basin and visits to a few of the Apostle Islands. The Apostle Islands were not comprehensively surveyed for this study as they were the subject of detailed rare plants surveys in the early 1990s (Judziewicz and Koch 1993). The rare plant species descriptions are arranged alphabetically within six groups: species state listed as Endangered, species state listed as Threatened, additional species of concern, species previously believed extirpated, species with restricted distribution, and exotic species with invasive potential. Note that the set of figures following the plant descriptions include both historic and extant population locations; reference the text for a complete distributional picture.

Species State Listed as Endangered

Armoracia lacustris (A. Gray) Al-Shehbaz and V. Bates (lake cress)

Heritage Code. PDBRA07010

Family. Mustard (Brassicaceae)

Global Rank. G4?

Federal Status. None

Wisconsin Status. Endangered

Distribution. Lake cress (*Armoracia lacustris*), long known by the later name *A. aquatica* (Eaton) Wiegand, is a member of the mustard family (Brassicaceae) and is closely related to the cultivated European horseradish, *A. rusticana*. However, as its name suggests, it is an aquatic species that is found from Minnesota to Quebec and south to Texas and Florida. It is rare throughout its range and is listed as threatened or Endangered in most of the states in which it occurs. In Wisconsin, it has been collected only six times from the following counties: Brown (1891), Lincoln (1915), Green Lake (1921), and Bayfield and adjacent Ashland (1979 to present). Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 4**.

Habitat and Associates. Lake cress is the only completely aquatic member of the mustard family to occur in the Great Lakes region, growing in quiet, shallow to deep (4 m) waters of rivers, sloughs, and lake bays. The Brown County location was in Green Bay of Lake Michigan, and the Bayfield County site is the shallow, sandy bottom of a creek estuary on Siskiwit Bay in Lake Superior. The Bayfield population is large, with tens of thousands of individual plants (W.S. Alverson, pers. comm.).

Appearance and Similar Species. Lake cress is usually a submerged, rhizomatous aquatic perennial with very finely dissected alternate leaves. Terrestrial forms (ca. 10-20 cm tall), which sometimes grow on riversides or lakeshores, differ in that the lowest leaves are spatulate and dentate (but not dissected), but these grade into the typical dissected leaves in the upper part of the stem. In both terrestrial and aquatic forms, the leaves are easily stripped from the stem. Because of the highly dissected leaves, sterile specimens of lake cress might be confused with other aquatic plants such as coonwort (*Ceratophyllum* spp.), water-milfoil (*Myriophyllum* spp.), and water-marigold (*Megalodonta beckii*), but the latter species have opposite rather than alternate leaves (Voss 1985). Similarly, the leaves of lake cress have a central axis quite unlike the more dichotomously branching leaves of bladderworts (*Utricularia* spp.) and aquatic buttercups (*Ranunculus* spp.).

Potential Threats. The reasons for this species' rarity and apparent decline throughout its range are unknown, but declining water quality has been suggested (Alverson and Iltis 1979). All "washed-up" fragments from Bark Bay through Stockton Island are presumed to have originated from the Lost Creek population, with most being carried east by longshore currents. These "wash-ups" are most common in the spring. Unless a colony of lake cress is found in suitable habitat, these washed-up plants may not be biologically significant.

Astragalus alpinus L. (Alpine milk vetch)

Heritage Code. PDFAB0F0D0

Family. Legume (Leguminosae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Endangered

Distribution. Circumboreal, south in North America to Colorado, Wisconsin, and New England. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 5**.

Habitat and Appearance. See extensive DNR files on this species.

Historic Sites. Bayfield County- Pigeon (known from 1926) and Mountain lakes west of Drummond; see voluminous DNR and U.S. Fish & Wildlife Service files on these sites. Since the Pigeon Lake area is internally drained and does not drain into Lake Superior, this species was not a priority. Ten plants were noted at Mountain Lake on 4 September 1996.

Botrychium lunaria (L.) Swartz (moonwort)

Heritage Code. PPOPH01080

Family. Adder's-tongue (Ophioglossaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Endangered

Distribution. Circumboreal, ranging south in North America to the Rocky Mountain states, northern Minnesota, northern Wisconsin, northern Michigan, northern New York, and northern New England. In Wisconsin, the species is known from the Lake Superior region (Ashland, Bayfield, and Sawyer

counties) and Door County on Lake Michigan. Scattered in the north, it may perhaps even be in Washburn County immediately south of the project area. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 6**.

Habitat and Associates. In Wisconsin, the species is most often found on coniferous forest edges, often in clearings near the Great Lakes. No associates are recorded for the Stockton Island site.

Appearance and Similar Species. Moonwort is a tiny grape-fern only 5-10 cm tall. It is a variable species but the typical form has distinctive sessile leaf blades with numerous, overlapping, entire, fan-shaped to nearly round pinnae. The overlapping nature of the pinnae tends to distinguish it from related species such as *B. minganense* and *B. simplex*, both of which rarely occur in the lakeshore. A specialist is often required to confirm determination of this species, especially if the plants are depauperate; for example, the Taylor collection from Stockton Island was at first identified as *B. minganense*.

Caltha natans Pall. (floating marsh marigold)

Heritage Code. PDRAN06020

Family. Buttercup (Ranunculaceae)

Global Rank. G4G5

Federal Status. None

Wisconsin Status. Endangered

Distribution. Circumboreal, south to Alaska, western Canada, western Ontario, northeastern Minnesota, and Wisconsin. The species is rare in northeastern Minnesota but may be more common than supposed, as another site has recently been found within the city limits of Duluth. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 7**.

Habitat and Associates. Generally found in mud or clay of shallow water of creeks and pools; at the Foxboro site it grows in the "slow-moving areas of a small stream with shallow water (usually less than 4" deep though deeper in the two groups of plants floating at the south end of the artificial pond) and on adjacent open red-clay mucky banks..." (Alverson 1981). The few associates included *Elatine* spp., *Calamagrostis canadensis*, and *Alisma* spp. The adjacent forest was a "ragged mix of white birch, hawthorn, ash, and quaking aspen" with an understory of hazelnut (*Corylus americana*) and juneberry (*Amelanchier bartramiana*).

Appearance and Similar Species. This species is very distinct from the common marsh marigold (*C. palustris*); its leaves are smaller and floating and its flowers are white (not yellow), smaller, and appear later in the season than those of *C. palustris*.

Comments. It seems possible that other sites may occur in the western Lake Superior Clay Plain subsection, particularly along the feeder streams of the Red and Nemadji rivers. Much of this rugged area is in private land and will be difficult to access.

Juncus stygius L. (bog rush)

Heritage Code. PDJUN012N0

Family. Rush (Juncaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Endangered

Distribution. Northern Eurasia and northeastern North America. In the U.S., it is found in Minnesota, Wisconsin, Michigan, and northern New England. In Wisconsin, known only from Florence County. Erroneously reported from Anderson Lake, Rainbow Lakes Wilderness Area, Bayfield County.

Habitat and Associates. In the Midwest, this rush is restricted to extensive bogs, often calcareous ones (fens); the Florence County site is dominated by *Scirpus hudsonianus*, *Carex lasiocarpa*, and *C. livida*.

Appearance and Similar Species. This is one of the smallest and most inconspicuous rushes. No other small rush would be found in its boggy habitat, and it is easily overlooked. It is only 10-15 cm tall and has very narrow ascending leaves. The tiny terminal inflorescence consists of only 1-4 small 6-merous flowers. Flowering occurs in June and early July and ends quickly. In a sterile state this species is very difficult to find.

Historic Site. Bayfield County- Chequamegon National Forest, Rainbow Lakes Wilderness, Anderson Lake, 28 September 1980, Dennis McCauley 203/179 (University of Wisconsin-LaCrosse Herbarium). The late Dr. Rudy Koch did not recall it, nor could he find the specimen (Sept. 1995 pers. comm.). The habitat was intensively searched on 26 July 1995 and the species was not found, habitat incorrect-- it was far too acid, sphagnum, and ericaceous. It is recommended that this record be removed from the BCD.

Listera auriculata Wiegand (auricled twayblade)

Heritage Code. PMORC1N010

Family. Orchidaceae (Orchid)

Global. G3

Federal Status. C3

Wisconsin Status. None

Distribution. Found in northeastern North America (Minnesota, Wisconsin, Michigan, northern New England). Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 8**.

Habitat and Associates. A species of moist sand under tag alder (*Alnus incana*) near the outlets of streams into the Great Lakes.

Appearance and Similar Species. This twayblade is a small orchid only 7-15 cm tall bearing two opposite oval blades each 2.5-5.0 cm long midway up the stem; the latter feature will distinguish it from any other orchid genus. The inflorescence is a terminal raceme bearing about 10-20 flowers. It can be distinguished from the other two regional twayblades as follows: *L. cordata* has much smaller pointed leaf blades only 1-2 cm long, and *L. convallarioides* has a distinctly basally narrowed usually purplish lip petal and glandular pedicels and ovaries. In contrast, *L. auriculata* has a greenish lip with a base as broad as the tip and non-glandular, glabrous pedicels and ovaries. Flowering occurs from late June to early August. Colonies are apparently short-lived and transient.

Melica smithii (A. Gray) Vasey (Smith melic grass)

Heritage Code. PMPOA3X0F0

Family. Grass (Poaceae)

Global Rank. G4
Federal Status. None
Wisconsin Status. Endangered

Distribution. Found only at one site in Wisconsin, a rich mesic woods in the Penokee Range, Ashland County. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 9**.

Historic Site. Ashland County- Northeast side of highest ridge of Eagle's Peak, several small clones in deer-damaged sugar maple (*Acer saccharum*) forest, 7 August 1971, Kowal s.n. (University of Wisconsin-Madison Herbarium); relocated here in 1993 on southwest flank of peak; searched for but not relocated in May and July 1996.

Moehringia macrophylla Hooker (*Arenaria macrophylla*) (bigleaf sandwort)
Heritage Code. PDCAR0H020
Family. Caryophyllaceae (Pink)
Global Rank. G4
Federal Status. None
Wisconsin Status. Endangered

Distribution. Far western and northeastern North America, with disjunct areas in New Mexico and the Lake Superior region. In the U.S., the species is found in Washington and Montana to California; New Mexico; far northern Minnesota, Wisconsin (perhaps extirpated; Schlising and Iltis 1961), and Michigan (Marquis and Voss 1981); several New England states. In Wisconsin, it is known from the Penokee Range of Ashland and Iron counties. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 10**.

Habitat and Associates. On basic, igneous rock, sometimes in talus in the shade among moss mats (Coffin and Pfanmuller 1988).

Identification Hints. Bigleaf sandwort is a small, weak perennial herb that could be mistaken for common stitchwort (*Stellaria borealis*). *Moehringia macrophylla* is about 10-20 cm tall and has opposite, lanceolate to elliptical, acute, nearly glabrous leaves 3-6 cm long and 2-4 cm wide. The flowers are few in a terminal inflorescence and have five white, un-notched petals (the petals are deeply notched or cleft in all species of *Stellaria*) that are longer than the five narrow sepals. There are ten stamens and three styles. Flowering is reported from May through August. Reproduction may be vegetative by stolons.

Oxytropis campestris (L.) DC. var. *chartacea* (Fassett) Barneby (Fassett's locoweed)
Heritage Code. PDFAB2X041
Family. Legume (Leguminosae)
Global Rank. G5?T1
Federal Status. LT
Wisconsin Status. Endangered

Distribution. Endemic to Wisconsin. Known only from Pigeon Lake and Mountain Lake, Bayfield County, and from several counties in central Wisconsin. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 11**.

Habitat and Appearance. See very extensive DNR and U.S. Fish & Wildlife Service files on this species and the Pigeon Lake area sites. Not intensively searched for in 1995-96 as this area is marginally a part of the Lake Superior drainage and has already been the site of intensive state, federal, and university searches and monitoring.

Historic Sites. The Pigeon Lake area is marginally part of the Lake Superior drainage so the species was not intensively searched for. Several other small pothole lakes were searched in 1995.

Pinguicula vulgaris L. (butterwort)
Heritage Code. PDLNT01090
Family. Bladderwort (Lentibulariaceae)
Global Rank. G5
Federal Status. None
Wisconsin Status. Endangered

Distribution. Butterwort is a widespread herb of the bladderwort family (Lentibulariaceae) that grows in arctic, subarctic, and boreal regions throughout the northern hemisphere. In the Great Lakes region it is rare, and in the Lake Superior Basin it is found on lake cliffs in Minnesota, Wisconsin, and Michigan. In Wisconsin, butterwort grows only on four of the Apostle Islands. All four island sites were revisited in June-August 1996 and population trends are shown in **Table 3**. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 12**.

Habitat and Associates. The principal habitat of butterwort in the Apostle Islands is north-, northeast-, or northwest-facing sandstone cliffs. The plants grow in small, mossy, seeping fissures or ledges, usually located 1-8 meters above the lake surface; often the colonies are semi-shaded by the cliff-top trees. Individuals grow in colonies of few to hundreds.

Appearance and Similar Species. Butterwort is a clumped, perennial herb 5-13 cm tall with a basal rosette of 3-6 spatulate leaves about 2-4 cm long. The leaves, which are a distinctive bright yellow-green color and are sticky, an adaptation for capturing small insects in the nutrient-poor environment in which the species grows; butterwort is one of 13 insectivorous vascular plant species in Wisconsin. The flowers are solitary on long scapes and superficially resemble violets. They are 1-2 cm long, deep violet and have fused five sepals and petals. The corolla is two-lipped, with the lower lip prolonged into a small spur. Butterwort resembles no other plant in the state's flora. Flowering occurs from early June through early July; fruiting, in July and August.

Table 3. Population trends for *Pinguicula vulgaris* on the Apostle Islands

	Number of Stems Found			% Change
	1980-81 (Gurnoe)	1991-92 (Judziewicz)	1996 (Judziewicz)	
Devils	3047	4135	4713	+ 14.0
Ironwood	unknown	1065	750	- 29.5
Otter	1019	2022	786	- 61.1
Outer	unknown	463	2362	+ 456.8
Total	> 4066	7735	8611	+ 11.3

Ranunculus cymbalaria Pursh (seaside crowfoot)

Heritage Code. PDRAN0L0Q0

Family. Buttercup (Ranunculaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Endangered, proposed¹ downlisting to Threatened.

Distribution. Western states, also south to Iowa, Illinois, and New Jersey. In Wisconsin, it is found scattered throughout the state, probably becoming more common because of road salting; most likely to be native in the northeast (Fewless 1991). Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 13**.

Habitat and Appearance. Habitat is in ditches and in mowed bluegrass lawns adjacent to sidewalks and streets in the Superior area; see Gleason and Cronquist (1991) and Voss (1985) for more information and a description. Common roadside weed (where salted in winter) in the City of Superior.

Ranunculus gmelinii DC. var. *hookeri* (Don) Benson (small yellow water crowfoot)

Heritage Code. PDRAN0L112

Family. Buttercup (Ranunculaceae)

Global Rank. G5TU

Federal Status. None

Wisconsin Status. Endangered

Distribution. Variety *hookeri* is only known from North America. It is known from Alaska, south to Minnesota, Wisconsin, and Michigan. In Wisconsin, it is scattered throughout the northern one-third of the state; apparently most common in the City of Superior area. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 14**.

Habitat and Associates. This species is most characteristic of wet (shallow to 2 ft deep) standing water in ditches as well as natural swales in cattail/*Carex lacustris*/*Calamagrostis canadensis*/willow/tag alder marsh/shrub swamps in the City of Superior area. It often grows in power or pipeline right-of-ways with other rare species such as *Petasites sagittatus*, *Sparganium glomeratum*, and *Eleocharis nitida*. In the Pokegama area, it sometimes occurs in sites with a little relict tamarack (*Larix laricina*) and a sphagnum understory.

Appearance and Similar Species. There are only two truly aquatic Wisconsin buttercups with yellow flowers. *Ranunculus gmelinii* has small flowers less than 1 cm wide, while the more southern *R. flabellaris* has larger flowers over 1 cm wide.

Comments. Although this species is much more common than suspected in the City of Superior area, it is disturbing that the historical Bark Bay, Bibon Swamp, and Ashland sites were not relocated, or any other new locations east of the City of Superior.

¹ A proposal to add 20 plant and 13 animal species to Wisconsin's list of Endangered and Threatened species as well as revise the legal status of 9 other species, has been approved by the Natural Resources Board and forwarded to the Wisconsin Legislature for action.

Vaccinium cespitosum Michaux (dwarf bilberry)

Heritage Code. PDERI18060

Family. Heath (Ericaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Endangered

Distribution. Found in northern Eurasia; northern and western North America. In the U.S., it is known from Alaska; south to California, Colorado, Minnesota, Wisconsin, Michigan, northern New York, and New England. Rare in the northern half of Wisconsin. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 15**.

Habitat and Associates. Besides being endangered, this species is significant in that it is the food plant for the rare Northern blue butterfly [*Lycaeides idas* (or *argyrognomon*) *nabokovi*]. It occurs on dry rock outcrops and barrens, especially on recently burned areas, and is not a wetland species.

Vaccinium vitis-idaea L. var. *minus* Lodd. (mountain-cranberry or lingonberry)

Heritage Code. PDERI18121

Family. Ericaceae (Heath)

Global Rank. G5

Federal Status. None

Wisconsin Status. Endangered

Distribution. Circumboreal, found in northern Eurasia and northern North America. In the U.S., it is found in Alaska; not in the Pacific Northwest; south to Minnesota, Wisconsin, Michigan, and northern New England. In Wisconsin, it is rare in the far north. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 16**.

Appearance and Similar Species. Mountain-cranberry could easily be overlooked. At a distance the colony with its trailing stems and glossy, sometimes reddened leaves resemble a patch of unusually small bearberry (*Arctostaphylos uva-ursi*), which is abundant on shoreline rocks. Bearberry, however, besides its generally larger stature and shreddy reddish-brown bark, has larger, flatter, more obovate or paddled-shaped leaves. Mountain-cranberry has elliptical leaves with a distinctive crease along the midrib on the upper (adaxial) surface, and at least a few tiny black dots on the lower surface. In flower, it is easily recognized by its 4-merous flowers, campanulate rather than urceolate corolla, and bright red globular fruit. Despite the common name, the flowers are not all "shooting-starlike" as in the common cranberries *V. oxycoccos* L. and *V. macrocarpon* Aiton.

Reproductive Biology. Flowering occurs in late June and early July; fruiting in late August and September. This is a widely distributed circumpolar species with, "...Rapid dispersal of seeds by birds and mammals through their droppings, followed by good seed germination and seedling establishment... [permitting] this species to colonize burned forests and open habitats..." (Hall and Shay 1981).

Potential Threats, Management. The historical Wisconsin stations, all from Douglas County, have not been relocated since 1930 in spite of intensive searches (Alverson and Iltis 1981; Judziewicz 1995) and are presumably extirpated. In the summer of 1994, a colony of *Vaccinium vitis-idaea* was relocated in the

state in a mixed conifer swamp near the Town of Crandon, Forest County; the specimen is deposited at the University of Wisconsin-Madison Herbarium (M. Jaunzems, pers. comm.). Management of this species is very uncertain; from various papers and collection labels it appears that it may benefit from fire in the coniferous swamps in which it often grows, as it appears as an invader in such sites, presumably brought in by migrating birds. It is surprising that the three Bayfield Peninsula sandstone cliff sites were not noted by L.S. Cheney in 1897, who collected these cliffs for mosses very thoroughly; perhaps these populations were not there a century ago.

Species State Listed as Threatened

Amerorchis rotundifolia (Banks) Hulten [*Orchis rotundifolia*] (small round-leaved orchid)

Heritage Code. PMORC01010

Family. Orchidaceae (Orchid)

Global Rank. G5

Federal Status. None

Wisconsin Status. Threatened

Distribution. Distributed in northern North America from Alaska south to Montana, Wyoming, Minnesota, Wisconsin, Michigan, and New York. In Wisconsin, it is rare and perhaps extirpated from conifer swamps in the lower Bad River area. The closest known extant site is in northwestern Sawyer County. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 17**.

Habitat and Associates. Prefers cold, wet calcareous conifer swamps with a mixture of white cedar (*Thuja occidentalis*), tamarack (*Larix laricina*), and black spruce (*Picea mariana*).

Appearance and Similar Species. This is a small orchid that can easily be overlooked, especially since its blooming period is short. Small round-leaved orchid has a single roundish basal leaf about 6-9 cm long and a bractless flowering stalk about 7-15 cm tall. The flowers number 5-12 per inflorescence and are loosely racemose. Each 6-10 mm long, spurless flower has a three-lipped white or lavender corolla with dark purple-red spots. Flowering occurs in June; the individual plants may be short-lived and may rely on re-seeding in suitable habitat to survive (Case 1987).

Calypso bulbosa L. (Calypso orchid)

Heritage Code. PMORC0D010

Family. Orchid (Orchidaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Threatened

Distribution. Circumboreal, ranging south in North America to the Rocky Mountain states, northern Minnesota, northern Wisconsin, northern Michigan, and northern New England. In Wisconsin, the species is known from many counties throughout the northern one-third of the state; it is always rare and local, however. In the Lake Superior Basin, it is rare in conifer woods, perhaps extant only in old growth cedar swamps along the Brule River. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 18**.

Habitat and Associates. In Wisconsin, calypso orchid is restricted to a very specific habitat type, namely old growth white cedar (*Thuja occidentalis*) swamps with a mossy but well-drained understory. Typically, the plants grow alone or in small groups at the very base of the largest trees in these densely shaded stands. Some of the few associates that are found with calypso include creeping snowberry (*Gaultheria hispidula*) and heart-leaved twayblade (*Listera cordata*).

Appearance and Similar Species. This is an absolutely unmistakable orchid. In the fall, a single, small, round, evergreen leaf appears; this overwinters, and in earliest spring a 5-20 cm long stalk is produced. This bears a single rather lady's-slipperlike flower at its summit. The 1-2 cm long sepals and petals are much alike and form a radiate "crown" over the slipperlike, 1.5-2.5 cm long lip petal, which is mostly pink but is yellow at the base. By the summer both the flower and single leaf have withered and disappeared. Flowering occurs in May and early June.

Potential Threats. It is suspected that browsing by white-tailed deer may be detrimental to this species. On my visit to heavily deer-impacted Washington Island, Door County, in May 1991, I failed to find this orchid in the cedar-fir thickets where it had been collected several times in the 1920s. I suspect that Cheney's collection from the Mainland Unit may have been made in the Sand Point white cedar swamp at a time when deer did not use it as a yard, or perhaps there were just much lower overall deer densities then, even if the stand was used as a yarding area.

Carex concinna R. Br. (beautiful sedge)

Heritage Code. PMCYP03300

Family. Sedge (Cyperaceae)

Global Rank. G4G5

Federal Status. None

Wisconsin Status. Threatened; known only from Door and Ashland counties.

Distribution. Distributed in North America from Alaska to Newfoundland, south to South Dakota, northern Wisconsin, and northern Michigan. In spite of its name, the "beautiful sedge" is a small, nondescript species. In Wisconsin's Lake Superior region, it grows in semi-shaded white cedar-balsam fir-white birch "krumholtz" thicket vegetation on the bluff edges at the northern tip of Devils Island, where it is rare. It was first collected there in 1975; in 1991 it was found in only three places, each site with only two to a dozen clumps of plants. On 22 June 1996, four colonies were found with over one-hundred fruiting stems; the species seems to have increased slightly since 1991. Beautiful sedge is otherwise known in Wisconsin only from the Ridges Sanctuary and Marshalls Point, both on Lake Michigan in Door County. It is rare in Michigan, where it is known from only four counties. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 19**.

Habitat and Associates. Beautiful sedge grows on cliff edges at the north tip of Devils Island, in semi-shade or on bare ground in open sun. Associates include the trees balsam-fir (*Abies balsamea*), white cedar (*Thuja occidentalis*), white birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), balsam-poplar (*Populus balsamifera*), and mountain-ash (*Sorbus decora*); the shrubs mountain juneberry (*Amelanchier bartramiana*), green alder (*Alnus viridis* subsp. *crispa*), Labrador tea (*Ledum groenlandicum*), and twinflower (*Linnaea borealis*); and herbs wild sasparilla (*Aralia nudicaulis*), strawberry (*Fragaria virginiana*), shinleaf (*Pyrola asarifolia*), bunchberry (*Cornus canadensis*), big-leaved aster (*Aster macrophyllus*), naked miterwort (*Mitella nuda*), and sedges *Carex capillaris*, *C. deflexa*, *C. castanea*, *C. aurea*, and *C. peckii*.

Appearance and Similar Species. Beautiful sedge is not easy for a lay person to identify (see Fernald (1950) and Voss (1972) for a complete technical description and illustration of this species). Briefly, it is an inconspicuous tufted perennial about 10-20 cm tall, with narrow inflorescences produced on long, naked stalks in late June. The spikelets are aggregated in a small, rather compact group at the culm tip, generally with 2-3 females and a single male spikelet. Each female spikelet has from 3-6 perigynia. The perigynia are 2.5-3.0 mm long, minutely hairy, and rather stubby-looking. Several other similar sedge species grow near *C. concinna*, and these might be mistaken for it. *Carex deflexa* and *C. peckii* both have perigynia that taper at both ends to an evident stipe and beak, in contrast to the more bullet-shaped perigynia of *C. concinna*.

Carex exilis L. (coast sedge)
Heritage Code. PMCYP034F0
Family. Sedge (Cyperaceae)
Global Rank. G5
Federal Status. None
Wisconsin Status. Threatened

Distribution. Coast sedge ranges from Ontario to Labrador, south to northern Minnesota, northern Wisconsin, northern Michigan, and Delaware. In Wisconsin, it is restricted to bogs on Madeline and Stockton islands, Ashland County. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 20**.

Habitat and Associates. *Carex exilis* is abundant in wet, sphagnum-sedge mats in Julian Bay bog on Presque Isle Point, Stockton Island. Common associates here are other sedges (*Carex lasiocarpa*, *C. michauxiana*, *C. oligosperma*, and *C. paupercula*), leatherleaf (*Chamaedaphne calyculata*), twig-rush (*Cladium mariscoides*), round-leaved sundew (*Drosera rotundifolia*), beak-rushes (*Rhynchospora alba* and *R. fusca*), horned bladderwort (*Utricularia cornuta*), and pitcher-plant (*Sarracenia purpurea*). Coast sedge also grows here at the margins of interdunal beach pools, with water-shield (*Brasenia schreberi*), pipewort (*Eriocaulon septangulare*), and Robbins' spikerush (*Eleocharis robbinsii*).

Appearance and Similar Species. Although *Carex* is a difficult genus, coast sedge is fairly easy to recognize. It is a rather coarse, clump-forming species about 30-60 cm tall and is distinctive in that it bears but a single spikelet at the apex of the culm. The spikelet is 1-2 cm long, with inconspicuous male flowers at the base and numerous, ovate, 3.0-3.5 mm long perigynia near the summit. The only other bog sedge in the archipelago bearing a single spikelet is the uncommon *C. pauciflora*, and it is a much more delicate plant with slenderly lanceolate perigynia 6-7 mm long. Flowering occurs in early June, fruiting in July.

Carex lenticularis Michaux (shore sedge)
Heritage Code. PMCYP037A0
Family. Sedge (Cyperaceae)
Global Rank. G5
Federal Status. None
Wisconsin Status. Threatened

Distribution. Shore sedge (*Carex lenticularis* Michaux) is a rare member of the Cyperaceae in the Great

Lakes region. Its total distribution is from British Columbia to Newfoundland, south to California, Nevada, Colorado, northern Minnesota, northern Michigan (where it is known mostly from the Lake Superior shoreline of the upper peninsula and Isle Royale), and Massachusetts. In Wisconsin, it is now known from six locations. One, at Two Rivers (Manitowoc County) on Lake Michigan, is an old collection and the species is presumed extirpated there. More recently, it has been collected at its only known inland station in the state, Big Muskellunge Lake in Vilas County, and on several gravelly lakeshores in that county in 1995-96. The four other known sites are from the Apostle Islands (Devils, Long, Outer, Stockton). Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 21**.

Appearance and Similar Species. Shore sedge is a densely tufted perennial only 10-30 cm tall, with leaves only 2-3 mm wide. The inflorescence consists of a single male spikelet and several crowded, appressed female spikelets about 1.5-3.0 cm long. Each elongate, cylindrical female spikelet has numerous, lenticular perigynia 2-3 mm long. The perigynia and indeed the whole plant has a distinctive greenish-waxy color. *Carex lenticularis* is an inconspicuous plant that is related to and superficially resembles one of the best-known of all sedge species, *Carex stricta* Lam., the tussock sedge, a species that is often dominant in sedge meadows in southern Wisconsin. Both are members of section *Acutae*, but shore sedge differs from that species in that the lower leaf sheaths are not strongly fibrillose, and can be distinguished from all other members of section *Acutae* occurring in the Lake Superior region by the following combination of characters (after Voss 1972): flowering culms arising centrally from tufts of the previous season's leaves; perigynia several-nerved; and male spikelet solitary.

Habitat and associated species. In the Apostle Islands, the shore sedge has three distinct habitats and sets of associates: crevices in wave-splashed sandstone rock ledges (Devils Island); sphagnum-sedge bog mats (Outer Island); and sandy bog-edge beach pool margins (Long and Stockton Islands). Flowering occurs in June, fruiting in July.

Carex michauxiana Boeckeler (Michaux's sedge)

Heritage Code. PMCYP038H0

Family. Sedge (Cyperaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Threatened

Distribution. Michaux's sedge ranges from Ontario to Newfoundland, south to northern Minnesota, northern Wisconsin, northern Michigan, and New York; it also occurs in eastern Asia. In Wisconsin, it is restricted to mostly coastal bogs in Ashland and Bayfield counties; more specifically, the Apostle Islands and Bayfield Peninsula. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 22**.

Habitat and Associates. *Carex michauxiana* is fairly common in wet, sphagnum-sedge mats in Julian Bay Bog on Presque Isle Point, Stockton Island. It especially seems to prefer the numerous, very slightly elevated old beach ridges, especially in the northern part of the bog. Common associates here are other sedges (*Carex exilis*, *C. lasiocarpa*, *C. oligosperma*, and *C. paupercula*), leatherleaf (*Chamaedaphne calyculata*), twig-rush (*Cladium mariscoides*), round-leaved sundew (*Drosera rotundifolia*), beak-rushes (*Rhynchospora alba* and *R. fusca*), horned bladderwort (*Utricularia cornuta*), and pitcher-plant (*Sarracenia purpurea*). On the mainland in coastal bogs, it prefers the ecotone between *Carex*

lasiocarpa-dominated poor fen and acid, sphagnum-dominated bog mat farther inland.

Appearance and Similar Species. *Carex michauxiana* is a very distinctive species that can hardly be mistaken for any other local member of the genus. It is a fairly robust plant 30-60 cm tall, bearing several short-peduncled large, star- or fan-like female spikelets, each 2.0-3.5 cm in diameter. The individual perigynia are slenderly lanceolate, tapering, and very long (8-13 mm). Flowering occurs in June, fruiting in July.

Potential Threats. None, as long as the bog is left undisturbed. Fluctuating lake levels may affect the abundance of this species.

Carex prasina Wahlenb. (drooping sedge)

Heritage Code. PMCYP03B10

Family. Sedge (Cyperaceae)

Global Rank. G4

Federal Status. None

Wisconsin Status. Threatened

Distribution. Drooping sedge is distributed from the Apostles Islands east to Quebec and Maine, south to Arkansas, Illinois, Kentucky, and South Carolina. In Wisconsin, it is known from only four locations: Baraboo Hills in Sauk County; Kickapoo River Valley of Vernon County; along the St. Croix River in southwestern Burnett County; and on Oak Island in Ashland County. It has not yet been recorded from Minnesota. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 23**.

Habitat and Associates. *Carex prasina* grows in rich, moist, shaded soil in hardwood stands, both in ravines and in seeping, shallow draws. On Oak Island it is most common under sugar maple (*Acer saccharum*), paper birch (*Betula papyrifera*), yellow birch (*Betula alleghaniensis*), quaking aspen (*Populus tremuloides*), and hemlock (*Tsuga canadensis*), and frequently grows with the rare herbs *Carex scabrata* and broad-lipped twayblade (*Listera convallarioides*).

Appearance and Similar Species. Drooping sedge is a densely clump-forming species with culms 30-60 cm tall. The leaves are scabrous and have narrow blades 3-5 mm wide. The inflorescence consists of a slender, terminal male spikelet (often with a few perigynia at the tip) and several lax, loosely-flowered, very slender, 3-5 cm long female spikelets borne laterally. The diamond-shaped, smooth, 3-4 mm long perigynia are absolutely distinctive among Wisconsin members of the genus; they are triangular in cross-section with each of the three sides strongly indented or concave. *Carex prasina* could be confused only with *C. scabrata*, with which it often grows. The latter species has more harshly scabrous leaf blades 4-8 mm wide and plump, scabrous, abruptly-beaked perigynia that are only weakly triangular (i.e., the sides are still convex and not at all concave). Flowering occurs in May and early June, fruiting in late June and throughout July.

Cypripedium arietinum R.Br. (Ram's-head lady's-slipper)

Heritage Code. PMORC020Q0

Family. Orchidaceae (Orchid)

Global Rank. G3

Federal Status. None

Wisconsin Status. Threatened

Distribution. China; northeastern North America. In the U.S., the species is found in Minnesota, Wisconsin, Michigan, and northern New England. In Wisconsin, it is rare throughout the northeastern one-third of the state.

Habitat and Associates. Local at summits or uppermost steep slopes of clay bluffs overlooking Bad River, under partially sunny to shady forest dominated by red pine (*Pinus resinosa*), quaking (*Populus tremuloides*) and big-toothed aspen (*Populus grandidentata*), often with white cedar (*Thuja occidentalis*), red maple (*Acer rubrum*), and white birch (*Betula papyrifera*); common associates are *Shepherdia canadensis*, *Carex eburnea*, *Cornus stolonifera*, *Lathyrus ochroleucus*, *Astragalus canadensis*, *Juniperus communis*, *Cypripedium calceolus* subsp. *parviflorum*, *Aster macrophyllus*, *Diervilla lonicera*, *Oryzopsis asperifolia*, *Rubus parviflorus*, *Corylus cornuta*, *Pteridium aquilinum*, and blueberries (*Vaccinium* spp.).

Appearance and Similar Species. This is an easily distinguished orchid when in flower. It is an unbranched, herbaceous perennial 20-35 cm tall with 3-4 alternate elliptical leaves 4-9 cm long and 1.5-2.5 cm wide. The single flower is borne at the stem apex. The sepals are narrow and greenish to purplish, while the lower petal is developed into a downward-pointing, pouchlike lip 1-2 cm long, which is whitish or pinkish streaked with vertical purple veins. The common yellow (*C. calceolus*), pink (*C. acaule*), and painted (*C. reginae*) lady's-slippers all have much larger, globular lip petals, and, in sterile condition, much wider leaf blades. The flowering season of this orchid is short, from late May to mid-June. Small bees are the pollinators, and individual plants appear to be short-lived.

