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CASS COUNTY BIOLOGICAL SURVEY

CASS COUNTY

BIOLOGICAL SURVEY 1992-1995



MINNESOTA DEPARTMENT OF NATURAL RESOURCES



Cass County Biological Survey 1992-1995

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Inclusion

Copy of Minnesota's Native Vegetation: a Key to
Natural Communities. Version 1.5. Natural
Heritage Program. 1993. MN DNR Biological
Report No. 20. Minnesota Department of Natural
Resources, St. Paul.



STATE OF
MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

500 LAFAYETTE ROAD • ST. PAUL, MINNESOTA • 55155-40_____

DNR INFORMATION
(612) 296-6157

12 June 1998

Dear Cass County Notebook Recipient,

This letter accompanies a copy of a notebook containing information on rare plants, rare animals, and other natural features that contribute to the biodiversity of Cass County.

The notebook contains original data collected on rare features and plant communities by Minnesota County Biological Survey (MCBS) staff during their work in Cass County from 1992 through 1995. It also contains information published or produced by other groups or agencies, including a description of Minnesota's bearing tree database produced by the Ecological Classification System Program of the MN Department of Natural Resources and reports on rare plants produced by The Nature Conservancy. Our intent was to gather in one place a body of information on biodiversity that would be useful to land managers in Cass County and would also be of interest to educators and the general public.

Data gathered or generated by MCBS, including rare plant records, rare animal records, vegetation plots, and site boundaries, are available as layers in an ArcView geographic information system. We invite land managers to obtain these data layers (see Chapter 1 in the notebook for directions) and use them when planning land use in Cass County.

Sites (see Chapter 4 in the notebook) are areas that MCBS considers important in Cass County from a biodiversity standpoint. Site boundaries were drawn without respect to ownership, so it is likely that any site will include more than one landowner. Although we have given each site a rank (high, medium, low) indicating our view of its biodiversity importance in the county, management decisions for each of these areas are the domain of landowners.

We thank the many residents of Cass County who participated in this biological survey in one way or another. Your interest and enthusiasm made our work here a joy. We hope that you will continue to search in the hidden places and far reaches of the county and share the secrets you discover about the plants and animals of Cass County.

Sincerely,

Cass County MCBS Staff

John A. Thompson (1871-1940)
John A. Thompson (1871-1940)
John A. Thompson (1871-1940)
John A. Thompson (1871-1940)

Minnesota County Biological Survey

Comment Sheet ♣ Cass County Notebook

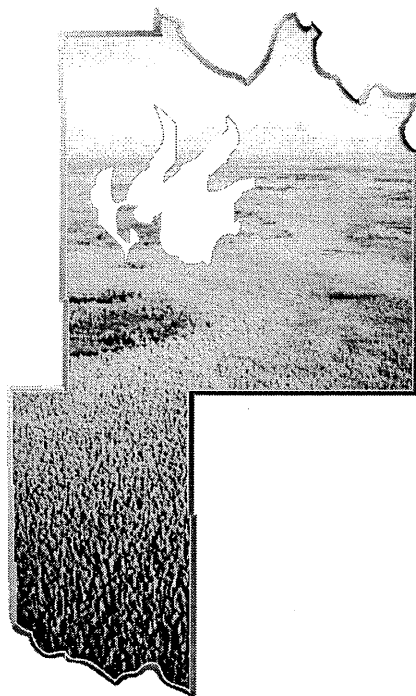
We would appreciate hearing from you about the information contained in this notebook and the format in which it is presented. Your comments will be especially valuable to us when we plan future MCBS products.

Comments:

Please return this form to: Minnesota County Biological Survey
MN Department of Natural Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155.

NEW YORK

CASS COUNTY BIOLOGICAL SURVEY 1992-1995



Minnesota County Biological Survey
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Minnesota Department of Natural Resources
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St. Paul, Minnesota 55155
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Biological Report No. 59

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List of abbreviations used in this notebook

CCLD	Cass County Land Department
CIR	color infra-red
CNF	Chippewa National Forest
DNR	Minnesota Department of Natural Resources
ECS	Ecological Classification System
ESA	Element Stewardship Abstract
GIS	geographic information system software (such as ArcView)
LLDRM	Leech Lake Reservation Division of Resources Management
LTA	landtype association (one level of an ecological classification system)
MCBS	Minnesota County Biological Survey
NHIS	Natural Heritage Information System (the group of databases maintained by NHNRP in St. Paul)
NHNRP	Natural Heritage and Nongame Research Program (Minnesota DNR)
NRCS	Natural Resources Conservation Service (formerly Soil Conservation Service)
TES	State list of endangered, threatened, and special concern species
TNC	The Nature Conservancy
USFS	United States Forest Service (Minnesota)

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Annotated Table of Contents

Because this notebook combines original data and previously published information, this table of contents has been expanded and annotated for use as a guide to locating and understanding the source and nature of the information provided. Page numbers consist of 3 parts; the first numeral indicates chapter number, the second indicates topic number within that chapter, and the third is the page number within that topic. For information from other sources or previously published information that contains its own page numbers, a numbered sheet precedes that item, and the page number on that sheet is listed in the table of contents.

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For plant species included in the 1996 revision of the state list of endangered, threatened and special concern species, the DNR adopted the scientific names used in *A synonymized checklist of the vascular flora of the United States, Canada, and Greenland*. (Kartesz, J. T. 1994. Timber Press, Inc., Portland, Oregon.) This resulted in a change in scientific name for several rare plants found in Cass County.

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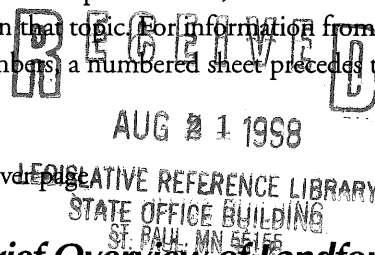
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system for Minnesota (Hargrave, B. 1994. Division of Forestry, Department of Natural Resources. Draft)

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(Heinselman, M.L. 1974. North Central Forest Experiment Station, St. Paul.) Although all communities on F. J. Marschner's original map are not found in Cass County, this interpretation, found on the back of the 1974 published version of Marschner's 1930 map, holds valuable information about the map's origin and community designations.

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Listed species are those on the current or previous state list of endangered, threatened, or special concern species. Tracked species (listed as NON) are not listed but are collected by MCBS botanists when encountered to gather more information about the species' biology and distribution.

*Rare plant information sheets for
collected listed species. 6.5.1 through 6.5.26*

These include habitat, field characteristics, best time to search for the plant, selected references, state and continental range maps, and a black-and-white illustration (line drawing or scanned image). Information is provided for the following species: *Arethusa bulbosa* (Dragon's-Mouth), *Botrychium minganense* (Mingan Moonwort), *Botrychium mormo* (Goblin fern), *Botrychium pallidum* (Pale Moonwort), *Botrychium oneidense* (Blunt-lobed Grapefern), *Botrychium rugulosum* (St. Lawrence Grapefern), *Botrychium simplex* (Least Moonwort), *Cypripedium arietinum* (Ram's-head Lady's-slipper), *Dryopteris goldiana* (Goldie's Fern), *Eleocharis olivacea* (Olivaceous Spikerush), *Eleocharis quinqueflora* (Few-flowered Spikerush), *Juglans cinerea* (Butternut), *Malaxis monophyllos* var. *brachypoda* (White Adder's-mouth), *Najas gracillima* (Slender Naiad), *Orobancha uniflora* (One-flowered Broom-rape), *Sparganium glomeratum* (Clustered Bur-reed), *Utricularia gibba* (Humped Bladderwort), *Utricularia purpurea* (Purple Flowered Bladderwort), *Viola novae-angliae* (New England Violet), *Waldsteinia fragarioides* (Barren Strawberry).

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Element Stewardship Abstracts (ESAs) are species reports compiled by The Network of Natu-

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The term "element" comes from the phrase "elements of natural diversity" and as used here is synonymous with "species." ESAs are not yet available for all species. Those available for rare plant species that occur in Cass County are *Arethusa bulbosa*, *Botrychium mormo*, *Botrychium rugulosum*, *Cypripedium arietinum*, *Viola novae-angliae*, and *Waldsteinia fragarioides*. A list of all species for which ESAs are available is included following the abstracts. Note that ESAs have also been prepared for some pest species. To request copies, contact the ESA coordinator at the Midwest Regional office of TNC (612) 331-0700.

*Chippewa National Forest Sensitive Species:
A Guide to Potential Habitats 6.7.1*

Prepared by Nancy Sather in 1992 as part of a cooperative agreement between Chippewa National Forest and the DNR Natural Heritage Program. Includes information, summarized from herbarium specimens, on habitat and collection dates for most rare plants likely to be found in Cass County.

*DNR Rare Species Statements of Need
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Prepared as part of the 1996 revision of the state endangered, threatened, and special concern list. A status sheet was prepared for each species for which a change in status was proposed (see List in INTRODUCTION). Similar information for listed species that did not undergo a change in status is available in Minnesota's Endangered Flora and Fauna (B. Coffin and L. Pfannmuller. 1988; University of Minnesota Press, Minneapolis). A status sheet was prepared for *Arethusa bulbosa*, *Botrychium minganense*, *Botrychium oneidense*, *Botrychium pallidum*, *Botrychium rugulosum*, *Botrychium simplex*, *Cypripedium arietinum*, *Juglans cinerea*, *Malaxis monophyllos* var. *brachypoda*, *Najas gracillima*, *Sparganium glomeratum*, *Utricularia gibba*, *Utricularia purpurea*, and *Viola novae-angliae*.

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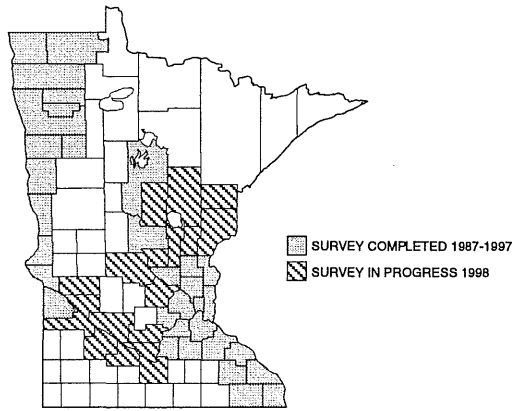
Inclusion

*Copy of Minnesota's Native Vegetation: a Key to
Natural Communities. Version 1.5. Natural Heri-
tage Program. 1993. MN DNR Biological Report
No. 20. Minnesota Department of Natural Resources,
St. Paul.*

A copy of this key is included in a pocket of this
notebook.

1. Introduction

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MINNESOTA COUNTY BIOLOGICAL SURVEY

Project Purpose: The Minnesota County Biological Survey began in 1987 as a systematic survey of rare biological features. The goal of the Survey is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals, and natural communities.

Procedure: The Survey uses a multi-level procedure, beginning with evaluation of existing inventory data and followed by an assessment of the quality and condition of selected areas using air photos, classified satellite imagery and ground survey. This is supplemented by specialized field surveys of selected rare species or groups of species. Data are entered into the Department of Natural Resources' Natural Heritage Information System, which includes the mapping capabilities of an ARC/INFO Geographic Information System.

Status: Survey results have contributed significantly to the knowledge of the status and distribution of the state's flora, fauna, and natural communities. To date the Survey has been completed in 33 counties and is underway in 18 counties. Since 1987, over 9240 new records of rare features have been recorded in the Rare Features Database and over 5000 vegetation samples have been added to the vegetation database. Nine species of native plants and one species of amphibian not previously documented in Minnesota were recorded by MCBS.

One outcome of MCBS is the publication of the book, *Minnesota's St. Croix River and Anoka Sandplain: a guide to native habitats*, and set of companion wall maps. Published maps that display the results of the Survey are now available for 17 counties.

Natural areas evaluated by MCBS as having high biodiversity significance have received various types of protection. An example is the consolidation of holdings within the Caribou Wildlife Management Area to provide for the more effective management of the aspen parkland, an extensive area of aspen groves, sedge fens and brush prairie in north-western Minnesota. Aspen Parkland provides important habitat for game species such as Sharp-tailed Grouse and rare species such as Yellow Rails, Nelson's Sharp-tailed Sparrows, and McCall's Willow. MCBS also has provided documentation and interpretation of rare features at Seminary Fen and Bluff Creek in Carver County to enable local citizens and municipalities to plan for the protection of these resources. Finally, the recent establishment of Wood Rill Scientific and Natural Area in Hennepin County protects one of the few remaining examples of Big Woods. One hundred and fifty years ago, Big Woods forest covered close to one-half of the county; MCBS work indicates that less than 1% of this forest remains.

Cooperators: The University of Minnesota Bell Museum of Natural History provides the repositories for specimens collected by MCBS. Examples of other cooperators have included the Chippewa National Forest (rare species surveys and Ecological Classification System development), Olmsted and Stearns counties, and the US Fish and Wildlife Service (recommendations for prairie sites to include in the Northern Tallgrass Prairie Habitat project).

Project Contact: Carmen Converse, Minnesota County Biological Survey Supervisor
Box 25, 500 Lafayette Road, St. Paul, MN 55155
(612) 296-9782 carmen.converse@dnr.state.mn.us

Preface

The Minnesota County Biological Survey (MCBS) is a state-wide program within the Minnesota Department of Natural Resources (DNR). Program botanists, zoologists, and ecologists search the state county by county for rare plants, rare animals, and high-quality plant communities. MCBS staff surveyed Cass County for rare features from 1992 through 1995.

We prepared this notebook with two objectives in mind. The first was to present data on rare plants, rare animals, and plant communities gathered by MCBS staff during the Survey's work in Cass County. The second objective was to provide background and supplementary information that would assist land managers in their interpretation and use of the MCBS data.

Although land managers are the intended audience for the material presented here, educators and members of the general public should also find the information of interest. Maps constructed in a computerized geographic information system (GIS) using MCBS data layers should also be useful to developers and land-use planners in Cass County.

The notebook format used here allows the presentation of MCBS and related information as a unit and also allows for the addition of new material. The annotated table of contents serves as a guide to the various types of information provided in this notebook.

In the Introduction (Chapter 1), we provide background information, including a brief history of MCBS and a 'flow-chart' showing the location of MCBS within the Section of Ecological Services in the DNR. We also include information about rare species legislation and ranking systems that should help readers make sense of the various terms used to describe categories of rare plants and animals. Please take the time to read the acknowledgements within this chapter, lest we give the impression that we did this work alone. We close the chapter with a data request form and instructions for requesting and obtaining data collected during the Survey.

The second chapter (Brief Overview of Landforms) covers some of the landforms and bodies of water in the county that influence the biota found here. We present information about several useful ways of dividing up the landscape to help us better understand and manage land here: geomorphic regions, an ecological classification system, and watersheds.

We address the past in Chapter 3, as further background for understanding the present landscape conditions in the county. The bearing trees of the county (recorded during the Public Land Survey from 1858 through 1875) have been digitized and are included in map form in this chapter. We also include information from an interview with Faye Harrington, retired Cass County Land Commissioner, who related his knowledge of land use changes in the county.

In Chapter 4, we describe one part of the work of MCBS in Cass County: the selection and evaluation of 'sites' or potential natural or special management areas. We include a map showing the sites delineated before our fieldwork and another map showing the final site boundaries. We also include a brief description of each of the sites that remains on our list of important areas in the county.

We discuss our plant community work in Chapter 5, including our tools and techniques. We also include directions for a self-guided tour of examples of various plant communities in the county.

In the next chapter, we discuss the survey of Cass County for rare plants. Included here are the complete records for rare plant collections entered into the NHIS database and a fact sheet for each listed species found in the county. We include several previously distributed reports that should prove helpful in rare species survey, monitoring, and management as well as rare plant collecting guidelines, permit requirements, and reporting forms.

The list of the entire vascular flora of the state is included in Chapter 7, with those plants collected in Cass County indicated. In addition, plant collection and identification guidelines are included.

Information on rare animals closes out the notebook. The MCBS Animal Survey of Cass County and Chippewa National Forest (including the parts of the CNF in Beltrami and Itasca counties) took place in 1994. This chapter includes survey methods and fact sheets for selected animals as well as complete records of rare animal locations entered into the NHIS database.

Throughout this notebook, we have provided brief annotated bibliographies that we hope will serve as starting points for anyone interested in more information on a given subject. We have also included maps that help to illustrate landforms and past vegetation as well as the results of the Survey.

A copy of *Minnesota's Native Vegetation: A Key to Natu-*

ral Communities (Minnesota DNR, Natural Heritage Program, 1993) is included in this notebook. Three programs within the Minnesota DNR, the Ecological Classification Program (Division of Forestry) and the Natural Heritage and Nongame Research Program and MCBS (Division of Fish and Wildlife), are now revising this key; a new edition should be available in 1999.

Data collected by MCBS and included in this notebook have been entered into databases of the Natural Heritage Information System maintained by the Natural Heritage and Nongame Research Program, Minnesota DNR, in St. Paul. This information is also available upon request from the Database Manager (see information on obtaining MCBS products later in this chapter). Data layers showing rare feature locations and site boundaries are also available from the NHNRP as electronic files at cost and upon written request.

Minnesota Department of Natural Resources/ Chippewa National Forest Cooperative Agreement

In 1991, Chippewa National Forest (CNF) was preparing to move forward on two fronts: an Ecological Classification System (ECS) had been started 12 years earlier and needed completion; and plans were being made for a ten-year Forest Plan revision, which would require gathering information on rare species. Forest Service staff ap-

proached the Minnesota Department of Natural Resources (DNR), and, in 1992, a two-pronged cooperative agreement was signed by CNF, the DNR Division of Forestry, and the DNR Section of Wildlife.

After the cooperative agreement was signed, CNF and the DNR Division of Forestry worked together on the continued development of an ECS. As part of the agreement, the Division assigned a plant ecologist to the Deer River Ranger District of CNF to begin working on an ECS with CNF staff.

CNF and the DNR Section of Wildlife worked together on a survey for rare species (surveys for rare animals took place in 1994), the identification of important areas for conservation and special management, and the completion of selected vegetation plots for use in development of the CNF's ECS. MCBS sent a plant ecologist and a botanist to conduct plant community and rare plant surveys in Cass County, which includes much of the CNF. As part of the agreement, the CNF Deer River Ranger District also provided office space for the MCBS plant ecologist.

A copy of the cooperative agreement is available from MCBS. Although the USFS provided the incentive to begin work in Cass County at that time, the Survey covered the entire county and included all ownerships.

A Brief History of MCBS

Early Natural History Surveys in Minnesota

As long ago as 1872, the legislature of the State of Minnesota mandated a geological and natural history survey of the state and entrusted this survey to the faculty of the University of Minnesota. The natural history survey was to include all trees, shrubs, herbs, and grasses in the state as well as the state's entire animal kingdom. Specimens were to be prepared and deposited in University of Minnesota museums. Certain state lands, known as the "state salt lands", were transferred to the University Board of Regents and sold by the Board to pay for these geological and natural history surveys (State Laws 1872, chap. 30, pg. 86).

The Geological and Natural History Survey was headed by Newton Horace Winchell, State Geologist, from 1872 until his retirement in 1899. The geological component of the Survey received the lion's share of effort in the earliest years. Winchell headed county surveys and managed to complete Olmsted, Hennepin, Steele, Rock, and a number of other counties as well as a survey of the Iron Regions of the state before his retirement (C. Weigel, Minnesota Historical Society, pers. comm.).

Nearer to 1880, the University Regents directed that botanists collect plant specimens with the goal of establishing an herbarium documenting the entire flora of the state (General Information, Minnesota University Calendar, 1874-1880). At this time, the Regents also encouraged the collection of observations of birds in the state and directed that entomological studies should begin (perhaps because of a grasshopper infestation at the time) (Swanson 1985). In its last years, the Survey was relatively inactive, although zoological and botanical materials published by the Survey continued to appear through 1916. Botanists and zoologists continued to collect specimens and deposit them at the University of Minnesota museums and herbarium after 1916, but this was done under the auspices of the University and not the Survey.

In 1911, the Minnesota Geological Survey was established as an entity separate from the Minnesota Geological and Natural History Survey. Geological work in the state had continued after the retirement of N.H. Winchell, and William Harvey Emmons made the establishment of the Minnesota Geological Survey a condition of his employment as Chairman of the De-

partment of Geology at the University of Minnesota. Following its establishment, he also served as the first director of the Minnesota Geological Survey (Swanson 1985).

The Nature Conservancy and Natural Heritage Program

In the early 1970s, The Nature Conservancy (TNC), a private international conservation organization, recognized that a source of objective information on the elements of biodiversity was required before it or any other agency could plan conservation actions. TNC then began entering into cooperative agreements with government agencies across the nation, resulting in the establishment of Natural Heritage programs. These programs were staffed with field biologists, who collected information on plant communities and rare plants and animals, and information managers, who organized and disseminated the information.

The first such cooperative venture was in 1974, when TNC helped establish the Natural Heritage Program in South Carolina. Since then, the network of Heritage programs has grown to include all 50 states, the District of Columbia, the Navajo Nation, five Canadian provinces, and 14 countries in Latin America and the Caribbean (The Nature Conservancy 1994).

Most Natural Heritage programs have now become independent entities that collaborate with TNC as well as many other private and public agencies. In the United States, Heritage programs are housed within state government agencies (84%), public universities (12%), and TNC itself (4%) (The Nature Conservancy 1995). The focus of the programs has also broadened. Today the Heritage Program network provides information on rare elements of biodiversity not only to government agencies and TNC but also to developers and corporations, helping to ensure that everyone is able to make informed decisions on land use.

The original methodology used by Heritage programs was developed by the Science Department of The Nature Conservancy, and its standardization across programs was an important factor in the success of the Heritage network (The Nature Conservancy 1982). The record-keeping system is built around Element Occurrences (EOs); these are individual examples of any element of biodiversity (e.g., a rare plant or a rare animal). Element Occurrence Reports are forms filled out by someone who locates an element occurrence; the exact location of the

element, date, conditions at the site, etc., are recorded and entered into the Natural Heritage database. A more thorough description of TNC methodology is given in the Natural Heritage Program Operations Manual (The Nature Conservancy 1982) and in *Building an Ark* (Hoose 1981).

Minnesota's Natural Heritage Program

In the late 1970s, a small group of individuals met to explore the possibility of again instituting a natural history survey in the state. The impetus for the meeting was concern over the rapid rate of development and land use change in certain areas of the state. Among the participants were several botanists and a representative of The Nature Conservancy. The group constructed a proposal for renewed emphasis on the gathering of natural history information, particularly information about rare species and plant communities, and submitted it in 1978 to the Legislative Committee on Minnesota's Resources (LCMR) for funding consideration.

With funding recommended by LCMR, provided by the state legislature, and matched by The Nature Conservancy, Minnesota's Natural Heritage Program began in 1979. The program was housed within the Minnesota Department of Natural Resources (DNR). Four field biologists and a data manager began to identify and inventory the state's rare species and threatened plant communities. Their first task was to review and record in the Heritage database the collections of plant and animal specimens already stored in museums and herbaria.

In October 1980, the Natural Heritage Program (NHP) became a permanent part of the DNR, and, in 1982, NHP was moved, along with the Nongame Wildlife Program and the Scientific and Natural Areas (SNA) Program, into the DNR's Section of Wildlife, within the Division of Fish and Wildlife.

The Minnesota County Biological Survey

Increased land development pressure focused attention on the need for increased and timely information about the state's plants, animals, and plant communities. The Minnesota County Biological Survey (MCBS) was established in 1987 as a result of a proposal recommended by LCMR and jointly funded by TNC and the Minnesota legislature. The initiation of this program fulfilled one of the recommendations made to the NHP at its inception (Coffin 1989).

MCBS is a systematic survey for rare biological features in the state. The goal of the Survey is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals, and natural communities.

Until August 1993, MCBS was a part of the NHP. Then, partly because of the scope of MCBS, it was separated from the NHP. At the same time, the research unit of the Nongame Wildlife Program joined the NHP, which became the Natural Heritage and Nongame Research Program (NHNRP). The supervisors of MCBS (Carmen Converse) and NHNRP (Bonita Eliason) hold equivalent positions (Eliason 1994). In July 1996, MCBS, NHNRP, and the SNA Program moved to the Section of Ecological Services, still within the Division of Fish and Wildlife.

While MCBS and NHNRP continue to work hand-in-glove to conserve rare elements of biodiversity in the state, the focus of their respective efforts is somewhat different. The old growth forest project, environmental review, federal endangered species coordination, coordination of the state rare species listing process, coordination of the small grants program, writing and updating the natural community key, and management of the various and extensive databases are housed within NHNRP.

MCBS staff focus on the collection of data in the field and the processing and dissemination of that information. Staff members now include a coordinator, eight botanist/plant ecologists, a mammalogist (who is also the animal survey coordinator), an ornithologist, a herpetologist, two data managers, a graphic artist, a public relations coordinator, and a technical writer. Additional temporary botanists and zoologists are hired to assist during the field season.

Currently about 67% of the funding for MCBS comes from the Minnesota Environment and Natural Resources Trust Fund, which is administered by LCMR. The remainder comes from the DNR General Fund (about 17%), Reinvest in Minnesota (RIM; about 12%), and the DNR Nongame Wildlife Program (about 4%) (Converse 1995).

An MCBS Fact Sheet found on page 1.1.1 describes the current status and projected completion date for the survey in the state.

The DNR website contains information about MCBS and can be reached at <http://www.dnr.state.mn.us/>. A TNC website containing information about MCBS and NHNRP as well as Natural Heritage programs in other states is located at <http://www.heritage.tnc.org>.

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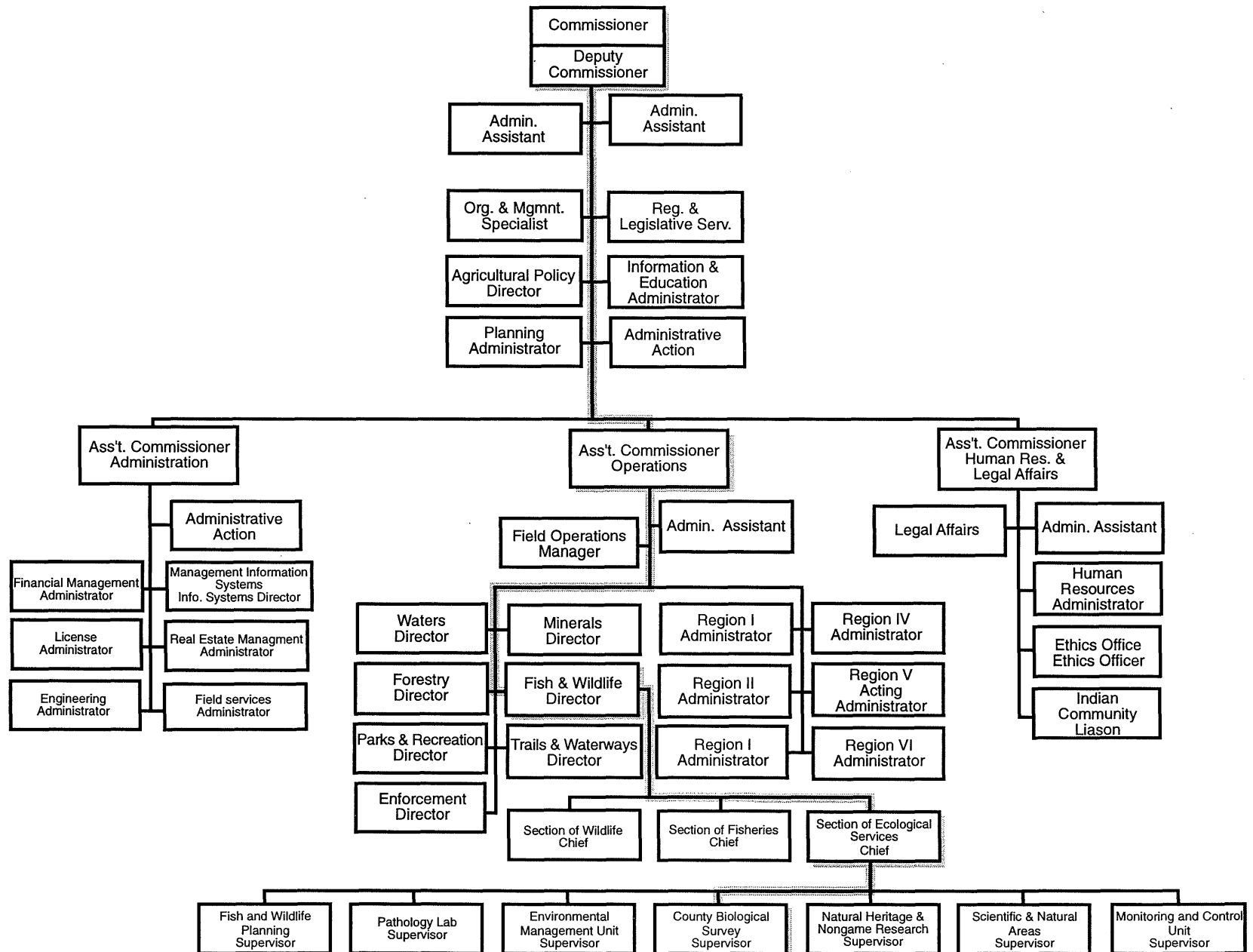
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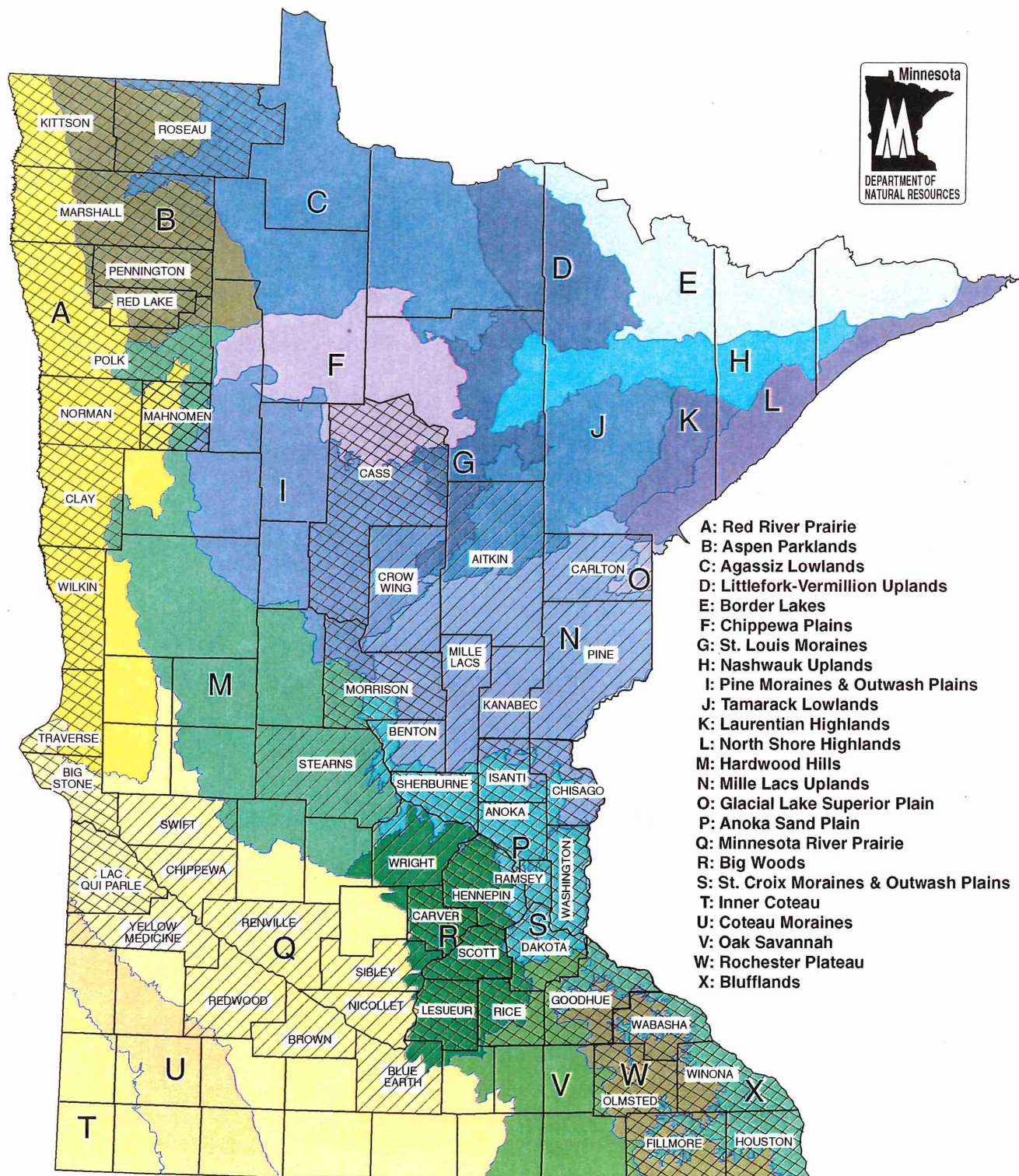
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Minnesota Department of Natural Resources/Section of Ecological Services Organization Chart



Minnesota County Biological Survey and Ecological Classification System Subsections



Acknowledgements

The survey of Cass County by the Minnesota County Biological Survey (MCBS) was a cooperative venture. Chippewa National Forest (CNF) provided office space and technical support for the MCBS plant ecologist as well as staff to assist with rare plant searches, drift fence operations, and other field activities. The Cass County Land Department, another cooperator in the survey, shouldered the significant financial burden of digitized data entry. Both agencies were the primary sources of low level aerial photographs used by Survey staff.

In a landmark experiment, four land management agencies shared their digital and tabular forest inventory data to produce a single GIS layer of forest stand polygons. The Cass County Land Department, the Division of Forestry of the Minnesota Department of Natural Resources (DNR), Chippewa National Forest, and Leech Lake Reservation pooled their data to provide the GIS base maps on which MCBS Site boundaries are drawn.

John Mathisen, CNF Forest Biologist (now retired), recognized the need on the Forest for the kind of information that MCBS provides. It was largely through his efforts that a cooperative agreement between the CNF and MCBS was written and MCBS began and completed work in Cass County. We thank John for his enthusiastic support and active participation in this project.

The DNR Division of Forestry and the Cass County Land Department provided forest inventory base maps for field use and loaned photographs, equipment, and personnel from time to time during the survey. We thank them for their help.

We thank Steve Mortensen and Carol Estes Mortensen of the Leech Lake Reservation Division of Resources Management (LLDRM) for their willingness to assist us throughout the years of the survey. Whenever there was a need, whether it was for a boat large enough to use on Leech Lake or a pair of eyes to search for rare plants, they always tried to help out.

We extend special thanks to these Chippewa National Forest staff who gave generously of their time to assist with the less-than-pleasant task of checking drift fences: Jeremy Cable, Jim Hoover, and Tom Suddendorf of the Marcell District; Kelly Cable, Ken Bruns, and Jeff Jerry from the Deer River District; and John Casson and Jack Davis from the Cass Lake District. In addition to checking drift fences, John and Jack took on the ambitious project of capturing foraging bats in the forest canopy. Most of these staff also helped out with rare plant searches

during the survey. We greatly appreciate their time and enthusiasm.

Many other persons, representing various public agencies, assisted with field work during the course of the survey in Cass County. We are grateful for the help provided in the field by these individuals: Larry Olson, Jerry Lamon, Mike Wadman, Scott Lind, and Kevin Sheppard of the Cass County Land Department; John Sumption of the Cass County Soil and Water Conservation District; Rob Naplin, Don Pierce, Tom Stursa, Jack Mooty, Coco Schlottman, Jeff Hines, Mike Loss, Dennis Hanson, Katie Haws, Bruce Lenning, Karen Noyce, and Joe Fraune of the Division of Fish and Wildlife, DNR; Kip Nelson, Dan Hanson, and John Almendinger of the Division of Forestry, DNR; Holly Ewing of the University of Minnesota; Char Bezanson and students of St. Olaf College; Paul Strong, Candy Fitzloff-Westfield, Mike Drotts, Jill Kelley, Jim Gallagher, Rose Johnson, Gil Morris, Nancy Skinner, Nancy Berlin, and Judy Gustafson of Chippewa National Forest; and John Finn, Brian Wise, and Scott Staples of the Leech Lake Reservation DRM.

A small but effective group of volunteers assisted with the Survey in various ways. Peripatetic DNR volunteer Rolf Dahle searched for and photographed rare plants and helped with plant labels. Retired physician George Rysgaard led an expedition to a rose pogonia population precariously perched at the edge of a floating mat. Sonia Meade and Jim Welch participated in rare plant searches early in the survey, and Tammy Larson helped out with turtle trapping, drift fences, and mammal grids.

We thank Pam Perry (Nongame Wildlife Program, DNR), Norm Moody (Cass County Land Department), and the many other state, county, tribal, and federal agency employees who helped us with selecting locations for survey, advised us on access, or provided guidance in some other way. Their assistance helped us with the timely completion of field work for this project.

Herb Wagner, Tom Trana, Gerald Ownbey, and Don Farrar provided information about and assistance with the identification of some rare plant species. Jan Janssens, then with the Department of Ecology, Evolution, and Behavior at the University of Minnesota, educated us about mosses.

DNR librarian Char Feist helped with bibliographies, and librarians at Itasca Community College in Grand Rapids helped obtain books and journal photocopies. Anita Cholewa, curator of the University of Minnesota herbarium, made those collections available to us.

Vera Ming Wong created the line drawings that illustrate some of the rare species information sheets. Gary Walton, of the Olga Lakela Herbarium at the University of Minnesota-Duluth, provided a specimen of New England violet for scanning and helpful information about clustered bur-reed.

We thank Kelly Cable (Chippewa National Forest), Doug Miedtke (DNR Forestry), Norm Moody (Cass County Land Department), Rob Naplin (DNR Wildlife), Steve and Carol Mortensen (Leech Lake Reserva-

tion Division of Resources Management), Steve Merchant (DNR Ecological Services) and Art Norton (Itasca County Soil and Water Conservation District) for reviewing all or a part of this notebook. However, we take responsibility for the contents, including typographical errors and other mistakes that are bound to have crept in.

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Rare Species Legislation

Rare plant and animal surveys in Cass County focused on species officially listed under the Federal Endangered Species Act of 1973, Public Law 93-205, or Minnesota Statute 84.0895. Listed species include federal and state endangered and threatened species, as well as state special concern species (Minnesota Natural Heritage Program and Nongame Research Program 1984). Endangered and threatened species are provided the highest protection under federal and state laws. In addition, the Natural Heritage and Nongame Research Program keeps track of selected species that are not legally listed or protected but require further field survey to determine their status. These non-listed rare species are 'tracked' in the Natural Heritage Information System rare features database.

Minnesota's Statute 84.0895 is entitled Protection of Threatened and Endangered Species. This statute and the associated Rule (6212.1800) prohibit or regulate the taking, import, transport, purchase, disposal, possession or sale of Endangered and Threatened plants and animals. Provisions for the designation of species to be on a state list of Endangered, Threatened, or Special Concern species are also part of this statute, and the statute requires routine reevaluation of this list. A major revision to the state list was completed in 1996.

The statute also describes the application, designation, studies, management, enforcement, exceptions, and violations associated with the protection of these species. The Rule addresses permitting otherwise prohibited activities.

Copies of the statute, rule, and current state list are available from the MN Department of Natural Resources, Natural Heritage and Nongame Research Program, 500 Lafayette Road, Box 25, St. Paul, MN 55155. A copy of the current list is included in the introductory chapter of this notebook.

Ranking Systems

States, several federal agencies, and The Nature Conservancy have systems in place for ranking species. The following systems rank species found in Cass County.

- Species recognized as Endangered or Threatened under the Federal Endangered Species Act of 1973 (administered by the U.S. Fish and Wildlife Service (USFWS)).

E: *Endangered*; taxa formally listed as endangered.

T: *Threatened*; taxa formally listed as threatened.

P: *Proposed E or T*; taxa formally proposed for listing as endangered or threatened.

A copy of the federal endangered species act is available from the U.S. Fish and Wildlife Regional Office, Federal Building, Fort Snelling, Twin Cities, MN 55111-4056. (612)725-3548.

No plant species listed under the federal endangered species act have been found in Cass County.

The Bald eagle (*Haliaeetus leucocephalus*) and the Gray wolf (*Canis lupus*), both federally threatened species, are the only animal species listed under the federal endangered species act known to occur in the county.

- U.S. Forest Service (USFS)

Sensitive Species: Species having population viability concerns as identified by the Regional Forester (USFS Region 9). A copy of the Regional Sensitive Species list is available by writing to Regional Forester, attn.: TES program manager, USDA Forest Service, Region 9, 310 W. Wisconsin Ave., Milwaukee, WI 53203.

- Chippewa National Forest (CNF).

Sensitive Species: All species included on the Minnesota Endangered, Threatened, and Special Concern List that have been found or are likely to be found within the boundaries of the Forest, and several species identified as sensitive species within U.S. Forest Service Region 9 that do not appear on Minnesota's list. A copy of the current list is available by writing to Forest Supervisor, attn.: TES program manager, Chippewa National Forest, Rt. 3 Box 244, Cass Lake, MN 56633.

- State of Minnesota (Legal Ranks)

Endangered: A species threatened with extinction throughout all or a significant portion of its range.

Threatened: A species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Special Concern: A species, although not endangered or threatened, that is extremely uncommon in the state, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range that are not listed as threatened may be included in this category.

along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

Legal ranks are used for individual species. The Natural Heritage and Nongame Research Program uses state ("S") ranks, which have no legal status, for plant communities. These ranks are described in Appendix 1 of *Minnesota's Native Vegetation: A Key to Natural Communities*.

- The Nature Conservancy

Global ranks (G1 through G5) indicate the relative endangerment of species based primarily on the number of occurrences of the species throughout its entire range.

G1: Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction.

G2: Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction throughout its range.

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

G4: Widespread, abundant, and apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery. Thus, the species is of long-term concern.

G5: Demonstrably widespread, abundant, and secure globally, although it may be quite rare in parts of its range, especially at the periphery.

G?: Unranked: The species is not yet ranked globally.

TNC global species ranks are available from the DNR Natural Heritage and Nongame Research Program and The Nature Conservancy.

*Minnesota's 1996 List of Endangered, Threatened,
and Special Concern Species*



MINNESOTA'S LIST OF ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

PURPOSE, SCOPE, AND RELATIONSHIP TO FEDERAL LAWS

Minnesota's Endangered Species Statute (Minnesota Statutes, Section 84.0895) requires the Minnesota Department of Natural Resources (DNR) to adopt rules designating species meeting the statutory definitions of endangered, threatened, or species of special concern. The resulting List of Endangered, Threatened, and Special Concern Species is codified as Minnesota Rules, Chapter 6134. The Endangered Species Statute also authorizes the DNR to adopt rules that regulate treatment of species designated as endangered and threatened. These regulations are codified as Minnesota Rules, Parts 6212.1800 to 6212.2300.

Minnesota's Endangered Species Statute and the associated Rules impose a variety of restrictions, a permit program, and several exemptions pertaining to species designated as endangered or threatened. A person may not take, import, transport, or sell any portion of an endangered or threatened species. However, these acts may be allowed by permit issued by the DNR; plants on certain agricultural lands and plants destroyed in consequence of certain agricultural practices are exempt; and the accidental, unknowing destruction of designated plants is exempt. Species of special concern are not protected by Minnesota's Endangered Species Statute or the associated Rules. Persons are advised to read the full text of the Statute and Rules in order to understand all regulations pertaining to species that are designated as endangered, threatened, or species of special concern.

Note that the federal Endangered Species Act of 1973, as amended (16 USC 1531 - 1544) requires the U.S. Department of the Interior to identify species as endangered or threatened according to a separate set of definitions, and imposes a separate set of restrictions pertaining to those species. In the following list, the federal status of the eleven federally-listed species that occur in Minnesota is noted to the right of those species' common names (E = endangered; T = threatened).

DEFINITIONS

A species is considered **endangered** if the species is threatened with extinction throughout all or a significant portion of its range within Minnesota.

A species is considered **threatened** if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota.

A species is considered a **species of special concern** if, although the species is not endangered or threatened, it is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

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FOR MORE INFORMATION, CONTACT:

Natural Heritage and Nongame Research Program
Section of Ecological Services, Minnesota Department of Natural Resources
500 Lafayette Rd., Box 25
St. Paul, MN 55155
Phone: 1-800-766-6000 (or 612-296-6157 in the metro area)
Fax: 612-296-1811

Effective 7/1/96

MAMMALS

Threatened

Spilogale putorius (Linnaeus) eastern spotted skunk

Special Concern

Canis lupus (Linnaeus) gray wolf (T)
Cervus elaphus Linnaeus elk
Cryptotis parva (Say) least shrew
Felis concolor Linnaeus mountain lion
Microtus ochrogaster (Wagner) prairie vole
Microtus pinetorum (Le Conte) woodland vole
Mustela nivalis Linnaeus least weasel
Myotis septentrionalis (Merriam) northern myotis
Perognathus flavescens Merriam plains pocket mouse
Phenacomys intermedius Merriam heather vole
Pipistrellus subflavus (F. Cuvier) eastern pipistrelle
Sorex fumeus G.M. Miller smokey shrew
Synaptomys borealis (Richardson) northern bog lemming
Thomomys talpoides (Richardson) northern pocket gopher

BIRDS

Endangered

Ammodramus bairdii (Audubon) Baird's sparrow
Ammodramus henslowii (Audubon) Henslow's sparrow
Anthus spragueii (Audubon) Sprague's pipit
Calcarius ornatus (Townsend) chestnut-collared longspur
Charadrius melodus Ord. piping plover (T)
Rallus elegans Audubon king rail
Speotyto cunicularia (Molina) burrowing owl

Threatened

Cygnus buccinator Richardson trumpeter swan
Falco peregrinus Tunstall peregrine falcon (E)
Lanius ludovicianus Linnaeus loggerhead shrike
Phalaropus tricolor (Vieillot) Wilson's phalarope
Podiceps auritus (Linnaeus) horned grebe
Sterna hirundo Linnaeus common tern

Special Concern

Ammodramus nelsoni Allen Nelson's sharp-tailed sparrow
Asio flammeus (Pontoppidan) short-eared owl
Buteo lineatus (Gmelin) red-shouldered hawk
Coturnicops noveboracensis (Gmelin) yellow rail
Dendroica cerulea (Wilson) cerulean warbler
Empidonax virescens (Vieillot) Acadian flycatcher
Gallinula chloropus (Linnaeus) common moorhen
Haliaeetus leucocephalus (Linnaeus) bald eagle (T)
Larus pipixcan (Wagler) Franklin's gull
Limosa fedoa (Linnaeus) marbled godwit
Pelecanus erythrorhynchos Gmelin American white pelican
Seiurus motacilla (Vieillot) Louisiana waterthrush
Sterna forsteri Nuttall Forster's tern
Tympanuchus cupido (Linnaeus) greater prairie-chicken
Wilsonia citrina (Boddaert) hooded warbler

AMPHIBIANS AND REPTILES

Endangered

<i>Acris crepitans</i> Green	northern cricket frog
<i>Sistrurus catenatus</i> (Rafinesque)	massasauga

Threatened

<i>Clemmys insculpta</i> (LeConte)	wood turtle
<i>Crotalus horridus</i> Linnaeus	timber rattlesnake
<i>Emydoidea blandingii</i> (Holbrook)	Blanding's turtle

Special Concern

<i>Apalone mutica</i> (LeSueur)	smooth softshell
<i>Chelydra serpentina</i> (Linnaeus)	snapping turtle
<i>Coluber constrictor</i> Linnaeus	racer
<i>Elaphe obsoleta</i> (Say)	rat snake
<i>Eumeces fasciatus</i> (Linnaeus)	five-lined skink
<i>Hemidactylium scutatum</i> (Temminck & Schlegel)	four-toed salamander
<i>Heterodon nasicus</i> Baird & Girard	western hognose snake
<i>Pituophis catenifer</i> (Blainville)	gopher snake
<i>Tropidoclonion lineatum</i> (Hallowell)	lined snake

FISH

Threatened

<i>Polyodon spathula</i> (Walbaum)	paddlefish
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Special Concern

<i>Acipenser fulvescens</i> Rafinesque	lake sturgeon
<i>Alosa chrysochloris</i> (Rafinesque)	skipjack herring
<i>Ammocrypta asprella</i> (Jordan)	crystal darter
<i>Aphredoderus sayanus</i> (Gilliams)	pirate perch
<i>Coregonus kiyi</i> (Koelz)	kiyi
<i>Coregonus zenithicus</i> (Jordan & Evermann)	shortjaw cisco
<i>Cycleptus elongatus</i> (Lesueur)	blue sucker
<i>Erimystax x-punctata</i> (Hubbs & Crowe)	gravel chub
<i>Etheostoma microperca</i> Jordan & Gilbert	least darter
<i>Fundulus sciadicus</i> Cope	plains topminnow
<i>Ichthyomyzon fossor</i> Reighard & Cummins	northern brook lamprey
<i>Ichthyomyzon gagei</i> Hubbs & Trautman	southern brook lamprey
<i>Ictiobus niger</i> (Rafinesque)	black buffalo
<i>Morone mississippiensis</i> Jordan and Eigenmann	yellow bass
<i>Notropis amnis</i> Hubbs and Green	pallid shiner
<i>Notropis anogenus</i> Forbes	pugnose shiner
<i>Notropis nubilus</i> (Forbes)	Ozark minnow
<i>Notropis topeka</i> (Gilbert)	Topeka shiner
<i>Noturus exilis</i> Nelson	slender madtom
<i>Percina evides</i> (Jordan & Copeland)	gilt darter

MOLLUSKS

Endangered

<i>Arcidens confragosus</i> (Say)	rock pocketbook
<i>Elliptio crassidens</i> (Lamarck)	elephant-ear
<i>Fusconaia ebena</i> (I. Lea)	ebonyshell
<i>Lampsilis higginsii</i> (I. Lea)	Higgins eye (E)
<i>Lampsilis teres</i> (Rafinesque)	yellow sandshell
<i>Novasuccinea</i> n. sp. Minnesota B Hoagland & Davis	Iowa Pleistocene ambersnail
<i>Plethobasus cyphus</i> (Rafinesque)	sheepnose
<i>Quadrula fragosa</i> (Conrad)	winged mapleleaf (E)
<i>Quadrula nodulata</i> (Rafinesque)	wartyback
<i>Vertigo hubrichti hubrichti</i> (Pilsbry)	Midwest Pleistocene vertigo

Threatened

<i>Actinonaias ligamentina</i> (Lamarck)	mucket
<i>Alasmodonta marginata</i> Say	elktoe
<i>Cumberlandia monodonta</i> (Say)	spectaclecase
<i>Cyclonaias tuberculata</i> (Rafinesque)	purple wartyback
<i>Ellipsaria lineolata</i> (Rafinesque)	butterfly
<i>Epioblasma triquetra</i> (Rafinesque)	snuffbox
<i>Megalonaias nervosa</i> (Rafinesque)	washboard
<i>Novasuccinea</i> n. sp. Minnesota A Hoagland & Davis	Minnesota Pleistocene ambersnail
<i>Pleurobema coccineum</i> (Conrad)	round pigtoe
<i>Quadrula metanevra</i> (Rafinesque)	monkeyface
<i>Simpsonaias ambigua</i> (Say)	salamander mussel
<i>Tritogonia verrucosa</i> (Rafinesque)	pistolgrip
<i>Venustaconcha ellipsiformis</i> (Conrad)	ellipse
<i>Vertigo hubrichti variabilis</i> n. subsp.	variable Pleistocene vertigo
<i>Vertigo meramecensis</i> Van Devender	bluff vertigo

Special Concern

<i>Elliptio dilatata</i> (Rafinesque)	spike
<i>Lasmigona compressa</i> (I. Lea)	creek heelsplitter
<i>Lasmigona costata</i> (Rafinesque)	fluted-shell
<i>Ligumia recta</i> (Lamarck)	black sandshell
<i>Obovaria olivaria</i> (Rafinesque)	hickorynut

JUMPING SPIDERS

Special Concern

<i>Habronattus texanus</i> Griswold	a species of jumping spider
<i>Marpissa grata</i> (Gertsch)	a species of jumping spider
<i>Metaphidippus arizonensis</i> (Peckham & Peckham)	a species of jumping spider
<i>Paradamoetas fontana</i> (Levi)	a species of jumping spider
<i>Phidippus apacheanus</i> Chamberlin & Gertsch	a species of jumping spider
<i>Phidippus pius</i> Scheffer	a species of jumping spider
<i>Sassacus papenhoei</i> Peckham & Peckham	a species of jumping spider
<i>Tutelina formicaria</i> (Emerton)	a species of jumping spider

LEAFHOPPERS

Special Concern

<i>Aflexia rubranura</i> (DeLong)	red-tailed prairie leafhopper
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DRAGONFLIES

Special Concern

<i>Ophiogomphus anomalis</i> Harvey	extra-striped snaketail
<i>Ophiogomphus susbehcha</i> Vogt & Smith	St. Croix snaketail

BUTTERFLIES AND MOTHS

Endangered

<i>Erynnis persius</i> (Scudder)	persius dusky wing
<i>Hesperia comma assiniboia</i> (Lyman)	assiniboia skipper
<i>Hesperia uncas</i> W.H. Edwards	uncas skipper
<i>Lycaeides melissa samuelis</i> Nabokov	Karner blue (E)
<i>Oeneis uhleri varuna</i> , (W.H. Edwards)	Uhler's arctic

Threatened

<i>Hesperia dacotae</i> (Skinner)	dakota skipper
<i>Hesperia ottoe</i> W.H. Edwards	ottoe skipper
<i>Oarisma garita</i> (Reakirt)	garita skipper

Special Concern

<i>Atrytone arogos</i> (Boisduval & Leconte)	arogos skipper
<i>Erebia disa mancinus</i> Doubleday & Hewitson	disa alpine
<i>Hesperia leonardus</i> Harris	leonardus skipper
<i>Lycaeides idas nabokovi</i> Masters	Nabokov's blue
<i>Oarisma powesheik</i> (Parker)	powesheik skipper
<i>Pyrgus centaureae freija</i> (Warren)	grizzled skipper
<i>Schinia indiana</i> (J.B. Smith)	phlox moth
<i>Speyeria idalia</i> (Drury)	regal fritillary

CADDISFLIES

Endangered

<i>Chilostigma itasca</i> Wiggins	headwaters chilostigman
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Special Concern

<i>Agapetus tomus</i> Ross	a species of caddisfly
<i>Asynarchus rossi</i> Leonard & Leonard	a species of caddisfly
<i>Ceraclea brevis</i> (Etnier)	a species of caddisfly
<i>Ceraclea vertreesi</i> (Denning)	a species of caddisfly
<i>Hydroptila metoeca</i> Blickle & Morse	a species of caddisfly
<i>Hydroptila novicola</i> Blickle & Morse	a species of caddisfly
<i>Hydroptila tortosa</i> Ross	a species of caddisfly
<i>Oxyethira ecornuta</i> Morton	a species of caddisfly
<i>Oxyethira itasca</i> Monson & Holzenthal	a species of caddisfly
<i>Polycentropus milaca</i> Etnier	a species of caddisfly
<i>Protophila talola</i> Denning	a species of caddisfly
<i>Setodes guttatus</i> (Banks)	a species of caddisfly

TIGER BEETLES

Endangered

<i>Cicindela fulgida fulgida</i> Say	a species of tiger beetle
<i>Cicindela limbata nympha</i> Casey	a species of tiger beetle

Threatened

<i>Cicindela denikei</i> W.J. Brown	a species of tiger beetle
<i>Cicindela fulgida westbournei</i> Calder	a species of tiger beetle
<i>Cicindela lepida</i> Dejean	a species of tiger beetle

Special concern

<i>Cicindela hirticollis rhodensis</i> Calder	a species of tiger beetle
<i>Cicindela macra macra</i> Leconte	a species of tiger beetle
<i>Cicindela patruela patruela</i> Dejean	a species of tiger beetle
<i>Cicindela splendida cyanocephalata</i> Eckhoff	a species of tiger beetle

VASCULAR PLANTS

Endangered

<i>Agalinis auriculata</i> (Michx.) Blake, Scrophulariaceae	eared false foxglove
<i>Agalinis gattingeri</i> (Sm.) Sm. ex Britt., Scrophulariaceae	round-stemmed false foxglove
<i>Asclepias stenophylla</i> Gray, Asclepiadaceae	narrow-leaved milkweed
<i>Astragalus alpinus</i> L., Fabaceae	alpine milk-vetch
<i>Bartonia virginica</i> (L.) B.S.P., Gentianaceae	Virginia bartonia
<i>Botrychium gallicomontanum</i> Farrar & Johnson-Groh, Ophioglossaceae	Frenchman's Bluff moonwort
<i>Botrychium oneidense</i> (Gilbert) House, Ophioglossaceae	blunt-lobed grapefern
<i>Botrychium pallidum</i> W.H. Wagner, Ophioglossaceae	pale moonwort
<i>Cacalia suaveolens</i> L., Asteraceae	sweet-smelling Indian-plantain
<i>Caltha natans</i> Pallas ex Georgi, Ranunculaceae	floating marsh-marigold
<i>Carex formosa</i> Dewey, Cyperaceae	handsome sedge
<i>Carex pallescens</i> L., Cyperaceae	pale sedge
<i>Carex plantaginea</i> Lam., Cyperaceae	plantain-leaved sedge
<i>Castilleja septentrionalis</i> Lindl., Scrophulariaceae	northern paintbrush
<i>Cheilanthes lanosa</i> (Michaux) D.C. Eaton, Pteridaceae	hairy lip-fern
<i>Chrysosplenium iowense</i> Rydb., Saxifragaceae	Iowa golden saxifrage
<i>Cristatella jamesii</i> T. & G., Capparidaceae	James' polanisia
<i>Dodecatheon meadia</i> L., Primulaceae	prairie shooting star
<i>Draba norvegica</i> Gunn., Brassicaceae	Norwegian whitlow-grass
<i>Eleocharis wolfii</i> Gray, Cyperaceae	Wolf's spike-rush
<i>Empetrum eamesii</i> Fern. & Wieg., Empetraceae	purple crowberry
<i>Empetrum nigrum</i> L., Empetraceae	black crowberry
<i>Erythronium propullans</i> Gray, Liliaceae	dwarf trout lily (E)
<i>Escobaria vivipara</i> (Nutt.) Buxbaum, Cactaceae	ball cactus
<i>Fimbristylis puberula</i> (Michx.) Vahl var. <i>interior</i> (Britt.) Kral, Cyperaceae	hairy fimbriistylis
<i>Glaux maritima</i> L., Primulaceae	sea milkwort
<i>Hydrastis canadensis</i> L., Ranunculaceae	golden-seal
<i>Iodanthus pinnatifidus</i> (Michx.) Steud., Brassicaceae	purple rocket
<i>Isoetes melanopoda</i> Gay & Dur., Isoetaceae	blackfoot quillwort
<i>Lechea tenuifolia</i> Michx., Cistaceae	narrow-leaved pinweed
<i>Lesquerella ludoviciana</i> (Nutt.) S. Wats., Brassicaceae	bladder pod
<i>Listera auriculata</i> Wieg., Orchidaceae	auricled twayblade
<i>Malaxis paludosa</i> (L.) Sw., Orchidaceae	bog adder's-mouth
<i>Marsilea vestita</i> Hooker & Greville, Marsileaceae	hairy water clover
<i>Montia chamissoi</i> (Ledeb. ex. Spreng.) Greene, Portulacaceae	montia
<i>Oryzopsis hymenoides</i> (R. & S.) Ricker ex Piper, Poaceae	Indian ricegrass
<i>Osmorhiza berteroi</i> H. & A., Apiaceae	Chilean sweet cicely
<i>Oxytropis viscida</i> Nutt., Fabaceae	sticky locoweed
<i>Paronychia fastigiata</i> (Raf.) Fern., Caryophyllaceae	forked chickweed
<i>Parthenium integrifolium</i> L., Asteraceae	wild quinine
<i>Platanthera flava</i> (L.) Lindl. var. <i>herbiola</i> (R. Br.) Ames & Correll, Orchidaceae	tubercled rein-orchid
<i>Platanthera praeclara</i> Sheviak & Bowles, Orchidaceae	western prairie fringed orchid (T)
<i>Polemonium occidentale</i> Greene ssp. <i>lacustre</i> Wherry, Polemoniaceae	western Jacob's-ladder
<i>Polygala cruciata</i> L., Polygalaceae	cross-leaved milkwort
<i>Polystichum braunii</i> (Spencer) Fee, Dryopteridaceae	Braun's holly fern
<i>Potamogeton bicupulatus</i> Fern., Potamogetonaceae	snailseed pondweed
<i>Potamogeton diversifolius</i> Raf., Potamogetonaceae	diverse-leaved pondweed
<i>Psoralea tenuiflora</i> (Pursch) Rydb., Fabaceae	slender-leaved scurf pea
<i>Sagina nodosa</i> (L.) fenzl ssp. <i>borealis</i> Crow, Caryophyllaceae	knotty pearlwort
<i>Saxifraga cernua</i> L., Saxifragaceae	nodding saxifrage
<i>Scleria triglomerata</i> Michx., Cyperaceae	tall nut-rush
<i>Sedum integrifolium</i> (Raf.) A. Nels. ssp. <i>leedyi</i> (Rosend. & Moore) Clausen, Crassulaceae	Leedy's roseroot (T)
<i>Selaginella selaginoides</i> (L.) Link, Selaginellaceae	northern spikemoss
<i>Senecio canus</i> Hook., Asteraceae	gray ragwort
<i>Talinum rugospermum</i> Holzinger, Portulacaceae	rough-seeded fameflower
<i>Tofieldia pusilla</i> (Michx.) Pers., Liliaceae	small false asphodel
<i>Xyris torta</i> Sm., Xyridaceae	twisted yellow-eyed grass