Drosera anglica Hudson (English sundew)

Heritage Code. PDDRO02010

Family. Sundew (Droseraceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Threatened

Distribution. Western and northern North America, including Minnesota, Wisconsin, and Michigan. In Wisconsin, it is rare in bogs; perhaps extirpated from several sites. The Bad River Slough is apparently the only extant site for this species in Wisconsin. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 24**.

Habitat and Associates. This is a plant of calcareous bogs or poor fens; see more comments under *Triglochin palustre*, which may have had a similar habitat in the Lake Superior region.

Appearance and Similar Species. Sundews, with their spoon- to thread-shaped basal rosette of leaves covered with stalked sticky red droplets to trap insects, are a familiar group. All four American species occur in Wisconsin; *D. rotundifolia* has round leaves, *D. linearis* thread-like leaves, and both *D. intermedia* and *D. anglica* have intermediate spoon-shaped leaves. This is a hybrid of *Drosera linearis* with *D. rotundifolia*. It includes both sterile diploids and fertile amphiploids. Voss (1985) gives the difference between the two as follows: (1) *D. intermedia* - Flowering stem arising laterally from the base of the plant before curving upward, petioles glabrous, blades 2-4 mm wide, seeds less than 4 times as long as wide and densely covered by prominent papillae; and (2) *D. x anglica* - Flowering stems

strictly erect, arising centrally from base of plant, petioles at least sparsely pubescent or glandular; blades 3-8 mm wide, seeds often not developed.

Drosera linearis Goldie (linear-leaved sundew)

Heritage Code. PDDRO02060

Family. Sundew (Droseraceae)

Global Rank. G4

Federal Status. None

Wisconsin Status. Threatened

Distribution. Extant in only two counties of eastern Wisconsin, where it is known from only two sites. In the Lake Superior Basin, it is perhaps extirpated. Neither historical site was relocated during several surveys from 1990-96. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 25**.

Habitat and Associates. This is a plant of calcareous bogs, now called fens.

Appearance and Similar Species. Sundews, with their spoon- to thread-shaped basal rosette of leaves covered with stalked sticky red droplets to trap insects, are a familiar group. All four American species occur in Wisconsin; *D. rotundifolia* has round leaves, *D. linearis* thread-like leaves, and both *D. intermedia* and *D. anglica* have intermediate spoon-shaped leaves. Voss (1985) gives the difference between the two as follows: (1) *D. intermedia* - Flowering stem arising laterally from the base of the plant before curving upward, petioles glabrous, blades 2-4 mm wide, seeds less than 4 times as long as wide and densely covered by prominent papillae; and (2) *D. x anglica* - Flowering stems strictly erect, arising centrally from base of plant, petioles at least sparsely pubescent or glandular, blades 3-8 mm wide, seeds often not developed.

Listera convallarioides (Swartz) Torrey (broad-lipped twayblade)

Heritage Code. PMORC1N050

Family. Orchid (Orchidaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Threatened

Distribution. Broad-lipped twayblade is an inconspicuous orchid that ranges from Alaska to Newfoundland south to montane Arizona, northern Minnesota, northern Wisconsin, northern Michigan, and montane North Carolina. In Wisconsin, it is known only from three (Bayfield, Ashland, and Iron) of the four counties bordering Lake Superior. In the current survey, it was found to be rare in ravines through old growth hemlock-hardwoods forests from Little Sand Bay to Frog Bay; also on Oak Island; rare in forests of the Penokee Range, with no recent records. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 26**.

Habitat and Associates. Broad-lipped twayblade grows in rich soil of wooded ravine bottoms and seeping, shaded slopes. Common woody associates are the trees hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*), white cedar (*Thuja occidentalis*), and birches (*B. allegheniensis* and *B. papyrifera*). Mountain maple (*Acer spicatum*) is a very common shrubby associate; common herbaceous associates include the rare drooping sedge (*Carex prasina*), the uncommon *C. scabrata*, enchanter's-

nightshade (*Circaea alpina*), big-leaved aster (*Aster macrophyllus*), corn-lily (*Clintonia borealis*), Canada mayflower (*Maianthemum canadense*), lady fern (*Athyrium angustum*), wood ferns (*Dryopteris carthusiana* and *D. intermedia*), shining clubmoss (*Lycopodium lucidulum*), white mandarin (*Streptopus amplexifolius*), marsh blue violet (*Viola cucullata*), naked mitrewort (*Mitella nuda*), and Chilean sweet cicely (*Osmorhiza chilensis*).

Appearance and Similar Species. Broad-lipped twayblade is a small plant only 7-25 cm tall. The stem is unbranched and bears near its midpoint a pair of nearly opposite leaves with ovate, acute blades 3-6 cm long. The stem terminates in a raceme of small, greenish, translucent flowers, these each with a relatively large lip petal that is distinctly clawed (narrowed) at the base. Two congeners of broad-lipped twayblade occur in or near the Apostle Islands, but each has quite different habitat preferences. *Listera cordata* (heartleaf twayblade) is a species of mossy *Thuja-Picea* swamps that is common in northern Wisconsin but rare in the lakeshore. It differs from *L. convallarioides* in its smaller (1-3 cm long), more heart-shaped leaf blades and its flowers with a prominent bifid (forked) lip. The auricled twayblade (*L. auriculata*) is a rare species listed as Endangered in Wisconsin. It is known only from a very specific habitat, namely from sandy, semi-open, periodically flooded soil in the shade of speckled alder (*Alnus incana*) thickets at creek and river mouths in Bayfield County. Its only Wisconsin occurrences are near the outlets of the Cranberry River (Herbster), Siskiwit River (Cornucopia), Pike Creek (Salmo), and the Sioux River sloughs. Morphologically it is quite similar to *L. convallarioides* but differs in its darker green foliage and flowers with an unclawed, distally notched lip. Flowering occurs in late June and during the first half of July.

***Parnassia palustris* L.** (marsh grass-of-Parnassus)

Heritage Code. PDSAXOP090

Family. Saxifrage (Saxifragaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Threatened

Distribution. Marsh grass-of-Parnassus is a common northern Eurasian species that is also found in North America from Alaska, northern Ontario, and Newfoundland south to California, Wyoming, North Dakota, northern Wisconsin, and northern Michigan, generally in moist, open areas. In Wisconsin, it is only found in Lake Superior drainage. The species is considered rare but locally common in swales and ditches in the vicinity of the City of Superior; also known from clay bluffs on Outer Island, and a springy lakeshore in central Bayfield County. Prior to the present survey, four stations of this officially Wisconsin Threatened species were known from Wisconsin (Alverson and Iltis 1978-79), three from Douglas County and one from Ashland County. Of the three Douglas County stations, two were not relocated during a 1981 search and may no longer be extant; namely those found in 1897 along the Lake Superior shore from the Brule River to the Amnicon River, and those collected in 1929 from the inland Village of Gordo. Two new sites were found during this survey. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 27**.

Habitat and Associates. The most typical habitat (subpopulations 1-52) was a moist, partially stabilized, moderately mossy and vegetated slope situated on a ridge or slope 20-40 feet above lake level, partially shaded by blufftop trees or smaller thickets of young trees just upslope or sideslope. A typical colony size was about 2x1 meters, with the long axis oriented upslope-downslope. Relatively few plants were found in bare, unstabilized clay. Conversely, if the site was too stabilized and herbaceous competition too

great, the colonies seemed to lack small, young individuals.

Appearance and Similar Species. The genus *Parnassia* is distinctive and when in flower can hardly be confused with any other in the region. Marsh grass-of-Parnassus is a small, perennial herb with several ovate, entire, glabrous leaves in a basal rosette, plus a single stem leaf midway up the flowering stalk. The solitary, terminal flower has 5 sepals, petals, stamens, and staminodes (sterile stamens). The petals are white with prominent pinkish or purplish veins. Three species of grass-of-Parnassus (*Parnassia*, *Saxifragaceae*) grow in Wisconsin. *Parnassia glauca* Raf. is a fairly common species of fens and wet calcareous meadows that is most frequent in the southern half of the state; the Wisconsin Endangered *P. parviflora* DC. is found on wet, sandy beaches and beach ridges near Lake Michigan in Door County; and the Wisconsin Threatened *P. palustris* L. is of rare occurrence in wet, open areas in the Lake Superior region, but more stations may be expected in interior northwest Wisconsin since it is common almost throughout Minnesota. Vegetatively, *P. palustris* differs from all other Wisconsin species in the presence of a relatively large, well-developed, heart-shaped stem leaf on the flowering culm. See Voss (1985) for a more comprehensive discussion of the 3 Midwestern species. Flowering apparently occurs in Wisconsin from early July through early September.

Petasites sagittatus (Pursh) A. Gray (sweet coltsfoot)

Heritage Code. PDAST71040

Family. Asteraceae (Composite family)

Global Rank. G4

Federal Status. None

Wisconsin Status. Threatened

Distribution. Alaska and Labrador south to Colorado, South Dakota, Minnesota, Wisconsin, and Michigan. In Wisconsin, it is known from counties bordering Lake Superior, plus Forest County; possible in Burnett County. In this survey, it was found to be locally common in marshes and alder thickets in the vicinity of the City of Superior (Douglas County) and the Bibon Swamp (Bayfield County) and as scattered colonies on the clay plain near the Brule and Iron rivers. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 28**.

Habitat and Associates. In Wisconsin, sweet coltsfoot (*Petasites sagittatus*) is most often found in cold, often boggy meadows dominated by grasses or sedges such as bluejoint (*Calamagrostis canadensis*) or *Carex lacustris*; it is also found in moist openings in boreal forests, where it may benefit from treefall gaps or selective cutting.

Appearance and Similar Species. Sweet coltsfoot (*Petasites sagittatus*) is a distinctive and easily recognized species. It is a rhizomatous perennial that often forms large clones in the marshy meadows in which it grows. The large (15-35 cm long, 8-20 cm wide), arrow-shaped leaves (slightly reminiscent of burdock) are all basal and are covered on the undersides and petioles with a dense mat of white, woolly hairs. The flowering shoot is clothed in usually bladeless bracts and produces a terminal cluster of heads of fuzzy white flowers. The only close relative is another species of coltsfoot (*P. frigidus* subsp. *palmatus*), which is occasional in boreal forests in the northern part of the riverway. It differs from *P. sagittatus* in its deeply, palmately-lobed leaves that are not nearly so whitened-woolly beneath as *P. sagittatus*. Flowering occurs in May and June.

Platanthera flava (L.) Lindley var. *herbiola* (R. Br.) Luer (tubercled orchid)
Heritage code. PMORC1Y082
Family. Orchid (Orchidaceae)
Global Rank. G4T4Q
Federal Status. None
Wisconsin Status. Threatened

Distribution. Minnesota to Nova Scotia, south to Kansas and Tennessee. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 29**.

Habitat and Associates. In southern Wisconsin and Minnesota, this species occurs in wet, acidic prairies and sedge meadows or sedge-shrub swamps.

Appearance and Similar Species. Tubercled orchid superficially resembles the common tall green orchid (*P. hyperborea*), which often grows in similar habitats. *Platanthera flava* differs most obviously in the presence of a large bump or tubercle on the lip of the flower. Flowering occurs in July.

Polystichum braunii (Spencer) Fee var. *purshii* Fern. (Braun's holly fern)
Heritage code. PPASPOU040
Family. Polypodiaceae (Polypody family)
Global Rank. G5
Federal Status. None
Wisconsin Status. Threatened

Distribution. In Wisconsin, it is found mostly in the Lake Superior region with a few sites in northeastern Wisconsin (Judziewicz 1983). Widespread in rich mesic ravines in the Penokee Range from eastern Bayfield to Iron counties. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 30**.

Potamogeton confervoides Reichenb. (algal-leaved pondweed)
Heritage code. PMPOT03050
Family. Pondweed (Potamogetonaceae)
Global Rank. G5
Federal Status. C2
Wisconsin Status. Threatened

Distribution. Scattered throughout far northern part of the state. In the current survey effort, it was found in one acid lake in southeast Bayfield County. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 31**.

Historic Site. Bayfield County - Lake Ree [on drainage divide], 23 August 1980, (TANS), in 1-2 feet of water, 100 plants; also located 6 August 1991; not searched for in 1996.

New Site. Bayfield County - possible population (identification needs verification), Moose Lake, August 1996, E. Epstein collection.

Ribes oxycanthoides L. (northern or hawthorn-leaved gooseberry)

Heritage code. PMPOT03150

Family. Grossulariaceae (Gooseberry)

Global Rank. G5

Federal Status. None

Wisconsin Status. Threatened

Distribution. Found in northern North America in Alaska; northern Minnesota, Wisconsin (rare), and Michigan. In Wisconsin, it is known from Wisconsin Point, Blue Hills talus, and Door County. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 32**.

Habitat and Associates. Roadside and barrow pit swale in sand near Coast Guard station at tip of point (Alverson and Koch mid-1980's).

Appearance and Similar Species. *Ribes oxycanthoides* is distinguished from others by its flowers borne in small clusters of 2-4 rather than in elongate, many-flowered racemes. The stems are very spiny unlike in all other island species except *R. lacustre*, which has prickly rather than usually smooth berries. Another good character is leaf size; the leaves of *R. oxycanthoides* are small, only 2-4 cm long. The only species with which it could be confused is *R. hirtellum*, which has never been recorded from the island. The latter species has glandless leaves, stamens equalling or exceeding the calyx lobes, and exceeding the petals. This 0.5-1.0 m tall sprawling shrub flowers in June and fruits in July and August.

Trisetum spicatum (L.) K. Richter (spike trisetum)

Heritage code. PMPOA690C0

Family. Grass (Gramineae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Threatened

Distribution. *Trisetum spicatum* is a widespread grass (family: Poaceae) that occurs in northern Eurasia and North America, ranging south in the New World to Central America in the mountains. Spike trisetum is uncommon in the Great Lakes region, and in Wisconsin it occurs only in the Lake Superior region in Ashland and Bayfield counties. Several collections of spike trisetum are known from localities in Wisconsin outside the Apostle Islands. These include two old (1897) collections from sandstone cliffs on the Lake Superior shoreline, and three recent (1974-76) collections on Madeline Island (Ashland County), and at Raspberry Point (Bayfield County) on the mainland. The present survey found new sites at 4 locations. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 33**.

Habitat and Associates. The principal habitat of spike trisetum in Wisconsin is north-, northeast-, or northwest-facing sandstone cliffs. The plants grow in small, moist pockets of soil in fissures or on seepy ledges, usually located from 1-5 meters above the lake surface; often the colonies are semi-shaded by cliff-top trees. Individuals grow singly or in lines up to 12 meters long in joints and fissures in the rock. A second, uncommon habitat in the islands are northwest-facing clay bluffs, such as at the Bear Island

population found by Middleton.

Spike trisetum frequently grows in areas that are semi-shaded by cliff-top "krumholtz" forest consisting of stunted trees of white cedar (*Thuja occidentalis*), yellow birch (*Betula alleghaniensis*), white birch (*B. papyrifera*), white spruce (*Picea glauca*), showy mountain-ash (*Sorbus decora*), and balsam-poplar (*Populus balsamifera*), as well as the shrubs red-osier dogwood (*Cornus stolonifera*) and green alder (*Alnus viridis* subsp. *crispa*). Herbaceous associates are infrequent but may include a bluegrass (*Poa nemoralis*), stitchwort (*Stellaria borealis*), ticklegrass (*Agrostis scabra*), and, on Ironwood, Otter, and Outer Islands, butterwort (*Pinguicula vulgaris*). At its stations on Madeline Island and on the mainland at Raspberry Point, other associates include bird's-eye primrose (*Primula mistassinica*), three-toothed cinquefoil (*Potentilla tridentata*), and a ragwort (*Senecio pauperculus*). In general, however, spike trisetum does not grow among other herbaceous vegetation.

Appearance and Similar Species. Spike trisetum is a caespitose perennial grass about 10-40 cm tall. The foliage and inflorescence stalks (peduncles) in all Wisconsin populations are softly pubescent, a good character for identifying this species in sterile condition. Taxonomically, *Trisetum spicatum* is a variable species that has been divided into numerous varieties that appear to freely intergrade. No varieties are recognized in this report. Several other grasses might be confused with spike trisetum. Timothy (*Phleum pratense*), a common Eurasian weed of clearings, and wedge grass (*Sphenopholis obtusata*), a native species that is frequent on clay banks throughout the archipelago. Spike trisetum flowers in June; fruiting in July. Apparently little is known about the reproductive biology of this species.

Valeriana sitchensis Borg. subsp. *uliginosa* (Torrey and A. Gray) F.G. Meyer (marsh valerian)
Heritage Code. PDVAL030E2
Family. Valerian (Valerianaceae)
Global Rank. G4G5T4
Federal Status. None
Wisconsin Status. Threatened

Distribution. In Wisconsin, the species is quite rare in calcareous conifer swamps in northern and eastern parts of the state. A historic record in the Lake Superior Basin, a marsh in Iron County near Gurney, was not relocated in the present study. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 34**.

Historical Site. Iron County- Site was upland sugar maple (*Acer saccharum*) forest; exact site given was a ditch next to a grassy opening in the forest, and had remnant populations of *Erythronium americanum*, not the correct habitat for this species. Perhaps there was a labelling error and the specimen is not from this locality.

Viola novae-angliae House (New England violet)
Heritage Code. PDVIO04180
Family. Violet (Violaceae)
Global Rank. G3Q
Federal Status. None
Wisconsin Status. Threatened, proposed for removal from protected status.

Distribution and Habitat. In the current Wisconsin survey effort, it was found to be locally common in moist open disturbed areas such as ditches and old fields in the vicinity of Superior; occasional in alder

thickets in the Superior area; present on dry exposed summits of basalt knobs in the South Range southeast of the city; also present on rock outcrops in the Penokee Range of Ashland County.

Additional Species of Concern

Eleocharis nitida Fern. (neat spikerush)

Heritage Code. PMCYP09180

Family. Sedge (Cyperaceae)

Global. G3G4

Federal Status. None

Wisconsin Status. None, proposed Endangered.

Distribution. Alaska to Newfoundland, south sporadically to Minnesota, Wisconsin, Michigan proposed Endangered in Minnesota; one site in northern Michigan; rare in northern New Hampshire. In Wisconsin, found only in Superior area. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 35**.

Habitat and Associates. Characteristic of disturbed, seasonally wet red clay soils of ditches, marshes, and shrub swamps (alder and willow), often with sedges (such as *Carex lacustris*), grasses (bluejoint--*Calamagrostis canadensis*), and rushes; sometimes in standing water an inch or two deep.

Appearance and Similar Species. This is an easy spikerush to recognize. It occurs in tiny rhizomatous pincushions, with stems only 7-12 cm tall. The achenes are 1 mm long, 3-angled, golden, lack bristles, minutely sculptured under a hand lens, and persist on the spike late into the fall, even after the subtending scales have fallen.

Eriophorum chamissonis C.A. Meyer (rusty cotton-grass)

Heritage Code. PMCYP0A060

Family. Sedge (Cyperaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. None, may be proposed in the future as Special Concern or Threatened.

Distribution. Circumboreal in Eurasia and northern North America. In the U.S., it is found in Alaska south to Oregon, Wyoming, eastern North Dakota, central Minnesota and northwestern Wisconsin; not recorded from Michigan. In Wisconsin, it is restricted to the Lake Superior region. In the current survey, it was found to be rare in very wet floating bog mats or less commonly poor fens, mostly along the drainage divide; at elevations from 1115-1705 feet (ca. 500-1100 feet above Lake Superior). Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 36**.

Habitat and Associates. Five sites, all discovered by project staff in July 1996, represent the first records for this boreal species in Wisconsin. *Eriophorum chamissonis* is known from three counties in North Dakota, well west of the coniferous forest zone, and is scattered throughout northern and north-central Minnesota south to the Twin Cities area. Therefore, it is probable that more stations may eventually be found in the northwestern counties of Wisconsin such as Burnett, Washburn, Polk, and Barron, perhaps even in prairie pothole "fens" (perhaps with indicator species such as *Triglochin maritimum* and *Platanthera dilatata*) as well as coniferous bogs (it should be looked for in Kissick Bog in Sawyer County). In two of the Wisconsin sites, tawny cotton-grass (*E. virginicum*) grows in very wet mats on the

upslope or ponded sides of bogs whose drainage has been impeded by a road or railroad grade.

Appearance and Similar Species. In appearance this is a quite distinctive cotton-grass. Like the common *E. spissum* it has only one spikelet per head, but this spikelet is huge--nearly the size of a golf ball when mature. It also has a slight tawny or brownish cast but this is not as noticeable as the manuals or common name indicate (specimens from the southern edge of the range such as from Minnesota also show this white rather than rusty coloration). Also, *E. chamissonis* is rhizomatous, so the stems arise scattered through the bog mat, not in dense clumps as in *E. spissum*. Other technical characters that differentiate *E. chamissonis* from *E. spissum* are the fewer spikelet scales (7 or fewer) and the more conspicuously beaked achenes.

Myriophyllum alterniflorum DC. (delicate water-milfoil)

Heritage Code. None

Family. Water-Milfoil (Haloragaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. None, recommended Special Concern.

Distribution. Northern Eurasia; northeastern North America. In the U.S., it is found in Minnesota, Michigan; south in the east to Massachusetts and New York. In Wisconsin, it is uncommon in the northernmost two tiers of counties plus Walworth County.

Habitat and Associates. This is a submersed aquatic of inland lakes; Voss (1985) gives the habitat as "soft water lakes and bays of Lake Superior."

Appearance and Similar Species. The water-milfoils are a distinctive aquatic genus characterized by their whorled, feathery leaves, and lower extremely dissected, the upper often merely toothed. *Myriophyllum alterniflorum* is fairly distinct in its short leaves at most 1 cm long, often shorter than the stem internodes. The other species generally have 2-4 cm long leaves. Voss (1985) notes that it is a "neat, slender plant... often [with a] sinuous, much-branched stem..." The flowers appear in the summer; they are small and are borne in the upper leaf axils.

Ranunculus lapponicus L. (Lapland buttercup)

Heritage Code. PDRAN0L1G0

Family. Buttercup (Ranunculaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Special Concern, proposed Endangered.

Distribution. Circumboreal; in the U.S., it is found south to northern Minnesota, northern Wisconsin, northern Michigan, and northern Maine. In Wisconsin it is rare; only known from Douglas County. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 37**.

Habitat and Associates. Known only from cold, old growth cedar swamps along the Brule and possibly St. Croix rivers.

Appearance and Similar Species. This is a distinctive but inconspicuous buttercup. It is only a few inches tall and bears small (1 cm wide) solitary flowers from long peduncles produced from the nodes. The leaves are three-parted and resemble those of goldthread (*Coptis trifolia*).

Sparganium glomeratum Laest. (clustered bur-reed)

Heritage Code. PMSPA01070

Family. Bur-reed (Sparganiaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Special Concern, proposed Threatened.

Distribution. Eurasia; known from scattered sites in Canada and the U.S. In the U.S., it is known from northeastern Minnesota and northwestern Wisconsin. In Wisconsin, it is known from the Lake Superior region near Superior, rarely south to the St. Croix River drainage in Washburn County. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 38**.

Habitat and Associates. Clustered bur-reed occurs in wet (at least seasonally standing water) swales and ditches in sedge meadows or shrubby alder (*Alnus rugosa*) willow (*Salix discolor*, *S. gracilis*, *S. lucida*, and *S. pyrifolia*) swamps on the poorly drained Lake Superior Clay Plain. Common associates include *Carex lacustris* (often dominant), *C. utriculata*, *Calamagrostis canadensis*, *Typha latifolia*, *Glyceria canadensis*, *Galium tinctorium*, *Rumex orbiculatus*, *Eleocharis obtusa*, *Alisma plantago-aquatica*, *Impatiens capensis*, *Polygonum sagittatum*, *Bidens cernua*, *Lysimachia terrestris*, *L. thysiflora*, *Scirpus microcarpus*, *Equisetum fluviatile*, *Utricularia* spp., and rare species such as *Petasites sagittatus*, *Ranunculus gmelinii* var. *hookeri*, *Eleocharis nitida*, and *Juncus vaseyi*. In Minnesota, clustered bur-reed is often found in boggy habitats in which *Sphagnum* moss is common.

Appearance and Similar Species. Clustered bur-reed is distinct from the other half-dozen bur-reeds in the Lake Superior area in that the inflorescence consists of 3-5 densely clustered pistillate (female) heads (inflorescences), surmounted by a single staminate (male) head.

Species Previously Believed Extirpated

Lonicera involucrata (Richardson) Banks (fly or involucred honeysuckle)

Heritage Code. PDCPR030F0

Family. Caprifoliaceae (Honeysuckle)

Global Rank. G4G5

Federal Status. None

Wisconsin Status. Presumed extirpated until 1994, now proposed for Threatened status.

Distribution. Northern North America. In the U.S., it is found in Alaska, south to California, New Mexico, Wisconsin, and Michigan (only Isle Royale). Not recorded from Minnesota. In Wisconsin, it is known only from one site (Port Wing, Bayfield County). Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 39**.

Habitat and Associates. The favored habitat on Isle Royale, Michigan (where the author is most familiar with this species) is in rich soil at the margins of alder thickets and open cedar swamps, in partial shade. It is also frequently found near human habitation (such as on Isle Royale at Mott Island, Davidson Island,

and Caribou Island Campground), sometimes in disturbed soil (such as at around a new outhouse on Caribou Island), especially on trailsides. Whether this predilection for anthropogenic sites is the result of more efficient bird dispersal to these sites or a more diverse matrix of habitat types is difficult to say. Certainly it appears to be more common near the Mott Island headquarters complex than anywhere else in the park.

Appearance and Similar Species. This is a distinctive shrub that is easily recognized and is unlike any other island honeysuckle. It is from 1-2 m tall and bears large, opposite, somewhat obovate entire leaves 6-12 cm long. The most distinctive character of this species are the twinned, stalked flowers borne in the leaf axils, subtended by several large, leaf-like, bright red-purple bracts that set off the small trumpet-shaped yellow flowers that later develop into black berries. The contrast between the small black fruits and large red-purple enveloping bracts is quite distinctive. Flowering occurs in June and early July, and fruit ripens in late July and early August. The trumpet-shaped flowers are pollinated by hawkmoths and hummingbirds.

Pyrola minor L. (small shinleaf)

Heritage Code. PDERI14090

Family. Pyrolaceae (Shinleaf)

Global Rank. G4G5

Federal Status. None

Wisconsin Status. Endangered

Distribution. Northern North America. In the U.S., it occurs in Alaska; south to California, New Mexico, Minnesota, Wisconsin, and Michigan. In Wisconsin, it is found only in the Lake Superior area. Before the current survey work, the species was presumed extirpated. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 40**.

Habitat and Associates. The preferred habitat is one that was not suspected to harbor rare plant species; an alder (*Alnus rugosa*) thicket, more specifically one mixed with a mossy but not necessarily sphagnum understory and an overstory of scattered pole-sized tamarack (*Larix laricina*) or less commonly black spruce (*Picea mariana*) and white cedar (*Thuja occidentalis*). Frequent associates are other *Pyrola* species (*P. elliptica*, *P. secunda*), *Viola macloskeyi* or *V. renifolia*, *Smilacina trifolia*, *Carex trisperma*, *C. disperma*, *C. leptalea*, *Vaccinium oxycoccos*, *Cornus canadensis*, *Listera cordata*, *Lycopus uniflorus*, *Gaultheria hispidula*, *Caltha palustris*, *Salix pedicellaris*, *Betula pumila*, *Coptis*, *Rubus pubescens*, *Trientalis*, *Campanula aparinoides*, *Ledum groenlandicum*, *Calamagrostis canadensis*, and *Glyceria canadensis*. Specifically, the preferred microhabitat is the bottoms and lower sides of small depressions in the swamp; colonies are often small, with only a dozen or so plants scattered in an area a meter or two in diameter.

Appearance and Similar Species. As the name indicates, this is a small shinleaf, about the size of *P. secunda*, with round leaf blades 1.5-3.0 cm long. It can be distinguished by its small (petals 5 mm long) flowers that are crowded spirally (not one-sided) into a short, rather densely flowered raceme; and its very short (2 mm long) straight stigma. Flowering occurs in June and July, fruiting soon afterwards. All three extant Wisconsin populations had low reproductive rates, with only 10% or less of the population in flower in 1996.

Species with Restricted Distribution

Carex livida (Wahlenb.) Willd. var. *radiculis* Paine (livid sedge)

Heritage Code. PMCYP037L1

Family. Sedge (Cyperaceae)

Global Rank. G5T5

Federal Status. None

Wisconsin Status. Special Concern

Distribution. Circumboreal, south in North America to Alaska, California, Idaho, Minnesota, Wisconsin, Michigan, New Jersey, and New York. Rare throughout Wisconsin. In the current survey effort, it was found to be locally common in fenny coastal bog mats (sedge fens) from Port Wing east; rare on the Apostle Islands. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 41**.

Habitat and Associates. Livid sedge is consistently found in calcareous bog mats (sedge fens) dominated by *Carex lasiocarpa*, *Myrica gale*, *Menyanthes trifoliata*, *Calopogon tuberosus*, *Pogonia ophioglossoides*, *Rhynchospora fusca*, *Cladium mariscoides*, and *Juncus canadensis*. Rare species such as *Triglochin maritimum*, *Arethusa bulbosa*, and *Scirpus hudsonianus* are also frequent associates.

Appearance and Similar Species. This is a very bluish-whitened, almost ghostly looking rhizomatous sedge forming beds up to 20 meters in diameter. In sterile condition it could be confused with *C. limosa*, a species with which it sometimes grows. The perigynia are found in slender spikelets and are pale gray-green, oval with pointed ends, and 3-5 mm long. They fall quickly at maturity, making identification difficult; thus, this species may be more common in Wisconsin than previously thought.

Lycopodium selago L. (fir clubmoss)

Heritage Code. PPLYC010X0

Family. Clubmoss (Lycopodiaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Special Concern

Distribution. Circumpolar; in the New World from Alaska to Greenland, south to Minnesota, Wisconsin, Michigan, North Carolina, and New York. In the current survey, it was found to be rare on moist, shaded lakeside sandstone cliffs; very rare inland in conifer swamps. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 42**.

Habitat and Associates. At the Sand Bay site the species grew in a wet, disturbed, open boggy ditch with round-leaved sundew (*Drosera rotundifolia*), sweet grass (*Hierochloa odorata*), cranberry (*Vaccinium oxycoccos*) and various sedges. On Hermit Island, a single small colony grew on a mossy (*Polytrichum* spp.), shaded, 2 m tall boulder in shallow water of Lake Superior, with spike trisetum (*Trisetum spicatum*), strawberries (*Fragaria virginiana*), rough goldenrod (*Solidago hispida*), ticklegrass (*Agrostis scabra*), and speckled alder (*Alnus incana*). The habitat for the Otter Island hybrid is a steep, moistened, north-facing sandstone cliff, with associates such as butterwort (*Pinguicula vulgaris*) and oak fern (*Gymnocarpium dryopteris*); the single clump grew on an inaccessible shelf about 4 meters above the water.

Appearance and Similar Species. Fir clubmoss can be distinguished from all other clubmosses in the region by its very small size (only 5-10 cm high). Other distinguishing characters include dichotomous branching, numerous (in 8 ranks) short, lanceolate, appressed, toothless leaves, and the sporophylls borne in zones along the stems, not in terminal strobuli. The hybrid with *L. lucidulum*, *L. x buttersii*, is a slightly larger plant with fatter, more diamond-shaped leaves that have at least a few teeth near the apex. Spores are produced during the summer.

Osmorhiza chilensis Hook. and Arn. (Chilean sweet cicely)

Heritage Code. PDAPI1K030

Family. Parsley (Apiaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Special Concern

Distribution. Southern Chile and Argentina; British Columbia to Quebec, south to California, Arizona, northern Minnesota, northern Wisconsin, northern Michigan, and Maine. In the current survey, it was found to be rare in ravine forests on Bayfield Peninsula and Iron County; fairly common on Apostle Islands. Nearly all the Wisconsin records are from the Lake Superior area. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 43**.

Habitat and Associates. Chilean sweet cicely is found in most types of upland hemlock-hardwoods stands, both young and mature, throughout the Apostle Island archipelago, but is much less common on the mainland. It seems to prefer the richest, most well-drained soils, and is especially common in ravine bottoms, on rich clay-lake-bluff shelf woods, and along trails, often under sugar maple (*Acer saccharum*) or hemlock (*Tsuga canadensis*). Common herbaceous associates include corn-lily (*Clintonia borealis*), Canada mayflower (*Maianthemum canadense*), rosy twisted-stalk (*Streptopus roseus*), white mandarin (*S. amplexifolius*), nodding trillium (*Trillium cernuum*), dwarf ginseng (*Panax trifolius*), rattlesnake-plantain (*Goodyera oblongifolia*), and the mesophytic sedge *Carex leptonervia*.

Appearance and Similar Species. Sweet cicely is a genus in the parsley family that is characterized by its fernlike foliage and compound-umbellate inflorescence of tiny white flowers that mature into needlelike, hispid fruits. Chilean sweet cicely is distinguished from several common species by its lack of bracts subtending the small "umbelllets" that represent the ultimate order of branching of the compound umbel. Flowering occurs from mid-June to early July; fruiting from late July through August.

Rhynchospora fusca (L.) Aiton (sooty beak-rush)

Heritage Code. PMCYP0N0U0

Family. Sedge (Cyperaceae)

Global Rank. G4G5

Federal Status. None

Wisconsin Status. Special Concern

Distribution. Europe; in the New World from Minnesota and Wisconsin to Newfoundland, south to New Jersey, Delaware, and Vermont. In the current survey, it was found to be uncommon in the muckiest, peatiest parts of coastal bogs from Port Wing east; also on the Apostle Islands; rare inland. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 44**.

Habitat and Associates. Sooty beak-rush grows in open sphagnum-sedge bog mats with such associates as sedges (*Carex lasiocarpa*, *C. oligosperma*, and *C. paupercula*), leatherleaf (*Chamaedaphne calyculata*), sundew (*Drosera rotundifolia*), beak-rush (*Rhynchospora alba*), horned bladderwort (*Utricularia cornuta*), and pitcher-plant (*Sarracenia purpurea*).

Appearance and Similar Species. Sooty beak-rush resembles the much more common white beak-rush (*Rhynchospora alba*) but differs in its brownish rather than white flowering heads and capillary leaves. Flowering occurs in June.

Senecio congestus (R. Br.) DC. (marsh fleabane)

Heritage Code. PDAST8H0U0

Family. Sunflower (Asteraceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Special Concern

Distribution. Circumpolar-circumboreal, ranging south to British Columbia, Alberta, North Dakota, Iowa (including algific talus slopes; J. Nekola, pers. comm.), Wisconsin, Michigan (one historical site from the limestone shores of Lake Michigan at Ninemile Point near Harbor Springs in the northern lower peninsula; D. Albert, pers. comm.), Ontario (common on shores of James Bay), Quebec, and Labrador. Known mostly from the northwestern part of Wisconsin. In the current survey, it was found to be rare and perhaps extirpated from coastal wetlands (none were relocated in 1995-96); habitat difficult to characterize from herbarium data. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 45**.

Habitat and Associates. Although its common name implies that this is a species of marshes, unfortunately nearly all Wisconsin collection data are vague as to habitat and associates. However, even this lack of information may offer hints about the species' habitat preferences. It may imply that the collections were made in disturbed, human-modified habitat that the collectors found hard to characterize on the terse labels typical of the early 20th century. Alverson and Iltis (1979) note that:

Marsh fleabane is a species which is adapted to harsh, cold, subarctic and boreal conditions which are simulated only to a small degree in Wisconsin habitats. The primary restriction on this species in the state may thus be climatic, but exactly how this limiting mechanism works (summers too hot? loss of competitive advantage over other species?), we do not know. Its habitats seem to be somewhat transitory in nature (e.g., drying pond margins) indicating that the plants might depend on a degree of available ecological "openness" of habitat for survival...

but it should also be noted that the species occurs nearly throughout Minnesota (Ownbey and Morley 1991), often in prairie wetland habitats. Since it is common around James Bay (Given and Soper 1981), one possibility is that the Jack Island Shoal, Door County and Ninemile Point, lower Michigan sites represent ephemeral populations dispersed there by fall migrating birds. It really must be presently rare or extirpated in Wisconsin, because it is a large distinctive composite that would be difficult to overlook.

Appearance and Similar Species. The several species of ragwort (*Senecio* spp.) that occur in Wisconsin

are apt to be confusing and difficult to tell apart, but *S. congestus* is exceptionally distinct. It is large (up to 80 cm tall), with stout but weak hollow stems and numerous coarse-toothed leaves all along the stem (and often clasping it). The inflorescence is dense, woolly, and has numerous flower heads. Each head has an involucre 7-10 mm tall and yellow ray flowers 5-10 mm long. The only other Wisconsin composite with which it may possibly be confused when not in flower might be fireweed (*Erechtites hieracifolia* (L.) Raf.), which has non-clasping leaves, white ray flowers, and larger heads with involucre 10-15 mm tall. Flowering occurs from late May until July.

***Streptopus amplexifolius* (L.) DC.** (white mandarin)

Heritage Code. PMLIL1X010

Family. Lily (Liliaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. Special Concern

Distribution. White mandarin grows from Alaska to Greenland, south to Arizona, South Dakota, northern Minnesota, northern Wisconsin, northern Michigan, New England, and in the mountains to North Carolina. In Wisconsin, it is restricted to rich woods and ravines in the counties bordering Lake Superior, plus Door County on Lake Michigan. Distribution of this species in the Lake Superior Basin, including findings from this study, are shown in **Figure 46**.

Habitat and Associates. White mandarin is characteristic of rich, well-drained upland woods, often near large stands of sugar maple (*Acer saccharum*) or hemlocks (*Tsuga canadensis*). It is also locally frequent in rich ravine bottoms. The species is not colonial; seldom does one find more than a few plants growing close together. Common herbaceous associates include Chilean sweet cicely (*Osmorhiza chilensis*), nodding trillium (*Trillium cernuum*), and dwarf ginseng (*Panax trifolius*), as well as ubiquitous understory species such as corn-lily (*Clintonia borealis*), Canada mayflower (*Maianthemum canadense*), and starflower (*Trientalis borealis*).

Appearance and Similar Species. Among the broad-leaved, lily-like plants that grow in regional forest understories, white mandarin is distinctive in its leaves, which clasp and nearly surround the stem. The species is robust, sometime reaching nearly a meter in height and often forking near the top. The flowers, which are greenish-white and about 1 cm long, are borne singly in the axils of the leaves on a long, kinked peduncle. They have recurved sepals and petals, and when mature the ovary develops into a reddish, berrylike fruit 1.0-1.5 cm long. Flowering occurs in June, fruiting in July.

Exotic Species with Invasive Potential

***Filipendula ulmaria* (L.) Maxim.** (queen-of-the-meadow)

Heritage Code. None

Family. Rose (Rosaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. None

Distribution and Comments. Becoming a potentially bad weed in wetlands on the Lake Superior Clay Plain from Duluth to Port Wing. It is an exotic species that could become a wetland invader, as at Port

Wing. Possibly originally introduced by Finnish-American farmers (see [Lakela 3233](#) [DUL], collected on 8 August 1939 from "along fences in fields, old Lakela Estate, Kestila, Finland").

Historic Sites.

St. Louis County, MN - Duluth, large colony at junction of Duluth, Missabe and Iron Range Railroad and Lakewood Road, 18 August 1943, [Lakela 5415](#) (DUL).

St. Louis County, MN - Duluth, large colony on Lake Superior terrace, Lakewood Road and U.S. Highway 61, 4 September 1943, [Lakela 5481](#) (DUL).

St. Louis County, MN - Duluth Waterworks, shore of Lake Superior, 8 August 1942, [Lakela 5126](#) (DUL).

St. Louis County, MN - Border of *Alnus* swamp on U.S. Highway 53, 1 mile north of Jackson's School, 21 August 1943, [Lakela 5426](#) (DUL).

Douglas County, WI - Junction of U.S. Highway 2 and County Trunk Highway U, near Amnicon Falls State Park; meadow opening, low ravines and somewhat shaded, 21 July 1981, [Koch 13039](#) (UWL).

Bayfield County, WI - Jardine Creek just north of State Trunk Highway 13, low brushy area dominated by *Alnus* and sedges, along creek and roadside, 29 July 1981, [Alverson 1816](#) (WIS); relocated on 16 August 1995 on west bank of creek north of State Trunk Highway 13 bridge, about 3 miles west of the Village of Port Wing, with tag alder (*Alnus incana*), *Scirpus* spp., and bluejoint (*Calamagrostis canadensis*), [J-11590](#).

New sites.

Douglas County, WI - City of Superior, Moccasin Mike Road 0.5 miles east of U.S. Highway 2, common in ditch on south side, with *Calamagrostis canadensis*, *Carex stricta*, *Typha* spp., and *Geum aleppicum*, 3 August 1995, [J-11493](#).

Douglas County, WI - Ditches along County Trunk Highway H, Brule River State Forest about 5 miles north of Brule, summer 1996 sight record.

Bayfield County, WI - Bibon Lake, Port Wing bog, common and thoroughly naturalized along boggy side slough, with tamarack (*Larix laricina*), sweet gale (*Myrica gale*), tag alder (*Alnus incana*), and *Phragmites*, 16 August 1995, [J-11584](#). Quarry Point just west of the Village of Port Wing, one plant noted on wave-splashed sandstone ledge, 16 August 1995 sight record.

***Juncus ensifolius* L.** (iris-leaved rush)

Heritage Code. None

Family. Rush (Juncaceae)

Global Rank. G5

Federal Status. None

Wisconsin Status. None

Distribution. Found from Alaska and Saskatchewan south to California, Arizona, Colorado, and the Black Hills of South Dakota, with disjunct (and presumably adventive) populations in Ontario (one site on James Bay), along the Delaware River in New York, and in northwestern Wisconsin. Gleason and Cronquist (1991) give the species as "disjunct" in Wisconsin, but all sites are from ditches and there is no reason to suppose that the species is native here.

Habitat and Associates. Moist open ditches, often with bedrock (mostly basalt) near the surface; often forming prominent (because of the dark inflorescences) solid stands. Frequent associates are *Carex*

pallescens, *C. vulpinoidea*, *C. castanea*, *Onoclea sensibilis*, *Platanthera lacera*, goldenrods and asters, and many exotics such as *Chrysanthemum leucanthemum*, *Prunella vulgaris*, *Trifolium* species, *Lotus corniculatus*, and *Plantago lanceolata*.

Historic Sites.

Ashland County, WI - Along State Trunk Highway 13 just south of the City of Mellen, 7 August 1971, Iltis 26312 (WIS) and "common [along State Trunk Highway 13] from 2-7 miles south of Mellen," 22 Sept 1974, Iltis 27727 (WIS). In 1996, the species had about the same distribution, 27 July 1996, J-11990 (WIS).

New Sites.

Ashland County, WI - Ditch at wayside of State Trunk Highway 13 on continental divide 3 miles south of the Village of Morse cut-off, 29 July 1996, J-11994.

Ashland County, WI - County Trunk Highway MM ditch just southwest of junction with Sackett Road, 29 July 1996, J-11997 (WIS).

Ashland County, WI - Ditch on north side of State Trunk Highway 77 just west of junction with County Trunk Highway MM, about 4 miles east of the City of Mellen, 15 and 29 July 1996 sight records.

Ashland County, WI - U.S. Fish & Wildlife Service staff reported the species south on roadsides to Popcorn Corners in 1996.

Figures 4-16. Distribution maps for plant species state listed as Endangered in Wisconsin

Figures 17-34. Distribution maps for plant species state listed as Threatened in Wisconsin.

Figures 35-38. Distribution maps for additional plant species of concern in Wisconsin

Figures 39-40. Distribution maps for plant species previously believed extirpated from Wisconsin

Figures 41-46. Distribution maps for plant species with restricted distribution in Wisconsin

Zoological Surveys

Terrestrial Animals of Dunes and Beaches

A total of 616 insects and 41 arachnid specimens was collected from the five study sites. The number of insect specimens collected by Order is given in **Table 4**. Franklin's ground squirrel (*Spermophilus franklinii*) and piping plover (*Charadrius melodus*) were not located in this study. The only rare grasshopper found was the blue-legged grasshopper (*Melanoplus flavidus*). Five males were collected from upper Chequamegon Point on 15 August 1996 from one site. The Lake Huron Locust (*Trimerotropis huroniana*) was not found at any of the sites. Taxonomic determinations are not complete for leafhoppers collected. Three tiger beetle taxa were found including the targeted *Cicindela hirticollis rhodensis*. This distinctive subspecies was found only at Chequamegon Point (upper and lower) and was present on all three sample dates.

Table 4. Terrestrial arthropods collected in the Lake Superior Basin, 1996

Order	No. of Specimens Collected	Order	No. of Specimens Collected
Arachnida	41	Lepidoptera	7
Coleoptera	103	Neuroptera	2
Diptera	76	Odonata	3
Ephemeroptera	6	Orthoptera	144
Hemiptera	75	Trichoptera	12
Homoptera	148	Unknown	10
Hymenoptera	29		

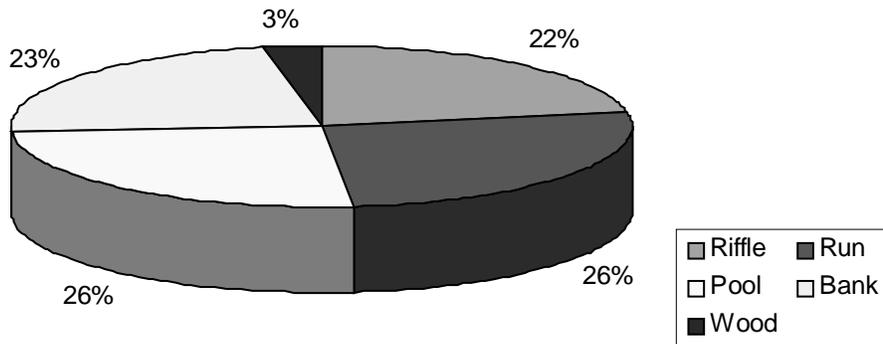
Aquatic Macroinvertebrates

Sample Site Locations and Descriptions. Two-hundred and eighteen sites were sampled on 203 waterbodies in the Lake Superior Basin. Their locations, along with waterbody name, date and effort are given in **Appendix C, Table 2**. Instream water quality, habitat quality and pollutant sources at each of the sampling sites were assessed and are described in **Appendix C, Table 3**. Lakes sampled are restricted to the Brule River State Forest and are reported on separately. The one-hundred and sixty-one streams in the Lake Superior Basin which were sampled are reported on below.

Stream habitats sampled included riffles, runs, pools, undercut banks, vegetation, and wood substrates. The major habitat types present at each site were consistently represented in samples (**Fig. 47**). An average of 70 minutes was spent sampling each site.

Physical descriptions of each waterbody/county segment are presented in **Appendix C, Table 4**. Except for Ecoregional Subsections, these data are county averages for each parameter as found in the DNR Surface Water Inventory database. At sample sites the width ranged from 1-110 ft and averaged 17 ft. Depth ranged from 0.05-65.0 ft and averaged 2.3 ft.

Figure 47. Types and frequency of stream habitats sampled in the Lake Superior Basin, 1996



The survey effort produced 10,595 specimens representing 387 species in 207 genera and 74 families (**App. D**). Taxonomic determinations were initiated on samples previously collected from Lake Superior Basin streams in the Bad River Reservation. About 5,000 insect specimens have been determined so far. Also, macroinvertebrate data previously collected for water quality samples for DNR were compiled for fourteen Lake Superior Basin streams.

Five-hundred and eighty-four mussel specimens representing 9 species in 6 genera and 1 family were collected. All sample sites with mussels found are located on the Bad River Reservation. We are in the process of developing a data sharing agreement with the Bad River Band of Lake Superior Chippewa. Until this agreement is in place, we will not be computerizing data or identifying locations for natural communities or rare species populations found on the Reservations.

Miscellaneous Aquatic Taxa. Some 1,197 aquatic organisms, other than targeted insects and unionid mussels, encountered in this study were preserved for future analysis. Taxa and number of specimens are Amphibia - 4, Crustacea - 484, Hirundea - 70, Mollusca - 588, and Osteichthyes - 49. Orders with the greatest numbers of specimens collected were Ephemeroptera (2,590), Trichoptera (2,487) and Odonata (2,405). Coleoptera were the most diverse (111 spp.), followed by Odonata (65 spp.) and Trichoptera (60 spp.).

The most frequently encountered taxa occurred in less than half of the streams sampled and a large proportion of taxa seen in this study (32%) were found on only one stream. The ten most frequently encountered taxa in this study include: *Cordulegaster maculata*, *Somatochlora minor*, *Ceratopsyche slossonae*, *Boyeria vinosa*, *Aeshna umbrosa*, *Haliplus immaculicollis*, *Epitheca canis*, *Nigronia serricornis*, *Baetis brunneicolor*, and *Calopteryx maculata*. All taxa found, sorted by frequency of occurrence, are given in **Table 5**.

Table 5. Macroinvertebrate taxa and frequency collected from streams in the Lake Superior Basin, 1996

Twenty-one taxa found in this study were determined to be rare to uncommon in Wisconsin and will be added to the NHI Working List. For nine taxa already on the Working List, one to several occurrences were found in the Lake Superior Basin (**Tbl. 6**). For a few taxa the priority ranks were changed to reflect the updated assessment of their population status. Several rare taxa potentially occurring in the Lake Superior Basin were not found in this study and after factoring the adequacy of inventory efforts this information will be used in reevaluating priority ranks of these taxa as well.

Two genera of chironomids found in this study have not previously been found in Wisconsin. Larvae of *Pseudodiamesa* found in this study key to *P. pertinax* which is not known east of Colorado. The only other known species in this genus are restricted to western North America and Greenland. Specimens of *Protonypus* were unidentifiable to species, but four of five North American species are restricted to the Pacific Northwest and the other is known from the Northwest Territory and Ontario. Mayflies from one site in the genus *Baetisca* keyed to *lacustris* but lacked other characteristic features of that species and may be a different taxa, possibly undescribed.

Waterbodies by Taxa Richness. Taxa diversity for each stream ranged from 1 to 66 species and averaged 13.6. Only 10% of the streams sampled had 25 or more taxa. These tended to be larger streams and or streams originating in the Winegar Moraines Ecoregional Subsection.

Average tolerance values were calculated for streams with at least 20 specimens as a means of assessing stream water quality (Lillie and Schlessler 1994). Values ranged from 1.59 to 6.73. Streams with average values less than 3 are probably not impacted by organic pollution. Highest values tended to be the larger streams of Douglas County. The average tolerance value for all the study streams was 2.9 suggesting overall low levels of organic pollution in the Lake Superior Basin.

Eighty-four streams had from one to six taxa considered rare or of unknown status by DNR (**Tbl. 7**). Bayfield County streams (Tader Creek, Long Lake Branch, Sand River, Cranberry River-East Fork, Saxine Creek and Twentymile Creek) plus Jerseth Creek in Douglas County and Tafelski Creek in Ashland County, all had four or more rare taxa. Streams with the greatest number of taxa unique to one stream are Twentymile Creek (8), St. Louis River (8), Long Lake Branch (7), Sioux River (6) and Jerseth Creek (4) (**Tbl. 8**).

Table 6. Rare macroinvertebrates collected from streams in the Lake Superior Basin, 1996

Table 7. Lake Superior Basin streams with rare macroinvertebrate taxa, 1996

Table 8. Taxa richness for streams in the Lake Superior Basin with rare macroinvertebrates, 1996

Butterflies and Skippers of Peatlands

Description and Distribution of Peatland Types. Although Curtis (1959) only recognizes a single 'bog' community for the state, a great diversity of peatlands actually exist based upon their landscape position, soil water saturation, soil pH, and nutrient inputs. Three main types of peatland habitats were observed in the study area: muskeg, pothole peatland, and coastal peatland. Muskeg sites are dominated by an open black spruce (*Picea mariana*)-*Carex oligosperma*-*Sphagnum* savanna and are relatively dry (except in the proximity to bog lakes) and oligotrophic. These sites usually have an elevation similar to the surrounding uplands.

Pothole peatlands are much wetter sites which commonly contain floating sphagnum-*Chamaedaphne* mats, and range from very oligotrophic (e.g., Micah Pine Lake) to eutrophic (Eagle Lake), depending upon the nature of infiltrating groundwater. These sites are typically found fringing lake margins or in depressions much lower than the surrounding uplands. Coastal wetlands are wet, relatively eutrophic sites dominated by *Larix laricina* and *Carex lasiocarpa* found in estuaries along the Lake Superior coast. Acid sphagnum mat conditions in these sites are limited to raised islands or ridges which are typically situated near the upland margin of sites. A strong statistical difference ($P=0.007$; $r^2=0.136$) was observed in mean size of these three peatland types. Average muskeg size was 300% greater than average coastal peatland size, which was 50% greater than average pothole peatland size.

Muskeg sites were limited to the general vicinity of the divide basin. While found in all four counties, none were located in the outwash plain extending from eastern Douglas to eastern Bayfield counties (Bayfield Sand Barrens Ecoregional Subsection). Pothole peatlands occurred in all four counties, but were most frequently encountered in the outwash plain extending from Brule in Douglas County to Lake Owen in central Bayfield County. Coastal peatland sites were essentially limited to the Bayfield Peninsula, although three sites were also encountered on Madeline Island (**Fig. 48**). A number of additional coastal peatland sites occur in the Apostle Islands (Judziewicz and Koch 1993) and the Kakagon Sloughs. Due to logistical and time constraints these sites were not inventoried.

All of the peatland sites observed clearly fall under the definition of fens, as all appear to be fed through ground- or lake water seepage. Most sites represent poor fens, based upon their acidic and nutrient poor soils (Sjörs 1952, Moore and Bellamy 1974). However, a few pothole and most coastal peatlands represent intermediate fens. No true rich fen sites, dominated by graminoids and the bryophytes *Aneura*, *Hypnum*, *Campyllum*, *Meesia*, *Callergionella*, etc. were observed. Such sites are likely restricted in Wisconsin to regions farther south and east which possess more calcareous soils.

Butterfly and Skipper Fauna of Surveyed Habitats. A total of sixteen butterfly and skipper taxa monitored by BER (*Amblyscirtes hegon*, *Clossiana freija*, *C. frigga saga*, *C. eunomia dawsonii*, *C. titania*, *Coenonympha inornata*, *Erebia discoidalis*, *Hesperia comma laurentina*, *Incisalia polios*, *Lycaena dorcas*, *L. epixanthe*, *Oeneis chryxus strigulosa*, *O. jutta*, *Pieris virginiana*, *Phyciodes batesii*, and *Satyrodes liparops strigosa*) were observed in the study area during the 1996 season. Records were also located in the BCD or Milwaukee Public Museum collections for an additional eight taxa (*Atrytonopsis hianna*, *Erynnis martialis*, *Euphyes dion*, *Everes amyntula*, *Gaeides xanthoides dione*, *Hemiargus isola*, *Hesperia leonardus leonardus*, and *H. metea*) which had previously been collected or reported from the region. Additionally, a new taxon (*Incisalia eryphon*) was added to the state fauna.

Figure 48. Distribution of peatland types surveyed for lepidoptera in the Lake Superior Basin

Peatland-restricted taxa were observed in muskegs, pothole peatlands, and coastal peatlands (**Tbl. 9**). A total of ten taxa were observed from muskeg sites. The most frequent of these were *Incisalia augustinus* (present on 81% of sites), *Clossiana eunomia dawsonii* (43%), *Oeneis jutta* (41%), *Lycaena dorcas* (35%), and *C. freija* (32%). Five taxa were located from pothole peatland sites. The most frequent of these were *C. eunomia dawsonii* (present on 58% of sites surveyed), *Incisalia augustinus* (33%), and *L. epixanthe* (29%). Four taxa were located from coastal peatland sites. The most frequent of these were *L. epixanthe* (present on 90% of sites surveyed), *C. eunomia dawsonii* (40%), and *Coenonympha inornata* (40%).

Additional populations of monitored taxa were located in sand barren and mesic forest habitats. As these sites were not a priority for investigation, and were not sampled as carefully or as regularly as peatland sites, the data gathered from them are not comparable. Six taxa monitored by BER (*Coenonympha inornata*, *Hesperia comma laurentina*, *Incisalia polios*, *Oeneis chryxus strigulosa*, *Phyciodes batesii*, and *Satyrrium liparops strigosa*) were located from sand barrens sites, plus one taxon (*I. eryphon*) previously unreported from the state. Seven additional BER monitored taxa (*Atrytonopsis hianna*, *Erynnis martialis*, *Everes amyntula*, *Gaeides xanthoides dione*, *Hemiargus isola*, *Hesperia leonardus leonardus*, and *H. metea*) have previously been reported from barrens sites in Ashland, Bayfield, Douglas, or Iron counties. A single BER monitored taxa, *Pieris virginiana*, was located in the mesic forest sites inventoried.

Table 9. Butterfly and Skipper taxa restricted to surveyed peatland sites, 1996

Taxa	Muskeg	Pothole Peatland	Coastal Peatland
<i>Clossiana freija</i>	x		
<i>Clossiana frigga saga</i>	x		
<i>Clossiana eunomia dawsonii</i>	x	x	x
<i>Clossiana titania</i>	x		
<i>Coenonympha inornata</i>	x	x	x
<i>Erebia discoidalis</i>	x		
<i>Incisalia augustinus</i>	x	x	x
<i>Lycaena epixanthe</i>	x	x	x
<i>Lycaena dorcas</i>	x		
<i>Oeneis jutta</i>	x	x	

The following paragraphs provide more detailed information on butterfly and skipper fauna found at each of the 5 habitat types surveyed.

Muskeg. Taxa were typically in one of three microsites. *Coenonympha inornata*, *Clossiana freija*, *C. frigga saga*, *Erebia discoidalis*, *Incisalia augustinus* and *Lycaena dorcas* were most often located in open *Carex oligosperma* meadows in site centers. *Oeneis jutta* was usually found flying within or at the periphery of black spruce (*Picea mariana*) groves. *C. eunomia dawsonii* and *L. epixanthe* were typically limited to very wet, floating sphagnum mats on the periphery of sites or surrounding bog lakes.

Clossiana frigga saga was limited in *Carex oligosperma* meadows to the immediate vicinity of stunted *Betula pumila* and *Salix pedicellaris* groves which apparently serve as its host plants. *C. titania* adults were rarely observed outside of open uplands possessing an abundance of composite nectar. This species presumably spends the bulk of its life, however, within *Carex oligosperma* meadows as occupied uplands were always in proximity to such habitats.

Muskegs harbored populations for twice as many peatland taxa as compared to the other peatland habitats, with five taxa (*Clossiana freija*, *C. frigga saga*, *C. titania*, *Erebia discoidalis*, *Lycaena dorcas*) being restricted to these sites. Two of these (*C. freija*, *Lycaena dorcas*) were among the more frequently encountered muskeg taxa. The muskeg-limited taxa principally represent tundra or taiga species which reach the southern limit of their range in northern Wisconsin (Opler and Krizek 1984).

Pothole Peatland. Populations of target butterfly taxa appear to be essentially restricted to floating sphagnum lawns, which were typically found along peatland-lake margins. A less extensive amount of the sphagnum lawn was also observed on raised 'islands' within inundated *Carex* meadows. These small patches were particularly favored by *Clossiana eunomia dawsonii*. Although *Lycaena epixanthe* and *Oeneis jutta* adults were observed flying only on peatland mats in proximity to their respective host plants, the other taxa (especially *C. eunomia dawsonii*) were also frequently encountered nectaring along site margins.

The total diversity of butterflies from this habitat was half that observed on muskeg sites, and the number of taxa observed per site was 33% less. All of the taxa located in this habitat were also found in muskeg sites. While the two most frequently occurring taxa were the same as in muskeg sites, the third most frequent taxa (*Lycaena epixanthe*) was much less frequent in muskegs. The three most frequent taxa of pothole peatlands represent boreal taxa at their southern range limit (*Clossiana eunomia dawsonii*, *Incisalia augustinus*) and a northeastern taxon at its southwestern range limit (*L. epixanthe*).

Coastal Peatland. All butterfly taxa found on these sites were restricted to the isolated sphagnum ridges and islands. It is possible that these features demarcate ombrotrophic areas within sites. While this habitat was extensive at Little Sand Bay, it was quite limited at the remainder of sites. At Blueberry Lane, for example, only 100 m² of such habitat exists.

Coastal peatlands harbored the fewest total taxa, and the fewest taxa/site of all peatland types sampled. While all taxa observed on these habitats were also found in muskeg and pothole peatland sites, the dominant species (*Lycaena epixanthe*) was much less frequent in these other sites. The species composition of these sites was very similar to pothole sites in that taxa which demand relatively dry, acid, and nutrient-poor peat mats were absent.

Sand Barrens. Only two sand barrens sites (Micah Barrens and Solon Springs South) were frequently surveyed for butterflies and skippers. These sites were found to harbor a distinctive fauna consisting of a number of rare taxa including *Coenonympha inornata*, *Hesperia comma laurentina*, *Incisalia eryphon*, *I. polios*, *Oeneis chryxus strigulosa*, and *Phyciodes batesii*. Most taxa seemed to favor xeric *Danthonia*-dominated openings in oak (*Quercus* spp.) or pine (*Pinus* spp.) forest. The large number of other rare taxa which have been previously been located on these sites but not seen this field season, indicates that this survey was very cursory.

Forest. One rare species (*Pieris virginiana*) was located in rich, mesic woods in the eastern section of the study region. This taxon appears to only use *Dentaria diphylla* and/or *D. x maxima* as a larval host. As such, inventoried sites were limited to mature stands dominated by sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and basswood (*Tilia americana*). Few sites were inventoried due to lack of time. It is expected that additional sites for this species will be located in eastern Iron County in the Gogebic and Penokee Ranges.

Species Diversity Patterns Within and Between Sites. A strong relationship ($P < 0.0005$; $r^2 = 0.373$) was observed between log-transformed habitat size and species richness in peatland areas. Significant differences ($P < 0.002$; $r^2 = 0.168$) were also observed in mean site richness across the three peatland types, with muskeg sites typically being the richest (3 taxa/site), followed by coastal peatlands (2 taxa/site), and pothole peatlands (1.38 taxa/site).

When observed over a regional scale, both richness per site and richness per 12x12 mile square grid were found to be bimodally distributed. Maximum site richness values (5+ taxa) occurred in extreme western Douglas, southern Ashland, and extreme eastern Iron counties. Separating these regions is a broad extent covering most of Bayfield and northern Ashland counties where 2 or fewer taxa were observed, on average, within sites. This pattern was clearer in richness patterns of 12x12 mile square grids. A number of individual species, including *Clossiana freija*, *C. frigga saga*, *C. eunomia dawsonii*, *C. titania*, *Erebia discoidalis*, and *Lycaena dorcas* avoided peatlands in the central part of the study region. However, *Incisalia augustinus*, *L. epixanthe*, and *Oeneis jutta* appeared to be more regular in their occurrence.

Distributional Patterns of Peatland Taxa. While it has been typical for researchers to suggest that in northern Wisconsin peatland lepidoptera will have the same ranges as their habitat (e.g., Masters 1972, Kuehn 1983), it is clear that at least in the Lake Superior drainage basin most taxa are much more limited than their respective habitats. The populations of *Clossiana freija*, *C. frigga saga*, *C. eunomia dawsonii*, *C. titania*, *Erebia discoidalis*, *Lycaena dorcas*, and to a lesser extent *Oeneis jutta* were found to be restricted to a few well-defined occurrence clusters. Inside these clusters, populations were found on the majority of appropriate sites. However, outside of these clusters few or no populations were located. Thus, while species such as *C. freija* might be locally common in a few small areas, they were absent over most of the study region.

The mechanisms underlying this clustering could not be addressed in the current study. One potential explanation may lie in the clustered distribution of the major peatland types. Thus, the avoidance of the central part of the study region by taxa such as *Clossiana freija* or *Lycaena dorcas* may relate to the lack of muskeg sites there. However, a number of seemingly appropriate muskeg sites in eastern Bayfield and western Ashland counties were also found to harbor few peatland butterfly taxa. This suggests that a more spatially explicit process may underlie the diversity trends observed. It is possible that these populations exist as a number of discrete metapopulations, and the absence of taxa from the central portion of the study area is due to incomplete dispersal coupled with migration patterns of these taxa.

If the latter explanation is correct, then these taxa should not be expected to occur throughout the range of northern Wisconsin peatlands. Areas which are more isolated, or which are more removed from migration pathways, may have low butterfly richness.

If found to exist as a number of discrete metapopulations, the conservation status of these species may not be best served by simply counting the number of sites of occurrence (Ehrlich and Murphy 1987). A

better way of characterizing the threats to a taxon would be to quantify the number and size of distributional clusters. In this framework, taxa such as *Clossiana freija* or *C. titania* would be of considerable conservation interest as their populations are limited to a small number of clusters, each of which covers a very limited extent.

Unique, Unusual, or Rare Taxa. The habitat associations, distributions, and flight times of selected butterfly and skipper taxa encountered during field sampling are discussed below. The current DNR status and BER rank are listed for each. Reasons for the extreme rarity or special significance of each species is also provided.

Clossiana freija Thunberg, 1791 (Freija fritillary)

Wisconsin Status. Special Concern

Wisconsin Rank. S2

1996 Flight period. 5/21 to 6/12

This taxon was found to be of very local occurrence and was limited to a dozen muskeg sites in Iron and western Douglas counties (**Fig. 49**). No populations were located over most of the study region, even though appropriate habitat existed throughout. This very spotty occurrence pattern was also found last year during a survey of muskeg sites in Forest, Langlade, and Oneida counties (Howe et al. 1995).

Although Opler and Krizek (1984) state that this species prefers bog margins, individuals were found throughout the sites inventoried, often preferring *Carex oligosperma* openings near site centers.

Clossiana freija has a very limited distribution in the eastern U.S., being found only in the Upper Peninsula of Michigan, northern Wisconsin and Minnesota. It had previously been reported from only six Wisconsin counties (Opler 1995), five Michigan counties (Opler 1995) and from nine sites in Minnesota (Coffin and Pfannmuller 1988). In the western U.S. it is restricted to alpine peatlands in the Rockies (Scott 1986).

The rarity of this taxon in the eastern U.S., combined with its very spotty occurrence, and degradation of many of its sites in the study area by off-road vehicular traffic, suggests that a S2 rank is warranted. It may be considered for state listing as Threatened in the future .

Clossiana frigga saga Staudinger, 1861 (Frigga fritillary)

Wisconsin Status. Special Concern

Wisconsin Rank. S2

1996 Flight Period. 6/7 to 6/12

By far the rarest of the lesser fritillaries in the study region, this taxon could only be located at two stations. A third new station was also located on the Iron-Vilas county line along U.S. Highway 47 southeast of Manitowish (**Fig. 49**). All of these sites represented large, open muskegs with an abundance of *Betula pumila* and *Salix pedicellaris*, two of its presumed host plants (Scott 1986, Opler and Malikul 1992).

This species does not appear to be fully utilizing all of its available habitat, as it was absent from eleven sites that supported populations of either one or both of these host plants. Like *Clossiana freija*, it appears to completely avoid a number of appropriate sites in Bayfield and Ashland counties. Intensive

survey work in northeastern Wisconsin in 1995 only uncovered two populations (Howe et al. 1995). Only four additional Wisconsin sites are represented in the collections of the Milwaukee Public Museum.

C. frigga saga was previously reported in the eastern U.S. from six counties in Michigan's Upper Peninsula (Opler 1995), eight northern Wisconsin counties (Opler 1995), and nine stations in northeastern Minnesota (Coffin and Pfannmuller 1988). In the western U.S. it is restricted to alpine willow bogs in the northern Rockies (Scott 1986).

The rarity of this species across Wisconsin suggests that this species may warrant a S1 ranking, and that it should be considered for state listing as Endangered in the future.

Erebia discoidalis Kirby, 1837 (red-disked alpine)

Wisconsin Status. Special Concern

Wisconsin Rank. S2S3

1996 Flight Period. 6/7 to 6/8

Along with *Clossiana frigga*, this taxon was the rarest of the peatland butterflies within the study region. It was only observed at two sites, with only single individuals being located at each site (**Fig. 49**). Both stations represent large acid muskegs with extensive *Carex oligosperma* lawns.

Only five additional Wisconsin sites (from Forest, Langlade, and Oneida counties) are represented in the collections of the Milwaukee Public Museum. Opler (1995) recorded it from five north-central Wisconsin counties. It is restricted in the lower 48 states to these stations plus 14 northern Minnesota sites (Coffin and Pfannmuller 1988), and three counties in the Upper Peninsula of Michigan (Opler 1995). Surveys for this taxon in northeastern Wisconsin in 1995 met with failure (Howe et al. 1995).

This species occurs on less than 10% of appropriate sites in the study area, its populations are very small, it is apparently rare throughout the state, and its habitats are being threatened by off-road vehicular traffic. Thus, a S1 ranking may be warranted and it should be considered for state listing as Endangered in the future.