VASCULAR PLANTS

Threatened

<i>Achillea sibirica</i> Ledeb., Asteraceae	Siberian yarrow
<i>Allium cernuum</i> Roth, Liliaceae	nodding wild onion
<i>Allium schoenoprasum</i> L. var. <i>sibiricum</i> (L.) Hartm., Liliaceae	wild chives
<i>Ammophila breviligulata</i> Fern., Poaceae	beachgrass
<i>Arabis holboellii</i> Hornem. var. <i>retrofracta</i> (Graham) Rydb., Brassicaceae	Holboell's rockcress
<i>Arnica lonchophylla</i> Greene, Asteraceae	long-leaved arnica
<i>Arnoglossum plantagineum</i> Raf., Asteraceae	tuberous Indian-plantain
<i>Asclepias hirtella</i> (Pennell) Woodson, Asclepiadaceae	prairie milkweed
<i>Asclepias sullivantii</i> Engelm., Asclepiadaceae	Sullivant's milkweed
<i>Asplenium trichomanes</i> L., Aspleniaceae	maidenhair spleenwort
<i>Aster shortii</i> Lindl., Asteraceae	Short's aster
<i>Aureolaria pedicularia</i> (L.) Raf., Scrophulariaceae	fernleaf false foxglove
<i>Besseyia bullii</i> (Eaton) Rydb., Scrophulariaceae	kitten-tails
<i>Botrychium lanceolatum</i> (S.G. Gmelin) Angstr., Ophioglossaceae	triangle moonwort
<i>Botrychium lunaria</i> (L.) Sw., Ophioglossaceae	common moonwort
<i>Botrychium rugulosum</i> W.H. Wagner, Ophioglossaceae	St. Lawrence grapefern
<i>Carex careyana</i> Torr. ex Dewey, Cyperaceae	Carey's sedge
<i>Carex conjuncta</i> Boott, Cyperaceae	jointed sedge
<i>Carex davisii</i> Schwein. & Torr., Cyperaceae	Davis' sedge
<i>Carex festucacea</i> Schkuhr ex Willd., Cyperaceae	fescue sedge
<i>Carex garberi</i> Fern., Cyperaceae	Garber's sedge
<i>Carex jamesii</i> Schwein., Cyperaceae	James' sedge
<i>Carex katahdinensis</i> Fern., Cyperaceae	Katahdin sedge
<i>Carex laevivaginata</i> (Kukenth.) Mackenzie, Cyperaceae	smooth-sheathed sedge
<i>Carex laxiculmis</i> Schwein., Cyperaceae	spreading sedge
<i>Carex sterilis</i> Willd., Cyperaceae	sterile sedge
<i>Crassula aquatica</i> (L.) Schoenl., Crassulaceae	pigmyweed
<i>Crataegus douglasii</i> Lindl., Rosaceae	black hawthorn
<i>Cyperus acuminatus</i> Torr. & Hook., Cyperaceae	short-pointed umbrella-sedge
<i>Cypripedium arietinum</i> R. Br., Orchidaceae	ram's-head lady's-slipper
<i>Diplazium pycnocarpon</i> (Spreng.) M. Broun, Dryopteridaceae	narrow-leaved spleenwort
<i>Dryopteris marginalis</i> (L.) Gray, Dryopteridaceae	marginal shield-fern
<i>Eleocharis nitida</i> Fern., Cyperaceae	neat spike-rush
<i>Eleocharis olivacea</i> Torr., Cyperaceae	olivaceous spike-rush
<i>Eleocharis rostellata</i> Torr., Cyperaceae	beaked spike-rush
<i>Eupatorium sessilifolium</i> L., Asteraceae	upland boneset
<i>Floerkea proserpinacoides</i> Willd., Limnanthaceae	false mermaid
<i>Heteranthera limosa</i> (Sw.) Willd., Pontederiaceae	mud plantain
<i>Huperzia porophila</i> (Lloyd & Underwood) Holub, Lycopodiaceae	rock clubmoss
<i>Lespedeza leptostachya</i> Engelm., Fabaceae	prairie bush clover (T)
<i>Melica nitens</i> (Scribn.) Nutt. ex Piper, Poaceae	three-flowered melic
<i>Moehringia macrophylla</i> (Hook.) Fenzl, Caryophyllaceae	large-leaved sandwort
<i>Napaea dioica</i> L., Malvaceae	glade mallow
<i>Nymphaea leibergii</i> (Morong) Boivin, Nymphaeaceae	small white waterlily
<i>Paronychia canadensis</i> (L.) Wood, Caryophyllaceae	Canadian forked chickweed
<i>Phegopteris hexagonoptera</i> (Michx.) Fee, Thelypteridaceae	broad beech-fern
<i>Plantago elongata</i> Pursh, Plantaginaceae	slender plantain
<i>Poa paludigena</i> Fern. & Wieg., Poaceae	bog bluegrass
<i>Polystichum acrostichoides</i> (Michx.) Schott, Dryopteridaceae	Christmas fern
<i>Rhynchospora capillacea</i> Torr., Cyperaceae	hair-like beak-rush
<i>Rotala ramosior</i> (L.) Koehne, Lythraceae	tooth-cup
<i>Rubus chamaemorus</i> L., Rosaceae	cloudberry
<i>Salicornia rubra</i> Nelson, Chenopodiaceae	red saltwort
<i>Saxifraga paniculata</i> P. Mill., Saxifragaceae	encrusted saxifrage
<i>Scleria verticillata</i> Muhl., Cyperaceae	whorled nut-rush
<i>Scutellaria ovata</i> Hill, Lamiaceae	ovate-leaved skullcap
<i>Shinnersoseris rostrata</i> (Gray) S. Tomb, Asteraceae	annual skeletonweed
<i>Silene nivea</i> (Nutt.) Muhl. ex Otth., Caryophyllaceae	snowy campion
<i>Subularia aquatica</i> L., Brassicaceae	awlwort
<i>Sullivantia sullivantii</i> (Torr. & Gray) Britt., Saxifragaceae	reniform sullivantia
<i>Vaccinium uliginosum</i> L., Ericaceae	alpine bilberry
<i>Valeriana edulis</i> Nutt. var. <i>ciliata</i> (Torr. & Gray) Cronq., Valerianaceae	valerian
<i>Viola lanceolata</i> L., Violaceae	lance-leaved violet
<i>Viola nuttallii</i> Pursh, Violaceae	yellow prairie violet
<i>Woodsia glabella</i> R. Br., Dryopteridaceae	smooth woodsia
<i>Woodsia scopulina</i> D.C. Eat., Dryopteridaceae	Rocky Mountain woodsia

VASCULAR PLANTS

Special Concern

<i>Adoxa moschatellina</i> L., Adoxaceae	moschatel
<i>Agrostis geminata</i> Trin., Poaceae	twin bentgrass
<i>Androsace septentrionalis</i> L. ssp. <i>puberulenta</i> (Rydb.) G.T. Robbins, Primulaceae	northern androsace
<i>Antennaria parvifolia</i> Nutt., Asteraceae	small-leaved pussytoes
<i>Aristida purpurea</i> Nutt. var. <i>longiseta</i> (Steud.) Vasey, Poaceae	red three-awn
<i>Aristida tuberculosa</i> Nutt., Poaceae	sea-beach needlegrass
<i>Asclepias amplexicaulis</i> Sm., Asclepiadaceae	clasping milkweed
<i>Asplenium platyneuron</i> (L.) Britt., Aspleniaceae	ebony spleenwort
<i>Astragalus flexuosus</i> (Hook.) Dougl., Fabaceae	slender milk-vetch
<i>Astragalus missouriensis</i> Nutt., Fabaceae	Missouri milk-vetch
<i>Bacopa rotundifolia</i> (Michx.) Wettst., Scrophulariaceae	water-hyssop
<i>Baptisia alba</i> (L.) Bent., Fabaceae	white wild indigo
<i>Baptisia bracteata</i> Muhl. ex Ell. var. <i>leucophaea</i> (Nutt.) Kartesz & Gandhi, Fabaceae	plains wild indigo
<i>Botrychium campestre</i> W.H. Wagner & Farrar, Ophioglossaceae	prairie moonwort
<i>Botrychium minganense</i> Victorin, Ophioglossaceae	Mingan moonwort
<i>Botrychium mormo</i> W.H. Wagner, Ophioglossaceae	goblin fern
<i>Botrychium simplex</i> E. Hitchc., Ophioglossaceae	least moonwort
<i>Buchloe dactyloides</i> (Nutt.) Engelm., Poaceae	buffalo grass
<i>Calamagrostis lacustris</i> (Kearney) Nash, Poaceae	marsh reedgrass
<i>Calamagrostis montanensis</i> Scribn. ex Vasey, Poaceae	plains reedgrass
<i>Calamagrostis purpurascens</i> R. Br., Poaceae	purple reedgrass
<i>Callitriche heterophylla</i> Pursh, Callitrichaceae	larger water-starwort
<i>Carex annectens</i> Bickn., Cyperaceae	yellow-fruited sedge
<i>Carex crus-corvi</i> Shuttlw. ex Kunze, Cyperaceae	raven's foot sedge
<i>Carex exilis</i> Dew., Cyperaceae	coastal sedge
<i>Carex flava</i> L., Cyperaceae	yellow sedge
<i>Carex hallii</i> Olney, Cyperaceae	Hall's sedge
<i>Carex michauxiana</i> Boeckl., Cyperaceae	Michaux's sedge
<i>Carex obtusata</i> Lilj., Cyperaceae	blunt sedge
<i>Carex praticola</i> Rydb., Cyperaceae	prairie sedge
<i>Carex scirpoidea</i> Michx., Cyperaceae	northern singlespike sedge
<i>Carex supina</i> Willd. ex Wahlenb. var. <i>spaniocarpa</i> (Steud.) Boivin, Cyperaceae	weak arctic sedge
<i>Carex typhina</i> Michx., Cyperaceae	cattail sedge
<i>Carex woodii</i> Dew., Cyperaceae	Wood's sedge
<i>Carex xerantica</i> Bailey, Cyperaceae	dry sedge
<i>Chamaesyce missurica</i> (Raf.) Shinnars, Euphorbiaceae	Missouri spurge
<i>Cirsium hillii</i> (Canby) Fern., Asteraceae	Hill's thistle
<i>Cladium mariscoides</i> (Muhl.) Torr., Cyperaceae	twig-rush
<i>Claytonia caroliniana</i> Michx., Portulacaceae	Carolina spring-beauty
<i>Cymopterus acaulis</i> (Pursh) Raf., Apiaceae	wild parsley
<i>Cypripedium candidum</i> Muhl., Orchidaceae	small white lady's-slipper
<i>Dalea candida</i> Willd., var. <i>oligophylla</i> (Torr.) Shinnars, Fabaceae	western white prairie-clover
<i>Decodon verticillatus</i> (L.) Ell., Lythraceae	waterwillow
<i>Deschampsia flexuosa</i> (L.) Trin., Poaceae	slender hairgrass
<i>Desmanthus illinoensis</i> (Michx.) MacM., Fabaceae	prairie mimosa
<i>Desmodium cuspidatum</i> (Muhl. ex Willd.) DC. ex Loud. var. <i>longifolium</i> (Torr. & Gray) Schub., Fabaceae	big tick-trefoil
<i>Desmodium nudiflorum</i> (L.) DC., Fabaceae	stemless tick-trefoil
<i>Diarrhena obovata</i> (Gleason) Brandenburg, Poaceae	American beakgrain
<i>Dicentra canadensis</i> (Goldie) Walp., Fumariaceae	squirrel-corn
<i>Draba arabisans</i> Michx., Brassicaceae	rock whitlow-grass
<i>Drosera anglica</i> Huds., Droseraceae	English sundew
<i>Drosera linearis</i> Goldie, Droseraceae	linear-leaved sundew
<i>Dryopteris goldiana</i> (Hook.) Gray, Dryopteridaceae	Goldie's fern
<i>Eleocharis parvula</i> (Roemer & J.A. Schultes) Link ex Bluff, Nees & Schauer, Cyperaceae	dwarf spike-rush
<i>Eleocharis quinqueflora</i> (F.X. Hartmann) Schwarz, Cyperaceae	few-flowered spike-rush
<i>Eryngium yuccifolium</i> Michx., Apiaceae	rattlesnake-master
<i>Euphrasia hudsoniana</i> Fern. & Wieg., Scrophulariaceae	Hudson Bay eyebright
<i>Fimbristylis autumnalis</i> (L.) Roemer & J.A. Schultes, Cyperaceae	autumn fimbristylis
<i>Gaillardia aristata</i> Pursh, Asteraceae	blanket-flower
<i>Gentiana affinis</i> Griseb., Gentianaceae	northern gentian
<i>Gentianella amarella</i> (L.) Borner ssp. <i>acuta</i> (Michx.) Gillett, Gentianaceae	felwort
<i>Hamamelis virginiana</i> L., Hamamelidaceae	witch-hazel
<i>Helianthus nuttallii</i> Torr. & Gray ssp. <i>rydbergii</i> (Br.) Long, Asteraceae	Nuttall's sunflower
<i>Helictotrichon hookeri</i> (Scribn.) Henr., Poaceae	oat-grass
<i>Hudsonia tomentosa</i> Nutt., Cistaceae	beach-heather
<i>Hydrocotyle americana</i> L., Apiaceae	American water-pennywort

VASCULAR PLANTS

Special Concern (continued)

<i>Jeffersonia diphylla</i> (L.) Pers., Berberidaceae	twingleaf
<i>Juglans cinerea</i> L., Juglandaceae	butternut
<i>Juncus marginatus</i> Rostk., Juncaceae	marginated rush
<i>Juncus stygius</i> L. var. <i>americanus</i> (Buch.) Hulten, Juncaceae	bog rush
<i>Juniperus horizontalis</i> Moench, Cupressaceae	creeping juniper
<i>Leersia lenticularis</i> Michx., Poaceae	catchfly grass
<i>Limosella aquatica</i> L., Scrophulariaceae	mudwort
<i>Listera convallarioides</i> (Sw.) Nutt. ex Ell., Orchidaceae	broad-lipped twayblade
<i>Littorella uniflora</i> (L.) Aschers., Plantaginaceae	American shore-plantain
<i>Luzula parviflora</i> (Ehrh.) Desv. ssp. <i>melanocarpa</i> (Michx.) Hamet-Ahti, Juncaceae	small-flowered woodrush
<i>Lysimachia quadrifolia</i> L., Primulaceae	whorled loosestrife
<i>Machaeranthera pinnatifida</i> (Hook.) Shinnery, Asteraceae	cutleaf ironplant
<i>Malaxis monophyllos</i> (L.) Sw. var. <i>brachypoda</i> (Gray) Morris & Eames, Orchidaceae	white adder's-mouth
<i>Minuartia dawsonensis</i> (Britt.) House, Caryophyllaceae	rock sandwort
<i>Muhlenbergia uniflora</i> (Muhl.) Fern., Poaceae	one flowered muhly
<i>Najas gracillima</i> (A. Braun ex Engelm.) Magnus, Najadaceae	slender naiad
<i>Najas marina</i> L., Najadaceae	sea naiad
<i>Oenothera rhombipetala</i> Nutt. ex Torr. & Gray, Onagraceae	rhombic-petaled evening primrose
<i>Opuntia macrorhiza</i> Engelm., Cactaceae	plains prickly pear
<i>Orobanche fasciculata</i> Nutt., Orobanchaceae	clustered broomrape
<i>Orobanche ludoviciana</i> Nutt., Orobanchaceae	Louisiana broomrape
<i>Orobanche uniflora</i> L., Orobanchaceae	one-flowered broomrape
<i>Osmorhiza depauperata</i> Phil., Apiaceae	blunt-fruited sweet cicely
<i>Panax quinquefolius</i> L., Araliaceae	American ginseng
<i>Pellaea atropurpurea</i> (L.) Link, Adiantaceae	purple cliff-brake
<i>Phacelia franklinii</i> (R.Br.) Gray, Hydrophyllaceae	Franklin's phacelia
<i>Pinguicula vulgaris</i> L., Lentibulariaceae	butterwort
<i>Platanthera clavellata</i> (Michx.) Luer, Orchidaceae	club-spur orchid
<i>Poa wolfii</i> Scribn., Poaceae	Wolf's bluegrass
<i>Polygonum careyi</i> (Olney), Polygonaceae	Carey's smartweed
<i>Polygonum viviparum</i> L., Polygonaceae	alpine bistort
<i>Polytaenia nuttallii</i> DC., Apiaceae	prairie-parsley
<i>Potamogeton vaginatus</i> Turcz., Potamogetonaceae	sheathed pondweed
<i>Potamogeton vaseyi</i> Robbins, Potamogetonaceae	Vasey's pondweed
<i>Prenanthes crepidinea</i> Michx., Asteraceae	nodding rattlesnake-root
<i>Pyrola minor</i> L., Pyrolaceae	small shinleaf
<i>Ranunculus lapponicus</i> L., Ranunculaceae	Lapland buttercup
<i>Rhynchospora fusca</i> (L.) Ait. f., Cyperaceae	sooty-colored beak-rush
<i>Rorippa sessiliflora</i> (Nutt.) A.S. Hitchc., Brassicaceae	sessile-flowered cress
<i>Rudbeckia triloba</i> L., Asteraceae	three-leaved coneflower
<i>Ruppia maritima</i> L., Ruppiaceae	ditch-grass
<i>Salix maccalliana</i> Rowlee, Salicaceae	Maccall's willow
<i>Salix pellita</i> (Anderss.) Anderss. ex Schneid., Salicaceae	satiny willow
<i>Sanicula trifoliata</i> Bickn., Apiaceae	beaked snakeroot
<i>Schedonnardus paniculatus</i> (Nutt.) Trel., Poaceae	tumblegrass
<i>Scirpus clintonii</i> Gray, Cyperaceae	Clinton's bulrush
<i>Senecio indecorus</i> Greene, Asteraceae	elegant grounzel
<i>Silene drummondii</i> Hook., Caryophyllaceae	Drummond's campion
<i>Solidago mollis</i> Bartl., Asteraceae	soft goldenrod
<i>Solidago sciaphila</i> Steele, Asteraceae	cliff goldenrod
<i>Sparganium glomeratum</i> Laest., Sparganiaceae	clustered bur-reed
<i>Stellaria longipes</i> Goldie, Caryophyllaceae	long-stalked chickweed
<i>Symphoricarpos orbiculatus</i> Moench, Caprifoliaceae	coralberry
<i>Tephrosia virginiana</i> (L.) Pers., Fabaceae	goat's-rue
<i>Torreyochloa pallida</i> (Torr.) Church, Poaceae	Torrey's manna-grass
<i>Trillium nivale</i> Riddell, Liliaceae	snow trillium
<i>Trimorpha acris</i> (L.) Nesom var. <i>asteroides</i> (Anderz. ex Bess.) Nesom, Asteraceae	bitter fleabane
<i>Trimorpha lonchophylla</i> (Hook.) Nesom, Asteraceae	shortray fleabane
<i>Triplasis purpurea</i> (Walt.) Champm., Poaceae	purple sand-grass
<i>Tsuga canadensis</i> (L.) Carr., Pinaceae	eastern hemlock
<i>Utricularia purpurea</i> Walt., Lentibulariaceae	purple-flowered bladderwort
<i>Utricularia resupinata</i> B.D. Greene ex Bigelow, Lentibulariaceae	lavender bladderwort
<i>Verbena simplex</i> Lehm., Verbenaceae	narrow-leaved vervain
<i>Vitis aestivalis</i> Michx., Vitaceae	silverleaf grape
<i>Waldsteinia fragarioides</i> (Michx.) Tratt., Rosaceae	barren strawberry
<i>Woodsia alpina</i> (Bolton) Gray, Dryopteridaceae	alpine woodsia
<i>Xyris montana</i> Ries, Xyridaceae	montane yellow-eyed grass

LICHENS

Endangered

<i>Buellia nigra</i> (Fink) Sheard	a species of lichen
<i>Caloplaca parvula</i> Wetm.	a species of lichen
<i>Dermatocarpon moulinii</i> (Mont.) Zahlbr.	a species of lichen
<i>Leptogium apalachense</i> (Tuck.) Nyl.	a species of lichen
<i>Lobaria scrobiculata</i> (Scop.) DC.	a species of lichen
<i>Parmelia stictica</i> (Del.) Nyl.	a species of lichen
<i>Pseudocyphellaria crocata</i> (L.) Vain.	a species of lichen
<i>Umbilicaria torrefacta</i> (Lightf.) Schrad.	a species of lichen

Threatened

<i>Cetraria oakesiana</i> Tuck.	a species of lichen
<i>Coccocarpia palmicola</i> (Sprengel) Arvid & Galloway	a species of lichen
<i>Parmelia stuppea</i> Tayl.	a species of lichen

Special concern

<i>Anaptychia setifera</i> Räs.	a species of lichen
<i>Cetraria aurescens</i> Tuck.	a species of lichen
<i>Cladonia pseudorangiformis</i> Asah.	a species of lichen
<i>Lobaria quercizans</i> Michx.	a species of lichen
<i>Peltigera venosa</i> (L.) Hoffm.	a species of lichen
<i>Sticta fuliginosa</i> (Dicks.) Ach.	a species of lichen

MOSSES

Endangered

<i>Schistostegia pennata</i> (Hedw.) Web. & Mohr	luminous moss
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Special Concern

<i>Bryoxiphium norvegicum</i> (Brid.) Mitt.	sword moss
<i>Tomenthypnum falcifolium</i> (Ren. ex Nich.) Tuom.	a species of moss

FUNGI

Endangered

<i>Fuscoboletinus weaverae</i> A.H. Smith & Shaffer	a species of fungus
<i>Psathyrella cystidiosa</i> (Peck) A.H. Smith	a species of fungus
<i>Psathyrella rhodospora</i> Weaver & A.H. Smith	a species of fungus

Special concern

<i>Laccaria trullisata</i> (Ellis)	a species of fungus
<i>Lactarius fuliginellus</i> A.H. Smith & Hesler	a species of fungus
<i>Lysurus cruciatus</i> (Lepr. & Mont.) Lloyd.	a species of fungus

Alphabetical Index by Scientific Name

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SCIENTIFIC NAME	COMMON NAME	STATUS	TAXONOMIC GROUP
<i>Achillea sibirica</i>	Siberian yarrow	T	vascular plant
<i>Acipenser fulvescens</i>	lake sturgeon	SC	fish
<i>Acris crepitans</i>	northern cricket frog	E	amphibian/reptile
<i>Actinonaias ligamentina</i>	mucket	T	mollusk
<i>Adoxa moschatellina</i>	moschatel	SC	vascular plant
<i>Aflexia rubranura</i>	red-tailed prairie leafhopper	SC	leafhopper
<i>Agalinis auriculata</i>	eared false foxglove	E	vascular plant
<i>Agalinis gattereri</i>	round-stemmed false foxglove	E	vascular plant
<i>Agapetus tomus</i>	a species of caddisfly	SC	caddisfly
<i>Agrostis geminata</i>	twin bentgrass	SC	vascular plant
<i>Alasmidonta marginata</i>	elktoe	T	mollusk
<i>Allium cernuum</i>	nodding wild onion	T	vascular plant
<i>Allium schoenoprasum</i> var. <i>sibiricum</i>	wild chives	T	vascular plant
<i>Alosa chrysochloris</i>	skipjack herring	SC	fish
<i>Ammocrypta asprella</i>	crystal darter	SC	fish
<i>Ammodramus bairdii</i>	Baird's sparrow	E	bird
<i>Ammodramus henslowii</i>	Henslow's sparrow	E	bird
<i>Ammodramus nelsoni</i>	Nelson's sharp-tailed sparrow	SC	bird
<i>Ammophila breviligulata</i>	beachgrass	T	vascular plant
<i>Anaptychia setifera</i>	a species of lichen	SC	lichen
<i>Androsace septentrionalis</i> ssp. <i>puberulenta</i>	northern androsace	SC	vascular plant
<i>Antennaria parvifolia</i>	small-leaved pussytoes	SC	vascular plant
<i>Anthus spragueii</i>	Sprague's pipit	E	bird
<i>Apalone mutica</i>	smooth softshell	SC	amphibian/reptile
<i>Aphredoderus sayanus</i>	pirate perch	SC	fish
<i>Arabis holboellii</i> var. <i>retrofracta</i>	Holboell's rockcress	T	vascular plant
<i>Arcidens confragosus</i>	rock pocketbook	E	mollusk
<i>Aristida purpurea</i> var. <i>longiseta</i>	red three-awn	SC	vascular plant
<i>Aristida tuberculosa</i>	sea-beach needlegrass	SC	vascular plant
<i>Arnica lonchophylla</i>	long-leaved arnica	T	vascular plant
<i>Arnoglossum plantagineum</i>	tuberous Indian-plantain	T	vascular plant
<i>Asclepias amplexicaulis</i>	clasping milkweed	SC	vascular plant
<i>Asclepias hirtella</i>	prairie milkweed	T	vascular plant
<i>Asclepias stenophylla</i>	narrow-leaved milkweed	E	vascular plant
<i>Asclepias sullivantii</i>	Sullivant's milkweed	T	vascular plant
<i>Asio flammeus</i>	short-eared owl	SC	bird
<i>Asplenium platyneuron</i>	ebony spleenwort	SC	vascular plant
<i>Asplenium trichomanes</i>	maidenhair spleenwort	T	vascular plant
<i>Aster shortii</i>	Short's aster	T	vascular plant
<i>Astragalus alpinus</i>	alpine milk-vetch	E	vascular plant
<i>Astragalus flexuosus</i>	slender milk-vetch	SC	vascular plant
<i>Astragalus missouriensis</i>	Missouri milk-vetch	SC	vascular plant
<i>Asynarchus rossi</i>	a species of caddisfly	SC	caddisfly
<i>Atrytone arogos</i>	arogos skipper	SC	butterfly/moth
<i>Aureolaria pedicularia</i>	fernleaf false foxglove	T	vascular plant
<i>Bacopa rotundifolia</i>	water-hyssop	SC	vascular plant
<i>Baptisia alba</i>	white wild indigo	SC	vascular plant
<i>Baptisia bracteata</i> var. <i>leucophaea</i>	plains wild indigo	SC	vascular plant
<i>Bartonia virginica</i>	Virginia bartonia	E	vascular plant
<i>Besseyia bullii</i>	kitten-tails	T	vascular plant
<i>Botrychium campestre</i>	prairie moonwort	SC	vascular plant
<i>Botrychium gallicomontanum</i>	Frenchman's Bluff moonwort	E	vascular plant
<i>Botrychium lanceolatum</i>	triangle moonwort	T	vascular plant
<i>Botrychium lunaria</i>	common moonwort	T	vascular plant
<i>Botrychium minganense</i>	Mingan moonwort	SC	vascular plant
<i>Botrychium mormo</i>	goblin fern	SC	vascular plant
<i>Botrychium oneidense</i>	blunt-lobed grapefern	E	vascular plant
<i>Botrychium pallidum</i>	pale moonwort	E	vascular plant
<i>Botrychium rugulosum</i>	St. Lawrence grapefern	T	vascular plant
<i>Botrychium simplex</i>	least moonwort	SC	vascular plant
<i>Bryoxiphium norvegicum</i>	sword moss	SC	moss
<i>Buchloe dactyloides</i>	buffalo grass	SC	vascular plant
<i>Buellia nigra</i>	a species of lichen	E	lichen
<i>Buteo lineatus</i>	red-shouldered hawk	SC	bird
<i>Cacalia suaveolens</i>	sweet-smelling Indian-plantain	E	vascular plant
<i>Calamagrostis lacustris</i>	marsh reedgrass	SC	vascular plant
<i>Calamagrostis montanensis</i>	plains reedgrass	SC	vascular plant
<i>Calamagrostis purpurascens</i>	purple reedgrass	SC	vascular plant
<i>Calcarius ornatus</i>	chestnut-collared longspur	E	bird
<i>Callitriche heterophylla</i>	larger water-starwort	SC	vascular plant
<i>Caloplaca parvula</i>	a species of lichen	E	lichen
<i>Caltha natans</i>	floating marsh-marigold	E	vascular plant
<i>Canis lupus</i>	gray wolf (Fed. Status: T)	SC	mammal
<i>Carex annectens</i>	yellow-fruited sedge	SC	vascular plant

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<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>TAXONOMIC GROUP</u>
<i>Carex careyana</i>	Carey's sedge	T	vascular plant
<i>Carex conjuncta</i>	jointed sedge	T	vascular plant
<i>Carex crus-corvi</i>	raven's foot sedge	SC	vascular plant
<i>Carex davisii</i>	Davis' sedge	T	vascular plant
<i>Carex exilis</i>	coastal sedge	SC	vascular plant
<i>Carex festucacea</i>	fescue sedge	T	vascular plant
<i>Carex flava</i>	yellow sedge	SC	vascular plant
<i>Carex formosa</i>	handsome sedge	E	vascular plant
<i>Carex garberi</i>	Garber's sedge	T	vascular plant
<i>Carex hallii</i>	Hall's sedge	SC	vascular plant
<i>Carex jamesii</i>	James' sedge	T	vascular plant
<i>Carex katahdinensis</i>	Katahdin sedge	T	vascular plant
<i>Carex laevivaginata</i>	smooth-sheathed sedge	T	vascular plant
<i>Carex laxiculmis</i>	spreading sedge	T	vascular plant
<i>Carex michauxiana</i>	Michaux's sedge	SC	vascular plant
<i>Carex obtusata</i>	blunt sedge	SC	vascular plant
<i>Carex pallescens</i>	pale sedge	E	vascular plant
<i>Carex plantaginea</i>	plantain-leaved sedge	E	vascular plant
<i>Carex praticola</i>	prairie sedge	SC	vascular plant
<i>Carex scirpoidea</i>	northern singlespike sedge	SC	vascular plant
<i>Carex sterilis</i>	sterile sedge	T	vascular plant
<i>Carex supina</i> var. <i>spaniocarpa</i>	weak arctic sedge	SC	vascular plant
<i>Carex typhina</i>	cattail sedge	SC	vascular plant
<i>Carex woodii</i>	Wood's sedge	SC	vascular plant
<i>Carex xerantica</i>	dry sedge	SC	vascular plant
<i>Castilleja septentrionalis</i>	northern paintbrush	E	vascular plant
<i>Ceraclea brevis</i>	a species of caddisfly	SC	caddisfly
<i>Ceraclea vertreesi</i>	a species of caddisfly	SC	caddisfly
<i>Cervus elaphus</i>	elk	SC	mammal
<i>Cetraria aurescens</i>	a species of lichen	SC	lichen
<i>Cetraria oakesiana</i>	a species of lichen	T	lichen
<i>Chamaesyce missurica</i>	Missouri spurge	SC	vascular plant
<i>Charadrius melodus</i>	pipin plover (Fed. Status: T)	E	bird
<i>Cheilanthes lanosa</i>	hairy lip-fern	E	vascular plant
<i>Chelydra serpentina</i>	snapping turtle	SC	amphibian/reptile
<i>Chilostigma itascaae</i>	headwaters chilostigman	E	caddisfly
<i>Chrysosplenium iowense</i>	Iowa golden saxifrage	E	vascular plant
<i>Cicindela denikei</i>	a species of tiger beetle	T	tiger beetle
<i>Cicindela fulgida westbournei</i>	a species of tiger beetle	T	tiger beetle
<i>Cicindela fulgida fulgida</i>	a species of tiger beetle	E	tiger beetle
<i>Cicindela hirticollis rhodensis</i>	a species of tiger beetle	SC	tiger beetle
<i>Cicindela lepida</i>	a species of tiger beetle	T	tiger beetle
<i>Cicindela limbata nympha</i>	a species of tiger beetle	E	tiger beetle
<i>Cicindela macra macra</i>	a species of tiger beetle	SC	tiger beetle
<i>Cicindela patruela patruela</i>	a species of tiger beetle	SC	tiger beetle
<i>Cicindela splendida cyanocephalata</i>	a species of tiger beetle	SC	tiger beetle
<i>Cirsium hillii</i>	Hill's thistle	SC	vascular plant
<i>Cladium mariscoides</i>	twig-rush	SC	vascular plant
<i>Cladonia pseudorangiformis</i>	a species of lichen	SC	lichen
<i>Claytonia caroliniana</i>	Carolina spring-beauty	SC	vascular plant
<i>Clemmys insculpta</i>	wood turtle	T	amphibian/reptile
<i>Coccocarpia palmicola</i>	a species of lichen	T	lichen
<i>Coluber constrictor</i>	racer	SC	amphibian/reptile
<i>Coregonus kiyi</i>	kiyi	SC	fish
<i>Coregonus zenithicus</i>	shortjaw cisco	SC	fish
<i>Coturnicops noveboracensis</i>	yellow rail	SC	bird
<i>Crassula aquatica</i>	pigmyweed	T	vascular plant
<i>Crataegus douglasii</i>	black hawthorn	T	vascular plant
<i>Cristatella jamesii</i>	James' polaniaia	E	vascular plant
<i>Crotalus horridus</i>	timber rattlesnake	T	amphibian/reptile
<i>Cryptotis parva</i>	least shrew	SC	mammal
<i>Cumberlandia monodonta</i>	spectaclecase	T	mollusk
<i>Cycleptus elongatus</i>	blue sucker	SC	fish
<i>Cyclonaias tuberculata</i>	purple wartyback	T	mollusk
<i>Cygnus buccinator</i>	trumpeter swan	T	bird
<i>Cymopterus acaulis</i>	wild parsley	SC	vascular plant
<i>Cyperus acuminatus</i>	short-pointed umbrella-sedge	T	vascular plant
<i>Cypripedium arietinum</i>	ram's-head lady's-slipper	T	vascular plant
<i>Cypripedium candidum</i>	small white lady's-slipper	SC	vascular plant
<i>Dalea candida</i> var. <i>oligophylla</i>	western white prairie-clover	SC	vascular plant
<i>Decodon verticillatus</i>	waterwillow	SC	vascular plant
<i>Dendroica cerulea</i>	cerulean warbler	SC	bird
<i>Dermatocarpon moulinsii</i>	a species of lichen	E	lichen
<i>Deschampsia flexuosa</i>	slender hairgrass	SC	vascular plant

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SCIENTIFIC NAME	COMMON NAME	STATUS	TAXONOMIC GROUP
<i>Desmanthus illinoensis</i>	prairie mimosa	SC	vascular plant
<i>Desmodium cuspidatum</i> var. <i>longifolium</i>	big tick-trefoil	SC	vascular plant
<i>Desmodium nudiflorum</i>	stemless tick-trefoil	SC	vascular plant
<i>Diarrhena obovata</i>	American beakgrass	SC	vascular plant
<i>Dicentra canadensis</i>	squirrel-corn	SC	vascular plant
<i>Diplazium pycnocarpon</i>	narrow-leaved spleenwort	T	vascular plant
<i>Dodecatheon meadia</i>	prairie shooting star	E	vascular plant
<i>Draba arabisans</i>	rock whitlow-grass	SC	vascular plant
<i>Draba norvegica</i>	Norwegian whitlow-grass	E	vascular plant
<i>Drosera anglica</i>	English sundew	SC	vascular plant
<i>Drosera linearis</i>	linear-leaved sundew	SC	vascular plant
<i>Dryopteris goldiana</i>	Goldie's fern	SC	vascular plant
<i>Dryopteris marginalis</i>	marginal shield-fern	T	vascular plant
<i>Elaphe obsoleta</i>	rat snake	SC	amphibian/reptile
<i>Eleocharis nitida</i>	neat spike-rush	T	vascular plant
<i>Eleocharis olivacea</i>	olivaceous spike-rush	T	vascular plant
<i>Eleocharis parvula</i>	dwarf spike-rush	SC	vascular plant
<i>Eleocharis quinqueflora</i>	few-flowered spike-rush	SC	vascular plant
<i>Eleocharis rostellata</i>	beaked spike-rush	T	vascular plant
<i>Eleocharis wolfii</i>	Wolf's spike-rush	E	vascular plant
<i>Ellipsaria lineolata</i>	butterfly	T	mollusk
<i>Elliptio crassidens</i>	elephant-ear	E	mollusk
<i>Elliptio dilatata</i>	spike	SC	mollusk
<i>Empetrum eamesii</i>	purple crowberry	E	vascular plant
<i>Empetrum nigrum</i>	black crowberry	E	vascular plant
<i>Empidonax virescens</i>	Acadian flycatcher	SC	bird
<i>Emydoidea blandingii</i>	Blanding's turtle	T	amphibian/reptile
<i>Epioblasma triquetra</i>	snuffbox	T	mollusk
<i>Erebia disa mancinus</i>	disa alpine	SC	butterfly/moth
<i>Erimystax x-punctata</i>	gravel chub	SC	fish
<i>Eryngium yuccifolium</i>	rattlesnake-master	SC	vascular plant
<i>Erynnis persius</i>	persius dusky wing	E	butterfly/moth
<i>Erythronium propullans</i>	dwarf trout lily (Fed. Status: E)	E	vascular plant
<i>Escobaria vivipara</i>	ball cactus	E	vascular plant
<i>Etheostoma microperca</i>	least darter	SC	fish
<i>Eumeces fasciatus</i>	five-lined skink	SC	amphibian/reptile
<i>Eupatorium sessilifolium</i>	upland boneset	T	vascular plant
<i>Euphrasia hudsoniana</i>	Hudson Bay eyebright	SC	vascular plant
<i>Falco peregrinus</i>	peregrine falcon (Fed. Status: E)	T	bird
<i>Felis concolor</i>	mountain lion	SC	mammal
<i>Fimbristylis autumnalis</i>	autumn fimbriatylis	SC	vascular plant
<i>Fimbristylis puberula</i> var. <i>interior</i>	hairy fimbriatylis	E	vascular plant
<i>Floerkea proserpinacoides</i>	false mermaid	T	vascular plant
<i>Fundulus sciadicus</i>	plains topminnow	SC	fish
<i>Fuscoboletinus weaverae</i>	a species of fungus	E	fungus
<i>Fusconaia ebena</i>	ebonyshell	E	mollusk
<i>Gaillardia aristata</i>	blanket-flower	SC	vascular plant
<i>Gallinula chloropus</i>	common moorhen	SC	bird
<i>Gentiana affinis</i>	northern gentian	SC	vascular plant
<i>Gentianella amarella</i> ssp. <i>acuta</i>	felwort	SC	vascular plant
<i>Glaux maritima</i>	sea milkwort	E	vascular plant
<i>Habronattus texanus</i>	a species of jumping spider	SC	jumping spider
<i>Haliaeetus leucocephalus</i>	bald eagle (Fed. Status: T)	SC	bird
<i>Hamamelis virginiana</i>	witch-hazel	SC	vascular plant
<i>Helianthus nuttallii</i> ssp. <i>rydbergii</i>	Nuttall's sunflower	SC	vascular plant
<i>Helictotrichon hookeri</i>	oat-grass	SC	vascular plant
<i>Hemidactylium scutatum</i>	four-toed salamander	SC	amphibian/reptile
<i>Hesperia comma assinihoaia</i>	assinihoaia skipper	E	butterfly/moth
<i>Hesperia dacotae</i>	dakota skipper	T	butterfly/moth
<i>Hesperia leonardus</i>	leonardus skipper	SC	butterfly/moth
<i>Hesperia ottoe</i>	ottoe skipper	T	butterfly/moth
<i>Hesperia uncas</i>	uncas skipper	E	butterfly/moth
<i>Heteranthera limosa</i>	mud plantain	T	vascular plant
<i>Heterodon nasicus</i>	western hognose snake	SC	amphibian/reptile
<i>Hudsonia tomentosa</i>	beach-heather	SC	vascular plant
<i>Huperzia porophila</i>	rock clubmoss	T	vascular plant
<i>Hydrastis canadensis</i>	golden-seal	E	vascular plant
<i>Hydrocotyle americana</i>	American water-pennywort	SC	vascular plant
<i>Hydroptila metoea</i>	a species of caddisfly	SC	caddisfly
<i>Hydroptila novicola</i>	a species of caddisfly	SC	caddisfly
<i>Hydroptila tortosa</i>	a species of caddisfly	SC	caddisfly
<i>Ichthyomyzon fossor</i>	northern brook lamprey	SC	fish
<i>Ichthyomyzon gagei</i>	southern brook lamprey	SC	fish
<i>Ictiobus niger</i>	black buffalo	SC	fish

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SCIENTIFIC NAME	COMMON NAME	STATUS	TAXONOMIC GROUP
<i>Iodanthus pinnatifidus</i>	purple rocket	E	vascular plant
<i>Isoetes melanopoda</i>	blackfoot quillwort	E	vascular plant
<i>Jeffersonia diphylla</i>	twinleaf	SC	vascular plant
<i>Juglans cinerea</i>	butternut	SC	vascular plant
<i>Juncus marginatus</i>	marginated rush	SC	vascular plant
<i>Juncus stygius</i> var. <i>americanus</i>	bog rush	SC	vascular plant
<i>Juniperus horizontalis</i>	creeping juniper	SC	vascular plant
<i>Laccaria trullisata</i>	a species of fungus	SC	fungus
<i>Lactarius fuliginellus</i>	a species of fungus	SC	fungus
<i>Lampsilis higginsii</i>	Higgins eye (Fed. Status: E)	E	mollusk
<i>Lampsilis teres</i>	yellow sandshell	E	mollusk
<i>Lanius ludovicianus</i>	loggerhead shrike	T	bird
<i>Larus pipixcan</i>	Franklin's gull	SC	bird
<i>Lasmigona compressa</i>	creek heelsplitter	SC	mollusk
<i>Lasmigona costata</i>	fluted-shell	SC	mollusk
<i>Lechea tenuifolia</i>	narrow-leaved pinweed	E	vascular plant
<i>Leersia lenticularis</i>	catchfly grass	SC	vascular plant
<i>Leptogium apalachense</i>	a species of lichen	E	lichen
<i>Lespedeza leptostachya</i>	prairie bush clover (Fed. Status: T)	T	vascular plant
<i>Lesquerella ludoviciana</i>	bladder pod	E	vascular plant
<i>Ligumia recta</i>	black sandshell	SC	mollusk
<i>Limosa fedoa</i>	marbled godwit	SC	bird
<i>Limosella aquatica</i>	mudwort	SC	vascular plant
<i>Listera auriculata</i>	auricled twayblade	E	vascular plant
<i>Listera convallarioides</i>	broad-lipped twayblade	SC	vascular plant
<i>Littorella uniflora</i>	American shore-plantain	SC	vascular plant
<i>Lobaria quercizans</i>	a species of lichen	SC	lichen
<i>Lobaria scrobiculata</i>	a species of lichen	E	lichen
<i>Luzula parviflora</i> ssp. <i>melanocarpa</i>	small-flowered woodrush	SC	vascular plant
<i>Lycaeides idas nabokovi</i>	Nabokov's blue	SC	butterfly/moth
<i>Lycaeides melissa samuelis</i>	Karner blue (Fed. Status: E)	E	butterfly/moth
<i>Lysimachia quadrifolia</i>	whorled loosestrife	SC	vascular plant
<i>Lysurus cruciatus</i>	a species of fungus	SC	fungus
<i>Machaeranthera pinnatifida</i>	cutleaf ironplant	SC	vascular plant
<i>Malaxis monophyllos</i> var. <i>brachypoda</i>	white adder's-mouth	SC	vascular plant
<i>Malaxis paludosa</i>	bog adder's-mouth	E	vascular plant
<i>Marpissa grata</i>	a species of jumping spider	SC	jumping spider
<i>Marsilea vestita</i>	hairy water clover	E	vascular plant
<i>Megaloniais nervosa</i>	washboard	T	mollusk
<i>Melica nitens</i>	three-flowered melic	T	vascular plant
<i>Metaphidippus arizonensis</i>	a species of jumping spider	SC	jumping spider
<i>Microtus ochrogaster</i>	prairie vole	SC	mammal
<i>Microtus pinetorum</i>	woodland vole	SC	mammal
<i>Minuartia dawsonensis</i>	rock sandwort	SC	vascular plant
<i>Moehringia macrophylla</i>	large-leaved sandwort	T	vascular plant
<i>Montia chamissoi</i>	montia	E	vascular plant
<i>Morone mississippiensis</i>	yellow bass	SC	fish
<i>Muhlenbergia uniflora</i>	one flowered muhly	SC	vascular plant
<i>Mustela nivalis</i>	least weasel	SC	mammal
<i>Myotis septentrionalis</i>	northern myotis	SC	mammal
<i>Najas gracillima</i>	slender naiad	SC	vascular plant
<i>Najas marina</i>	sea naiad	SC	vascular plant
<i>Napaea dioica</i>	glade mallow	T	vascular plant
<i>Notropis amnis</i>	pallid shiner	SC	fish
<i>Notropis anogenus</i>	pugnose shiner	SC	fish
<i>Notropis nubilus</i>	Ozark minnow	SC	fish
<i>Notropis topeka</i>	Topeka shiner	SC	fish
<i>Noturus exilis</i>	slender madtom	SC	fish
<i>Novasuccinea</i> n. sp. Minnesota B	Iowa Pleistocene ambersnail	E	mollusk
<i>Novasuccinea</i> n. sp. Minnesota A	Minnesota Pleistocene ambersnail	T	mollusk
<i>Nymphaea leibergii</i>	small white waterlily	T	vascular plant
<i>Oarisma garita</i>	garita skipper	T	butterfly/moth
<i>Oarisma poweshiek</i>	poweshiek skipper	SC	butterfly/moth
<i>Obovaria olivaria</i>	hickorynut	SC	mollusk
<i>Oeneis uhleri varuna</i>	Uhler's arctic	E	butterfly/moth
<i>Oenothera rhombipetala</i>	rhombic-petaled evening primrose	SC	vascular plant
<i>Ophiogomphus anomalis</i>	extra-striped snaketail	SC	dragonfly
<i>Ophiogomphus susbehcha</i>	St. Croix snaketail	SC	dragonfly
<i>Opuntia macrorhiza</i>	plains prickly pear	SC	vascular plant
<i>Orobanche fasciculata</i>	clustered broomrape	SC	vascular plant
<i>Orobanche ludoviciana</i>	Louisiana broomrape	SC	vascular plant
<i>Orobanche uniflora</i>	one-flowered broomrape	SC	vascular plant
<i>Oryzopsis hymenoides</i>	Indian ricegrass	E	vascular plant
<i>Osmorhiza berteroi</i>	Chilean sweet cicely	E	vascular plant

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<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>TAXONOMIC GROUP</u>
<i>Osmorhiza depauperata</i>	blunt-fruited sweet cicely	SC	vascular plant
<i>Oxyethira ecornuta</i>	a species of caddisfly	SC	caddisfly
<i>Oxyethira itasca</i>	a species of caddisfly	SC	caddisfly
<i>Oxytropis viscida</i>	sticky locoweed	E	vascular plant
<i>Panax quinquefolius</i>	American ginseng	SC	vascular plant
<i>Paradamoetas fontana</i>	a species of jumping spider	SC	jumping spider
<i>Parmelia stictica</i>	a species of lichen	E	lichen
<i>Parmelia stippea</i>	a species of lichen	T	lichen
<i>Paronychia canadensis</i>	Canadian forked chickweed	T	vascular plant
<i>Paronychia fastigiata</i>	forked chickweed	E	vascular plant
<i>Parthenium integrifolium</i>	wild quinine	E	vascular plant
<i>Pelecanus erythrorhynchos</i>	American white pelican	SC	bird
<i>Pellaea atropurpurea</i>	purple cliff-brake	SC	vascular plant
<i>Peltigera venosa</i>	a species of lichen	SC	lichen
<i>Percina evides</i>	gilt darter	SC	fish
<i>Perognathus flavescens</i>	plains pocket mouse	SC	mammal
<i>Phacelia franklinii</i>	Franklin's phacelia	SC	vascular plant
<i>Phalaropus tricolor</i>	Wilson's phalarope	T	bird
<i>Phegopteris hexagonoptera</i>	broad beech-fern	T	vascular plant
<i>Phenacomys intermedius</i>	heather vole	SC	mammal
<i>Phidippus apacheanus</i>	a species of jumping spider	SC	jumping spider
<i>Phidippus pius</i>	a species of jumping spider	SC	jumping spider
<i>Pinguicula vulgaris</i>	butterwort	SC	vascular plant
<i>Pipistrellus subflavus</i>	eastern pipistrelle	SC	mammal
<i>Pituophis catenifer</i>	gopher snake	SC	amphibian/reptile
<i>Plantago elongata</i>	slender plantain	T	vascular plant
<i>Platanthera clavellata</i>	club-spur orchid	SC	vascular plant
<i>Platanthera flava</i> var. <i>herbiola</i>	tubercled rein-orchid	E	vascular plant
<i>Platanthera praeclara</i>	western prairie fringed orchid (Fed. Status: T)	E	vascular plant
<i>Plethobasus cyphus</i>	sheepnose	E	mollusk
<i>Pleurobema coccineum</i>	round pigtoe	T	mollusk
<i>Poa paludigena</i>	bog bluegrass	T	vascular plant
<i>Poa wolffii</i>	Wolf's bluegrass	SC	vascular plant
<i>Podiceps auritus</i>	horned grebe	T	bird
<i>Polemonium occidentale</i> ssp. <i>lacustre</i>	western Jacob's-ladder	E	vascular plant
<i>Polycentropus milaca</i>	a species of caddisfly	SC	caddisfly
<i>Polygala cruciata</i>	cross-leaved milkwort	E	vascular plant
<i>Polygonum careyi</i>	Carey's smartweed	SC	vascular plant
<i>Polygonum viviparum</i>	alpine bistort	SC	vascular plant
<i>Polyodon spathula</i>	paddlefish	T	fish
<i>Polystichum acrostichoides</i>	Christmas fern	T	vascular plant
<i>Polystichum braunii</i>	Braun's holly fern	E	vascular plant
<i>Polytaenia nuttallii</i>	prairie-parsley	SC	vascular plant
<i>Potamogeton bicupulatus</i>	snailseed pondweed	E	vascular plant
<i>Potamogeton diversifolius</i>	diverse-leaved pondweed	E	vascular plant
<i>Potamogeton vaginatus</i>	sheathed pondweed	SC	vascular plant
<i>Potamogeton vaseyi</i>	Vasey's pondweed	SC	vascular plant
<i>Prenanthes crepidinea</i>	nodding rattlesnake-root	SC	vascular plant
<i>Protophila talola</i>	a species of caddisfly	SC	caddisfly
<i>Psathyrella cystidiosa</i>	a species of fungus	E	fungus
<i>Psathyrella rhodospora</i>	a species of fungus	E	fungus
<i>Pseudocyphellaria crocata</i>	a species of lichen	E	lichen
<i>Psoralidium tenuiflora</i>	slender-leaved scurf pea	E	vascular plant
<i>Pyrgus centaureae freija</i>	grizzled skipper	SC	butterfly/moth
<i>Pyrola minor</i>	small shinleaf	SC	vascular plant
<i>Quadrula fragosa</i>	winged mapleleaf (Fed. Status: E)	E	mollusk
<i>Quadrula metanevra</i>	monkeyface	T	mollusk
<i>Quadrula nodulata</i>	wartyback	E	mollusk
<i>Rallus elegans</i>	king rail	E	bird
<i>Ranunculus lapponicus</i>	Lapland buttercup	SC	vascular plant
<i>Rhynchospora capillacea</i>	hair-like beak-rush	T	vascular plant
<i>Rhynchospora fusca</i>	sooty-colored beak-rush	SC	vascular plant
<i>Rorippa sessiliflora</i>	sessile-flowered cress	SC	vascular plant
<i>Rotala ramosior</i>	tooth-cup	T	vascular plant
<i>Rubus chamaemorus</i>	cloudberry	T	vascular plant
<i>Rudbeckia triloba</i>	three-leaved coneflower	SC	vascular plant
<i>Ruppia maritima</i>	ditch-grass	SC	vascular plant
<i>Sagina nodosa</i> ssp. <i>borealis</i>	knotty pearlwort	E	vascular plant
<i>Salicornia rubra</i>	red saltwort	T	vascular plant
<i>Salix maccalliana</i>	Maccall's willow	SC	vascular plant
<i>Salix pellita</i>	satiny willow	SC	vascular plant
<i>Sanicula trifoliata</i>	beaked snakeroot	SC	vascular plant
<i>Sassacus papenhoei</i>	a species of jumping spider	SC	jumping spider
<i>Saxifraga cernua</i>	nodding saxifrage	E	vascular plant

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<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>TAXONOMIC GROUP</u>
<i>Saxifraga paniculata</i>	encrusted saxifrage	T	vascular plant
<i>Schedonnardus paniculatus</i>	tumblegrass	SC	vascular plant
<i>Schinia indiana</i>	phlox moth	SC	butterfly/moth
<i>Schistostegia pennata</i>	luminous moss	E	moss
<i>Scirpus clintonii</i>	Clinton's bulrush	SC	vascular plant
<i>Scleria triglomerata</i>	tall nut-rush	E	vascular plant
<i>Scleria verticillata</i>	whorled nut-rush	T	vascular plant
<i>Scutellaria ovata</i>	ovate-leaved skullcap	T	vascular plant
<i>Sedum integrifolium</i> ssp. <i>leedyi</i>	Leedy's roseroot (Fed. Status: T)	E	vascular plant
<i>Seiurus motacilla</i>	Louisiana waterthrush	SC	bird
<i>Selaginella selaginoides</i>	northern spikemoss	E	vascular plant
<i>Senecio canus</i>	gray ragwort	E	vascular plant
<i>Senecio indecorus</i>	elegant groundsel	SC	vascular plant
<i>Setodes guttatus</i>	a species of caddisfly	SC	caddisfly
<i>Shinnersoseris rostrata</i>	annual skeletonweed	T	vascular plant
<i>Silene drummondii</i>	Drummond's campion	SC	vascular plant
<i>Silene nivea</i>	snowy campion	T	vascular plant
<i>Simpsonaias ambigua</i>	salamander mussel	T	mollusk
<i>Sistrurus catenatus</i>	massasauga	E	amphibian/reptile
<i>Solidago mollis</i>	soft goldenrod	SC	vascular plant
<i>Solidago sciaphila</i>	cliff goldenrod	SC	vascular plant
<i>Sorex fumeus</i>	smokey shrew	SC	mammal
<i>Sparganium glomeratum</i>	clustered bur-reed	SC	vascular plant
<i>Speotyto cunicularia</i>	burrowing owl	E	bird
<i>Speyeria idalia</i>	regal fritillary	SC	butterfly/moth
<i>Spilogale putorius</i>	eastern spotted skunk	T	mammal
<i>Stellaria longipes</i>	long-stalked chickweed	SC	vascular plant
<i>Sterna forsteri</i>	Forster's tern	SC	bird
<i>Sterna hirundo</i>	common tern	T	bird
<i>Sticta fuliginosa</i>	a species of lichen	SC	lichen
<i>Subularia aquatica</i>	awlwort	T	vascular plant
<i>Sullivantia sullivantii</i>	reniform sullivantia	T	vascular plant
<i>Symphoricarpos orbiculatus</i>	coralberry	SC	vascular plant
<i>Synaptomys borealis</i>	northern bog lemming	SC	mammal
<i>Talinum rugospermum</i>	rough-seeded fameflower	E	vascular plant
<i>Tephrosia virginiana</i>	goat's-rue	SC	vascular plant
<i>Thomomys talpoides</i>	northern pocket gopher	SC	mammal
<i>Tofieldia pusilla</i>	small false asphodel	E	vascular plant
<i>Tomenthypnum falcifolium</i>	a species of moss	SC	moss
<i>Torreyochloa pallida</i>	Torrey's manna-grass	SC	vascular plant
<i>Trillium nivale</i>	snow trillium	SC	vascular plant
<i>Trimorpha acris</i> var. <i>asteroides</i>	bitter fleabane	SC	vascular plant
<i>Trimorpha lonchophylla</i>	shortray fleabane	SC	vascular plant
<i>Triplasis purpurea</i>	purple sand-grass	SC	vascular plant
<i>Tritogonia verrucosa</i>	pistolgrip	T	mollusk
<i>Tropidoclonion lineatum</i>	lined snake	SC	amphibian/reptile
<i>Tsuga canadensis</i>	eastern hemlock	SC	vascular plant
<i>Tutelina formicaria</i>	a species of jumping spider	SC	jumping spider
<i>Tympanuchus cupido</i>	greater prairie-chicken	SC	bird
<i>Umbilicaria torrefacta</i>	a species of lichen	E	lichen
<i>Utricularia purpurea</i>	purple-flowered bladderwort	SC	vascular plant
<i>Utricularia resupinata</i>	lavender bladderwort	SC	vascular plant
<i>Vaccinium uliginosum</i>	alpine bilberry	T	vascular plant
<i>Valeriana edulis</i> var. <i>ciliata</i>	valerian	T	vascular plant
<i>Venustaconcha ellipsiformis</i>	ellipse	T	mollusk
<i>Verbena simplex</i>	narrow-leaved vervain	SC	vascular plant
<i>Vertigo hubrichti variabilis</i> n. subsp.	variable Pleistocene vertigo	T	mollusk
<i>Vertigo hubrichti hubrichti</i>	Midwest Pleistocene vertigo	E	mollusk
<i>Vertigo meramecensis</i>	bluff vertigo	T	mollusk
<i>Viola lanceolata</i>	lance-leaved violet	T	vascular plant
<i>Viola nuttallii</i>	yellow prairie violet	T	vascular plant
<i>Vitis aestivalis</i>	silverleaf grape	SC	vascular plant
<i>Waldsteinia fragarioides</i>	barren strawberry	SC	vascular plant
<i>Wilsonia citrina</i>	hooded warbler	SC	bird
<i>Woodsia alpina</i>	alpine woodsia	SC	vascular plant
<i>Woodsia glabella</i>	smooth woodsia	T	vascular plant
<i>Woodsia scopulina</i>	Rocky Mountain woodsia	T	vascular plant
<i>Xyris montana</i>	montane yellow-eyed grass	SC	vascular plant
<i>Xyris torta</i>	twisted yellow-eyed grass	E	vascular plant

MCBS Products

The Natural Heritage and Nongame Research Program (NHNRP) maintains the Natural Heritage Information System (NHIS), which now includes more than 20 component databases. The oldest of these is the Rare Features Database, which contains statewide information on the locations of rare plants and animals and animal aggregations. A complete list of rare features tracked in this database is available upon request from NHNRP. Presently over 21,000 locations of rare features are documented for the state of Minnesota in this database. All rare features data collected by MCBS are entered into this database, and each location constitutes a record. Other databases include the Minnesota County Biological Survey (MCBS) Site Database, Bald Eagle Historical Database, Colonial Waterbird Historical Database, County Flora Database, Bearing Tree Database, and Relve (vegetation plots) Database.

In addition to being presented in this notebook, the following data on Cass County are available from the

NHIS in a variety of printed and electronic formats. For access to these data, contact Karen Cieminski, Database Manager, Natural Heritage and Nongame Research Program, Section of Ecological Services, Minnesota Department of Natural Resources, Box 25, 500 Lafayette Road, St. Paul, MN 55155, (612/296-8319).

- 1) Public Land Survey Bearing Tree Data
- 2) Rare Features Data (plants, animals, animal aggregations)
- 3) MCBS Site Polygons and Attribute Data
- 4) Vegetation Plot (relve) Data
- 5) Plant Lists
- 6) County Checklist (plants)

A NHIS user's guide and a request form follow this page. Please contact the NHNRP Information Systems Manager for an estimate of delivery time and to discuss any costs that might be incurred.

Natural Heritage User's Guide and Request Form

A NHIS user's guide and a request form follow this page. Please contact the NHNRP Database Manager for an estimate of delivery time and to discuss any costs that might be incurred.

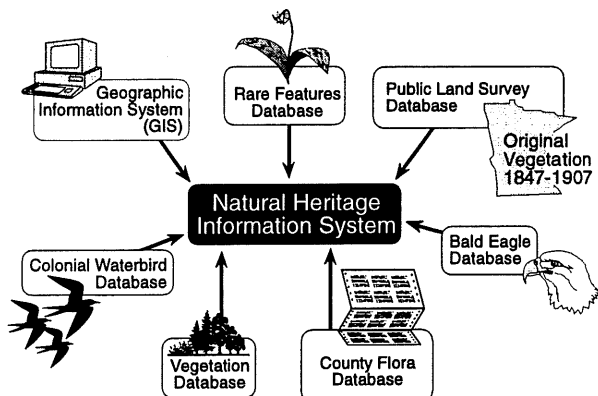
A User's Guide To The Minnesota Natural Heritage Information System

The Challenge of the Minnesota Natural Heritage Information System is to effectively provide information on Minnesota's rare plants, animals, natural communities, and geologic features. This information assists Minnesotans in planning for the protection and management of the State's biological diversity.

The Minnesota Natural Heritage Information System is maintained by the Natural Heritage Program and the Nongame Wildlife Program, units within the Minnesota Department of Natural Resources Division of Fish and Wildlife. The mission of these two programs is to inventory, research, and protect features of the State's biological diversity.

The Natural Heritage Information System now includes more than 20 component databases. The oldest feature of this system is the Rare Features Database. This database includes locations of species officially listed under the provisions of the Federal Endangered Species Act of 1973, Public Law 93-205 and/or Minnesota Statute 84.0895. The federal law prohibits the "taking" of endangered animals wherever they occur and protects plants wherever there is federal involvement in the form of funding or permits. The state law imposes the same restrictions on taking, import, transport or sale to both endangered and threatened animal and plant species.

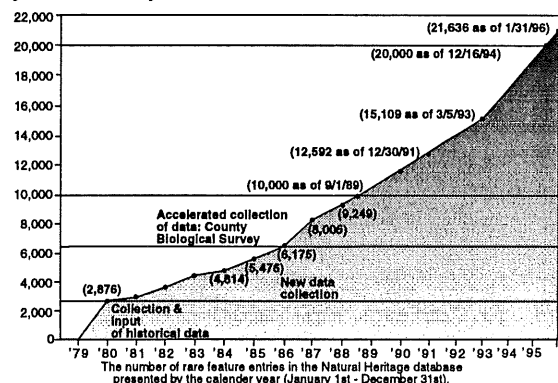
Other databases in the System contain a variety of complementary information such as nest histories of bald eagles and colonial waterbirds, plant lists for counties and selected sites, original public land survey records (1847-1907), and detailed site descriptions in selected counties.



The purpose of this brochure is to explain the nature of the data maintained, provide examples of potential uses of the information, illustrate possible formats in which data can be supplied, and to explain the procedure for requesting data.

The Rare Features Database

The Rare Features Database is the most complete single source of locational information about Minnesota's rare or otherwise significant plant and animal species, natural communities, and natural features. The Database began as a compilation of historical records from museum collections and published information. This has been supplemented with data from years of field work on Minnesota's rare features. Most recently, our knowledge of Minnesota's rare features has increased substantially with the progress of the Minnesota County Biological Survey, a county-by-county inventory of rare natural features.



The Rare Features Database comprises locational records of rare and endangered natural features. The data are maintained in several formats. All locations are plotted on USGS 7.5 minute topographic maps. Each record is also tracked in a computerized database, with supporting information kept in manual files. Each record is composed of a number of fields containing information such as location, date, State and Federal legal status, land ownership, numbers of individuals observed, and associated species.



**NATURE
OF THE
DATA**

Rare Plants

The following rare plants are tracked: all species that are listed as Federally endangered, threatened, or as candidates for Federal listing; all species that are State listed as endangered, threatened or special concern. Several rare species are also tracked which currently have no legal status but need further monitoring to determine their status.

Rare Animals

All animal species that are listed as Federally endangered or threatened (except the gray wolf) are tracked, as well as all birds, small mammals, reptiles, amphibians, mussels, and butterflies that are listed as State endangered, threatened or special concern. Fish data are currently maintained in manual files only.

Natural Communities

Natural communities are functional units of the landscape that are characterized and defined by their most prominent habitat features – a combination of vegetation, hydrology, landform, soil and natural disturbance cycles. Although natural communities have no legal protection in Minnesota, the Natural Heritage Program has evaluated and ranked community types according to their relative rarity and endangerment throughout their range. Locations of high quality examples are tracked by the Rare Features Database.

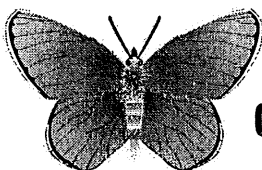
Geologic Features

Noteworthy examples of geologic features throughout Minnesota are tracked if they are unique or rare, extraordinarily well-preserved, widely documented, highly representative of a certain period of geologic history, or very useful in regional geologic correlation.

Animal Aggregations

Certain types of animal aggregations, such as nesting colonies of waterbirds (herons, egrets, grebes, gulls and terns), bat hibernacula, prairie chicken booming grounds, and winter bald eagle roosts are tracked regardless of the legal status of the species that comprise them. The tendency to aggregate makes these species vulnerable because a single catastrophic event could result in the loss of many individuals.

As the only repository for statewide locational information on rare natural features, the Rare Features Database can be useful to many agencies and individuals.



**USE
OF THE
DATA**

The data are used for:

Land Conservation Programs: to identify those areas most deserving protection by DNR programs such as the Scientific and Natural Areas, Reinvest in Minnesota, and Native Prairie Bank Programs, as well as private conservation organizations such as the Nature Conservancy.

Environmental Review: for review of specific project-related impacts through the state environmental review process. Examples include commercial and residential developments, transportation projects, utility construction, landfills, mining, and flood control projects.

Planning: to notify private and public planners and developers of locations of rare species or biologically sensitive areas early in the planning process.

Management: to provide data to government agencies and other land management organizations so that management decisions can be made with consideration for rare features.

Research: to provide baseline information on rare features to support population monitoring and other ecological research.

Education: to promote public awareness and appreciation of Minnesota's rare resources.

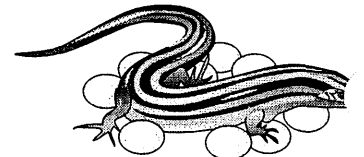
Although the most common request is for the locational information contained in the Rare Features Database, there is a growing demand for other types of information about rare species and natural communities, such as detailed plant lists, site evaluations, and site-based priorities. Applicants with specific interests should inquire if their needs can be met by other databases in the Natural Heritage Information System.

**NATURE
OF THE
DATA**



Information from the Rare Features Database can be provided for review of land-use plans, impacts of specific development projects, research projects, and for other legitimate uses. The publication of exact locational information, however, may threaten the continued existence of some rare species. For example, some endangered wildflowers, such as orchids, have very attractive blooms that can lead to exploita-

DATA SECURITY



tion by collectors. Some rare animal species, such as are sensitive to disturbance by humans, and may desert a breeding area that is approached too closely during certain portions of the breeding season. For this reason, program staff must carefully screen all requests, and may ask that the level of detail in publication of locational information be modified, or that interpretation of data be reviewed by program staff.

Data can be supplied to users in several formats:



DATA REQUESTS

1. Printed

Custom computer printouts are available that display data selected and sorted to meet the user's needs. Some examples include sorting by:

- Geographic area, e.g., county, township, 7.5 minute topographic map (scale 1:24,000).
- Species or major taxonomic groups such as birds.
- Status, e.g., all endangered species, all Federally listed species.
- Date of information, i.e., date occurrence was last field checked.
- Land ownership, e.g., public or private.

2. Electronic

The information described above can also be provided in electronic form on floppy disks or tapes.

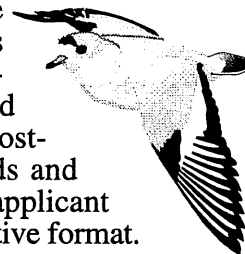
3. Maps

Certain mapping capabilities also exist, and these are currently being expanded. Data are managed with an ARC/INFO Geographic Information System; data conversion to other GIS formats is possible. Interested users should inquire about the type of mapping available at the time they place their request.

Data Request Forms are available from:

Endangered Resource/Environmental Review Specialist
Minnesota Natural Heritage and Nongame Wildlife
Research Program
Department of Natural Resources
500 Lafayette Road, Box 25
St. Paul, Minnesota 55155
Phone: 612/296-2835

By completing data request forms, applicants supply detailed information about the nature of the data required and the intended use of the data. Staff review the data request and determine the level of detail necessary to adequately meet the data applicant's needs. Information is retrieved using the most cost-efficient methods and provided to the applicant in the most effective format.



APPLICATION PROCEDURE

The applicant must agree to secure permission from the Natural Heritage and Nongame Wildlife Programs before publishing precise locational information, and to credit the Natural Heritage Information System as the source of the information. Typical response time is two weeks following the receipt of the data request form.



Equal opportunity to participate in and benefit from programs of the Minnesota Department of Natural Resources is available to all individuals regardless of race, color, national origin, sex, age or disability. Discrimination inquiries should be sent to MN/DNR, 500 Lafayette Rd., St. Paul, MN 55155-4049 or the Equal Opportunity Office, Department of the Interior, Washington, D.C. 20240

MINNESOTA NATURAL HERITAGE INFORMATION SYSTEM DATA REQUEST FORM

****Requests generally take 2 to 3 weeks from date of receipt to process
and are processed in the order received.****

For a description of the Natural Heritage Information System, consult "A User's Guide to the Natural Heritage Information System" (available by calling or writing the contact shown on the reverse side of this form).

DATE OF REQUEST _____

WHO IS REQUESTING THE INFORMATION?

Agency _____

Name and Title _____

Address _____

Phone _____

FAX _____

STANDARD INFORMATION PROVIDED: You will be provided with information on the known locations of plants and animals that are Federally or State listed and rare species with no legal status, as well as high quality natural plant communities and aggregation sites such as bat hibernacula, colonial waterbird nesting sites, prairie chicken booming grounds, etc. If you need information only on certain groups or species, or need additional information not listed above, please specify below. If additional clarification of your request is required, you will be contacted by phone.

AREA FOR WHICH INFORMATION IS DESIRED (FOR LOCALIZED AREAS, SPECIFY COUNTY, TOWNSHIP, RANGE AND SECTION); ENCLOSE A MAP SHOWING THE BOUNDARIES OF THE AREA OF INTEREST.

HOW WILL THE INFORMATION BE USED AND IN WHAT FORM AND DETAIL DO YOU WISH TO PUBLISH THIS INFORMATION?_____

(OVER)

IF DATA ARE BEING REQUESTED FOR REVIEW OF A DEVELOPMENT PROJECT, PLEASE PROVIDE THE FOLLOWING INFORMATION:

PROJECT NAME _____

PROJECT PROPOSER _____

BRIEFLY DESCRIBE THE PROJECT. _____

BRIEFLY DESCRIBE CURRENT AND PAST LAND USE OF PROJECT SITE, IF KNOWN:

The information supplied above is complete and accurate. I understand that material supplied to me from the Minnesota Natural Heritage Information System is copyrighted and that I can not reproduce or publish any of this copyrighted material without prior written permission from the Minnesota DNR. Further, that if permission to publish is given, I understand that I must credit the Minnesota Natural Heritage and Nongame Wildlife Programs, Minnesota Department of Natural Resources as the source of the material.

Signature _____

Return completed form to: Endangered Species Environmental Review Coordinator
 Section of Ecological Services
 Department of Natural Resources
 500 Lafayette Road, Box 25
 St. Paul, Minnesota 55155

Phone (612) 296-8319 or 296-8324
FAX (612) 296-1811

Fees

For-profit organizations are charged a fee for this service. In addition, a surcharge is applied for rush orders and a fee may be charged for large requests from any source. Fee schedule available on request. Please do not include payment with your request. An invoice will be included with our response letter.

2. Brief Overview of Landforms

<i>Bedrock and Glacial Geology</i>	2.1.1	<i>Ecological Classification System</i>	
<i>Shaded relief map of Cass County</i>	2.2.1	<i>(ECS) Map and Information Sheet</i>	2.6.1
<i>Soils</i>	2.3.1	<i>Descriptions of the Three ECS</i>	
<i>Geomorphic Regions</i>	2.3.1	<i>Subsections in Cass County</i>	2.7.1
<i>Ecological Classification System</i>	2.3.1	<i>ECS Landtype Associations (LTA)</i>	2.8.1
<i>Lakes and Rivers</i>	2.3.1	<i>Watershed Map Showing Lakes and</i>	
<i>Soils Map of Cass County</i>	2.4.1	<i>Rivers for the ECS Section</i>	
<i>Map of Geomorphic Regions</i>	2.5.1	<i>that includes Cass County.</i>	2.9.1
		<i>Hypothetical Topographic Cross-sections</i>	2.10.1
		<i>Annotated Bibliography: Landforms</i>	2.11.1

Bedrock and Glacial Geology

All of Cass County is blanketed thickly with material deposited by glaciers over 10,000 years ago. The depth of this glacial drift ranges from 300 to 500 feet over much of the county, thinning to less than 100 feet in the south (Oakes and Bidwell, 1968). Some of the deepest till in the state is found in the vicinity of Leech Lake (A. Norton, pers. comm.). These glacial deposits give the county its hilly topography and soften the jagged contours of the underlying eroded bedrock. Major landforms in Cass County are apparent in the figure on page 2.1.3; this map shows the relief present in the county.

Metamorphosed Lower Precambrian volcanic and intrusive bedrock (2.7 billion years old), formerly the southern edge of the Canadian Shield, underlies glacial drift throughout most of Cass County. In the southeast part of the county, metamorphosed mudstones and siltstones of Middle Precambrian age make up the bedrock surface. Cretaceous age (115 million years to 65 million years old) sedimentary rocks have been reported at scattered locations throughout the county and most likely occur in depressions on the Precambrian bedrock surface (A. Norton, pers. comm.).

The Pleistocene epoch, also known as the Great Ice Age, began about 2 million years ago when the first of a series of glaciers moved south of the arctic regions. Glaciers grew and moved south during cool periods, when more snow fell during the cold part of the year than melted during the warm season. During the Great Ice Age, cool periods and glacial advances alternated with warm periods when glaciers melted back.

The fractured bedrock underlying Cass County was easily eroded by the first glaciers, creating an irregular surface. The resulting underlying features influenced the flow rate and direction of subsequent glaciers advancing from the north (Mickelson et al. 1983).

The Wisconsin glaciation, the most recent glacial advance, began about 100,000 years ago. The huge Laurentide Ice Sheet, carrying glacial debris derived from rocks of the Canadian Shield, covered much of eastern North America and had many lobes and sublobes. About 20,000 years ago, the last of the lobes and sublobes began to melt (Pielou 1991).

The rate at which the south end of a glacier melted determined how the glacial drift (unsorted debris carried by the glacier) was deposited (Schwartz and Thiel 1963). If the south end of the glacier melted at about

the same rate that the glacier was being formed in the north, the south end of the glacier remained stationary, essentially "melting in place." When this happened, a great deal of coarse glacial debris was deposited in a relatively narrow area along the edge of the melting lobe. The resulting landform is called an end moraine.

In Cass County there are two striking examples of end moraine. Highway 200 travels across the Itasca Moraine from the Hubbard County line west of Walker until it crosses the Boy River. This band of hills formed when the Wadena lobe melted in place and left its load of limey sandy loam debris about 20,000 years ago.

The St. Croix Moraine extends south from Ten Mile Lake near Hackensack nearly to Pillager and is one of the sharpest moraines in the state (Wright 1972). The Deerfield Trail west of Backus and the Spider Lake Trail in Foothills State Forest unmistakably pass over it. This end moraine, with its sandy loam noncalcareous till (Univ. of Minnesota 1977), averages about 6 miles in width and is a textbook example of "kame and kettle" topography. The kames were formed when small areas of the glacier melted and deposited their debris as conical hills. Kettles are lakes of various shapes and sizes formed by the irregular deposition of glacial material (depressions then filled with water) or by the melting of iceblocks left mixed in the debris as the glacier retreated. The iceblocks eventually melted, but the meltwater didn't fill the depression as completely as the ice block did, giving the impression of a partly filled kettle of water (Schwartz and Thiel 1963).

Another type of moraine, ground moraine, forms when the south end of a glacier is melting much faster than the north end is developing, and, in effect, the glacier is making a rapid retreat. In doing so, the glacier drops its debris over a broad area. In ground moraine, the hills aren't as high and the lakes aren't as deep as they are in an end moraine; the landscape is gently rolling rather than rugged and hilly. The Guthrie Till Plain in northwestern Cass County is an example of ground moraine (Chippewa National Forest 1985). The Sucker Bay Road south of Highway 2 travels the length of Ottertail Peninsula, all of which is part of the Guthrie Till Plain.

The Wadena Drumlin Field lies just to the west of the St. Croix Moraine, between Highway 64 and the

county line to the west and beyond. Drumlins are long, narrow hills that are formed under actively moving glaciers. They are molded and streamlined with their long axes parallel to the direction of ice flow. This drumlin field contains over 1000 drumlins and was formed when the Wadena lobe spread to the south and west (Wright 1972).

Outwash plains are formed when meltwater from a retreating glacier carries fine particles some distance away from the glacier. This finer debris, sandy outwash, forms an extensive, gently sloping, plain. In northwestern Cass County, the Bemidji Sand Plain (an outwash plain) extends north and south of Highway 2 as the highway passes in the vicinity of Cass Lake and Pike Bay.

To the east, Bena Dunes is an outwash plain on which dunes were shaped by wind action. Katabatic winds (fast-moving, cold, dense air flowing off the surface of a retreating glacier) may have reshaped the sand recently deposited by glacial meltwaters into dunes. However, significant dune movement took place during the hypsithermal, a warm period that occurred here from 3,000 to 7,000 years ago (Grigal et al. 1976). Most of the modern dune topography probably resulted from sand movement during that more recent period. Highway 9 northeast of Bena to Winnie Dam passes through this landform; ancient dunes have upland species such as pine growing on them, while conifer swamps and other wetlands cover the more or less level outwash plain.

The Pleistocene epoch ended and the Holocene epoch began with the melting of the last of the Wisconsin-era glaciers about 10,000 years ago. The legacy of the Pleistocene in Cass County is a mosaic of glacial deposits including rugged end moraine, rolling ground moraine, gently sloping outwash plains, and flat glacial lake plains. The two end moraines that dominate the landscape here earn this area the name "moraine terrain" (Ojakangas and Matsch 1982).

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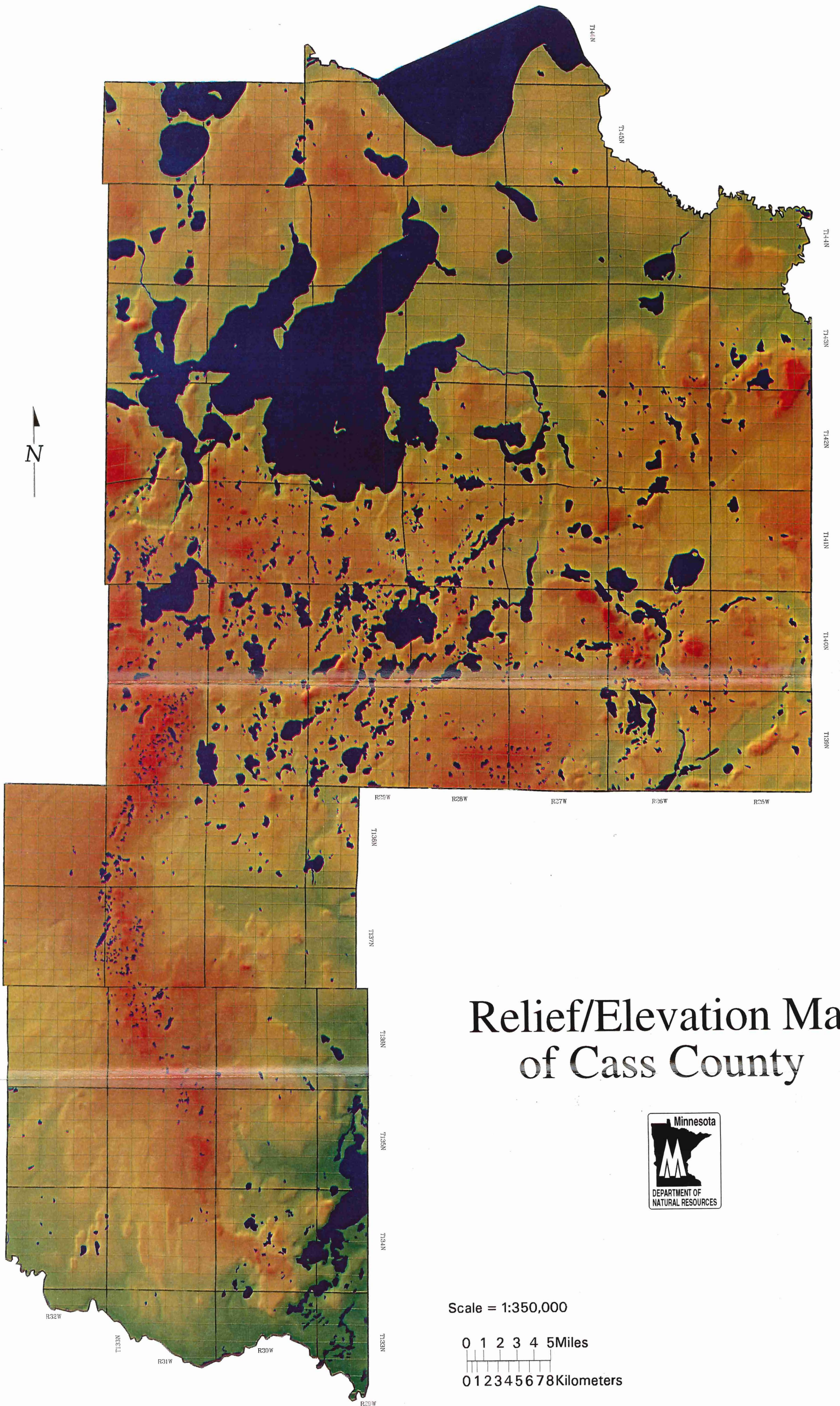
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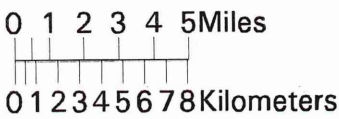
*Shaded Relief Map
of Cass County*



Relief/Elevation Map of Cass County



Scale = 1:350,000



Soils

The soils of Cass County developed in glacial deposits ranging from coarse gravel in end moraines to fine, lake-laid sediments in lake plains. Soils of the various geomorphic regions found in the county are described in the Chippewa National Forest Ecological Classification System Handbook (Chippewa National Forest 1985) and in the series of soil atlases published by the University of Minnesota Agricultural Experiment Station.

Fieldwork for the soil survey of Cass County was completed by the Soil Conservation Service (now the Natural Resources Conservation Service (NRCS)) in 1989. The Soil Survey of Cass County was published by NRCS in cooperation with the University of Minnesota Agricultural Experiment Station and the U.S. Forest Service in October 1997. Copies are available from NRCS, 300 Minnesota Avenue, Walker, MN 56484; (218) 547-7254. The map of the soils of Cass County on page 2.1.6 was digitized by the Cass County Land Department and ProWest, Inc., from maps provided by NRCS.

Geomorphic Regions

Geomorphic regions are divisions of the landscape based on glacial geologic features and the soils that developed in these glacial deposits. The geomorphic regions found in Cass County are mapped and described in the Minnesota Soil Atlases and the accompanying sheets (maps) for Duluth, Bemidji, Brainerd, and Hibbing published by the University of Minnesota Agricultural Experiment Station. The map on page 2.1.8 illustrates the geomorphic regions found in the county. A brief description of each geomorphic regions follows the map.

Ecological Classification System

An ecological classification system (ECS) carries the concept of geomorphic regions several steps further. In this system, landscape divisions are based on climatic and biological features as well as glacial geology.

The Minnesota Department of Natural Resources, the U.S. Forest Service, and other government agencies in Minnesota are developing an ECS for the state (Hanson and Hargrave 1996). These agencies also are cooperating with agencies in other states as well as agencies world-wide in the development of a hierarchical system that divides the world into landscape units based

on abiotic and biotic factors (Bailey 1996).

The units of this ECS include Province, Section, Subsection, and Landtype Association (LTA). Cass County lies in the Laurentian Mixed Forest Province and the Northern Minnesota Drift and Lake Plains Section. The three Subsections in the county are the Pine Moraines and Outwash Plains, Chippewa Plains, and St. Louis Moraines. These three upper levels of ECS are shown on a map in this chapter. Descriptions of the three subsections in the county, from a draft publication prepared by Bryan Hargrave in 1994, follow the map. Draft LTAs have been delineated for the county and are shown on page 2.1.12; a brief description of each follows the map.

The division of the landscape into ecologically defined units is the first step in ecosystem-based management. These landscape units provide the foundation for land use planning in the state, the continent, and the world.

Lakes and Rivers

Cass County has 514 lakes over 10 acres in size. Many of these were formed when iceblocks in glacial till or outwash melted or when basins formed by the irregular deposition of till filled with water.

The basin of Big Rice Lake was formed by the irregular deposition of till. Leech Lake is dammed on the south by the Itasca End Moraine. Pine Mountain, Winnibigoshish, Woman, and Inguadona lakes are iceblock basins formed in till or outwash. Ten Mile Lake is one of the deepest in the state; an iceblock basin lying in a preglacial valley, it may, at its deepest point, be in Precambrian bedrock rather than glacial till (Minnesota Department of Conservation 1968).

Major rivers in Cass County include the Mississippi, which forms the northeast boundary of the county; the Crow Wing, which forms the southern boundary of the county; and the Leech Lake River, which flows from Leech Lake through Mud and Goose lakes to the Mississippi. All three rivers are dammed at least once, and the Mississippi and Leech Lake rivers have been channelized.

Several publications produced by the Division of Fish and Wildlife of the MN Department of Natural Resources address the major watersheds in Cass County. The Crow Wing River watershed is discussed in Lockwood (1969), Johnson (1967), and Johnson (1968). Kuchera and Peterson (1980) report on the Mississippi River watershed.

The map on page 2.1.14 shows the major watersheds for the county and the ECS section (Northern Minnesota Drift and Lake Plains) in which this county lies.

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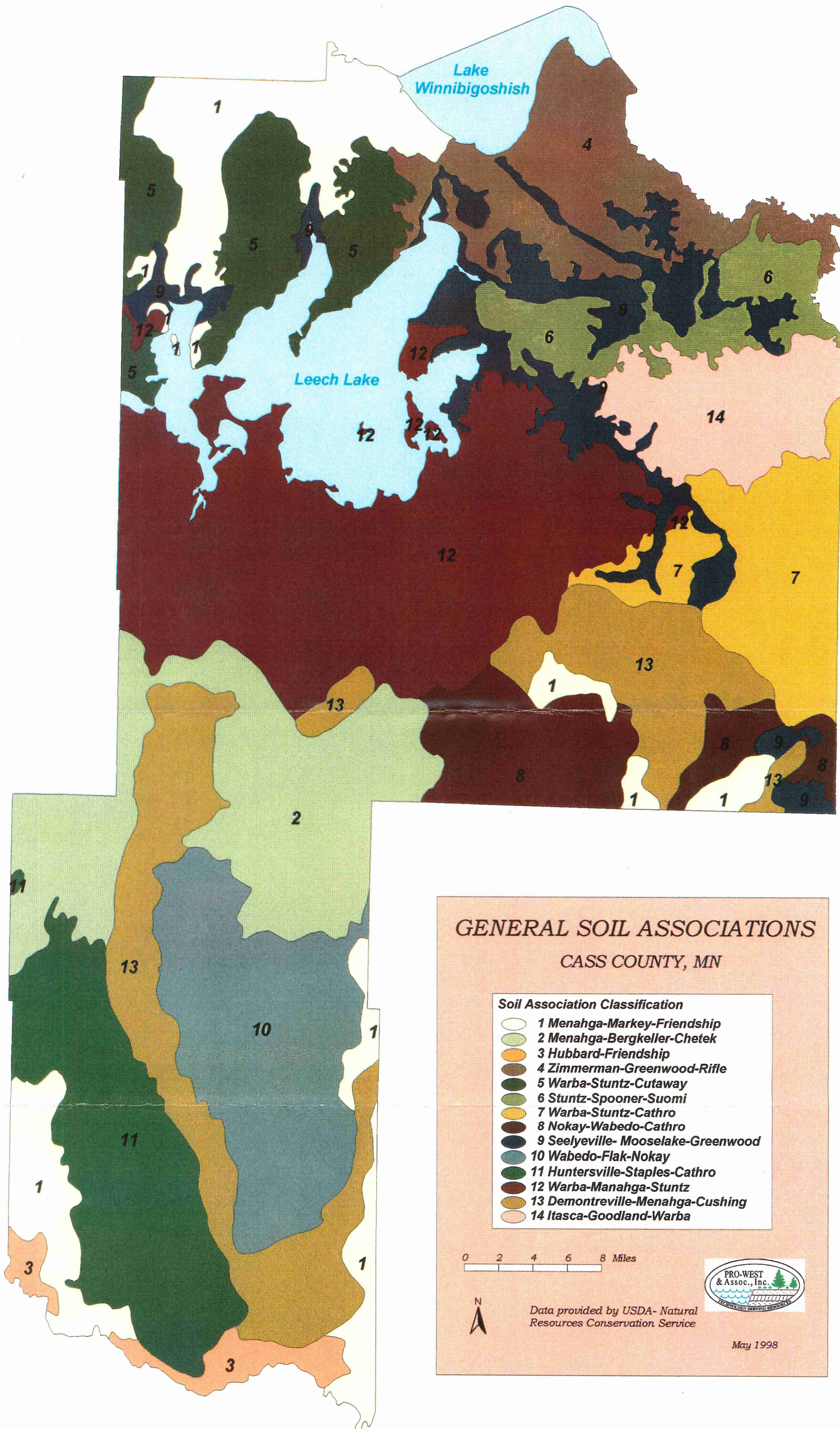
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Soils Map of Cass County

Prepared by Cass County Land Dept. and ProWest, Inc. from NRCS maps.



GENERAL SOIL ASSOCIATIONS

CASS COUNTY, MN

Soil Association Classification

- 1 Menahga-Markey-Friendship
- 2 Menahga-Bergkeller-Chetek
- 3 Hubbard-Friendship
- 4 Zimmerman-Greenwood-Rifle
- 5 Warba-Stuntz-Cutaway
- 6 Stuntz-Spooner-Suomi
- 7 Warba-Stuntz-Cathro
- 8 Nokay-Wabedo-Cathro
- 9 Seelyeville- Mooselake-Greenwood
- 10 Wabedo-Flak-Nokay
- 11 Huntersville-Staples-Cathro
- 12 Warba-Manahga-Stuntz
- 13 Demontreville-Menahga-Cushing
- 14 Itasca-Goodland-Warba

0 2 4 6 8 Miles



Data provided by USDA- Natural
Resources Conservation Service



May 1998

**LEGEND TO THE GENERAL SOILS MAP
CASS COUNTY, MINNESOTA****Nearly Level to Rolling Sandy, Loamy over Sandy, and Organic Soils on Outwash Plains and Terminal Moraine Margins**

1. Menahga-Markey-Friendship: Nearly level to rolling, excessively drained, very poorly drained, and moderately well drained soils formed in sandy sediments and organic soil materials on outwash plains
2. Menahga-Bergkeller-Sanburn: Nearly level to rolling, excessively drained, well drained, and moderately well drained soils formed in sandy and loamy over sandy sediments on outwash plains and terminal moraine margins
3. Hubbard-Friendship: Nearly level to gently undulating, excessively drained and moderately well drained soils formed in sandy sediments on outwash plains
4. Zimmerman-Greenwood-Rifle: Nearly level to gently sloping, excessively drained and very poorly drained soils formed in sandy sediments and organic soils materials on outwash plains

Nearly Level to Rolling Loamy, Silty, Clayey, and Organic Soils on Moraine and Lake Plains

5. Warba-Stuntz-Cutaway: Nearly level to rolling, well drained, somewhat poorly drained and well drained soils formed in loamy glacial till and sands over loamy glacial till on moraines
6. Stuntz-Spooner-Suomi: Nearly level to rolling, somewhat poorly drained, poorly drained, and moderately well drained soils formed in loamy glacial till, silty lacustrine sediments, and clayey glacial till on moraines and lake plains
7. Warba-Stuntz-Cathro: Nearly level to rolling, well drained, somewhat poorly drained, and very poorly drained soils formed in dense loamy till and organic materials on moraines
8. Nokay-Wabedo-Cathro: Nearly level to rolling, poorly drained, moderately well drained, and very poorly drained soils formed in dense loamy till and organic materials on moraines
9. Itasca-Goodland-Warba: Nearly level to rolling, well drained soils formed in silty sediments over loamy till on moraines

Nearly Level Organic Soils on Lake Plains, Outwash Plains, and Moraines

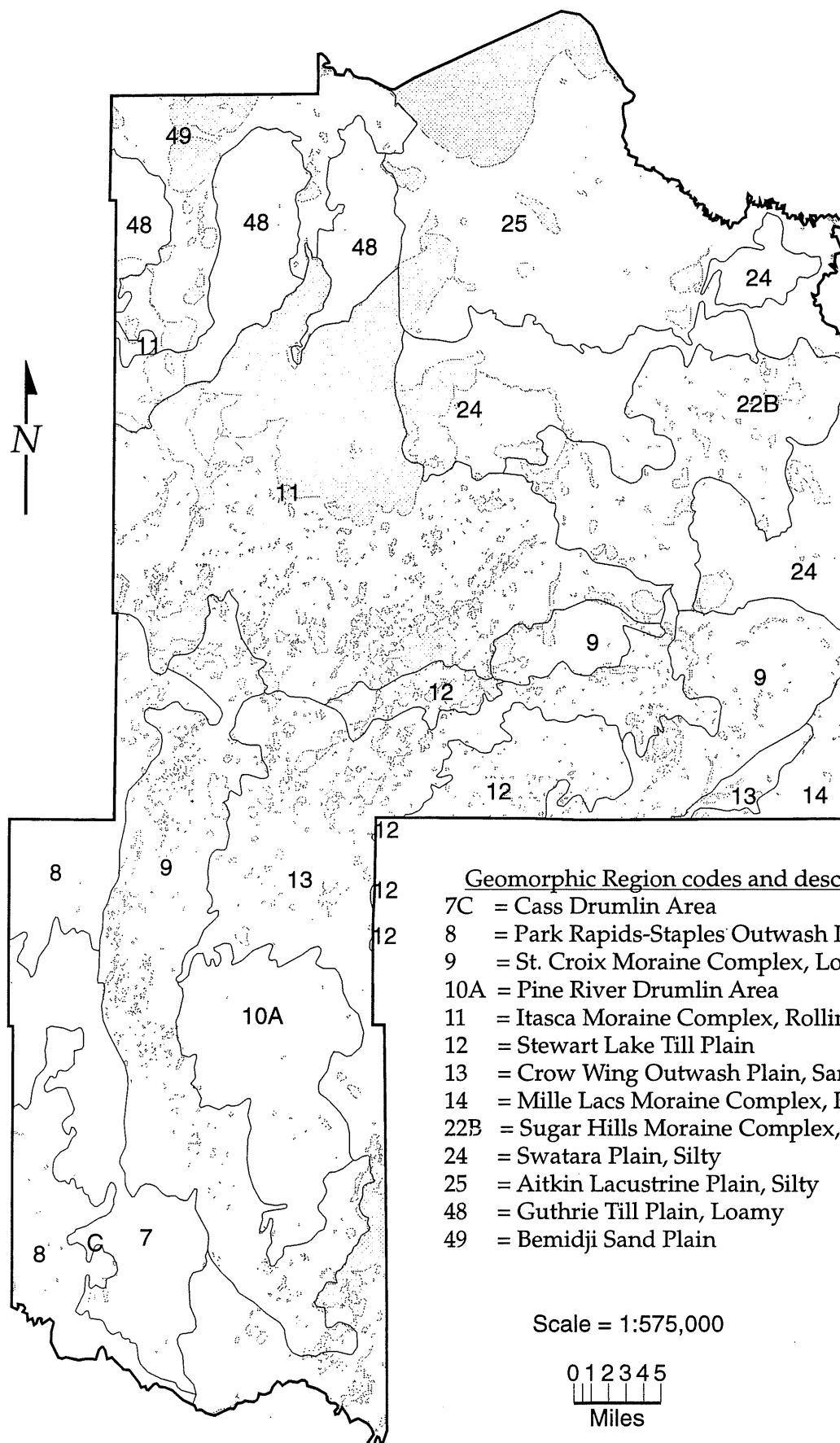
10. Seelyeville-Mooselake-Greenwood: Nearly level, very poorly drained soils formed in woody or herbaceous organic soil materials

Nearly Level to Sloping Loamy and Sandy Over Loamy Soils on Drumlins

11. Wabedo-Flak-Nokay: Nearly level to sloping, well drained, moderately well drained, and poorly drained soils formed in dense loamy glacial till on drumlins
12. Huntersville-Staples-Cathro: Nearly level to sloping, moderately well drained, poorly drained, and very poorly drained soils formed in sandy over loamy dense till and organic materials on drumlins

Nearly Level to Very Steeply Sloping Loamy, Sandy and Sandy Over Loamy Soils on Terminal Moraines

13. Warba-Menahga-Stuntz: Gently sloping to steeply sloping, well and excessively drained soils formed in loamy glacial till and sandy sediments on terminal moraines
14. DeMontreville-Menahga-Cushing: Gently sloping to very steeply sloping, well drained and excessively drained soils formed in sandy over loamy till, sandy sediments and loamy till on terminal moraines



CASS COUNTY GEOMORPHIC REGIONS

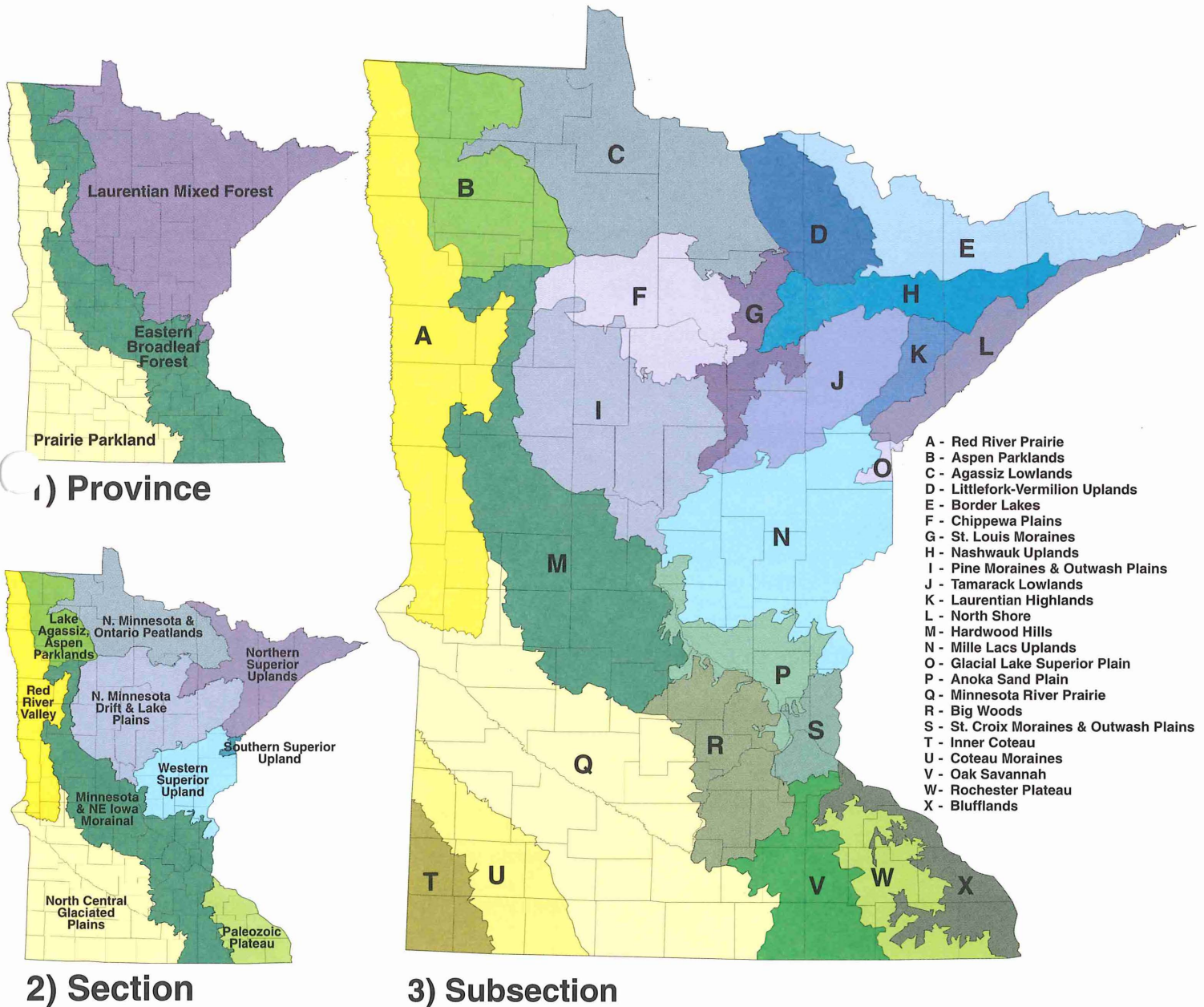
Brief descriptions adapted from Minnesota Soil Atlases, University of Minnesota Agrigultural Experiment Station.

- 7C Cass Drumlin Area: An area of north-south oriented drumlins 0.25 to 0.75 miles in width and 0.5 to 1.5 miles in length with a core of calcareous sandy loam till capped by noncalcareous brown sandy loam.
- 8 Park Rapids-Staples Outwash Plain: Sandy loam underlain by sand and gravel deposited by glacial meltwaters from the ice sheet that formed the Itasca Moraine.
- 9 St. Croix Moraine Complex: An end moraine formed by ice advancing from the east-northeast.
- 10A Pine River Drumlin Area: An area of low relief drumlins 0.25 to 0.5 miles wide and 0.75 to 1.5 miles long.
- 11 Itasca Moraine Complex: An end moraine with rolling to steep knob and kettle topography.
- 12 Stewart Lake Till Plain: A stony area of low relief and poorly drained soils.
- 13 Crow Wing Outwash Plain: An area of sandy to gravelly soils with level to rolling topography.
- 14 Mille Lacs Moraine Complex: An area with rolling to hilly knob and kettle topography.
- 22B Sugar Hills Moraine Complex: An area of rolling, irregular topography with small depressions.
- 24 Swatara Plain: An area with silt-rich till and high water-holding capacity soils.
- 25 Aitkin Lacustrine Plain: Nearly level glacial lake plain with a few discontinuous beach lines and low sandy islands.
- 48 Guthrie Till Plain: An area of gently rolling loam glacial till.
- 49 Bemidji Sand Plain: An outwash plain with sandy soils.

Map of Upper Three Levels of ECS in Minnesota

An information sheet prepared by DNR ECS Specialist Dan Hanson explaining the status of ECS in Minnesota can be found on the back of the ECS map.

Upper Three Levels of ECS for Minnesota



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What is an Ecological Classification System (ECS)?

The ECS is part of a nationwide mapping initiative developed to improve our ability to manage all natural resources on a sustainable basis.

- Definition: Ecological Classification System is a method to identify, describe, and map units of land with different capabilities to support natural resources. This is done by integrating climatic, geologic, hydrologic, topographic, soil and vegetation data.
- In Minnesota, the classification and mapping is divided into six levels of detail. These levels are:

Province: Largest units representing the major climate zones in North America, each covering several states. Minnesota has three provinces. Example: Eastern Broadleaf Forest.

Section: Divisions within provinces that often cross state lines. Sections are defined by the origin of glacial deposits, regional elevation, distribution of plants and regional climate. Minnesota has 10 sections. Example: Red River Valley.

Subsection: County-sized areas within sections that are defined by glacial land-forming processes, bedrock formations, local climate, topographic relief, and the distribution of plants. Minnesota has 24 subsections. Example: Mille Lacs Uplands.

Land Type Association: Landscapes within subsections, characterized by glacial formations, bedrock types, topographic roughness, lake and stream patterns, depth to ground water table and soil material. Example: Alexandria Moraine.

Land Type: The individual elements of Land Type Associations, defined by recurring patterns of uplands and wetlands, soil types, plant communities, and fire history. Example: Fire-dependant Xeric Pine-Hardwood Association.

Community: Unique combinations of plants and soils within Land Types, defined by characteristic trees, shrubs and forbs; elevation and soil moisture. Example: Sugar Maple-Basswood Forest.

What can an Ecological Classification System do?

- Define the units of Minnesota's landscape using a consistent methodology.
- Provide a common means for communication among a variety of resource managers and with the public.
- Provide a framework to organize natural resource information.
- Improve predictions about how vegetation will change over time in response to various influences.
- Improve our understanding of the interrelationships between plant communities, wildlife habitat, timber production, and water quality.

What are the end products?

- Maps and descriptions of ecological units for provinces through land types.
- Field keys and descriptions to determine which communities are present on a parcel of land.
- Applications for management for provinces through communities.
- Mapping of province, section, and subsection boundaries is complete throughout Minnesota, as shown by the maps on the reverse. The development of other levels is under way.

Descriptions of the Three ECS Subsections Found in Cass County

The following three pages contain descriptions of three ECS subsections; Chippewa Plains, Pine Moraines and Outwash Plains, and St. Louis Moraines, portions of which are found in Cass County (see map on page 2.1.10). From *The Upper Levels of an Ecological Classification System for Minnesota*, (Hargrave, B. 1994. Division of Forestry, Minnesota Department of Natural Resources. Draft).

SUBSECTION 212N-3 - CHIPPEWA PLAINS

DISCUSSION

Level to gently rolling lake plains and till plains characterize this subsection. Three large well used lakes are found here. These include Leech Lake, Lake Winnibigoshish, and Cass Lake. Conifers dominated the sandier portions of the subsection before settlement. Aspen-birch, sugar maple, basswood, red oak, and bur oak were common components on more productive sites. Present day land use is recreation and forestry.

ELEVATION

1200 to 1450 feet ASL

AREA

2,079,379 acres

CLIMATE

Total annual precipitation ranges from 23 inches in the northwest to 27 inches in the east, with about 40% occurring during the growing season. Only 12-16% of the annual precipitation falls during winter months (based on Midwest Climate Center 1992). Growing season length varies from 111 to 131 days.

BEDROCK GEOLOGY

Thick glacial drift covers bedrock over most of the subsection. Drift thickness range from 200 to over 600 feet. The underlying bedrock consists of a diversity of Precambrian rock, including Early Precambrian (Late Archean) and Middle Precambrian (Early Proterozoic) gneiss, undifferentiated granite, and metamorphosed mafic to intermediate volcanic and sedimentary rocks (Morey 1976; Morey et al. 1981).

LANDFORMS

The primary landforms are ground moraines, a lake plain, stagnation moraines, and an outwash plain. All these are associated with the Des Moines Lobe, or the Wadena Lobe (middle to late Wisconsin glaciation period). The ground moraines are characterized by gently rolling topography and have calcareous loamy parent material. The lake plain (Glacial Lake Aitkin) is level to gently rolling and has variable parent material, ranging from fine sands to clays. The stagnation moraines have gently rolling to hilly topography and have calcareous, loamy parent materials. The outwash plain has level to gently rolling topography and has fine to medium sandy parent material.

SOILS

Soils range from sandy to clayey, depending on parent material. Most fall in the Flisols, Entisols, or Histosols orders. On moraines, most soils are loamy well to moderately well drained and are classified as Boralis. Soils on the outwash plain are dominantly sandy and excessively well drained. They are classified as Psammets (young, undeveloped sandy soils).

HYDROLOGY

The major river running through this subsection is the Mississippi River. The headwaters is just to the south in the Pine Moraines and Outwash Plains Subsection. Two large bodies of water are present - they are Lake Winnibigoshish (a reservoir) and Cass Lake. The drainage network throughout the subsection is poorly developed due to the age and characteristics of the landforms.

PRESETTLEMENT FOREST

Presettlement vegetation was a mixture of deciduous and conifer trees. White pine and red pine were present on the moraines. Jack pine was the dominant covertype on outwash plains and sandy lake plains. Hardwoods (red oak, sugar maple and basswood) grew

in sheltered areas of the moraines, generally close to large lakes. Forested lowlands were occupied by black spruce, tamarack, white cedar, and black ash. Non-forested wetlands were dominated by sedge meadow communities.

NATURAL DISTURBANCE

Fire was an important disturbance within the white pine-red pine forests. However, it is not clear whether the fires were from the Bemidji Outwash Plain immediately to the south or from lightning fires originating within the pine stands themselves.

PRESENT VEGETATION AND LAND USE

Much of this subsection is presently forested and forestry is one of the most important land uses. Aspen is the most common tree species. It is found in both pure stands and mixed stands with birch, maple, oak, white spruce, jack pine, and red pine. Tourism and recreation is the other important land use. There are many lakes present and most are developed with summer homes. Agriculture is important locally, particularly in the western part.

RARE PLANTS

Carex sterilis, *Cypripedium arietinum*, *Drosera anglica*, *Eleocharis olivacea*, *Eleocharis rostellata*, *Malaxis paludosa*, *Rhynchospora capillacea*, *Arethusa bulbosa*, *Botrychium mormo*, *Cladium mariscoides*, *Dryopteris goldiana*, *Eleocharis pauciflora*, *Tofieldia glutinosa*, *Waldsteina fragarioides* (Coffin & Pfannmuller 1988)

RARE ANIMALS

Haliaeetus leucocephalus (Bald eagle), *Canis lupus* (Gray wolf) (Coffin & Pfannmuller 1988)

NATURAL AREAS

State: Lake Bemidji State Park; Pennington Bog SNA

PUBLIC LAND MANAGERS

Federal: Chippewa National Forest, Red Lake Indian Reservation, Leech Lake Indian Reservation, Lake Winnibigoshish Recreation Area, Leech Lake Recreation Area; State: Blackduck, Red Lake, Pine Island, Bowstring Buena Vista, Mississippi Headwaters, Battleground, Welsh Lake State Forests; Morph Meadows WMA, Dishpan WMA, Long Lake WMA, Mud Goose WMA, Sugar Lake WMA, Bagley Lake WMA, Spike Lake WMA, Old Red Lake Trail WMA, West Four Legged Lake WMA, Little Pine WMA, Carter WMA, Minnow Lake WMA, Lone Lake WMA, Bemidji, Clearbrook, and Bagley State Game Refuges; Preston Lakes State Waterfowl Refuge; County: Three Island Lake County Park

CONSERVATION CONCERNS

Timber harvesting is one of the major conservation concerns in this subsection. The state is currently completing a generic environmental impact statement (GEIS) on timber harvest. This includes estimates on how much can be cut without significant environmental impacts. Other conservation concerns include water quality issues. There is a strong planning effort being undertaken by the state in the Leech Lake Watershed.

BOUNDARIES

The southern boundary is Leech Lake and the moraines south of the lake. The northern boundary is the southern shore of Glacial Lake Agassiz. On the east side, the boundary of this subsection is a series of end moraines (Rainy Lobe in origin, but later covered by the St. Louis Sublobe). The west side is framed by the Alexandria Moraine Complex.

SUBSECTION 212N-I - ST. LOUIS MORAINES

DISCUSSION

Rolling to steep slopes characterize much of this subsection. End moraines are the dominant landform. The underlying topography was formed by the Rainy Lobe. It was later overridden by the St. Louis sublobe of the last glaciation period. Northern hardwoods were common in the southern portion of the region, south of Grand Rapids, North of Grand Rapids, white pine, sugar maple, basswood, and balsam fir were common tree species. Presently, forestry and tourism are the major landuses.

ELEVATION

1200 to 1600 feet ASL

AREA

990,291 acres

CLIMATE

Total annual precipitation ranges from 24 inches in the northwest to 27 inches in the southeast, with about 40% occurring during the growing season. Only 12-16% of the annual precipitation falls during winter months (based on Midwest Climate Center 1992). Growing season length varies from 111 to 131 days.

BEDROCK GEOLOGY

The glacial drift in this subsection ranges from 100 to 200 feet in depth (Olsen and Mossler 1982). Lower Precambrian undivided granites, metavolcanics, and metasedimentary rocks underlie the glacial drift (Sims et al. 1970c).

LANDFORMS

This subsection consists of distinct end moraines associated with the St. Louis and Koochiching Sublobes, and a pitted outwash plain (Hobbs and Goebel 1982). These sublobes overrode Rainy Lobe moraines, which formed the framework or landform characteristics. The cap of calcareous gray sediment varies from 1 to 10 plus feet in depth. Coarse loamy Rainy Lobe sediments underlie the cap. Portions of this unit, both north and south of Grand Rapids, have very steep topography. These areas are ice disintegration features. Topography on the rest is gently rolling to rolling.

SOILS

Loamy calcareous soils make up about 75 percent of the soils in this subsection (Dept. of Soil Science, Univ. of Minnesota 110-1971). Excessively well drained outwash sands account for another 10 to 15 percent and poorly drained soils account for about 3 percent. The soils are classified as Boralfs (well drained soils developed under forest vegetation), Hemists (moderately decomposed organic soils), and Psamments (sandy, poorly developed well drained soils), with Boralfs most common (Cummins and Grigal 1981).

HYDROLOGY

The Mississippi River cuts this subsection virtually in half. It flows northwest to southeast close to the midpoint north-south. There are some small, relatively short rivers that are present. They include the Prairie, Willow, Hill, and Moose Rivers. The drainage network is poorly developed due to landform characteristics. Lakes are numerous. In fact, there are over 66 lakes that have a surface area greater than 160 acres; lakes account for over 10 percent of the surface area.

PRESETTLEMENT VEGETATION

White pine-red pine forest covered large portions of the steep moraines and portions of the pitted outwash along the eastern edge of the subsection. South of Grand Rapids, there was an area of

the moraine dominated by northern hardwoods. Aspen-birch forests also grew on the moraines, but were more common on the outwash, which had excessively well drained sandy soils. Mixed hardwood-pine forest was locally found on the moraines, generally near large lakes. Conifer swamp and bogs were scattered throughout the subsection, occupying both kettles and linear depressions in the pitted outwash and moraines (Albert 1993).

NATURAL DISTURBANCE

Fire and windthrow were the most common natural disturbances. Fire was an important agent in maintaining fairly pure red and white pine stands.

PRESENT VEGETATION AND LAND USE

The most important land uses in this subsection are forestry and recreation. This area is heavily forested and timber harvesting is extensive. Quaking aspen is the primary species harvested. Recreation is primarily associated with the unit's lakes and the areas around them. Fishing, hunting, snowmobiling, and skiing are popular.

RARE PLANTS

Cypripedium arietinum, *Elocharis olivacea*, *Nymphaea tetragona*, *Sparganium glomeratum* (Coffin & Pfannmuller 1988)

RARE ANIMALS

Haliaeetus leucocephalus (Bald eagle), *Canis lupus* (Gray wolf) (Coffin & Pfannmuller 1988)

NATURAL AREAS

State: Scenic State Park; Ladies-Tresses Swamp SNA

PUBLIC LAND MANAGERS

Federal: Chippewa National Forest; State: George Washington State Forest, Big Fork State Forest, Remer State Forest, Land O' Lakes State Forest, Hill River State Forest, Golden Anniversary State Forest, Prairie Lake Deer Yard WMA, Little Hill River WMA, Little Willow River WMA.

CONSERVATION CONCERNS

Timber harvesting is one of the major conservation concerns in this subsection. The state is currently completing a generic environmental impact statement (GEIS) on timber harvest. This includes estimates on how much can be cut without significant environmental impacts. There are also concerns by forest industry that there is a shortage of quality conifer and/or hardwood sawlogs. Another conservation concern is lakeshore development. As more building goes on around lakes, more problems crop up which include nonconforming septic systems, beach development, and increased weed and algae growth.

BOUNDARIES

The boundaries of this subsection primarily encompass the dhe, dce, do, and part of the dhg units from Hobbs and Goebel (1982).

SUBSECTION 212N-2 - PINE MORAINES AND OUTWASH PLAINS

DISCUSSION

This subsection is a real mix of end moraines, outwash plains, till plains, and drumlin fields. White and red pine dominated the majority of forest communities on end moraines and till plains; Jack pine barrens and jack pine woods were found on well drained sites on outwash plains. Black spruce, tamarack, white cedar, and black ash were prominent tree species in poorly to very poorly drained soils. Lakes are very common on the end moraines and some of the outwash plains. Current landuses include tourism, forestry, and some agriculture.

ELEVATION

1100 to 1850 feet ASL

AREA

3,585,423 acres

CLIMATE

Total annual precipitation ranges from 23 inches in the northwest to 27 inches in the east with about 40% occurring during the growing season. Only 12-16% of the annual precipitation falls during winter months (based on Midwest Climate Center 1991). Growing season length varies from 111 to 131 days.

BEDROCK GEOLOGY

Thick glacial drift covers bedrock over most of the subsection. Thickness' range from 200 to over 600 feet. The greatest depths are in the southwestern portion (Olsen and Mossler, 1982). A diversity of Precambrian rock underlies the glacial drift (Morey 1976; Morey et al. 1981). There are also iron formation at the southeastern edge of the subsection, along with argillite, siltstone, quartzite, and graywacke. Cretaceous marine shale, sandstone, and variegated shale are localized in the southwest (Albert 1993).

LANDFORMS

This subsection consists primarily of large outwash plains, narrow outwash channels, and end moraines (Hobbs and Goebel 1982). The moraines are relatively large and were formed from portions of several glacial lobes. Most of the glacial drift was sandy, but there is loamy drift to the north.

SOILS

The morainic soils are predominantly coarse to moderately coarse in texture (sands and sandy loams). There are exceptions to this on the Itasca Moraine and the Fosston Till Plain, where calcareous loamy soils are present (Dept. of Soil Science, Univ. of Minnesota 1969, 1980). On outwash plains, excessively drained sands are prevalent, but they are interspersed with numerous wetlands. Over 10% of the soils are organic. The soils are classified as Psamments and Aquepts on outwash plains (Anderson and Origel 1984). Boralis are most common on moraines.

HYDROLOGY

Kettle lakes are common on pitted outwash plains, and within stagnation moraines. There are hundreds of lakes within the subsection that have a surface area greater than 160 acres. The headwaters of the Mississippi River (Itasca Lake in Itasca State Park) is in this subsection. Other large rivers flowing through the outwash plains of the subsection include the Pine and Crow Wing Rivers.

PRESETTLEMENT VEGETATION

Jack pine, in a mix with northern pin oak, was the most common species on excessively drained portions of broad outwash plains. Large areas of the other landforms were dominated by aspen-birch and pine forests (mixture of red and white pine). Red pine-white pine forests, occupied the rolling to irregularly sloped end moraines.

Mixed hardwood and pine forests, dominated by a diverse mix of northern hardwoods and white pine, were found in the most fire-protected areas at the northern and eastern edges of the subsection. Fire protection was offered by irregular topography, broad wetlands, and relatively large lakes. Some of the hardwood-pine forests mapped by Marschner may have been dominated by red oak and basswood, without sugar maple (Albert 1993).

NATURAL DISTURBANCE

Fire occurred on a 10-40 year rotation within much of the subsection, accounting for the dominance by upland conifers and trembling aspen-birch forests (Frissel 1973).

PRESENT VEGETATION AND LAND USE

Forest management and tourism are the most important land uses. Agriculture is common in the west, where center pivot irrigation of corn and potatoes is common. Tourism is common where there are concentrations of lakes. Summertime swells the population of these areas significantly. Brainerd, a community of 14,000 absorbs more than ten times that number within a 30 mile radius during summer weekends.

RARE PLANTS

Cypripedium arietinum, *Eleocharis olivacea*, *Lespedeza leptostachya*, *Malaxis paludosa*, *Naja gracillima*, *Potamogeton laterilis*, *Tomentopnum falcifolium* (Coffin & Pfannmuller 1988).

RARE ANIMALS

Charadrius melodus (Piping plover), *Haliaeetus leucocephalus* (Bald eagle), *Canis lupus* (Gray wolf), *Emydoidea blandingi* (Blanding's turtle) (Coffin & Pfannmuller 1988)

NATURAL AREAS

State: Itasca State Park, Crow Wing State Park; Paul Bunyan Savanna SNA.

PUBLIC LAND MANAGERS

Federal: Chippewa National Forest, Tamarack National Wildlife Refuge. State: State Forests: Two Inlets; White Earth, Huntersville, Crow Wing, Badoura, Foothills, Lyons, Paul Bunyan, Land O'Lakes, Mississippi Headwaters, Pillsbury; Smoky Hills; Camp Ripley Military Reservation; Meadowbrook WMA, Birchdale WMA, Duck Lake WMA, Burgen Lake WMA, Huntersville WMA, North Germany WMA, Strike WMA, Yeager Lake WMA, Ah Gwah Ching WMA, Dry Sand WMA, Moose Wallow WMA, Crow Wing Chain WMA, Kabekona WMA, Bluff Creek WMA, Hubbell Pond WMA

CONSERVATION CONCERNS

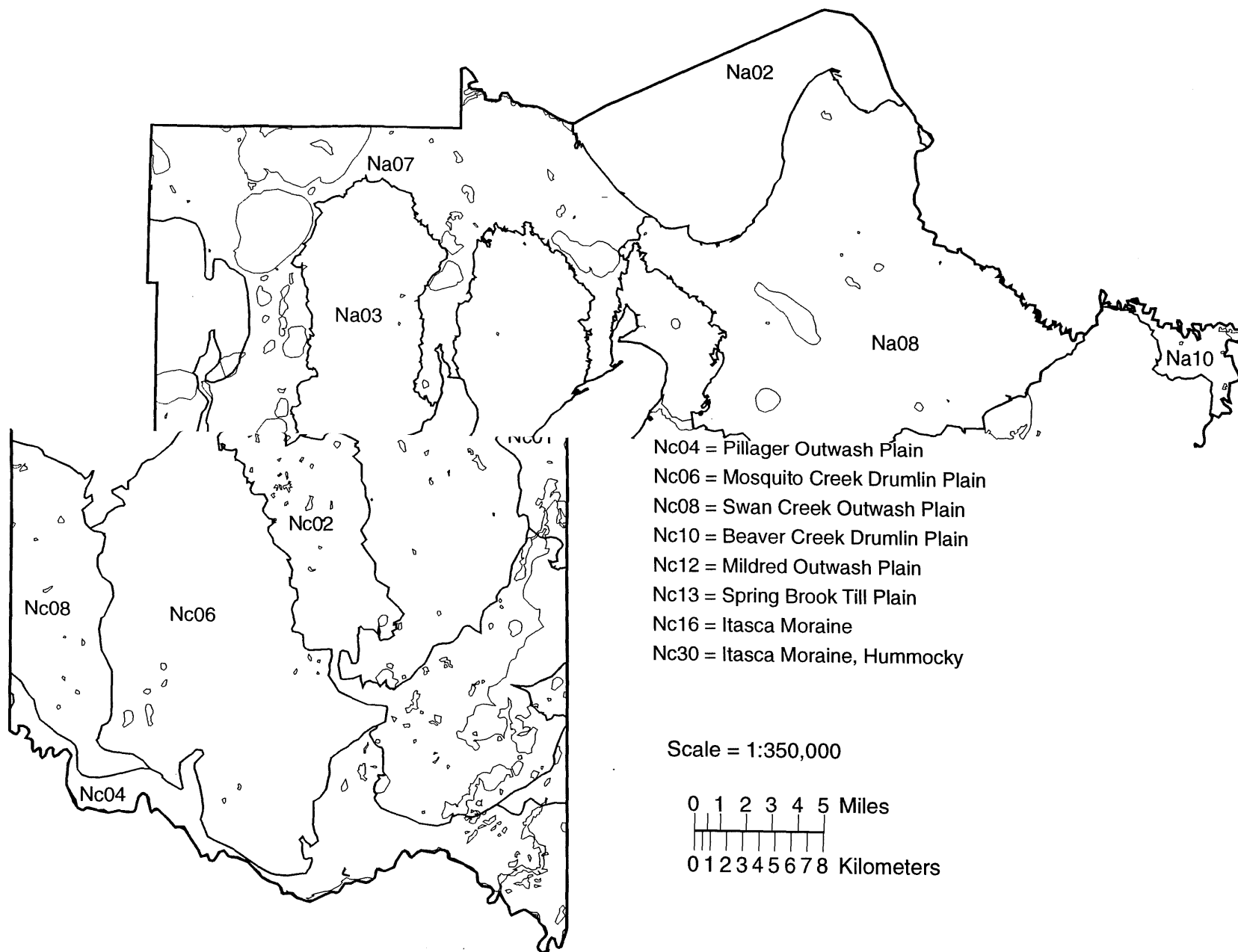
The Minnesota DNR planning team has recommended that 1) a certain percentage of each forest community be maintained in old growth conditions, 2) the amount of oak, northern white-cedar, and white pine within the subsection be increased, 3) that large areas of contiguous forest be maintained for forest-interior dwelling species, 4) semi-primitive (few or no roads) be maintained, 5) habitat be provided for endangered, threatened, and special concern biota, and 6) that cultural resources be protected. Other concerns include lakeshore development, amount of timber harvesting, and water quality issues.

BOUNDARIES

The Itasca Moraine forms most of the northern boundary. To the west, the east side of the Alexandria Moraine is the dividing line. Rainy Lobe ground moraine and end moraines from the eastern line.