Incisalia eryphon Boisduval, 1852 (western pine elfin)

Wisconsin Status. None

Wisconsin Rank. None

1996 Flight Period. 5/31 to 6/7

The two stations located for this taxon represent the first reports from Wisconsin (**Fig. 49**). Both were found in xeric jack pine barrens. The Micah population was the larger of the two, with individuals being frequently observed in *Danthonia* grassland at the edge of pine (*Pinus* spp.) groves.

This species was only previously documented in the eastern U.S. from a single northeastern Minnesota station, seven counties in the Upper Peninsula of Michigan, and single counties in western Maine and northern New Hampshire (Opler 1985). This species is also known across the north shore of Lake Superior (Opler and Malikul 1992). Its main range extends from the Black Hills west to British Columbia and south to central New Mexico and Arizona (Scott 1986). The single Minnesota site was located immediately west of Douglas County.

Although other xeric jack pine barrens exist across the northern third of the state, it is unlikely that many additional populations for this species will be found. This species seems to have a distribution similar to many of the western disjunct plants along the southern shore of Lake Superior (e.g., Fernald 1925), and may be largely restricted to areas within 50 miles of the shore.

The limited nature of these populations, management practices which remove its host plant (*Pinus banksiana*) from barrens sites, and off-road vehicular traffic are all threatening this species. Thus, a rank of S1 may be warranted and it should be considered for state listing as Endangered in the future.

Clossiana titania Esper, 1793 (purple lesser fritillary)

Wisconsin Status. Special Concern

Wisconsin Rank. SU

1996 Flight Period. 8/9 to ??

One of the more recent additions to the Wisconsin butterfly fauna, this species was first collected in 1991 at the Lyman Lake site. An additional two populations were located in the same region in August 1995 (Howe et al. 1995). Three other populations were located this year, all in the same part of Douglas County (**Fig. 50**).

All populations were found in the vicinity of muskegs, although individuals are only very rarely seen in this habitat. Rather, they are usually found nectaring and mating on a variety of plants along site margins (often roadsides). Adults are commonly found nectaring up to ¼-mile from bog sites, and may use road ditches as movement corridors. A large number of seemingly appropriate muskeg sites occur throughout the study region and northern Wisconsin. However, extensive searches elsewhere in the study region, and in Price, Oneida, Forest, Langlade and Oconto counties have located no additional populations.

This species is restricted in the eastern U.S. to single sites in northern Maine, the White Mountains of New Hampshire, and seven northern Minnesota counties (Opler 1995). It is also known from alpine tundra in the Rockies. Given the few populations located, the small extent over which they are found, and the high use of off-road vehicles within this region, this species may merit a state rank of S1 and should be considered for state listing as Endangered in the future.

Pieris virginiana Edwards, 1870 (West Virginia white)

Wisconsin Status. Special Concern

Wisconsin Rank. S2

1996 Flight Period. 5/24 to 5/30

Four populations for this rare vernal woodland butterfly were found in Iron and central Ashland counties (**Fig. 50**). The species appeared restricted to very rich *Acer saccharum* woods and floodplains which supported dense colonies of *Dentaria diphylla* and/or *D. x maxima*. The species was previously known in Wisconsin from only 10 northeastern counties (Opler 1995), ranging as far south as the University of Wisconsin-Green Bay campus. The populations reported here form the westernmost sites yet reported for this taxon.

The species is quite limited throughout the eastern portion of its range from northern Georgia to southern New Hampshire to southern Ontario (Opler and Krizek 1984). It can be locally abundant in the northern half of Michigan, where it is characteristic of *Acer saccharum* woodland (Wagner 1978).

Although Opler and Krizek (1984) report *Dentaria laciniata* as a host plant, the regions' woodlands supporting only *D. laciniata* never supported *P. virginiana* populations. The western limit of *P. virginiana* and *Dentaria diphylla/ x maxima* appear to coincide exactly, with the Bad River Bottoms being the western-most station for both.

None of the populations observed were large. As this species is restricted to areas possessing valuable lumber resources, it is particularly endangered by forestry practices. Few of the populations of this species in the state are located in areas protected from forestry activities. As such, maintenance of an S2 rank seems appropriate and it should be considered for state listing as Threatened in the future.

Lycaena dorcas Kirby, 1837 (dorcas copper)

Wisconsin Status. Special Concern

Wisconsin Rank. S2

1996 flight Period. 7/14 to 8/12

Considered the rarest copper in the region (Swengel 1995), this taxon was located from a total of twelve muskeg stations extending over all four counties (**Fig. 50**). Unlike other muskeg taxa, *L. dorcas* had a population cluster centered on southern Ashland County. Fewer than 5 individuals were noted at all stations.

Although typically thought to be an obligate consumer of *Potentilla fruticosa* (e.g., Opler and Malikul 1992), this plant does not occur within at least 100 miles of the study region. Laplante (1985) also lists *P. palustris* as a host for eastern Canadian populations. Although this seems a more likely local host, only once (at Twin Lake) were individuals observed flying in its vicinity. Strangely, no populations were found from coastal peatlands even though they supported the largest noted *P. palustris* populations. These data suggest that *L. dorcas* may be using yet another host plant, perhaps cranberry or some other Ericaceous shrub.

This species is very limited in the eastern U.S., being known from only 18 stations in northeastern Minnesota (Coffin and Pfannmuller 1988), 14 Wisconsin counties (Opler 1995 and personal observations), 34 counties in the Upper and Lower Peninsulas of Michigan (Opler 1995), four northeastern Indiana counties (Shull 1987), a single northwestern Ohio county (Opler 1995), and a single county in central Maine (Opler 1995). Only three stations were located in northeastern Wisconsin during intensive surveys of peatland sites (Howe et al. 1995). The largest of these was observed with *P. fruticosa* in dune swales in Door County.

The small size of populations, and restriction to muskeg sites suggests that this species should be continued to be monitored. A rank of S2S3 may be appropriate, given the number of sites located.

Figure 49. Distribution of the rare *Clossiana freija*, *Clossiana frigga saga*, *Erebia discoidalis*, and *Incisalia eryphon* in the Lake Superior Basin

Figure 50. Distribution of the rare *Clossiana titania*, *Pieris virginiana*, and *Lycaena dorcas* in the Lake Superior Basin

Migratory Birds

By most estimates, spring of 1996 was three or more weeks behind schedule in the Lake Superior region. When this survey began on 29 April 1996, there was still ice on Lake Superior, its beaches, and portions of the estuaries; by mid-May, most of the ice was gone. The late spring experienced in the upper Midwest probably delayed migration in the Lake Superior region, but it is difficult to say by how much. When the survey began in late April, it was obvious that migration was already underway despite the ice and inclement weather. In “normal” years a migratory bird survey would ideally begin two to three weeks earlier. By the end of the survey period, numbers of migrants had dwindled and most waterfowl and songbirds observed appeared to be in the breeding phase.

Weather is a controlling factor in migration in this region. Favorable migration winds were recorded on 2, 13, and 20 May, with corresponding increases in the numbers of birds counted. Fewer birds were counted when unfavorable weather conditions existed, such as on 9-10 May (northeast winds 15-25 mph) and 15-17 May (fog--though there were probably more birds present than were counted). The counts for 29 May are small because on that day the survey focused primarily on shorebirds and included only Allouez Bay and Fish Creek Sloughs.

Over the survey period, a total of 106 bird species were recorded. Of these, 80 species were found at Fish Creek Sloughs, 70 at Allouez Bay, 50 at Port Wing, 29 at Bark Bay, and 26 species at the Sioux River Slough. Based on individual counts and estimations, a total of 24,969 birds utilized these Lake Superior estuaries: Allouez Bay 19,548; Bark Bay 155, Sioux River 267; Port Wing 1,005; Fish Creek 3,994. This number represents a minimum since surveys were conducted only twice weekly and counts were not consistently made for song birds. For a more accurate idea of the numbers and species of migrants utilizing these estuaries, it would help to be omnipotent.

Almost four times as many birds were counted at Allouez Bay than at the other four sites combined, illustrating the importance of the larger estuarine wetlands (**Fig. 51** and **App. E, Figs. 1-4**). An expected relationship can be seen between wetland size and the number of individuals counted. However, at least in this survey, migratory bird species richness (number of species per unit area) appears to be equal or higher in some of the smaller estuaries such as those at Fish Creek and Port Wing. This would be an important reason to include smaller wetlands in any plan to preserve or restore freshwater coastal wetlands.

Breeding Birds: Coastal Zone Wetlands of the Apostle Islands

A total of 962 birds of 76 species were recorded during the inventory of these 10 coastal sites (**Tbl. 10**). Sand Island South Bog had the greatest average number of birds counted per point at 18.7; Outer Island Lagoon was the lowest at 14.0.

The mean number of birds/point was 16.49, with a standard deviation of 1.74. Outer Island Lagoon and Sand Island North Bog were slightly below the standard deviation. Long Island Wetlands and Sand Island South were slightly above the standard deviation. It appears that, based on number of birds/point, all sites regardless of size have good densities of breeding birds and are of equal importance in this respect.

Figure 51. Results of migratory bird surveys in the Lake Superior Basin, 1996.

Assuming the number of sample points at each site sufficiently represents that site in terms of species composition and density, a comparison of number of species per acre was made to provide some approximation of "species richness" for each site (**Tbl. 11**). Keep in mind that small, heterogeneous sites may have "high species richness" but can be of low conservation significance. In addition, "richness" by itself, is an inadequate and sometimes misleading measure of biodiversity value.

For the ten survey sites, the mean number of species per acre was 0.356 with a standard deviation of 0.240. Most sites fell within this range with the notable exceptions of Long Island Wetlands (0.647 spp/ac) and the Sioux River Slough (0.939 spp/ac). The species richness of these sites is particularly important given their small sizes: 34 ac and 33 ac, respectively. Among the remaining sites, Stockton Island (Brander) Bog (0.346 spp/ac) and Stockton Island Julian Bay Northwest Bog (0.368 spp/ac) were notably rich, again particularly for their relatively small sizes: 78 ac and 57 ac, respectively.

Table 10. Results of breeding bird surveys in the Lake Superior Basin coastal wetlands, 1996

Site	Acres	No. of Points	No. of Species	No. of Birds (5 min.)	No. of Birds (10 min.)	Birds/Point (10 min.)
Long Island Wetlands	34	8	22	101	147	18.4
Outer Island Lagoon	122	5	22	41	70	14
Sand Island North Bog	143	5	22	57	71	14.2
Sand Island South Bog	54	3	15	35	56	18.7
Stockton Island (Brander) Bog	78	6	27	88	108	18
Stockton Island Julian Bay Bog	134	7	30	93	112	16
Stockton Island Julian Bay Northwest Bog	57	3	21	32	46	15.3
Madeline Island Amnicon Bay Bog	155	7	31	84	107	15.3
Sand River Estuary	125	6	28	73	105	17.5
Sioux River Slough	33	8	33	94	140	17.5

Table 11. Richness of breeding bird species in the Lake Superior Basin coastal wetlands, 1996

Location	Species/Acre	Location	Species/Acre
Long Island Wetlands	0.647	Stockton Island Julian Bay Bog	0.223
Outer Island Lagoon	0.180	Stockton Island Julian Bay Northwest Bog	0.368
Sand Island North Bog	0.154	Madeline Island Amnicon Bay Bog	0.200
Sand Island South Bog	0.277	Sand River Estuary	0.224
Stockton Island (Brander) Bog	0.346	Sioux River Slough	0.939

Infrequent species such as warbling and solitary vireos, scarlet tanager, and blackburnian and Tennessee warblers were observed and recorded. Other uncommon sightings were also recorded at several sites. By species and date these are:

White-winged Crossbill: Stockton Island Brander Bog (29 counted on 21 June 1996) and Sand Island South Bog (13 counted on 25 June 1996). I am not aware of nesting records for this species in the Apostle Islands area. Apparently, their last recorded nesting was around 100 years

ago (Dr. Dick Verch, Northland College, pers. comm.).

LeConte's Sparrow: Madeline Island Amnicon Bay Bog (1 observed closely while singing and 1 singing, 30 June 1996).

Yellow-bellied Flycatcher: Sand River Estuary (2 heard calling 16 June 1996) and Stockton Island Brander Bog (1 calling 21 June 1996).

Philadelphia Vireo: Sand Island North Bog (1 singing 25 June 1996), Stockton Island Brander Bog (1 singing 21 June 1996), and Stockton Island Julian Bay Bog (1 singing 20 June 1996).

Several active nest sites were also discovered during the 1996 survey. On 16 June, a bald eagle nest with at least one nestling was found in the Sand River Estuary, in a tall pine near the mouth of the river. Near the same location two nests with eggs were found, one spotted sandpiper and one killdeer. An active hermit thrush nest with eggs and an adult present were located in Stockton Island Brander Bog on 21 June. An adult killdeer with several young and a yellow warbler nest with eggs and an adult present were discovered in Long Island Wetlands on 27 June.

Breeding Birds: Additional Coastal Zone and Basin Interior Wetlands

In all, 134 avian species were observed at the 18 sampling sites (**Tbl. 12**). Relative abundance information, which ranks species as rare, uncommon, common, or abundant, is provided in **Appendix E, Table 1**. Twenty-eight species had a widespread distribution within the confines of this project, being encountered at 10 or more sites (species in italics are on the NHI Working List):

alder flycatcher	northern flicker
American crow	ovenbird
American redstart	purple finch
American goldfinch	red-eyed vireo
American robin	red-winged blackbird
black-and-white warbler	sedge wren
black-capped chickadee	song sparrow
blue jay	swamp sparrow
cedar waxwing	tree swallow
common yellowthroat	<i>veery</i>
chestnut-sided warbler	white-throated sparrow
great-crested flycatcher	winter wren
mallard	yellow warbler
<i>Nashville warbler</i>	yellow-rumped warbler

Point Count Results. In all, 70 species were encountered during the point counts (**App. E, Tbl. 2**). Results from these counts show the following 10 species to be the most abundant (in decreasing order; species in italics are on the NHI Working List):

<i>Nashville warbler</i>	yellow-rumped warbler
white-throated sparrow	<i>yellow-bellied flycatcher</i>
common yellowthroat	alder flycatcher
sedge wren	song sparrow
swamp sparrow	red-winged blackbird

These 10 species accounted for 56% of the total number of individuals observed during the point counts. Nashville warblers alone accounted for over 16% of the total individuals, and are listed above as among the most widespread as well as most abundant species.

Rare Species Observed During This Project. Twenty-six species of birds included on the NHI Working List were observed during the course of this project (**Tbl. 13A**). Several of these species were encountered at only one site (American black duck, redhead duck, yellow rail, least bittern, red-breasted merganser, boreal chickadee, Caspian tern), and may be relatively rare in these habitats. Other species were frequently encountered (blue-winged teal, veery, Nashville warbler, golden-winged warbler). The habitats in which these species are found may be source habitats for these species in Wisconsin. Source habitats for rare species should be protected in order to help perpetuate Wisconsin's populations of these species.

In addition to the species on the NHI Working List, 7 bird species (black-billed cuckoo, Brewer's blackbird, golden-crowned kinglet, Lincoln's sparrow, olive-sided flycatcher, palm warbler, sandhill crane) uncommon in the Lake Superior area were observed during the course of this project (**Tbl. 13B**). While some of these species were found at several sites (e.g. golden-crowned kinglet at 8 sites) they were always found at low abundance levels.

The Lake Superior coastal wetlands and nearby inland peatlands sampled for this project probably represent appropriate breeding habitats for these species. Since these habitat types are not abundant or extensive in the area, the species associated with them were found infrequently or in limited abundances.

Similarity Among Sites. The habitats sampled for birds during this project may be divided into 3 distinct types: marsh, wiregrass, and forested. Marsh habitats are dominated by wetland emergent vegetation such as *Typha*, *Sagittaria*, robust *Carex* spp. (e.g., *C. lacustris*, *C. rostrata*, *C. retrorsa*), *Sparganium*, and *Pontederia*, with floating-leaf (e.g., *Nuphar*, *Brasenia*, *Nymphaea*) and submergent vegetation (e.g., *Myriophyllum*, *Ceratophyllum*, *Potamogeton*, *Utricularia*) commonly present. Expansive areas of open water usually exist in a marsh. Open water areas are usually present in wiregrass habitats, also, though the vegetation here is dominated by ericads (*Vaccinium*, *Ledum*, *Andromeda*), *Sarracenia*, and fine-leaved sedges (*C. lasiocarpa*, *C. chordorrhiza*), with or without a sphagnum mat. Forested sites (both swamps and bogs) are typified by a canopy of *Picea mariana*, *Larix laricina*, *Thuja occidentalis*, and/or *Fraxinus nigra*; a shrub layer of *Alnus incana*, *Cornus* spp., *Viburnum* spp., and/or *Myrica gale*; and a ground layer of either a sphagnum lawn, or richer with hummocks and pools of water. A sampling site may consist of a single habitat type (e.g., Caroline Lake Wetlands, an inland, forested bog) or may contain two or more habitat types (e.g., Fish Creek Sloughs, with both marsh and forested areas).

Table 12. Breeding bird sampling sites in the Lake Superior Basin interior wetlands, 1994-96

Site Name	Site Location	Survey Date	Survey Type (No.)
Belden Swamp	Douglas County T45N R14W sec. 19, 30; T45N R15W sec. 24, 25	28-Jun-96	Point Counts (8)
Bibon Swamp	Bayfield County T46N R6W sec. 31, 32	27-Apr-96 11-May-96 2-Jul-96	Canoe Canoe Point Counts (7)
Vogue's Road Swamp	Iron County T46N R1W sec. 28, 33	30-Jun-96	Point Counts (6)
Siskiwit Swamp	Bayfield County T50N R6W sec. 28, 29	20-Jun-96	Point Counts (4)
Caroline Lake Wetlands	Iron County T44N R1W sec. 20	19-Jun-96	Point Counts (8)
Odanah Swamp	Ashland County T48N R2W sec. 31 T48N R3W sec. 36	29-Jun-94 1, 8, 19, 23, 29-Jun-95 11-Jul-95 17-Jun-96 19-Jul-96	Point Counts (4) Point Counts (2) Point Counts (2) Point Counts (7) Relevé
Sultz Swamp	Bayfield County T50N R4W sec. 6	16-Jun-96	Point Counts (9)
Fish Creek Sloughs	Bayfield County T47N R5W sec. 1, 2 T48N R5W sec. 36	1-Jun-96 2-Jun-96 3-Jun-96	Relevé Canoe, Point Counts (2) Relevé
Bibon Swamp	Bayfield County T50N R8W sec. 20, 21, 28, 29	11-Jun-96 12-Jun-96	Canoe Night, Point Counts (5)
Big Bay	Ashland County	13-Jun-96	Canoe, Point Counts (2)
Bad River	Ashland County T48N R2W sec. 17, 18, 19, 20 T48N R3W sec. 13, 24, 25	21-Jun-94 13-Jun-95 18-Jun-96 3-Jul-96 6-Aug-96	Canoe Canoe Point Counts (4) Boat Boat
Bark Bay	Bayfield County T50N R7W sec. 1; T51N R7W sec. 35, 36	9-Jun-96 10-Jun-96	Canoe, Night Point Counts (5)
Pokegama River	Douglas County T48N R14W sec. 4; T49N R14W sec. 5, 32	27-Jun-96	Canoe, Point Count (1)
Lost Creek	Bayfield County T51N R6W sec. 32, 33	5-Jun-96 7-Jun-96	Canoe, Point Count (1) Point Counts (7)
Honest John Lake	Ashland County T48N R2W sec. 20, 21	18-Jun-96 3-Jul-96 6-Aug-96 7-Aug-96	Canoe, Relevé Point Counts (4) Boat, Relevé Boat, Relevé
Sioux River Slough	Bayfield County T49N R4W sec. 9, 17	4-Jun-96	Relevé
Kakagon Sloughs	Ashland County T48N R3W sec. 2, 3, 10, 11, 12, 14, 15, 22, 23	22-Jun-96 1-Jul-96	Canoe Night
Allouez Bay	Douglas County T49N R13W sec. 34	25-Jun-96	Canoe

Table 13A. Breeding birds on the NHI Working List observed in the Lake Superior Basin interior wetlands

Species ¹	Bibon Swamp	Belden Swamp	Vogues Road	Siskiwit Swamp	Caroline Lake Wetlands	Odanah Swamp	Sultz Swamp	Fish Creek Sloughs	Bibon Swamp	Big Bay	Bad River	Bark Bay	Pokegama River	Lost Creek	Honest John Lake	Sioux River Slough	Kakagon Sloughs	Allouez Bay	Total Sites
LCSP		x															x		2
BWTE	x							x	x	x	x	x	x				x	x	9
ABDU																	x		1
REDH	x ²																		1
AMBI		x						x	x	x	x	x					x		7
VEER			x	x				x	x		x	x	x	x	x	x	x		11
NOHA											x			x				x	3
EVGR	x					x					x			x					4
YERA												x							1
TRUS															x		x		2
CMWA								x ²			x								2
BOBO	x																x		2
YBFL	x	x	x	x	x	x	x							x					8
MERL	x									x				x					3
COLO										x		x			x		x		4
BAEA									x		x	x			x		x		5
LEBI																		x	1
COME	x									x	x					x			4
RBME								x											1
BOCH	x																		1
RCKI	x ²			x			x							x					4
CATE																x			1
COTE													x	x				x	3
GWWA	x		x	x			x				x	x		x		x	x		9
NAWA	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x		15
WIWA										x		x							2
Total Species	11	4	4	5	2	3	4	6	5	6	10	9	4	9	5	4	11	4	

¹ Species codes according to the American Ornithologist's Union standards.

² Birds observed early in the season, probably migrating.

Table 13B. Other uncommon breeding birds observed in the Lake Superior Basin interior wetlands.

Sites	BBCU	BRBL	GCKI	LISP	OSFL	PAWA	SACR	Total Species ¹
Bibon Swamp	x	x	x			x ²		4
Belden Swamp				x		x		2
Vogues Road			x					1
Siskiwit Swamp			x					1
Caroline Lake Wetlands			x	x	x	x		4
Odanah Swamp			x					1
Sultz Swamp			x	x		x		3
Fish Creek Sloughs								
Bibon Lake					x			1
Big Bay		x					x	2
Bad River			x	x		x	x	4
Bark Bay		x						1
Pokegama River								
Lost Creek			x			x		2
Honest John Lake						x		1
Sioux River Slough								
Kakagon Sloughs							x	1
Allouez Bay								
Total Sites	1	3	8	4	2	7	3	

¹ Species codes according to the American Ornithologists' Union standards.

² Birds observed early in the season, probably migrating.

A detrended correspondence analysis of sampling sites (McCune and Mefford 1995), using relative species abundance data, showed no clear separation of sites. This lack of a clear division of sites by habitat type is not unexpected since several sites contain more than one habitat type. Even within a habitat type, micro-habitats often occur as in a wiregrass habitat with small patches of shrubs or *Typha*, which may attract bird species otherwise not found in the habitat (e.g., chestnut-sided warbler and common yellowthroat in a small patch of shrubs; red-wing blackbird and marsh wren in a small *Typha* patch).

Some species of birds (red-wing blackbird, common yellowthroat, chestnut-sided warbler, song sparrow, white-throated sparrow) were common in all habitat types, while other species seemed to show a preference for one or two habitat types (**App. E, Tbl. 3**). Due to the mix of habitats within a site, it is difficult to determine habitat preferences for bird species using the data collected by sites. It can be said that the following species were most common at the inland forested sites (species in italics are on the NHI Working List): golden-crowned kinglet, golden-winged warbler, hermit thrush, *Nashville warbler*, northern waterthrush, palm warbler, *yellow-bellied flycatcher*, and yellow-rumped warbler. It is even more difficult to present a list of species associated with wiregrass or marsh habitats, perhaps due to the similarity in structure in the two habitat types. Savannah sparrow, LeConte's sparrow, and bobolink were found only in wiregrass habitats, though never in high numbers. Rails and bitterns tended to occur in marsh habitats. Because of the complexity of habitats within sites, a rigorous analysis of species preferences was not possible.

Wetland Priority Sites

During the compilation phase of this project, we developed a method of prioritizing among the many potential wetland sites in order to decide which should be targeted for field work. Sites were ranked for comparison based on wetland size, diversity of wetland communities, association with terrestrial features of interest, documented occurrences of rare plants and animals (in this document, any species on the NHI Working List), and degree of past disturbance based on examination of files and air photos. Sites about which we knew little or nothing were placed in a separate "gap" category, and were compared with better known areas by studying maps and air photos. We determined that it should be possible to conduct field surveys at virtually all coastal wetlands of over 10 acres.

In the second year of the project we included wetlands from the interior of the Lake Superior Basin, and had to be much more selective. We used some of the same criteria as in the first year, but also prioritized sites for field survey that were linked to coastal wetlands by streams, and seemed most representative of wetland types within the Ecoregional Subsections delineated for the basin. We also revisited the coastal wetlands that had been most productive in the first year of the project by yielding the most records of interest, and scheduled surveys for various taxa appropriate to the type and scale of wetlands present at a given site. Knowledge gaps were filled as we went along and as our work on the priority sites was completed. Following the two seasons of field work, we incorporated all of the data gathered into our files and reexamined the sites surveyed to evaluate their relative conservation values. We now had a much more complete and comparable dataset upon which to base our assessments.

This process resulted in the identification of 30 priority wetland sites (**Fig. 52**). Aquatic priority sites were also identified (see p. 205). The descriptions of priority sites in the pages that follow document those places that contain the best examples of wetlands and aquatic features found in both the coastal and interior portions of the basin. This is based partly on rankings of the communities and rare species populations at the various sites, but also on landscape context and representation. We included several sites which were severely disturbed in the past, but now afford important opportunities for the restoration of rare features. In some cases, they also offer a measure of protection to significant features nearby by increasing effective area and providing a buffer to ongoing disturbances.

BER is in the process of developing data sharing agreements with both the Bad River and Red Cliff Bands of Lake Superior Chippewa. Until those agreements are in place, we will not be computerizing data or identifying locations for natural communities or rare species populations found on the two Reservations. Also, many wetlands not among our priority sites are, of course, still very important. We have computerized data from the other sites and will use it for a variety of purposes. As neither our inventory nor public needs are static, it is likely that additional priorities will emerge over time.

Figure 52. Priority wetland and aquatic sites of the Lake Superior Basin.

The following pages summarize the 30 priority wetland sites. Each site description includes natural community, plant, and animal components as well as a table of rare element occurrences when appropriate. Maps depicting site boundaries and rare element occurrences are provided at the end of this section. The following details should be taken into account when utilizing the priority site maps: (1) Priority site boundaries were drawn using a combination of ecosystem features, administrative ownerships, and simple locators such as roads; (2) Dot symbols may represent multiple element occurrences; (3) Terrestrial occurrences include mammals, birds, reptiles, butterflies, moths, other invertebrates and terrestrial plants; and (4) Aquatic occurrences represent water-dependent taxa such as some birds, amphibians, fish, mussels, dragonflies, other invertebrates, and aquatic plants.

Black Lake Bog

Douglas County

USGS 7.5' Quadrangles: Black Lake, Foxboro

Black Lake Bog is a vast acid peatland in the headwaters of the Black River (**Fig. 53**). Several thousand acres of open bog, muskeg, and black spruce swamp surround a large shallow lake that drains northward via the Black River, which eventually joins the Nemadji River south of the City of Superior.

Sphagnum mosses, ericaceous shrubs, and sedges blanket the level surface of the site. Representative vascular plants include leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), small cranberry (*Vaccinium oxycoccos*), round-leaved sundew (*Drosera rotundifolia*), and the sedges *Carex oligosperma*, *C. pauciflora*, *C. paupercula*, and *Eriophorum spissum*. Stunted black spruce (*Picea mariana*), often associated with tamarack (*Larix laricina*), are scattered throughout the bog. In areas where the spruces form closed stands, Labrador tea (*Ledum groenlandicum*) and the sedge *Carex trisperma* are frequently members of the understory. Small upland "islands" occur in a few places within the bog, supporting mature stands of red pine (*Pinus resinosa*).

Among the animals, only birds have received even cursory attention. A number of habitat specialists occur here, among them the palm warbler and Lincoln's sparrow. The LeConte's sparrow has been noted in open areas with high sedge cover. Other characteristic birds of the site include common yellowthroat, song sparrow, white-throated sparrow, Nashville warbler, sedge wren, and purple finch. The yellow-bellied flycatcher and yellow-rumped warbler occur where the cover of spruce trees is high. Mammals observed on or adjacent to the site in recent years include the timber wolf and moose.

Black Lake Bog occupies portions of both Minnesota and Wisconsin. Ownership is primarily public, with Douglas County and the state of Minnesota the major landowners. The site is managed by cooperative agreement as an interstate natural area.

Rare species of Black Lake Bog, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Ammodramus leconteii</i>	LeConte's sparrow	1996	1
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Belden Swamp

Douglas County

USGS 7.5' Quadrangle: Moose Junction

This large, undisturbed acid peatland straddles the drainage divide between the St. Croix River and Lake Superior (**Fig. 54**). The Spruce River originates here, draining southwestward to join the Tamarack River and then the St. Croix River. Several small streams drain northward from Belden Swamp, eventually reaching the Black River.

The peatlands are composed of open bog, muskeg, black spruce swamp, and poor fen communities. A thick carpet of *Sphagnum* mosses covers the surface of most of this wetland. Ericaceous shrubs, sedges, and stunted swamp conifers are the most prominent vascular plants. Important species include leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), small cranberry (*Vaccinium oxycoccos*), black spruce (*Picea mariana*), tamarack (*Larix laricina*), and the sedges *Carex lasiocarpa*, *C. limosa*, *C. oligosperma*, *C. paupercula*, *Eriophorum angustifolium*, *E. spissum*, and *E. virginicum*. Possibly reflecting subsurface drainage patterns, the vegetation is not uniformly structured throughout the site. Open, sedge-dominated swales alternate with muskeg stands in which scattered, stunted spruces are prominent.

In a few areas, the coniferous trees are dense, and species such as Labrador tea (*Ledum groenlandicum*) and the sedge *Carex trisperma* are abundant in the understory. A wet, tall shrub zone of alder (*Alnus incana*) and willows (*Salix* spp.) is found at the upland-wetland interface. In the eastern portion of this wetland interior to the tall shrub community is an extensive stand of bog birch (*Betula pumila*) and beaked sedge (*Carex rostrata*). Birds of the open sedge swales include sedge wren, savanna sparrow, LeConte's sparrow, and northern harrier. In areas of stunted conifers, palm warbler, Lincoln's sparrow, white-throated sparrow, and Nashville warbler are common. More closed coniferous forest supports yellow-bellied flycatcher, yellow-rumped warbler, and sharp-shinned hawk.

Belden Swamp is owned by Douglas County. The site contains extensive, undisturbed examples of representative acid peatland communities and biota and merits serious consideration for special management designation.

Rare species of Belden Swamp, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Ammodramus leconteii</i>	LeConte's sparrow	1996	1
<i>Boloria freija</i>	Freija fritillary	1996	2
<i>Boloria frigga</i>	Frigga fritillary	1996	1
<i>Boloria titania</i>	Purple lesser fritillary	1995	1
<i>Boloria eunomia</i>	Bog fritillary	1996	2
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	1
<i>Lycaena epixanthe</i>	Bog copper	1996	1
<i>Oeneis jutta ascerta</i>	Jutta arctic	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Mud Lake Bog/Ericson Creek

Douglas County

USGS 7.5' Quadrangle: Amnicon Lake

This site encompasses a diverse assemblage of wetland and terrestrial features, including extensive open and forested acid peatlands, seepage lake, stream, mesic hardwood forest, and dry-mesic pine forest. Ericson Creek is part of the Amnicon River system, while the peatlands to the west of Mud Lake drain to the Black River (**Fig. 55**). County Trunk Highway A runs north-south between Ericson Creek and Mud Lake (only the wetlands west of Mud Lake are represented in Figure 55).

The peatland communities include open bog, muskeg, and black spruce swamp. Thick carpets of *Sphagnum* mosses support ericaceous shrubs, sedges, and swamp conifers. Characteristic species are leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), small cranberry (*Vaccinium oxycoccos*), black spruce (*Picea mariana*), tamarack (*Larix laricina*), and the sedges *Carex oligosperma*, *C. pauciflora*, *C. paupercula*, *Eriophorum angustifolium*, *E. spissum*, and *E. virginicum*. *Carex trisperma* and Labrador tea (*Ledum groenlandicum*) are important where cover of the conifers is relatively high.

Noteworthy peatland birds include Lincoln's sparrow, palm warbler, gray jay, Nashville warbler, white-throated sparrow, and red crossbill. Near Ericson Creek, the wetlands are bordered by or surround scattered stands of mature trees including mesic maple-basswood forest and dry-mesic red pine-white pine forest. Patches of white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*) lend a boreal flavor to the complex.

Significant portions of this site are owned by Douglas County and should be considered for special recognition in the Douglas County Forest Plan. Currently, Douglas County, DNR and BER are working on special protection needs for this site.

Rare species of Mud Lake Bog/Ericson Creek, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Boloria freija</i>	Freija fritillary	1996	3
<i>Boloria titania</i>	Purple lesser fritillary	1996	3
<i>Boloria eunomia</i>	Bog fritillary	1996	3
<i>Erebia discoidalis</i>	Red-disked alpine	1996	1
<i>Haliaeetus leucocephalus</i>	Bald eagle	1992	1
<i>Lycaena epixanthe</i>	Bog copper	1996	1
<i>Oeneis jutta ascerta</i>	Jutta arctic	1996	5
<i>Perisoreus canadensis</i>	Gray jay	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Nemadji River Bottoms

Douglas County

USGS 7.5' Quadrangle: Sunnyside

This portion of the deeply incised Nemadji River valley is mostly forested but also contains abandoned oxbows with emergent marsh and shrub swamp (**Fig. 56**). The level landscape away from the river is a mixture of small farms, woodlots, and residential areas.

This forest type is rare, and possibly unique to the Lake Superior Clay Plain subsection. Terraces inside the sharp meanders of the river are situated 3-5 meters above normal flow stages. The canopy is dominated by black ash (*Fraxinus nigra*), and includes green ash (*F. pennsylvanica*), basswood (*Tilia americana*), red maple (*Acer rubrum*), silver maple (*A. saccharinum*), balsam poplar (*Populus balsamifera*), and bur oak (*Quercus macrocarpa*). Scattered conifers are also members of the canopy, though their cover is highest on the steep slopes bordering the river and terraces. Included among these are white spruce (*Picea glauca*), white cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), and balsam fir (*Abies balsamea*). The herb layer is exceptionally rich, and while no rare species have been documented here to date, the flora is diverse and contains many plants more typical of maple-basswood forests far to the south. Spring ephemerals and their associates are especially well-represented, including false rue anemone (*Isopyrum biternatum*), wild leek (*Allium tricoccum*), Virginia waterleaf (*Hydrophyllum virginiana*), toothwort (*Dentaria laciniata*), spring beauty (*Claytonia virginica*), wild ginger (*Asarum canadense*), yellow trout lily (*Erythronium americanum*), Dutchman's breeches (*Dicentra cucullaria*), bloodroot (*Sanguinaria canadense*), and blue cohosh (*Caulophyllum thalictroides*).