ECS Landtype Associations

A brief description of each LTA prepared by ECS Specialist Dan Hanson and is included following the map.



Landtype Associations (LTAs)

Subsection 212Na - Chippewa Plains (F)

Na01 Leech Lake

Na02 Lake Winnibigoshish

Na03 Guthrie Till Plain

Concept: A nearly level to gently rolling till plain formed by the Wadena Lobe. Soil parent material is loamy till that has a moderate amount of stones and calcium. Lakes occupy 2% of the LTA. Many small, mostly intermittent streams are present.

Na07 Bemidji Sand Plain

Concept: A nearly level to gently rolling outwash plain formed by meltwater from the Des Moines lobe. Soil parent material is sand. Calcium carbonate has been leached out of the upper six feet or more. Lakes occupy 12% of the area.

Na08 Bena Dunes and Peatlands

Concept: A nearly level outwash plain formed by meltwaters from the Des Moines Lobe that was extensively reshaped by wind action. Soil parent material is predominantly fine sand. Calcium carbonate has been leached out of the upper six feet or more. Lakes occupy 2% of the area. Extensive swamps and bogs occur, especially in the southern portions of the LTA.

Na09 Rosey Lake Plain

Concept: A nearly level glacial lake basin (Aitkin) formed by meltwaters of the Des Moines Lobe. Soil parent material is predominantly fine-textured lake sediments (silts and clays). Lakes occupy 3% of the area.

Na10 Deer River Peatlands

Concept: A level glacial lake basin that was formed by meltwaters from the Des Moines lobe. Extensive peatlands now cover the fine-textured soil parent materials. Lakes are absent.

Subsection 212Nb - St. Louis Moraines (G)

Nb03 Sugar Hills Moraine

Concept: A rolling to hummocky stagnation moraine formed by the Wadena Lobe and later by the Des Moines Lobe. Soil parent material is loamy till, however coarse (sandy) material is common in the western portions of the LTA. Rocks and stones are common. Some places have a surface of windblown silt. Lakes occupy 3% of the LTA.

Nb12 Hill City Till Plain

Concept: A nearly level to gently rolling till plain formed by the St. Louis Lobe. Soil parent materials consist of loamy till with a low amount of stones. A thin, wind deposited silty mantle covers much of the area. Lakes occupy 3% of the area. Several large and many medium to small swamps and bogs are present.

Subsection 212Nc - Pine Moraines and Outwash Plains (I)

Nc01 Pequot Lakes Outwash Plain

Concept: A hummocky pitted outwash plain with islands of till formed by the Rainy Lobe. Lakes occupy 24% of the area.

Nc02 St. Croix Moraine

Concept: A hummocky stagnation moraine formed by the Rainy Lobe. Lakes occupy 12% of the area.

Nc03 Sugar Hills Moraine

Concept: A rolling till plain with some drumlin features formed by the Rainy Lobe. Lakes occupy 0.3% of the area.

Nc04 Pillager Outwash Plain

Concept: A nearly level outwash plain intermixed with peatlands (west side) formed by the Superior Lobe. This is a transition area into the Wadena drumlins to the west. Lakes occupy 2.8% of the LTA.

Nc06 Mosquito Creek Drumlin Plain

Concept: A rolling drumlin field formed by the Wadena Lobe. The till is mantled with a blanket of sand. Peatlands are common. Lakes occupy 0.5% of the LTA.

Nc08 Swan Creek Outwash Plain

Concept: A landscape dominated by level Rainy and Wadena Lobe outwash plains. The outwash has been reworked by wind; dune features are common. Peatlands are very common. Lakes occupy 0.8% of the area.

Nc10 Beaver Creek Drumlin Plain

Concept: A landscape dominated by level Rainy and Wadena Lobe outwash plains. Long, narrow ridges (drumlins) of till material are very common. Peatlands are very common. Lakes occupy 0.3% of the LTA.

Nc11 Park Rapids Outwash Plain

Concept: A landscape dominated by level to rolling Wadena Lobe outwash plains. Channels formed by post-glacial meltwater are common. Lakes occupy 6% of the area, often in the channels.

Nc12 Mildred Outwash Plain

Concept: A landscape dominated by hummocky Rainy and Wadena Lobe outwash plains. Peatlands are common. Lakes occupy 1% of the area.

Nc13 Spring Brook Till Plain

Concept: A landscape dominated by a rolling till plain with small areas of hummocky pitted outwash, eskers, and meltwater channels. All landforms were formed by the Rainy Lobe. Lakes occupy 6% of the area.

Nc14 Outing Moraine

Concept: A landscape dominated by rolling till plains and small areas of hummocky stagnation moraines dissected by outwash channels all formed by the Rainy Lobe. Lakes occupy 5% of the area.

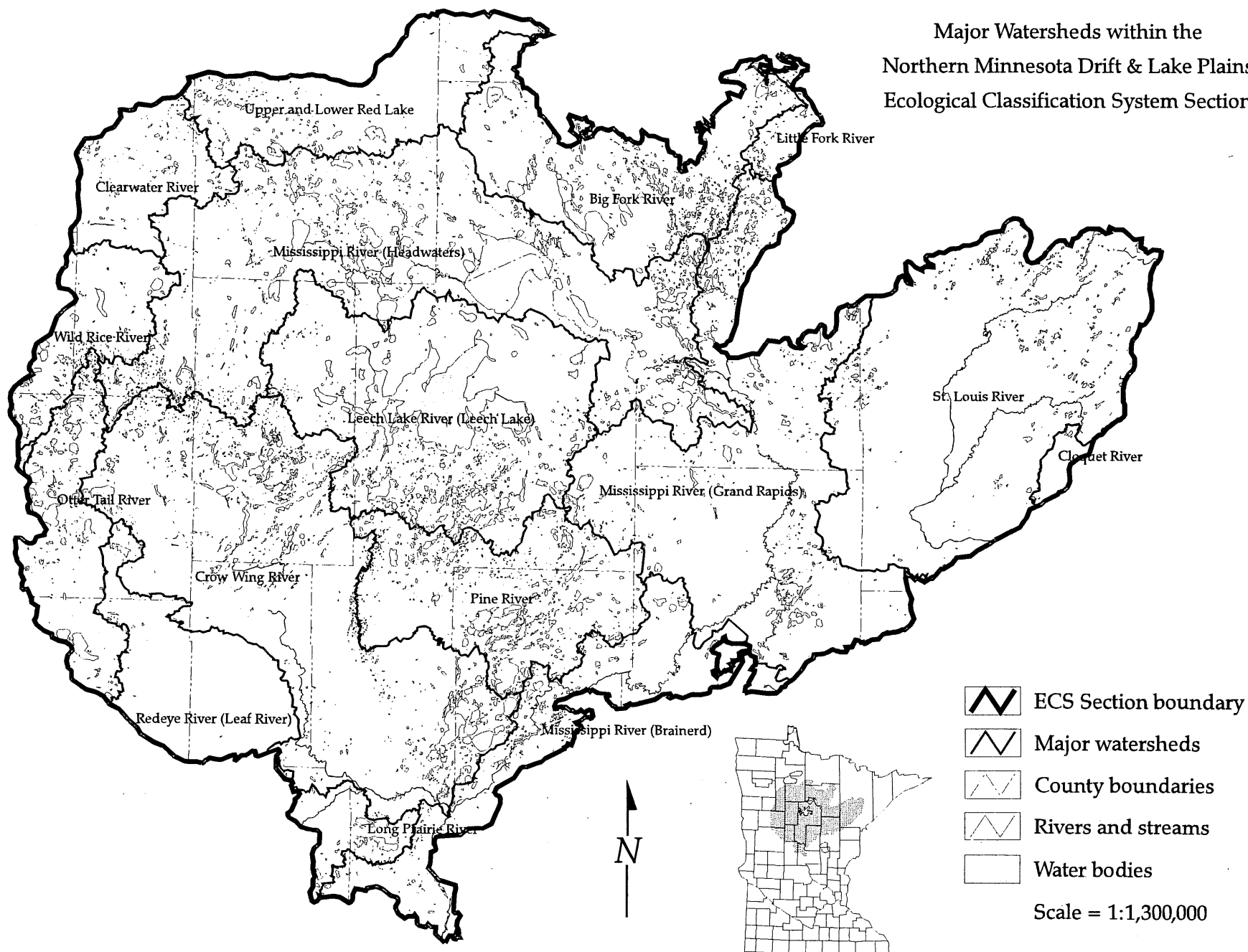
Nc16 Itasca Moraine

Concept: A rolling to hummocky complex stagnation moraine formed by the Wadena lobe. Soil parent material is a complex of sandy to loamy and clay loam till with a high content of granitic stones. Calcium carbonates have been leached to depths of four to six feet. Organic soil deposits are common, often as small, closed depressions. Lakes occupy 21% of the LTA.

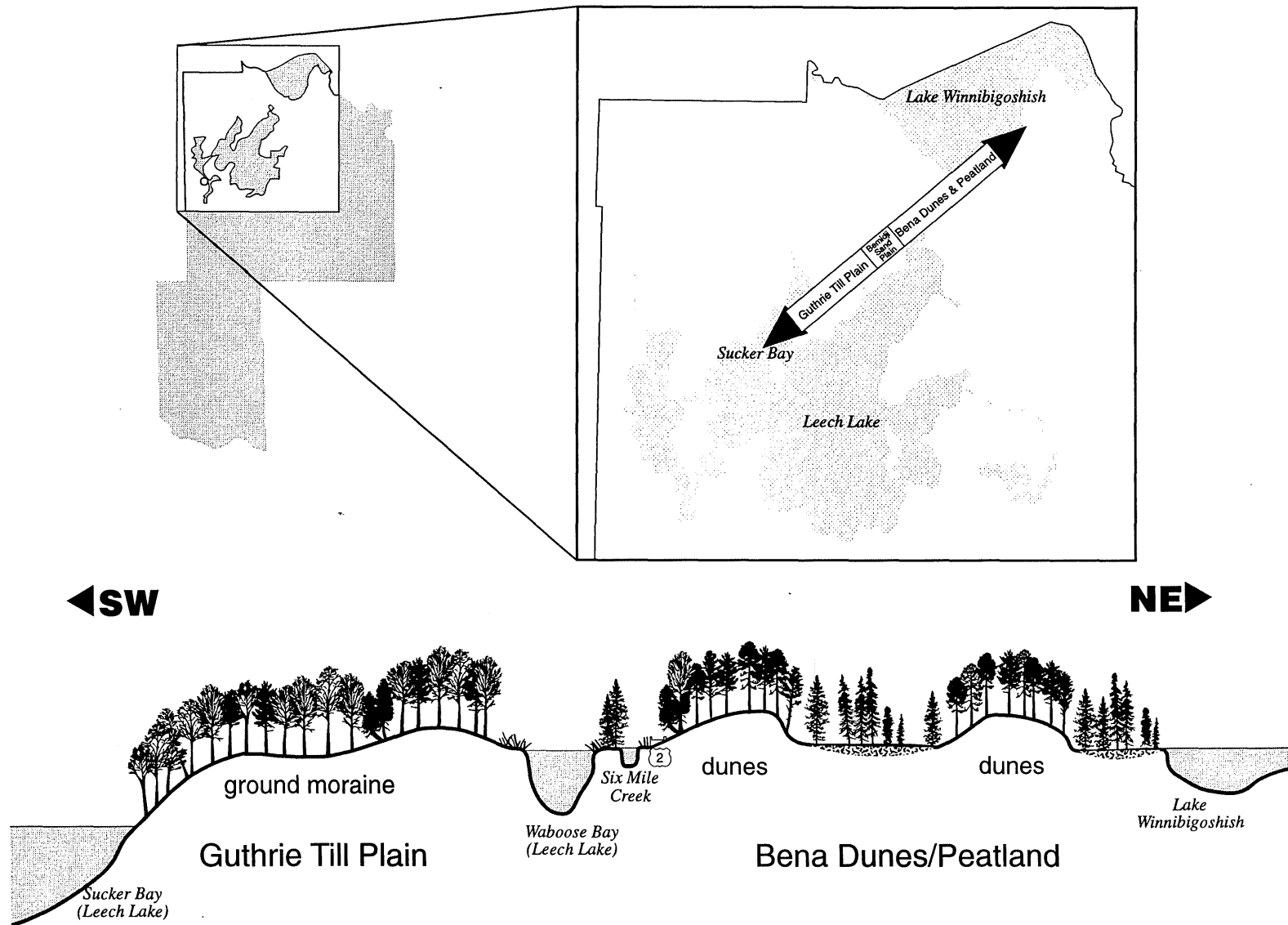
Nc30 Itasca Moraine, Hummocky

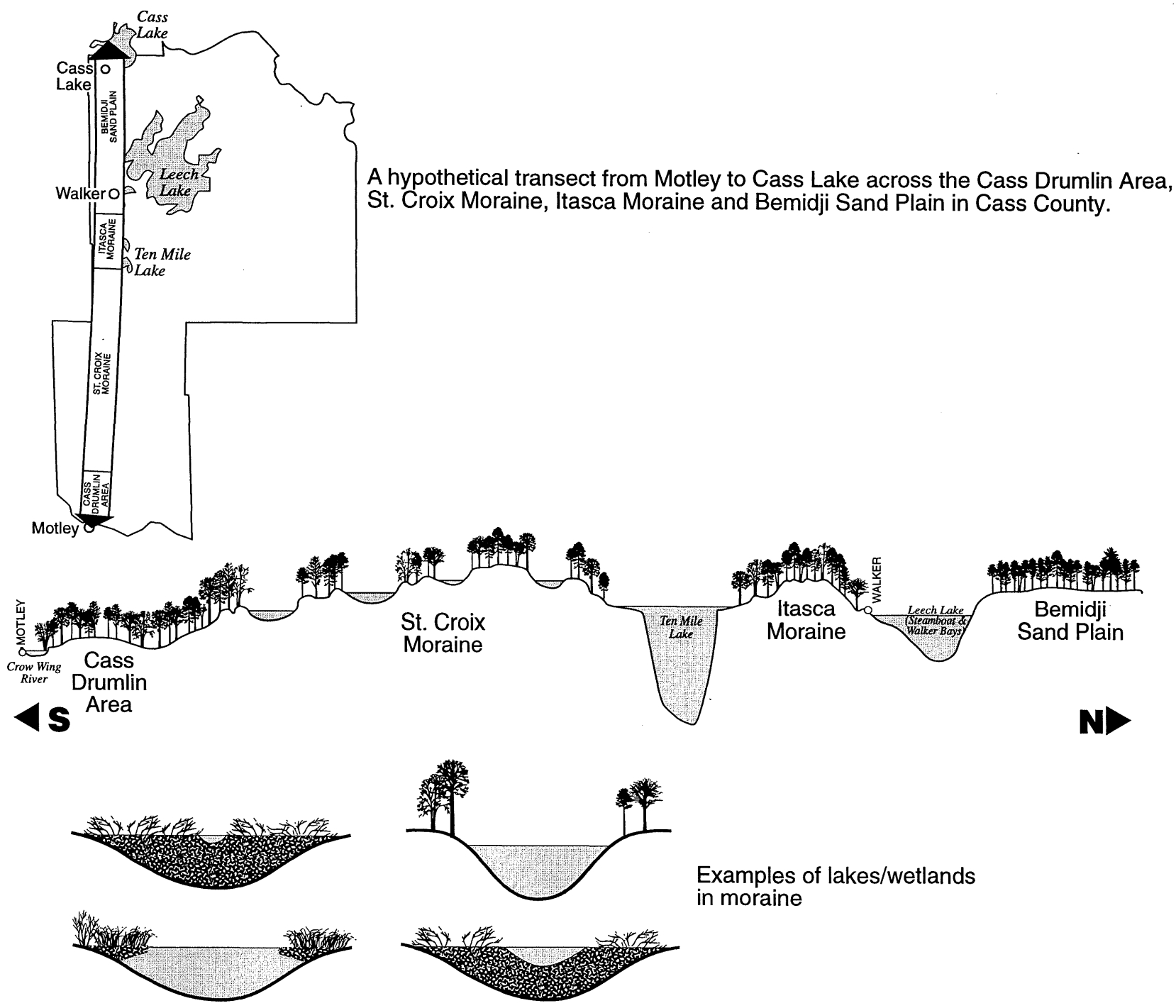
Concept: A stagnation moraine characterized by steep rugged terrain. Soil parent materials are predominantly a well-drained gray loamy till. Soil textures are commonly one to three feet of sandy loam OVER sandy clay loam OVER sandy loam; stones are often common. Some areas may have a surface texture of sandy loam OVER sand and gravel. Lakes occupy 2% of the area. Small kettle lakes are abundant.

Major Watersheds within the Northern Minnesota Drift & Lake Plains Ecological Classification System Section



A hypothetical transect from Sucker Bay to Lake Winnibigoshish across the Guthrie Till Plain, the Bemidji Sand Plain and Bena Dunes/Peatland in Cass County.





Annotated Bibliography: Landforms

Bailey, R.G. 1996. Ecosystem geography. Springer-Verlag New York, Inc. New York.

Landmark book. Explains history of development of ecological classification system and criteria used in development of upper levels. Includes world map showing upper levels (domains, divisions) of the ECS.

Chippewa National Forest. 1985. Ecological classification system handbook.

Preliminary descriptions of landtype associations found within Chippewa National Forest.

Flint, R.F. 1957. Glacial and Pleistocene geology. John Wiley and Sons, Inc., New York.

Thorough description of glaciation and glacial features. Profusely illustrated with line drawings and black-and-white photographs.

Forman, R.T.T. 1995. Land mosaics. Cambridge University Press, Cambridge.

Should be required reading for all land managers. Topics include patch size, number and shape; corridors; and wind and water flow. Illustrated with black-and-white line drawings and photographs.

Hanson, D., and B. Hargrave. 1996. Development of a multilevel ecological classification system for the state of Minnesota. Environmental Monitoring and Assessment 39:75-84.

Includes history of development of ecological classification system in state and description of levels. Illustrated with line drawings showing provinces, sections, and sub sections.

Hargrave, B. 1994. The upper levels of an ecological classification system for Minnesota. Minnesota Department of Natural Resources. Draft.

Describes provinces, sections, and subsections of state.

Krishnamurthy, R.V., K.A. Syrup, M. Baskaran, A. Long. 1995. Late glacial climate of midwestern United States from the hydrogen isotope ratio of lake organic matter. Science 269:1565-1567.

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Postglaciation: tundra replaced by spruce forest replaced by birch and alder replaced by jack and red pine. Oak spread up from the south about 8500 years ago; white pine advanced from the east, and, by 7000 years ago, prairie openings occurred in the region. With advent of cooler climate, prairie withdrew; spruce, tamarack, and pine advanced, and wetlands formed.

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Old but valuable source of information on geologic factors involved in formation of lakes in the state.

3. Vegetation and Land Use

<i>Brief Vegetation History of Cass County</i>	3.1.1	<i>Public Land Survey notes by township for Cass County</i>	3.10.1
<i>Brief Cultural History of Cass County</i>	3.1.1	<i>Natural Vegetation of Minnesota</i>	3.11.1
<i>Brief Land Use History of Cass County</i>	3.1.1	Brochure. MN DNR Biological Report No. 1. This map was adapted from a map compiled in 1930 by F.J. Marschner.	
<i>Land ownership map</i>	3.2.1	<i>Marschner's original vegetation map for Cass County</i>	3.12.1
<i>Minnesota's Bearing Tree Database</i>	3.4.1	<i>Interpretation of Francis J. Marschner's Map of the Original Vegetation of Minnesota</i>	3.12.2
(Almendinger, J.C. 1997. MN Department of Natural Resources Biological Report No. 56).		(Heinselman, M.L. 1974. North Central Forest Experiment Station, St. Paul.)	
<i>Bearing tree map for Cass County</i>	3.5.1	<i>A crosswalk between Marschner's vegetation types and DNR Natural Heritage and Nongame Research Program plant community types found in Cass County.</i>	3.13.1
<i>Bearing tree map showing distribution of pine</i>	3.6.1	<i>Annotated bibliography: vegetation</i>	3.14.1
<i>Bearing tree map showing distribution of lowland conifer.</i>	3.7.1		
<i>Bearing tree map showing distribution of hardwoods.</i>	3.8.1		
<i>State-wide species distribution maps based on bearing tree data. For pines, tamarack, white cedar, maple, oak, aspen, spruce, birch and other species</i>	3.9.1		

Brief Vegetation History

With the melting of the last of the Wisconsin-era glaciers, the Pleistocene epoch ended and the Holocene epoch began. Spruce (*Picea*) forest succeeded the tundra vegetation that probably followed the melting of the glaciers. This was quickly replaced by Red Pine (*Pinus resinosa*) or Jack pine (*Pinus banksiana*) forest. About 7000 years ago, warm, dry conditions (sometimes called the Hypsithermal) prevailed and the pine was replaced by Oak (*Quercus*) Savannah. By about 4000 years ago, cooler, moister conditions returned, White Pine (*Pinus strobus*) increased on the landscape (Janssen 1968), oak declined (Grigal 1976), and extensive bogs began forming (Janssen 1968).

Brief Cultural History

The first humans to occupy what is now Cass County probably followed the retreat of the last of the glaciers to cover this area. These earliest residents, occupying or passing through this region from 10,000 to 7,000 years ago, were nomadic big game hunters. About 7,000 years ago, semi-nomadic hunter-gatherers replaced the big game hunters. During the Woodland era, beginning about 2000 years ago, human groups became less nomadic, and wild rice became an important part of their diet.

About 600 years ago, the Sandy Lake culture began to dominate the region; members of this culture are considered ancestors of the Dakota or Sioux, the tribe present in this area when Europeans first passed through about 300 years ago (Matson, K. undated). By about 200 years ago, the Dakota had been forced out of the area by another tribe, the Ojibway or Chippewa.

The first Europeans to reside in this area arrived about two hundred years ago and found a rugged landscape with abundant pine, extensive level plains covered by conifer swamps, maple and other mesic hardwoods north and east of Leech Lake, and oak concentrated in the southern part of the county. Of the 14592 bearing trees recorded in Cass County by surveyors during the Public Land Survey from 1858 to 1875, 5037 were pine and 4310 were lowland conifers (Natural Heritage and Nongame Research Program 1995). See the bearing tree maps for Cass County later in this chapter. Information on how to obtain bearing tree maps and data from the Natural Heritage and Nongame Research Program is found in *Minnesota's Bearing Tree Database* on page 3.2.1.

Brief Land Use History

Both natural disturbances and anthropogenic (human-induced) disturbances have affected the vegetation of Cass County over the years. Natural disturbances include wind storms, tornadoes, wildfire, insect infestations, floods, and drought. The most significant anthropogenic disturbances affecting vegetation in the county at present are logging and livestock grazing. Tilling of land for crops and livestock grazing are disturbances concentrated in the central and southern parts of the county, while logging occurs throughout.

Logging

We thank Fay Harrington, Cass County Forester beginning in 1946 and Land Commissioner from the early 1970's until 1985, for discussions about the history of logging on Cass County lands. Much of the following information about logging from 1930 on was provided by Mr. Harrington during an interview in November 1995.

By the mid 1800s, timber supplies in forests to the east were being depleted while the demand for lumber to build eastern cities was increasing. Improved transportation, including steampowered riverboats and a railroad, made it possible to transport logs from northcentral Minnesota to mills in Minneapolis and points farther south and east in the country.

With transportation in place, the timber industry was poised to move into the stands of pine in central Minnesota. However, the land on which the pine grew belonged to the Ojibway. The U.S. government, under pressure from timber interests, entered into a series of cession treaties with the Ojibway. In 1855, financial and political pressures forced Chief Hole-in-the-Day (in Ojibway, "Bug-O-Nay-Geshig"), leader of the Pillager Band, to sign the last of this series of cession treaties (Clarke 1979). Lands west to the Red River and north to the Rainy River, the location of Minnesota's largest timber reserves, were ceded.

During the late 1800s, logging interests dominated the county. After the government took possession of the timberlands from the Ojibway and these lands were surveyed and opened for sale, timber interests were the first in line. Early logging operations took only the largest and best trees; later in the era, as timber stumpage declined, minimum size requirements decreased and

clearcuts were the norm (Clarke 1979).

In 1889, Congress decreed that public lands were no longer open to private purchase, but by then most White Pine and Red Pine had been sold to private timber interests. By the early 1900s, it was apparent that the pine supply had been depleted here, and logging companies moved farther north.

By the 1930s, Jack Pine was in demand for pulp. However, aspen was virtually ignored until the early 1940s. From then until the 1960s, there were many sawmills throughout the county, most of which were cutting only the largest aspen into box lumber. With a market for only the largest aspen, loggers high-graded aspen stands to supply the mills. Only in the last 20-30 years has there been a market for aspen pulpwood (F. Harrington, pers. comm.).

In the early years, pine logging took place in winter, the season in which log movement over land was easiest. Logs were skidded or moved on a sleigh to the landing. In spring, logs were floated from the landing to the mills on rivers full of snowmelt water (Twining 1983). The early homesteaders also used horses, sleighs, and drays to move logs. By 1946, some logging was still done using horses and sleighs; however, by then, loggers also were using wheeled tractors and were putting together makeshift equipment to harvest pulpwood and small logs. Caterpillars came into use in the 1950s, then boom trucks in the 1960s, and, later, wheeled skidders and grapples, etc. (F. Harrington, pers. comm.).

In the homesteading era and into the early 1900's, the county government had no timber management program, so parcels of tax-delinquent land were resold to private citizens. The new owners cut the timber off the land; then, when these owners were unable to continue to pay taxes on the land after the timber had been harvested and sold, they forfeited the land again for non-payment of taxes (Shadduck 1980). Several cycles of this took place before the early 1940s when the county began managing tax-delinquent land (that is, land forfeited to the state but administered by the county via Chapter 386, passed in 1935, and Chapter 328, passed in 1939; Dana 1960) for timber production and selling much less of it (F. Harrington, pers. comm.; see also Dana 1960).

Fire

The Ojibway, the Dakota, and their ancestors probably employed fire as a tool to produce berry crops, to

produce abundant game populations, and to drive game (Day 1953).

In the late 1800s, pine stands that had been logged were called "slashings". Many of these slashings were burned in fires (Ayres 1899) which were often set intentionally (K. Matson, pers. comm.). By the 1920s, much of northern Minnesota had been burned, and blackened trees, Fireweed (*Epilobium angustifolium*), and raspberry (*Rubus* spp.) bushes were common on the landscape (Shadduck 1980).

The two most extensive fires of recent times were those in 1959 and 1976. They both burned on the sandy outwash plain in the Badoura area. The 1959 fire started in Wadena County and jumped a mile ahead of firefighters, crossing Highway 64 in places. The 1976 fire burned a smaller area. In both cases, rain stopped the fires. Stories circulated that farmers wanted the land cleared and started the fires; other stories credited a tossed cigarette (F. Harrington, pers. comm.).

Leech Lake Reservation

During the late 1700s and early 1800s, fur trading posts were established on the major lakes in the county by the Northwest Company and the American Fur Company. The Ojibway trapped and traded their furs at these posts. About this time, explorers, especially those looking for the source of the Mississippi River, passed through the region. Zebulon Pike, Lewis Cass, and Henry Schoolcraft are memorialized by the names of lakes and a state park in the county, as well as by the name of the county itself.

Following a series of cession treaties in the mid 1800s, the Ojibway then moved to reservations within the ceded lands that were created by these treaties. In 1867, some of the smaller reservations were abandoned for a single, larger reservation in the area of Leech, Cass, and Winnibigoshish lakes now known as Leech Lake Reservation (Dana et al. 1960).

Although reservation lands were to be held in common, a series of Congressional acts from 1891 through 1906 provided for ownership of parcels called allotments by individual American Indians. This made it possible for private lumber, agriculture, and mining interests to purchase allotments from individual American Indians (Shadduck 1980). By 1934, when American Indians throughout the state had parted with 90 million acres of their land through the allotment system, it had become apparent that the allotment system benefited other in-

terests more than it did the American Indians. Further allotment designations were prohibited by the 1934 Wheeler-Howard Act (Dana 1960).

Ojibway history throughout Cass County remains evident in many of the place names here. Leech Lake, Ottertail Point, Sugar Point (named for its maples), Pelican Island, and Bear Island are all translations of the names given these places by the Ojibway. Lake Winnibigoshish, when translated from the Ojibway, means lake of dirty water. Bena, the name of the small town on Highway 2, is the Ojibway word for partridge. A township and river near Walker are called Shingobee, the Ojibway word for evergreen trees (Upham 1969).

Chippewa National Forest

In 1899, 400-year-old pine stands were being cut as "dead and down" timber by trespass loggers on Ojibway-owned lands surrounding Cass, Leech, and Winnibigoshish lakes. (Russell 1979). Lydia Williams, Florence Bramhall, and other members of the Minnesota Federation of Women's Clubs were outraged by the destruction of the old pine forests and the injustice being done to the Ojibway. They began an all-out effort to inform the public and influence the legislators who controlled the fate of the land. Investigations ensued, eventually Women's Clubs from throughout the nation joined the effort, and in 1902 the Morris Act was passed. This Act set aside 275,000 acres of the land in question as a forest reserve. As a result, the Ojibway were paid \$1.5 million for their land, and Chippewa National Forest was established, becoming the first forest reserve created by an act of Congress (Russell 1979).

Protests followed, and an attempt was made to open the Forest to settlement. At last, in 1908, by Public Order No. 137, the Minnesota National Forest was created, its boundaries were specified, ten sections were reserved from sale or settlement, and a number of other restrictions were placed on its development (see Dana 1960). The Forest's name was changed in 1928 to Chippewa National Forest, and in 1933 a program of land acquisition began (Dana 1960).

Homesteading

Surveys of public lands west of the Mississippi River began in 1853 (see *Minnesota's Bearing Tree Database* later in this chapter), and, with the Ojibway cessions in the 1850s, the influx of immigrants to the area started.

Homesteaders acquired lands after the lumber companies were finished logging the pine. These smaller operators took the remaining timber from lands abandoned by the large companies. After all the timber was harvested on a parcel, the land often was forfeited for non-payment of taxes. When the timber again grew to merchantable size, the parcel was sold and logged once more (F. Harrington, pers. comm.).

Today, primarily as a result of tax forfeiture and the establishment of managed forest areas, 58% of the county is public land; of this, 23% is in federal ownership, 15% is in state ownership, and 20% is owned or managed by the county. Tourism, forest products, and agriculture form the county's economic base. Summer residents (40% of personal real estate is held by out-of-county owners) and resorts (251 on the 514 lakes in the county) are the foundation of a tourist industry that far surpasses the other two industries in its contribution to the economy of the area (Anderson undated).

Forested land makes up 69% of the land area of the county. Most of the forest is considered commercial, and its harvest contributes significantly to the county economy.

About 23% of land in the county is farmland, and most of that is in the central and southern townships. The sale of livestock (primarily beef cattle) provides the bulk of the county's farm income (Anderson undated).

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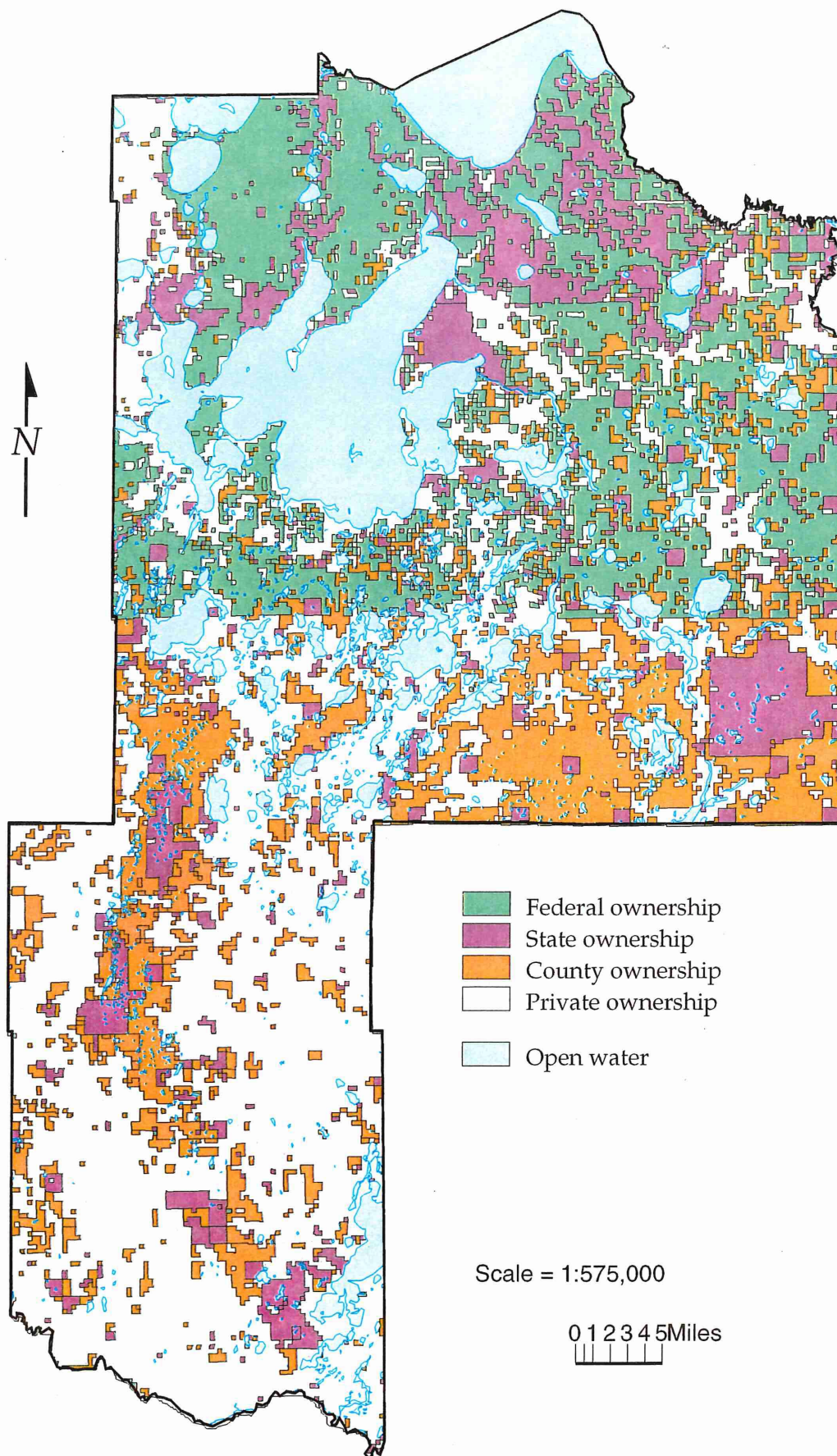
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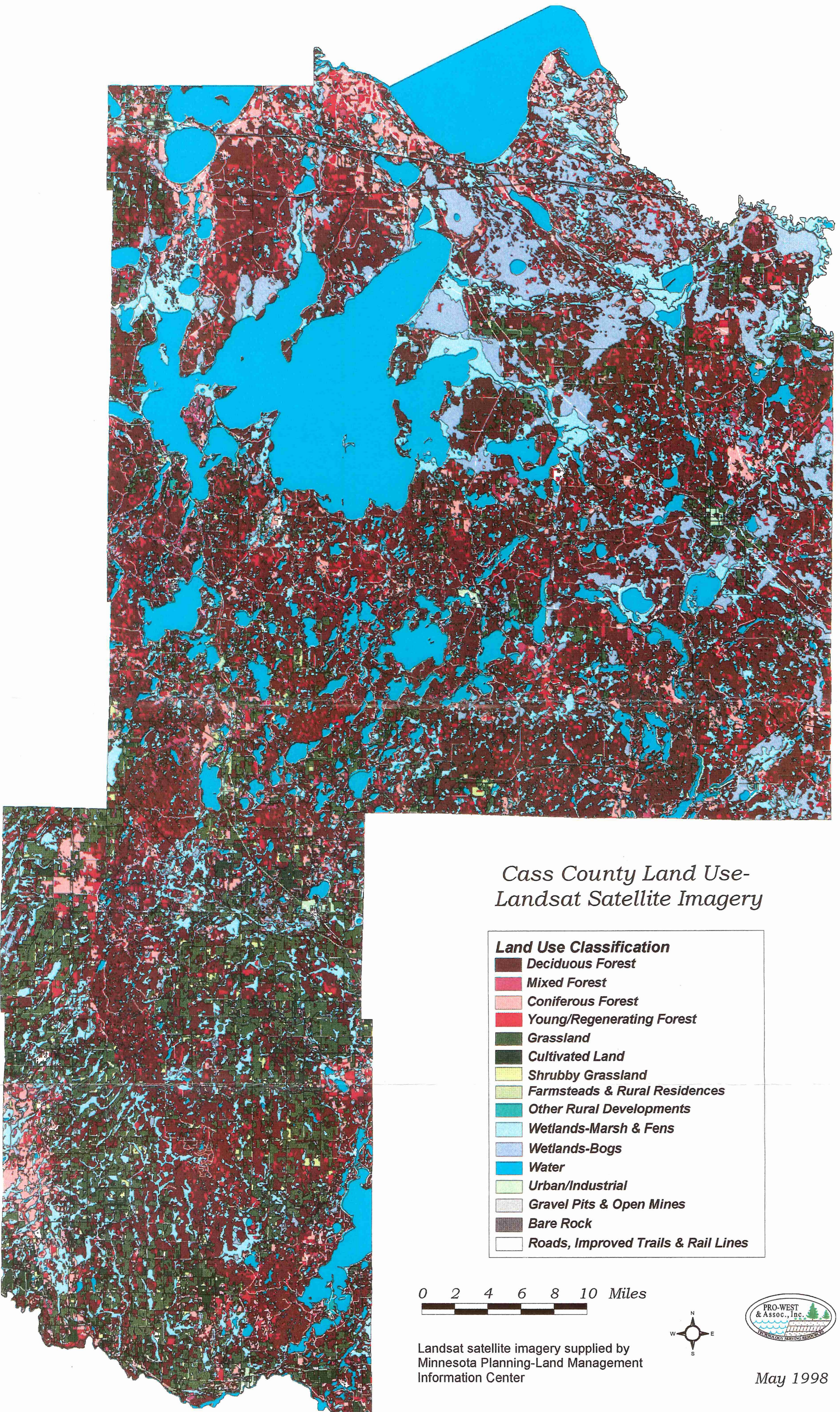
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Cass County Land Use Map

Data produced by Manitoba Remote Sensing Centre, Winnipeg, Manitoba, Canada, using 18 June 1995
LANDSAT imagery.

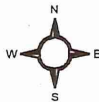


*Cass County Land Use-
Landsat Satellite Imagery*

Land Use Classification	
	Deciduous Forest
	Mixed Forest
	Coniferous Forest
	Young/Regenerating Forest
	Grassland
	Cultivated Land
	Shrubby Grassland
	Farmsteads & Rural Residences
	Other Rural Developments
	Wetlands-Marsh & Fens
	Wetlands-Bogs
	Water
	Urban/Industrial
	Gravel Pits & Open Mines
	Bare Rock
	Roads, Improved Trails & Rail Lines

0 2 4 6 8 10 Miles

Landsat satellite imagery supplied by
Minnesota Planning-Land Management
Information Center



May 1998

Minnesota's Bearing Tree Database

By John C. Almendinger, Minnesota Department of Natural Resources, Biological Report No. 56. This report explains the history of the Public Land Survey, the content and location of the bearing tree database, and how to obtain bearing tree data.

MINNESOTA'S BEARING TREE DATABASE

Maintained within the
Natural Heritage Information System
Section of Ecological Services
Division of Fish and Wildlife
Minnesota Department of Natural Resources

Prepared by John C. Almendinger, September 1996
Ecological Classification System Program
Department of Natural Resources

Introduction

Brief Background on the Public Land Survey

Survey records and notes from the rectangular survey of public lands (PLS) in the United States can provide ecologists with valuable information about trees and vegetation. These historical data predate widespread settlement by Europeans and thus, are especially valuable where the vegetation has been altered greatly in the past century. The fact that the PLS predates settlement is no accident. The survey was prerequisite for the public sale of lands in what was then the western territory. On 20 May 1785 Congress passed "An Ordinance for Ascertaining the Mode of Disposing of Lands in the Western Territory," thus initiating the PLS. Except for some experimentation in the early phases of the survey in Ohio, the survey of the historic Seven-Ranges in eastern Ohio set the precedent of six-mile square townships with 36 mile-square sections that would be followed throughout the history of the PLS -- including the survey of Minnesota. Grimm provides a useful summary of the "Administrative and Statutory History of the Public Land Surveys" in his Dissertation (1981) as it pertains to Minnesota, and those interested in these historical aspects of the PLS should consult White (1983), Rhorbough (1968), Gates (1968), Stewart (1935), or Lester (1860).

The PLS started in 1847 in Minnesota with the westward extension of standard parallels from the fourth principal meridian. The PLS was essentially complete for lands available for public sale by 1908, at which time, the office of the Surveyor General was closed in St. Paul and the "original" records were transferred to the State. The passage of the Civil Appropriations Act of June 25, 1910 brought an end to the contract survey system and reorganization of the General Land Office. Further surveys in the United States and Minnesota were then accomplished by government surveyors ("direct system") rather than by contractors appointed as Deputy Surveyors. In Minnesota these government surveyors were occupied by: 1) surveying any missing subdivisions of townships in Indian reservations and "unwanted" lands, 2) performing resurveys where the surveys were poor or fraudulent, 3) surveying railroads, 4) surveying special forest lands, and 5) performing special surveys upon the request of settlers (i.e. "deposit surveys"). *Except for a very few records from cleanup and resurveys, the Natural Heritage Information System (NHIS) database records do not include survey data from the direct-system era of the PLS. That is, the NHIS database contains the oldest survey records available for the standard section and quarter-section corners.*

Information Collected in Conjunction with the Public Land Survey

An important point that is often neglected in the ecological application of PLS notes is the fact that the purpose of the survey was not to sample the vegetation. The PLS was a means of raising revenue for the government through the sale of public lands to private individuals or companies. Thus, the emphasis was on an initial survey to make sales possible, perpetuation of the survey in anticipation of resale and further subdivision, and a means of evaluating a reasonable price for the lands, based mostly on the natural resources present. The exploitive nature of the survey is clearly evident in the instructions issued to surveyors, and the ecologist would do well to keep in mind this bias in applying PLS data to ecological problems. The *Summary of Objects and Data Required to be Noted* in the 1855 instruction manual is reprinted in Appendix A.

The data most often considered in ecological studies consist of hand-copied records of:

- corner monumentation (posts, stones, pits)
- the kind of corner established (township, section, quarter-section, meander)
- the trees marked to relocate the corners (line, witness, and bearing trees)
- points of intersection along the survey lines where there are notable features such as changes in vegetation, physiographic features, lake and river shorelines, soil changes, mineral deposits, fields, cabins, etc. (These are the so-called “line notes.”)
- hand-drawn township plat maps based upon the line notes
- timber and soil summaries for each mile of line
- summaries of the vegetation, timber, soils, etc. for the entire township.

The NHIS Bearing Tree Database contains computerized records only of the bearing trees at standard section and quarter-section survey corners. Meander corners, which mark the point of departure from section lines in order to traverse around impassable objects, are not included in the database. Codes for the type of vegetation at each standard survey corner are included as stated in the line notes or, alternatively, as inferred from the line summary notes (see next section for details).

Ecological Application of PLS Data

Below is a listing of some applications that have found their way into ecological publications.

Ecologists have utilized PLS data to:

- Make maps of presettlement vegetation
- Reconstruct absolute and relative densities of tree types in former forests
- Reconstruct characteristic size (~age) distributions for certain forest types
- Evaluate the importance and character of forest disturbance regimes
- Understand the co-association of major tree types
- Reconstruct the density and distribution of wetlands, lakes, and rivers
- Evaluate the effect of physical factors on the distribution of tree types
- Locate archaeological sites
- Provide vegetational interpretations of presettlement pollen spectra

The use of PLS data for ecological reconstructions and analyses carries with it the responsibility of knowing the survey instructions and likely implementation of those instructions for a given study area. The ecologist must know both of these things in order to construct appropriate study methods and discuss reasonably the reliability of results, given that the PLS was not designed as an ecological sampling method:

“... not having sufficient familiarity with the nature of the land surveys, many ecologists have made faulty and naive assumptions leading to inappropriate uses of the data and to dubious or incorrect results and conclusions.” (Grimm 1981)

Grimm’s warning is followed in his dissertation by a comprehensive review of the literature and how various authors have applied or misapplied PLS records in ecological studies. The first chapter of Grimm’s thesis (1981) and the classic paper by Bourdo (1956) should be required reading for anyone interested in applying PLS data to ecological problems in Minnesota. A fair summary of the concern about using PLS data is that it is, at best, a biased ecological sampling. Bias does not render data useless, but it does require study and discussion of its effects on ecological interpretation. The great value of PLS data is its spatial comprehensiveness, and many of the concerns about applying PLS data to ecological problems are alleviated by selecting large study areas.

Definition of Bearing Trees and Instructions for their Selection

Bearing trees are a special kind of witness tree which the surveyors notched, blazed, and scribed in a standard way to facilitate the relocation of the survey corner should the wooden corner post or corner stone be lost or moved. The surveyor was required to note for each bearing tree: 1) its type (~species), 2) its diameter, 3) its distance to the corner, and 4) its azimuth or “bearing” from the corner and hence its applied name. *These are the actual data associated with an individual bearing tree that ecologists use.* Witness tree is a broader term that includes trees that were marked on line or near the corner, generally without the required distance and bearing notes required of a true bearing tree. Thus true bearing trees, line trees, and generic witness trees were distinguished in the field with appropriate inscriptions (BT, LT, WT respectively) and are distinguished in the notes as well. Bearing trees were required at both the standard corners of the rectangular survey grid and at points on the survey lines where the surveyors were forced to meander around impassable areas such as lakes. *The NHIS Bearing Tree Database Contains only records of true bearing trees at the standard survey corners.*

Much of the concern about ecological interpretation of bearing tree data has to do with surveyor bias in selecting bearing trees. For this reason, it is important that the ecologist be aware of the surveyor’s instructions for selecting bearing trees. Appendix B presents a chronological record of the actual instructions for selecting bearing trees that were issued at various times in the history of the Public Land Survey of Minnesota. The instructions are very general and really only address the method of marking trees and the required number of trees to be marked. The requirement of 5" or larger trees was dropped in the 1851 instructions, and applies only to a comparatively few surveys in Minnesota. If the surveyors were instructed to bias their selection of bearing trees with regard to species or

diameter (after 1851), those instructions would have to be in the personal correspondence between the Surveyor General and the individual Deputy Surveyors.

Error, Bias, and Considerations for Ecological Use of Bearing Tree Records

Error Associated with the Versions of PLS Notes and Collection Process

The “original” field notes and corresponding plat maps are now archived by the Minnesota Historical Society. These “original” notes were hand-copied by clerks in the Surveyor General’s office in Dubuque, Iowa and then later in St. Paul. These copies were periodically sent to the General Land Office (GLO) in Washington D.C. These GLO copies were microfilmed by the Bureau of Land Management, and these microfilms are available to the public at the Wilson Library, University of Minnesota. A comparison of the “original records” at the Historical Society and the further removed GLO microfilms show that there is approximately a 1-5% error rate for corner records. An error in any of the 16 possible entries (up to 4 per trees X 4 attributes per corner) constitutes an error. One source of this error occurs during transcription of the data from the GLO microfilms to data-entry forms, relating mostly to illegible entries. The other source of error is in the hand-copying procedure executed by the clerks in the Surveyor General’s office. *In the NHIS Bearing Tree Database, only the township records collected for Grimm’s study of the Big Woods (193 townships, Grimm 1981); the records collected for J.C. Almendinger in his study of jack pine forests (88 townships, Almendinger 1985); and townships missing from or illegible in the GLO microfilms match the “original” notes. Otherwise all data were collected from the GLO microfilms.*

Surveying Error and Resurveys

Cases of outright fraud and poor surveying did occur during the history of the PLS, and government field examiners were used to identify townships in need of being resurveyed. Provisions for withholding payment appear in the instructions to surveyors, and from this I have assumed that inspections closely followed a completed survey. Some of these problems were caught and fixed prior to accepting a survey and incorporation of the data into the “original” notes; others slipped through. *The NHIS has not attempted to substitute data from resurveys of townships that were poorly surveyed or fraudulently contrived. In my experience this was infrequent, but poor or fraudulent surveys could significantly affect ecological interpretations in studies that look at just one or a few townships.*

Error and Ambiguity in Tree Identification

Another source of error is that of tree misidentification or our misinterpretation of the common names that the surveyors used for the trees. Table 1 shows our best interpretation of the taxonomic equivalents for the tree types referenced by the surveyors and also the coding for the tree types that is used in the NHIS Bearing Tree Database. Users of the database should be aware that often tree types are assignable to genus only: oak, pine, maple, ash, etc. In nearly all of these cases of species ambiguity, it is impossible to infer a particular species. In the cases where a common name might be applied to just two species, ambiguity can often be cleared up based on the modern distributions of the trees or known habitat. For example, there are many references to black oak statewide. This name was clearly used to refer to both true black oak and red oak. In the small area of southeastern Minnesota where both black and red oak occur, this is an irresolvable ambiguity; however, north of the Twin Cities, black oak references may be assigned safely to red oak. Up until about 1988,

bearing tree records were collected in areas where most tree type assignments could be safely inferred, and the data collectors made the appropriate type assignments to a single type code. As the data collection moved into areas of type ambiguity, it was decided to record exactly what the surveyor called the tree, and several codes were used for what is probably the same species. *It is up to the user to recognize and combine the type equivalents. The best way to approach this problem is to make plots of the bearing trees showing both the lines surveyed by different crews and any modern range limits of the tree types.*

Table 1. PLS bearing tree types, codes, taxonomic equivalents, frequency, and percent of 352,896 bearing trees reported for Minnesota.

PLS Tree Type	Code	Taxonomic Equivalent	Frequency	Percent
Ash	AH	<i>Fraxinus nigra</i> , <i>F. pennsylvanica</i> , <i>F. americana</i>	5,602	1.587
Alder	AL	<i>Alnus incana</i> , <i>A. viridis</i>	103	0.029
Aspen	AS	<i>Populus tremuloides</i> , <i>P. grandidentata</i> , <i>P. balsamifera</i> (in lesser part)	45,702	12.950
Black Ash	BA	<i>Fraxinus nigra</i>	1,852	0.525
Black Birch	BB	<i>Betula nigra</i> , <i>B. alleghaniensis</i> (in part ?)	10	0.003
Beech	BE	<i>Fagus grandifolia</i> (unknown from Minn. possibly <i>Carpinus caroliniana</i>)	45	0.013
Balm-of-Gilead	BG	<i>Populus balsamifera</i> (in greater part)	2,300	0.652
Birch	BI	<i>Betula papyrifera</i> , <i>B. cordifolia</i>	20,668	5.857
Black Oak	BK	<i>Quercus nigra</i> , <i>Q. ellipsoidalis</i> (in part)	6,758	1.915
Blue Beech	BL	<i>Carpinus caroliniana</i>	9	0.003
Bur Oak	BO	<i>Quercus macrocarpa</i>	30,283	8.581
Babswood	BP	<i>Tilia americana</i>	11	0.003
Black Spruce	BS	<i>Picea mariana</i>	12	0.003
Buttonwood	BT	<i>Platanus occidentalis</i> (unknown from Minn. ?)	7	0.002
Butternut	BU	<i>Juglans cinerea</i>	449	0.127
Black Walnut	BW	<i>Juglans nigra</i>	129	0.037
Box-Elder	BX	<i>Acer negundo</i>	113	0.032
Buckeye	BY	<i>Aesculus glabra</i> (unknown from Minn. ?)	1	0.000
Cedar	CE	<i>Thuja occidentalis</i> , rarely <i>Juniperus virginiana</i>	10,836	3.069
Cherry	CH	<i>Prunus serotina</i> , <i>P. pennsylvanica</i>	262	0.074
Cottonwood	CO	<i>Populus deltoides</i>	299	0.085
Crab-Apple	CR	<i>Crataegus</i> spp.	4	0.001
Elm	EL	<i>Ulmus americana</i> , <i>U. rubra</i> , <i>U. thomasii</i>	13,397	3.796
Fir	FI	<i>Abies balsamea</i>	13,714	3.886
Hackberry	HA	<i>Celtis occidentalis</i>	174	0.049
Hornbeam	HB	<i>Ostrya virginiana</i>	8	0.002
Hickory	HI	<i>Carya cordiformis</i> , <i>C. ovata</i>	754	0.214
Hawthorn	HT	<i>Crataegus</i> spp.	1	0.000
Ironwood	IR	<i>Ostrya virginiana</i>	2,919	0.827
Jack Oak	JO	<i>Quercus ellipsoidalis</i>	1,645	0.466

Jack Pine	JP	<i>Pinus banksiana</i>	16,541	4.687
Juniper or Red Cedar	JU	<i>Juniperus virginiana</i>	9	0.003
Linden or Basswood	LI	<i>Tilia americana</i>	7,232	2.049
Maple	MA	<i>Acer rubrum</i> , <i>A. saccharum</i> , <i>A. saccharinum</i>	4,624	1.310
Mountain Ash	MH	<i>Sorbus decora</i> , <i>S. americana</i>	4	0.001
Mountain Spruce	MS	probably <i>Picea glauca</i>	3	0.001
Oak	OA	<i>Quercus rubra</i> , <i>Q. macrocarpa</i> , <i>Q. ellipsoidalis</i> , <i>Q. velutina</i> , <i>Q. alba</i> , <i>Q. bicolor</i>	9,068	2.570
Pine	PI	<i>Pinus strobus</i> , <i>P. resinosa</i> , <i>P. banksiana</i>	5,861	1.661
Plum	PL	probably <i>Prunus americana</i>	3	0.001
Pitch Pine	PP	<i>Pinus banksiana</i>	1,080	0.306
Spruce Pine	PS	<i>Pinus banksiana</i>	241	0.068
Red Ash	RA	<i>Fraxinus pennsylvanica</i>	1	0.000
Red Elm	RE	<i>Ulmus rubra</i>	8	0.002
Red Maple	RM	<i>Acer rubrum</i>	20	0.006
Red Oak	RO	<i>Quercus rubra</i> , <i>Q. ellipsoidalis</i> (in part or as hybrid)	6,766	1.917
Red, Norway, or Yellow Pine	RP	<i>Pinus resinosa</i>	10,918	3.094
Soft or White Maple	SM	<i>Acer rubrum</i> or <i>A. Saccharinum</i>	223	0.063
Spanish Oak	SO	<i>Quercus ellipsoidalis</i>	12	0.003
Spruce	SP	<i>Picea mariana</i> , <i>P. glauca</i>	33,802	9.578
Sugar Maple	SU	<i>Acer saccharum</i>	6,892	1.953
Tamarack	TA	<i>Larix laricina</i>	59,651	16.903
Thorn	TH	probably <i>Crataegus</i> spp.	7	0.002
Scrub Oak	OU	predominantly <i>Quercus ellipsoidalis</i> , but includes <i>Q. macrocarpa</i> as well	26	0.007
Burned Pine	UP	<i>Pinus</i> spp.	137	0.039
White Ash	WA	<i>Fraxinus americana</i> , <i>F. pennsylvanica</i> (in part)	306	0.087
White Birch	WB	<i>Betula papyrifera</i> , <i>B. cordifolia</i>	6,159	1.745
White Cedar	WC	<i>Thuja occidentalis</i>	492	0.139
Water Elm	WE	<i>Ulmus</i> spp.	6	0.002
Witch Hazel	WH	<i>Hamamelis virginiana</i>	1	0.000
Willow	WI	<i>Salix</i> spp.	1,002	0.284
White Oak	WO	<i>Quercus alba</i> , <i>Q. macrocarpa</i> (in part)	8,133	2.305
White Pine	WP	<i>Pinus strobus</i>	13,865	3.929
White Spruce	WS	<i>Picea glauca</i>	2	0.001
Illegible or Not Recorded	XX	equivalent unknown	28	0.008
Yellow Birch	YB	<i>Betula alleghaniensis</i>	1,211	0.343
Yellow Pine	YP	<i>Pinus resinosa</i>	495	0.140
TOTAL			352896	99.995

Bias in Bearing Tree Selection

There is undoubtedly some bias in selecting or rejecting certain species of trees as bearing trees. Species-specific characteristics that may have influenced surveyor selection include size (for subtrees like ironwood), longevity, bark thickness, persistent lower branches, wood density, visibility, and marketability as the loggers were close at hand. Anecdotes concerning the relative influence of these characteristics on bearing tree selection abound. These anecdotes often are conflicting and are curiously correlated with different social perspectives on forest use. Ecologists have tried many quantitative approaches of measuring species bias by considering diameter or distance distributions that vary among the species, but so many statistical assumptions are violated that the tests are unreliable (Grimm 1981). *Without reliable quantitative approaches to species bias, the user should beware.* In my experience, species bias is not a serious concern over large areas and comparisons of relative tree abundances are useful. My opinion comes from observing consistency of tree references among many surveyors in the same general area and from the fact that many survey corners occurred in places where there were few species present, thus limiting the opportunity to make biased selections. *A reasonably safe interpretation of bearing tree records is to assume that tree type was present at a corner if the surveyor said so (but see error Sections regarding the collection process and tree identification); however, it is unsafe to assume that an unreferenced tree type was absent from a corner because of the small sample size and possibly surveyor bias.*

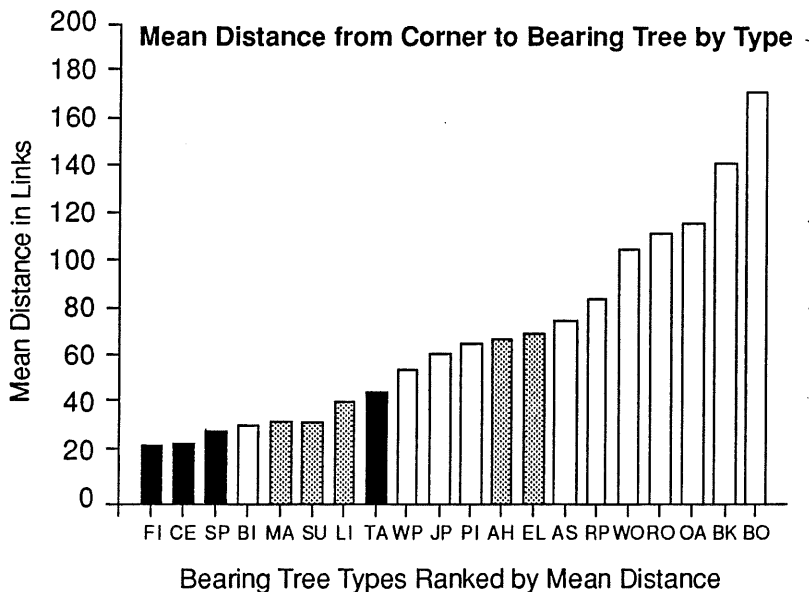


Figure 1. Mean distance from survey corners to tree types: FIr, CEdar, SPruce, BIrch, MAple, SUGar maple, LInden (basswood), TAmaraack, White Pine, Jack Pine, PIne, ASH, ELm, ASpen, Red Pine, White Oak, Red Oak, OAk, Black oak, Bur Oak.

Although distances can't be used quantitatively to assess species bias, some qualitative interpretation can be made. Figure 1 shows the mean distance from survey corners to particular tree types. Swamp conifers (black bars) show the shortest distances, which is consistent with their tendency to grow in tight stands and in monotypes (no bias options) in modern forests. Upland, fire-sensitive taxa (gray bars: maple, sugar maple, basswood) of forests with gap-phase dynamics tend also to have short distances. The fire-tolerant pines, aspen, and birch (white bars) of forests with coarser-scale patch dynamics have intermediate mean distances. Intermediate distances are characteristic also of fire-sensitive ash and elm (gray bars), which historically regenerated from windthrow due to their shallow rooting in wet

areas. Thus, species with intermediate mean distances tend to occur in landscapes where the tree canopy was often patchy due to fire or windthrow. Tree types with long distances are all fire-tolerant oaks (white bars) that occurred along the prairie-forest border. Often the survey corners would fall in small prairie openings, and long distances were traveled to mark an oak tree in the nearest grove. The ranking then is basically a gradient of increasing fire tolerance or disturbance patch size. My interpretation of this is that there was little species bias with regard to the physical properties of trees. Rather, the surveyors had to go long distances in disturbed areas to find any live tree, and trees with long mean distances are those that tend to survive broad-scale disturbances better than others.

This interpretation is consistent with the frequency distributions of individual tree-types. The types with short mean distances tend to have near-normal distributions, and the types with long mean distances have distributions with long tails. The long tails are created mostly from corners falling in areas described as burned, thickets/brush, windthrow, or prairie openings where very long distances (often >10 chains) were recorded for the trees. Obviously, such corners would have to be eliminated from the dataset for any attempt to reconstruct tree density in past forests. Even when this is done, it is my experience that bearing tree distances are 2-4 times greater than distances recorded from point-center quarter samplings of modern forests, which suggests that surveyors did pass up trees close to corners for more distant trees that were better suited for scribing or that had greater estimated longevity. *Based upon this experience, bearing tree distances are useful only within the PLS dataset to make broad-scale interpretations of physiognomy. Tree densities calculated from bearing trees cannot be reasonably compared with modern forest data.*

An alternative approach for estimating species bias in bearing tree selection is to compare the relative frequency of bearing trees with their relative frequency on line descriptions. The surveyors were required to list “the several kinds of timber and undergrowth, in the order in which they predominate.” The surveyors could list as many tree types as they wanted, thus the line notes are free from the small sample size problem associated with selecting bearing trees. The surveyors did not have to mark the referenced trees, thus the line notes are free from bias associated with the task of blazing and scribing certain kinds of trees. Table 2 uses the differences in surveyor instructions regarding bearing tree selection and line-notes to infer bias in bearing tree selection.

Table 2. The relative frequency of tree types as bearing trees (15,286 trees) versus relative frequency as types mentioned in line notes (28,782 trees) for the Chippewa National Forest. Clear bias was assumed when a type was mentioned more than twice as often in one set of notes versus the other. Bias listed as “preferred” means that the surveyors tended mark that type as a bearing tree more often than one would guess from the line notes, and “avoided” indicates the converse.