Animals were not formally surveyed at this site, but among the common resident birds found in similar habitats upstream are veery, mourning warbler, red-eyed vireo, ovenbird, and broad-winged hawk. Four adult wood turtles (Wisconsin Threatened) were noted at the site in May of 1994.

Though not a virgin stand, many large trees remain and there has been little recent disturbance. Douglas County is the principal landowner, and is partially protecting the site via a special use designation. This site, and a similar stand several miles upstream, have many properties which are unique at least at the regional level. Protection efforts should be strongly encouraged throughout the Nemadji corridor, including the steep, fragile clay slopes where protection or restoration of long-lived coniferous trees is highly desirable. Slumping banks are common on the outside of stream meanders and the Nemadji River contributes a great deal of sediment to Allouez and Superior bays. The slopes bordering this river were badly damaged during past logging events. Present cover is mostly trembling aspen (*Populus tremuloides*).

Rare species of Nemadji River Bottoms, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
Clemmys insculpta	Wood turtle	1994	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Pokegama-Carnegie Wetlands

Douglas County

USGS 7.5' Quadrangle: West Duluth

The extensive, poorly drained, red clay flats in the headwaters of the Pokegama and Little Pokegama rivers support a large wetland mosaic of shrub swamp, sedge meadow, emergent marsh, and small ponds (**Fig. 57**). Tiny, upland "islets" of white spruce (*Picea glauca*), white pine (*Pinus strobus*), red pine (*Pinus resinosa*), balsam poplar (*Populus balsamifera*), and trembling aspen (*Populus tremuloides*) punctuate the flats. The shrub wetlands are composed mostly of speckled alder (*Alnus incana*) and willows (*Salix petiolaris*, *S. discolor*, *S. pyrifolia*, others). The more open wet meadows are dominated by sedges (*Carex lacustris*, *C. stricta*) and bluejoint grass (*Calamagrostis canadensis*). Widely scattered small pools support a variety of emergent and submergent aquatic macrophytes.

Of special significance are the many populations of rare plants occurring in the site's wetlands. Many of the rarities are represented by large and/or multiple populations. It is important to recognize that some of these species are not widespread in the Lake Superior region, but are concentrated in the vicinity of the City of Superior. Amphibians and birds found here include: wood frog, spring peeper, green frog, leopard frog, eastern gray tree frog, American toad, yellow warbler, golden-winged warbler, gray catbird, alder flycatcher, white-throated sparrow, swamp sparrow, song sparrow, sora, Virginia rail, common snipe, woodcock, sharp-shinned hawk, northern goshawk, and common raven.

Appropriate management and protection of this site is critically important. Study of the site's hydrology is needed, as several right-of-ways cross the wetland and may be having impacts which are not clearly understood. Several of these right-of-ways are currently managed via brush-cutting, which appears to be an effective and appropriate means of maintaining conditions to the liking of at least some of the rare plants. Examination of the original land survey notes, as well as historical and current aerial photographs, would be helpful in understanding changes in land use and vegetation composition and structure, which could have management implications. Invasive exotic species are not a problem at present, but should be looked for periodically. At least one of the corridors crossing this wetland carries petroleum. A spill could have a devastating impact on the biota.

The vegetation of the Pokegama-Carnegie Wetlands resembles that occurring at several other sites, all in the vicinity of the City of Superior. Pokegama-Carnegie, however, is the largest site, has the greatest floristic diversity, supports some of the largest populations of rare species, and may be less likely in the short-term to suffer destruction or fragmentation owing to expanded development, disrupted hydrology, or incursions of aggressive species.

Rare species of Pokegama-Carnegie Wetlands, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Eleocharis nitida</i>	Slender spike-rush	1995	3
<i>Juncus vaseyi</i>	Vasey's rush	1995	3
<i>Parnassia palustris</i>	Marsh grass-of-Parnassus	1995	1
<i>Petasites sagittatus</i>	Arrow-leaved sweet-coltsfoot	1995	3
<i>Ranunculus gmelinii</i> var <i>hookeri</i>	Small yellow water crowfoot	1995	3
<i>Ranunculus cymbalaria</i>	Seaside crowfoot	1996	1
<i>Sparganium glomeratum</i>	Northern bur-reed	1995	2
<i>Viola novae-angliae</i>	New England violet	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Red River Breaks/St. Louis River Marshes

Douglas County

USGS 7.5' Quadrangles: Esko, Frogner, Borea, West Duluth

Red River Breaks. This rough, deeply dissected, red clay landscape drained by the Red River and its tributaries borders the St. Louis River above the City of Superior (**Fig. 58**). Much of the site is forested, with pole-size trembling aspen (*Populus tremuloides*) the dominant tree. The canopy is rather sparse, with a dense understory of speckled alder (*Alnus incana*) prominent in many stands. Conifers, which were formerly dominant in this area, presently occur as scattered individuals or in small stands, with white spruce (*Picea glauca*), white pine (*Pinus strobus*), and white cedar (*Thuja occidentalis*) the most important species. In poorly drained "flats" on the level ridges between ravines there are patches of black

ash-dominated hardwood swamp and thickets of speckled alder and other tall wetland shrubs. Areas of standing water are infrequent, but where present support small emergent marshes and broad-leaved sedge meadows. A few patches of well-drained mesic hardwood forest occur on the ridges, with sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*), but these are not extensive and, in general, the "northern hardwoods" community is rare on the site.

The lower slopes of the steep-sided ravines are often springy, sometimes supporting remnant stands of white cedar (*Thuja occidentalis*) and unusual herbs. Several springs were flowing with brightly colored orange water, the result of the presence of iron bacteria. Another spring was noted in which the deposition of "tufa" (calcium carbonate) was occurring. Some of the small terraces a few meters above the streams in the ravine bottoms contain mature stands of large white spruce (*Picea glauca*), black ash (*Fraxinus nigra*), and balsam poplar (*Populus balsamifera*).

Several of the small feeder creeks entering the site from the vicinity of Minnesota's Jay Cooke State Park to the west were running clear, even after heavy rains. Bottom materials included sand, gravel, and boulders. Small fish and a number of invertebrates were noted in these upper stretches. Closer to the St. Louis River, the water is more turbid, carrying a heavier load of fine sediments. Along the St. Louis River there are stands of emergent macrophytes, shrub swamp, and small patches of black ash swamp.

At least 10 species of rare plants have been documented on the site. No rare animals have been observed to date, but the area supports a representative diversity of the region's birds, including large populations of many neotropical migrants. Further inventory is desirable, especially for breeding birds and aquatic macroinvertebrates. Access to the interior is slow going and difficult.

The site's forests, soils, and waters were seriously damaged during past catastrophic logging episodes. Many of the fragile seeps along the lower valley walls are slumping badly, leading to excessive sedimentation in the lower drainages. Conifers are generally not reproducing well, due to loss of seed source, unstable and possibly waterlogged substrates, overbrowsing by white-tailed deer, and possible past damage to soil structure. Thickets of tall shrubs and dense stands of bluejoint grass (*Calamagrostis canadensis*) may be inhibiting the establishment of seedlings of some species. Recovery is proceeding, but very slowly.

Recommendations include the development of a management plan focused on maintaining the site's extensive forests and unroaded condition, as well as protection of the rare plant populations occurring there. In the short term, any active forest management should focus on stabilization of eroding areas and reestablishment of the diverse coniferous forests native to the site and no longer common in the region. Added study is needed on the regeneration problems currently exhibited by cedar, fir, and pine. Actions on these problems should first be implemented only on the periphery of the site.

St. Louis River Marshes. Upper portions of the St. Louis River Estuary from Fond du Lac downstream to Oliver feature extensive emergent marshes (**Fig. 58**). These are typically located inside the main channel's meanders, but also occur in protected, shallow bays along the upland shore. Important emergent aquatics include arrowheads (*Sagittaria latifolia*, *S. rigida*), bulrushes (*Scirpus americanus*, *S. validus*), bur-reed (*Sparganium eurycarpum*), lake sedge (*Carex lacustris*), and cattail (*Typha* spp.). Wild rice (*Zizania aquatica*) and sweet flag (*Acorus calamus*) are locally common. Deeper waters of the marsh complexes support submergent and floating-leaved macrophytes such as coontail (*Ceratophyllum demersum*), waterweed (*Elodea canadensis*), yellow water lily (*Nuphar variegatum*), wild celery (*Vallisneria americana*), and pondweeds (*Potamogeton* spp.).

The patches of marsh associated with the main channel are often bordered by a natural levee adjoining the flowing river. Where well-developed, the levees are vegetated with tall wetland shrubs and lowland hardwoods, especially speckled alder (*Alnus incana*), red-osier dogwood (*Cornus stolonifera*), meadowsweet (*Spiraea alba*), willows (*Salix* spp.), ashes (*Fraxinus nigra* and *F. pennsylvanica*), and box elder (*Acer negundo*).

Animals have not yet been surveyed in detail but use by waterfowl was heavy in early fall. Foraging birds noted during the nesting season included bald eagle, osprey, common tern, merlin, and belted kingfisher. Among the common avian residents were red-winged blackbird, common yellow-throat, swamp sparrow, song sparrow, yellow warbler, and sora.

The Wisconsin shoreline is almost entirely undeveloped, and includes a large block of rough, forested, roadless terrain (see "Red River Breaks" for additional information). A large area was purchased by the State of Wisconsin in the mid-1990's. Termed the St. Louis River Streambank Protection Area, the project acquisition goal is 5,000 acres. Shoreline protection, water quality improvement projects, and exotic species monitoring and control are important management considerations for this site. Other significant wetlands are within the St. Louis River Estuary, to the north, below the Village of Oliver (see "Oliver Marsh" and "Superior Municipal Forest"). The Minnesota side of the St. Louis River also harbors valuable wetlands, including remnant patches of wire-leaved sedge fen at the Oliver Bridge and downstream at Grassy Point.

The Red River Breaks/St. Louis River Marshes site was considered a priority owing to its large size, recent state acquisition, and significance to water quality in the St. Louis River Estuary. Also, a big information gap existed which needed to be filled in order to clarify the biological significance of the area for local and regional planning purposes.

Rare species of Red River Breaks/St. Louis River Marshes, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
Cypripedium parviflorum	Small yellow lady's-slipper	1996	1
Cypripedium reginae	Showy lady's-slipper	1996	1
Equisetum variegatum	Variiegated horsetail	1996	2
Equisetum palustre	Marsh horsetail	1996	2
Haliaeetus leucocephalus	Bald eagle	1992	1
Juncus vaseyi	Vasey rush	1996	1
Petasites sagittatus	Arrow-leaved sweet-coltsfoot	1996	1
Ranunculus gmelinii var hookeri	Small yellow water crowfoot	1996	1
Ribes hudsonianum	Northern black currant	1996	1
Salix planifolia	Tea-leaved willow	1996	1
Sparganium glomeratum	Northern bur-reed	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Oliver Marsh

Douglas County

USGS 7.5' Quadrangle: West Duluth

This large marsh occupies a part of the St. Louis River Estuary between the Village of Oliver and the City of Superior Municipal Forest (**Fig. 59**). A narrow natural levee has developed on the outside bend of a channel meander and is partially vegetated with shrubs and small lowland hardwoods. This separates the northern portion of the marsh from the main channel. The emergent beds are generally composed of tall, narrow-leaved plants, especially bulrushes (*Scirpus americanus*, *S. fluviatilis*, *S. validus*), bur-reeds (*Sparganium chlorocarpum*, *S. eurycarpum*), lake sedge (*Carex lacustris*), cattails (*Typha* spp.), sweetflag (*Acorus calamus*), and arrowheads (*Sagittaria latifolia*, *S. rigida*). Pockets of wild rice (*Zizania aquatica*) occur in several protected bays fed by tiny streams draining the uplands to the east. A deep central lagoon between the natural levee and the emergent beds adjacent to the upland shore harbors significant stands of floating-leaved and submergent macrophytes such as waterweed (*Elodea canadensis*), wild celery (*Vallisneria americana*), yellow water lily (*Nuphar variegatum*), and pondweeds (*Potamogeton* spp.).

Animal life has not been studied in detail, but surveys are planned for the near future. Waterfowl, rails, double-crested cormorants, common terns, northern harrier, merlin, and bald eagles were noted during our August 1996 vegetation survey.

Most of the Wisconsin shoreline is undeveloped, and forested with paper birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*). Remnant stands of conifers, mostly spruce and pine, are scattered along the clay bluffs. Where homes and docks have been constructed, as is the case near the Village of Oliver, erosion is often noticeable. Small patches of purple loosestrife (*Lythrum salicaria*) are often associated with the natural levees, or disturbed shoreline areas. Slumps occur on many of the clay bluffs exposed to the direct action of water and ice, especially when unprotected by stands of aquatic vegetation. The Minnesota side of the river has more residential and industrial development but also has extensive marshes.

Superior Municipal Forest

Douglas County

USGS 7.5' Quadrangles: West Duluth, Superior

The 4,000 acre City of Superior Municipal Forest contains a wealth of natural features unusual in the context of an urban-industrial center. Among the most significant of these are stands of mature coniferous forest, extensive emergent marsh, and wet clay flats supporting a mixture of shrub swamp and wet meadow. The site borders the St. Louis River Estuary, which dissects the uplands into a series of narrow, steep-sided ridges (**Fig. 60**).

The coniferous forests are composed primarily of species often associated with the boreal regions. Canopy dominants include white spruce (*Picea glauca*), white pine (*Pinus strobus*), balsam fir (*Abies balsamea*), balsam poplar (*Populus balsamifera*), and paper birch (*Betula papyrifera*). In some stands, red pine (*Pinus resinosa*), black ash (*Fraxinus nigra*), or white cedar (*Thuja occidentalis*) are important. Stands still showing the influence of past logging followed by fire are generally composed of trembling aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*). The moist understories are also reminiscent of a boreal flora, and include uncommon species such as lungwort (*Mertensia paniculata*) and rabbit-berry (*Shepherdia canadensis*).

Resident birds include many species associated with mature conifers, such as Blackburnian, black-throated green, pine, yellow-rumped, parula, and Cape May warblers. Winter wren, mourning warbler, veery, and hermit thrush inhabit the forest understory.

Throughout the Lake Superior Clay Plain Ecoregional Subsection, this forest type has been greatly fragmented and often replaced by monotypic stands of aspen (*Populus* spp.). Thus the stands within this site have at least a regional conservation significance. They could also provide a template for restoration actions considered elsewhere.

An extensive emergent marsh borders both sides of the Pokegama River (which is really an arm of the St. Louis River Estuary). Marsh composition is very similar to that of the stands found along the lower stretches of the St. Louis. Dominants include bur-reed (*Sparganium eurycarpum*), bulrushes (*Scirpus americanus*, *S. validus*), arrowheads (*Sagittaria latifolia*, *S. rigidus*), and cattail (*Typha* spp.). Deeper waters support submergent and floating-leaved species, such as coontail (*Ceratophyllum demersum*), bladderwort (*Utricularia macrorhiza*), and many pondweeds (*Potamogeton* spp.). Among the resident birds are Virginia rail, sora, and marsh wren. Northern harrier, common tern, and bald eagle were noted foraging in the marsh on several occasions.

The invasive exotic purple loosestrife (*Lythrum salicaria*) is uncommon but unfortunately widespread in the marsh. Efforts to control it should begin as soon as possible. A heavy infestation occurs just to the east of the city forest in ditched wetlands bordering railroad tracks and State Trunk Highway 105 on the west side of the Village of South Superior. As these ditches drain into ravines which eventually reach the Pokegama River, it is possible that this roadside population is a source of propagules which eventually are washed into the marsh. Eradication of this potential source population is recommended.

The shrub swamp and meadow complex provides habitat for several rare plants, including clustered bur-reed (*Sparganium glomeratum*), small yellow water crowfoot (*Ranunculus gmelinii*), and sweet coltsfoot (*Petasites sagittatus*). Dominant plants include speckled alder (*Alnus incana*), willows (*Salix* spp.), lake sedge (*Carex lacustris*), and bluejoint grass (*Calamagrostis canadensis*). Birds such as alder flycatcher, yellow warbler, sedge wren, and white-throated sparrow are common in these communities. This wetland is the southwesternmost portion of a formerly much larger and contiguous wetland which has been partially destroyed and greatly disrupted by growth of the City of Superior. Additional surveys are desirable in the Municipal Forest's shrub swamp and meadow habitats.

A significant portion of this site was designated as a State Natural Area in 1996. This designation encompassed much of the mature forest and marsh, and also included a part of the wet clay flats in which rare plants occur.

Rare species of Superior Municipal Forest, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Carduelis pinus</i>	Pine siskin	1994	1
<i>Juncus vaseyi</i>	Vasey rush	1995	1
<i>Petasites sagittatus</i>	Arrow-leaved sweet-coltsfoot	1995	1
<i>Ranunculus gmelinii</i> var <i>hookeri</i>	Small yellow water crowfoot	1996	2
<i>Sparganium glomeratum</i>	Northern bur-reed	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Superior Airport/Hill Avenue Wetlands/South Superior Triangle

Douglas County

USGS 7.5' Quadrangle: Superior

These three sites, now separated by roads, railroad tracks, and other urban developments, are the largest remnants of a formerly contiguous wetland within the City of Superior (**Figs. 61-63**). The wetlands are mosaics of shrub swamp and open meadow, with a few small patches of emergent marsh. Trembling aspen (*Populus tremuloides*) often occupies drier portions of the sites. Despite the severe disturbances which have altered the composition, structure, function, size, and configuration of these wetlands, they harbor significant populations of rare plants.

Dominant shrubs are speckled alder (*Alnus incana*) and willows (*Salix discolor*, *S. petiolaris*, *S. pyrifolia*, several others). Open meadows are typically dominated by broad-leaved sedges, most commonly lake sedge (*Carex lacustris*). Characteristic associates are flat-topped white aster (*Aster umbellatus*), joe-pye weed (*Eupatorium maculatum*), late goldenrod (*Solidago gigantea*), bedstraw bellflower (*Campanula aparinoides*), and marsh fern (*Thelypteris palustris*). Rare species occurring here include neat spikerush (*Eleocharis nitida*), clustered bur-reed (*Sparganium glomeratum*), small yellow water crowfoot (*Ranunculus gmelinii*), sweet coltsfoot (*Petasites sagittatus*), Vasey's rush (*Juncus vaseyi*), and New England violet (*Viola novae-angliae*).

Among the resident birds are swamp sparrow, song sparrow, common yellowthroat, yellow warbler, gray catbird, alder flycatcher, and sedge wren.

Because of habitat fragmentation and isolation, and disrupted hydrology, these sites are highly vulnerable to damage even in the absence of future developments. The City of Superior has developed a Rare Plant Conservation Plan in association with the expansion of its airport. As part of the Plan, the City relocated many of the rare plant populations occurring at the new runway site. In addition, the Plan calls for the City to manage the wetlands to benefit rare plant species at the airport site that will not be impacted by the new runway, as well as lands it will be acquiring soon along Hill Avenue. This could include techniques such as brushing, prescribed burning, and scarification to create and perpetuate the microhabitats used by many of these rare species. In an effort to better understand which translocation and management techniques are most effective for these rare species, the City will monitor rare species populations at the airport for ten years.

The City of Superior also recently received approval from the U.S. Army Corps of Engineers for its Special Area Management Plan (SAMP). The goal of SAMP is to encourage residential, commercial, and industrial development in areas of the City that are most logical from a land-use planning perspective while minimizing environmental impacts. In developing the list of potential development sites in the SAMP, the City removed a site initially recommended for development along Hill Avenue due to the presence of rare plants. To ensure that important populations of rare species and high-quality natural communities are protected, the City will also contact BER for guidance on rare species inventories each time a site identified in the SAMP is proposed for development.

Rare species of Superior Airport, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
Eleocharis nitida	Slender spike-rush	1995	2
Juncus vaseyi	Vasey rush	1995	1
Petasites sagittatus	Arrow-leaved sweet-coltsfoot	1994	1
Ranunculus gmelinii var hookeri	Small yellow water crowfoot	1994	2
Ranunculus cymbalaria	Seaside crowfoot	1994	1
Sparganium glomeratum	Northern bur-reed	1995	2
Viola novae-angliae	New England violet	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Rare species of Hill Avenue Wetlands, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
Eleocharis nitida	Slender spike-rush	1995	1
Juncus vaseyi	Vasey rush	1995	1
Petasites sagittatus	Arrow-leaved sweet-coltsfoot	1995	1
Viola novae-angliae	New England violet	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Rare species of South Superior Triangle, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
Eleocharis nitida	Slender spike-rush	1995	1
Juncus vaseyi	Vasey rush	1995	1
Petasites sagittatus	Arrow-leaved sweet-coltsfoot	1995	1
Ranunculus gmelinii var hookeri	Small yellow water crowfoot	1995	1
Viola novae-angliae	New England violet	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Nemadji River Marshes

Douglas County

USGS 7.5' Quadrangle: Superior

The lower stretches of the Nemadji River flow in a narrow valley through a heavily industrialized and urbanized portion of the City of Superior before emptying into Allouez Bay (**Fig. 64**). A series of emergent marshes occurs along the inside of the well-developed meanders characteristic of this river. These are separated from the main channel by natural levees, which support a mixture of tall wetland shrubs and small lowland hardwoods. They also tend to be quite weedy. The steep clay bluffs confining the valley are generally undeveloped, sometimes forested, and provide a measure of buffering between the river system and the urban areas.

Important marsh plants include bur-reed (*Sparganium eurycarpum*), arrowheads (*Sagittaria latifolia*, *S. rigida*), soft-stemmed bulrush (*Scirpus validus*), broad-leaved cattail (*Typha latifolia*), lake sedge (*Carex lacustris*), marsh cinquefoil (*Potentilla palustris*), water horsetail (*Equisetum fluviatile*), and water parsnip (*Sium suave*). Locally deep, slowly flowing sloughs support stands of wild rice (*Zizania*

aquatica) and beds of pondweeds (*Potamogeton* spp.). Drier portions of the wetlands contain patches of sedge meadow dominated by tussock sedge (*Carex stricta*) and bluejoint grass (*Calamagrostis canadensis*). Animals were not formally surveyed here but we recorded incidental observations during the breeding season of American bittern, wood duck, blue-winged teal, mallard, hooded merganser, and sedge wren.

Though the lower Nemadji system has suffered many abuses, it has retained many significant natural features and should be a prime candidate for remedial attention. The marshes are representatively diverse, dominated by native species, appear reasonably functional, and support uncommon birds. Exotic plants are still quite localized, associated mostly with the disturbed levees and formerly dredged areas near U.S. Highway 2. It would be worthwhile to expand biological surveys to allow a more complete evaluation of at least the vegetation and the resident birdlife. Future surveys should include additional wetlands upstream.

Wisconsin Point-Allouez Bay Marshes

Douglas County

USGS 7.5' Quadrangles: Superior, Parkland

Wisconsin Point. Wisconsin Point is the eastern portion of a long coastal barrier spit separating the waters of Lake Superior from Allouez Bay (**Fig. 65**). Major site features include several miles of open sand beach and dunes, small interdunal wetlands, and a xeric forest of white (*Pinus strobus*) and red pines (*P. resinosa*). The point and adjacent Allouez Bay receive heavy visitation by migrating birds in the spring. Developments include roads, vehicle turnouts, a Coast Guard station, and breakwater.

The open dunes are dominated by marram grass (*Ammophila breviligulata*) and beach pea (*Lathyrus japonicus*). Other characteristic plants are evening primrose (*Oenothera biennis*), sand cherry (*Prunus pumila*), Canada wild-rye (*Elymus canadensis*), common milkweed (*Asclepias syriaca*), jointweed (*Polygonella articulata*), rock cress (*Arabis lyrata*), and scouring rushes (*Equisetum* spp.). Stabilized dunes are colonized by shrubs such as common juniper (*Juniperus communis*) and false heather (*Hudsonia tomentosa*), and sapling trees. Disturbed areas are very weedy, with many exotic species present, and often support extensive beds of poison ivy (*Rhus radicans*). The exposed outer beaches are unvegetated.

A small, open, interdunal swale near the western tip of the point supports a community dominated by low graminoid plants, especially sedges (*Carex viridula*, *C. lasiocarpa*), rushes (*Juncus balticus*), and scouring rushes (*Equisetum* spp.). Other noteworthy species include red-stemmed gentian (*Gentiana rubricaulis*), nodding ladies'-tresses (*Spiranthes cernua*), and a large population of the rare marsh grass-of-Parnassus (*Parnassia palustris*). The swale is surrounded by dense thickets of tall shrubs, mostly speckled alder (*Alnus incana*), willows (*Salix* spp.), and red-osier dogwood (*Cornus stolonifera*). These shrubs are encroaching on the openings and should be monitored and controlled if necessary. The shrubs do provide a measure of security for this fragile site by screening it from most passersby. During 1996 this swale was very wet, with standing water reaching a depth of over 30 cm in July and August.

Many of these same species occur in a small opening east of the Coast Guard station on the bay side of the point. This area was apparently cleared of vegetation and then fenced in the hope that it would provide nesting habitat for the critically endangered piping plover. The center of this sand area was excavated to a depth slightly below the water table, providing suitable conditions for colonization by some of the interdunal swale plants. Of additional interest are other rarities, including little grape fern

(*Botrychium simplex*), marsh horsetail (*Equisetum palustre*), and a possible first Wisconsin record for juniper clubmoss (*Lycopodium sabinaefolium*). Identification of the latter by specialists is pending.

The mature xeric forest covering the western half of the point is composed of white and red pines (*Pinus resinosa*), with a dense shrub layer of beaked hazelnut (*Corylus cornuta*). There may be a long-term concern for this forest as the pines cannot reproduce under the dense shade of the shrubs and hardwood saplings. Natural disturbances (such as fire) that formerly occurred here and ultimately benefitted shade intolerant species may no longer be acceptable. Pine plantations adjoin the natural forest and it would be desirable to eventually phase these out, restoring open dune vegetation or pine forest, whichever is most appropriate.

Resident birds include pine, black-throated green, and yellow-rumped warblers, ovenbird, red-breasted nuthatch, hermit thrush, and, possibly, merlin. This site will require both vigilance and active management to maintain and protect the many valuable natural features present.

Allouez Bay. Allouez Bay is situated between the City of Superior's east-side neighborhood of Allouez and Wisconsin Point (**Fig. 65**). The eastern end of the bay is shallow and contains a large marsh, with patches of sedge meadow and a drowned tamarack swamp present near the base of Wisconsin Point. Several small streams, including Bear Creek and Bluff Creek, empty into the bay. A portion of the wetland at the head of the bay, but now cut off by the access road to Wisconsin Point, was filled in the past.

The marsh is dominated by tall graminoids, such as bur-reeds (*Sparganium eurycarpum*), bulrushes (*Scirpus validus*, *S. americanus*), spikerush (*Eleocharis smallii*), sedges (*Carex lacustris*, *C. aquatilis*), and cattails (*Typha* spp.). Broad-leaved arrowhead (*Sagittaria latifolia*) is also among the dominants. Other characteristic plant species include water horsetail (*Equisetum fluviatile*), water parsnip (*Sium suave*), and water hemlock (*Cicuta* spp.). Deep areas within and on the margins of the emergent marsh support floating-leaved and submergent aquatic macrophytes, especially coontail (*Ceratophyllum demersum*), pondweeds (*Potamogeton* spp.), common bladderwort (*Utricularia macrorhiza*), and yellow water lily (*Nuphar variegatum*). The uncommon small-leaved yellow water lily (*Nuphar microphyllum*) occurs in the deepest waters of the bay capable of supporting rooted aquatic vegetation. The portions of the wetland nearest the shore are dominated by sedges (especially *Carex lacustris*, *C. stricta*, *C. lasiocarpa*). Tamarack (*Larix laricina*) snags are scattered throughout parts of this area.

It is possible that this wetland formerly contained extensive mats of wire-leaved sedges, but that eutrophication and other disturbances led to changed conditions which aided the spread and eventual dominance of the coarser, more tolerant emergents. Nevertheless, this wetland retains high wildlife values. In the early spring, substantial numbers of waterbirds of many kinds congregate here. This site may be especially significant in years when the break-up of ice on Lake Superior is late (as it was in 1996), and little open water is available elsewhere. The marsh also supports many nesting birds, including uncommon species like American bittern, least bittern, and northern harrier. The DNR has been supporting a tern nesting habitat restoration project at Wisconsin Point-Allouez Bay and common terns, sometimes several score, were observed foraging on the bay in 1995-96.

Rare species of Wisconsin Point-Allouez Bay Marshes, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
Circus cyaneus	Northern harrier	1996	1
Deschampsia flexuosa	Crinkled hairgrass	1995	1
Equisetum palustre	Marsh horsetail	1996	1
Equisetum variegatum	Variegated horsetail	1995	1
Falco columbarius	Merlin	1994	1
Incisalia polia	Hoary elfin	1989	1
Ixobrychus exilis	Least bittern	1996	1
Lycopodium selago	Fir clubmoss	1985	1
Lycopodium sabinaefolium	Savin-leaved club moss	1996	1
Ophioglossum vulgatum var pseudopodium	Adder's-tongue	1995	1
Parnassia palustris	Marsh grass-of-Parnassus	1996	1
Ribes oxycanthoides	Canada gooseberry	1995	1
Spermophilus franklinii	Franklin's ground squirrel	1996	1
Sterna hirundo	Common tern	1996	1
Sympetrum danae	Black meadowhawk	1989	1
Thalictrum venulosum	Veined meadowrue	1990	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Divide Swamp

Douglas County

USGS 7.5' Quadrangle: Bennet

This complex of lowland forests, shrub swamp, and springs is the headwaters region of both the St. Croix and Brule rivers (**Fig. 66**). The diverse lowland forests include stands of tamarack (*Larix laricina*), white cedar (*Thuja occidentalis*), black spruce (*Picea mariana*), and black ash (*Fraxinus nigra*). The sandy, rolling uplands are intensively managed for trembling aspen (*Populus tremuloides*) and pine (*Pinus* spp.). Much of the latter is grown in plantations. County Trunk Highway P crosses the site from north to south.

The mature tamarack swamp is even-aged and has few canopy associates. The understory features a well-developed layer of tall shrubs, especially speckled alder (*Alnus incana*). Saplings are mostly black ash (*Fraxinus nigra*), with occasional balsam fir (*Abies balsamea*). Representative herbs include the sedges *Carex disperma*, *C. leptalea*, and *C. vaginata*, manna grass (*Glyceria striata*), cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), marsh marigold (*Caltha palustris*), and the violets *Viola cucullata* and *V. pallens*. *Sphagnum* and other mosses are significant in parts of this community. Small pools are frequent where there is a hummock-hollow microtopography. Several rare plants occur here.

The white cedar-dominated (*Thuja occidentalis*) forest is quite extensive. Though evidence of past logging was noted, the canopy has closed and recent disturbance is mostly due to heavy browse by white-tailed deer. Trees are mostly in the 9"-15" d.b.h. size class but larger individuals are occasionally encountered. Generally drier than the tamarack swamp, understory plants include goldthread (*Coptis trifolia*), bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), sedges and mosses. Where black spruce (*Picea mariana*) becomes dominant, the understory often includes many ericaceous shrubs,

such as Labrador tea (*Ledum groenlandicum*), blueberries (*Vaccinium angustifolium*, *V. myrtilloides*), leatherleaf (*Chamaedaphne calyculata*) and creeping snowberry (*Gaultheria hispidula*). The moss layer is well-developed and includes a number of *Sphagnum* spp.

Several small rectangular clearcuts occurred in the 1970s just east of County Trunk Highway P, close to the Brule River. Each of these was given a different post-cutting treatment to study regeneration of white cedar (*Thuja occidentalis*). None of the treatments appeared successful, but it would be worthwhile to examine this problem in considerably more detail, as cedar reproduction is as poor throughout the Lake Superior drainage basin as it is elsewhere in Wisconsin. The cedar forests of the Brule River are major repositories of biodiversity and their loss would be of great significance.

Black ash (*Fraxinus nigra*) is the primary canopy component of the site's hardwood swamps. Tree size, canopy closure, and shrub/sapling density are all variable. Common understory plants are speckled alder (*Alnus incana*), manna grass (*Glyceria striata*), marsh marigold (*Caltha palustris*), bluejoint grass (*Calamagrostis canadensis*), sensitive fern (*Onoclea sensibilis*), crested shield fern (*Dryopteris cristata*) and sedges (*Carex* spp.).

Divide Swamp is within the Brule River State Forest and its ecological attributes should be thoroughly evaluated prior to committing to any management decisions. As a new master plan for the Brule River State Forest is scheduled to be developed in the near future, that would be an appropriate time to consider the site's values.

Rare species of Divide Swamp, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Aeshna tuberculifera</i>	Black-tipped damer	1996	1
<i>Caenis youngi</i>	A caenid mayfly	1996	1
<i>Callitriche hermaphroditica</i>	Autumnal water-starwort	1996	1
<i>Callitriche heterophylla</i>	Large water-starwort	1996	1
<i>Carex tenuiflora</i>	Sparse-flowered sedge	1996	2
<i>Carex vaginata</i>	Sheathed sedge	1996	1
<i>Cypripedium parviflorum</i>	Small yellow lady's-slipper	1996	1
<i>Epilobium palustre</i>	Marsh willow-herb	1996	2
<i>Hydroporus pseudovilis</i>	A predaceous diving beetle	1996	1
<i>Lycopodium selago</i>	Fir clubmoss	1996	1
<i>Pandion haliaetus</i>	Osprey	1996	1
<i>Ribes hudsonianum</i>	Northern black currant	1996	2

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Brule Spillway

Douglas County

USGS 7.5' Quadrangle: Lake Minnesuing

This six-mile stretch of the Brule River features an extensive conifer swamp, shrub swamp, sedge meadow, and numerous springs and spring runs (**Fig. 67**). The site also contains several stands of old-growth white (*Pinus strobus*) and red pine (*P. resinosa*), an extremely rare successional stage of this formerly widespread community.

The conifer swamp is dominated by white cedar (*Thuja occidentalis*), with balsam fir (*Abies balsamea*), tamarack (*Larix laricina*), black spruce (*Picea mariana*), and black ash (*Fraxinus nigra*) the major associates. Some stands are in or are approaching old-growth condition. The sapling layer is composed mostly of fir, with black ash (*Fraxinus nigra*) locally common. Cedar seedlings are common but saplings are very rare. Important shrubs include mountain maple (*Acer spicatum*), speckled alder (*Alnus incana*), and alder-leaved buckthorn (*Rhamnus alnifolia*). A few small patches of Canada yew (*Taxus canadensis*) are present. The vascular flora is quite rich. Among the common herbs and low shrubs are goldthread (*Coptis trifolia*), twinflower (*Linnaea borealis*), Labrador tea (*Ledum groenlandicum*), bunchberry (*Cornus canadensis*), and many sedges and orchids. Rich lichen and bryophyte flora also occur here.