Tree Type	Relative Frequency as Bearing Tree	Relative Frequency as Line-Note Tree	Difference	Inferred Bias as Bearing Tree
Aspen	11.9%	15.9%	-4.0%	somewhat avoided
Balm-of-Gilead	0.6%	0.1%	0.5%	preferred
Sum of Aspen	12.5%	16.0%	-3.5%	somewhat avoided
Paper Birch	10.0%	12.3%	-2.3%	somewhat avoided
Bur Oak	0.8%	0.1%	0.7%	preferred
Red Oak	0.7%	0.1%	0.6%	preferred
Oak	1.0%	1.7%	-0.7%	somewhat avoided
Sum of Oak	2.5%	1.9%	0.6%	somewhat preferred
Jack Pine	5.5%	2.6%	2.9%	preferred
Red Pine	8.1%	4.3%	3.8%	somewhat preferred
White Pine	6.0%	2.8%	3.2%	preferred
Pine	1.2%	7.0%	-5.8%	avoided
Sum of Pine	20.8%	16.7%	4.1%	somewhat preferred
Ash	1.5%	2.1%	-0.7%	somewhat avoided
Elm	1.6%	1.5%	0.1%	somewhat preferred
Ironwood	0.4%	0.1%	0.3%	preferred
Basswood	1.3%	0.9%	0.4%	somewhat preferred
Sugar Maple	1.5%	1.2%	0.3%	somewhat preferred
Maple	2.1%	2.3%	-0.2%	somewhat avoided
Yellow Birch	0.2%	0.1%	0.1%	somewhat preferred
Hardwoods	0.0%	1.7%	-1.7%	avoided
Sum of Hardwoods	8.6%	9.9%	-1.3%	somewhat avoided
Spruce	9.6%	10.6%	-1.0%	somewhat avoided
Balsam Fir	5.4%	5.2%	0.2%	somewhat preferred
Tamarack	20.9%	19.0%	1.9%	somewhat preferred
White Cedar	9.2%	8.5%	0.7%	somewhat preferred

My interpretation of Table 2 is that, for the more common types, there are not great differences between their relative abundance as bearing trees versus line-note trees. That is, there is not a strong case for species bias in selecting bearing trees. The fact that generic oak, pine, aspen, and hardwoods appear to have been avoided, but oaks, pines, aspen, and hardwoods identified to species appear

preferred, seems to indicate that surveyors tended more often to identify a tree to species if it was a bearing tree and generalize the type in the line-note. If the sum of types with generic terms are compared, there are no cases of clear bias as defined by the doubling or halving rule.

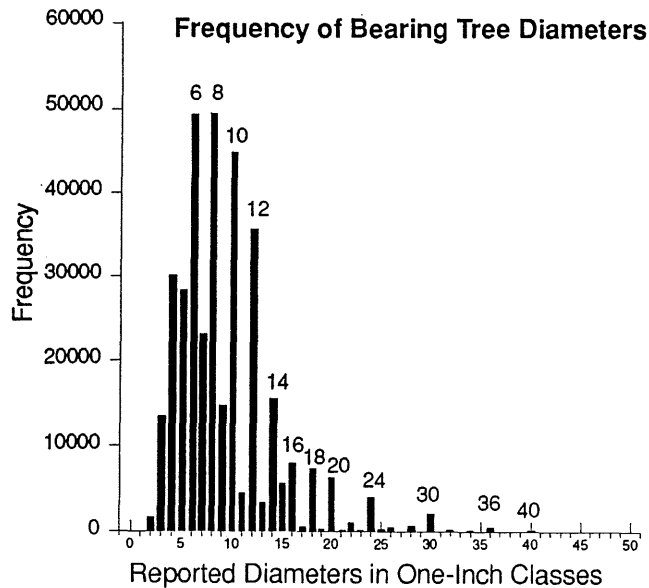


Figure 2. Frequency of bearing tree diameters in Minnesota.

There is clear bias in recording bearing tree diameters. The surveyors were looking for healthy trees to perpetuate the corner and thus, there is a preponderance of 4-10" diameter trees selected (Figure 2). Presumably this is the case because trees of that diameter were clearly established and likely to survive for some time. Figure 2 also shows clear bias for even-inch measurements of smaller trees, and for even feet and tens-of-inches for larger trees. *If diameter data are to be reported for bearing trees, conversion to at least even-inch classes should be performed.* Plots of diameters, comparisons of tree diameters by species within the bearing tree data, and variability of diameters at corners can shed some light on gross vegetation structure and age structure of former forests. *I do not recommend direct comparison of bearing tree diameters with tree diameters in modern forests.*

Considerations for Analysis of Association

Understanding how bearing trees were co-associated is essential to the task of making map units for presettlement vegetation. Comparisons of bearing tree associations with modern associations, is also of ecological interest. For many of the published maps (e.g., Marschner 1974) this was done intuitively. More recently, ecologists have applied quantitative measures of interspecific association to bearing tree data (White and Mladenoff 1994, Almendinger 1985, Grimm 1981). Basically, the idea is to calculate for each pair of bearing tree types, a number that indicates the strength and nature (positive or negative) of the association based upon the number of corners where both species occur together (positive association), the number of corners where neither species occurs (positive association), and the number of corners where one species occurs without the other (negative association). Grimm explains nicely the problems and considerations of applying Cole's Coefficient of Association (Cole 1949) to bearing trees; the reader should also consider reading Pielou (1977) for a broader discussion of measures of interspecific association.

The main problem with applying quantitative measures of ecological association to bearing trees is the small sample size at survey corners (4 trees maximum). Most measures of association were contrived with the assumption that it is theoretically possible for all of the species of interest to co-occur in the sample. Most bearing tree datasets have 15-25 bearing tree taxa, and just 4 can be sampled at any single corner. Table 3 shows the frequency of survey corners with 0-4 trees recorded. *Although it greatly reduces the number of corners available for analysis, I recommend using only survey corners with all four trees present for analyses of association.*

Table 3. The number of PLS survey corners, trees per corner, and total bearing trees in the NHIS database.

Number of trees at survey corner	Number of corners	Number of bearing trees
0	106,864	0
1	6,419	6,419
2	96,874	193,748
3	4,507	13,521
4	34,802	139,208
Totals	249,466	352,896

Considerations for Selecting a Study Area

Choosing a study area and units for subanalysis is one of the most important decisions in applying bearing tree data to ecological problems. Size of the study area is the most critical consideration, and appropriate size depends upon the analyses one performs. For example, one of the more common uses of bearing tree data is to show how landforms controlled the distribution of tree types within fairly large areas of Minnesota by looking at maps and by comparing differences in relative abundance of tree types among landforms. In this example, the ecologist needs to configure the study area so that there are enough trees occurring on a landform to calculate reasonable estimates of relative abundance. Increasing the size of a study area increases the reliability of factors estimated from the population of bearing trees in that unit (e.g., relative abundance); however, increased size diminishes the specificity of the results that can be applied back to the landscape. Also, increasing the size of the study area relieves some concern about the errors discussed above. This can also relieve some of the concern about bias, because different survey crews clearly had different biases in selecting bearing trees that may offset one another. *A general rule for analyses influenced by the frequency of bearing tree types is that the study area should be large enough to pick up about 25 individuals of the least abundant type of interest, with rarer types eliminated from the analysis.*

The size of the study area also strongly influences analysis of association. For most measures of association, 2x2 contingency tables are constructed for each pair of tree types where the four cells of the table contain the frequency of their joint occurrence, joint absence, and the two cases where one is present without the other. The ecologist should select a study area large enough so that, for

the set of tree types considered (usually ~20), most of the cells of the contingency table cells are filled with numbers other than zero. By restricting the set of tree types to the more common taxa, the ecologist can eliminate survey corners where rare types create lots of zero frequencies in the contingency tables. *In my experience, study areas with less than about 400 corners with the full contingent of four bearing trees (1,600 trees) of the types being considered is about the minimum size for analysis of association. For the forested portions of Minnesota, townships have a mean of about 25 survey corners with 4 trees, therefore about 16 full townships are needed to reach the 400 corner minimum.*

Checking and Corroborating Bearing Tree Data

There is no better way to check bearing tree data than to plot the tree types and diameters. Observable pattern in tree types and diameters should make some geographical and ecological sense. Surveyor bias and nomenclature problems are often made obvious by comparing areas mapped by different survey crews. Often, type ambiguity can be reasonably cleared up by studying the plots. Clearly erroneous corners can be eliminated from the analytic dataset. *Any modification of the NHIS bearing tree data that appears justified from the plots should be reported in the methods section of any published work and reported to the NHIS.*

PLS bearing tree data are, for the most part, a landscape-scale tool. Most of the valid criticism of their application to ecological problems comes when the ecologist tries to reconstruct or characterize presettlement vegetation for areas that are simply too small. All applications of bearing tree data benefit from corroboration of historical descriptions of presettlement vegetation, but such corroboration is essential for small study areas. The PLS line notes and line descriptions are an excellent source of additional finer-scale data to help interpret bearing tree analyses. The line notes are comprehensive and can be associated with survey corners. The line descriptions were to contain, in order of abundance, *all* of the tree types encountered and therefore, can help ecologists get around the problem created by selecting just two or four trees at a survey corner. The types listed in the line notes should also be free of any surveyor bias associated with ease of marking bearing trees and bias based upon expected longevity. Historic journals from early expeditions, notes from the construction of the military road system, the writings of N.H. Winchell and W. Upham associated with the Minnesota Geological and Natural History Survey (*ca.* 1875-1890), and the personal journals of the Deputy Surveyors can all contribute to a better interpretation of bearing tree data.

Description of the NHIS Bearing Tree Database

The NHIS Bearing Tree Database consists of two flat files, linked by a single overlap variable, TWP_RNG, formed from the combination of township and range number, e.g. T143NR36W. One database, BTSTWP, contains a single record for each of the 2,674 townships in Minnesota. The other database, BTS, contains a single record for each survey corner associated with a township, including section corners, quarter-section corners, the north township boundary, the east township boundary, and the south township boundary for townships just north of standard “correction” parallels. There are 108 corners for standard townships, and 120 for townships that include also the south boundary, where the corners do not match the north boundary of the township below. A schematic showing the

standard corner numbering is shown in Appendix C. Tables 4 and 5 below present the table definitions of the variables, their type, and length in the two flat files containing the bearing tree data.

Except for the bearings (DIRECT1-4), there are few unfilled variables in the BTS database. Grimm (1981) and Almendinger (1985) did not record the bearings, and many of the first townships collected by the Minnesota County Biological Survey also do not have bearings recorded. *Consequently, GIS plots of actual bearing tree locations are possible only for part of the state.* In practice this is generally not important for maps of many townships, where the convention has been to add or subtract 200m from both the northings and eastings of the Universal Transverse Mercator (UTM) coordinates for a survey corner in order to produce a point cover of bearing trees. For example, 200m would be added to both UTM coordinates for a bearing tree NE of a survey corner, and 200m would be subtracted from both UTM coordinates for a bearing tree SW of a survey corner. The net effect of making plots this way is to form a near-perfect grid of coordinates for bearing tree plots that can serve as the centers of map symbols.

Table 4. Variable names, length, type, and description for data records associated with standard PLS survey corners in Minnesota (BTS database).

Variable Name	Length	Type	Description
TWP	5	A	township number, e.g. T154N
RNG	4	A	range number, e.g. R23W
TIC	4	N	standard survey corner number, see attached
VEGTYPE	1	A	code for vegetation type, see below
SPECIES1-4	2	A	code for tree type, see Table 1 for codes
DIAM1-4	2	N	tree diameter in inches
DIRECT1-4	4	A	bearing, e.g. S15°E (=165° azimuth)
DIST1-4	4	N	distance from corner in links (7.92 inches)
XTIC	6	N	corner UTM coordinate relative to Zone 15
YTIC	6	N	corner UTM coordinate relative to Zone 15, shifted - 4,700,000m
TWP_RNG	9	OV	overlapped TWP and RNG fields

Table 5. Variable names, length, type, and description for data records associated with each PLS township in Minnesota (BTSTWP database).

Variable Name	Length	Type	Description
TWP	5	A	township number, e.g. T154N
RNG	4	A	range number, e.g. R23W
MERIDIAN	1	A	principle meridian (4th or 5th)
COLLECTOR	20	A	name of person collecting the data
SUBDIVNAME	20	A	name of surveyor performing township subdivision
SUBDIVDATE	20	A	date of the subdivision
NBOUNDNAME	20	A	name of surveyor of the north township boundary
NBOUNDDATE	20	A	date of survey of north township boundary
EBOUNDNAME	20	A	name of surveyor of the east township boundary
EBOUNDDATE	20	A	date of survey of east township boundary
TWP_RNG	9	OV	overlapped TWP and RNG fields

In addition to the standard listing of bearing tree type, diameter, bearing, and distance from the corner, the collectors were instructed to record the vegetation type at the corner. This information was recorded from the line notes when stated, or inferred from the line summary if not specifically referenced in the line notes. *These codes are especially valuable in reconstructing the gross physiognomy of the vegetation and help with interpretation of the bearing tree data.* Tree distances and diameters are correlated with the vegetation codes. *The vegetation types allow the ecologist to subdivide the bearing tree datasets for more limited analyses.* For example, one might eliminate all aquatic and wetland corners in order to understand tree associations on upland habitats. The vegetation codes and descriptions are presented below in Table 6.

Table 6. Vegetation codes, description, frequency, and percent for 249,466 PLS survey corners in Minnesota.

Vegetation Code	Description	Frequency	Percent
A	creek	155	0.06
B	oak barrens	1,391	0.55
C	plowed field, field	98	0.03
D	dry ridge	513	0.20
E	meadow	1,682	0.67
F	forest, timber	76,344	30.60
G	grove	289	0.11
H	bottom	2,863	1.14
I	pine openings, pine barrens, scattered pine	505	0.20
J	pine grove	28	0.01
K	scattering oak, scattering timber	7,957	3.18
L	lake, slough, pond	9,786	3.92
M	marsh	11,670	4.67
N	dry land	293	0.11
O	oak openings	2,167	0.86
P	prairie	81,439	32.64
R	river	1,268	0.50
S	swamp	30,401	12.18
T	thicket, brush, underbrush	8,989	3.60
U	burned area	3,536	1.41
V	valley, ravine	226	0.09
W	windthrow, windfall	1,384	0.55
X	only tree around	259	0.10
Y	island	57	0.02
Z	wet prairie	986	0.39
blank	no code recorded by collector	5,180	2.07
Totals		249,466	99.86

Obtaining and Citing Bearing Tree Data

Data Sources

Bearing tree data in computerized formats as described in this document are obtainable from the Minnesota Natural Heritage & Nongame Research Program.

Richard Baker, Information Systems Manager
Minnesota Natural Heritage and Nongame Research Program
Department of Natural Resources
Box 25
500 Lafayette Rd.
St. Paul, MN 55155
(612) 297-3764

Microfilms of the General Land Office's hand-copies of the "original" PLS notes can be viewed at the Wilson Library.

Wilson Library
University of Minnesota, West Bank Campus
Minneapolis, MN 55455
(612) 626-2227

The bound volumes of the "original" PLS notes and plat maps turned over to the State of Minnesota are housed at the Minnesota Historical Society.

Minnesota Historical Society
Attn: Charles Rodgers
345 Kellogg Bvd. W
St. Paul, MN 55102
(612) 297-2344

Scanned microfilms of the "original" PLS notes and plat maps are housed at the Minnesota Secretary of State's office.

Minnesota Secretary of State
Attn: Bert Black
180 State Office Bldg.
100 Constitution Ave.
St. Paul, MN 55155
(612) 296-9215

Appropriate Citation and Acknowledgment

The PLS survey notes are some of the first truly public information collected by the Federal Government and have always been available for use. Ecologists at the University of Minnesota and other academic or government institutions in Minnesota have long used these data for ecological interpretations. The collection of PLS data in a computerized format was initiated by Eric Grimm and Edward Cushing of the University of Minnesota, and they deserve much of the credit for the database design and the collection of 193 townships in the area of the Big Woods. Also under the tutelage of Edward Cushing, John Almendinger later collected 88 townships of PLS bearing tree data in north-central Minnesota. These 281 townships formed the initial core of the computerized records, and studies using data from these townships should acknowledge these individuals as the source of computerized data or cite their respective theses (Grimm 1981, Almendinger 1985). The initiative for collecting the remaining 2,393 townships was provided by the Minnesota County Biological Survey (MCBS), Division of Fish and Wildlife with support from the Division of Forestry, Minnesota Department of Natural Resources. Sharron Nelson (MCBS) directed the data collection. The data from these three sources are managed by the Minnesota Natural Heritage and Nongame Research Program, and they request the following acknowledgment:

The bearing tree data included here were provided by the Minnesota Natural Heritage and Nongame Research Program of the Division of Fish and Wildlife, Minnesota Department of Natural Resources (DNR). The DNR is not responsible for any inaccuracies in these data. Use of these data does not imply endorsement or approval by the DNR of any interpretations or products derived from the data.

The PLS records have been variously cited in ecological literature. The following citation is appropriate for the records pertaining to Minnesota:

U.S. Surveyor General. 1847-1908. Field notes: Township and exterior subdivision lines. Minnesota State Archives, 57.J.5.9B-57.J.8.8F, Minnesota Historical Society, St. Paul.

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Appendices

Appendix A -- Instructions for Information to be Collected

Most of Minnesota was surveyed according to the 1855 instructions to the surveyors. Below is the appropriate excerpt from White's (1983) reprinting of that manual covering the information required in a contract PLS survey. Italics and capitalizations are theirs in all cases.

SUMMARY OF OBJECTS AND DATA REQUIRED TO BE NOTED.

1. The precise length of every line run, noting all necessary offsets therefrom, with the reason and mode thereof.
2. The kind and diameter of all "*bearing trees*," with the course and distance of the same from their respective corners; and the precise relative position of WITNESS CORNERS to the *true corners*.
3. The kinds of materials (earth or stone) of which MOUNDS are constructed -- the fact of their being conditioned according to instructions -- with the course and distance of the "*pits*," from the centre of the mound, where necessity exists for deviating from the *general rule*.
4. *Trees on line*. The name, diameter, and distance on line to all trees which it intersects.
5. Intersections by line of *land objects*. The distance at which the line first intersects and then leaves every *settler's claim and improvement*; prairie; river, creek, or other "*bottom*;" or swamp, marsh, grove, and wind fall, with the course of the same at both points of intersection; also the distances at which you begin to ascend, arrive at the top, begin to descend, and reach the foot of all remarkable hills and ridges, with their courses, and *estimated* height, in feet, above the level land of the surrounding country, or above the bottom lands, ravines, or waters near which they are situated.
6. Intersections by line of *water objects*. All rivers, creeks, and smaller streams of water which the line crosses; the distance on line at the points of intersection, and their *widths on line*. In cases of *navigable* streams, their width will be ascertained between the *meander corners*, as set forth under the proper head.
7. The land's *surface*--whether level, rolling, broken, or hilly.
8. The *soil*--whether first, second, or third rate.
9. *Timber*--the several kinds of timber and undergrowth, in the order in which they predominate.
10. *Bottom lands*--to be described as wet or dry, and if subject to inundation, state to what depth.
11. *Springs of water*--whether fresh, saline, or mineral, and the course of the stream flowing from them.
12. *Lakes and ponds*--describing their banks and giving their height, and also the depth of water, and whether it be pure or stagnant.
13. *Improvements*. Towns and villages; Indian towns and wigwams; houses or cabins; fields, or other improvements; sugar tree groves, sugar camps, mill seats, forges, and factories.
14. *Coal banks or beds*; *peat* or turf grounds; *minerals* and ores; with particular description of the same as to quality and extent, and all *diggings* therefor; also *salt* springs and licks. All reliable information you can obtain respecting these objects, whether they be on your immediate line or not, is to appear in the general description to be given at the end of the notes.
15. *Roads and trails*, with their directions, whence and whither.
16. Rapids, cataracts, cascades, or falls of water, with the height of their fall in feet.
17. Precipices, caves, sink-holes, ravines, stone quarries, ledges of rocks, with the kind of stone they afford.
18. *Natural curiosities*, interesting fossils, petrifications, organic remains, &c.; also all ancient works of art, such as mounds, fortifications, embankments, ditches, or objects of like nature.
19. The *variation* of the needle must be noted at all points or places on the lines where there is found any material *change* of variation, and the position of such points must be perfectly identified in the notes.
20. Besides the ordinary notes taken on line, (and which must always be written down on the spot, leaving nothing to be supplied by memory,) the deputy will subjoin, at the conclusion of his book, such further description or information touching any matter or thing connected with the township (or other survey) which he may be able to afford, and may deem useful or necessary to be known--with a *general description* of the township in the *aggregate*, as respects the face of the country, its soil and geological features, timber, minerals, waters, &c.

Appendix B -- Instructions for Selecting Bearing Trees in Minnesota

FOR SURVEYS RELATIVE TO THE 4TH PRINCIPAL MERIDIAN, 1847-1852

On 12 June 1838 Congress approved a statute (5 Stat. 235) that divided the Iowa Territory from the Wisconsin territory, thus placing the portions of Minnesota east of the Mississippi river in the Wisconsin Territory and the portions of Minnesota west of the Mississippi river in the Iowa Territory. In 1846 the 4th Principal Meridian was extended northward from southern Wisconsin to Lake Superior and provided the starting point for the survey of standard parallels westward into Minnesota. Thus, land surveyed prior to 1852 in Minnesota relative to the 4th Principal Meridian were executed under the *General Instructions* issued by the Office of the Surveyor General of Wisconsin and Iowa, Dubuque, May 28, 1846 (see White 1983 p. 339). The instructions for establishing bearing trees are extracted from that document and presented below:

“Bearing trees are those of which you take the course and distance from a corner. They are distinguished by a large smooth blaze or chop, fronting the corner, upon which is marked, with an iron made for that purpose, the number of the range, township and section, except at quarter section corners where 1/4 S. will supply the number of the section, thus;

R ----- E. or W.

T ----- N.

S ----- or 1/4 S.

The letters B.T. are also to be marked upon a smaller chop, directly under the large one and as near the ground as practicable.”

“From all posts established for township corners, or for section corners upon township lines, four bearing trees, if within a reasonable distance, must be taken; one to stand within each of the four sections.”

“At the interior section corners, one to stand within each of the four sections, are to be marked; two of them as bearing and two as witness trees.”

“From quarter section and meander corners two bearing trees are marked, one within each of the adjoining sections.”

FOR SURVEYS RELATIVE TO THE 4TH AND 5TH PRINCIPAL MERIDIANS 1852-1855.

On 3 March 1849, the Territory of Minnesota was created, and the Surveyor General of Iowa and Wisconsin was to administer the continued survey of Minnesota. On that very same date, the U.S. Department of Interior was created and absorbed the General Land Office among other agencies. One of the first things accomplished by the Department of Interior was the publication of *Instructions to the Surveyor General of Oregon; Being a Manual for Field Operations* (White 1983, p.433) in 1851. This manual was prepared for the initial rectangular survey of Oregon, and on 10 July 1852 the Surveyor General of Iowa and Wisconsin was instructed to use the Oregon instructions for surveys in Minnesota relative to the 5th Principal Meridian. My interpretation of White (1983) is that surveys relative to the 4th Principal Meridian also fell under these instructions at that time. The instructions for establishing bearing trees are extracted from that document and presented below:

“The position of all corner posts, or corner trees, of whatever description, which may be established, is to be perpetuated in the following manner, viz: From such post or tree the courses shall be taken, and the distances measured, to two or more adjacent trees, in opposite directions, as nearly as may be, which are called “*bearing trees*,” [italics theirs] and are to be blazed near the ground, with a large blaze facing the post, and have one notch in it, neatly and plainly made with an axe, square across, and a little below the middle of the blaze. The kind of tree and the diameter of each are facts to be distinctly set forth in the field book.

On each bearing tree the letters B.T., to denote the fact of its being a bearing tree, must be distinctly cut into the wood, in the blaze, a little above the notch, or on the bark with the number of the range, township, and section.

At all township corners, and at all section corners, on range or township lines, *four* [italics theirs] bearing trees are to be marked in this manner, one in each of the adjoining sections.

At interior section corners *four* [italics theirs] trees, one to stand within each of the four sections to which such corner is common, are to be marked in manner aforesaid, is such be found.

... From quarter section and meander corners two bearing trees are to be marked, one within each of the adjoining sections.”

FOR SURVEYS RELATIVE TO THE 4TH AND 5TH PRINCIPAL MERIDIANS 1855-1864.

A new manual, *Instructions to the Surveyors General of Public Lands of the United States, for Those Surveying Districts Established in and since the Year 1850; containing, also A Manual of Instructions to regulate the Field Operations of Deputy Surveyors, Illustrated by Diagrams*, was published in 1855. This was the manual that guided the rectangular survey of most lands in the United States, and set the standards for the survey with only slight modification in later years. The instructions for establishing bearing trees are extracted from that document and presented below:

The position of all corner posts, or corner trees, of whatever description, that may be established, is to be evidenced in the following manner, viz: From such post or tree the courses must be taken and the distances measured to two or more adjacent trees in opposite directions, as nearly as may be, and these are called “bearing trees.” Such are to be distinguished by a large *smooth blaze*, [italics theirs] with a *notch* [italics theirs] at its lower end, facing the corner, and in the blaze is to be marked the number of the *range, township, and section* [italics theirs]; but at quarter section corners nothing but 1/4 S. Need be marked. The letters B.T. (Bearing tree) are also to be marked upon a smaller blaze directly under the large one, and as near the ground as practicable.

At all township corners, and at all section corners, on range or township lines, *four* [italics theirs] bearing trees are to be marked in this manner, one in each of the adjoining sections.

At interior section corners *four* [italics theirs] trees, one to stand within each of the four sections to which such corner is common, are to be marked in manner aforesaid, if such be found...

... From quarter section and meander corners two bearing trees are to be marked, one within each of the adjoining sections.

During this period, the office of the Surveyor General was opened in St. Paul (23 May) with no changes in instructions.

FOR SURVEYS RELATIVE TO THE 4TH AND 5TH PRINCIPAL MERIDIANS 1864-1907

An instruction circular, *Instructions to the Surveyors General of the United States, Relating to Their Duties and to the Field Operations of Deputy Surveyors*, was published in 1864 with a minor revision in instructions for selecting bearing trees.

“Where a tree not less than two and a half inches in diameter can be found for a bearing tree within 300 links of the corner, it should be preferred to the trench or pit.”

The 1864 circular was reprinted in 1871 with no changes concerning bearing trees. The manual published as *Instructions of the Commissioner of the General Land Office to the Surveyors General of the United States relative to the Survey of the Public Land and Private Land Claims* was published in 1881, and it too, had no further instructions for selecting bearing trees than those spelled out in the 1855 Manual and the 1864 note.

The office of the Surveyor General of Minnesota was closed on 4 February 1908, and the records transferred to the State of Minnesota.

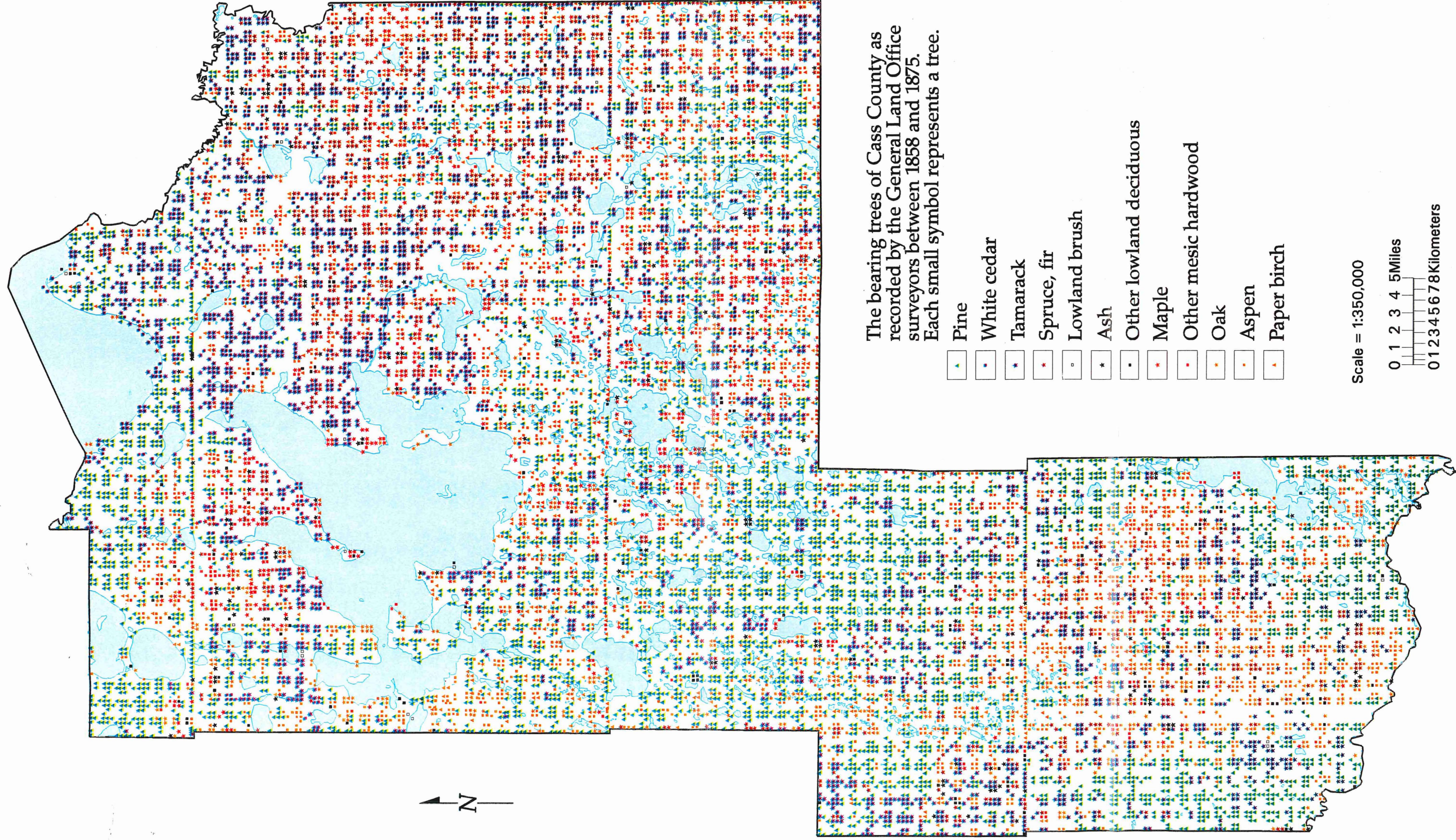
Appendix C -- Schematic of Standard Township Corner Numbers for Computerized Records

Below is the standard numbering system for referencing section and quarter-section corners in the computerized database (variable TIC) for bearing trees. The order for interior corners follows the standard path of township subdivision. The orders for the north, east, and south township boundaries were assigned to increase in the standard direction of survey. Corners 109-120 are recorded only when the south township line is also a standard correction parallel (e.g., corner 119 does not correspond with corner 95 of the next township south).

96	95	94	93	92	91	90	89	88	87	86	108
6 84	85 5 82 83	64 4 62 63	48 3 46 47	32 2 30 31	16 1 14 15	107	106				
7 80	81 8 78 79	61 9 59 60	45 10 43 44	29 11 27 28	13 12 11 12	105	104				
18 76	77 17 74 75	58 16 56 57	42 15 40 41	26 14 24 25	10 13 8 9	103	102				
19 72	73 20 70 71	55 21 53 54	39 22 37 38	23 23 21 22	7 24 5 6	101	100				
30 68	69 29 66 67	52 28 50 51	36 27 34 35	20 26 18 19	4 25 2 3	99	98				
31	65 32	49 33	33 34	17 35	1 36	97					
120	119	118	117	116	115	114	113	112	111	110	109

Bearing Tree Map for Cass County

Bearing trees were mapped in a geographic information system (GIS) from original surveyors' maps by Sharron Nelson, NHNGR Program. Species grouped by color.



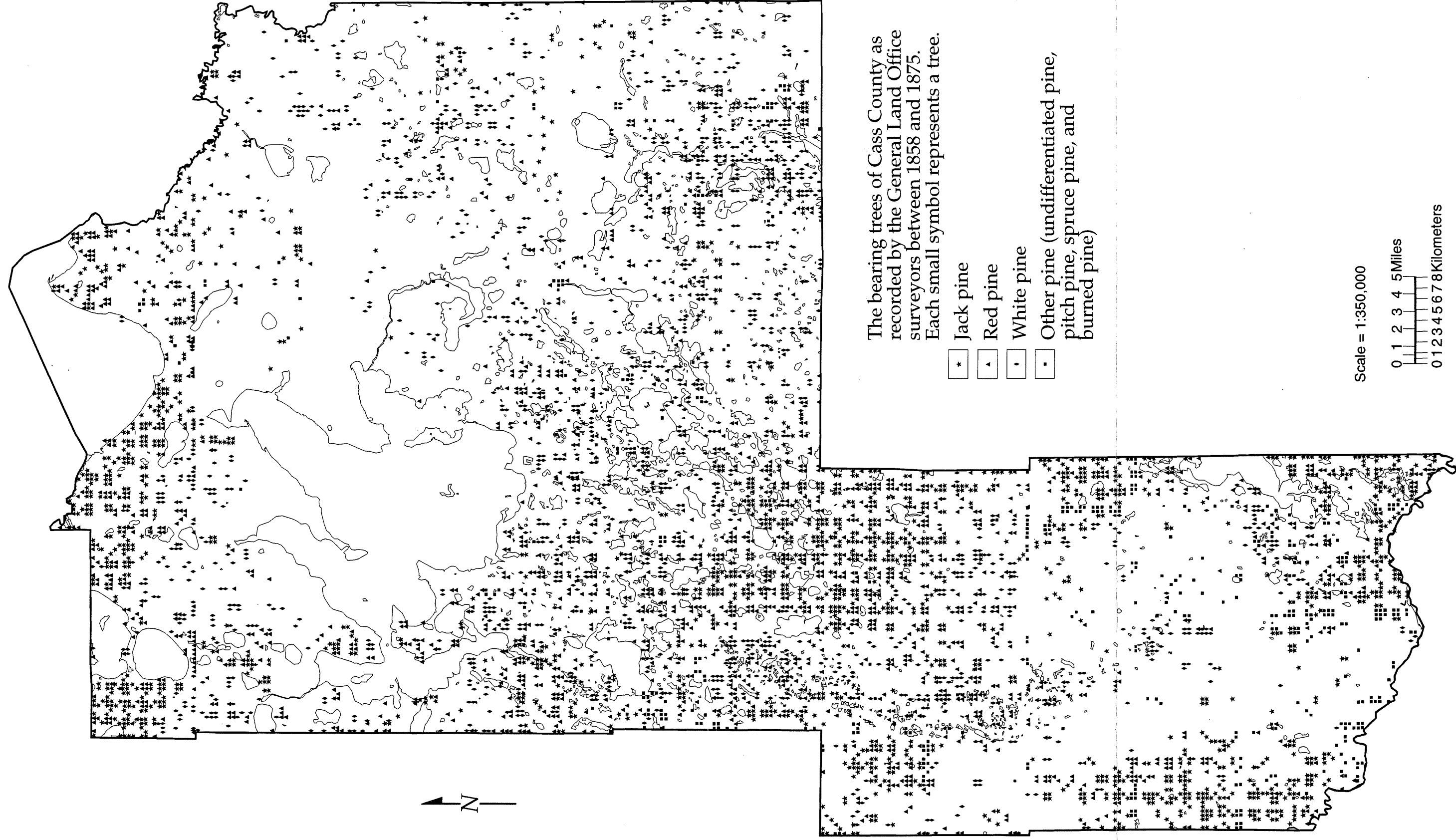
The bearing trees of Cass County as recorded by the General Land Office surveyors between 1858 and 1875. Each small symbol represents a tree.

- | | |
|--|-------------------------|
| | Pine |
| | White cedar |
| | Tamarack |
| | Spruce, fir |
| | Lowland brush |
| | Ash |
| | Other lowland deciduous |
| | Maple |
| | Other mesic hardwood |
| | Oak |
| | Aspen |
| | Paper birch |

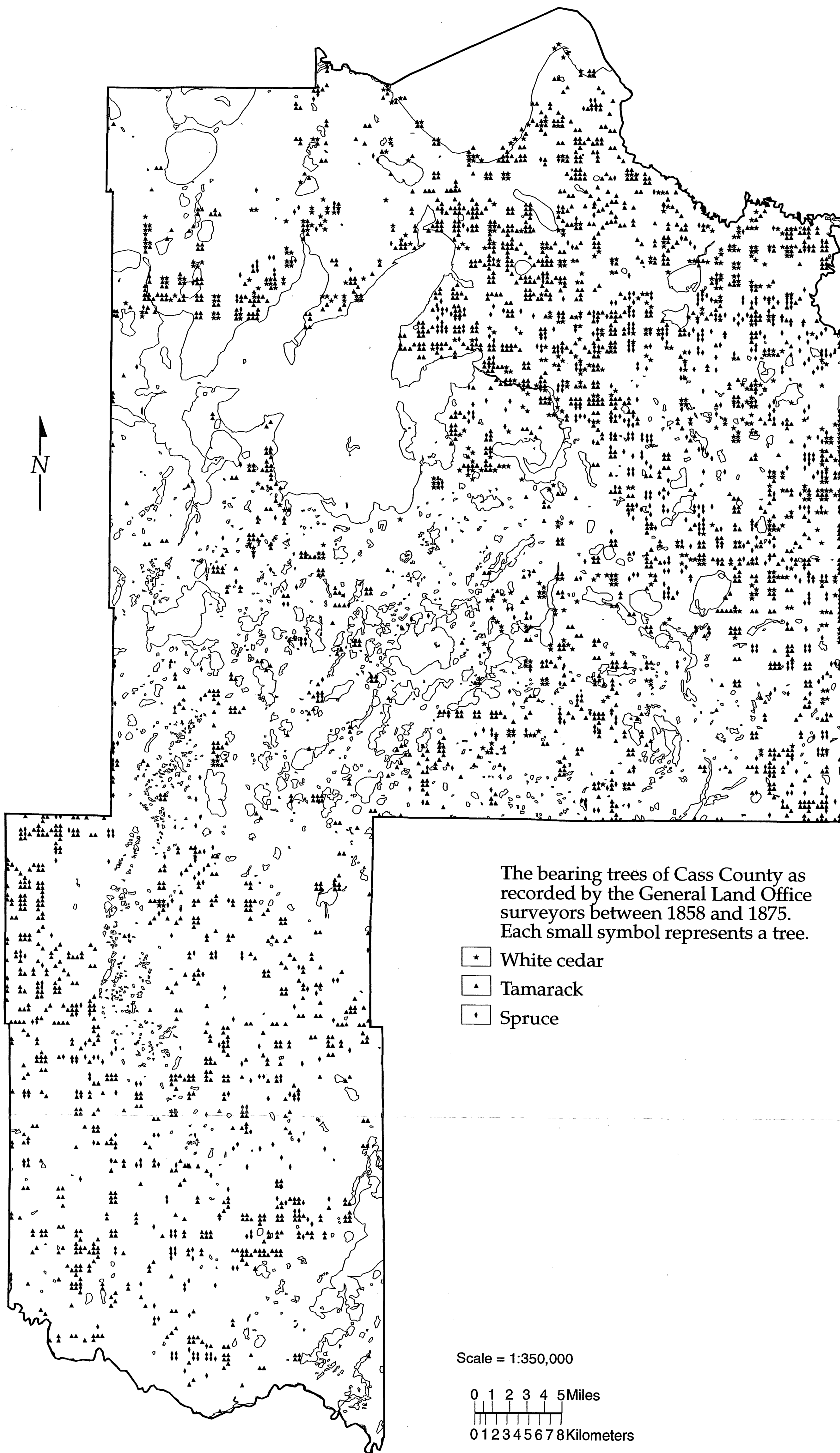
Scale = 1:350,000

0 1 2 3 4 5 Miles
0 1 2 3 4 5 6 7 8 Kilometers

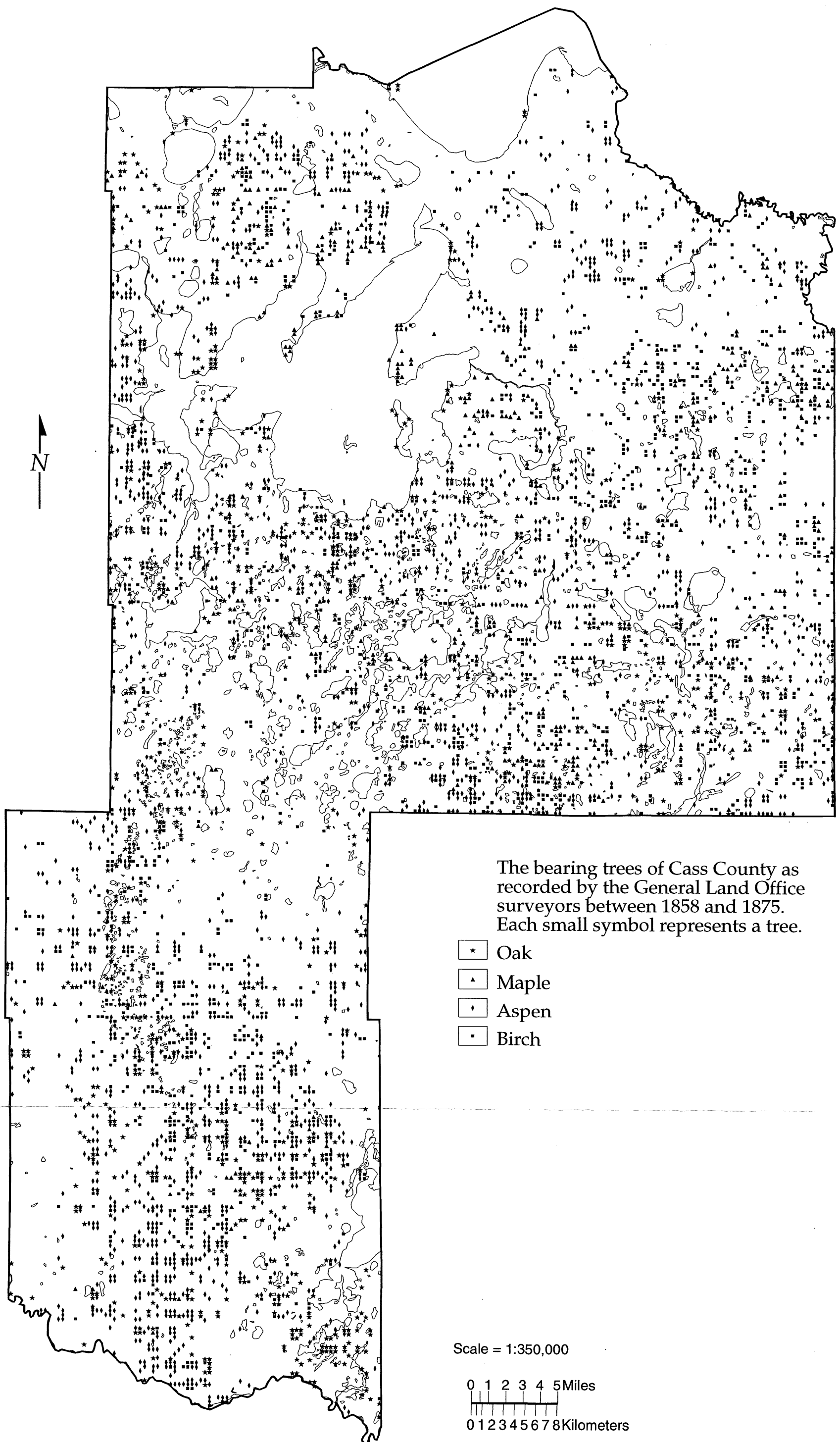
*Cass County Bearing Tree Map
Showing Pine*



*Cass County Bearing Tree Map
Showing Lowland Conifer*



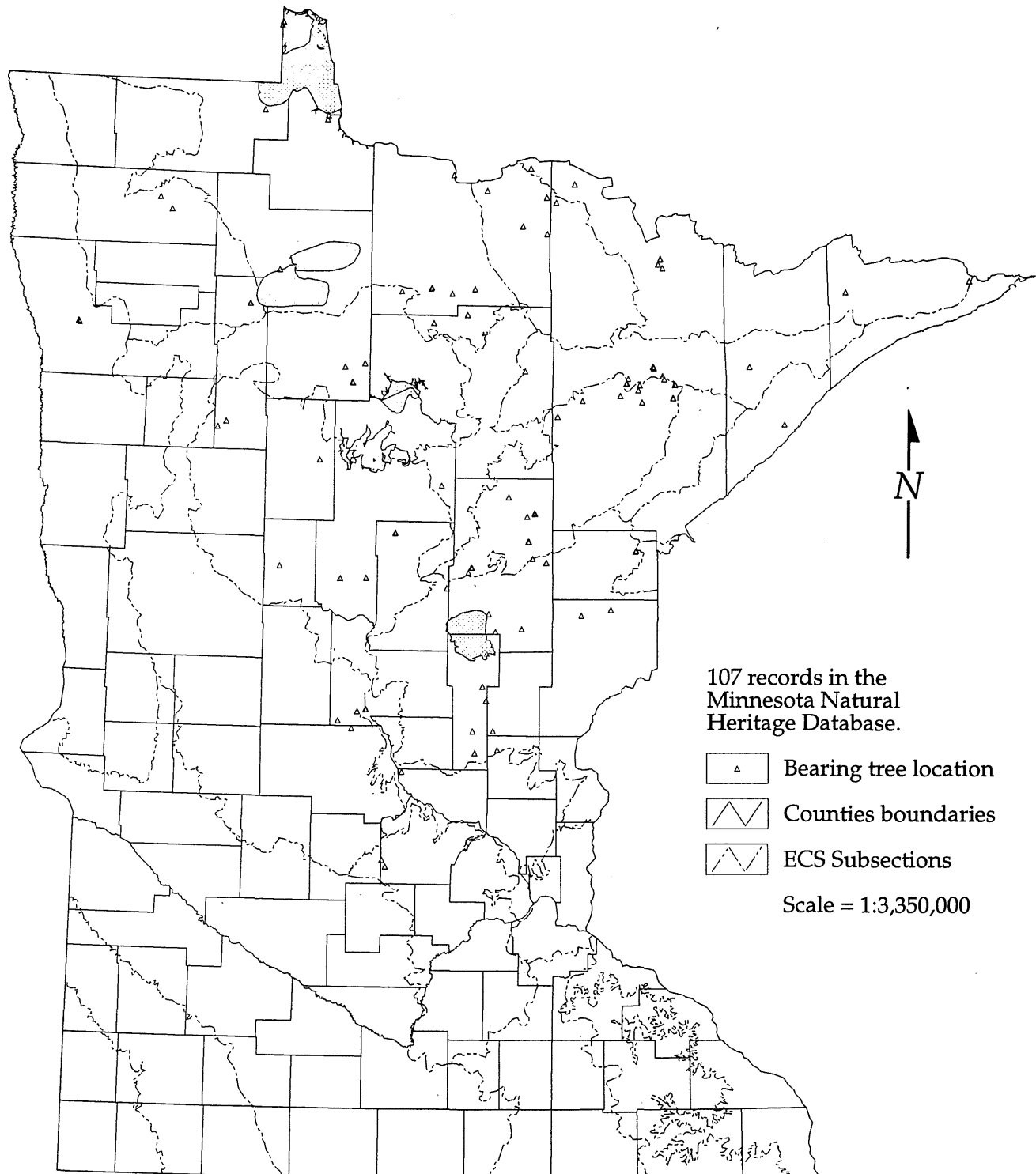
*Cass County Bearing Tree Map
Showing Hardwoods*