Many species of rare plants are found here, including lapland buttercup (*Ranunculus lapponicus*), fairy slipper (*Calypso bulbosa*), northern black currant (*Ribes hudsonianum*), small yellow lady's-slipper (*Cypripedium parviflorum*), and sheathed sedge (*Carex vaginata*).

Rare species of Brule Spillway, Douglas County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Accipiter gentilis</i>	Northern goshawk	1996	1
<i>Ammodramus leconteii</i>	LeCoonte's sparrow	1996	1
<i>Callitriche hermaphroditica</i>	Autumnal water-starwort	1996	1
<i>Calypso bulbosa</i>	Fairy slipper	1996	4
<i>Cartelist pinus</i>	Pine siskin	1996	1
<i>Carex vaginata</i>	Sheathed sedge	1996	7
<i>Coccothraustes vespertinus</i>	Evening grosbeak	1997	1
<i>Cypripedium parviflorum</i>	Small yellow lady's-slipper	1996	7
<i>Dendroica tigrina</i>	Cape may warbler	1996	3
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	2
<i>Epilobium palustre</i>	Marsh willow-herb	1996	7
<i>Haliaeetus leucocephalus</i>	Bald eagle	1995	2
<i>Oeneis jutta ascerta</i>	Jutta arctic	1996	1
<i>Perisoreus canadensis</i>	Gray jay	1997	1
<i>Picoides arcticus</i>	Black-backed woodpecker	1996	1
<i>Ranunculus lapponicus</i>	Lapland buttercup	1996	2
<i>Ribes hudsonianum</i>	Northern black currant	1996	6
<i>Somatochlora elongata</i>	Ski-tailed emerald	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Bibon Swamp

Bayfield County

USGS 7.5' Quadrangles: Grand View NW, Mason

Bibon Swamp is a vast wetland of over 10,000 acres within the drainage of the White River (**Fig. 68**). The western portion of the site is a mosaic of several extensive wetland communities of generally good quality: a rich wet-mesic conifer swamp dominated by white cedar (*Thuja occidentalis*); a much more acid peaty swamp of black spruce (*Picea mariana*) and tamarack (*Larix laricina*); a hardwood swamp of black ash (*Fraxinus nigra*); and large stands of tall shrubs, especially speckled alder (*Alnus incana*) and willows (*Salix* spp.). Other communities of significance though of lesser areal extent are: northern sedge meadow composed of *Carex* spp. and bluejoint grass (*Calamagrostis canadensis*); and patches or strips of riparian hardwoods composed of American elm (*Ulmus americana*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and box elder (*Acer negundo*) along the White River.

The white cedar swamp canopy is made up of mostly medium-size trees (9-15" d.b.h. size class). Trunk corings revealed that at least parts of this stand are in excess of 150 years old. Saplings are mostly of black ash (*Fraxinus nigra*) and balsam fir (*Abies balsamea*), with cedar reproduction limited to small seedlings. A tall shrub layer of moderate density is composed of mountain maple (*Acer spicatum*), alder buckthorn (*Rhamnus alnifolia*), and speckled alder (*Alnus incana*). Representative herbs and low shrubs include bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*), small bishop's cap (*Mitella nuda*), and dwarf raspberry (*Rubus pubescens*). A number of orchid taxa are scattered through portions of this forest. Mosses of several genera form a surface cover which is broken by pools of muck and occasional spring runs. Overall, groundlayer species richness is high. Resident birds include Nashville, parula and Canada warblers, northern waterthrush, and winter wren. Deer remains were noted in the interior of the stand, victims of the harsh winter of 1995-96. This community is located south of the White River near the western edge of the site.

Bordering the cedar swamp on the extreme western edge of the site is a wet forest of mature black ash (*Fraxinus nigra*). In portions of this forested wetland the trees grow on low hummocks, which are separated by pools of soupy muck. The ash is represented in all vegetative strata. Characteristic groundlayer species are speckled alder (*Alnus incana*), fowl manna grass (*Glyceria striata*), sensitive fern (*Onoclea sensibilis*), orange touch-me-not (*Impatiens biflora*), lake sedge (*Carex lacustris*), and wood nettle (*Laportea canadensis*). Poison ivy (*Rhus radicans*) is abundant (maddeningly so!) in some areas. Red-eyed vireo, black-and-white warbler, Nashville warbler, and veery are common in this forest.

North of the river conditions are very different and there is a large complex of acid peatland communities including open bog, muskeg, and black spruce swamp. The more open areas are characterized by scattered, stunted black spruce (*Picea mariana*) with some tamarack (*Larix laricina*). Deep sphagnum hummocks form a continuous ground cover, upon which ericaceous shrubs grow including leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), and small cranberry (*Vaccinium oxycoccos*). Common herbs include the sedges *Carex oligosperma*, *C. pauciflora*, and *C. paupercula*, and *Eriophorum spissum*. Where the canopy of spruce is more closed, Labrador tea (*Ledum groenlandicum*), three-leaved false Solomon's seal (*Smilacina trifolia*), and three-seeded sedge (*Carex trisperma*) are common understory members.

From the air it was apparent that the depth of the sphagnum peat has formed a dome, somewhat isolating the peatland vegetation from the influence of mineral rich groundwater or runoff from the uplands. A ring of large tamarack (*Larix laricina*) encircles the bog, and beyond that is a minerotrophic shrub

swamp of alder (*Alnus* spp.) and willow (*Salix* spp.). Among the resident birds of these coniferous peatlands are palm warbler, Lincoln's sparrow, white-throated sparrow, yellow-bellied flycatcher, sharp-shinned hawk, and boreal chickadee.

The shrub swamps are vast, densely structured, and very difficult to cross. In some places, especially to the east, they may be a result of the combined impacts of disrupted hydrology, past logging, fire suppression, and natural succession. Stumps and remnants of open sedge meadows give evidence of historical changes in the vegetation. Dominant or characteristic species include slender willow (*Salix gracilis*), red-osier dogwood (*Cornus stolonifera*), speckled alder (*Alnus incana*), meadowsweet (*Spiraea alba*), rough bedstraw (*Galium asprellum*), and many sedges (*Carex* spp.). Representative species of the open meadows are lake sedge, tussock sedge (*Carex stricta*), bluejoint grass (*Calamagrostis canadensis*), spotted joe-pye-weed (*Eupatorium maculatum*), flat-topped aster (*Aster umbellatus*), marsh marigold (*Caltha palustris*), marsh bellflower (*Campanula aparinoides*), and fringed brome (*Bromus ciliatus*). Occasional tamarack (*Larix laricina*), balsam poplar (*Populus balsamifera*), and trembling aspen (*P. tremuloides*) rise above the shrub canopy.

Birds present in the shrub and meadow stands are common yellowthroat, yellow warbler, gray catbird, alder flycatcher, mourning warbler, golden-winged warbler, sedge wren, common snipe, woodcock, ruffed grouse, and black-billed cuckoo.

This site has considerable intrinsic value owing to its size, roadlessness, and the quality of some of its communities. It also supports at least seven rare plant and animal species. Formerly disturbed areas are recovering in some places, but seem to be in a holding pattern in others. Agricultural lands adjacent to the wetlands could pose runoff problems. White cedar (*Thuja occidentalis*) is not successfully reproducing due to heavy browse pressure. This site also supports a valuable sport fishery, and is fed by small streams and springs coming from the south and west. Bibon Swamp is a vital connecting link between the extensive forests to the south and the Bad River corridor downstream. Maintenance of high water quality and streamside vegetation, especially along the White River, is critical throughout the watershed.

Rare species of Bibon Swamp, Bayfield County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Clemmys insculpta</i>	Wood turtle	1986	2
<i>Cypripedium reginae</i>	Showy lady's-slipper	1996	1
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	2
<i>Equisetum palustre</i>	Marsh horsetail	1970	1
<i>Parus hudsonicus</i>	Boreal chickadee	1996	1
<i>Petasites sagittatus</i>	Arrow-leaved sweet-coltsfoot	1996	2
<i>Viola novae-angliae</i>	New England violet	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Port Wing

Bayfield County

USGS 7.5' Quadrangles: Port Wing, Herbster

This large complex of wetlands, forested sand ridges, beach and open dune, occurs at the mouth of the Flag River adjacent to the Village of Port Wing. A large slough, Bibon Lake, is situated within the southwestern portion of the site (Fig. 69). Significant communities include coastal fen, coastal bog, lake dune, tamarack swamp, and several stands of dry pine forest with a strong boreal flavor. Overall quality of the natural communities is good to excellent. At least twelve species of rare plants and animals have been documented here including the state's only known population of fly honeysuckle (*Lonicera involucrata*).

The fen community consists of a floating mat of sedges, dominated by woolly sedge (*Carex lasiocarpa*). Important associates are twig rush (*Cladium mariscoides*), sweet gale (*Myrica gale*), and buckbean (*Menyanthes trifoliata*). The coastal bog fringes the margins of the uplands, with a mat of *Sphagnum* mosses, ericaceous shrubs, and sedges. It contains a number of species not typically found in truly ombrotrophic bogs, such as buckbean, mud sedge (*Carex limosa*), white and sooty beak-rushes (*Rhynchospora alba*, *R. fusca*), livid sedge (*Carex livida*), and speckled alder (*Alnus incana*). Small tamarack (*Larix laricina*) are scattered unevenly through this community. The tamarack swamp consists of three stands, each with an even-aged canopy of mature tamarack, a dense tall shrub layer of speckled alder, and a diverse low shrub/herb/bryophyte flora. The sandspits and ridges are forested with a mixture of red pine (*Pinus resinosa*), white pine (*P. strobus*), black spruce (*Picea mariana*), and balsam fir (*Abies balsamea*). The stands east of the Flag River are in or approaching old-growth condition. Along the Lake Superior shore, dune and beach communities occur.

Partially protected via a State Natural Area designation, management and protection of the site's natural features will present many challenges. Potential problems include: spread of the aggressive giant reed grass (*Phragmites australis*) which is well-established in the open peatlands around Bibon Lake; diminished water quality due to effluent discharge from the village sewage ponds into Bibon Lake; encroachment of developments into sensitive areas; disruption of coastal processes including longshore sediment transport by the jetties at the mouth of the river; and successional changes to the fire-dependent pine (*Pinus* spp.) forests. A more comprehensive management and monitoring plan is needed, with participation from appropriate agency personnel, local governments, conservation organizations, and private citizens.

Rare species of Port Wing, Bayfield County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Aeshna eremita</i>	Lake darner	1989	1
<i>Arethusa bulbosa</i>	Swamp-pink	1995	1
<i>Botaurus lentiginosus</i>	American bittern	1996	1
<i>Carex tenuiflora</i>	Sparse-flowered sedge	1995	1
<i>Carex livida</i> var <i>radicaulis</i>	Livid sedge	1995	1
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	2
<i>Lonicera involucrata</i>	Fly honeysuckle	1995	1
<i>Lycaena epixanthe</i>	Bog copper	1996	2
<i>Platanthera dilatata</i>	Leafy white orchis	1995	1
<i>Rhynchospora fusca</i>	Brown beak-rush	1995	2
<i>Sympetrum danae</i>	Black meadowhawk	1989	1
<i>Triglochin maritimum</i>	Common bog arrow-grass	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Bark Bay

Bayfield County

USGS 7.5' Quadrangle: Bark Bay

This large complex of coastal barrier spit, lagoon, springs, and wetlands occupies an embayment between two rocky headlands (**Fig. 70**). The wetlands are extensive and include two major types; coastal fen and coastal bog. The fen dominants are woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), sweet gale (*Myrica gale*), water horsetail (*Equisetum fluviatile*) and buckbean (*Menyanthes trifoliata*). The coastal bog is composed of a mat of *Sphagnum* mosses, ericaceous shrubs, sedges, and scattered small tamarack (*Larix laricina*). Both communities are floristically diverse, in excellent condition, and support many rare species. Among the latter are plants, birds, and butterflies. A large lagoon occupies the center of the site and supports submergent and floating-leaved aquatic macrophytes. A forested interior spit parallel to the coastal barrier spit breaks the wetlands into two major sections. Communities are similar on both sides of the interior spit but the interior wetlands lack a central lagoon. Other significant features include a narrow strip of dry pine forest on the coastal spit, springs associated with the mouth of the Bark River on the eastern edge of the site, and small stands of tamarack and tall shrubs.

Birds present during the breeding season included bald eagle, merlin, northern harrier, yellow rail, sandhill crane, Brewer's blackbird, and American bittern. Substantial numbers of migrating shorebirds were noted after late June through August in both 1995 and 1996.

This site is a protection priority as its wetlands are extensive, in excellent condition, and support many rare, uncommon, and representative species. The unnamed inlet stream on the west side of the site is bordered by several large clones of the invasive giant reed grass (*Phragmites australis*). This species should be monitored, and controlled if necessary. A portion of the site is designated as a State Natural Area but the boundary is not adequate to prevent negative impacts associated with increased development in the area. A broader view of the local watershed and the land uses therein is desirable to assess and better anticipate/address threats and protection needs.

Rare species of Bark Bay, Bayfield County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Arethusa bulbosa</i>	Swamp-pink	1995	1
<i>Boloria eunomia</i>	Bog fritillary	1996	1
<i>Botaurus lentiginosus</i>	American bittern	1996	1
<i>Callitriche hermaphroditica</i>	Autumnal water-starwort	1995	1
<i>Carex livida</i> var <i>radicaulis</i>	Livid sedge	1995	1
<i>Carex michauxiana</i>	Michaux sedge	1995	1
<i>Carex tenuiflora</i>	Sparse-flowered sedge	1995	1
<i>Coturnicops noveboracensis</i>	Yellow rail	1996	1
<i>Deschampsia flexuosa</i>	Crinkled hairgrass	1995	1
<i>Epilobium strictum</i>	Downy willow-herb	1988	1
<i>Lycaena epixanthe</i>	Bog copper	1996	1
<i>Myriophyllum farwellii</i>	Farwell's water-milfoil	1974	1
<i>Phyciodes batesii</i>	Tawny crescent spot	1991	1
<i>Platanthera orbiculata</i>	Large roundleaf orchid	1996	1
<i>Rhynchospora fusca</i>	Brown beak-rush	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Lost Creek

Bayfield County

USGS 7.5' Quadrangle: Bark Bay

This estuarine complex is located at the drowned mouths of three small creeks, just south of Lake Superior (Fig. 71). A forested coastal barrier spit separates the site from the lake. Sandstone headlands flank the sandspit and estuary to the east and west. The major communities within the site are coastal fen, coastal bog, and shrub swamp. The lagoon at the junction of the creeks contains significant stands of emergent, submergent, and floating-leaved aquatic macrophytes. A mature dry forest of pine and spruce occurs on the sandspit, upon which a number of cabins and an access road have been built. The eastern end of the complex is forested with a shrubby second-growth stand of white cedar (*Thuja occidentalis*) and black ash (*Fraxinus nigra*). Resident birds include merlin, sedge wren, and yellow-bellied flycatcher.

The fen community is well-developed on the west and north sides of the lagoon. The mat is composed of woolly sedge (*Carex lasiocarpa*), livid sedge (*C. livida*), buckbean (*Menyanthes trifoliata*), sweet gale (*Myrica gale*), and cotton grass (*Scirpus hudsonianus*). Boggier areas with more firmly grounded moss peat are composed of *Sphagnum* spp., ericaceous shrubs, and sedges. Community boundaries are quite indistinct between these types at this site. The emergent marsh is composed of lake sedge (*Carex lacustris*), water arum (*Calla palustris*), marsh cinquefoil (*Potentilla palustris*), and broad-leaved cattail (*Typha latifolia*). Characteristic submergent and floating-leaved species are a floating-leaved bur-reed (*Sparganium fluctuans*), water-milfoils (*Myriophyllum* spp., including *M. verticillatum*), yellow water lily (*Nuphar variegatum*), common bladderwort (*Utricularia macrorhiza*), water-marigold (*Megalodonta beckii*), and pondweeds (*Potamogeton* spp.).

Though not a large site, at least fourteen rare species of plants, birds, and butterflies were documented here over the course of the project. Among the rarities is one of only two established populations in Wisconsin of the regionally rare lake cress (*Armoracia lacustris*). A portion of this site is designated as a State Natural Area, but increasing developments on the sandspit adjacent to the wetlands could threaten water quality and make the area unsuitable for sensitive species. Increased powerboat traffic in the lagoon could damage the aquatic beds and lead to the inadvertent introduction of invasive species. Promoting awareness of this site's values with local residents should be a priority for those with stewardship responsibilities.

Rare species of Lost Creek, Bayfield County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Arethusa bulbosa</i>	Swamp-pink	1995	1
<i>Armoracia lacustris</i>	Lake cress	1996	1
<i>Boloria eunomia</i>	Bog fritillary	1996	1
<i>Carex tenuiflora</i>	Sparse-flowered sedge	1995	1
<i>Carex livida</i> var <i>radicaulis</i>	Livid sedge	1995	1
<i>Coccythraustes vespertinus</i>	Evening grosbeak	1996	1
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	1
<i>Falco columbarius</i>	Merlin	1996	1
<i>Incisalia polia</i>	Hoary elfin	1989	1
<i>Lycaena epixanthe</i>	Bog copper	1996	2
<i>Platanthera hookeri</i>	Hooker orchis	1991	1
<i>Platanthera dilatata</i>	Leafy white orchis	1995	1
<i>Rhynchospora fusca</i>	Brown beak-rush	1995	1
<i>Triglochin maritimum</i>	Common bog arrow-grass	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Sand Bay

Bayfield County

USGS 7.5' Quadrangle: Sand Island

The drowned mouth of the Sand River is bordered by a complex of wetlands separated from Lake Superior by a forested sandspit (**Fig. 72**). The lower portions of the stream are bordered by northern sedge meadow and alder thicket. West of the lagoon at the stream's outlet are several spring runs. East of the lagoon is a peatland with coastal fen, coastal bog, and tamarack swamp. Ownership is mostly by the National Park Service. The Red Cliff Band of Lake Superior Chippewa hold title to the forested spit west of the river mouth. Rocky headlands with significant outcroppings of sandstone cliffs occur on either side of Sand Bay. Most of the watershed is forested and undeveloped.

Most of the open peatland is a coastal bog composed of *Sphagnum* mosses, ericaceous shrubs, sedges, and insectivorous plants. Common vascular species include leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), woolly sedge (*Carex lasiocarpa*), pitcher plant (*Sarracenia purpurea*), mud sedge (*Carex limosa*), white beak-rush (*Rhynchospora alba*), small cranberry (*Vaccinium oxycoccos*), and scattered sapling-size tamarack (*Larix laricina*). A very wet mat within the sphagnum community between the sandspit and tamarack swamp is composed mostly of woolly sedge, with very low moss cover. Associates of this coastal fen include livid sedge (*Carex livida*), sooty beak-rush (*Rhynchospora fusca*), intermediate sundew (*Drosera intermedia*), water horsetail (*Equisetum fluviatile*), bog arrow-grass (*Triglochin maritimum*), and intermediate bladderwort (*Utricularia intermedia*). Buckbean (*Menyanthes trifoliata*) and sweet gale (*Myrica gale*) are common throughout both open peatland communities. The tamarack swamp is composed of small trees over a dense layer of speckled alder (*Alnus incana*). Leatherleaf, lake sedge (*Carex lacustris*), water horsetail, dwarf raspberry (*Rubus pubescens*), and marsh cinquefoil (*Potentilla palustris*) are common understory species.

Rare species of Sand Bay, Bayfield County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Arethusa bulbosa</i>	Swamp-pink	1995	2
<i>Boloria eunomia</i>	Bog fritillary	1996	1
<i>Callitriche hermaphroditica</i>	Autumnal water-starwort	1988	1
<i>Carex livida</i> var <i>radicaulis</i>	Livid sedge	1995	1
<i>Carex tenuiflora</i>	Sparse-flowered sedge	1995	1
<i>Coccothraustes vespertinus</i>	Evening grosbeak	1996	1
<i>Deschampsia flexuosa</i>	Crinkled hairgrass	1990	1
<i>Eleocharis robbinsii</i>	Robbins spikerush	1988	1
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	1
<i>Epilobium palustre</i>	Marsh willow-herb	1988	1
<i>Epilobium strictum</i>	Downy willow-herb	1988	1
<i>Listera convallarioides</i>	Broad-leaved twayblade	1992	1
<i>Lycaena epixanthe</i>	Bog copper	1996	1
<i>Oporornis agilis</i>	Connecticut warbler	1996	1
<i>Perisoreus canadensis</i>	Gray jay	1996	1
<i>Platanthera orbiculata</i>	Large roundleaf orchid	1992	1
<i>Rhynchospora fusca</i>	Brown beak-rush	1995	1
<i>Vermivora peregrina</i>	Tennessee warbler	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Red Cliff Reservation

Bayfield County

USGS 7.5' Quadrangles: Sand Island, York Island

The Reservation of the Red Cliff Band of Lake Superior Chippewa occupies the northeastern margin of the Bayfield Peninsula. Surveys were not initiated until July 1996 when a number of sites within the Reservation boundary were inventoried for natural communities and rare flora. Currently, we are in the process of developing a data sharing agreement with the Red Cliff Band of Lake Superior Chippewa. Until this agreement is in place, we will not be computerizing data or identifying locations for natural communities or rare species populations found on the Reservation.

Among the outstanding features within the Reservation boundary, several are especially important. These include two undisturbed wetland complexes containing coastal fen, coastal bog, northern sedge meadow, lagoon, and dry pine forest. Each of these sites harbors a diverse flora with significant populations of rare plants. Though we were unable to survey animals formally, we did obtain incidental records of rare birds and butterflies while conducting vegetation work at these sites. Future faunal surveys are a priority.

Wave-sprayed sandstone cliffs and ledges are prominent and characteristic features of the northern Bayfield Peninsula. Some of the most extensive and ecologically significant outcroppings occur within the Reservation. These sites are inhabited by a number of rare plants, most of which are habitat specialists and do not grow in other habitats.

Also of regional significance are the mature stands of hemlock-hardwoods. Most stands of this regionally widespread forest type have been severely altered owing to repeated episodes of intensive logging. Many stands have entirely lost their complement of native conifers, as well as their structural diversity. A number of uncommon and/or geographically restricted plants, several of them of Special Concern in Wisconsin, occur primarily in these mature stands, especially when they are associated with deep ravines. The Red Cliff Reservation and Apostle Islands National Lakeshore presently maintain the majority of the older hemlock-hardwoods forest remaining in the region. It is worth noting that such stands near Lake Superior typically include species absent from this forest type in other regions, such as white spruce (*Picea glauca*), white cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), showy mountain ash (*Sorbus decora*), and thimbleberry (*Rubus parviflorus*). Future analysis may indicate that the Lake Superior hemlock-hardwoods warrant recognition as distinct natural communities, or at the least, as important regional variants.

The Sand River supports regionally significant diversity among its aquatic macroinvertebrates. This should be an important management consideration across administrative boundaries, as few of the area's streams are confined to a single-owner watershed.

Sultz Swamp

Bayfield County

USGS 7.5' Quadrangle: Mt. Ashwabay

This acid peatland occupies a depression high on the Bayfield Peninsula approximately six miles inland from the Lake Superior coast. Although there are other, similar wetlands in this part of the basin, Sultz Swamp is the largest and embedded within vast stretches of county-owned forest (**Fig. 73**). The major features of this insular peatland include a mature forest of black spruce (*Picea mariana*), an extensive muskeg/open bog, and large populations of several rare species. Disturbances to the interior of the site have been minimal, with the exception of a maintained power line corridor which crosses the area east-west. White cedar (*Thuja occidentalis*) logs were removed from the minerotrophic margins of the wetland in the distant past.

Underneath its closed canopy, the spruce forest is very open and park-like. Characteristic understory plants are Labrador tea (*Ledum groenlandicum*), three-leaved false Solomon's-seal (*Smilacina trifolia*), creeping snowberry (*Gaultheria hispidula*), moccasin flower (*Cypripedium acaule*), blueberries (*Vaccinium angustifolium*, *V. myrtilloides*), and the sedges *Carex paupercula* and *C. trisperma*. A level carpet of *Sphagnum* mosses covers the surface. Canopy gaps are filled with thickets of young black spruce or tamarack (*Larix laricina*).

Where peat has accumulated and forms a deep, hummocky layer of sphagnum, the spruce and tamarack become scattered and often stunted. The understory is dominated by ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), and small cranberry (*Vaccinium oxycoccos*). Dense patches of blueberries also occur, perhaps evidence of past fire. The presence of gnarly jack pine (*Pinus banksiana*) among the stunted spruces also hints at a fire history. Common sedges of the open bog and muskeg include the cotton grasses *Eriophorum spissum* and *E. virginicum*, plus *Carex oligosperma* and *C. pauciflora*. Of special interest is a large population of the Wisconsin Threatened Michaux's sedge (*Carex michauxiana*).

Among the resident birds are solitary vireo, yellow-bellied flycatcher, ruby-crowned kinglet, Lincoln's sparrow, and palm warbler. Large numbers of white-winged crossbills were noted in July 1996, but breeding was not confirmed. A rare butterfly, the Dorcas copper (*Lycaena dorcas*), was collected here in 1996.

The site is county-owned and merits serious consideration for special management designation in the county forest plan. Managers should work with the utility responsible for maintaining the power line corridor to ensure that introduction of invasive species is avoided and that no harmful chemicals are used in keeping the corridor open.

Rare species of Sultz Swamp, Bayfield County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Arethusa bulbosa</i>	Swamp-pink	1996	1
<i>Carex michauxiana</i>	Michaux sedge	1996	1
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	1
<i>Lycaena dorcas</i>	Dorcas copper	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Bayview Beach-Sioux River Slough

Bayfield County

USGS 7.5' Quadrangle: Washburn

The wetland complex at the Sioux River mouth includes emergent marsh and alder thicket communities. North of the river mouth is a narrow, mile-long peaty swale between two parallel sandspits (**Fig. 74**). Major swale communities are an acid, weakly minerotrophic coastal bog and a wet coastal fen. The beach ridges are forested with white (*Pinus strobus*) and red pines (*P. resinosa*), balsam fir (*Abies balsamea*), and paper birch (*Betula papyrifera*). Many rare plants and animals occur at the site. Use by migratory birds can be significant, especially in the spring. A large cliff swallow colony with approximately 100 active nests is present under the State Trunk Highway 13 bridge across the Sioux River.

The coastal bog is composed of *Sphagnum* mosses, ericaceous shrubs, and sedges, with scattered small tamarack (*Larix laricina*), plus species such as speckled alder (*Alnus incana*), royal fern (*Osmunda regalis*), and bog willow (*Salix pedicellaris*). Wetter portions of the swale, support a mat of woolly sedge (*Carex lasiocarpa*) with buckbean (*Menyanthes trifoliata*), sweet gale (*Myrica gale*) and water horsetail (*Equisetum fluviatile*). The emergent marsh at the Sioux River mouth consists of bur-reed (*Sparganium eurycarpum*), soft-stemmed bulrush (*Scirpus validus*), cattails (*Typha* spp.), lake sedge (*Carex lacustris*), and water arum (*Calla Palustris*).

Threats include the spread of giant reed grass (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*), disruption of hydrology and water chemistry, overuse by recreationalists, and maintenance activities on State Trunk Highway 13. Recommendations include development of a management and protection plan with the township, DNR Bureaus of Fish Management and Endangered Resources, and Wisconsin Department of Transportation. Plan should provide for periodic monitoring of water quality, and both rare and invasive plant species.

Rare species of Bayview Beach-Sioux River Slough, Bayfield County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Arethusa bulbosa</i>	Swamp-pink	1995	1
<i>Boloria eunomia</i>	Bog fritillary	1996	1
<i>Callitriche hermaphroditica</i>	Autumnal water-starwort	1981	1
<i>Carex tenuiflora</i>	Sparse-flowered sedge	1995	1
<i>Carex livida</i> var <i>radicaulis</i>	Livid sedge	1995	1
<i>Epilobium palustre</i>	Marsh willow-herb	1988	1
<i>Epilobium strictum</i>	Downy willow-herb	1988	1
<i>Falco columbarius</i>	Merlin	1990	1
<i>Listera auriculata</i>	Auricled twayblade	1996	1
<i>Lycaena epixanthe</i>	Bog copper	1996	1
<i>Oporornis agilis</i>	Connecticut warbler	1996	1
<i>Platanthera orbiculata</i>	Large roundleaf orchid	1996	1
<i>Triglochin maritimum</i>	Common bog arrow-grass	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Fish Creek Sloughs

Bayfield and Ashland counties

USGS 7.5' Quadrangle: Ashland West

The drowned mouth of Fish Creek and its associated wetlands occupy the head of Chequamegon Bay. Located on the outskirts of the City of Ashland and crossed by busy U.S. Highway 2, this site has been subjected to many disturbances in the past and remains vulnerable to further deterioration unless efforts to address problems are maintained (**Fig. 75**). The primary wetland communities are emergent marsh, shrub swamp, and hardwood swamp. The open waters of the "sloughs" also constitute an important feature. This wetland is particularly dynamic, owing to the funnel shape of Chequamegon Bay, and the seiche activity which causes frequent and sometimes substantial short-term water level changes.

The emergent marsh occupies several hundred acres close to the creek mouth. Dominants include bur-reed (*Sparganium eurycarpum*), soft-stemmed bulrush (*Scirpus validus*), arrowheads (*Sagittaria latifolia*, *S. rigida*), lake sedge (*Carex lacustris*), and cattails (*Typha* spp.). *Carex aquatilis* is locally abundant. Beds of submergent and floating-leaved aquatic macrophytes occur in the open waters of the sloughs and intermingle with the emergents where conditions are suitable. Widespread members of this group are coontail (*Ceratophyllum demersum*), waterweed (*Elodea canadensis*), yellow water lily (*Nuphar variegatum*), and Richardson's pondweed (*Potamogeton richardsonii*). Forked duckweed (*Lemna trisulca*) is abundant in backwaters protected from currents. The exotic and aggressive purple loosestrife (*Lythrum salicaria*) is still widespread but its presence appears considerably diminished following several years of control efforts.

The marsh grades into a shrub swamp of speckled alder (*Alnus incana*) and willows (*Salix* spp.) to the south. The shrub swamp gives way to an extensive forest of swamp hardwoods composed of black ash (*Fraxinus nigra*), green ash (*F. pennsylvanica*), and box elder (*Acer negundo*).

In the shallow waters of the bay, just north of the mouth of Fish Creek, flats of sand and mud are exposed when the water level is low. These areas are used heavily by waterfowl, gulls, terns, and shorebirds as loafing or feeding sites. Several uncommon birds have been documented during the breeding season in the marsh and sloughs, including American bittern and red-breasted merganser. A colony of cliff swallows occurs underneath the U.S. Highway 2 bridge. The site hosts large numbers of waterbirds in the spring, especially noticeable when the bay waters are still locked in ice. Ducks, geese, swans, gulls, grebes, terns, and herons are among the groups finding suitable resting and feeding areas here when such amenities are scarce in the region.

Efforts to maintain the functional values of this site should be continued. Fish Creek Sloughs continue to have high importance as wildlife and fish habitat. Purple loosestrife (*Lythrum salicaria*) control is critical here, as bay currents and several wildlife species could serve as agents of seed dispersal, affecting other valuable wetlands in the bay ecosystem.

Rare species of Fish Creek Sloughs, Bayfield and Ashland counties.			
Scientific Name	Common Name	Year	No. of EOs*
Botaurus lentiginosus	American bittern	1996	1
Callitriche hermaphroditica	Autumnal water-starwort	1995	1
Dendroica tigrina	Cape May warbler	1996	1
Epilobium palustre	Marsh willow-herb	1989	1
Mergus serrator	Red-breasted merganser	1996	1
Migratory bird concentration site	Migratory bird concentration site	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Long Island-Chequamegon Point

Ashland County

USGS 7.5' Quadrangles: Long Island, Chequamegon Point

Western Lake Superior's most extensive and least disturbed coastal barrier spit separates the waters of Chequamegon Bay from Lake Superior (**Fig. 76**). The natural dynamics of erosion and deposition are expressed in changed size and shape of the spit over time. An especially vivid example of this occurred following a severe November storm in the late 1970s when Long Island and Chequamegon Point were joined. Important communities at the site include beach and lake dune, xeric forest, interdunal wetland, open bog, shrub swamp, and wet sand flats. The few developments, all on Long Island, include an automated lighthouse, an abandoned Coast Guard station and dock, and a small cabin maintained by the National Park Service.

The beach and dune system is best developed where active deposition of sand is occurring. Owing to wind, wave, and ice exposure the beaches are unvegetated. The dune vegetation is composed mostly of marram grass (*Ammophila breviligulata*) and beach-pea (*Lathyrus japonicus*). False heather (*Hudsonia tomentosa*), bearberry (*Arctostaphylos uva-ursi*), and sand cherry (*Prunus pumila*) are among the other members of the dune community. This site was the last breeding place in Wisconsin for the piping plover. It continues to attract large numbers of gulls, terns, and sometimes shorebirds and raptors. Rare dune insects, absent from other dune systems on western Lake Superior, occur here.

Most of Long Island is forested with mature stands of jack pine (*Pinus banksiana*), Hill's oak (*Quercus ellipsoidalis*), red pine (*Pinus resinosa*), and white pine (*P. strobus*). Common understory plants include Canada mayflower (*Maianthemum canadense*), blueberry (*Vaccinium angustifolium*), wintergreen (*Gaultheria procumbens*), and bracken fern (*Pteridium aquilinum*). Resident birds include bald eagle, merlin, yellow-rumped, pine, and Nashville warblers, and red-breasted nuthatch. During the spring, large numbers of passerines and raptors can migrate through this area.

While wetlands cover only a very small percentage of the site, the interdunal ponds located near the western end of Long Island are a very rare community statewide and also provide habitat for several rare plants. The bogs of the ridge and swale system on the Chequamegon Bay side of the island generally contain a subset of the common bog ericads and sedges.

The wet sand flats occur at the former gap between the point and the island, along the bay. The flora is an interesting mix of plants from many communities but also contains several that are rare or absent

elsewhere in the region such as green twayblade (*Liparis loeselii*) and nodding ladies' tresses (*Spiranthes cernua*). Other characteristic species are shore rush (*Juncus balticus*) and the sedge, *Carex viridula*. Unfortunately, the aggressive exotic purple loosestrife (*Lythrum salicaria*) is well established on the sand flats.

This site comprises the most intact coastal barrier spit system on western Lake Superior. Included are excellent examples of both rare and widespread natural communities. A number of rare species are resident here, some of them specialized to dune environments. The site is used heavily by migratory birds. Of great added significance is the role this coastal barrier spit plays in protecting the vast wetlands of the Bad and Kakagon river systems just to the south. It will be essential for the owners and stewards of these properties to continue working together to address management issues and needs.

Pressures to develop amenities and facilitate access will continue, particularly on Long Island. That portion of the site for which the National Park Service is responsible could benefit from special designation and recognition in the property management plan.

Rare species of Long Island-Chequamegon Point, Ashland County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Carex lenticularis</i>	Shore sedge	1996	3
<i>Cicindela hirticollis rhodensis</i>	Beach-dune tiger beetle	1996	2
<i>Deschampsia cespitosa</i>	Tufted hairgrass	1975	1
<i>Equisetum variegatum</i>	Variegated horsetail	1992	2
<i>Melanoplus flavidus</i>	Blue-legged grasshopper	1996	1
Migratory bird concentration site	Migratory bird concentration site	1996	2

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Big Bay

Ashland County

USGS 7.5' Quadrangle: Madeline Island

This large embayment on the eastern coast of Madeline Island contains a coastal barrier spit, beach and dunes, xeric pine forest, lagoon, and a diverse array of peatlands. The lagoon is bordered by coastal fen, coastal bog, shrub swamp, and tamarack swamp. An abandoned sandspit now three-quarters of a mile inland from Lake Superior separates a much more acid complex of peatland types, including open bog, muskeg, and black spruce swamp, from the more minerotrophic types to the east (**Fig. 77**).

The floating mat around the lagoon is composed of woolly sedge (*Carex lasiocarpa*), coast sedge (*C. exilis*--one of only four known stations statewide), twig rush (*Cladium mariscoides*), sweet gale (*Myrica gale*), and buckbean (*Menyanthes trifoliata*). Away from the lagoon the more firmly grounded mat consists of *Sphagnum* mosses, ericaceous shrubs, and a different complement of sedges. Important species include leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), bog laurel (*Kalmia polifolia*), small cranberry (*Vaccinium oxycoccos*), scheuchzeria (*Scheuchzeria palustris*), pitcher plant (*Sarracenia purpurea*), white beak-rush (*Rhynchospora alba*), sweet gale, and woolly sedge. Small tamarack (*Larix laricina*) are present, and closer to the interior spit they form a nearly closed forest of 4"-11" d.b.h. trees. Characteristic understory plants of this conifer swamp include speckled alder (*Alnus incana*), Labrador tea (*Ledum groenlandicum*), crested shield fern (*Dryopteris*

cristata), lake sedge (*Carex lacustris*), beaked sedge (*C. rostrata*), few-seeded sedge (*C. oligosperma*), three-seeded sedge (*C. trisperma*), cinnamon fern (*Osmunda cinnamomea*), and small black spruce (*Picea mariana*).

To the west of the interior spit, which supports a boreal conifer-hardwood forest, is an oddly patterned acid peatland. The interior is quite open, with deep, hummocky *Sphagnum* mosses, ericads, and a depauperate flora representative of a truly ombrotrophic community. Among the few herbs present are the sedges *Carex oligosperma*, *C. pauciflora*, *C. paupercula*, the cespitose cotton-grass *Eriophorum spissum*, and round-leaved sundew (*Drosera rotundifolia*). Stunted black spruce (*Picea mariana*) are abundant. To the east of the more open muskeg, there is a closed stand of mature black spruce. Prevalent understory species include Labrador tea (*Ledum groenlandicum*), three-seeded sedge (*Carex trisperma*), three-leaved false Solomon's seal (*Smilacina trifolia*), and creeping snowberry (*Gaultheria hispidula*). The sphagnum carpet is nearly level, and except where blowdowns have occurred, this stand was easy to traverse. Deep accumulations of sphagnum peat have apparently raised the surface of this bog enough to isolate it from the influence of the more alkaline, mineral rich waters of either Lake Superior, the substrate underlying the peatland, or runoff from the uplands. Large tamarack (*Larix laricina*) ring the bog and spruce swamp, and a wet zone of alder (*Alnus* spp.), black ash (*Fraxinus nigra*), and lake sedge (*Carex lacustris*) occurs at the upland margins. This may be the only coastal wetland where the fens adjoin a true ombrotrophic bog.

The coastal spit is mostly forested, with all three pine species native to Wisconsin present. Wintergreen (*Gaultheria procumbens*), cow-wheat (*Melampyrum lineare*), blueberries (*Vaccinium angustifolium*, *V. myrtilloides*), and bracken fern (*Pteridium aquilinum*) comprise the understory. A narrow but extensive strip of unvegetated beach, and a dune with marram grass (*Ammophila breviligulata*) and beach-pea (*Lathyrus japonicus*) borders the shoreline.

Breeding bird surveys conducted in the open wetlands during June yielded records for merlin, American bittern, northern harrier, and LeConte's sparrow. The conifer swamp and muskeg supported, among many others, palm warbler, Lincoln's sparrow, red crossbill, and yellow-bellied flycatcher.

This site is rich in rare and uncommon species and contains excellent examples of many natural communities. As it is within Big Bay State Park and also a designated State Natural Area, the major tasks are to ensure that inappropriate use does not occur and to monitor periodically for invasive species. Most of the watershed is forested but there are also scattered small farms and residences. Working with local landowners to maintain forest block size and dispersal corridors, and prevent damage from runoff would be worthwhile.

Rare species of Big Bay, Ashland County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Ammodramus leconteii</i>	LeConte's sparrow	1996	1
<i>Botaurus lentiginosus</i>	American bittern	1996	1
<i>Carex michauxiana</i>	Michaux sedge	1995	2
<i>Carex pallescens</i> var <i>neogaea</i>	Pale sedge	1992	1
<i>Carex tenuiflora</i>	Sparse-flowered sedge	1974	1
<i>Carex livida</i> var <i>radicalis</i>	Livid sedge	1995	1
<i>Deschampsia flexuosa</i>	Crinkled hairgrass	1971	1

Rare species of Big Bay, Ashland County, cont'd.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	1
<i>Falco columbarius</i>	Merlin	1996	1
<i>Lycaena epixanthe</i>	Bog copper	1996	1
<i>Mergus merganser</i>	Common merganser	1996	1
<i>Rhynchospora fusca</i>	Brown beak-rush	1974	1
<i>Triglochin maritimum</i>	Common bog arrow-grass	1995	1
<i>Trisetum spicatum</i>	Narrow false oats	1973	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Stockton Island Tombolo

Ashland County

USGS 7.5' Quadrangle: Stockton Island

The tombolo is an exceptionally diverse and complex association of rare landforms and natural communities on the southeast end of 10,000 acre Stockton Island (**Fig. 78**). Two sandspits have connected Presque Isle Point, historically an islet, with the main body of the island. The spits enclose a large wetland and lagoon which are traversed by a series of narrow, parallel, sand ridges. The swales between the ridges support a variety of wetlands including submergent aquatic, emergent aquatic, coastal fen, coastal bog, alder thicket, and tamarack swamp.

Communities associated with the sandspits are beach, lake dune, Great Lakes barrens, dry boreal forest, northern dry-mesic forest, and interdunal wetland. Several small streams drain the island's interior and reach Lake Superior via an outlet through the eastern sandspit into Julian Bay.

The fen mat is composed of woolly sedge (*Carex lasiocarpa*), the very rare coast sedge (*C. exilis*), twig rush (*Cladium mariscoides*), beak-rushes (*Rhynchospora alba*, *R. fusca*), sweet gale (*Myrica gale*), and buckbean (*Menyanthes trifoliata*). A boggy mat of *Sphagnum* mosses, ericaceous shrubs, sedges, and scattered small tamarack (*Larix laricina*) occurs in the drier swales and along the upland margins of the wetland. An interdunal pond supports an unusual flora that includes shore rush (*Juncus balticus*), Robbins spikerush (*Eleocharis robbinsii*), twig rush, and the carnivorous bladderworts *Utricularia cornuta* and *U. resupinata*. A large, isolated portion of the wetland in the northwestern sector of the tombolo is quite acid, dominated by ericaceous shrubs, especially leatherleaf (*Chamaedaphne calyculata*), few-seeded sedge (*Carex oligosperma*) and beaked sedge (*C. rostrata*). Speckled alder (*Alnus incana*) is locally common here.

Terrestrial communities in close association with the wetlands include extensive unvegetated sand beach, and a lake dune system of marram grass (*Ammophila breviligulata*) and beach pea (*Lathyrus japonicus*). The southeastern corner of the tombolo supports a small but excellent example of the very rare Great Lakes barrens community. Open-grown red pine (*Pinus resinosa*) and white pine (*P. strobus*) are interspersed among patches of open heath, of blueberry (*Vaccinium angustifolium*), bearberry (*Arctostaphylos uva-ursi*), false heather (*Hudsonia tomentosa*), grasses and lichens. Large colonies of moccasin flower (*Cypripedium acaule*) grow under the pines. The forked sandspit bordering Presque Isle Bay on the west side of the tombolo is forested with mature pines. The canopy on the eastern fork is dominated by red pine (*Pinus resinosa*), with a subcanopy of black spruce (*Picea mariana*) and balsam fir (*Abies balsamea*). Common groundlayer species are bracken fern (*Pteridium aquilinum*), trailing

arbutus (*Epigaea repens*), wintergreen (*Gaultheria procumbens*), cow-wheat (*Melampyrum lineare*), blueberries (*Vaccinium angustifolium*, *V. myrtilloides*), and huckleberry (*Gaylussacia baccata*). Mosses and lichens form a significant groundcover, and several lichen species are abundant on the lower branches of the conifers. The other part of this spit supports a mixed mature forest of white (*Pinus strobus*) and red pines (*P. resinosa*), with less of the spruce-moss-lichen component that gave the boreal feel to the other stand.

Presque Isle Point is vegetated with a mature, mesic hemlock-hardwood forest, also with a distinct boreal flavor. The shoreline of the point is rocky, with frequent sandstone ledges and low cliffs. The main body of the island is forested but much of it is still recovering from past catastrophic logging. The eastern coast is also rocky, with long expanses of substantial sandstone cliffs.

A very high concentration of rare species has been documented here, mostly plants and birds. Apart from the many rare species, the diversity, extent, and quality of the natural communities are reflected in the very high overall species diversity at this site.

The National Park Service maintains a dock, several buildings, and a small campground on the southwestern edge of the tombolo. Other than a few foot trails, these are the only developments at the site. The only problems to watch for at this time would be overuse by visitors and the appearance of invasive species. Stockton Island Tombolo is a designated State Natural Area within the Apostle Islands National Lakeshore.

Rare species of Stockton Island Tombolo, Ashland County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Arethusa bulbosa</i>	Swamp-pink	1992	1
<i>Bucephala clangula</i>	Common goldeneye	1990	1
<i>Carex exilis</i>	Coast sedge	1992	1
<i>Carex michauxiana</i>	Michaux sedge	1995	1
<i>Carex lenticularis</i>	Shore sedge	1995	5
<i>Catharus ustulatus</i>	Swainson's thrush	1990	1
<i>Circus cyaneus</i>	Northern harrier	1990	1
<i>Dendroica fusca</i>	Blackburnian warbler	1990	1
<i>Dendroica tigrina</i>	Cape May warbler	1990	1
<i>Deschampsia cespitosa</i>	Tufted hairgrass	1996	1
<i>Deschampsia flexuosa</i>	Crinkled hairgrass	1991	1
<i>Eleocharis robbinsii</i>	Robbins spikerush	1992	1
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	1
<i>Falco columbarius</i>	Merlin	1992	1
<i>Hemidactylium scutatum</i>	Four-toed salamander	1976	2
<i>Mergus serrator</i>	Red-breasted merganser	1996	1
<i>Mergus merganser</i>	Common merganser	1990	1
<i>Platanthera orbiculata</i>	Large roundleaf orchid	1993	1
<i>Primula mistassinica</i>	Bird's-eye primrose	1996	1
<i>Rhynchospora fusca</i>	Brown beak-rush	1992	1
<i>Trisetum spicatum</i>	Narrow false oats	1996	1
<i>Utricularia resupinata</i>	Northeastern bladderwort	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Outer Island Sandspit and Lagoon

Ashland County

USGS 7.5' Quadrangle: Outer Island

The attenuated southern tip of the remote, 8,000 acre Outer Island, part of the Apostle Islands National Lakeshore, forms a long sandspit which encloses a large lagoon and wetland (**Fig. 79**). The spit features extensive unvegetated beach, lake dunes, and a xeric pine forest. The open peatlands surrounding the lagoon are sedge-dominated to the south, more boggy to the north. Thickets of tall shrubs, and small, scattered stands of conifers add structural diversity to the site's wetlands.

The sedge-dominated mat around the southern end of the lagoon is composed primarily of woolly sedge (*Carex lasiocarpa*), twig rush (*Cladium mariscoides*), beak-rushes (*Rhynchospora alba*, *R. fusca*), buckbean (*Menyanthes trifoliata*), and sweet gale (*Myrica gale*). To the north, the mat is boggy, becoming *Sphagnum*-dominated, with ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), and small cranberry (*Vaccinium oxycoccos*); as well as few-seeded sedge (*Carex oligosperma*), scheuchzeria (*Scheuchzeria palustris*), and pitcher plant (*Sarracenia purpurea*).

Of the terrestrial communities, the dunes are vegetated with marram grass (*Ammophila brevilgolata*), beach-pea (*Lathyrus japonicus*), and sand cherry (*Prunus pumila*). The second-growth, maturing xeric forest has a canopy of red pine (*Pinus resinosa*), white pine (*P. strobus*), and paper birch (*Betula papyrifera*). Jack pine (*P. banksiana*) occurs in a few locations but is uncommon. Balsam fir (*Abies balsamea*) is present in gaps and scattered throughout the forest understory. The groundlayer includes bracken fern (*Pteridium aquilinum*), bunchberry (*Cornus canadensis*), cow-wheat (*Melampyrum lineare*), wintergreen (*Gaultheria procumbens*), blueberry (*Vaccinium angustifolium*), and clubmosses (*Lycopodium* spp.).

At least five rare plants species have been documented at this site. Three rare birds have been observed during the breeding season. The site hosts notable concentrations of migratory birds in the fall, especially among the passerines and raptors. Loons, grebes, and cormorants congregate in the waters off of the spit, and there are frequent visits from southbound shorebirds. Gulls and terns commonly "loaf" on the tip of the spit. Outer Island has been designated as a State Natural Area. There are no immediate threats to this site, but it should be monitored periodically for invasive species, changes in abundance of rare species, and human use (currently light).

Rare species of Outer Island Sandspit and Lagoon, Ashland County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Arethusa bulbosa</i>	Swamp-pink	1990	1
<i>Carex lenticularis</i>	Shore sedge	1995	2
<i>Catharus ustulatus</i>	Swainson's thrush	1996	1
<i>Eleocharis robbinsii</i>	Robbins spikerush	1995	1
<i>Falco columbarius</i>	Merlin	1993	2
<i>Mergus serrator</i>	Red-breasted merganser	1996	1
Migratory bird concentration site	Migratory bird concentration site	1996	1
<i>Rhynchospora fusca</i>	Brown beak-rush	1992	1
<i>Utricularia resupinata</i>	Northeastern bladderwort	1995	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Bad River Reservation

Ashland County

USGS 7.5' Quadrangles: Odanah, Ashland East, Cedar

The Reservation of the Bad River Band of Lake Superior Chippewa encompasses the lower portions of the Bad River drainage in northeastern Ashland and extreme northwestern Iron counties. Surveys conducted in 1996 focused on the vast wetland ecosystems of the lower Bad and Kakagon (a separate but ecologically linked system just west of the Bad River) rivers, and the corridor of the Bad River south of U.S. Highway 2. Major wetland communities of the lower Bad and Kakagon rivers include emergent marsh, coastal fen, coastal bog, tamarack swamp, and shrub swamp. A number of coastal lakes (lagoons) support beds of submergent and floating-leaved aquatic plants and provide critical habitat for many aquatic animals. These communities are the most extensive and among the least disturbed of their respective types in the project area, and certainly rank among the most significant in the Great lakes.

As the wetlands of the Bad and Kakagon systems are partially separated from and protected by terrestrial features, these deserve mention as well. A coastal barrier spit (see "Long Island-Chequamegon Point") borders the Bad and Kakagon wetlands on the north. This spit contains extensive beach and dune communities, and in several locations, dry forest of pine and oak. Oak Point, north of the Kakagon River mouth, consists of nearly-parallel sand ridges radiating from a common base on its eastern end. These ridges support significant stands of dry forest, with pine and oak dominant.

South of U.S. Highway 2, the course of the Bad River is confined within steep clay banks. Between the sharp meanders is a series of terraces occupied primarily by mesic hardwood forests of sugar maple (*Acer saccharum*) and basswood (*Tilia americana*). The groundflora of these terraces is exceptionally rich and includes many plants which are rare or absent elsewhere in northern Wisconsin. Rare animals also occur here. This is a unique ecosystem within both the project area and northern Wisconsin. Only the much more disturbed lower Nemadji River corridor of northwestern Douglas County has similar characteristics, but there the dominant trees are black ash (*Fraxinus nigra*) and white spruce (*Picea glauca*). A data sharing agreement with the Bad River Band of Lake Superior Chippewa is in development. Until this agreement is in place, we will not be computerizing data or identifying locations for natural communities or rare species populations found on the Reservation.

Associated with the mesic bottoms of the meander "tongues" are stands of floodplain forest, black ash swamp, shrub swamp, hemlock-hardwood forest, and oxbow lakes. The red clay and sand bluffs flanking the Bad River and its tributaries also support significant communities, including boreal conifer-hardwoods, dry pine forest, hemlock-white cedar forest, and spring seeps. A large complex of tamarack swamp, white cedar swamp, black ash swamp, and fen occurs where the river exits the deep clay "canyons" to spread out over the plain to the north.

Due to the scale of the natural features of the site and the complex ownership patterns within and beyond the Reservation boundaries, partnerships among tribal, public, and private entities will be essential in addressing important conservation issues of the Bad River Watershed such as invasive species, eutrophication, and sedimentation. Planning should be done on a watershed basis wherever possible.

Caroline Lake Wetlands

Ashland and Iron counties

USGS 7.5' Quadrangle: Mt. Whittlesey

This site lies near the southern edge of the Lake Superior Basin, in the Winegar Moraines subsection. The location of the site is strategic, as it occupies the headwaters region of the Bad River (**Fig. 80**). Major features include a large undeveloped lake and several hundred acres of undisturbed wetlands. Most surrounding land is forested with second-growth northern hardwoods, though some stands have retained a significant component of conifers. Human population density is low, but development is increasing rapidly, especially around other lakes in the area. Caroline Lake covers 129 acres, has a maximum depth of 8 ft, and has soft, slightly acid water. Bottom materials include muck, sand, and gravel. It is fed by several small streams which originate in the extensive peatlands to the east. The outlet is the Bad River. Based on these physical and chemical attributes we have classified it as a soft, shallow, drainage lake, a relatively rare type in Wisconsin.

A narrow zone of emergent aquatic macrophytes 1-15 m wide borders much of the shoreline. Dominant species are water horsetail (*Equisetum fluviatile*), hard-stemmed bulrush (*Scirpus acutus*), and Small's spike rush (*Eleocharis smallii*). Shallow portions of the lake basin support dense beds of submerged and floating-leaved aquatic vegetation, such as water shield (*Brasenia schreberi*), coontail (*Ceratophyllum demersum*), yellow water lily (*Nuphar variegatum*), and pondweeds (*Potamogeton* spp.). Small stands of tamarack swamp, sedge meadow, and shrub swamp adjoin the lake.

The acid peatlands to the east consist of extensive muskeg/open bog, with small pools bordered by a poor fen (sphagnum lawn) community. The muskeg is characterized by scattered, stunted black spruce (*Picea mariana*) and tamarack (*Larix laricina*); ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), and small cranberry (*Vaccinium oxycoccos*); and sedges, especially *Carex oligosperma*, *C. pauciflora*, *C. paupercula*, and *Eriophorum spissum*. Deep accumulations of sphagnum peat create a pronounced hummock-hollow microtopography across the surface. In some areas the trees are larger and denser, creating a near-forest condition. Labrador tea (*Ledum groenlandicum*) and three-seeded sedge (*Carex trisperma*) are abundant in the understory of such stands. Around the margins of the small pools within the peatland interior, the flora differs markedly. Here the sphagnum mat is level and quaking. The common sedges are white beak-rush (*Rhynchospora alba*) and mud sedge (*Carex limosa*); and scheuchzeria (*Scheuchzeria palustris*) and grass pink orchid (*Calopogon tuberosus*) are more abundant.

Animals noted on or near the lake during the summer of 1996 include bald eagle, osprey (fishing), broad-winged hawk, common loon (pair on lake), blue-winged teal, and hooded merganser. Freshwater sponges were common on submerged woody debris near the shore. A diverse complement of boreal lepidoptera and birds resides here. Lincoln's sparrow, palm warbler, magnolia warbler, olive-sided flycatcher, and yellow-bellied flycatcher are representative avifauna. Caroline Lake and Wetlands has high intrinsic values but is also worthy of protection for its important role in the Bad River Watershed. Protection work will have to proceed quickly as the rate of lake development has accelerated in recent years.

Rare species of Caroline Lake Wetlands, Iron County.			
Scientific Name	Common Name	Year	No. of EOs*
<i>Boloria freija</i>	Freija fritillary	1996	1
<i>Empidonax flaviventris</i>	Yellow-bellied flycatcher	1996	1
<i>Lycaena dorcas</i>	Dorcas copper	1996	1
<i>Oeneis jutta ascerta</i>	Jutta arctic	1996	1
<i>Perisoreus canadensis</i>	Gray jay	1996	1

*Element Occurrences (EOs) are locational records of rare species or natural communities.

Figures 53-80. Maps of priority wetland sites

Aquatic Priority Sites

Aquatic sampling was added in the second year of the inventory work. By sampling a cross-section of lakes and streams, we were able to assess significance of the various water features from a biodiversity perspective. The following 18 sites were identified as priority sites for protection and management. These waterbodies harbor rare taxa and/or exhibit high species diversity (see Fig. 52). A brief description of each site is provided. More work is needed on these sites as well as other aquatic sites in the basin, to more thoroughly evaluate their characteristics and assess priorities.

Anodanta Lake

Bayfield County

USGS 7.5' Quadrangle: Grandview NW

Size: 26 acres

A relatively deep drainage lake with a large proportion of rubble and gravel bottom. This lake lies entirely in the Winegar Moraines subsection. Water levels are relatively stable and flow out of the lake averages 25 cfs. The relatively rich macroinvertebrate fauna was dominated by caddisflies and included several taxa found only in this waterbody. Management is for bass and panfish. No specific threats were noted.

Bad River Slough

Ashland County

USGS 7.5' Quadrangle: Chequamegon Point

Size: 204 acres

A hard water drainage lake adjacent to Lake Superior with a broad outlet channel to the Bad River. Water entering the slough can be from three different sources depending on conditions. Normally, drainage water from Honest John Slough flows through. Waters from Lake Superior and the Bad River often enter the slough. A regionally significant mussel bed is located in the outlet channel and contains rare species and species not known elsewhere in the Lake Superior Basin. The fishery is reportedly very diverse and includes Lake Sturgeon.

Determination of mussel population dynamics and clarifying taxonomic status of unusual forms is recommended. Threats to the aquatic features are diverse as the site lies at the mouth of the largest stream system in the Wisconsin portion of the basin.

Hoodoo Lake

Douglas County

USGS 7.5' Quadrangle: Brule

Size: 32 acres

A landlocked acid bog lake that has occasional winterkill of fish. The lake lies entirely in the Bayfield Sand Barrens subsection. Thirty acres of spruce, tamarack, and leatherleaf bog surround the lake, but the water is quite transparent and only slightly acidic. The east shore has a firm bottom of gravel and sand, while the rest is muck bottomed. The very rich macroinvertebrate fauna includes two rare species, one of which is globally rare and is the first known breeding location in Wisconsin. Aquatic beetles make up almost half the taxa sampled.

Residences on the shore are a potential source of water quality degradation. Adults of the rare dragonfly present require forest cover immediately adjacent to the water body they breed in and indiscriminate logging could be detrimental.

Rush Lake

Douglas County

USGS 7.5' Quadrangle: Island Lake

Size: 22 acres

A soft water seepage lake which is landlocked. The lake lies entirely in the Bayfield Sand Barrens subsection. The entire littoral bottom is sand and aquatic vegetation is sparse. The macroinvertebrate fauna is dominated by beetles. One globally rare mayfly and other taxa not found elsewhere in this study are also present. Winterkill and stunted fish are known from this lake. Former fish management efforts included chemical reduction and introduction of predatory fish. It is recommended that no future fish management activities be conducted, unless it can be shown they have no impact on the native fauna.

Smith Lake

Douglas County

USGS 7.5' Quadrangle: Lake Minnesuing

Size: 30 acres

A shallow soft water seepage lake in the Bayfield Sand Barrens subsection. Fish winterkill occurs frequently and water level fluctuations of five feet are probable. Most of the shore is upland except for the southeast bay which is edged by leatherleaf bog. Floating and emergent aquatic vegetation is common. Macroinvertebrate diversity was greater here than at any lake sampled in the Lake Superior Basin. Three rare species are present including one that is globally rare. Over half the taxa present were beetles with caddisflies, mayflies and dragonflies also well represented.

It is likely that the near fishless condition of this lake is responsible for the rich insect diversity. No fisheries enhancement should be conducted here. Also, the lake is not entirely in protective ownership and steps should be taken to protect the entire lake.

Casey Creek

Douglas County

USGS 7.5' Quadrangle: Brule

Length: 4.1 miles

Width: 10 ft

A high quality trout stream with some past variations in flow conditions. Bottom type is mostly sand with gravel and silt present. The watershed is almost entirely in the Bayfield Sand Barrens subsection and is forested. A very rare mayfly and a globally rare dragonfly breed in this stream. Dragonflies, caddisflies and mayflies were the dominant forms. No direct management concerns were noted.

Nebagamon Creek

Douglas County

USGS 7.5' Quadrangle: Brule

Length: 6.4 miles

Width: 21 ft

This stream originates in Nebagamon Lake as a warm water stream in the Mille Lacs Uplands subsection and becomes trout water by the time it reaches the Brule River in the Bayfield Sand Barrens subsection. Bottom types are varied. A rich macroinvertebrate fauna represented by eighteen Families is present and includes one globally rare dragonfly and two rare caddisflies. Low flow conditions were noted. Bank erosion was considered a significant source of pollution, at least at the sample site.

White River

Bayfield County

USGS 7.5' Quadrangles: Sanborn, Mason, Grandview NW

Length: 33.9 miles

Width: 44 ft

This stream is the largest in Bayfield County. It originates in tributaries in the Bayfield Sand Barrens subsection and flows for most of its length through the Lake Superior Clay Plain subsection. Substrate is dominated by sand throughout, with large amounts of clay mixed in below the Bibon Swamp. The macroinvertebrate fauna is diverse, despite the limited sampling. Two rare dragonflies were found in the upstream section.

A variety of water quality problems are present including point-source pollution, a hydro-electric dam, large areas of agricultural land in the watershed, bank erosion, etc. Much more sampling is needed at reaches distributed throughout this diverse system.

Montreal River, West Fork

Iron County

USGS 7.5' Quadrangle: Iron Belt

Length: 18.5 miles

Width: 27 ft

A soft warm water stream having neutral, medium brown water. Above the Gile Flowage, the stream is warm and is influenced by the attributes of the Winegar Moraines subsection. Below the Gile Flowage, the stream becomes suitable for trout and is influenced by the Gogebic-Penokee Iron Range subsection. While only seventeen taxa were collected in this initial effort, two of these are very rare in Wisconsin. The predominate groups were mayflies and caddisflies. Turbidity and impoundment present challenges to the maintenance of water quality.

Sand River

Bayfield County

USGS 7.5' Quadrangle: Sand Island

Length: 13.4 miles

Width: 14 ft

A trout stream with spring water sources; the upper 70% being intermittent. While the headwaters are near the Bayfield Sand Barrens subsection and might be influenced by it, the stream is contained within the Lake Superior Clay Plain subsection. Many small springs and streamlets flow into the river and enhance its water quality. The Sand River is subject to periodic massive flash-floods. Of the twenty aquatic insect taxa found in this effort, five are considered rare in Wisconsin. Significant management concerns include turbidity, low flow, exotics, and bank erosion.

Angel Creek

Douglas County

USGS 7.5' Quadrangle: Lake Minnesuing

Length: 0.7 miles

Width: 3 ft

A small clear brook trout stream originating from springs located at the base of the Brule Valley, in the Bayfield Sand Barrens subsection. Bottom materials consist of mostly sand and gravel. Stream flow is stable and the gradient is steep. Insect fauna was fairly rich and was made up of mostly caddisflies, mayflies, true bugs and beetles. Two rare taxa were present. Some impacts due to turbidity, silt and bank erosion were noted.

Long Lake Branch

Bayfield County

USGS 7.5' Quadrangles: Grandview NW, Mason

Length: 16 miles

Width: 20 ft

A fairly large stream with a lake at the origin and many springs. Most of the streams influence stems from the Winegar Moraines subsection, but the lower few miles are in the Lake Superior Clay Plain subsection. The insect fauna here was the richest seen in this study with 66 taxa, five of which are rare. The 33 taxonomic Families were comprised mostly of caddisflies and mayflies, with significant numbers of dragonflies and true flies. Negative impacts noted included impoundment (Rust Flowage) and some silt.

Twentymile Creek

Bayfield County

USGS 7.5' Quadrangle: Grandview

Length: 13 miles

Width: 10 ft

This stream originates from several spring-fed streamlets in the Gogebic-Penokee Iron Range subsection and flows into the Lake Superior Clay Plain subsection. The entire stream is considered trout water. Macroinvertebrates were very diverse including 50 taxa, five of which are rare. Fauna is dominated by mayflies, caddisflies and stoneflies. Management concerns include the presence of pastured land in the watershed and some siltation. Rapid runoff has resulted in the initiation of stream improvement projects.

Sioux River

Bayfield County

USGS 7.5' Quadrangle: Washburn

Length: 17 miles

Width: 16 ft

A relatively large stream with spring water sources originating in the Bayfield Sand Barrens subsection and flowing through the Lake Superior Clay Plain subsection. The water is relatively clear upstream and bears suspended clay downstream. The fauna was diverse with 35 taxa present, four of which are rare. Caddisflies, mayflies and beetles were dominants. Management concerns noted included turbidity, low flow, filamentous algae, and silt.

Jerseth Creek

Douglas County
USGS 7.5' Quadrangles: Bennet, Lake Minnesuing
Length: 1 mile
Width: 5 ft

A high quality trout stream originating in the Bayfield Sand Barrens Eco-regional Subsection. Sand is the predominant bottom type and flow is quite stable. The insect fauna had 4 rare taxa and was dominated by caddisflies. Midge diversity was notable. No significant management concerns were noted.

Porcupine Creek

Bayfield County
USGS 7.5' Quadrangles: Bennet, Diamond Lake
Length: 1 mile
Width: 10 ft

Originating in a lake and contained in the Winegar Moraines subsection, this creek is considered trout water for its entire length. Gravel and rock were the major bottom types. The fauna was predominated by mayflies and dragonflies and had two rare species. No significant management concerns were noted.

Eighteenmile Creek

Bayfield County
USGS 7.5' Quadrangle: Mason
Length: 16 miles
Width: 12 ft

A medium-sized cold spring-fed stream originating in the Winegar Moraines subsection. Numerous bank springs are found in the upper two-thirds of its length. The modest insect fauna contained two rare taxa and was predominated by mayflies and caddisflies. No significant management concerns were noted.

Bad River

Ashland County
USGS 7.5' Quadrangle: Odanah
Length: 70.2 miles
Width: 80 ft

This large stream originates in the Winegar Moraines subsection, crosses the Gogebic-Penokee Iron Range subsection, and finally flows through the Lake Superior Clay Plain subsection making it one of the most hydrologically diverse streams in the basin. The very limited sampling turned up a moderate number of taxa, mostly dragonflies. One rare species was found. This stream also contained taxa not found elsewhere in this study. Management concerns include exotics, toxic chemicals, bank erosion, silt, and impoundment.

Recommendations

Our recommendations are of a preliminary nature, based on an initial review of the data gathered and the comments of our many collaborators. In those cases where recommended actions are already occurring or are being contemplated, this document provides further support for, and brings a basin-wide perspective to, those projects. As the data are more thoroughly analyzed, it is almost certain that additional recommendations will be made.

There are, of course, gaps in this evaluation. Several taxa, such as fish and herptiles, received relatively little attention in the work completed under this grant. However, other sources of information exist for fish of the Lake Superior Basin and these should be consulted to complete the picture of biological values there. Information gaps for fish and other taxa need to be evaluated and addressed through the Department's Aquatic and Terrestrial Resources Inventory efforts.

Also, the Reservations of both the Red Cliff and Bad River Bands of Lake Superior Chippewa merit additional inventory. These properties contain extensive stretches of shoreline, exceptional coastal wetlands, highly significant terrestrial communities, and aquatic biota of high regional significance. Elements of global significance occur on these properties as well. A data sharing agreement between the Bands and BER is being developed, and when formalized, it is hoped that work on the Reservations will continue to the benefit of the resources. The agreement will cover rare species and natural communities.

The recommendations proposed below will need to be translated to specific actions. This can be done by (1) considering the recommendations in the Department's formal planning processes such as master planning; (2) considering the recommendations during the Department's biennial work planning process to ensure that specific individuals and teams agree to take on the work; and (3) approaching the various partners involved (e.g., National Park Service, The Nature Conservancy, counties) to assure that they are aware of the management/protection needs and opportunities identified in this report and to try to gain their cooperation in implementation. The recommendation section of this report will be forwarded to the DNR Regional Directors and the Program Bureau Directors. In addition, the Bureau of Endangered Resources will work closely with the Binational Program to integrate results of this study into their overall efforts.

The recommendations are divided into five categories: Protection; Management and Monitoring; Restoration and Mitigation; and Research and Inventory. There is considerable overlap between categories. When reviewing the recommendations, keep in mind that our work was most comprehensive in the coastal wetlands, focused on sites which best met prioritization criteria in the basin interior, and was spotty for terrestrial features.

Protection

Actions for consideration under protection could include acquisition, conservation easement, special use designation on public lands, landowner agreements, or other, as appropriate and feasible to the situation. In most cases, success will depend on cooperative efforts among public agencies, conservation organizations, tribal governments, and private individuals. The following recommendations for protection are grouped according to type of natural feature and location. Within each group, sites recommended for protection are listed, along with a brief description of their attributes.