*State-wide Species Distribution Maps
Based on Bearing Tree Data*

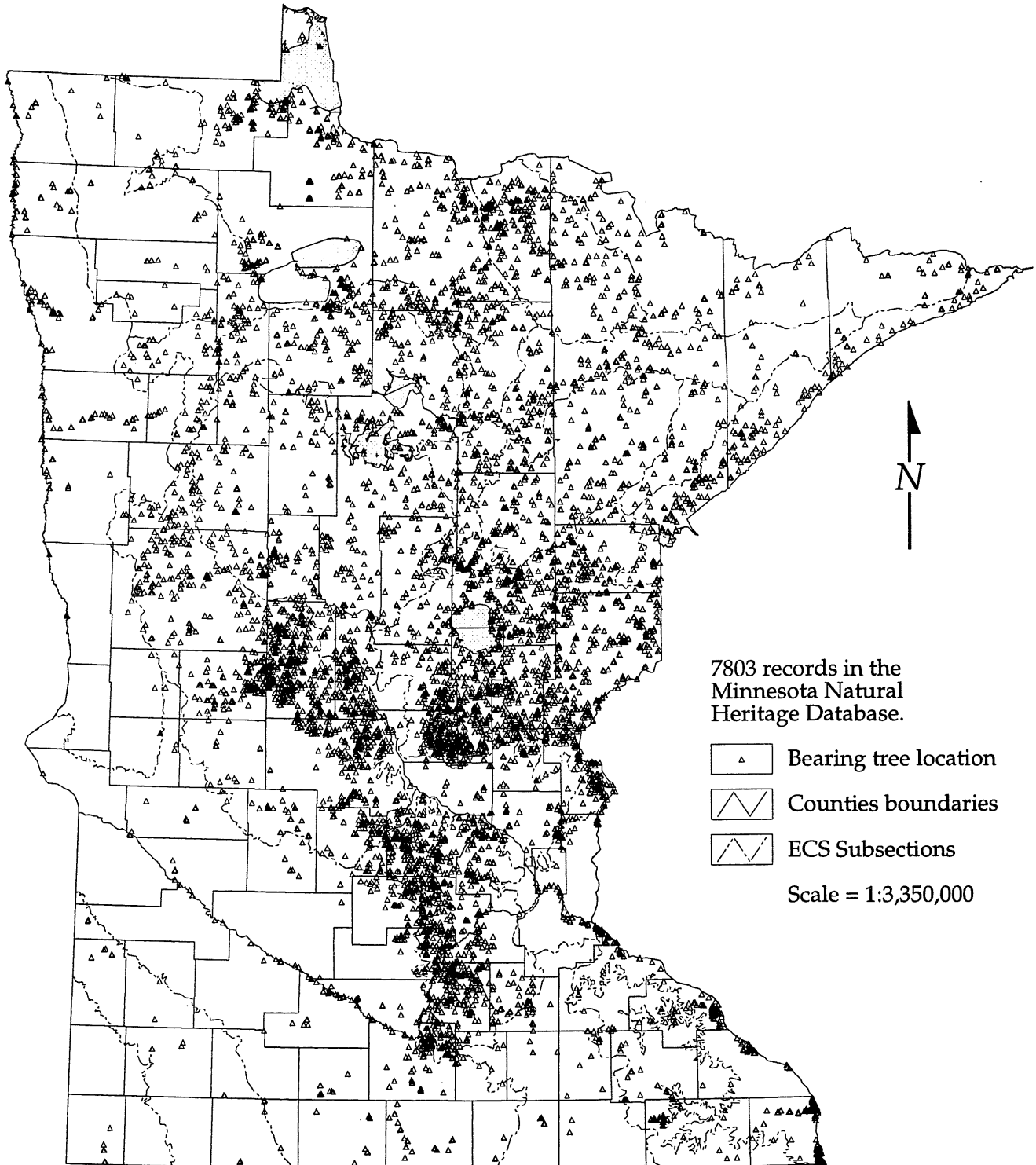
Alder

Original Land Survey Bearing Trees



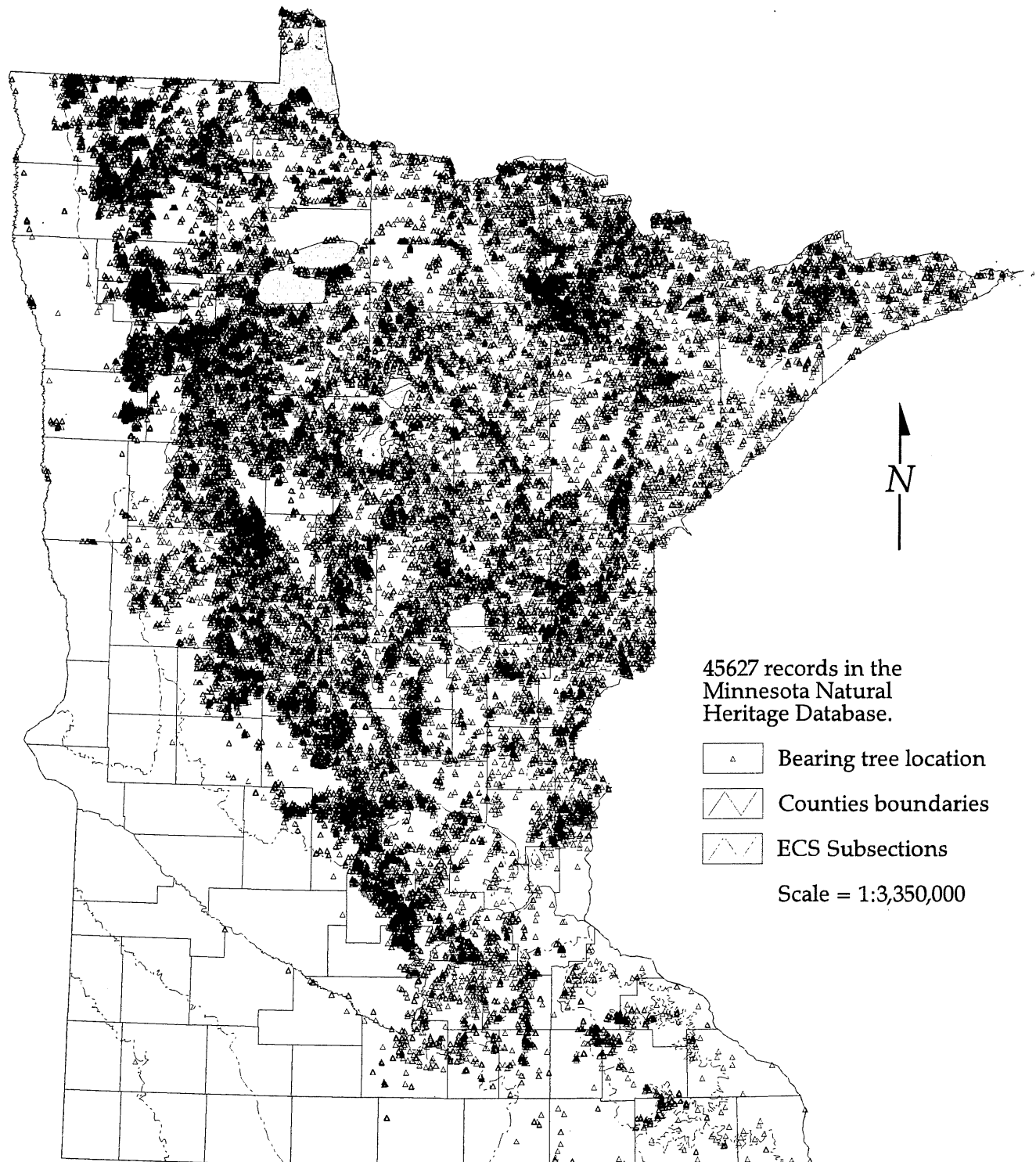
Ash

Original Land Survey Bearing Trees

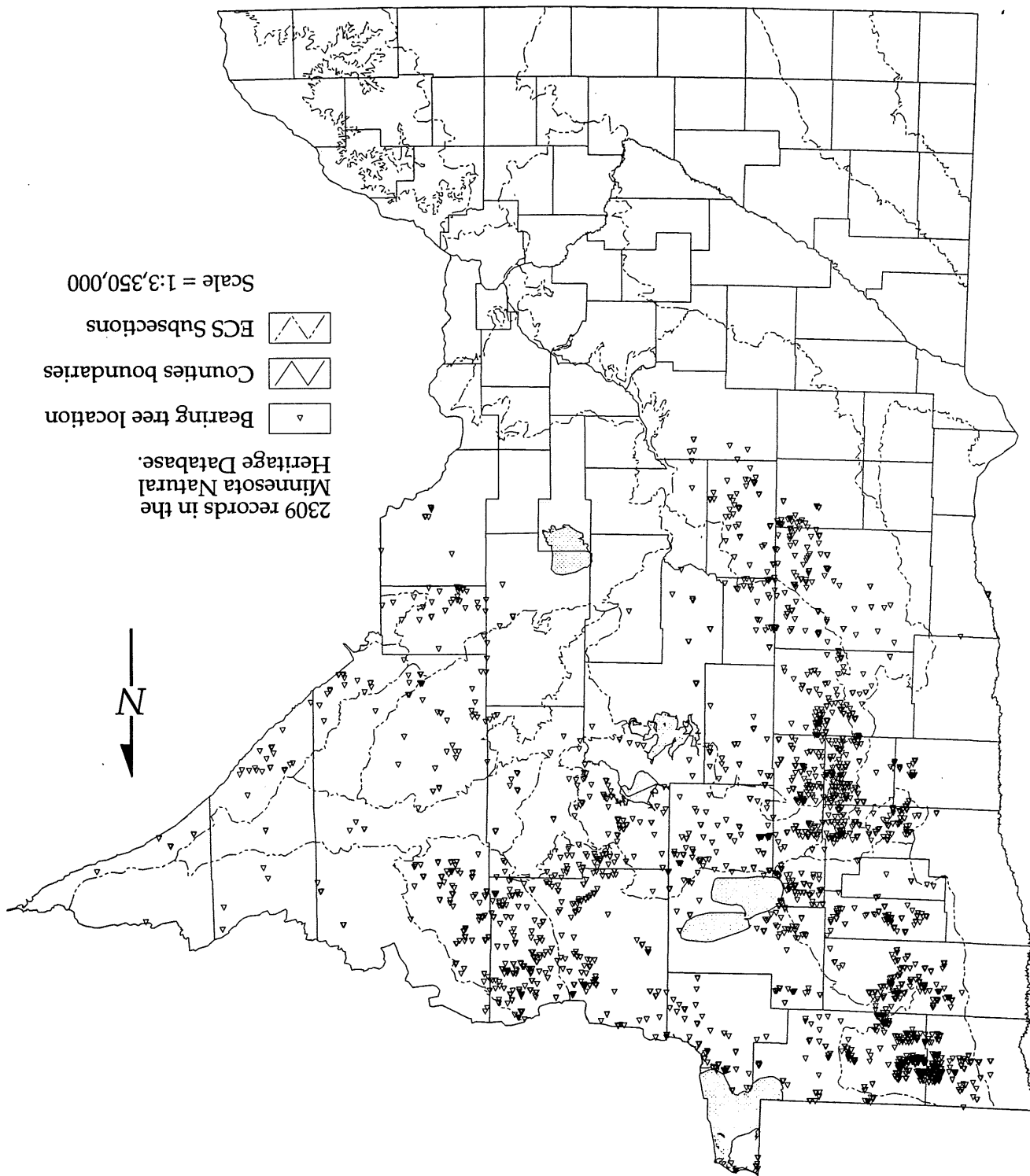


Aspen

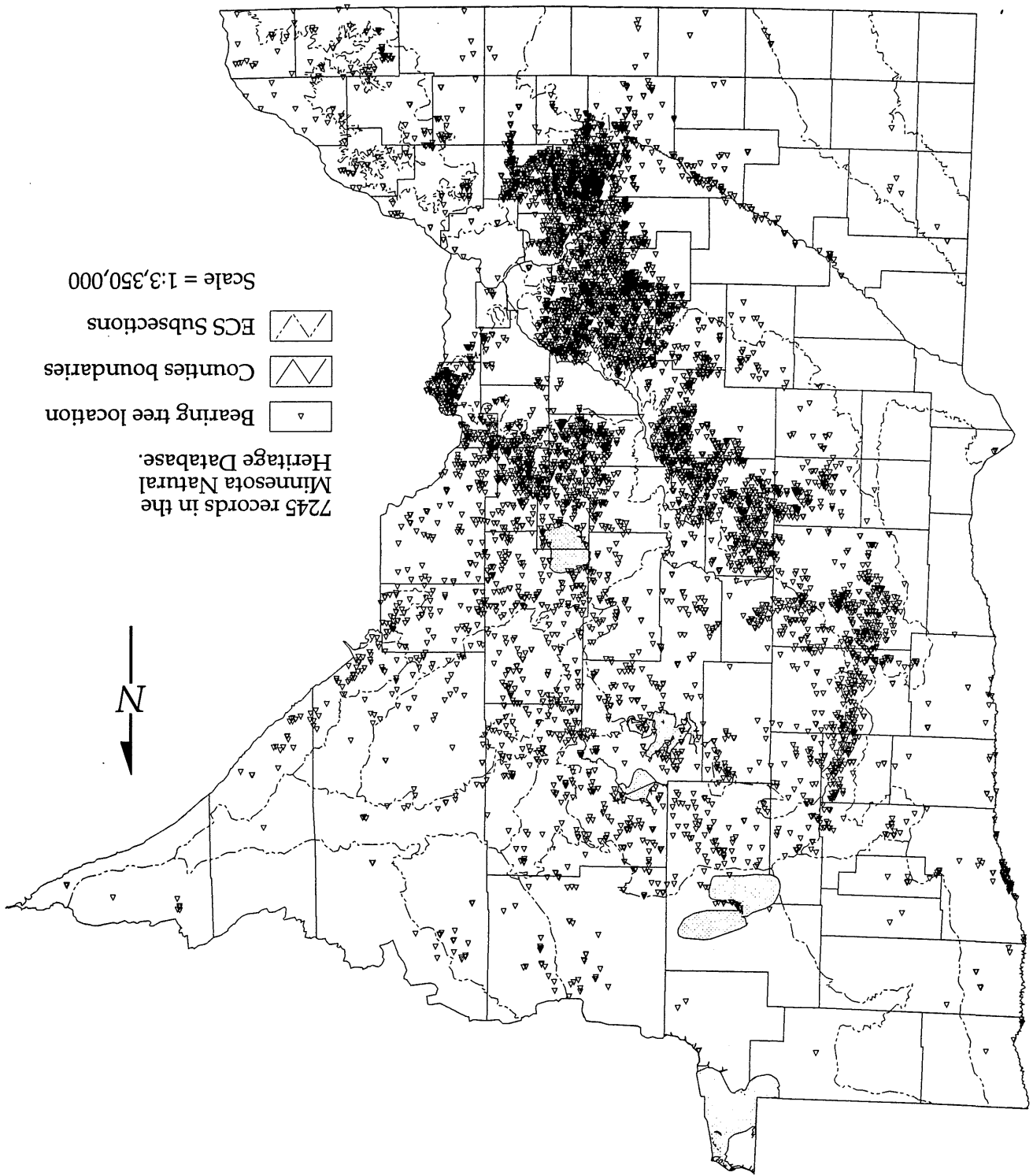
Original Land Survey Bearing Trees



Balm of Gilead Original Land Survey Bearing Trees

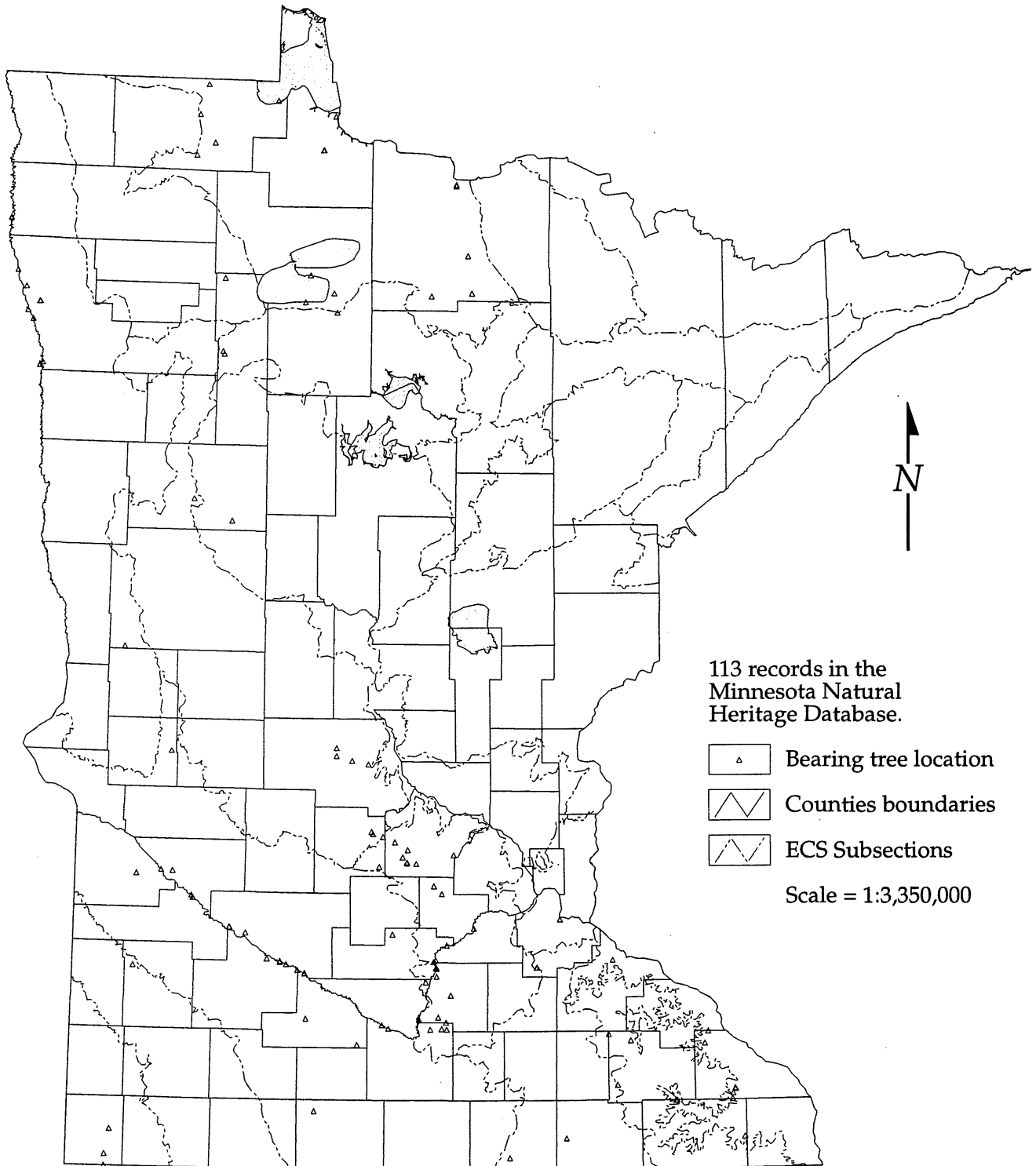


Basswood Original Land Survey Bearing Trees



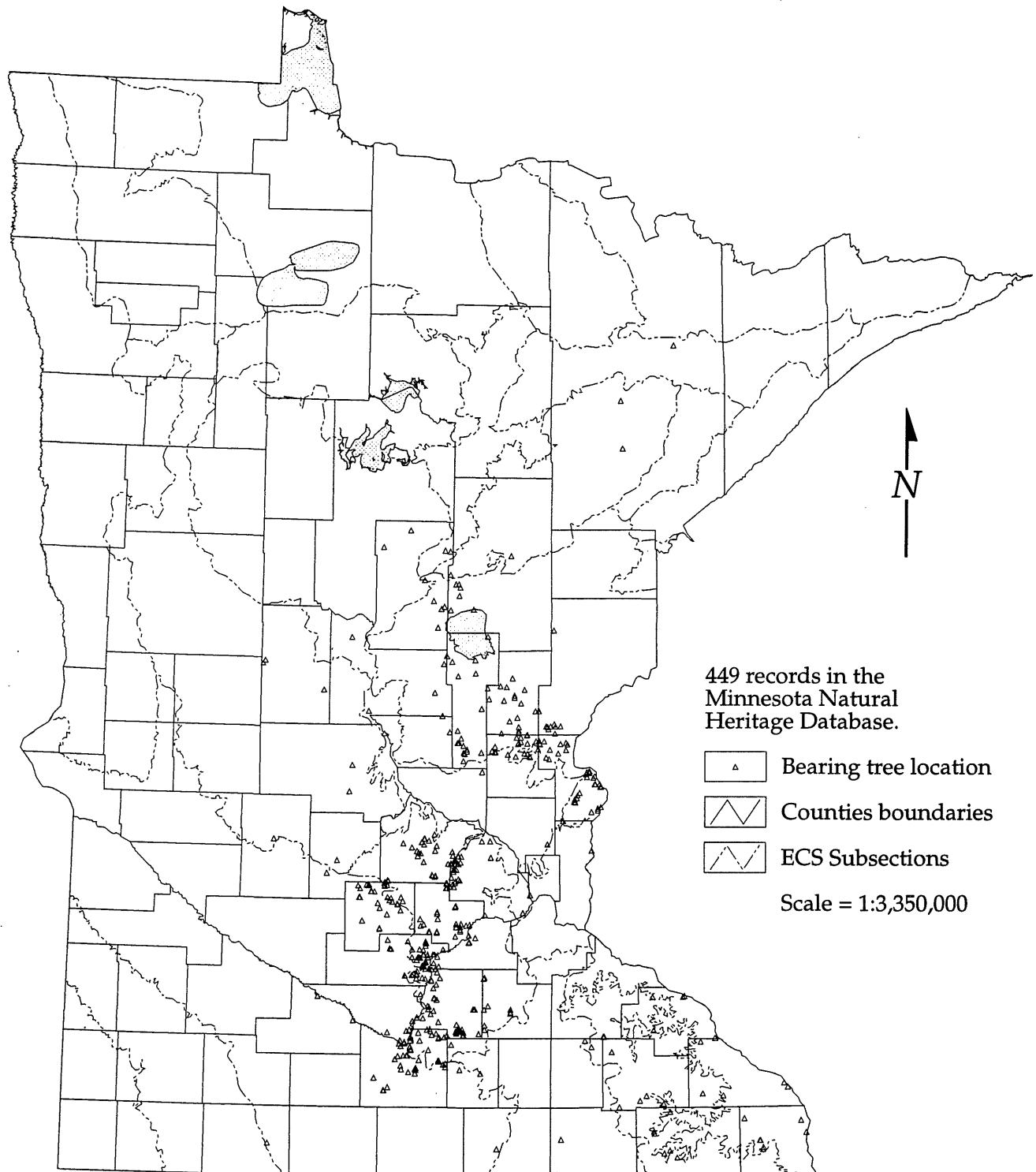
Boxelder

Original Land Survey Bearing Trees



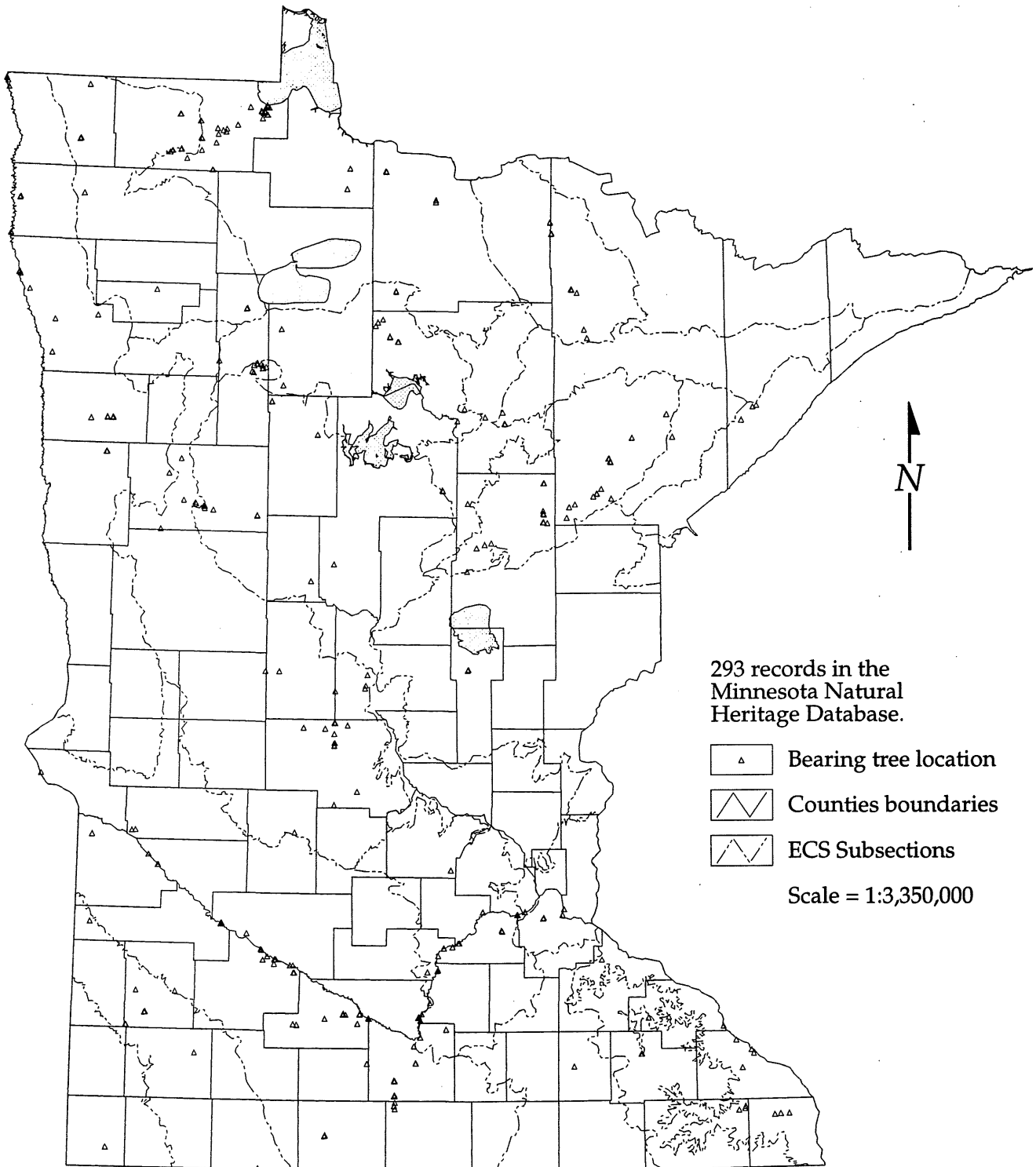
Butternut

Original Land Survey Bearing Trees

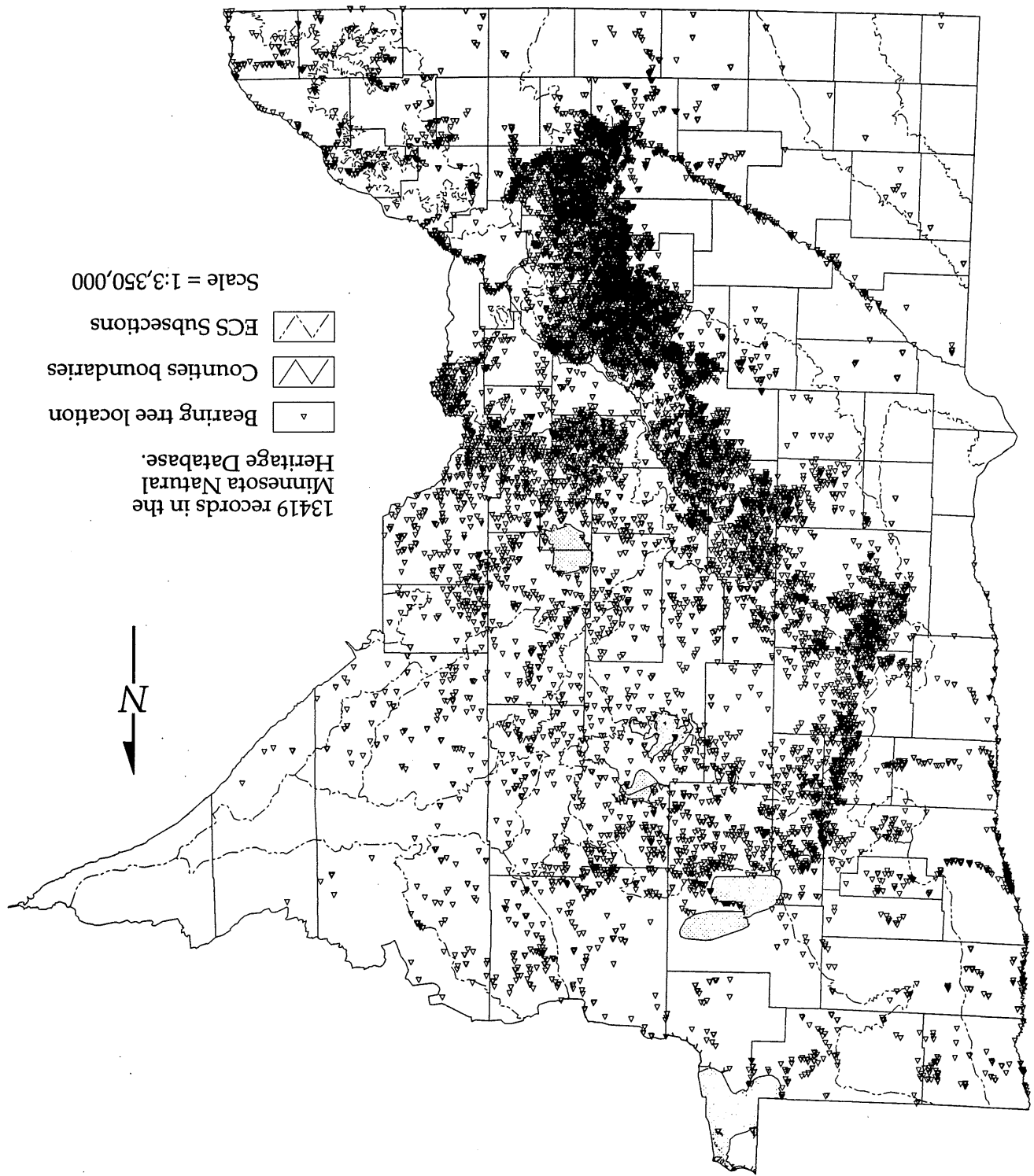


Cottonwood

Original Land Survey Bearing Trees

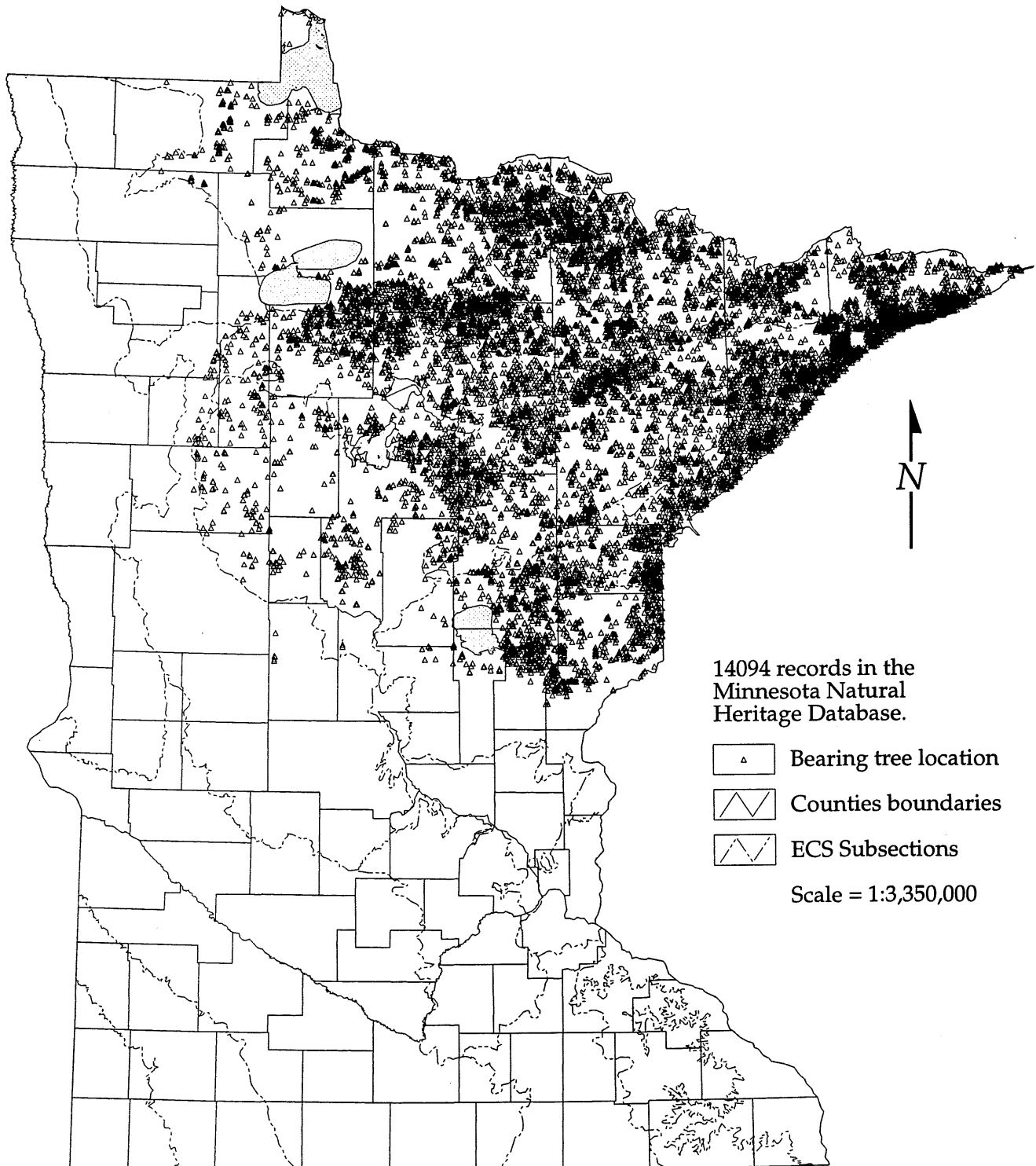


Elm Original Land Survey Bearing Trees



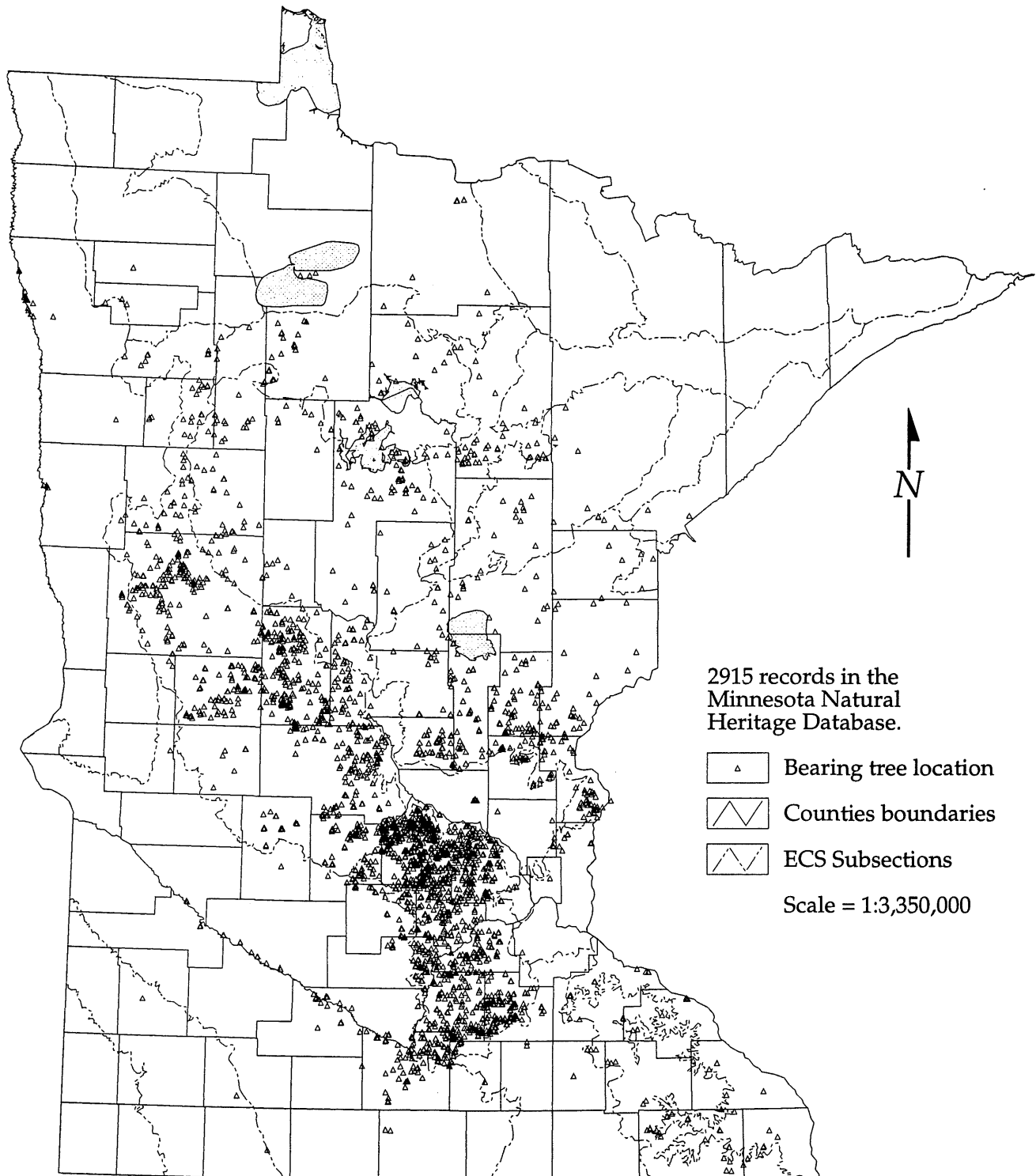
Fir

Original Land Survey Bearing Trees

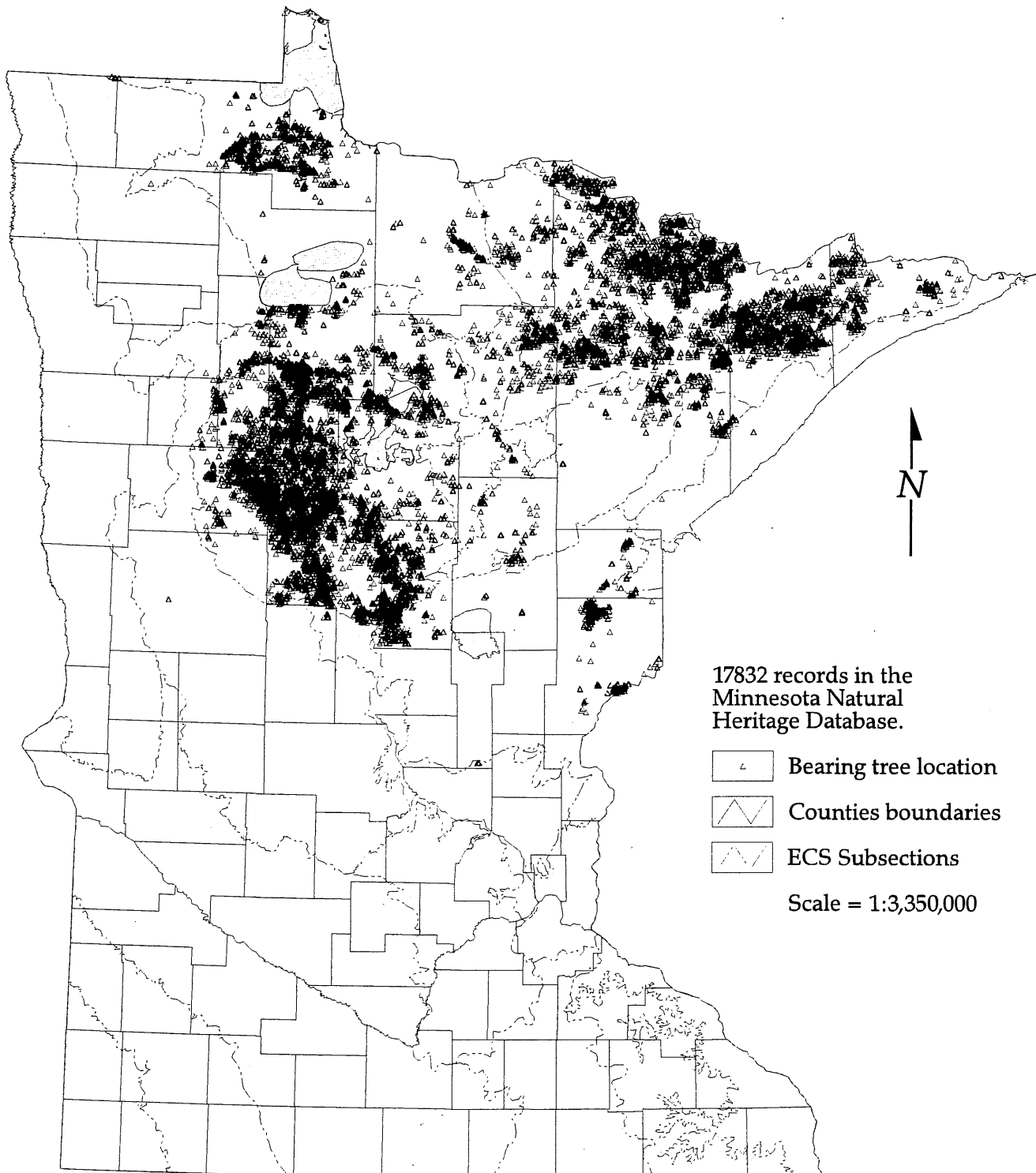


Ironwood

Original Land Survey Bearing Trees

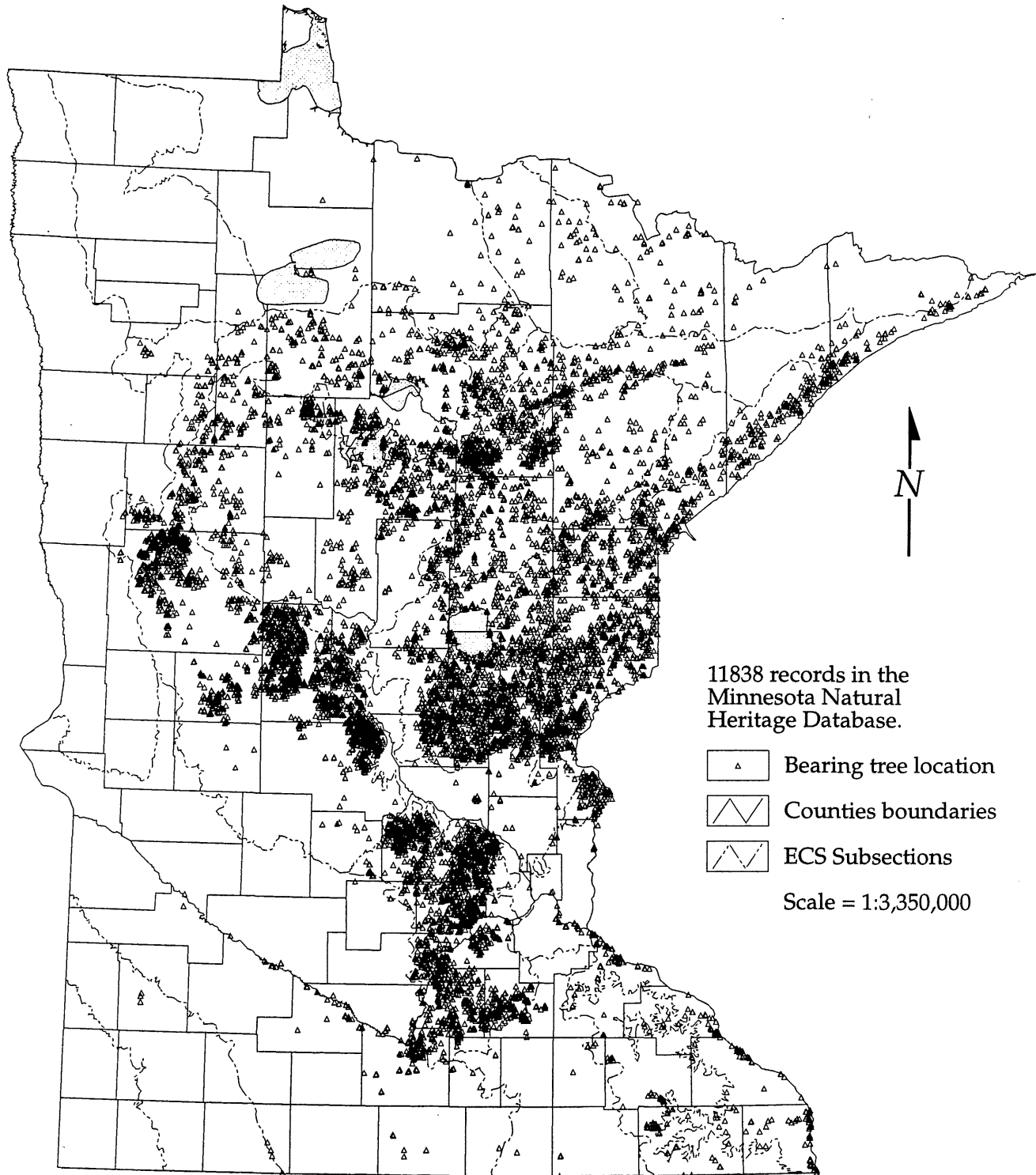


Jack pine Original Land Survey Bearing Trees

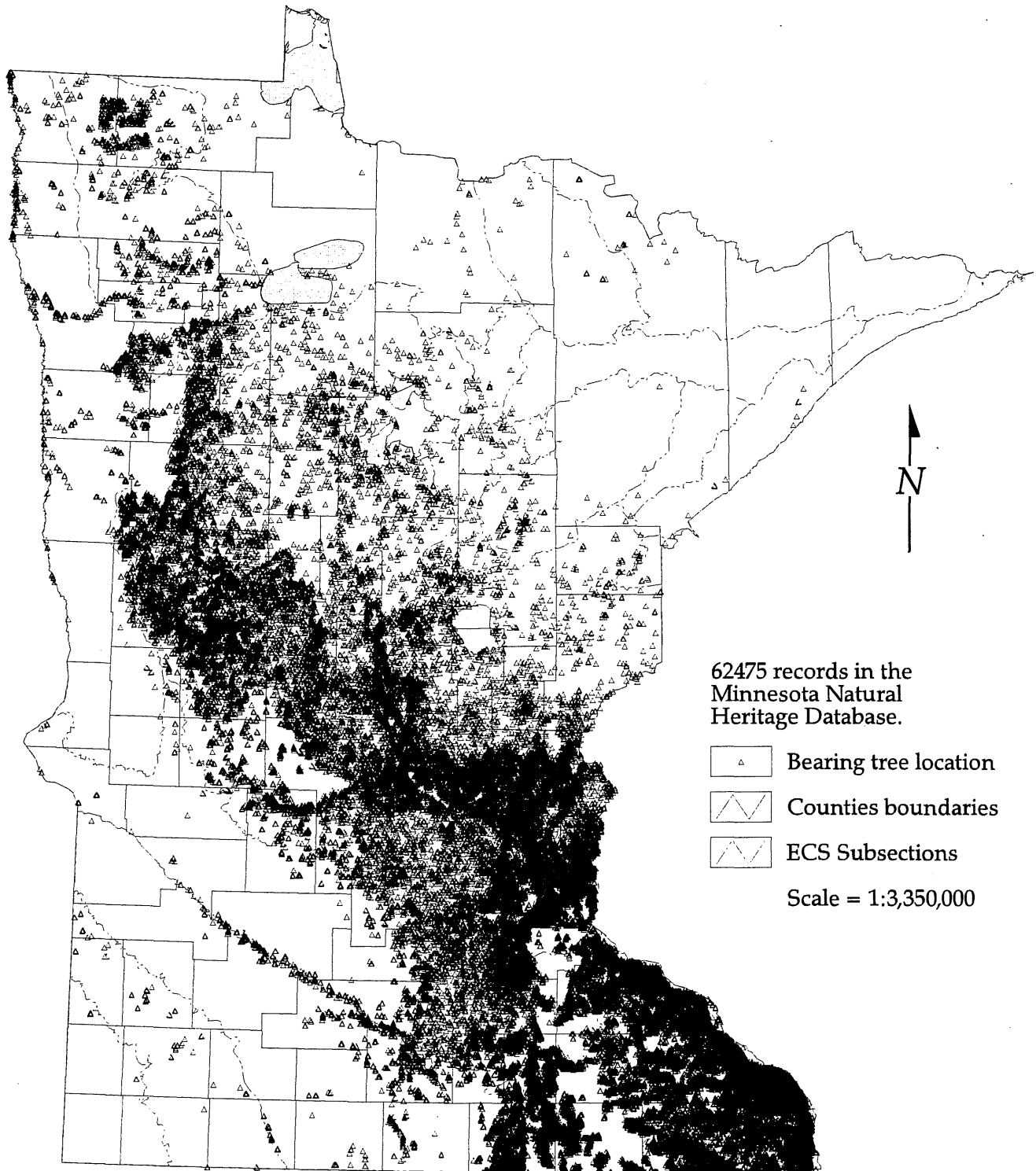


Maple

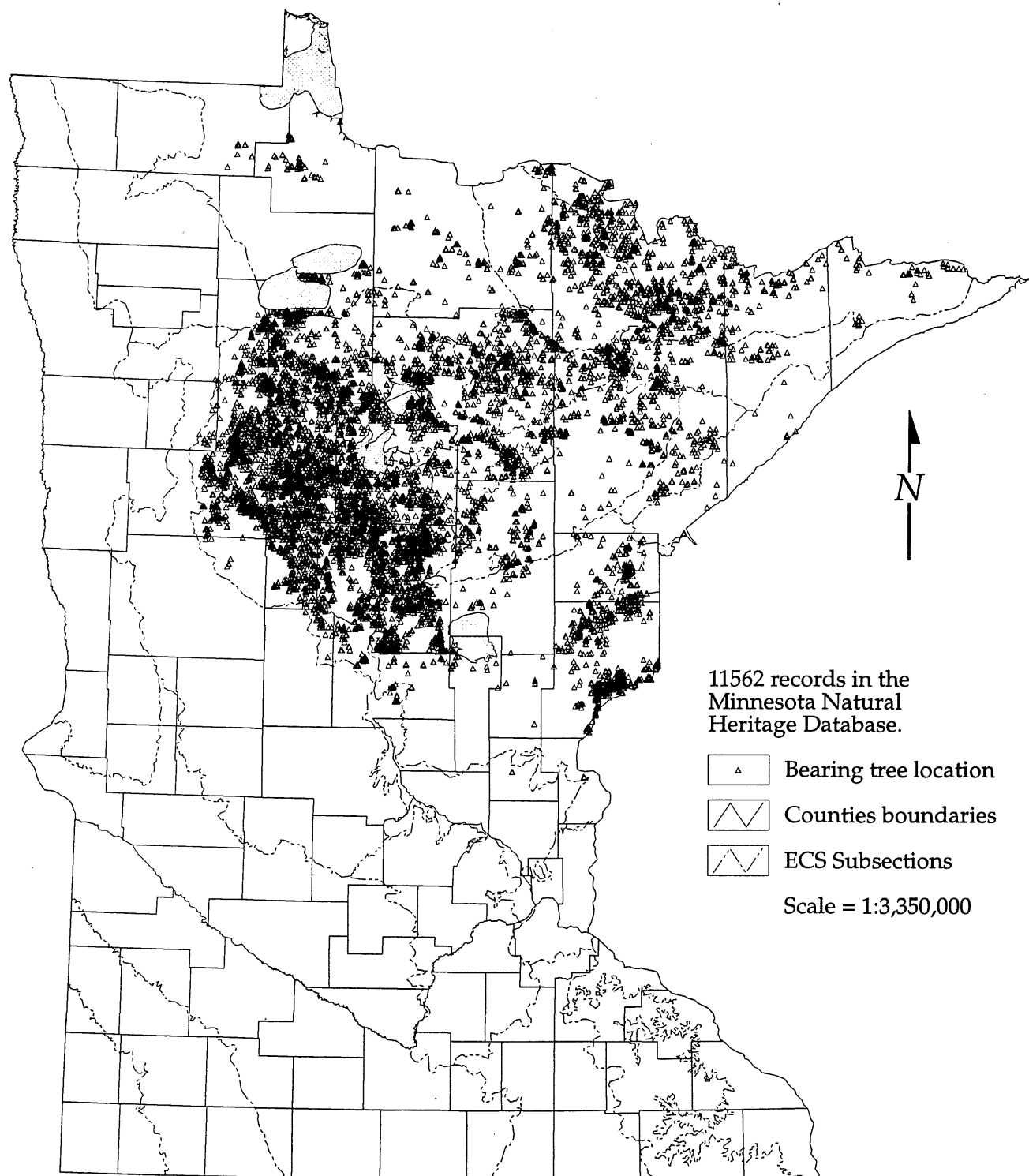
Original Land Survey Bearing Trees



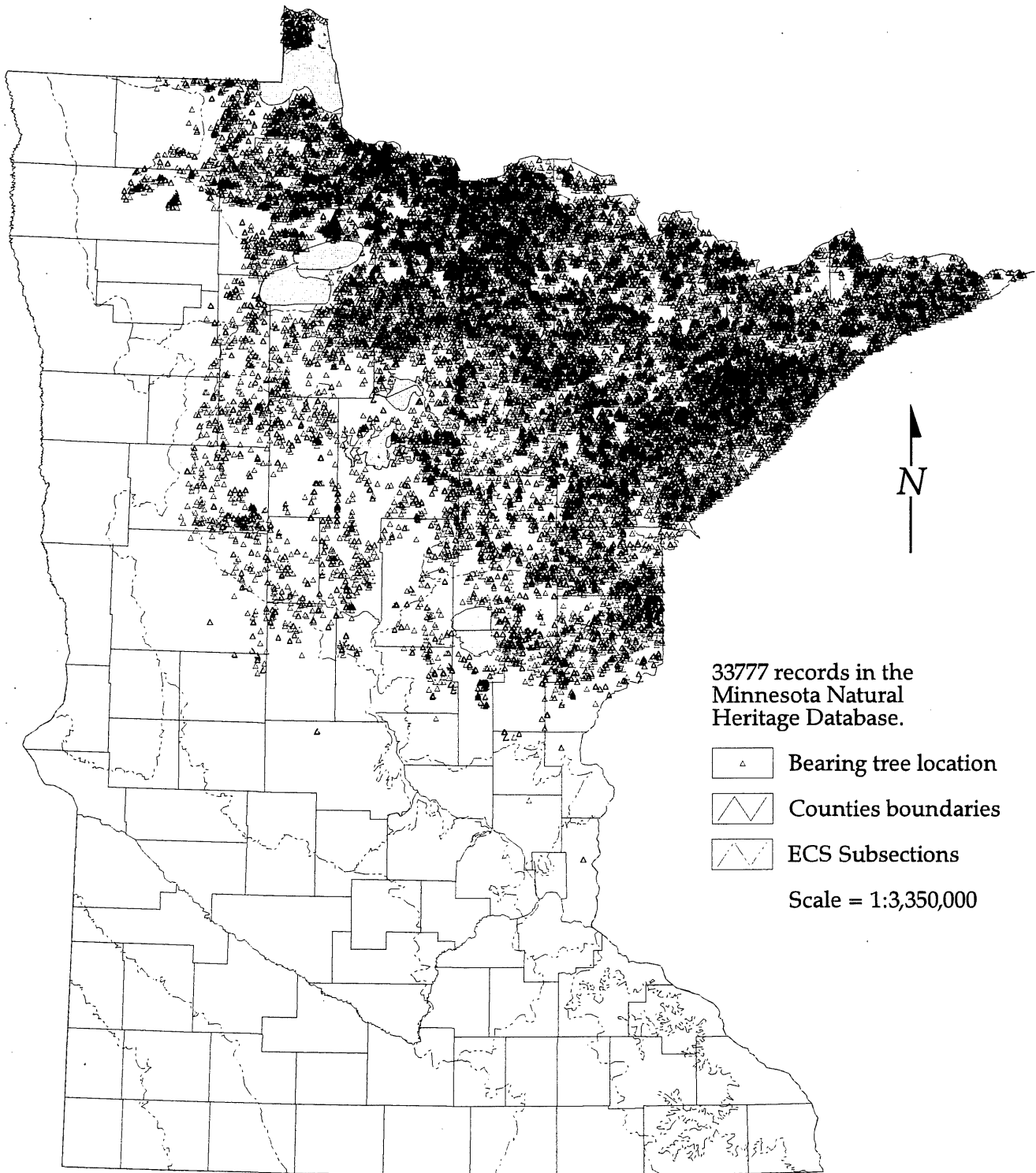
Oak Original Land Survey Bearing Trees



Red pine Original Land Survey Bearing Trees

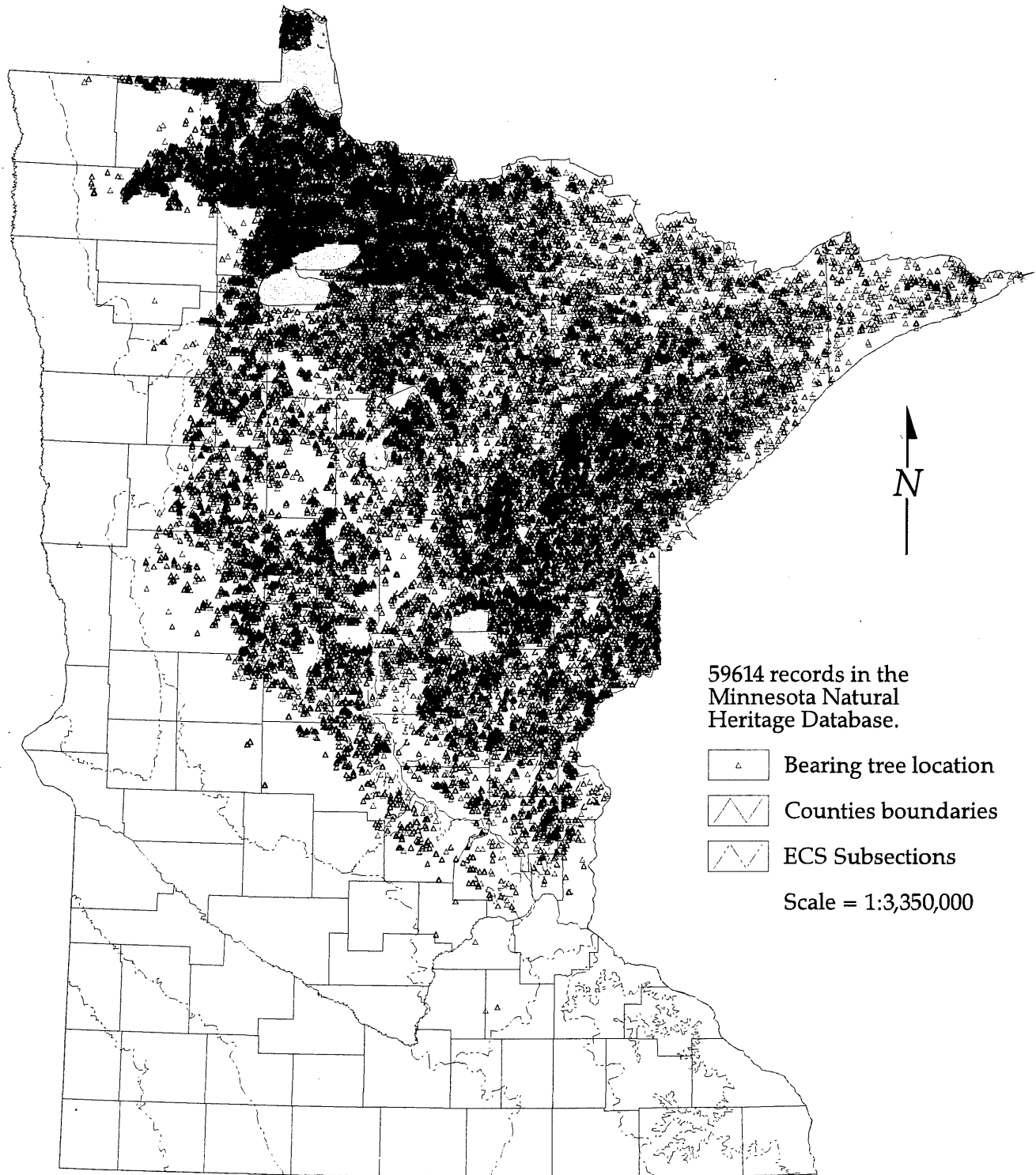


Spruce Original Land Survey Bearing Trees



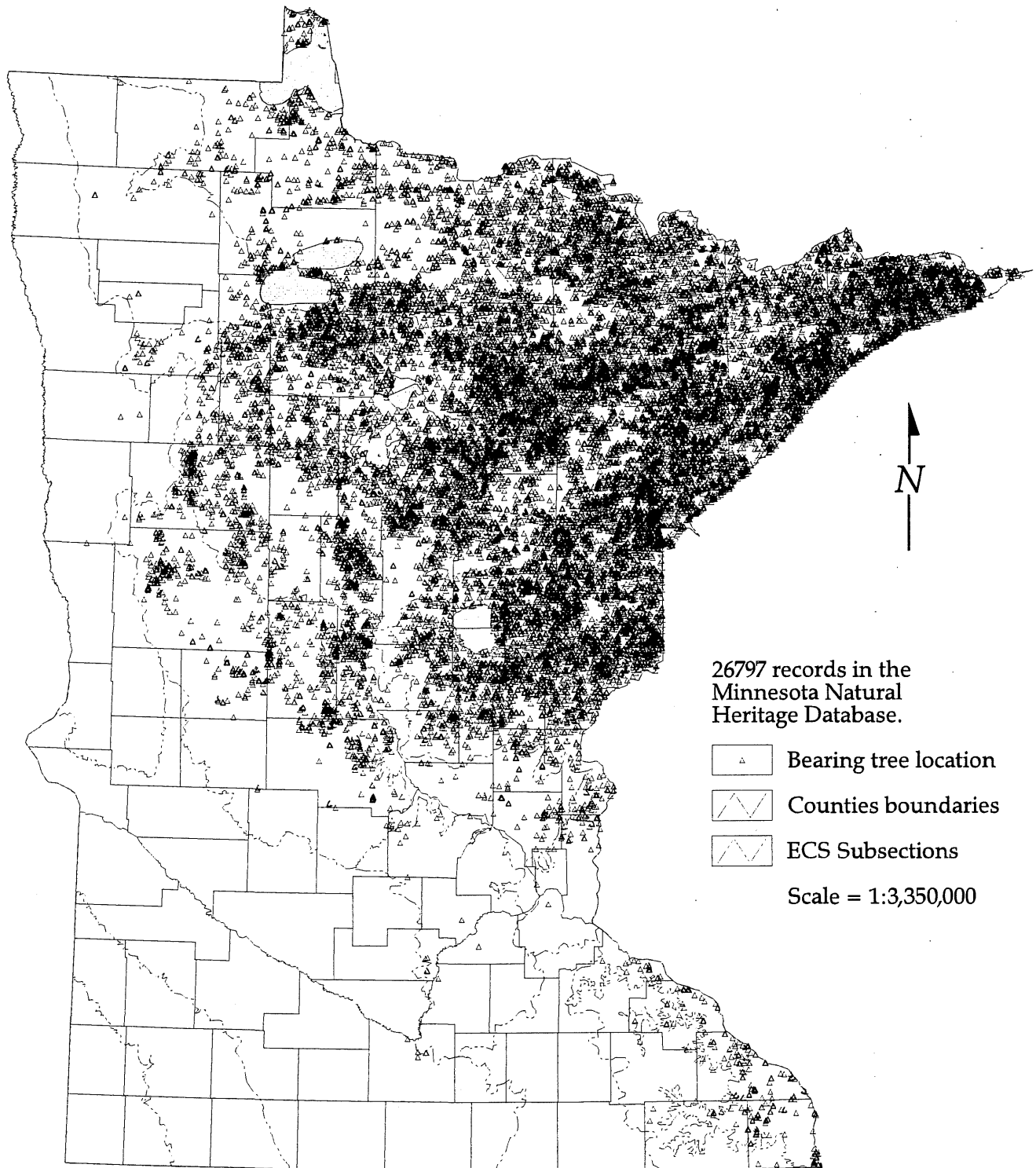
Tamarack

Original Land Survey Bearing Trees

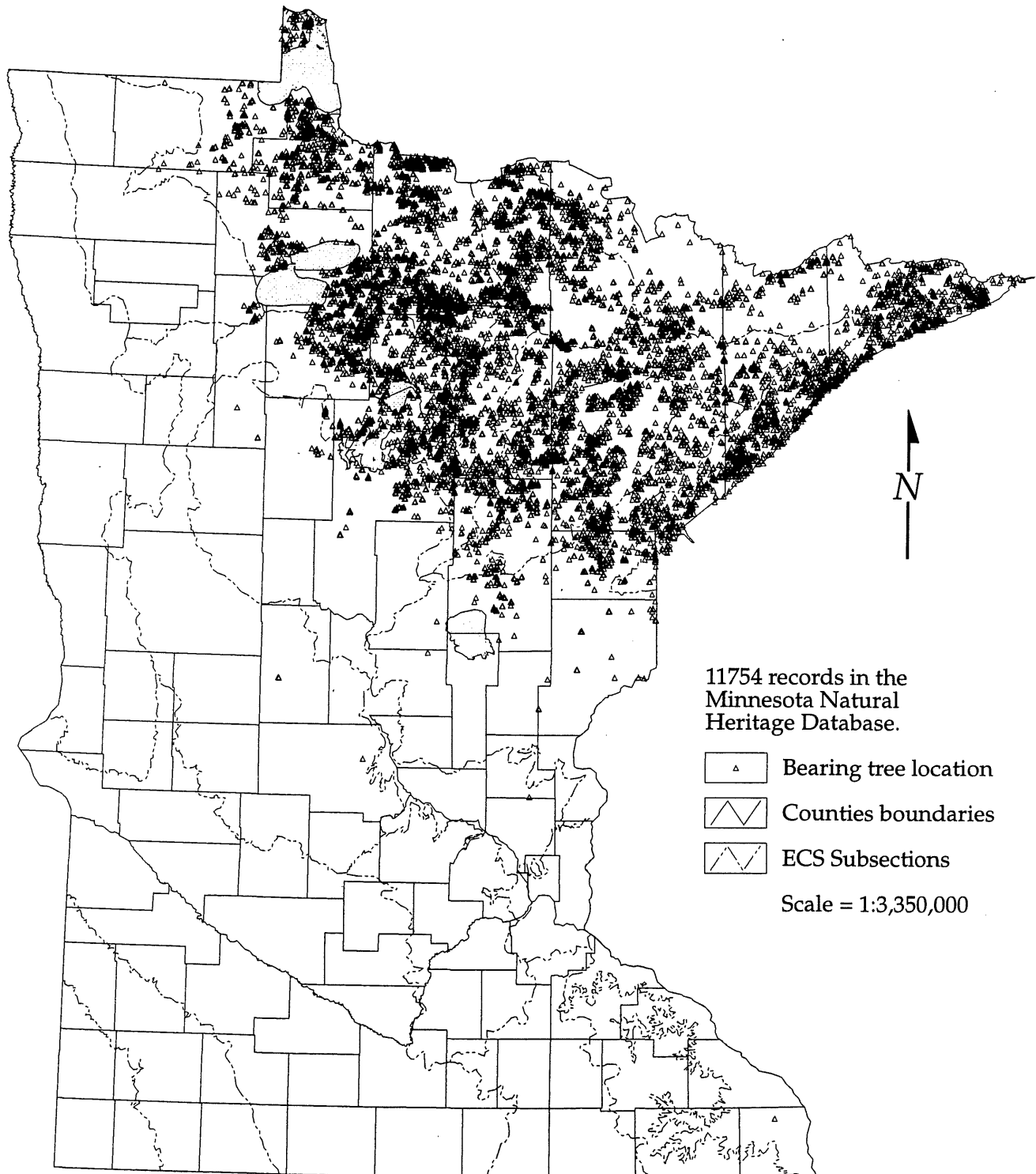


White birch

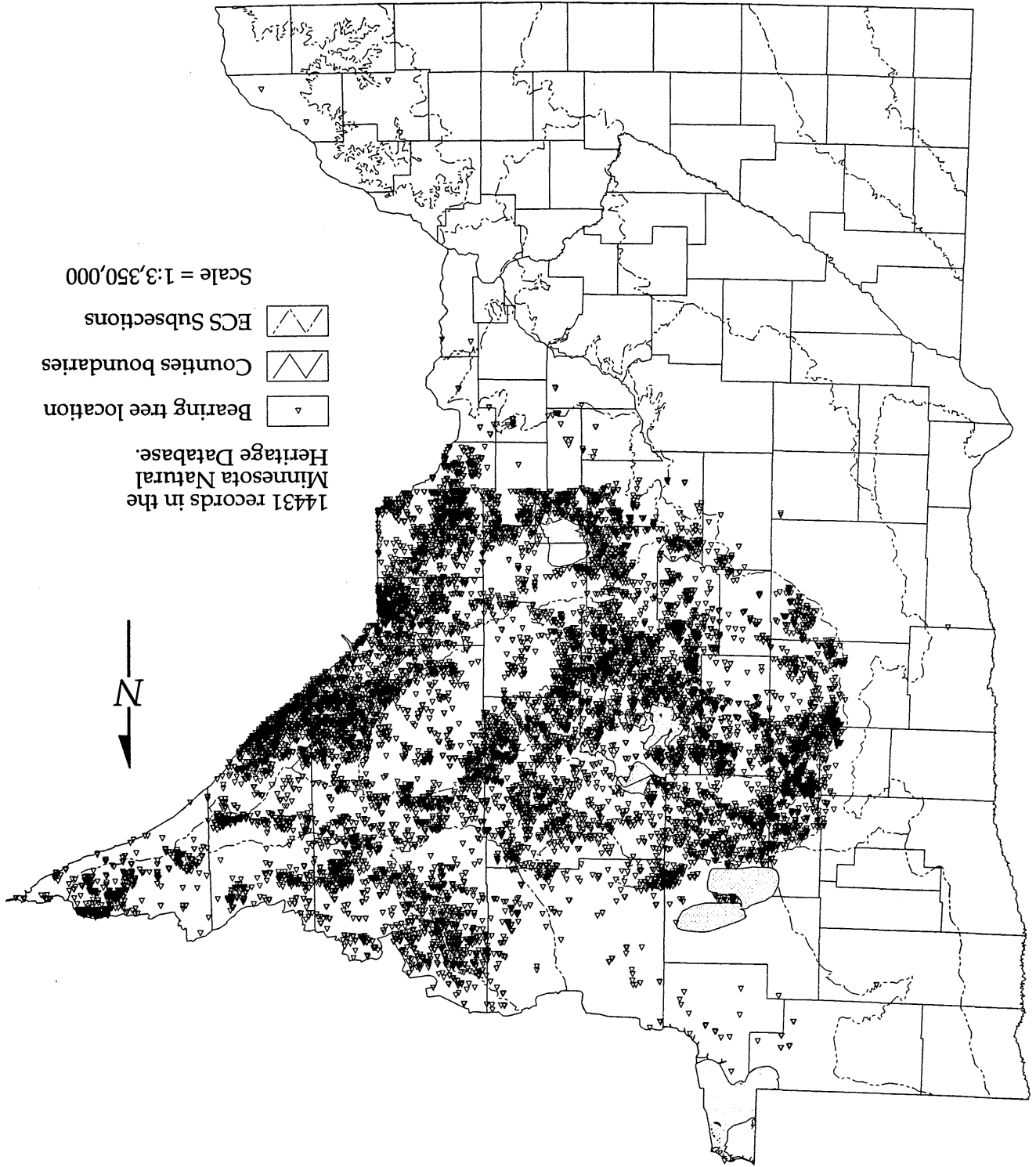
Original Land Survey Bearing Trees



White cedar Original Land Survey Bearing Trees

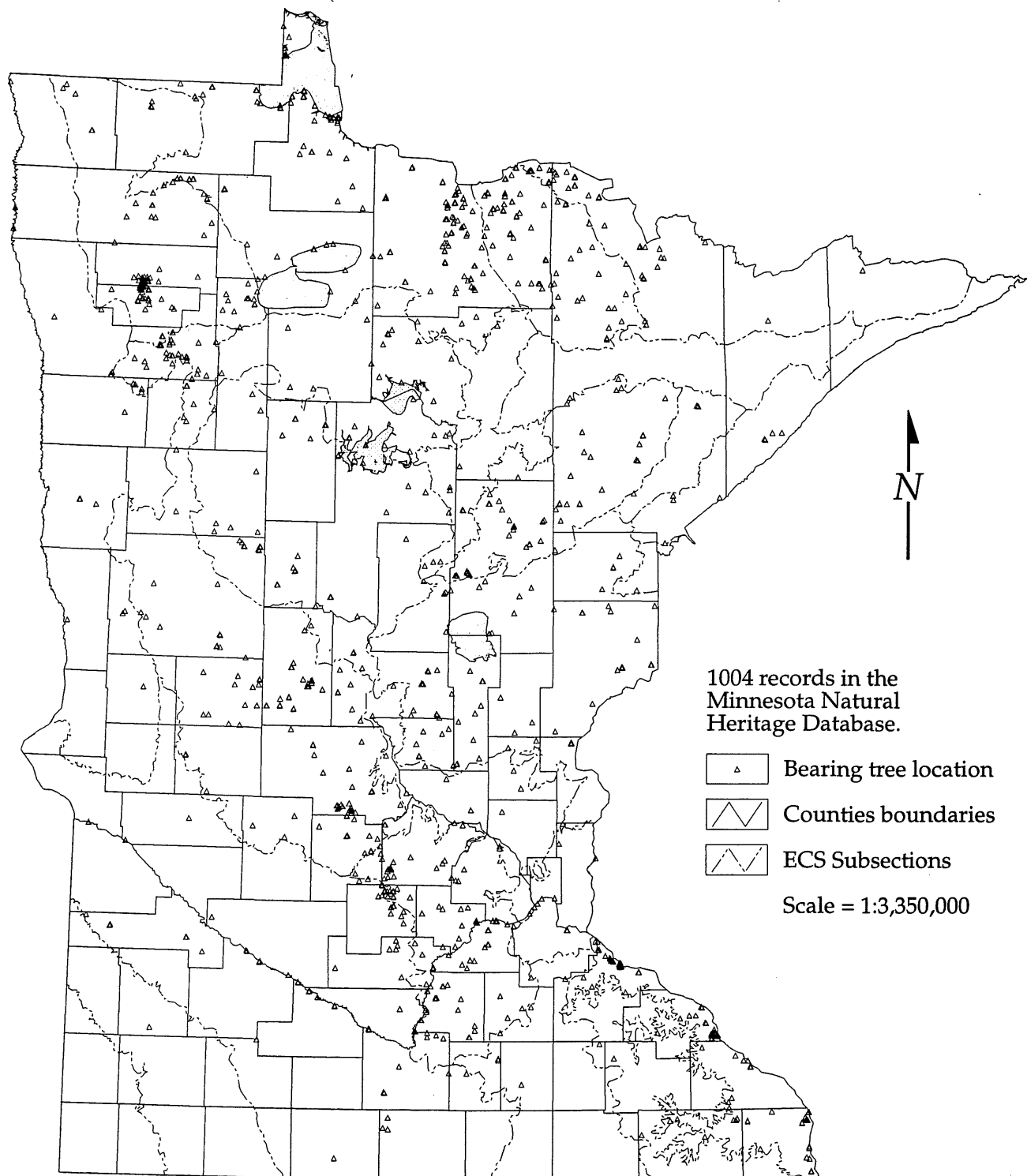


White pine Original Land Survey Bearing Trees



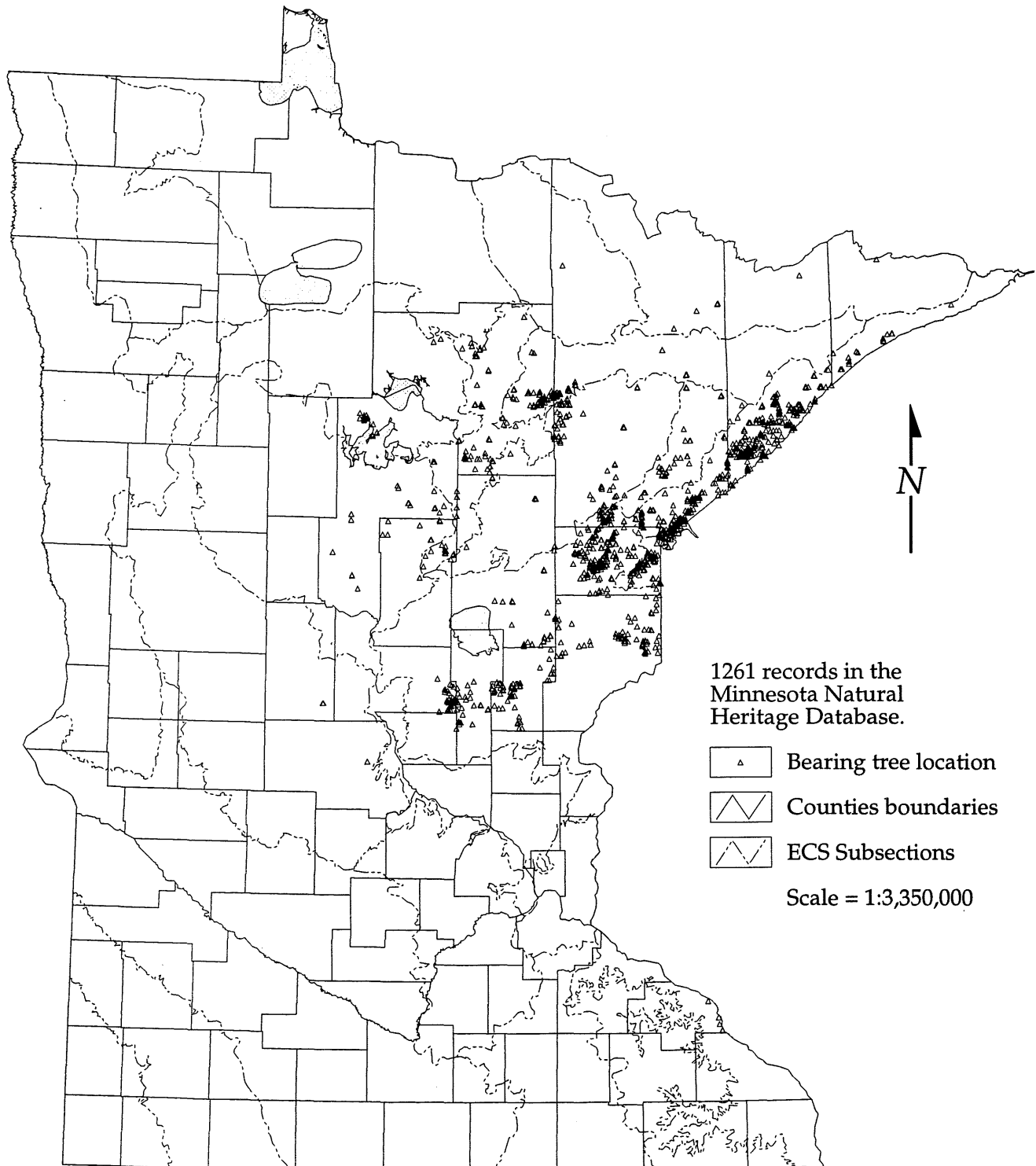
Willow

Original Land Survey Bearing Trees



Yellow birch

Original Land Survey Bearing Trees



Public Land Survey Notes

The following notes and general township descriptions were transcribed by DNR Minnesota County Biological Survey staff from original Public Land Survey notes recorded during the survey of Cass County from 1858 through 1875. See the preceding report, *Minnesota's Bearing Tree Database*, by J.C. Almendinger, for an explanation of the survey and the database.