Coastal Zone Sites

Many natural features of the coastal region possess unique attributes not found elsewhere and these merit especially strong protection. Among these features are freshwater estuaries, coastal barrier spits, and wave-sprayed sandstone outcroppings, which in turn contain communities such as coastal fen, coastal bog, beach, dune, interdunal wetland, Great Lakes pine barrens, dry boreal forest, dry cliff, moist cliff, and Great Lakes rocky shore. Many rare species are restricted to or occur primarily in the coastal region. Major features are listed, with lead agencies, organizations, governments, and partners.

Bad River Reservation. Vast coastal wetlands, coastal barrier spit, marshes, mesic bottomland hardwoods, floodplain forest, hardwood swamp, conifer swamp, boreal forest, and many rare species. Owners: Bad River Band of Lake Superior Chippewa.

Bayview Beach-Sioux River Slough. Coastal bog and fen with many rare species but significant management problems. Owners: DNR, Township, private.

Long Island-Chequamegon Point. This is the largest, least disturbed coastal barrier spit on western Lake Superior. Many rare as well as representative features in a strategic location. Owners: National Park Service, U.S. Coast Guard, Bad River Band, The Nature Conservancy (easement), private.

Nemadji River Corridor (Douglas County). Marshes, hardwood bottomlands, and conifer-clad slopes. With erosion and past water quality problems, needs comprehensive protection/restoration plan. Owners: Douglas County, many private.

Pokegama-Carnegie Wetlands. Critical habitat for many rare plants. Owners: Douglas County, several private.

Red Cliff Reservation. Coastal wetlands, shoreline cliffs, extensive hemlock-hardwoods forest, and many rare species. Owners: Red Cliff Band of Lake Superior Chippewa.

St. Louis River Estuary. St. Louis River Marshes, Oliver Marsh, Red River Breaks, and Superior Municipal Forest. Wetlands, boreal forest, extensive forest, and critical fish and wildlife habitat. Owners: DNR, City of Superior, private.

Sand Bay. Diverse, undisturbed coastal wetland complex, includes the Sand River and rare species. Owners: Apostle Islands National Lakeshore, Red Cliff Band.

Squaw Bay Cliffs (Bayfield County). Extensive and undisturbed with many rarities. Owners: mostly Apostle Islands National Lakeshore.

Wisconsin Point-Allouez Bay. Coastal barrier spit, beach, dune, interdunal wetland, emergent marsh, migratory bird concentration area, and several rare species. Owners: City of Superior, U.S. Coast Guard.

Basin Interior Sites

Several sites away from the Lake Superior coast but within the basin have outstanding attributes or opportunities to protect features representative or rare in the basin but scarce or absent in the coastal region. Many additional sites containing valuable features are not mentioned here because of their small size, incomplete evaluation, landscape context, or for other reasons.

Bad River Corridor. Features include mesic bottoms, conifer forests, and rocky gorges with extensive forest, lakes, many tributary streams, and wetlands in the headwaters. Owners: Bad River Band, Copper Falls State Park (DNR), Ashland County, Iron County, Chequamegon-Nicolet National Forest, private.

Brule Spillway. Extensive rich conifer swamp, springs, steep, forested slopes, and old-growth pine forest with a high concentration of rare species. Owners: Brule River State Forest (DNR), private, The Nature Conservancy.

Caroline Lake and Wetlands. Large undeveloped drainage lake and acid peatlands with rare species. Headwaters region of the Bad River. Owners: private, Iron County, The Nature Conservancy.

Douglas County Peatlands. Includes Black Lake Bog, Mud Lake Bog, Ericson Creek Headwaters, and Belden Swamp. Extensive acid peatlands of bog, muskeg, and spruce swamp. Many rare animals. Owners: Douglas County, private.

Sultz Swamp. Large insular acid peatland with conifer swamp and muskeg with several rare species and forested watershed. Owners: Bayfield County.

Small Rivers and Lakes

Only a few headwaters streams and lakes are mentioned here, due to their location within public lands for which management plans will soon be revised.

Eighteen Mile Creek. Similar to Long Lake Branch, this high gradient cold water stream originates in a federally designated wilderness area and flows into the White River. Owners: U.S. Fish & Wildlife Service, private.

Long Lake Branch. Cold water stream with exceptionally high diversity of aquatic macroinvertebrates. Good stands of older mixed conifer-hardwood forest occur along some stretches. Several rare species present. Tributary of the White River. Owners: U.S. Fish & Wildlife Service, private.

Smith Lake. This sand-bottomed seepage lake supports an unusual macroinvertebrate fauna which includes rare species. Owners: Brule River State Forest (DNR), private.

Large Rivers

Large river systems possess unique attributes and challenges, as they may be vulnerable to adverse impacts from activities anywhere within their extensive watersheds.

Bad River. Associated attributes have been mentioned in the brief discussions of several of the sites listed above. Also supports rare fish, mussels, and macroinvertebrates not found in smaller streams.

Brule River. This former Lake Superior outlet originates in the Bayfield Sand Barrens subsection and is unlike the other large stream systems in the drainage basin. Associated features are exceptional.

St. Louis River. The largest stream in Wisconsin's part of the basin still contains extensive, if somewhat diminished, wetlands, and provides critical habitat for many representative and rare species. Shoreline and water quality protection is essential, especially in the lower stretches where human population density is highest, the terrain is steep, and the soils fragile.

Forests of the Basin

With the major exception of the fire-maintained openings within the Bayfield Sand Barrens subsection, most of the Lake Superior Basin was forested prior to European settlement. While most of the watershed remains forested, there have been many changes, most notably the almost total loss of old-growth forests and the greatly diminished role of conifers in the present forest. In the Lake Superior Clay Plain subsection, the changes in forest composition and age structure have been accompanied by significant fragmentation. It is important to maintain existing large blocks of forest and, where appropriate, restore native conifers and address the absence of older stands on the landscape. Existing stands of old-growth forest merit protection at the few sites on which they occur, and stands with a substantial coniferous component, especially when mature, should be considered for special management.

Apostle Islands National Lakeshore. The old-growth stands within the lakeshore are small but exceptional. Though not threatened by logging or development, stands on Oak and Stockton islands merit special recognition in the National Park's management plan.

Bad River Reservation. The slopes flanking the Bad River and its tributaries support several forest communities of high significance in the region. Dry stands of mixed pine, fir, and aspen; more mesic stands of white spruce and fir; and wet-mesic stands of white cedar and hemlock are extensive along the slopes of the ravines carrying the Reservation's streams and at a very few locations on the flatlands above the river valleys. Maintaining these forests is a high priority, to both protect their intrinsic values and to ensure that the fragile soils do not find their way into the vast wetlands at the mouths of the Bad and Kakagon rivers.

Bayfield County Forest. Some of the best remaining stands of mature dry-mesic white and red pine forest occur in the upper parts of the Lost Creek drainage.

Brule River State Forest. Existing old-growth forest on the Brule is limited to areas very near the river, and includes conifer swamp, white and red pine forest, and a boreal white spruce-white pine type near Lake Superior.

Chequamegon-Nicolet National Forest. Excellent opportunities for the protection and management of extensive, mature hemlock-hardwoods forest exist in the western portion of the Gogebic-Penoque Iron Range, particularly around St. Peters Dome (Ashland County). An area north and east of Lake Owen affords similar opportunities. Both areas are headwaters regions for some of the Lake Superior Basin's outstanding streams, a number of which have been shown to have highly significant aquatic biota, and flow into two major streams, the White and the Bad rivers.

Douglas County Forest. Most of the inventoried forests in Douglas County were wetlands, but small stands of mature upland types were noted within the corridor of the Nemadji River and in the Ericson Creek area.

Iron County Forest. East of Weber Lake there are sites within the Penokee Range with extensive hardwood forests, including a few older stands, and stands demonstrating strong recovery by eastern hemlock. This area of rugged terrain also features basalt "balds" on the crests of some of the bedrock ridges and knobs, and high-gradient headwaters streams with associated rare flora.

Red Cliff Reservation. The northern Bayfield Peninsula contains the most extensive stands of mature hemlock-hardwoods in the Lake Superior Clay Plain subsection. Though not pristine, the stands in this area have retained a strong component of coniferous species and are of basin-wide importance. Several rare or geographically restricted plant species are still locally common here, especially in some of the deep ravines that occur near the coast. The characteristic presence of white spruce and balsam fir in many of the stands lends a boreal flavor absent in most forests of this type farther south.

Management and Monitoring

Existing Plans

Information contained within this report can assist administrators and managers in their review of management and protection area plans. Listed below are private and public lands within the Lake Superior Basin for which planning documents already exist:

Public Lands

- Amnicon Falls State Park - DNR Parks and Recreation
- Apostle Islands National Lakeshore
- Bark Bay State Natural Area - BER
- Bayview Beach/Sioux River Slough - DNR Fish Management, Township
- Big Bay State Park - DNR Parks and Recreation
- Brule River State Forest - 1979 Master Plan, due to be revised
- Chequamegon-Nicolet National Forest - 1997 Forest Plan
- Copper Falls State Park - DNR Parks and Recreation
- County Forests
- Lost Creek State Natural Area - BER
- Pattison State Park - DNR Parks and Recreation
- Port Wing State Natural Area - BER, DNR Fish Management
- Superior Municipal Forest - City of Superior property plans

Private/Tribal Lands

- Bad River Reservation
- Bad River Watershed - The Nature Conservancy
- Brule River - The Nature Conservancy
- Red Cliff Reservation

Invasive Species

Among the many potential and existing threats to the Lake Superior Basin's native biota, several invasive species deserve special mention. These species were documented in the Lake Superior Basin during the course of this project. Invasive species can quickly spread and negatively impact the structure and function of natural communities. Thus, it is important to take action to manage and monitor the sites that harbor invasive species.

Giant Reed (*Phragmites australis*). Well-established and apparently spreading at Port Wing, Bark Bay, Bayview Beach, and Honest John Lake (Bad River Reservation). Giant reed has the potential to alter structure and reduce diversity in the most valuable coastal wetlands, the fens and bogs.

Glossy Buckthorn (*Rhamnus frangula*). Currently local but well-established at several sites (e.g., Prentice Park in Ashland), this exotic may have the potential to cause serious problems in moist forests and wet shrub communities throughout the basin.

Purple Loosestrife (*Lythrum salicaria*). Although much work on this species is in progress, we urge that control efforts continue, especially around Chequamegon Bay and the St. Louis River Estuary. Work should begin as soon as possible in the Pokegama River (Superior Municipal Forest), including eradication of a large, dense population in ditches bordering State Highway 105 on the western edge of South Superior.

Queen of the Meadow (*Filipendula ulmaria*). Very local at present (e.g., Port Wing), this garden escapee may have the potential to cause significant problems in the basin's open wetlands.

Valerian (*Valeriana officinalis*). This exotic has spread explosively in and around the City of Superior in recent years. The threat to native species is not understood at present, but it has now "jumped the fence" in many roadside locations and should be watched.

Rare Plant and Animal Species

It must be recognized that, within the context of this report, few recommendations are made which address the monitoring and management needs of rare plant species occurring within the survey area. In most cases, very little is known of each species' life history and what constitutes a viable, self-sustaining population. To determine the appropriate management regime which will contribute to, or enhance, the latter will likely require specific experimental studies for each species. Likewise, monitoring work must be based on at least a limited understanding of species biology and, most importantly, a clearly-defined goal to guide methodology.

Both management and monitoring studies are multi-year projects which cannot be addressed within the context of the present study. Other than for those species populations where management needs are quite obvious, it is hoped that rare plant conservation will occur within the context of the preservation of natural communities and the ecological functions which they support. We encourage that statewide and regional surveys such as the federal breeding bird survey and DNR's frog and toad survey be continued, and, if possible, expanded. Several individual plant and animal species are potentially good candidates for monitoring:

Auricled Twayblade (*Listera auriculata*). A globally rare plant, all three extant Wisconsin populations are at risk, despite occurring on public lands.

Butterwort (*Pinguicula vulgaris*). This boreal plant species is at the extreme southern edge of its

range in specialized habitats on the Lake Superior coast.

Canada Yew (*Taxus canadensis*). Sensitive to excessive browse, damage was noted in formerly vigorous and extensive beds. Recovery potential is uncertain.

Clustered Bur-reed (*Sparganium glomeratum*). Only recently discovered in Wisconsin, better information is needed on the life history and habitat requirements of this plant of curious distribution.

Lake Cress (*Armoracia lacustris*). A globally rare plant, extant at only two stations in the state, which may be vulnerable to disturbance.

Ram's-head Lady's Slipper (*Cypripedium arietinum*). Restricted to a single drainage in the Lake Superior Basin, the habitat preferences of this globally rare plant need to be better understood.

Shore Sedge (*Carex lenticularis*). This rare plant of coastal dune systems occupies dynamic, possibly ephemeral habitats.

Slender Spike-rush (*Eleocharis nitida*). Also a recent addition to the state's flora, little is known of its life history.

White Mandarin (*Streptopus amplexifolius*). Of limited geographic distribution, this herb of cool, shady ravines may be vulnerable to excessive deer browse and some types of logging.

Black Tern (*Chlidonias niger*). At least 4 breeding colonies were known from Lake Superior coastal marshes as late as the mid-1980s; today there are none. We found only one small colony of 5-10 pairs in the basin, at a Wisconsin Department of Transportation wetland mitigation site south of the City of Superior (Kimmes-Tobin Wetlands). High water in 1995-96 may have played a role in the disappearance of this graceful marsh nester from the coast, but at least one of those colonies has been deserted since the 1980s.

Common Tern (*Sterna hirundo*). This species nests only at single colonies at the cities of Ashland and Duluth. It is critical to continue existing monitoring and management efforts.

Beach-dune Tiger Beetle (*Cicindela hirticollis rhodensis*). Despite searches in appropriate habitat all along the Lake Superior coast, this habitat specialist was found only in the undisturbed beach and dune systems from Long Island-Chequamegon Point to the mouth of the Brule River. (Several other dune insects also were found only at this site, and might also be worth monitoring.)

Ebony Bog Haunter Dragonfly (*Williamsonia fletcheri*). Located at a single site within the Brule River State Forest.

Mussels. The basin's most significant mussel beds occur in the lower Bad River drainage. Until a formal data sharing agreement between the DNR and the Bad River Band of Lake Superior Chippewa has been developed, contact the Bad River Natural Resources Department for additional information.

Land Use Conflicts

Several conflicts in land use were noted during this study. These conflicts need to be evaluated from an ecosystem management perspective and data from this project should be useful in the evaluation process.

- Off-Road Vehicles were mentioned by several project biologists as causing damage in peatlands and dunes.
- Logging practices adjacent to wetlands may cause problems for certain organisms, interrupt processes (such as maintaining water flow in spring areas, or providing for dispersal of animals that spend portions of their life cycles in different habitats), or damage fragile sites (slope erosion, inadvertent introduction of weedy species). The problems caused by these practices are perhaps better treated as research questions.
- Lake and shoreline development continues to expand, decreasing natural habitat and interrupting natural processes.

Ecosystem Management

Some excellent opportunities exist to implement large-scale ecosystem management in the Lake Superior Basin. Listed below are the potential areas to consider and partners to involve.

Apostle Islands-Bayfield Peninsula. Apostle Islands National Lakeshore, DNR, Red Cliff Band, Bayfield County.

Bad River Watershed. Bad River Band, The Nature Conservancy, Apostle Islands National Lakeshore, U.S. Fish & Wildlife Service, Ashland and Iron counties, DNR Parks and Recreation.

Bayfield Sand Barrens. Bayfield County, Chequamegon-Nicolet National Forest.

Brule River Watershed. DNR, Douglas County, industrial forests.

Chequamegon Bay. Bad River Band, Apostle Islands National Lakeshore, DNR, municipalities.

Mille Lacs Peatlands. Douglas County, Minnesota Department of Natural Resources.

Nemadji River Corridor. Douglas County, DNR, private.

Penokee Range. Iron and Ashland counties, Chequamegon-Nicolet National Forest.

St. Louis River Estuary. DNR, City of Superior, Douglas County, Minnesota Department of Natural Resources.

Restoration and Mitigation

Traditional mitigation measures in which drained or physically altered wetlands are restored are difficult to apply in the Lake Superior Basin. Few such altered wetlands exist, due primarily to the low level of agriculture both at present and historically. Without these opportunities, traditional mitigation is often based on creation of new wetlands. Within the basin, there are increasing threats to the quality and integrity of existing significant but unprotected features, therefore we recommend focusing on the restoration and maintenance of functional values at existing wetland sites as a means of mitigation, including mitigation to address future losses. We recommend that any traditional mitigation efforts be

designed to complement existing features in ways that might increase their viability. The following five sites are examples of areas that would benefit greatly by restoration and maintenance of functional value. All are large areas that can make significant contributions to ecosystem function within the Lake Superior Basin. Mitigation at these sites could occur at a variety of scales. Efforts to identify additional sites for mitigation will continue. Invasive species management and monitoring (see p. 216) can play an important role in restoring/preserving functional value at other sites.

Bayview Beach-Sioux River Slough. This valuable coastal wetland is beset by a multitude of problems, including the presence of invasive species and the placement of several fill access roads which fragment the wetlands, provide entry for off-road vehicles to the beach and dune, and may disrupt hydrology. Proposed construction on adjacent State Highway 13 could easily damage the habitat of several rare plants.

Brule River State Forest. One of the few legitimate sites at which to consider restoration of boreal conifer-hardwood forests. Very few substantial blocks of public land occur in the portions of the clay plain that formerly supported this now rare community.

Nemadji River Corridor. This river system (and Allouez Bay) would also benefit by the protection and restoration of more diverse and stable forests dominated by long-lived conifers. The Nemadji's linked marshes, mesic bottomlands, and coniferous slopes suggest serious consideration for a watershed approach to protection.

Pokegama-Carnegie Wetlands. The open wet meadows, marshes, and pools found in these unusual wetlands are being affected by natural succession and, possibly, disrupted hydrology. The most effective methods for maintaining the many populations of rare wetland plants are unknown and the process only begins with site protection. Comments here also apply to the Superior Municipal Forest, and the Hill Avenue/South Superior Triangle/Superior Airport "macrosite".

Red River Breaks. Comments above (Pokegama-Carnegie Wetlands) referring to open communities also apply here. In addition, restoration of forests composed primarily of the conifers native to the site would diversify the available habitats and possibly aid in curbing the slumping and erosion so prevalent along northern Douglas County streams.

Research and Inventory

Our evaluation of the Lake Superior coastal wetlands identified the need for further research and inventory in several areas. A basin-wide gap analysis would be helpful in further clarifying protection needs and opportunities within and beyond the borders of Wisconsin.

Research

More research is necessary in the following areas:

Water Quality. All coastal peatlands are sensitive, and most are vulnerable, to eutrophication. A comprehensive bio-monitoring project specifically addressing this problem is needed. A study in progress in the Bad River-Kakagon Sloughs may serve as a model.

Vegetation Structure and Composition. A subset of wetland (and terrestrial) communities important because of their rarity, suspected sensitivity, representativeness, or other factors should

be monitored to track vegetation changes and better predict trends. An assessment of the recovery potential for severely disturbed vegetation would be especially useful to agencies and others responsible for managing land and water.

Coastal Barrier. Maintenance of the coastal barrier spits along the Lake Superior shore are essential to protecting the wetlands that are associated with them. The longshore movement of sediment, and patterns of deposition and erosion, are key features needing additional understanding if long-term protection is going to be achieved for our unique estuarine wetlands.

Timber Harvest. The impacts of timber harvest on ground flora and other organisms needs further study. Some current assumptions regarding these impacts are based in large part on a group of widespread, rather generalized herbs. The landscape patterns related to some kinds of forest management and the resulting effects on ecosystem diversity is a related topic.

Inventory

Additional surveys are recommended for certain taxa, communities, and sites:

Rare Peatland Birds. Those species more easily detected at night such as rails, sparrows, and owls, should be surveyed for in all of the large coastal peatlands, as well as at selected interior sites.

Macroinvertebrates. Spring seeps and spring ponds, lakes, and representative streams should be surveyed in early spring for rare stoneflies and other macroinvertebrates active at that time.

Interior Wetlands. More thorough inventory of the interior wetlands, especially on county-owned lands, would almost certainly identify additional sites of high value, aid county forest administrators, and provide needed information for large-scale protection projects.

Bad River Sloughs. One of the largest and most intact watersheds; preliminary work revealed good diversity. Further surveying and keying of macroinvertebrates would be very informative. Electrophoretic work on mussels is necessary to answer questions of taxonomy.

Blueberry Creek Swamp. This large, mostly forested wetland in eastern Douglas County needs additional work to allow a more complete assessment. Preliminary surveys found the site to contain several rare plants.

Eagle Lake Fen. This wetland community is rare away from the coast and should be looked at more closely.

Penokee Range. Headwaters streams in the Penokee Range of Iron and Ashland counties should be surveyed for macroinvertebrates.

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Appendixes

Appendix A. Subsections of the National Hierarchical Framework of Ecological Units--Lake Superior Drainage Basin of Northwestern Wisconsin.

Lake Superior Clay Plain - 212Ja

The clay plain borders the coastal areas of Lake Superior in a narrow band which stretches from the western Upper Peninsula of Michigan to the vicinity of Duluth, Minnesota. It is most extensive and best developed in Wisconsin. As implied by the name, the clay plain is relatively level, dissected by many streams which have cut deeply through red clay soils en route to Lake Superior from the highlands to the south. Though the northern margins of the Bayfield Peninsula and the Apostle Islands are included within this subsection, they are ecologically quite distinct and may warrant a separate treatment (perhaps at the Land Type Association level, which is below the Subsection Level in the Hierarchy).

Historically, this region was almost entirely forested, with coniferous species such as white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), white pine (*Pinus strobus*), and white cedar (*Thuja occidentalis*) especially important among the canopy dominants. The present forest is highly disturbed and severely fragmented, with vast areas of even-aged trembling aspen (*Populus tremuloides*) often replacing the conifers. Significant wetlands occur along the coast at the estuarine mouths of the major rivers. Lakes are virtually absent from the clay plain.

This region is a high priority for conservation work as it adjoins the Lake Superior coast, harbors many rare or otherwise significant natural features, some of them unique to the region, and is threatened by increasing development.

Gogebic-Penokee Iron Range - 212Jb

This subsection runs from the Keweenaw Peninsula of western Upper Michigan west into Wisconsin through central Iron and Ashland counties, terminating in southeastern Bayfield County.

Remnants of an ancient mountain range persist as bedrock ridges and domes. Many high-gradient headwaters streams have their origins in this subsection, and several large streams have cut impressive gorges through the rock. Mesic hemlock-hardwoods forests comprised the predominant vegetation in the past. For the most part, these forests are still present but their coniferous component has been greatly reduced and their age structure altered to over-represent young stands.

Conservation priorities include not only protection of the many bedrock-influenced microhabitats of the region, but of the extensive upland mesic forest. Some headwaters streams and river gorges have demonstrated exceptionally high diversity among the aquatic macroinvertebrates, and also provide habitat for a number of specialized vascular plants and herptiles.

Winegar Moraines - 212Jc

A relatively small portion of this region of rolling topography, lakes, wetlands, headwaters streams, and vast forests is within the Lake Superior drainage.

Prior to European settlement, forests of the region were mostly mesic hemlock-hardwoods; but where more coarsely-textured soils occurred, drier forests of white and red pines (*Pinus resinosa*) were significant. Current forests are dominated by young hardwoods, with drastically reduced representation of conifers. Even-aged aspen (*Populus* spp.) monocultures are distributed throughout the moraines, interspersed with the hardwoods. Wetlands are widespread and include extensive areas of acid peatland communities such as open bog, muskeg, and black spruce swamp.

Despite the small acreage of this subsection within the Lake Superior drainage, it is of importance to basin-wide conservation concerns because it includes the headwaters of the Bad River and contains features poorly represented elsewhere.

Bayfield Sand Barrens - 212Ka

Almost entirely contained within Wisconsin, this subsection runs from the northern Bayfield Peninsula southwestward to the St. Croix River in Polk County. The interior of the region is characterized by sandy soils, rolling terrain, numerous small seepage lakes and kettle wetlands, and extensive xeric forests. A significant area of level outwash sands occurs near the upper regions of the Brule River.

Pine forests, pine barrens, oak scrub, and sand prairie were important vegetation types historically. Today most of the area is forested, with pine plantations and aspen (*Populus* spp.) the major forest cover types. Large barrens maintenance and restoration projects are in progress on some of the public lands. Forested wetlands of high ecological value are located within the southern portion of the Brule River State Forest.

Conservation focus is most appropriately on the extensive xeric forests, pine and oak barrens, the Brule wetlands, and at least a subset of the seepage lakes and kettle wetlands found in the Bayfield Sand Barrens subsection.

Mille Lacs Uplands - 212Kb

Located primarily in eastern Minnesota, this subsection forms a wedge in western Douglas County between the Lake Superior Clay Plain and the Bayfield Sand Barrens subsections. Most of the region is forested, but the outstanding natural feature is a cluster of large acid peatlands, several of which straddle the drainage divide between the St. Croix River and Lake Superior. These wetlands are the headwaters of some of the important streams in the western portion of the Lake Superior basin.

Forests of the past were a mix of sugar maple (*Acer saccharum*), aspen (*Populus* spp.), paper birch (*Betula papyrifera*), and white pine (*Pinus strobus*). Young second-growth stands of mesic hardwoods and aspen (*Populus* spp.) are widespread forest types at present. The boggy wetlands are extensive and relatively undisturbed.

Protection of the large peatlands, headwaters streams, and stream corridors are of major consideration for regional conservation actions.

Appendix B. Wisconsin Natural Heritage Working List

Appendix C. Descriptions of rare lepidoptera and stream sampling sites in the Lake Superior Basin.

Table C.1. Peatland sites surveyed for rare lepidoptera in the Lake Superior Basin of Wisconsin.

Site Name	Legal Location	Habitat Size (ha)	Habitat Type
<i>Ashland County</i>			
Ashland Mud Lake	T. 44 N., R. 4 W.	74.36	Muskeg
Bad River Bottoms	T. 47 N., R. 3 W.	25.20	Forest
Ballou Barrens	T. 44 N., R. 2 W.	2.25	Barrens
Big Bay East	T. 50 N., R. 3 W.	19.05	Coastal
Big Bay West	T. 50 N., R. 3 W.	34.31	Coastal
Bog Lake	T. 51 N., R. 2 W.	11.49	Coastal
Clam Lake Road	T. 43 N., R. 4 W.	24.90	Muskeg
Dingdong Creek	T. 43 N., R. 4 W.	28.83	Muskeg
Glidden	T. 42 N., R. 2 W.	80.16	Muskeg
Loon Lake	T. 42 N., R. 2 W.	3.65	Pothole
Meder Lake	T. 44 N., R. 2 W.	15.18	Muskeg
North County Trail	T. 45 N., R. 2 W.	5.97	Forest
Popcorn Corners	T. 43 N., R. 3 W.	7.93	Muskeg
St. Peter's Dome	T. 45 N., R. 4 W.	37.53	Forest
Twin Lake	T. 43 N., R. 4 W.	49.75	Muskeg
<i>Bayfield County</i>			
Atkins-Taylor	T. 44 N., R. 5 W.	61.59	Muskeg
Bark Bay	T. 50 N., R. 7 W.	9.23	Coastal
Basswood Lake	T. 46 N., R. 8 W.	3.70	Pothole
Basswood South	T. 46 N., R. 8 W.	1.65	Pothole
Bayfield County Line	T. 43 N., R. 5 W.	17.56	Muskeg
Bellevue Lake	T. 46 N., R. 7 W.	1.91	Pothole
Blueberry Lane	T. 50 N., R. 6 W.	2.93	Coastal
Cat Lake	T. 47 N., R. 8 W.	0.92	Pothole
County H Bog	T. 47 N., R. 8 W.	2.48	Pothole
Eagle Lake	T. 46 N., R. 8 W.	6.44	Pothole
East Crane	T. 44 N., R. 7 W.	7.82	Pothole
East Roger Lake	T. 44 N., R. 7 W.	1.84	Pothole
East Wishbone	T. 45 N., R. 7 W.	4.12	Pothole
Egg Lake	T. 45 N., R. 7 W.	10.48	Pothole
Eighteen-Mile Lake Barrens	T. 46 N., R. 9 W.	11.05	Barrens
Everett Lake	T. 46 N., R. 7 W.	0.80	Pothole
Heart Lake	T. 46 N., R. 7 W.	3.07	Pothole
Iron River	T. 47 N., R. 9 W.	67.24	Pothole
Little Sand Bay	T. 51 N., R. 5 W.	10.23	Coastal

Site Name	Legal Location	Habitat Size (ha)	Habitat Type
<i>Bayfield County Cont'd.</i>			
Little Sioux River	T. 49 N., R. 4 W.	5.90	Coastal
Lost Lake	T. 47 N., R. 9 W.	1.87	Pothole
McCarry Lake	T. 47 N., R. 8 W.	0.98	Pothole
Moquah Barrens	T. 48 N., R. 7 W.	22.29	Barrens
Moquah Pine Lake	T. 48 N., R. 7 W.	1.96	Pothole
North Frog Lake	T. 46 N., R. 8 W.	1.23	Pothole
Port Wing East	T. 50 N., R. 8 W.	2.68	Coastal
Port Wing West	T. 50 N., R. 8 W.	16.56	Coastal
Raspberry Bay	T. 51 N., R. 4 W.	3.10	Coastal
Southwest Lake	T. 44 N., R. 6 W.	2.09	Pothole
Sugarbush Lake	T. 44 N., R. 7 W.	32.14	Pothole
Sultz Swamp	T. 50 N., R. 4 W.	66.60	Muskeg
Trapper Lake	T. 44 N., R. 6 W.	24.45	Muskeg
Wilderness Lake Road Barrens	T. 45 N., R. 9 W.	1.44	Barrens
<i>Douglas County</i>			
Amnicon Bar	T. 46 N., R. 14 W.	8.46	Muskeg
Bear Creek	T. 46 N., R. 14 W.	72.02	Muskeg
Belden North	T. 45 N., R. 15 W.	288.10	Muskeg
Belden South	T. 45 N., R. 14 W.	14.95	Muskeg
Bennett Town Line	T. 46 N., R. 12 W.	32.17	Muskeg
Blueberry	T. 47 N., R. 10 W.	1.82	Muskeg
Breitzman Lake Road	T. 46 N., R. 15 W.	14.38	Muskeg
Dergerman Road	T. 47 N., R. 11 W.	29.36	Muskeg
Dergerman Road Cedars	T. 47 N., R. 11 W.	25.71	Muskeg
Empire Wilderness Road North	T. 45 N., R. 13 W.	7.44	Muskeg
Empire Wilderness Road South	T. 45 N., R. 13 W.	20.74	Muskeg
Hoodoo Lake	T. 47 N., R. 10 W.	7.29	Pothole
Hoodoo Lake Barrens	T. 47 N., R. 10 W.	3.77	Barrens
Lyman Lake	T. 46 N., R. 13 W.	50.55	Muskeg
McCreary School	T. 46 N., R. 15 W.	10.48	Muskeg
Milchesky Road East	T. 46 N., R. 14 W.	18.92	Muskeg
Milchesky Road West	T. 46 N., R. 14 W.	114.80	Muskeg
Nemadji Bottoms	T. 47 N., R. 15 W.	5.90	Forest
One Buck	T. 46 N., R. 13 W.	8.95	Muskeg
Sharptail Barrens	T. 44 N., R. 12 W.	51.82	Barrens
Solon Springs East	T. 45 N., R. 11 W.	9.56	Barrens
Solon Springs East	T. 45 N., R. 11 W.	8.58	Barrens
Solon Springs South	T. 44 N., R. 12 W.	93.13	Barrens
Winter Road	T. 46 N., R. 15 W.	19.80	Muskeg

Site Name	Legal Location	Habitat Size (ha)	Habitat Type
<i>Iron County</i>			
Caroline Lake Road	T. 44 N., R. 1 W.	52.58	Muskeg
Erickson Creek Headwaters	T. 45 N., R. 1 W.	0.24	Forest
Iron Mud Lake	T. 44 N., R. 2 E.	11.60	Muskeg
Island Lake South	T. 44 N., R. 1 E.	3.72	Muskeg
Joan Elias	T. 46 N., R. 1 W.	2.00	Forest
Layman Creek	T. 44 N., R. 3 E.	2.31	Muskeg
Layman Creek South	T. 44 N., R. 3 E.	4.11	Muskeg
Pine Lake	T. 44 N., R. 3 E.	2.12	Pothole
Pleasant Lake Road	T. 44 N., R. 3 E.	0.49	Pothole
Ruby Lake	T. 44 N., R. 2 E.	12.53	Muskeg
Sandrock North	T. 44 N., R. 3 E.	43.27	Muskeg
Sandrock South	T. 44 N., R. 3 E.	1.59	Muskeg
Tyler Forks	T. 44 N., R. 1 W.	62.34	Muskeg
Upton South	T. 45 N., R. 1 E.	1.48	Forest
West Shirley Lake	T. 44 N., R. 1 W.	1.29	Pothole

Table C.2. Sample site locations and sampling methods for streams surveyed in the Lake Superior Basin, 1996.

Table C.3. Factors affecting water quality of Lake Superior Basin sampling sites, 1996.

Table C.4. Physical descriptions of streams sampled in the Lake Superior Basin, 1996.

Appendix D. Macroinvertebrate taxa collected from streams in the Lake Superior Basin, 1996.

Appendix E. Results of migratory and breeding bird surveys in the Lake Superior Basin.

Figure E.1. Approximate number of migratory birds using Allouez Bay Wetlands, 1996. (312)

Figure E.2. Approximate number of migratory birds using Bark Bay Slough, 1996. (313)

Figure E.3. Approximate number of migratory birds using Port Wing Wetlands, 1996. (314)

Figure E.4. Approximate number of migratory birds using Sioux River Slough, 1996. (315)

Table E.1. Relative abundance of breeding birds by sampling site. (317)

Table E.2. Number of breeding birds per sampling site using the Point Count method. (321)

Table E.3. Relative abundance of breeding birds by site and habitat type. (325)

Figure E.1. Approximate number of migratory birds using Allouez Bay Wetlands, 1996.

Figure E.2. Approximate number of migratory birds using Bark Bay Slough, 1996.

Figure E.3. Approximate number of migratory birds using Port Wing Wetlands, 1996.

Figure E.4. Approximate number of migratory birds using Sioux River Slough, 1996.

Table E.1. Relative abundance of breeding birds by sampling site.

'R' = rare, 'U' = uncommon, 'C' = common, 'A' = abundant. Species codes according to the American Ornithologist's Union standards.

Table E.2. Number of breeding birds per sampling site using the Point Count method. Species codes according to the American Ornithologist's Union standards.

Table E.3. Relative abundance of breeding birds by site and habitat type.

Sites with more than one habitat type are listed under each habitat. 'R' = rare, 'U' = uncommon, 'C' = common, 'A' = abundant. Species codes according to the American Ornithologist's Union standards.