These descriptions are arranged by township tier, beginning in the northwest corner of the county. A few townships have no descriptions.

More detailed line notes recorded by the surveyors are available from the surveyors' notebooks, which are stored in Minnesota Historical Society archives in St. Paul. See *Minnesota's Bearing Tree Database* for information on obtaining bearing tree data and line notes.

General Description & Notes T146N R29W Cass County

Meanders of Miss. River in Secs 19, 30, 31, 32, 29, 33, 34, 35, & 36.

Meanders of island in River in Secs 29 & 30.

Meanders of a Lake in Secs 13, 14, 23, 24, 25 & 26.

Sec 23: Cedar swamp

Sec 14: Indian trail

Meanders of a lake in Secs 4, 5, 8 & 9.

Meanders of a lake in Secs 6 & 7, 10 & 11.

The soil in this Tp. is generally sandy & of poor quality. The timber is of inferior quality. Some small groves of Norway Pine exist in the S. part of the Tp, near the Miss. River.

The surface is generally rolling & large Tamarack & Cedar swamps exist in the N. part of the Tp. The Miss. River runs through the S. part of the Tp. & winds through a wide marsh; varying from 10 chains - over 1/2 mile in width. Much of the marsh is good hay meadow, but portions of it are impassable, being overflowed in most stages of water & covered with tall reed grass.

General Description T146N R28W Cass County

-Meanders of Lake Winnebigoishish in Secs 5,8,7,17,18,19,20,& 30

Note* This little Tp was surveyed at the request of the Chief of the band living in Sec 18.

The long point entirely into the lake is called Cormorant Point

Notes & General Description T146N R27W Cass County

Meanders of Lake Winnebigoishish in Secs 31, 32, 29, 20, 21, 16, 15, 22, 27, 26, 25, 36.

Sec 15: Meadow shores

Sec 22: Meadow shores

Sec 27: Marsh shores

Sec 26: Meadow, Miss R. leaves lake

Sec 36: Meadow shore line

Meanders of Little Lake Winnebigoishish in Secs 25, 36, 26, 23, 24, 13, 14, 11, 10, 3 & 4.

Sec 36: Meadow & timber shores w/ No 1 Pine
 Indian village

Sec 26: Indian village & fields

Sec 24: Timbered shores & swampy

Sec 13: Swampy

Sec 14: Meadow

Sec 10: Timbered shore, sand beach

Sec 3: River 100 lks wide, deep clear stream

Meanders of Lake in Secs 26 & 27: Marsh shores

General Description and Notes**T145N R31W****Cass County**

Wagon road to Leech Lake & Red Lake crosses S. boundary in Section 33.

Indian trail crosses N. boundary at 66.00 chains E. between Sections 2 & 35.

Meanders of lakes in Sections 36, 3 & 4, 6 & 7.

Meanders of island in Cass Lake in Sections 1 & 2.

Meanders of Pike Bay & Cass Lake in Sections 25, 35, 36, 34, 27, 22, 15, 10, 3.

In Section 35: Landing for portage.

Meanders of Point between Pike Bay & Cass Lake in Sections 11, 12, 13, 14 & 15.

The quality of land in this Township is mostly very poor, being a light sand & is covered generally with Jack Pine timber. A few sections in the S. & S.E. part of the township are above the general average & may be worth something for cultivation. Some fair land is found on the point between Cass Lake & Pike Bay. 2 or 3 families of Indians are living on the N.W. corner of the point & have a few acres under cultivation. Most of the E. 1/2 of the township is occupied by Cass Lake & Pike Bay.

General Description and Notes**T145N R30W****Cass County**

Meanders of a lake in Secs 35 & 36: Banks low, water clear & deep. Timber on margin Tamarack & Cedar.

Meanders of a lake in Secs 24 & 25: Banks low, water clear & deep. Timber on margin of lake is Tamarack, Cedar, Birch & Pine.

Meanders of a lake in Sec 24: Banks low, water turbid & deep.

Meanders of Cass Lake in Secs 18, 19 & 30, 4, 5, 6, 7, 8, 9, 17 & 18.

Sec 18: Banks high, water clear & deep. Timber on margin of lake is Pine.

Meanders of an island in Secs 5 & 6: Banks high & good land for farming. Timber Pine, Aspen & Birch.

Meanders of a lake in Secs 1 & 12.

The land in this Tp is of poor quality & not adapted to farming purposes, the soil being nearly all sand & contains no streams. It contains a number of lakes & some of large size. Cass Lake is the largest.

General Description**T145N R30W****Cass County**

Subdivisions surveyed by P. H. Conger, Jan. 15 - 27, 1874

E boundary surveyed by P. H. Conger, Dec. 24, 1873

N boundary surveyed by P. H. Conger, Dec. 25, 1873

The land in this township is of poor quality and not adapted to farming purposes. The soil being nearly all sand and contains no streams. It contains a number of lakes and some of large size.

Cass Lake is the largest and is in the NW corner of the township.

It is well adapted to logging purposes as the Mississippi River runs through it. The township contains a large amount of good yellow and white pine. It contains but few swamps all of which are unfit for cultivation.

General Description**T145N R29W****Cass County**

Subdivisions surveyed by P. H. Conger, Jan. 1 - 13, 1874

E boundary surveyed by P. H. Conger, Dec. 10, 1873

N boundary surveyed by P. H. Conger, Dec. 26, 1873

This township contains by a small portion of land that is fit for cultivation. The N portion of the township is sandy and generally covered by a small growth of black and yellow pine.

The S portion contains a large amount of good white and yellow pine, also numerous hardwood ridges well adapted to cultivation.

There are numerous lakes all of which have clear fine water and contain fine fish. There are but few streams in the township. There are numerous swamp and marshes all of which are unfit for cultivation. There is no improvement in the township.

General Description & Notes**T145N R28W****Cass County**

Portage from Lake Winne between Secs 25 & 26 at 30.00 chains North.

Portage trail fr. Lake Winne to Leech Lake at 37.00 chains E between Secs 19 & 30.

Meanders of Lake Winnebigoishish in Secs 7, 18, 17, 20, 21, 22, 27, 26, 23, 24, 13, 12.

Sec 7: Sand beach, straight shore

Sec 18: Sand beach, straight shore line

Sec 17: Sand Beach, meadow land

Sec 21: Meadow shore, portage landing

Sec 22: Meadow shore, sand beach

Sec 26, 27, 23, 24, 13: Sand beach

Two other lakes:

Sec 36: Marsh shores & timber

Secs 30 & 31: Marsh shores

This Tp has a great deal of swamp land & much good meadow & hay land. There are no streams of any length. There are 3 lakes, all well stocked with fish.

Notes & General Description**T145N R27W****Cass County**

Meanders of Lake Winnebigoishish in Secs 6 & 7: Sand beach, timbered shore.

Meanders of Lake in Secs 26, 27, 34 & 35: Marsh shores.

Meanders of Little Lake Winnebigoishish in Sec 1: Marsh shores, good meadow land, flat.

Meanders of Mississippi River in Secs 1, 12, 13, 24: This river is apparently a continuation of lake, has little current. The main channel deep, the rice marshes underwater, extending to timbered banks.

Meanders of lake in Secs 33 & 34.

This Township has a great deal of valuable Pine on the ridges, though the greatest portion of the Township is tamarack swamp.

Notes & General Description**T145N R26W****Cass County**

Meanders of Ball Club Lake in Secs 36, 35, 34, 27, 22, 21, 16, 9, 4, 5, 10, 15, 14, 23, & 25.

Meanders of Miss. River in Secs 19, 30, 29, 28, 33 & 34.

Meanders of lake in Secs 5 & 6.

The soil in this Township is light & sandy of poor quality. The surface is gently rolling. Many small swamps & marshes are found in the depressions between the ridges. The timber except in the swamps, is principally Jack & Norway Pine of little value. The Pine is scattering, a large proportion having been destroyed by fire.

General Description and Notes**T144N R31W****Cass County**

Meanders of lake in Sections 34, 35 & 36, 25 & 26, 12, 13 & 14, 11 & 12, 1, 2 & 11, 14, 2 & 3, 15, 16, 21 & 22, 19, 20, 29 & 30, 20, 28, 29, 32 & 33.

11 & 12: This lake has an E. shore high banks & good Norway Pine. Marshy on W. shore.

2 & 3: This lake has high banks around it, no inlet or outlet.

Meanders of river in Sections 20, 21, 28, 29, 32 & 33. This river has a marsh on both banks its whole length.

The land in this Township is nearly all of it sandy & poor & worthless for cultivation. Surface gently rolling.

The timber is mostly Jack & Norway Pine & some scattering White Pine. The township abounds in lakes & marshes. An extensive Tamarac swamp is found in the S. part of the township. A wide marsh which is fair meadow land lies along both sides of the river in Sections 20, 21, 28, 29, 32 & 33.

General Description and Notes**T144N R30W****Cass County**

Meanders of Leech Lake in Sections 36, 35, 34, 26, 23, 14, 13, 24 & 25.

Meanders of lake on N. boundary of Township in Sections 1 & 2.

Extensive Tamarac & Cedar swamps, very thick are found in the southern & eastern part of this township. A wide marsh surrounds the upper end of the bay from Leech Lake & lies along the stream running through the eastern part of the township. A portion of this marsh is good meadow land, particularly in Sections 1 & 2.

The land in the N.W. part of the township is rolling & covered with hardwood timber, aspen & scattering White & Norway Pine. The soil is 2nd rate, some of it fair for cultivation.

General Description**T144N R30W****Cass County**

Subdivisions surveyed by B. Baldwin, July 21 - Aug 5, 1875

E boundary surveyed by P. H. Conger - July 22, 1873

N boundary is 11th Standard Parallel

Extensive tamarac and cedar swamps, very thick are found in the S and E part of this township. A wide marsh surrounds the upper end of the bay from Leech Lake and lies along the stream running through the E part of the township. A portion of this marsh is good meadow land, particularly in secs 1 and 2. The land in the NW part of the township is rolling and covered with hardwood timber, aspen and scattering white and norway pine. The soil is second rate, some of it fair for cultivation.

General Description**T144N R29W****Cass County**

Meanders of Leech Lake in Sections 30, 31, 27, 28, 22, 23, 33, 24, 13, 12.

In Section 30: Good banks, sand beach shore

This Township has a great deal of good farm land as compared to others, and also much valuable pine. The surface is gently rolling and undergrowth Hazel outside of the swamps.

General Description**T144N R29W****Cass County**

Subdivisions surveyed by P. H. Conger, Oct. 16 - Nov. 2, 1873

E boundary surveyed by P. H. Conger, Aug. 4, 1873

N boundary is 11th Standard Parallel

This township has a great deal of good farm land as compared to others and also much valuable pine.

The surface is gently rolling and the undergrowth hazel outside of the swamp.

General Description**T144N R28W****Cass County**

Good farm and meadow lands out of swamps and marshes near the river.

General Description**T144N R27W****Cass County**

- Farm land at 57.00 chains N between Secs 17 & 18
- Meanders of lake in Secs 18,19 & 30, marsh shores
- Meanders of lake in Secs 5,6,8,7, & 17
- Meanders of Leech Lake River in Secs 35 & 36

This Tp has a great deal of swamp and valueless land, its surface lies perfectly flat, or nearly so.

There is much good Pine on the NW corner. The lakes are muddy with marsh banks. The streams deep, slow current in a marsh.

Notes & General Description**T144N R26W****Cass County**

Lumber Road along E. boundary.

Meanders of Leech Lake River in Secs 31, 32.

Meanders of Mud Lake & Right bank of Leech Lake River in Secs 34, 35, 26, 27, 22, 14, 13, 12.

Meanders of left bank of Leech Lake River & N. shore of Mud Lake in Secs 31, 32, 33, 28, 27, 22, 23, 14, 13, 12.

Meanders of Miss. River in Secs 2, 3, 11, 12.

Meanders of Ball Club Lake in Secs 1 & 2.

The soil in this Township is generally of poor quality. East of Leech Lake River it is low & wet. North of Leech Lake River, outside of swamps, the soil is sandy & light. A large portion of the Township is covered by Tam & Cedar swamps & marshes.

A wide marsh extends along both sides of the Miss River & also on the W. side of Mud Lake & along Leech Lake River above Mud Lake, very wet & impassable where not frozen.

The timber is of poor quality, consisting of Pine, Birch, Aspen. The most of the Pine of any value S. of Leech Lake River has been cut & hauled off.

General Description**T143N R31W****Cass County**

Meanders of Leech Lake in secs 33, 34, 36, 28, 32, 16, 20, 21, 29, 2, 3, 9, 10, 11, 14, 23, 22, 25, 26.

Meanders of river in sec 4

The N tier of sections in this township is principally tamarac swamp and wet marsh. The rest of the land is mostly dry and covered with timber. The timber is principally sugar tree, lind, elm, oak, birch, aspen and scattering white and norway pine with occasional groves of jack pine. The land is rolling and the soil is second and third rate. A river navigable for steamboats empties into Leech Lake from the NW.

Nearly 1/3 of the township lies in Leech Lake.

General Description**T143N R30W****Cass County**

-corn field between secs 11 and 14 at 14.00 chains W

Meanders of Leech Lake in secs 12, 11, 14, 23, 22, 15, 1, 2, 31, 32, 3, 4, 7, 8, 9, 18, 19, 30

A large portion of the land in this township is cedar and tamarac swamp, very thick. The land out of the swamp is rolling and generally well timbered. The timber is sugar tree, lind, elm, oak, and birch and some aspen and scattering white and norway pine. The soil is second rate and fair for cultivation.

Most of this township lies in Leech Lake.

General Description**T143N R29W****Cass County**

Meanders of Leech Lake

- in sec 12: to timber line, open marsh, flat beach, brushy. Balance of line bold rock covered shore.
- in sec 11: rocky beach, sugar maple timber
- in sec 14: wigwam and field, sand beach, large swamp lay E of shore. soil first rate.
- in sec 26: wigwam and field, marsh N of line
- in sec 35: bold rock bound shore nearly all cultivated by Indians
- in sec 8: a little island about 3 chains from shore, 1/4 acre. Two wigwams and fields N of island on main shore
- in sec 7: sand beach

The 2 fractional portions of this township have fine sugar maple groves along the lakeshore with tamarac swamp laying in the background. There are 14 wigwams that are inhabited and all have small irregular fields of corn, potatoes and squashes.

The maple has been used for making sugar for many years. There is but little pine and of no value. The soil on the high land has black sand loam surface with clay subsoil and is generally good.

General Description**T143N R28W****Cass County**

- Indian trail at 20.50 chains between secs 1 and 2 bears NE and SW

The most of this township is swamp and utterly worthless.

South of Little Boy River is some good hardwood. The bay of Leech Lake that reaches into this township is surrounded by an immense bog and marsh, impassable near the mouth of Boy River except when frozen.

Little Boy River has a sluggish current running through wild rice beds. The clear water in the stream averages about 4 chains in width. Timber is spruce, tamarac, elm, ash, birch and hardwood.

Meanders of Little Boy River in secs 35, 36, 26, 27

Meanders of Leech Lake River in secs 1, 2

Meanders of Leech Lake in secs 32, 33, 34, 27, 22, 21, 20, 19, 30, 6, 7

Notes & General Description**T143N R27W****Cass County**

Meanders of Leech Lake River in Secs 2, 3, 4, 5 & 6.

Meanders of Little Boy River in Secs 31 & 32.

The surface of this Township is generally very level with but little 1st rate soil. The rivers running through it are all sluggish streams with, in many places several distinct channels. The spaces between the different channels being impassable beds of rushes & wild rice. Both Leech Lake & Little Boy rivers are deep & navigable for large boats.

Notes & General Description**T143N R26W****Cass County**

N. boundary - Intersect Leech Lake River & Mud Lake. In this season of the year the lake is nearly all covered over with Wild Rice & tall rushes about 12 ft. high which prohibits getting line across Mud Lake by triangulations or seeing an object on the other side of the lake. The water is from 3 - 6 ft deep & very muddy bottom. (Aug 1872)

This Township is well timbered w/ Birch, Sugar, Wh Pine, Cedar & Tamarack. The surface is gently rolling. Soil fair 2nd rate with a good amount of Hazel & Popple underbrush. The current of the stream running through the Township is very slow & sluggish near the lake.

Meanders of Mud Lake in Secs 10, 9, 16, 8, 5.

General Description**T142N R30W****Cass County**

Field along shore of Leech Lake at 32.00 chains between secs 6 and 31 (N. Boundary) bears NE and SW.

Indian trail from Agency to Village at 40.85 chains between secs 15 and 16.

Mission School Building along the shore of Lake in sec 17.

Meanders of Leech Lake in secs 35, 36, 34, 27, 22, 15, 10, 3, 9, 4, 8, 17, 18, 19, 6, 7, 30, 20.

In sec 10 - Land dry. Timber ash and maple.

General Description**T142N R29W****Cass County**

-Meanders of Leech Lake in Secs 36, 25, 24, 23, 14, 13, 12, 11 & 2

In Sec 12: High banks, timber mostly Oak

In Sec 11: Timber Maple, Elm, Lynn, Oak & Birch

In Sec 2: Timber is Maple, Oak, Elm, Lynn, rock bound shores

In Sec 14: Indian village, chief's wigwam. High, bold, rock bound shore from chief's wigwam, sand beach above.

In Sec 23: High bluff shores and rock bound coast

-Meanders of Pelican Island in Secs 17, 18 & 31

In Sec 17: Low sand beach, low flat island containing a great deal of marsh. Very little timber. Four wigwams and small corn field. Soil 2nd rate.

This fractional Tp is made up of long points jutting into the Lake and islands. Bear Island is generally timbered with Wh. Oak, Sugar, Maple, Lynn, and has some valuable Pine. It has a settlement of about 25 lodges of Indians who have raised large crops of corn and potatoes. The soil is of excellent quality.

Pelican Island has no timber of any account, being marshes and bogs, though there is 4 lodges of Indians cultivating small parcels of ground. This island has no value except as a fishing ground.

P.H. Conger Feb 1874

General Description**T142N R28W****Cass County**

This township has a great deal of marsh most of it comparatively good meadow. The surface is rolling outside of the marshes. There is some valuable pine and on Leech Lake some good sugar bushes and farm land.

-Indian trail crosses at 35.00 chains between secs 28 and 29 bears NW and SE

Meanders of Boy Lake in Secs 13, 14, 23, 24

Meanders of lake in secs 34 and 35

Meanders of small lake in secs 28 and 33

Meanders of Leech Lake in secs 19, 29, 30, 16, 17, 20, 21, 5, 7, 8

General Description & Notes**T142N R27W****Cass County**

Meanders of Boy River in Secs 5, 8, 9 & 21, 28, 33
Meanders of Boy Lake in Secs 9, 16, 17, 19, 20, 30, 18, 29, 21
Meanders of Portage Lake in Secs 28, 29, 32, 33
Meanders of Tonish Lake (meaning "Ugly Mouth") in Secs 31, 32, 29
Meanders of Island in Boy Lake in Sec 19.

The land lying W. of Boy River is dry & either good farm, meadow or pine land.
Steamboats can without difficulty run into Boy Lake & up Swift River to
and into Swift Lake.

Meanders of Spring Lake in Sec 36.

Meanders of Clear Lake in Sec 1.

Meanders of Swift Lake in Secs 15, 22, 26 & 27.

Meanders of Swift River in Secs 16 & 21: Left bank of Swift River & Boy Lake River
winds through wet marsh.

All the land lying S & E of Boy River & Swift Lake is swampy & of but little
value.

There are 6 lakes in the Township, all have plenty of fish.

The land lying W of the above indicated is dry & either farm, meadow or pine
land.

General Description**T142N R26W****Cass County**

-Meanders of lakes in Secs 36, 23, 24, 25 & 26, 13, 14 & 24, 1 & 12, 10, 11, 14, 15 & 23,
2 & 11, 2 & 3, 33 & 34, 21, 22, 27 & 28, 15 & 22, 3, 19 & 30, 5, 6, 7 & 8, 31

This Tp is well timbered with White and Norway Pine, Birch, Aspen, Fir, Spruce,
Tamarac and Cedar.

Surface of land is generally level, only in the NE part which is gently rolling.

The lakes are mostly surrounded with Spruce and Cedar, water clear and deep. There
is but one stream of any account, Mud River, which heads in Grave Lake.

General Description**T141N R30W****Cass County**

This Township appears to be the divide between the waters that go south to Ten
Mile Lake and north into Leech Lake and while it appears to be the watershed made
up of ridges and valleys, it has no streams of any movement.

There is very little good agricultural land and not much valuable timber, though
a ridge running from the middle on the north boundary, south and east, about 1 1/
2 miles wide contains all the timber and is probably nearly all on the reservation.

The timber at each mile gives the best idea of its distribution.

Chippewa Reservation boundary contained within township.

Wagon road from Agency to Brainard at 34.50 chains E between secs 30 and 30. Road
continues N and S through secs 7, 18, 6, 7.

General Description**T141N R29W****Cass County**

Indian trail along E boundary at 41.00 chains between secs 1 and 6
Indian portage trail from Leech Lake at 11.00 chains between secs 25 and 36

This Township has generally a rolling surface in places almost broken too much for agriculture and it seems to be the dividing ridge between the water that goes south and makes Boy River and those that go north to Leech Lake.

There is a great deal of valuable agricultural lands and much valuable pine in the S 1/2 of the township. There are 3 portage trails going south through the township but in many places so dim as not to be noticed in passing over them though easily followed.

General Description & Notes**T141N R27W****Cass County**

Meanders of lakes in Secs 17, 18, 13 & 24.

Meanders of lakes in Secs 29 & 32, 13, 14 & 23, 3 & 10, 14 & 15, 26, 27, 34 & 35, 7 & 18, 25 & 36.

This Township has but little valuable timber for lumbering. The surface is rolling with Jack Pine ridges & Pine Barrens.

The lakes are well stocked with fish. There are 8 lakes, have high banks & timbered shores.

The lake in Secs 29 & 32 is "Ming low wan now"

General Description**T141N R26W****Cass County**

- Meanders of Big Rice Lake in Secs 35,36,25,24,23,22,27 & 34
- Meanders of a lake in Secs 3,4 & 5
- Meanders of a lake in Secs 16 & 17
- Meanders of a lake in Secs 29,30,31, & 32
- Meanders of a lake on N. boundary of Sec 6

This Tp is generally given over to swamp. The eastern portion is low, level and wet. The middle and NW portions are dry, rolling, and in Secs 8 & 9, hilly.

The SW corner of the Tp is flat and swampy. The timber in the swamps is Cedar, Tamarac, and Spruce. On the ridges it is Birch, Aspen, Maple, Linden, Oak, Pine and Fir.

The SE shore of Rice Lake in Sec 36 is land with Indian wigwams, this being their favorite summer resort for gathering wild rice.

The lakes generally have low swampy shores.

General Description & Notes**T140N R30W****Cass County**

Meanders of lakes in Secs 1, 12 & 13, 22 & 23, 21 & 22, 10 & 11, 14 & 15, 9 & 16, 19 & 18, 21, 22, 27, 28, 33 & 34, 29, 20 & 29, 4, 5, 8 & 9, 16 & 17, 30 & 31, 6 & 7, 36.

This Township is rolling, in some places quite hilly. The soil mostly poor. Generally very brush, the timber mostly Norway, Blk & White Pine, Aspen brush. Considerable good timber in NE part & along N. line. Numerous lakes & ponds scattered all over the Township.

General Description & Notes**T140N R29W****Cass County**

Meanders of lakes in Secs 25, 36, 26, 34, 35, 33, 27, 28, 22 & 27, 22 & 23, 9, 10, 15 & 16, 29, 30, 31 & 32.

Meanders of Woman Lake partly in Secs 1, 2, 11, 12, 13, 14, 15, 22, 23 & 24.

Meanders of Lakes in Secs 17, 18, 19 & 20, 3 & 10, 7, 8, 17 & 18, 2 & 3, 3, 4, 9 & 10, 4, 5, 8, 9 & 17, 7 & 18, 6 & 7, 31.

General Description & Notes**T140N R28W****Cass County**

Meanders of Lakes in Secs 13 & 24, 1, 2, 11 & 12, 22, 23, 26, 27, 28, 32, 33 & 34, 21 & 28, 17 & 20.

Meanders of Little Boy Lake in Secs 10, 11, 12, 13, 14, 15, 22 & 23.

Meanders of Lake partly in Secs 19, 20, 29, 30 & 31.

Meanders of Woman Lake partly in Secs 5, 6, 7, 8, 17, 18, 19 & 20. Island in Sec 7.

This Township is all timber consisting of Oak, Elm, Lind, Maple, Birch, Poplar, Tamarack, Fir, Spruce & Pine. There is also some Cedar.

It is well watered, containing 3 large lakes besides numerous small ones.

There is a large Tamarack swamp in Sec 35 & 36.

The surface is generally rolling & soil 2nd quality.

General Description & Notes**T140N R27W****Cass County**

Meanders of lake in Secs 23 & 24: Banks low & marshy on NW & W sides, on the SW, S & SE they are about 5 or 6 ft high on the NE & they are broken & hilly. Water good & fresh.

Meanders of lake in SEcs 23 & 26: The banks of this lake are low & marshy on the E, NE, W & NW, S & SW. On the SE they are rolling & broken for a short distance with Norway Pine, water pure & fresh.

Meanders of lake in Secs 14 & 23: The banks of this lake on the NW & W sides are rolling & a little broken on the SW, S, SE, E & NE they are low & marshy, not more than 1 ft high. Water pure & good.

Meanders of lake in Secs 22 & 27: On the NW, W & S sides of this lake the banks are broken & about 3-10 ft high. On the E & NE they are low & marshy. Water good & fresh.

Meanders of lake in Secs 5, 6, 7 & 8: The banks of this lake on the NW side are rolling with a good growth of hardwood timber & Norway Pine. On the W side they are low & swampy. On the S they are about 5 ft high. On the E they vary from 1-10 ft in height.

The quality of land in this Township is considerably below the common average. It is filled with Cedar & Tamarack swamps & marshes. The uplands are all light lands, mostly poor & sandy. I noted no minerals while surveying this Township & only found 1 spring on the E. boundary of Sec 20.

There are 4 claims taken in this Township. 1 on the SE 1/4 of Sec 21 taken by Taylor Hazen. 1 on the NE 1/4 of Sec 21 taken by W.H. Kelly. 1 on the SE 1/4 Sec 16 taken by F.O. Hazen, & 1 on the SW 1/4 Sec 15 taken by John Donovan.

There is some good Norway & White Pine in Secs 15, 16, 21 & 28 & a few small spots of timber in different parts of the Township, generally the timber is small & poor.

The NE 1/4 of the Township has been badly damaged by fire & also about 1/4 of the NW 1/4 of the Township.

General Description & Notes**T140N R26W****Cass County**

Meanders of Big Rice Lake in Secs 2 & 3.

Meanders of lake in Secs 21, 27, 28 & 34, 22 & 27.

Meanders of Thunder Lake in Secs 9, 10, 15, 4, 5, 8, 17, 16, 22.

Meanders of lakes on S. boundary of Sec 32, SW corner of Sec 31, Secs 19 & 30, 6, 7 & 8, W. boundary of Sec 6, N. boundary of Secs 5 & 6.

The quality of the land in this Tp is generally very poor, soil sandy, surface uneven. In the N. portion, very hilly. The lakes are fine clear bodies of water with abrupt banks in most cases.

The timber is White & Norway Pine, Birch & Aspen with a thick undergrowth of Hazel, Birch, Oak & Aspen. There is much dead timber standing. Much burnt land covered now with 2nd growth of Aspen & Birch.

The portage trail marked through the Tp is the usual summer route of the Indians from Crow Wing to Leech Lake & Pokegama Lake.

General Description & Notes**T140N R25W****Cass County**

Willow River is a sluggish stream 10 ft deep w/ soft bottoms.

Meanders of lakes in Secs 4, 5, 6, 7 & 8, 13 & 24, 11, 12, 13 & 14.

The land in this Tp is as good as the average of the whole country. The middle portion is high rolling land with Pine, Birch, Aspen, Maple & Oak timber.

The SE part, especially Secs 25 & 36 has 1st rate Pine & the Moose (?) River which enters the TP in Sec 35 running NE to near the corner to 25, 26, 35 & 36 where it receives the water drainage from the SE part of the TP. There is a volume of water sufficiently large to run out logs.

The N & NE parts of the Tp is level & swampy, the Willow River having a deep sluggish current through the whole part which it draws & there is some pretty good Cedar swamps with valuable Cedar.

There is also good Pine scattered throughout the Tp in small clumps. The largest & best being on Secs 19, 20, 21, 30 & 31. Also on Secs 4, 5, 6, 18 & 19. There is pretty fair Pine also on Sec 3. All of the last named Secs have the Willow River within reasonable distance for drawing logs.

General Description & Notes**T139N R30W****Cass County**

Meanders of lakes in Secs 25, 26, 35 & 36; 13, 14, 23, & 24; 1: 23 & 26; 14, 15, 22, & 23; 2, 3, 10 & 11; 15, 16, 21 & 22; 3; 7 & 8; 32 & 33; 9, 10, 15 & 16; 10 & 15

Meanders of Big Rice Lake in Secs 27, 28, 33, & 34

Meanders of Pine or Mountain Lake in Secs 31 & 36, 30, 19

The surface of this Tp is generally rolling & the soil 3rd rate & sandy with numerous lakes and ponds. A large part of the Tp is open burnt land & pine barrens. Some scattering Norway Pine, but not of much value for lumber.

General Description & Notes**T139N R29W****Cass County**

Meanders of lakes in Secs. 4 & 5; 32 & 33; 1, 2, 11, & 12; 36, 7, 34 & 35; 1, 12 & 13; 29, 30, 31 & 32; 7 & 18; 16, 17, 20 & 21; 6, 7 & 8.

Meanders of Lake Ada in Secs. 21, 22, 27, 28, 29 & 33.

Meanders of Hand Lake in Secs. 14, 15, 22 & 23.

Meanders of Interior Lake no. 2 in Sec. 15.

Meanders of Lake Ponto in Secs. 3, 9, 10, 15, & 16.

The surface of this township is mostly level or gently rolling. Soil 3rd rate and timber Black Norway and White Pine. Good Pine timber in Secs. 1, 12, 13, & 24 and some also in SW part of township. The NW corner of the township is extremely hilly and covered with brush.

General Description**T139N R28W****Cass County**

Meanders of lakes in Secs. 6 & 7, 27 & 28.

The surface of this township is quite level. The water from the North part of the township runs North through Bog River into Pine River.

There are no large streams in the township. Soil generally poor. Timber Pine, Aspen, Birch, Tamarac and Spruce.

General Description & Notes**T139N R27W****Cass County**

Meanders of lake in Secs 1 & 12, 27 & 34.

Surface level soil, poor timber: Birch, Aspen, Pine, Tamarack, Fir, Maple, Ash. Unfit for cultivation.

General Description & Notes**T139N R26W****Cass County**

Indian trail crosses N. boundary at 24.00 chains between Secs 3 & 34.

Meanders of Leavit Lake in Secs 24 & 25.

Meanders of small Lake in Secs 12 & 1.

Meanders of Lawrence Lake in Secs 25; 26 & 35.

Meanders of small Lake in Secs 34 & 35.

Meanders of Crooked Lake in Secs 26, 27, 34 & 35, 23, 14, 33.

Meanders of small Lake in Secs 1, 11 & 12.

Meanders of Washburn Lake in Secs 7, 8, 17 & 18, 4 & 5, 9, 16.

Meanders of Lake on line between Secs 17 & 20.

Meanders of Lake Wood in Sec 31.

Meanders of Lake George in Secs 6 & 7.

The quality of the land in this Tp. is above the common average. It has some fine lakes & good White & Norway Pine. The shores of the lakes are high & dry. Pine timber near most of them.

In this Tp the local attraction was very great, in some parts it was almost impossible to use the needle. The variation frequently changed 2 & 3 degrees in one mile.

General Description & Notes**T139N R25W****Cass County**

Meanders of Lake Mounitou in Secs 29 & 30.

Meanders of Leavitt Lake in Sec 19. Shore on N. side low & springy, S. side high. Soil 3rd rate. Timber Pine, Fir & Tam.

Meanders of lake in Secs 6 & 7.

Meanders of Lake Edna in Secs 13, 24.

Meanders of lake in Sec 1.

Meanders of Egg Lake in Secs 23 & 24.

General Description & Notes**T138N R30W****Cass County**

Meanders of lakes in Secs 10 & 15; 1 & 2 ; 25 & 36; 35; 15, 16 & 21; 17 & 18; 9; 4 & 5; 6; & 4.

This Tp is mostly rolling surface to sandy worthless soil. The timber principally Black & Norway Pine. In Secs 25, 36, 17, 19, 20 & 30 there is some Norway Pine fit for lumber, some also in Secs 13, 24, & 25. N. Fork of Pine River runs along the E margin of the Tp to the S Fork along the southern margin. The Tp has no value for agricultural purposes.

General Description & Notes**T138N R29W****Cass County**

Meanders of lakes in Secs 16 & 21;
Sand beach & banks 6 - 10 ft high, marshy 3, 4, 9 & 10; 1 & 2; 2 & 3; 6

Meanders of Granite Lake in Secs 10 & 11

Meanders of Norway Lake in Secs 29, 30 & 31

Surface generally rolling soil, mostly sandy. In East part very stony & nearly all poor. The E & SE portions of the Township is thickly timbered, very brushy & with numerous swamps & windfall.

The central & western part is open & burnt Norway Pine land. Pine River is sufficiently large for lumbering purposes but generally shallow. Heavy Wh Pine in Secs 13, 24, 25, 26, 35 & 36. Considerable good Norway Pine in the W. part of the township & along Pine River but not in large quantities or very thick growth. Old pine cutting in Secs 30 & 31.

General Description & Notes**T137N R30W****Cass County**

Meanders of lake in Secs 5 & 8: land around this lake poor. Banks except the SE & W parts from 2-6 ft high Timber Pine & Aspen.

The quality of the land in this Tp is poor. The uplands are generally gently rolling & poor 2nd & 3rd rate land. Timber chiefly Pine, Aspen, Birch, Balsam & Spruce.

General Description & Notes**T137N R29W****Cass County**

-Meanders of Hay Lake in Secs 25, 26, 35 & 36: Clear handsome lake with sand beach and good banks

-Meanders of lakes in Secs 23, 24, 25 & 26; 24, 25, 13 & 14

-Meanders of Pine River in Secs 11, 12, 13, 14, 10, 15, 7, 8, & 9

The surface of this Tp is generally somewhat rolling and the soil poor. The NE part is heavily timbered, along Pine River very brushy. The central part of the Tp covered mostly with Blk Pine and the SW part low, swampy, brush and burnt land. Excellent Wh Pine timber in Secs 1 & 2 and good Norway Pine in Secs 6 & 7. Pine River below the Forks averages 2 chains wide and is fordable at this time in all places.

General Description**T136N R30W****Cass County**

The quality of land in the foregoing township is 3rd rate. There are a great many Tamarac, Spruce and Fir swamps, the remainder of the land is mostly covered with Birch and Aspen timber.

June 1858

General Description & Notes**T136N R29W****Cass County**

Meanders of lakes in Secs. 36, 25, 13, 14, 23, 24, 34 & 35, 26 & 35, 27, 28, 33 & 34, 22 & 15, 9, 10, 15 & 16, 19, 20, 29, 18 & 19.

The quality of the soil is generally poor. The timber is almost exclusively Black and Norway Pine, small in size. The surface is rolling and with the exception of the NW corner of the township, quite dry. The lakes in the East and middle portions of the township have abrupt banks and abound in fish. The two lakes lying in the West portion are surrounded by marsh and swamp.

General Descriptions & Notes

T135N R30W

Cass County

Meanders of the lake in Secs 32 & 33

The quality of the land in this Tp is generally poor. Some portions where hardwood timbers abound will make average farmland. The Southern part of the Tp is largely occupied by Tamarac swamps or marshy ponds. The Northern portion is more Elevated but thickly interspersed with marshes and windfall.

Notes & General Description

T135N R29W

Cass County

Round Lake in Sec 36, bottom & shore of lake sandy, water clear. Large white pines around shoreline.

Road from Crow Wing to Leech Lake between Secs 2 & 35 along N. boundary at 44.00 chains.

Indian trail bears NE & SW at 70.69 chains West between SEcs 25 & 36.

Pine River Road & Leech Lake Road run between Secs 26 & 35 (21.50 & 22.50 chains)

Mission house at 42.00 chains N between Secs 34 & 35 bears N34W

Meanders of lake in Secs 25 & 36: This lake has a handsome sand beach all around it.

Meanders of Lake Hubert in Secs 24 & 25: Handsome lake with sand beach

Meanders of lakes in Secs 12 & 13; 11 & 14

Meanders of lake in Secs 1 & 2: Burnt land & hardwood timber around lake.

Meanders of lakes in Secs 23, 24 & 26; 9 & 10; 9, 10, 15 & 16: Lake has marshy margin all around

Meanders of Gull Lake in Secs 34, 35, 26, 23, 22, 21, 16, 9, 4, 20, 29, 32, 33

Meanders of Agate Lake in Secs 31 & 32

Meanders of lakes in Secs 17, 20 & 29; 2, 3 & 10

Surface generally rolling & soil mostly poor. Timber Black & Norway Pine with Oak brush in east part of Township. Oak, Pine, Aspen, Birch in the west part, but with little Pine suitable for lumber. The Gull Lake Mission is on the NE 1/4 Sec 34. Gull Lake extends across the Township N & S. Numerous small lakes connected by broad sloughs in N. part of Township.

Natural Vegetation of Minnesota

Brochure. MN DNR Biological Report No. 1. This map was adapted from a map compiled in 1930 by F.J. Marschner.

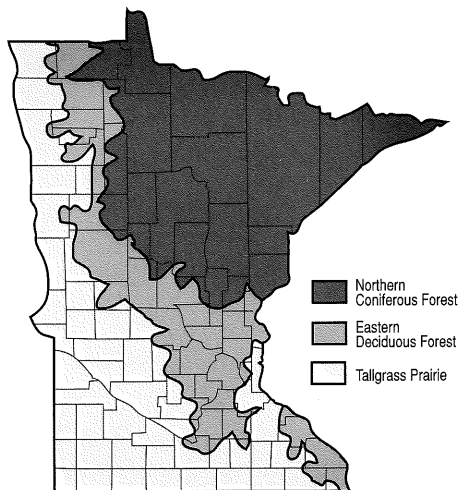
Natural Vegetation of Minnesota

At the Time of the Public Land Survey
1847-1907



Presettlement Minnesota. Imagine. "...rolling prairies... undulation upon undulation as far as the eye can reach ...a view of peculiar sublimity..." wrote H.D. Ruggles of the western Minnesota landscape in 1835. Early accounts of the towering pines in the north abounded with equally vivid impressions. And in the south, French explorers extolled the vast forests of maple, basswood, and elm, calling them the "Big Woods."

The early European settlers had described, in astonished detail, the three major biomes that meet in Minnesota: tallgrass prairie, northern coniferous forest, and eastern deciduous forest.



The vegetation types that defined these biomes were distributed on the landscape according to climate, soil, and landform patterns. Natural disturbances such as fire, severe drought, windstorm, and insect outbreaks modified the vegetation on a local and regional scale. Of these, fire was the most important disturbance agent.

Frequent fires—started by lightning and by Indians for hunting and other purposes—helped to maintain the species composition and treeless structure of the tallgrass prairie. Where fires were less frequent or intense, trees invaded the prairie in scattered groves to form woodland and parkland communities. This created a vegetational ecotone known as the prairie/forest border. Within the deciduous forest biome, where firebreaks such as rivers, lakes, and rough

topography prevented the spread of fires, a dense forest of maple, basswood, and elm developed. Within the coniferous forest biome, fires created a mosaic of forest types from young postfire stands of aspen-birch and jack pine, to old-growth stands of white and red pine, spruce-fir, northern white cedar, and maple-basswood-yellow birch forest. This complex interaction of fire with climate, soils, and topography created a dynamic landscape—a constantly shifting mosaic of vegetation types.

Vegetation Types of the Prairie and Deciduous Forest

Upland Prairie and Prairie Wetland

Tallgrass prairie, at the time of the public land survey in the 1850s, covered one-third of the state. It occupied a wide variety of landforms, including beach



Prairie Coteau Scientific and Natural Area, Pipestone County

ridges and swales, glacial lake beds, morainic hills, steep bluffs, and rolling till plains. Along these landforms, important differences occurred in the plants and animals that compose the prairie ecosystem. The most striking indicator was the predictable change in dominance of a few major prairie grasses. The distribution pattern of these grasses coincided with differences in soil moisture levels related to topography. In general, prairie cordgrass and bluejoint dominated the wet lowlands; big bluestem and Indian grass occupied the deep fertile soils of the moist uplands;

and little bluestem and sideoats grama occurred on the thin soils of dry uplands.

Throughout the prairie biome, numerous wetland communities dominated by sedges and rushes, rather than grasses, were interspersed with upland prairie. The glacial moraine landforms of the prairie region were ideally suited for wetland formation; their hilly knob and kettle-type topography abounded with prairie pothole marshes.

Aspen Parkland

The aspen parkland formed an ecotone between the prairie and coniferous forest of extreme northwest Minnesota and



Dittmer Wildlife Management Area, Mahnomon County

adjacent Canada. It covered vast acreages within the poorly drained flatlands left by Glacial Lake Agassiz. Sometimes referred to as brush prairie, the aspen parkland was a fire-maintained mosaic of wet prairie, sedge meadow, shrub thicket, and aspen groves.

Oak Woodland and Brushland

The oak woodland and brushland was a common ecotonal type between the prairie and deciduous forest. Fire, more than landform type or climate, was the significant factor influencing the position and extent of this community.

The oak woodland and brushland vegetation type has often been referred to as savanna. However, in Minnesota the image of a tallgrass prairie dotted with trees to create an orchard-like appearance is more myth than fact. Careful study of the original public land survey records has led to a new interpretation. The oak woodland and brushland ranged from small groves of trees intermixed with open prairie to a chaparral-like commu-



Cedar Creek Natural History Area, Anoka County

nity of scrub forest and dense shrub thicket. The structure of the community was largely determined by soil conditions and fire frequency. The oaks, especially bur oak and northern pin oak, were the dominant trees. In the southeast, white oak and black oak were also common.

Floodplain Forest

Floodplain forests occupy both major and minor water courses throughout the state. They are especially well developed in the valleys of the Mississippi, Minnesota, and Red rivers. The lowland sites occupied by these forests are subjected to periodic flood and drought. Spring



St. Croix River, Chisago County

floodwaters enrich the soil as they deposit silt over the forest floor. Silver maple, American elm, green ash, black willow, and cottonwood are the dominant trees and poison ivy and stinging nettle the characteristic understory plants.

Maple-Basswood Forest

Minnesota's maple-basswood forests, dominated by elm, basswood, sugar maple, and red oak, occur at the western edge of the deciduous forest biome of eastern North America. The largest continuous area of maple-basswood forest in Minnesota at the time of the

original public land survey covered over 3,000 square miles in the south-central part of the state. The early settlers called this area the "Big Woods." Smaller areas of maple-basswood occurred in the rugged, stream-dissected lands of southeastern Minnesota and in the west-central part of the state. The boundaries of this forest were in large part controlled by the frequency of fire. The dominant



Wolsfeld Woods Scientific and Natural Area, Hennepin County

trees are highly fire-sensitive and were restricted to areas where natural fire-breaks such as rivers, lakes, and rough topography prevented the spread of fire from the adjacent prairie lands.

Vegetation Types of the Conifer Forest

Northern Hardwood Forest

In Minnesota, the northern hardwood forest is dominated by sugar maple, basswood, yellow birch, and red oak. Conifers, particularly white pine, northern white cedar, and balsam fir are often found scattered through the forest. Due to the fire-sensitivity of the dominant trees, this forest association was



Tettegouche State Park, Lake County

relatively rare in the state. It was generally restricted to rich, morainic soils where fire frequencies were low. The most conspicuous area of northern hardwoods was the narrow belt along the North Shore Highlands that stretches from Duluth to the Canadian border. It was also found in fire-protected pockets across north-central Minnesota, as far west as Cass Lake.

Great Lakes Pine Forest

The Great Lakes pine forest occurs in Minnesota primarily on thin glacial till



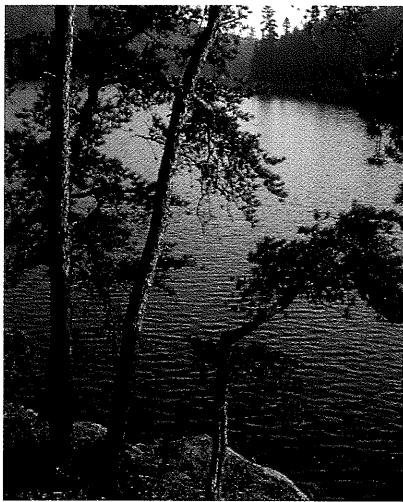
Boundary Waters Canoe Area, Cook County

over bedrock in the Canadian-Minnesota border lakes area and in the gravelly moraines and sandy outwash plains in the north-central part of the state. This forest is defined by its characteristic trees—eastern white pine and red pine.

Historically, tree composition and age structure of the pine forest were largely determined by natural fire cycles. Fires of varying frequency and intensity created a dynamic ecosystem composed of early postfire stands of jack pine and red pine and mature old-growth stands of white pine. In general, red pine was more abundant than white pine and occurred on coarsely-textured, dry sites prone to fires. White pine stands occurred on the mesic sites of lake margins and lower slopes less subject to fires.

Jack Pine Forest

This forest community occurs on the driest, least fertile soils of the pine region. It is especially prevalent on sandy outwash plains in north-central Minnesota and on bedrock outcrops north of Lake Superior. Jack pine grows in



Boundary Waters Canoe Area, Lake County

pure stands or in mixtures with aspen, northern red oak, and red pine. Most natural stands originate following fire. Fire opens the habitat to direct sunlight and exposes a mineral soil seedbed—both requirements for jack pine reproduction. The dry, open conditions under the jack pine canopy allow for a variety of understory plants. Ericaceous shrubs such as wintergreen and blueberry are especially common. On deeper soils, hazel may form impenetrable thickets, whereas on rocky balds, a dense blanket of feather mosses may be the only understory.

Boreal Hardwood-Conifer Forest

The boreal hardwood-conifer forest in Minnesota is a southern extension of the large boreal forest of Canada. This forest type occupies much of northern Minne-



Suzy Island Preserve, Cook County

sota—a region characterized by a short, moist growing season and deep snow. The dominant tree species, balsam fir, white spruce, black spruce, trembling aspen, and white birch occur in pure or mixed stands.

Species composition varies considerably in response to differences in site conditions and natural fire cycles. Balsam fir, owing to its great shade tolerance, tends to form extensive stands in the absence of frequent fires. Natural disturbances, including fire, wind, and spruce budworm epidemics often result in extensive areas of even-aged stands of spruce-fir or aspen-birch forest. Far less extensive, and found mainly in extreme northeast Minnesota, old-growth white cedar forests occur on fire-protected uplands.

Peatland

Extensive peatlands blanket the nearly flat landscape left when the waters drained from the ancient glacial lakes of north-central Minnesota. Scattered throughout northern Minnesota, smaller



Winter Road Lake Peatland, Beltrami County

peatlands occur in the basins of glacial moraines. Although there were several attempts—mostly unsuccessful—to drain the largest peatlands, the vegetation mosaic of these areas is relatively unchanged since presettlement times.

The extensive peatlands that developed in ancient glacial lake plains exhibit a variety of bog, fen, and swamp vegetation. Bogs are forested with black spruce or tamarack, or are open and dominated by sphagnum mosses, sedges, and low ericaceous shrubs. They occur on nutrient-poor, acid peat deposits. In

contrast, fens and swamps develop on mildly acid to highly alkaline peat deposits affected by mineral-rich groundwater. Fens are composed of grasses and sedges, while swamps are dominated by woody plants—either coniferous trees (e.g., northern white cedar) or deciduous trees (e.g., black ash).

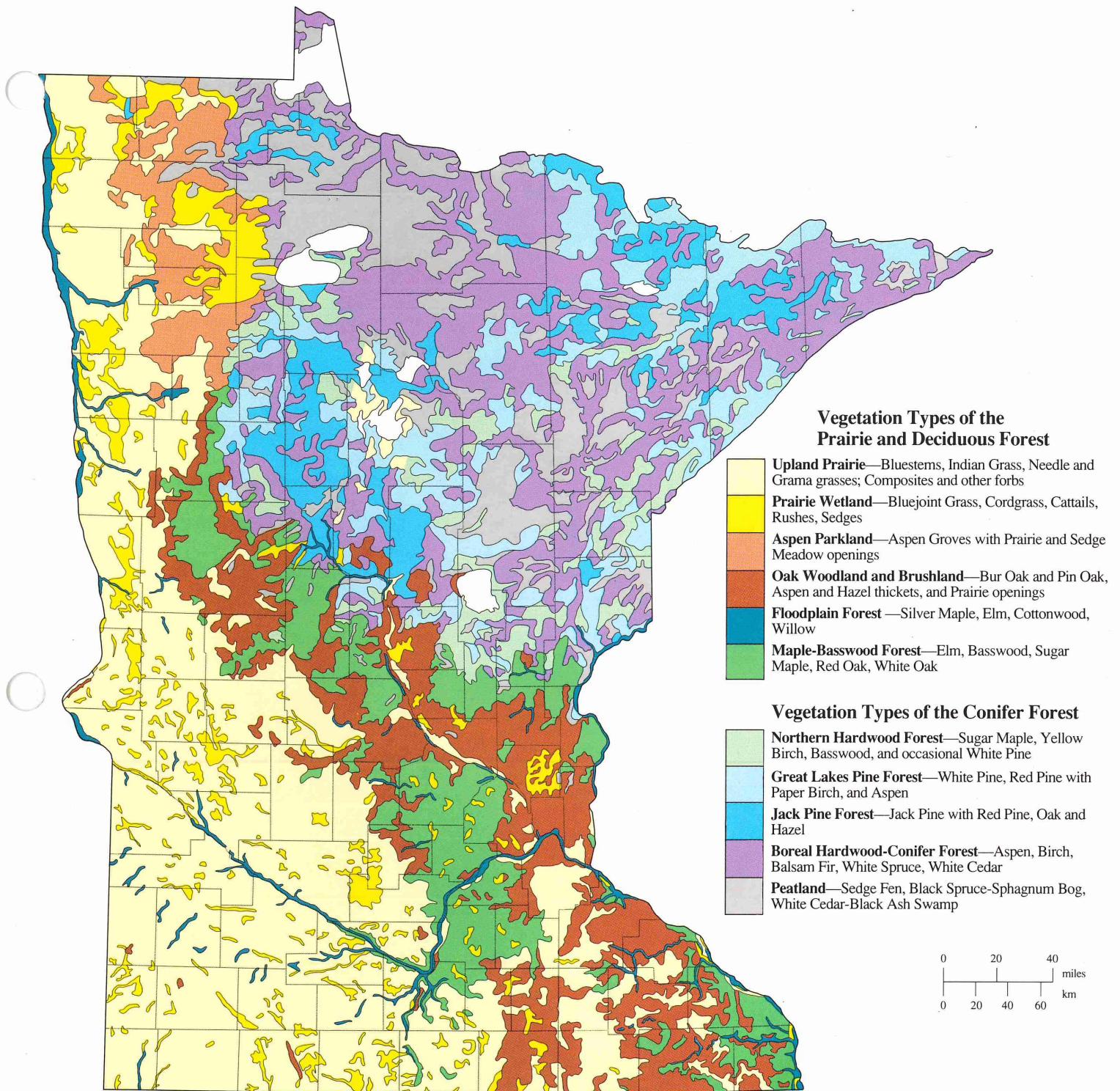
Changes in the Natural Vegetation Since Settlement

After more than a century of European settlement, nearly all the natural communities composing the three major biomes have been substantially altered. The vast tallgrass prairie that once covered one-third of the state has been reduced to less than one percent of its original expanse. The largest continuous area of climax deciduous forest—the “Big Woods”—is now restricted to small, scattered islands of forest surrounded by cropland. The great stands of virgin pine that once defined the North Woods have been replaced by essentially pure forests of aspen and birch. And throughout the state more than nine million acres of wetlands have been lost to agriculture.

Examples of the above vegetation types that still maintain their characteristic natural features are now uncommon on the Minnesota landscape.

Interest in protecting these natural environments as part of the state's historical and biological heritage began in 1891 when Itasca State Park was established to preserve remnants of the primeval pine forest. Today, public resource agencies and private conservation organizations are cooperating to establish a network of preserves that represents Minnesota's extant natural ecosystems.

Developing such a network depends on accurate ecological information. Comprehensive data on the distribution and status of intact biotic communities is now being compiled by the Minnesota County Biological Survey. Initiated in 1987, and conducted in cooperation with the Natural Heritage and Nongame Wildlife Programs, the survey systematically gathers, county-by-county, information on Minnesota's rare natural habitats and the plants and animals they shelter. ■



The Natural Vegetation of Minnesota at the Time of the Public Land Survey: 1847-1907

This map was adapted by Barbara Coffin of the DNR, Natural Heritage Program from *The Original Vegetation of Minnesota*, a map compiled in 1930 by F. J. Marschner from the U. S. General Land Office Survey Notes and published in 1974 under the direction of M. L. Heinselman of the U. S. Forest Service. It was produced by the Cartography Laboratory of the Department of Geography, University of Minnesota.

Notes on the History of the Map

The map presented here is a modification of the 1974 published version of F.J. Marschner's map, *The Original Vegetation of Minnesota*. Marschner, a research assistant in the Office of Agricultural Economics, U.S. Department of Agriculture, Washington, D.C. compiled a vegetation map of Minnesota in 1929-30 from the U.S. General Land Office Survey Notes. M.L. Heinselman in his *Interpretation of Francis J. Marschner's Map of the Original Vegetation of Minnesota*, published by the U.S. Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota, 1974, describes the sources of information available to Marschner and the methods of mapping he employed.

Unfortunately, as Heinselman points out in his description of the 1974 published version, Marschner did not leave detailed notes on the methods he used to construct this map. According to Heinselman:

"The information available to Marschner included brief written descriptions of the soils, land-forms, and vegetation of each township: the township plat maps; and location notes for each section corner, meander corner, quarter corner, or other monumented point on survey lines. Where trees were available, corners were usually identified by inscribing the corner's legal description on a deep axe-blaze on three 'witness trees' facing the actual monumented corner. Where witness trees were used, their species, diameters and compass bearings, and distances from the corner are given in the notes. The plat maps also may show lakes, streams, wetlands, etc. There may also be notes on the terrain and vegetation along section lines."

This 1988 version of Marschner's map is a direct generalization of the map published in 1974. It was determined that a vegetation map of Minnesota that could be produced in smaller format than

the existing 1:500,000 scale map would be useful to many. In order to accomplish this, the intricate detail of the original map had to be simplified.

In generalizing the vegetation types and simplifying boundaries, a new classification was developed (see cross-reference chart). Many of the decisions to combine types or to eliminate a geographically small occurrence of a type are not significant because this detail would be

lost in such a major reduction of Marschner's original map. However, a few changes were made to reflect new understanding of the distribution and composition of Minnesota vegetation types. ■

We gratefully acknowledge the critical review of this 1988 version of the map by Drs. M.L. Heinselman, J.C. Almendinger, E.J. Cushing, E.C. Grimm, D.B. Lawrence, and L.F. Ohmann.

Marschner's Map 1974 Version

Grassland

Prairie _____
Wet Prairies, Marshes & Sloughs _____

Upland Prairie _____
Prairie Wetland _____

Brushland

Brush Prairie _____
Aspen-Oak Land _____
Oak Openings and Barrens _____

Aspen Parkland _____
Oak Wookland and Brushland _____

Hardwood Forest

Big Woods _____
River Bottom Forest _____
Aspen-Birch (Hardwoods) _____

Maple-Basswood Forest _____
Floodplain Forest _____

Pineries

Aspen-Birch (Conifer) _____
Mixed Hardwood and Pine _____
Pine Groves:
White Pine _____
White and Norway Pine _____
Pine Flats _____
Jack Pine Barrens and Openings _____

Vegetation Types of the Conifer Forest

Boreal Hardwood-Conifer Forest _____
Northern Hardwood Forest _____

Great Lakes Pine Forest _____

Jack Pine Forest _____

Bogs and Swamps

Conifer Bogs and Swamps _____
Open Muskeg _____

Peatland _____

Text by Keith M. Wendt and Barbara A Coffin of the Natural Heritage Program, Section of Wildlife, Minnesota Department of Natural Resources, Designed by Linda J. McNary December 1988.

The photographs in this publication are of remnant natural vegetation types that have escaped significant human alteration.

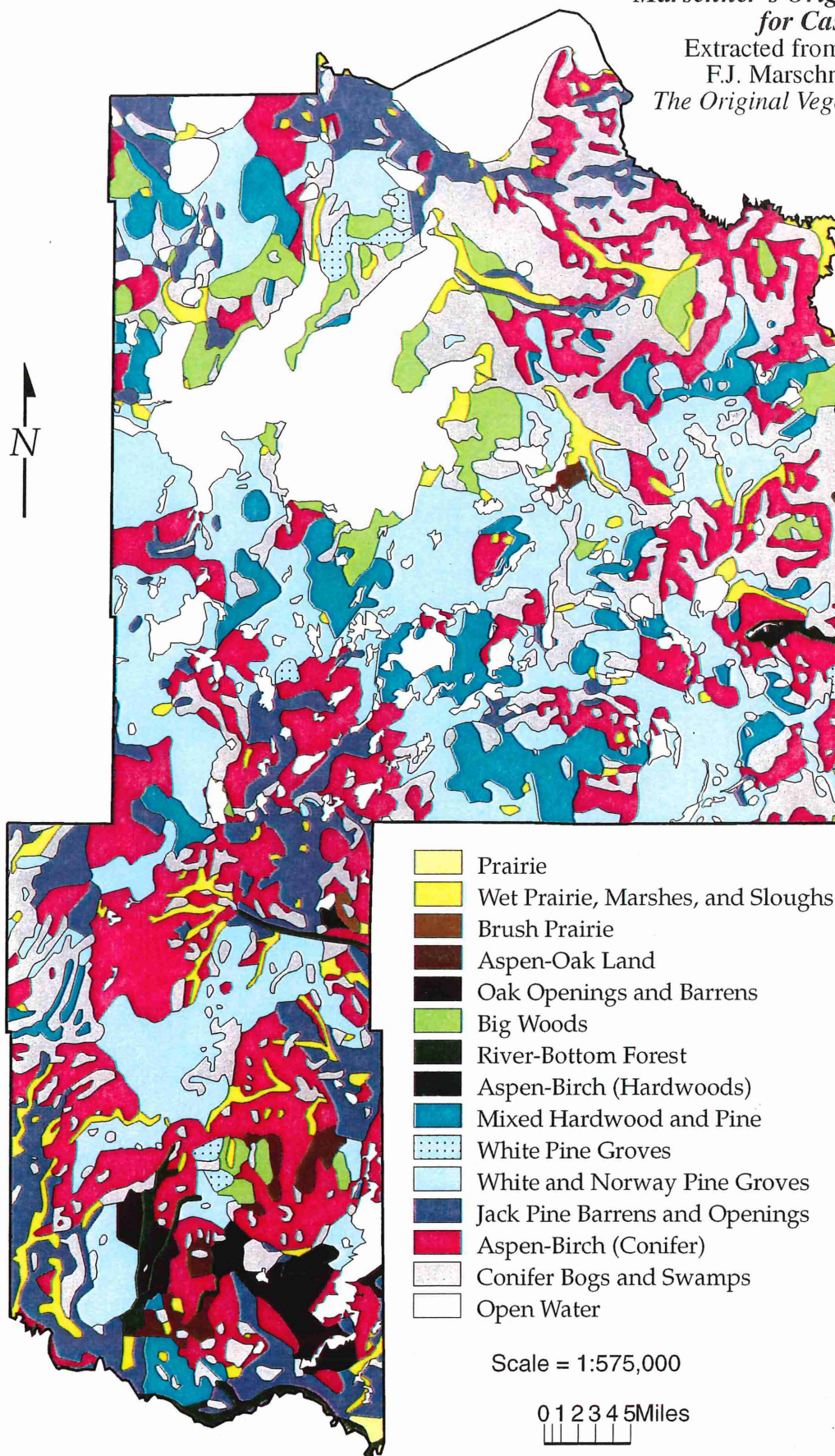
Photo credits:

Richard Hamilton Smith, cover photos and 1, 3, 4, 7, 8; Keith Wendt, photos 2, 5, 6, 9; Barbara Coffin, photo 10.



*Marschner's Original Vegetation Map
for Cass County*

Extracted from a digital copy of
F.J. Marschner's 1930 map,
The Original Vegetation of Minnesota



Interpretation of Francis J. Marschner's Map of the Original Vegetation of Minnesota

(Heinselman, M.L. 1974. North Central Forest Experiment Station, St. Paul.) Although all communities on F.J. Marschner's original map are not found in Cass County, this interpretation, found on the back of the 1974 published version of Marschner's 1930 map, holds valuable information about the map's origin and community designations.

Interpretation of Francis J. Marschner's Map of the Original Vegetation of Minnesota

Miron L. Heinselman

History of the Map

About 1929, Mr. Francis J. Marschner, then a Research Assistant in the Office of Agricultural Economics, U.S. Department of Agriculture, Washington, D.C., began work on a map of the original vegetation of Minnesota. On July 2, 1930, the completed map was sent to Dr. Raphael Zon, then Director of the Lake States Forest Experiment Station, St. Paul, Minnesota. Apparently only two hand-colored copies were made by Marschner or by others under his direction. One was filed in the Washington Office of the USDA Forest Service, the other sent to Dr. Zon as noted above. Possibly the original map sent to Zon was more detailed than the Washington Office copy, but unfortunately Zon's copy was somehow lost between 1940 and 1950.

The map published here is the USDA Forest Service's Washington Office copy. It was sent to the Lake States Forest Experiment Station on April 23, 1963, with a memorandum from Dr. Carl E. Ostrom, Division of Forest Management Research that stated that the map was "a copy made by the Washington Office in February 1930." It is no longer known why Marschner became interested in the vegetation of Minnesota or why he undertook this assignment. Marschner died in the late 1960's.

No other map of the presettlement vegetation has ever been made with the degree of detail of the Marschner map. The information on the unpublished Marschner map has often been used in research and will continue to be useful as the passage of time increases interest in Minnesota's original vegetation. The North Central Forest Experiment Station, therefore, decided to publish the map, both to satisfy rising interest and to preserve it as a permanent documentation of Minnesota's original plant cover.

Marschner's Information and Sources

The vegetation types delineated by Marschner were based largely on the survey notes, descriptions, and maps of the original land surveys of Minnesota made by the

U.S. General Land Office between about 1850 and 1905. These surveys were usually made just ahead of settlement. They began in the southeast before the Civil War and were largely completed in extreme northeastern Minnesota by about 1905. Thus the map shows vegetation before it was directly altered by cultivation, commercial logging, or land clearing.

The survey subdivided the entire State into "townships" bounded by "town lines" on the north and south sides and by "range lines" on the east and west sides. Townships are 6 statute miles on a side, except for corrections for sphericity of the Earth and surveying errors. Each township was subdivided into 36 "sections," each about 1 mile square. The township grid, as it now exists, is overprinted on this published map. Descriptions of the G.L.O. Survey and the procedures followed can be found in elementary surveying texts (such as Rayner 1937). Bourdo (1956) describes in detail the survey procedures used in the Midwest and their applicability to reconstructing past vegetation.

The information available to Marschner included brief written descriptions of the soils, landforms, and vegetation of each township; the township plot maps; and the location notes for each section corner, meander corner, quarter corner, or other monumented point on survey lines. Where trees were available, corners were usually identified by inscribing the corner's legal description on a deep axe-blaze on three "witness trees" facing the actual monumented corner. Where witness trees were used, their species, diameters, and compass bearings and distances from the corner are given in the notes. The plat maps also may show lakes, streams, wetlands, etc. There may also be notes on the terrain and vegetation along section lines.

Unfortunately, Marschner never gave the USDA Forest Service a detailed description of how he used these notes to construct the map, nothing was ever published by him on his subject, and no further records of this work became available upon his death. Clearly, he did not use the sophisticated quantitative methods for gen-

erating vegetation data from witness tree distributions developed later by Bourdo (1956) and others.

Three brief memoranda in the files of the North Central Forest Experiment Station give us what information there is on Marschner's methods. The only memo definitely written by Marschner himself, dated February 3, 1956 (26 years after completion of the map) is here quoted in full:

Source Material and Construction of the Natural Vegetation Map of Minnesota

The Natural Vegetation Map of Minnesota is in the main based on the field notes written, and the plats prepared by the surveyors of the General Land Office. These surveys necessarily stretched over quite a number of years but almost everywhere they were made ahead of settlement. The conditions they portray are therefore those which existed before white man arrived at the scene, and consequently may be considered as natural. Indians had used this part of the country mainly as a hunting ground. Some Indian sugar camp sites were noted in the hardwoods of East-Central Minnesota, but aside from these, little evidence was reported that would indicate the Indians had disturbed to any extent the original forest cover.

The distribution pattern of the vegetation types was constructed by checking out the tree associations according to significant distinctions which reflected casual relationship with climate, soil, and slope conditions. The distribution patterns were developed on the township plats, which usually contained already such distinctions as swamp, tree groves in the prairies, and, if I remember correctly, the boundary between woodland and prairie where it was sufficiently distinct. From the plats these distribution patterns were transferred by hand, township by township, to the 1:500,000 scale base map of Minnesota. The procedure required reading of more than 200 volumes of field notes, nearly all written in longhand, only the latest ones are typed.

As may be perceived from these notes, a considerable amount of work is involved in the preparation of this map.

-F.J. Marschner

A memo dated June 30, 1930, also probably written by Marschner, contains a map legend slightly different from the one published here, and in addition the following paragraph:

Based on the main on the records of the General Land Office. Other material used: Geology of Minnesota, Final Report, Vol. I and II of the Geological and Natural History Survey of Minn. 1872-85; Frank Leverett & Frederick W. Sardeson, Surface Formations and Agricultural Conditions of Minnesota, Bulls. No. 12, 13, 14, of the Minn. Geol. Survey, 1915-19; Soil Surveys, Bureau of Soils, U.S. Department of Agriculture; Topographical Surveys, U.S. Geol. Survey; House Document 27, 61st Congress 1st Session; H. B. Ayres, Timber Conditions in the Pine Region of Minn. 21st Ann. Report, U.S. Geol. Survey; H. L. Pammel, A Comparative Study of the Vegetation of Swamp, Clay and Sandstone areas of West. Wis., Southeastern Minn., Northeastern and Central Iowa, Vol. X, Proceedings of the Davenport Academy of Science, 1905; Samuel B. Green, Forestry in Minnesota, Geol. And Nat. History Survey of Minn. 1902.

Marschner was last asked about his methods by Dr. Carl Ostrom of the Division of Forest Management Research, USDA Forest Service, Washington, D.C. A memo by Ostrom dated April 23, 1963, contains the following statement: "He (Marschner) says that he read 240 volumes of original handwritten field notes and drew type lines from the descriptions of each section line. It took one year of continuous work to accomplish this."

From these statements it is clear that Marschner used the full set of field notes, and that the map shows his best estimates of the vegetation of each township at the time the township was surveyed. The date of survey for any township can be determined from copies of the original notes obtainable from numerous State, County, and Federal offices in Minnesota.

It will never be entirely clear to what extent Marschner based certain vegetation boundaries on the surficial geology maps of Leverett and Sardeson, the earlier U.S. Geological Survey maps and paper by Ayres and others, the (very limited) soils reports and topographic maps then available, or on the reports of Pammel, Green, and others. But I have compared Marschner's map with several of these documents and it is apparent that his types could not have come from them alone. The detail shown could only have come from the original survey notes and maps. Further, his types check well with what has recently been learned about the presettlement vegetation of the Boundary Waters Canoe Area and the Lake Agassiz

peatlands region where my own work based on actual remnants of presettlement vegetation permits direct evaluation. There is much loss of detail due to the small scale of Marschner's map, and there are many inaccuracies due to his lack of aerial photographs or good base maps. But for most areas his map is a remarkably good generalization of actual conditions. It is my considered opinion that this map is worthy of use in serious scientific investigations and as a visual aid in teaching ecology, paleoecology, plant geography, and in related disciplines.

Changes Made in this Published Version of Marschner's Map

The present map has been printed on a new base at the same scale as the original (1:500,000). This new base includes the General Land Office Survey township grid, place names of principal cities, towns, and villages (as of about 1970), railroads, and county names and boundaries. The vegetation type boundaries have been carefully redrafted and transferred to this new base without significant loss of detail or accuracy. The lakes shown have been transferred directly from Marschner's original map (instead of using the lake boundaries on the new base map) to avoid altering many adjacent vegetation type lines to conform to the new lake patterns. The color scheme has also been changed to improve comprehension of ecological relationships and to sharpen distinctions between certain types. Marschner's two forested swamp and bog types were combined because the only difference between them was in size of areas shown. Minor changes in the wording of his legend were made to accommodate that change and improve comprehension. Except as noted above, the vegetation types and the legend itself are faithful reproductions of the Marschner map sent to the Lake States Forest Experiment Station by Dr. Ostrom on April 23, 1963.

Dynamic Nature of the Primeval Ecosystem

Marschner's map shows the character of Minnesota's vegetation just before land settlement by European and African peoples. But because the G.L.O. Surveys spanned more than half a century, it is not a picture of the State at one point in time. In the northeast the map shows conditions between about 1875 and 1900, but in the south and west the conditions shown are those from about 1850 to 1875.

Actually, the natural vegetation was in a constant state of flux due to gradual plant migrations caused by climatic changes (Wright and Watts 1969, McAndrews 1966, Waddington 1969), local successional changes initiated by fires, windstorms, or insect and plant disease outbreaks (Spurr 1954, Ahlgren 1960, Frissell 1973, Swain 1973, Heinselman 1973), and the gradual modification of wetlands by bog and swamp-forming processes (Conway 1949; Heinselman 1963, 1970, 1974; Janssen 1968).

Fires created the most dramatic, widespread, and significant short-term vegetation changes. Lightning was a frequent source of ignitions in both prairie and forest, but ignitions by Indians, fur traders, and explorers must also have been extremely common. The prairie-forest border was an unstable zone maintained by periodic fires (see Buell and Facey 1960, Waddington 1969). Deep tongues of prairie that penetrated the forest region have been interpreted as "fire scars" that marked the frequent incursion of grassland fires — often on sandy, drouthy soils.

There is also much evidence that the pine forests of northern Minnesota were maintained by periodic fires (Spurr 1954, Ahlgren 1960, Frissell 1973, Heinselman 1973, Swain 1973). In fact, the whole forest ecosystem of the conifer region required periodic perturbations by fire to maintain its diversity, productivity, and stability. For example, the abundant ASPEN-BIRCH (Conifer) types and the JACK PINE BARRENS AND OPENINGS of Marschner were clearly products of recent or repeated fires or both. Most old pine groves were scarred by frequent surface fires that kept them in a park-like condition and often created openings large enough for regeneration to occur (see Ayres 1899, Spurr 1954, Frissell 1973, Heinselman 1973). Along the western and southern borders of the forest the OAK OPENINGS, BRUSH PRAIRIES, and ASPEN-OAK areas were clearly fire-maintained types.

Thus many areas of vegetation mapped by Marschner were the result of recent (but natural) fires that burned only a few decades or years before the Land Office survey crews reached them. Some of these burns were certainly very large (see Heinselman 1973). Had the survey been made just before such areas burned, Marschner's types often would have been different, especially within the more mesic forests. The vegetation as a whole was relatively stable, but the details of the mosaic shifted like

pieces in a kaleidoscope (see Wright and Heinselman 1973). Students of the natural vegetation of Minnesota must recognize this, and not interpret Marschner's map as the record of a long-standing stable climax vegetation.

Relation of the Map to Later Maps and Vegetation Descriptions

Marschner's map is an honest attempt to depict the vegetation of Minnesota as it actually was at the time of settlement. It is not burdened by the climax concept or by notions of what the vegetation *would* be if such natural perturbations as fires and windstorms had not recently "disturbed" much of the region. In contrast, K  chler (1964) portrayed the "potential" natural vegetation. Actually, Marschner's map was one of K  chler's principal information sources for Minnesota, but be considered the extensive aspen-birch forests shown by Marschner to be temporary (seral) types and therefore assigned all such forests to other (climax?) types. K  chler shows most of Marschner's ASPEN-BIRCH (Conifer) types as SPRUCE-FIR (*Picea-Abies*), while Marschner did not use the spruce-fir type at all. Curiously, K  chler did not adopt a similar philosophy with respect to most of the clearly successional pine forests of Minnesota. The successional status of the pine communities has now been thoroughly dealt with (Cooper 1913, Lee 1924, Grant 1934, Buell and Gordon 1945, Buell and Niering 1957, Spurr 1954, Ohmann and Ream 1971, Frissell 1973, Heinselman 1973, Wright and Heinselman 1973), and clearly most such forests were fire-dependent, not climax. Similar questions might be raised concerning Marschner's vs. K  chler's mapping of BRUSH PRAIRIE, ASPEN-OAK, OAK OPENINGS, WET PRAIRIES, and the PRAIRIE border itself. All of these vegetation units were fire-maintained, and it is not clear how K  chler decided on the types and boundaries used. However, K  chler's map places Minnesota's vegetation in perspective with adjacent States, and it is an important work that should be consulted by all serious students of Marschner's map.

John T. Curtis' (1959) monumental work on the vegetation of Wisconsin is the only other complete regional vegetation description that covers an area sufficiently close to Minnesota both geographically and ecologically to be of major value in interpreting Marschner's map. Curtis was a founder of the *vegetation continuum* concept, but he nevertheless resorted to plant communities and maps to describe vegetation. Many of Curtis' communities

have close analogues in Minnesota. Of course, some important dominants do not occur in Minnesota, or are rare; for example, beech (*Fagus grandifolia*) or hemlock (*Tsuga canadensis*). And there are many subtle changes in community composition and structure as one moves westward into the drier, more continental climate of Minnesota. But because no comparable description of Minnesota's vegetation yet exists, Curtis' community data provide some of the best descriptions for certain of Marschner's types.

Users of Marschner's map will also profit from careful readings of relevant sections in Braun (1950) and Rowe (1959).

Marschner's Vegetation Units

Many users will desire more information about plant community composition and structure and about the environmental conditions associated with Marschner's types than the map provides. Because Marschner left us no such legacy, one must relate his vegetation units to any relevant literature. Some of the type names are traceable to early works on Minnesota's flora and resources such as those of Upham (1884), Ayres (1899), and Rosendahl and Butters (1928). Others were simply in common usage at the time. A brief consideration of each of Marschner's mapping units follows:

Prairie

The upland prairies of Minnesota were largely of the so-called "tall grass prairie" type. Some important species were: big bluestem (*Andropogon gerardi*), little bluestem (*Andropogon scoparius*), indian grass (*Sorghastrum nutans*), *Koeleria cristata*, several other grasses, many forbs such as prairie clover (*Petalostemon purpureum* and *P. candidum*), asters, goldenrods, (*Solidago*), and pasque flower (*Anemone patens*), and several shrubs, especially roses and wolfberry (*Symphoricarpos occidentalis*). The composition and structure of communities varied, depending on latitude, longitude, distance from the forest, and local soil and moisture conditions. An appreciation of this can be gained from Curtis' (1959) tables giving species presence and frequency for several prairie types. Fire was a major factor preventing the encroachment of forest, and in maintaining the diversity and productivity of prairies (see Buell and Facey 1960; Waddington 1969; Winchell 1884a, b, 1888).

Wet Prairies, Marshes and Sloughs

This type encompassed a wide range of wetlands, from seasonally inundated grasslands on mineral soil to cattail marshes and sedge and reed-covered peatlands within the forest region, and even some wild rice areas. Prominent species were bluejoint grass (*Calamagrostis canadensis*), big bluestem (*Andropogon gerardi*), many sedges (*Carex*), the common reed (*Phragmites communis*), cattails (*Typha*), bulrushes (*Scirpus*), wild rice (*Zizania*), iris, willows (*Salix*), speckled alder (*Alnus rugosa*), and bog birch (*Betula pumila*). Marschner did not intend to include the somewhat more acid fens of the forest region that support some of the heath family (*Ericaceae*) and sphagnum mosses, along with many of the above species. These northern fens were usually assigned to his OPEN MUSKEG type, but this distinction was not consistently maintained, and these types in fact do intergrade (see below). Winchell (1884a, b, 1888) describes Minnesota's original wetlands in some detail.

Brush Prairie

This type was a fire-maintained mosaic of low shrub thickets, patches of small trees, and bits of prairie, located between the true prairies and the forest region to the east and northeast. Together with the ASPEN-OAK type, it was Minnesota's equivalent of the aspen parkland of western Canada. Important species included most of the prairie plants listed above, plus quaking aspen (*Populus tremuloides*), Balm of Gilead (*Populus balsamifera*), a few oaks (especially *Quercus macrocarpa* and *Q. rubra*) and numerous shrubs: hazel (*Corylus americana*, *C. cornuta*), dogwoods (*Cornus*), willows (*Salix*), wolfberry, cherries (*Prunus*), Juneberries (*Amelanchier*), and roses (*Rosa*). The tree component was kept sparse, young, and short by recurrent fires. Aspen often occurred in small clumps or groves. Significant changes in species composition must have existed with latitude. See Winchell (1884a, b, 1888), Ewing (1924), Buell and Buell (1959), and Buell and Facey (1960) for further detail.

Aspen-Oakland

This type occurred in the prairie border region, often between the BRUSH PRAIRIES and the other forest types to the east and northeast. It was apparently characterized by dense, but young, closed stands of quaking and bigtooth aspen (*Populus tremuloides* and *P.*

grandidentata), several oaks (*Quercus macrocarpa*, *Q. ellipsoidalis*, *Q. rubra*), and probably also by elms (*Ulmus*), ash (*Fraxinus*), and basswood (*Tilia americana*) along stream courses. This type was also fire-maintained (see Buell and Facey 1960) but probably had fewer fires than the BRUSH PRAIRIE type. Küchler (1964) mapped most of this type as Oak Savannah.

Oak Openings and Barrens

This type group, also fire-maintained, usually occurred as a buffer between the PRAIRIES and BIG WOODS. Sandy, drouthy soils, such as those of the Anoka Sandplain (Anoka, Isanti, and Chisago Counties), were often associated with it. It consisted of oak groves or single trees (most bur oak — *Quercus macrocarpa*) in a matrix of xeric tall-grass prairie. Other important species were: big bluestem, little bluestem, indian grass, panic grass (*Panicum leibergii*), porcupine grass (*Stipa spartea*), hazel, rose, and many herbs. Küchler (1964) called this type Oak Savanna (*Quercus-Andropogon*) and followed Marschner's boundaries closely. Curtis (1959) recognized OAK OPENINGS AND OAK BARRENS as two distinct types. His data provide rich detail, and both types are probably close analogues of Marschner's type, especially for southeastern and south-central Minnesota. Toward the north the OAK OPENINGS AND BARRENS intergrade with JACK PINE BARRENS AND OPENINGS.

Big Woods

The name BIG WOODS had long been applied to the closed mesic deciduous forests of east-central and southeastern Minnesota, but Marschner used it for nearly all of the richer upland hardwood forests, even certain northern outliers in Itasca and Beltrami Counties. Actually, the type intergrades with his MIXED HARDWOOD AND PINE type in the northeast. His choice between these two classes was quite arbitrary in the north.

Daubenmire (1936) made an extensive study of the BIG WOODS of central Minnesota, and is responsible for the still prevalent belief that it was primarily a sugar maple-basswood (*Acer saccharum-Tilia americana*) forest in presettlement times. In fact, however, the maple-basswood component may have increased considerably in the last century due to fire protection and succession. The classic BIG WOODS area of the south-central re-

gion may be no more than 400 years old, having developed through the invasion of prairie by oak forest (Waddington 1969). But Küchler (1964) mapped all of Marschner's BIG WOODS as Maple-Basswood Forest, and Braun (1950) also shows a BIG WOODS section in Minnesota, but confined it to the earlier east-central area.

Actually, the full area mapped by Marschner as BIG WOODS is much more diverse than the stands described by Daubenmire. In places the oaks — especially red oak (*Quercus rubra*) and bur oak — were dominant, and yellow birch (*Betula alleghaniensis*), paper birch (*Betula papyrifera*), ash, elms (*Ulmus americana*, *U. fulva*), and other trees were prominent. Toward the southeast, hickory (*Carya* spp.), black walnut (*Juglans nigra*), butternut (*Juglans cinerea*), and black cherry (*Prunus serotina*) were also common. Northeastward these species disappeared, and occasional specimens of white pine (*Pinus strobus*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), and northern white-cedar (*Thuja occidentalis*) appeared. Fires and other disturbances were probably responsible for the presence of oaks, walnut, cherry, ash, white pine, the birches, and similar species that cannot tolerate as much shade as sugar maple. Rich shrub and ground layers were characteristic of the BIG WOODS. Species lists and other data are available in Daubenmire (1936), Braun (1950), and Curtis (1959) for related Wisconsin forests. Complete community descriptions for several northern outliers are available in Grant (1934), Buell and Gordon (1945), Buell and Wilbur (1948), Buell and Cantlon (1951), Buell and Bormann (1955), Buell and Martin (1961), and Flaccus and Ohmann (1964).

River Bottom Forest

Marschner uses this one type for nearly all major floodplain and valley-bottom forests. His list of dominants in the legend is quite complete. Curtis' (1959) data for the ground layer in his Southern Wet Forest are suggestive of conditions in the floodplain forests of southeastern Minnesota.

Aspen Birch (Hardwoods)

Marschner evidently used this type for all forests dominated by quaking or bigtooth aspen and paper birch, and having a successional understory or codominant

canopy component of the broadleaf trees characteristic of his BIG WOODS type. The agent of disturbance was probably fire in most cases. It is clear from his legend that Marschner recognized the successional position of this type and knew that in the absence of further disturbance the longer-lived or more shade-tolerant hardwoods would replace the aspen-birch overstory. Vegetation descriptions for this type must be extrapolated from papers relevant to the BIG WOODS type.

Mixed Hardwood and Pine

This type is transitional between the BIG WOODS and WHITE PINE types. It occurs in north-central and northeast Minnesota in areas where white pine stands often intermingled with forests of sugar maple, red maple (*Acer rubrum*), basswood, red oak, bur oak, elm, black ash (*Fraxinus nigra*), yellow birch, paper birch, and aspen. Where white pine in such stands was significant but not dominant, Marschner evidently used this type. The white pine probably resulted from disturbance by fires or windstorms. The best description of such forests may be that of Grant (1934).

Pine Groves: Nearly Pure White Pine

This is the classic, old-growth white pine forest upon which the early sawmilling industry was supposedly based. Such stands probably consisted of even-aged groves and small groups of trees of postfire origin (Spurr 1954, Frissel 1973, Heinzelman 1973). Marschner used this type primarily for mature stands because most young stands probably fell in his ASPEN-BIRCH (Conifer) type. Some will be surprised to note that this type was assigned to only a few areas in north-central and northeastern Minnesota. The famed white pine forests of the upper Rum River country (Mille Lacs and Kanabec Counties), of Pine County, and of northwestern Aitkin County are shown, as are scattered well-known stands elsewhere. But the scarcity of pure white pine implies that most white pines occurred either as scattered elements in other types, or in mixture with red (Norway) pine (*Pinus resinosa*). This contrasted strongly with the situation in New England, Pennsylvania, Michigan, and Wisconsin, where pure white pine stands were more abundant.

Ohmann and Ream (1971) have published vegetation data for nearly pure virgin white pine stands, but

their stands were located in the Boundary Waters Canoe Area in extreme northeastern Minnesota. They certainly are not typical of the majority of Marschner's type which centered some 150 miles to the southwest. No studies of virgin stands in east-central Minnesota have been published, but many older stands probably had understories of tolerant hardwoods, with perhaps a scattering of balsam fir or white spruce. Where surface fires had been frequent, such understories may have been lacking, however, Ayres' (1899) description suggests that most old stands had been burned through, but by then most of Marschner's WHITE PINE types had already been cut.

Pine Groves; White and Norway Pine

This is the more abundant class of old-growth pine forest mapped by Marschner. He used the type chiefly for mature stands, because young stands would usually fall in either the ASPEN-BIRCH (Conifer) type, or in the JACK PINE type. Most of the areas of pine sawtimber known to have been cut in Minnesota's early lumbering era (1870 to 1930) were located in this type. For example, on the Superior National Forest where logging history studies have recently been completed in and near the Boundary Waters Canoe Area, Marschner's WHITE AND NORWAY PINE type agrees closely with the areas known to have been cut for pine between 1895 and 1930 (Heinselman 1969, 1973). Vegetation data for virgin mixed red and white pine in the Canoe Area are given in Ohmann and Ream (1971). There, many stands now have dense understories of balsam fir, black spruce (*Picea mariana*), and northern white-cedar (*Thuja occidentalis*). Occasional large specimens of white spruce (*Picea glauca*) are codominant with the pines. Many stands have a history of repeated surface fires, and if the last such fire was not too long ago, understories of tolerant conifers may be lacking or sparse. Most extant virgin stands tend to be even-aged in groups or groves, with scattered individuals or groups of older trees intermingled or nearby—a structure clearly traceable to past fires (see Maissurow 1941, Spurr 1954, Frissel 1973, Swain 1973, Heinselman 1973).

Jack Pine Barrens and Openings

This type occurred chiefly on sandy glacial outwash plains in north-central Minnesota, and on the thin rock-outcrop soils of the Laurentian Shield region north of Lake Superior. It was a fire-maintained mosaic of jack

pine (*Pinus banksiana*) stands, or in places extensive forest interspersed with nearly treeless heaths or open, lichen-covered, rock outcrops. Common shrubs and ground cover species included hazel (*Corylus cornuta*), blueberries (*Vaccinium* spp.), sweet fern (*Comptonia peregrina*), bearberry (*Arctostaphylos uva-ursi*), wintergreen (*Gaultheria procumbens*), bracken (*Pteridium aquilinum*), and reindeer moss (*Cladonia* spp.). In the more southerly and westerly sections, red oak and bur oak were common members of the tree layer, and aspen (both species) and paper birch were common associates throughout. In the northeast, jack pine stands often intergraded with upland black spruce types, and here a moss ground layer dominated by *Pleurozium schreberi* was common. In older stands in the northeast, understories of balsam fir, black and white spruce, and northern white-cedar were also common.

Jack pine forests were regenerated by periodic fires that are required to open this tree's persistent closed cones in much of the Minnesota range (there are some open-cone ecotypes in the State). Fires also killed the old stands, creating the open land essential for jack pine regrowth. Most of this type probably burned at least once per century; many areas probably at 10- to 50-year intervals (Frissel 1973, Heinselman 1973, Swain 1973). Vegetation data for jack pine communities can be found in Ohmann and Ream (1971) and Curtis (1959).

Pine Flats

This is a confusing type that Marschner used for a also occurred very sparingly at least as far west as Mille Lacs County near Opstead (Roe and Rudolf 1937), and northwestward as far as Togo in Itasca County¹. Just how this type differed from the PINE GROVES is not clear because the PINE GROVES also often contained a component of white or black spruce, balsam fir, or northern white cedar—other species listed for PINE FLATS. Perhaps a significant presence of hemlock on wet-mesic sites was its distinguishing feature. If so, it is likely that considerable yellow birch, some black ash, red maple, and sugar maple were also present in addition to the trees listed by Marschner. Only careful restudy of the original Land Office Survey notes might settle this point. The vegetation data in Roe and Rudolf (1937) and those of Curtis (1959) for Northern Wet-Mesic forest may suggest this community's structure and composition.

1Roe and Heinselman. Unpublished data on file at the North Central Forest Experiment Station, St. Paul, Minn.

Aspen-Birch (Conifer)

Marschner apparently used this type for all successional forests dominated by quaking aspen, bigtooth aspen, and paper birch having significant conifer elements, either as codominants (notably the pines and white spruce), or as understories (usually balsam fir, both spruces, or northern white-cedar). Thus many young stands that might otherwise have been considered pine types probably are included. Most stands that other workers might classify as Fir-Spruce-Birch or Spruce-Fir may also be included. K  chler (1964) included essentially all of this type in his Great Lakes Spruce-Fir Forest (*Picea-Abies*). His chief information source was apparently Marschner's map. Vegetation data can be found in Buell and Gordon (1945), Buell and Niering (1957), MacLean (1960), Maycock and Curtis (1960), Bakuzis and Hansen (1965), and Ohmann and Ream (1971).

Essentially all of this type was of postfire origin. Most of the fires that created the stands mapped by Marschner had occurred a century or less before the Land Office Survey. An idea of the size and frequency of such fires can be gained from Spurr (1954), Frissell (1973), Heinselman (1973), and Swain (1973).

Conifer Bogs and Swamps

Marschner's original legend called these areas simply "SWAMP" (Cedar, balsam, tamarack). He used two type symbols differing only in the size of areas shown. I combined these, relabeled the type as above, and added spruce and balsam fir to the trees given in the legend. No changes were made in the mapping itself. The areas mapped included most of the larger forested peatlands of Minnesota, including the paludified beds of extinct glacial lakes Agassiz, Upham, and Aitkin, and many smaller bogs resulting from lake or stream-filling processes.

Many of the vegetation types involved are more properly called "bogs" than "swamps" (see Conway 1949; Heinselman 1963, 1970). Most have acid ground water, acid peats—at least in the upper peat layers—and originally had vegetation dominated by black spruce, tamarack, heaths (esp. *Ledum groenlandicum*,

Chamaedaphne calyculata, *Kalmia polifolia*, *Andromeda glaucophylla*, *Vaccinium* spp.), by bog birch (*Betula pumila*) and by sphagnum mosses. Less acid peats also supported northern white-cedar, balsam fir, paper birch, and speckled alder. Some areas were nearly treeless "fens," dominated by sedges, Phragmites, grasses, and bog birch. For details see Conway (1949), Curtis (1959), Heinselman (1963, 1970, 1974), Janssen (1967), Hofstetter (1969), and Griffin (1973). Paludification of northern Minnesota's poorly drained land is still proceeding in the forest region, and many peatlands have probably existed for only a few thousand years (Heinselman 1970, 1974; Griffin 1973). Some smaller areas that belong in the OPEN MUSKEG types were mapped as CONIFER BOGS AND SWAMPS.

Open Muskeg

Marschner used this type sparingly for a few of the largest expanses of nearly treeless peatland in the glacial lakes Agassiz and Upham regions. Most areas so mapped were really Patterned (or ribbed) Fens of the string bog (Strangmoor) type (see Heinselman 1963, 1970, 1974; Hofstetter 1969). Not all such areas are shown by Marschner, and they are really properly called "floating bogs." But to the layman that description is apt because their peats are fluid and will hardly support a man. OPEN MUSKEG is dominated by sedges, reeds, grasses, bog birch, some of the Ericaceae, certain mosses, and stunted tamarack. For further data see Heinselman (1963, 1970), Hofstetter (1969), and Griffin (1973).

Present Status of Minnesota's Natural Vegetation

As of 1974 most of the presettlement vegetation of Minnesota has been vastly altered or obliterated by cultivation, land clearing, tree planting, herbiciding, drainage, timbering, destructive and unnatural fires in logging debris and for land clearing, peat fires, fire exclusion, roadbuilding, urbanization, mining, and many other man-related factors.

Only a few tiny remnants of the once vast PRAIRIES still exist, but fortunately some are now managed to preserve their natural vegetation by the Minnesota Department of Natural Resources, The Nature Conservancy, and the U.S. D.I. Fish and Wildlife Service. Several fine examples of WET PRAIRIES, MARSHES AND SLOUGHS are also preserved in State and Fed-

eral wetland areas in northwestern Minnesota and elsewhere. Marschner's OAK OPENINGS AND BARRENS type is being maintained by prescribed burning on the Allison Savanna and at the Cedar Creek Natural History Area through the cooperation of The Nature Conservancy and the University of Minnesota. A few areas of BIG WOODS are being preserved in State Parks (such as Nerstrand Woods) and in Nature Conservancy tracts.

Fine examples of PINE GROVES still exist in Itasca State Park, Pine Point Research Natural Area (Chippewa National Forest), and in the Boundary Waters Canoe Area (Superior National Forest). The Canoe Area contains some 530,000 acres of natural landscape still unaltered by timbering, but even here the natural proportion of successional stages has been changed by excluding fire. One can still see natural examples of Marschner's ASPEN-BIRCH (Conifer) and ASPEN-BIRCH (Hardwood) types in the Canoe Area, and there are large areas of natural JACK PINE types, including several distinct communities, and a wide range of CONIFER BOGS AND SWAMPS and small areas of OPEN MUSKEG.

The only other large areas that still contains much natural vegetation is the Lake Agassiz peatlands region. Here there are several large areas of CONIFER BOG AND SWAMP and OPEN MUSKEG in relatively pristine condition, including a fascinating variety of "patterned peatland" types. Most of this region has had partial drainage and considerable timbering, but some localities are still little affected. One of the best examples is the Lake Agassiz Peatlands Natural Area in Koochiching County, managed as a Scientific and Natural Area by the Minnesota Department of Natural Resources.

A visit to any of these nature reserves is a journey back in time to an era still barely a century past, when most of Minnesota was still a vast mosaic of dynamic natural vegetation types, as depicted by Frank Marschner on this map. The environment was then little changed by industrial man, and the State's resources had only lightly felt the press of human numbers. The serious layman or scientist who uses this map will gain much from visits to such nature reserves. For only through such first-hand experiences can one really comprehend how quickly mankind is changing the face of our Earth.

Within the lifetimes of a few surviving pioneers we

have already replaced the complex and diverse natural ecosystems of at least two-thirds of Minnesota's landscape with monocultures of a few nonnative plants, with the concrete of our cities and highways, and with the waste dumps and pits of our depleted mines. All of this has come so quickly that we have not yet even described all of Minnesota's natural ecosystems, let alone understood what these changes will mean in the centuries ahead.

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*A crosswalk between Marschner's vegetation types and
DNR Natural Heritage and Nongame Research Program
plant community types found in Cass County*

Marschner's	Natural Heritage Plant Communities						
Wet prairies, marshes, sloughs	Cattail Marsh	Mixed Emergent Marsh	Rich Fen	Wet Meadow			
Aspen-oak land	Aspen Woodland	Aspen Openings	Aspen Forest				
Oak openings and barrens	Oak Woodland-brushland	Mesic Oak Savanna	Dry Oak Savanna				
Big Woods	Maple-basswood Forest	Oak Forest	Northern Hardwood Forest	Northern Hardwood-conifer Forest	Black Ash Swamp	Lowland Hardwood Forest	
River Bottom Forest	Lowland Hardwood Forest	Floodplain Forest	Black Ash Swamp	Mixed Hardwood Swamp			
Aspen-birch (hardwoods)	Aspen-birch Forest	Aspen Forest	Paper Birch Forest				
Mixed hardwood and pine	White Pine-hardwood Forest	White Pine Forest					
Aspen-birch (conifer)	Mixed Pine-hardwood Forest	Boreal Hardwood-conifer Forest	Black Spruce-feathermoss Forest	Spruce-fir Forest			
Pine groves (white pine)	White Pine Forest						
Pine groves (white and Norway pine)	Red Pine Forest						
Jack pine barrens and openings	Jack Pine Forest	Jack Pine Woodland	Jack Pine Barrens	Northern Conifer Scrubland			
Conifer bogs and swamps	Black Spruce Bog	White Cedar Swamp	Tamarack Swamp	Alder Swamp, Willow Swamp	Black Spruce Swamp	Open Sphagnum Bog	Poor Fen

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4. Sites

*MCBS Procedures, Methods
and Results* 4.1.1

*Original MCBS site boundaries
in county*..... 4.2.1

*Final MCBS site boundaries
in county*..... 4.3.1

List of Final MCBS sites 4.4.1

*Brief description of each
final MCBS site* 4.5.1

MCBS Procedures, Methods and Results

MCBS sites are areas that are relatively undisturbed by cultivation, housing, livestock grazing, ditching, or other human-generated activities. Several different native plant community types of relatively high quality and some disturbed land typically are found within sites. In some instances, MCBS sites are identified primarily because of the presence of rare animal habitat rather than native plant communities.

The Survey uses a hierarchical method to determine a final set of areas meriting conservation consideration or special management because of the biodiversity or landscape significance of the site. The first step is for plant ecologists to interpret aerial photography or other remote sensing data to select a potential set of sites for further evaluation. This is supplemented by review of other data such as forest inventories, soil surveys, public land surveys and museum records. Boundaries are mapped on topographic maps and based on existing information, plant ecologists determine priorities for further survey. Boundaries are recorded in an computerized geographic information system (GIS), and priorities for survey (high, medium, and low) are entered into a site database used to track the progress of survey work.

Next, selected sites are evaluated by assessing the quality of their plant communities during ground surveys. This evaluation includes the application of native plant community ranking guidelines and recording of information about the site to be later entered into the MCBS site database of the Natural Heritage Information System. Other data collected include releve samples (vegetation plots) and plant lists. Aerial surveys are also conducted over selected sites, and some sites are surveyed from vehicles. Surveys for rare species are conducted in selected sites and in other suitable habitats.

The final step consists of a reevaluation of the site boundaries based on new field information and a reinterpretation of aerial photography. This reevaluation may result in the removal of some sites from further consideration and boundary changes in others. The final set of sites represents those meriting some special management or conservation consideration due to biodiversity significance, and this biodiversity significance is reflected in a ranking system developed on a county level to assign relative site importance.

Sites displayed on final maps are those considered by MCBS to have biodiversity significance in a county. The recording of these sites in databases and on maps does

not imply that all will be proposed for natural area protection. The goals and strategies for management of these sites will be determined by landowners within each site and will likely differ based on the rare features and landscape characteristics present. Future NHRP collaboration with current land owners and land managers may help shape the management of these sites.

MCBS Methods in Cass County

In April 1992, MCBS plant ecologist Donna Sheridan began the Survey in Cass County. She viewed 1:15,840 CIR 1989-90 aerial photography stereoscopically at the Cass County Land Department in Backus and at the headquarters of the Chippewa National Forest (CNF) in Cass Lake. With the assistance of John Almendinger, ECS plant ecologist, she delineated on 7.5 minute topographic maps MCBS sites within the three main LTAs (Landtype Associations; see Chapter 2 for a description of this level of the Ecological Classification System) found in the Cass County part of the CNF. In areas south of the CNF in Cass County, where LTAs had not yet been defined, MCBS sites were selected using the traditional MCBS approach (without reference to landform boundaries).

Sites were identified that had relatively intact native plant communities, had known concentrations of rare species, or were the least disturbed areas remaining on a landscape in the county. Criteria apparent on aerial photographs and topographic maps that played a role in the initial selection of an area as a site included closed canopy forests, lack of obvious recent disturbance, the presence of uncommon plant community types, a relatively large area of intact plant communities, habitat for rare animals, distinctive topographic features, and the age of forested communities in the site. Boundaries of these original MCBS sites were digitized from topographic maps into an Arc/Info GIS in 1993.

During the 1992-95 field seasons, MCBS plant ecologists Donna Sheridan (1992) and Janet Boe (1993-95) conducted ground surveys of selected plant communities within most sites. In October 1993, Janet Boe conducted a low-level aerial survey of many sites in the county. Following field work (including rare plant and rare animal surveys) and reevaluation of other information, including aerial photography, the plant ecologist eliminated some sites from the list and changed the boundaries of most other sites.

In Cass County, a body of forestry stand data has been digitized by public agency landowners. The Cass County Land Department, the CNF, the DNR Division of Forestry, and the Leech Lake Division of Resources Management (DRM) cooperated in an important and progressive venture that pooled these digitized data and resulted in a single GIS layer with stand boundaries of all four agencies delineated and labeled.

This multi agency forestry stand GIS layer became available for Cass County in mid-1995. Quad scale (1:24,000) GIS maps of townships with 1) section lines, 2) roads, 3) lakes and rivers, 4) forestry stand boundaries, and 5) MCBS original site boundaries were then used to reevaluate MCBS site boundaries following the completion of ground surveys. In addition, the forestry stand polygons were reclassified and labeled with plant community names by using algorithms in a software program called Reclass (See Chapter 5 for a description of Reclass) and the tabular data that are associated with the polygons. These maps of reclassified forestry stand data, as well as the LTA boundaries that became available for the entire county in 1997, were helpful in delineating final MCBS site boundaries. In 1998, these final site boundaries were redrawn and redigitized into a GIS.

A GIS layer showing plant communities within MCBS site boundaries is in progress and will be available from NHNRP. These plant community delineations are based on reclassified forest inventory polygons but also include photo-interpreted and field-checked plant community boundaries.

Results

Of 222 sites delineated by MCBS at the beginning of the survey in Cass County, 83 remain listed as MCBS sites. A table listing these sites is included later in this chapter. Final site boundaries and original site boundaries are each available as a GIS layer from NHNRP (see Chapter 1 for information on obtaining MCBS products).

Site summaries for each site are in the MCBS site database of the Natural Heritage Information System. Brief site descriptions and maps showing original and final site boundaries are included later in this chapter.

County priority rankings are given in the table in this chapter and are also included with the brief site descriptions. These are relative rankings (high, medium and low) that reflect the biodiversity significance of these sites

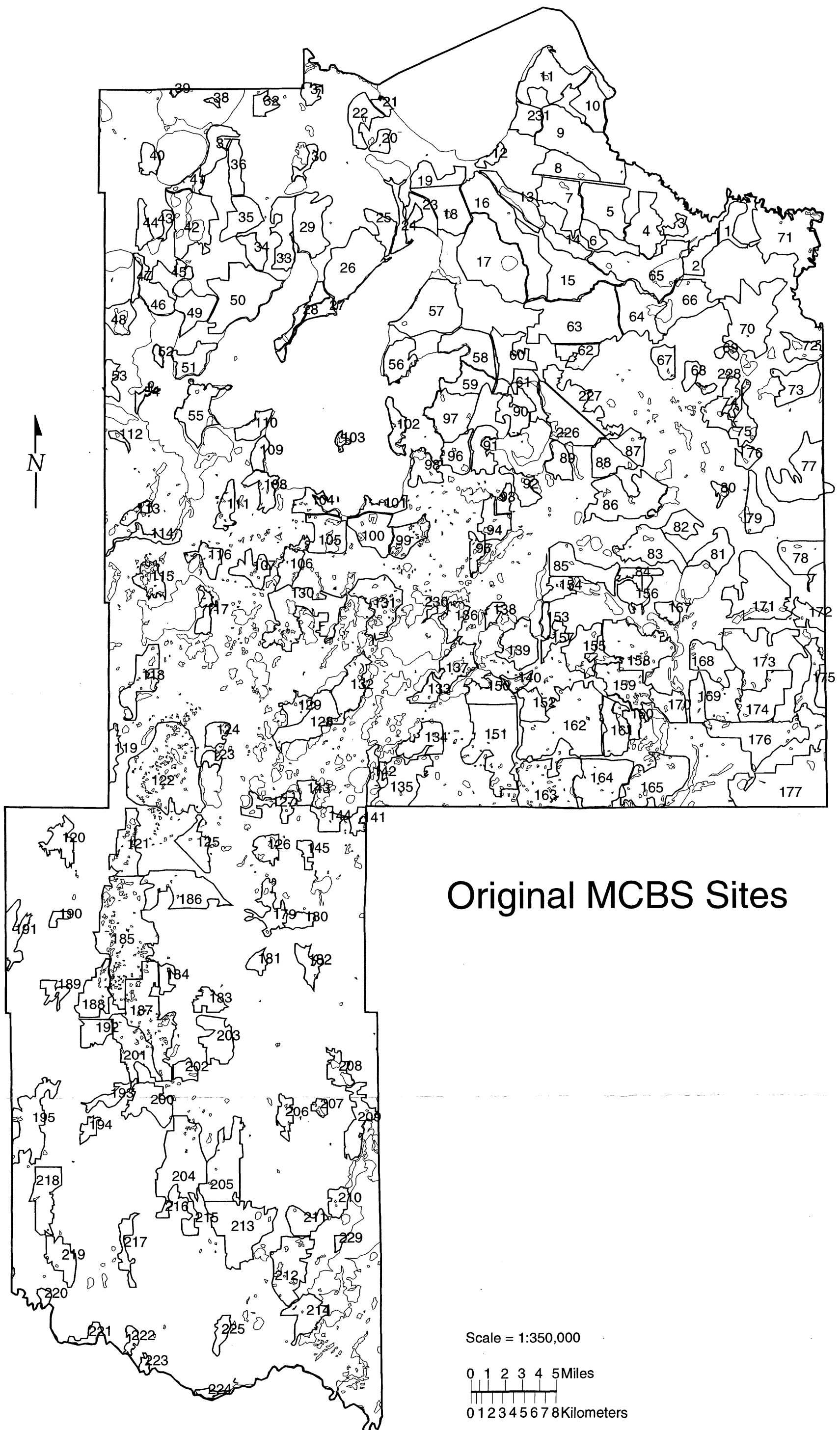
in Cass County, based on evaluations by MCBS staff. Criteria used to determine this final ranking included the level of human-generated disturbance, the size of the area, the number and abundance of rare species, and the importance of the site on an LTA in the county. Again, these are relative rankings, so a site ranked low merits some consideration for special management but not the same level as a high priority site.

Fifteen of the sites are ranked high priority in the county, 22 are medium priority sites, and the remaining 46 are ranked low priority. Readers will notice that some of the high priority sites already receive special management. Most of site 18 (Hole-in-the-bog Lake) is a state Scientific and Natural Area, site 55 is the Chippewa National Forests Pine Point Research Natural Area, Drumbeater Lake (site 17) is a State Waterfowl Refuge, and Bena Bog (site 20) is managed under a Registry Agreement between the state and the Chippewa National Forest. Conservation recommendations will be prepared and presented to landowners in high priority sites that do not already receive special management.

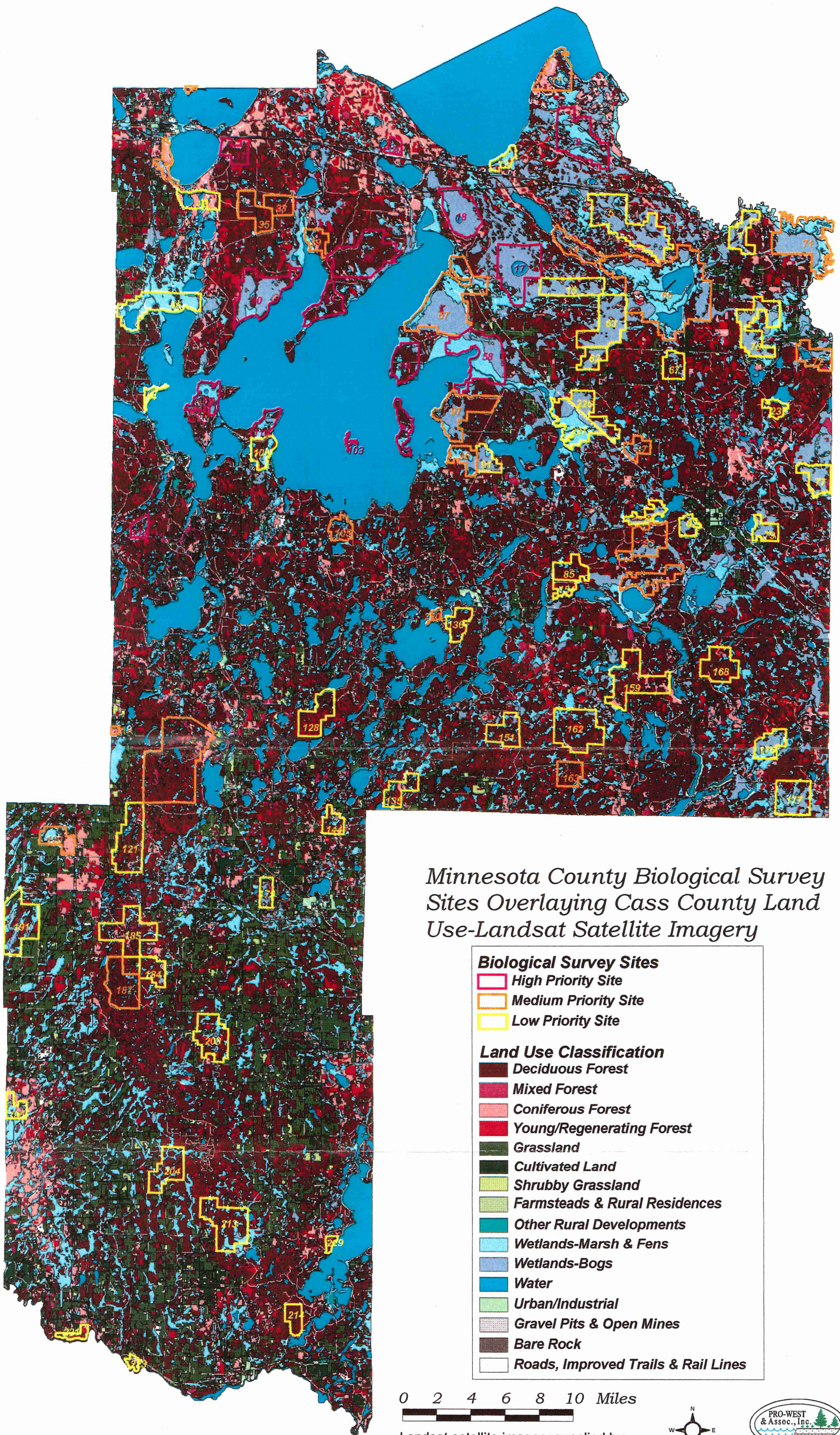
Many of the low priority sites are included on the list because they represent locations on a particular LTA in the county where there has been the least amount of recent, human-induced disturbance. While these may represent the best remaining areas on the part of an LTA within Cass County, there may be larger, less disturbed, more representative areas on the LTA in other counties into which the LTA extends.

LTAs provide a framework to land managers for future ecological management of the landscape. Multiownership landscape teams designing plans within an LTA could consider some of these sites for designation as benchmark locations to which more intensively managed lands within the LTA might be compared.

Original MCBS Site Boundaries



Final MCBS Site Boundaries



*Minnesota County Biological Survey
Sites Overlaying Cass County Land
Use-Landsat Satellite Imagery*

Biological Survey Sites

High Priority Site

Medium Priority Site

Low Priority Site

Land Use Classification

Deciduous Forest

Mixed Forest

Coniferous Forest

Young/Regenerating Forest

Grassland

Cultivated Land

Shrubby Grassland

Farmsteads & Rural Residences

Other Rural Developments

Wetlands-Marsh & Fens

Wetlands-Bogs

Water

Urban/Industrial

Gravel Pits & Open Mines

Bare Rock

Roads, Improved Trails & Rail Lines

0 2 4 6 8 10 Miles

Landsat satellite imagery supplied by
Minnesota Planning-Land Management
Information Center



May 1998

List of Final MCBS Sites by Site Number

Site #	Site Name	LTA	County Priority	T	R	S
1	WAHNENA 18	Rosey Lake Plain	Low	144	25	18
5	WAHNENA 17	Bena Dunes & Peatlands	Low	144	26	17
9	NUSHKA LAKE 23	Bena Dunes & Peatlands	High	145	27	15
11	TAMARACK LAKE	Bena Dunes & Peatlands	Med	146	27	33
12	BENA ROADSIDE PARK	Bena Dunes & Peatlands	Low	145	28	24
14	SIXMILE BROOK SOUTH	Bena Dunes & Peatlands	Med	144	27	22
15	CHUB LAKE 34	Bena Dunes & Peatlands	Low	144	27	34
17	DRUMBEATER LAKE	Bena Dunes & Peatlands	High	144	28	24
18	HOLE-IN-BOG LAKE	Bena Dunes & Peatlands	High	144	28	9
20	BENA BOG	Bemidji Sand Plain	High	145	29	23
26	DIAMOND 28	Guthrie Till Plain	High	144	29	28
28	OTTERTAIL POINT WEST	Guthrie Till Plain	High	143	29	6
29	EAST SUCKER CREEK	Guthrie Till Plain	Med	144	30	13
33	WEST SUCKER CREEK	Guthrie Till Plain	Med	144	30	3
35	LIFE RAFT LAKE 08	Guthrie Till Plain	Med	144	30	9
37	EAST PIKE BAY	Guthrie Till Plain	High	145	30	20
39	STAR ISLAND SOUTH	Bemidji Sand Plain	Med	145	31	2
40	PIKE BAY 27	Bemidji Sand Plain	Med	145	31	22
42	LAKE THIRTEEN	Bemidji Sand Plain	Low	144	31	1
46	STEAMBOAT RIVER EAST	Bemidji Sand Plain	Low	143	31	3
50	HARDWOOD POINT	Guthrie Till Plain	High	143	30	5
54	WELSHES BAY	Guthrie Till Plain	Low	143	31	33
55	PINE POINT	Itasca Moraine, Humm.	High	142	31	1
56	SUGAR POINT	Guthrie Till Plain	High	143	29	24
57	SUGAR POINT BOG	Rosey Lake Plain	Med	143	28	8
58	GOULD 22	Rosey Lake Plain	High	143	28	22
62	BOY RIVER ORCHID BOG	Rosey Lake Plain	Low	143	27	23
63	BOY RIVER 10	Rosey Lake Plain	Low	143	27	12
65	WAHNENA 32	Rosey LP/Bena Dunes & Pt.	Med	143	26	5
67	SALEM 21	Sug Hills Mor/Rosey LP	Low	143	26	28
70	TASHER ISLANDS	Rosey Lake Plain	Low	143	25	17
71	WAHNENA 14	Deer River Peatlands	Med	144	25	14
72	SKUNK LAKE	Rosey Lake Plain	Med	143	25	24
77	SHINGLE MILL LAKE SWAMP	Hill City Till Plain	Low	142	25	25
79	LIMA 04	Hill City Till Plain	Low	141	25	9
82	REMER 10	Hill City Till Plain	Low	141	26	10
83	OXBOW LAKE	Itasca Moraine	Med	141	26	17
84	LAURA LAKE NORTH	It Mor/Spr Brk Till Pl	Med	141	26	29
85	INGUADONA 26	Itasca Moraine	Low	141	27	22
86	REMER 6	Itasca Moraine	Low	141	26	5
87	TOBIQUE SE	Sug Hills Mor/It Mor	Med	142	26	18
91	BOY LAKE 23	Itasca Moraine	Low	142	28	23
96	MAD DOG LAKE BOG	Itasca Moraine	Med	142	28	21
97	BOY LAKE 09	Guthrie Till Plain	Med	142	28	4
102	BEAR ISLAND	Guthrie Till Plain	High	142	29	11
103	PELICAN ISLAND	Itasca Moraine	High	142	29	17
105	PINE LAKE 07	Itasca Moraine	Med	141	29	8
109	WABEGON LAKE	Itasca Moraine, Humm	Low	142	30	21
110	STONY POINT	Itasca Moraine, Humm	High	142	30	10
114	SHINGOBEE RIVER	Itasca Moraine, Humm	High	141	31	17
119	DEERFIELD 18	Park Rapids Outwash Pl	Med	139	31	7
120	MCKINLEY 10	Beaver Cr. Drumlin Pl	Med	138	32	15
121	BULL MOOSE 17	St. Croix Moraine	Low	138	31	17
122	DEERFIELD 22	St. Croix Moraine	Med	139	31	22
128	PONTO LAKE 06	Itasca Moraine	Low	139	30	12
135	PONTO LAKE 25	Itasca Moraine	Low	139	29	35
136	WABEDO 04	Itasca Moraine	Low	140	28	9
144	LITTLE SAND LAKE	Mildred Outw Pl/It Mor	Low	138	29	6
151	BLIND LAKE 11	Spring Brook Til	Low	139	28	12

List of Final MCBS Sites by Site Number

Site #	Site Name	LTA	County Priority	T	R	S
154	INGUADONA 33	Spr Brk Till Pl/lt Mor	Low			
159	THUNDER LAKE 30	Outing Moraine	Low	140	26	30
162	TRELIPE 03	Spring Brook Till Pl	Low	139	27	10
163	BLIND LAKE 29	Spring Brook Till Pl	Low	139	27	21
168	THUNDER LAKE 24	Outing Moraine	Low	140	26	24
176	BEULAH 16	Outing Moraine	Low	139	25	9
177	BEULAH 27	Outing Moraine	Low	139	25	26
179	PINE RIVER 34	Mildred Outwash	Low	138	30	27
184	BUNGO 22	St C Mor/PR Drum	Low	137	31	21
185	BUNGO 07	St. Croix Moraine	Low	137	31	8
187	BUNGO 29	St. Croix Moraine	Med	137	31	32
191	ANSEL 07	Beaver Crk Drum Pl	Low	137	32	7
195	BYRON 05	Swan Creek Outwash Pl	Low	136	32	32
203	MOOSE LAKE 08	Pine River Drumlin Pl	Low	136	31	12
204	MEADOW BROOK 15	Mosquito Crk. Drumlin Pl	Low	135	31	22
213	FAIRVIEW 05	St C Mor/PR Drumlin Pl	Low	134	30	6
214	FAIRVIEW 35	St. Croix Morain	Low	134	30	35
221	BECKER 02	Pillager Outwash Pl	Low	133	32	11
223	17-May	Pillager Outwash Pl	Low	133	31	17
226	TOBIQUE NW	Rosey Lake Plain	Low	142	27	3
227	TOBIQUE NE	Rosey Lake Plain	Low	142	27	10
229	GULL LAKE	St. Croix Moraine	Low	134	29	7
230	WOMAN LAKE PENINSULA	Itasca Moraine	Med	140	28	6
232	SUGAR LAKE	Sugar Hills Mora	Low	142	25	4

*Minnesota County Biological Survey
Site Database*

COUNTY PRIORITY RANK: Low

SITE NUMBER: 1

SITE NAME: Wahnena 18

LEGAL LOCATION: T144N R25W parts of sections 5,6,7,8,17,18,19,20.

BRIEF SITE DESCRIPTION:

1/26/98: Relatively undisturbed conifer (mostly cedar) swamp on organic soils on Rosey Lake Plain. Includes upland aspen islands (mostly harvested) and ash swales.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 5

SITE NAME: Wahnena 17

LEGAL LOCATION: T 144N R26W parts of sections 8,16,17,18,19,20,21. T144N R27W parts of sections 1,2,3,11,12,13.

BRIEF SITE DESCRIPTION:

Large wetland complex with incipient patterning on Bena Dunes and Peatlands LTA. Primarily minerotrophic Tamarack Swamp; smaller areas of Black Spruce Swamp, Shrub Swamp, and other wetland communities; with upland islands. Most upland islands have been harvested recently, and uplands surrounding site have been harvested extensively. The huge Tamarack Swamp is an important feature of this site; other conifer swamps (cedar, Black Spruce) are much smaller. Site includes a few stands of old Red Pine Forest.

COUNTY PRIORITY RANK: High

SITE NUMBER: 9

SITE NAME: Nushka Lake 23

LEGAL LOCATION: T145N R27W parts of sections 9,10,14,15,16,21,22,23,26.

BRIEF SITE DESCRIPTION:

Large wetland between Lake Winnibigoshish and Ball Club Lake. Extensive peatland with incipient patterning. Large Black Spruce island narrowing to long graminoid wetland. Old Red Pine Forest on dune complex. Primarily state ownership but includes some Forest Service land. Bena Dunes and Peatlands LTA.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 11

SITE NAME: Tamarack Lake

LEGAL LOCATION: T146N R27W parts of sections

20,21,28,29,31,32,33.

BRIEF SITE DESCRIPTION:

1/28/98: Moderately large site in Highbanks area of Chippewa National Forest. Tamarack Point extends into Lake Winnibigoshish. History of harvest (1912-15) and ice/wind storm damage (1940) followed by some planting of pine by CCC crews and others (1941, 1947). Most of extensive red pine probably naturally regenerated but has been heavily thinned. Tamarack Lake and its surrounding wetland complex (including Poor Fen, Tamarack Swamp) is also part of the site. Trail system throughout uplands. Bena Dunes and Peatlands LTA.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 12

SITE NAME: Bena Roadside Park

LEGAL LOCATION: T145N R28W parts of sections 24,25,26.

BRIEF SITE DESCRIPTION:

Predominantly wetland site on southeast shore of Lake Winnibigoshish. Uplands in and around site harvested extensively. Includes small Black Spruce Swamp and Tamarack Swamp. Highlight of site is extensive graminoid wetland along shore of Lake Winnibigoshish. State and USFS ownership. Bena Dunes and Peatlands LTA.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 14

SITE NAME: Sixmile Brook South

LEGAL LOCATION: T144N R27W parts of sections 8,9,15,16,17,21,22,23, 26,27.

BRIEF SITE DESCRIPTION:

Linear site on both sides of Sixmile Brook between Sixmile Lake and Chub Lake. On Bena Dunes and Peatlands LTA. Cedar swamps along the brook form the centerpiece of the site. Part of CNF Old Growth Complex #65. Site also includes Black Ash Swamps and several stands of old pine forest. Much upland in site in recent clearcuts or plantations; included as part of site because of proximity to wetlands. Bald Eagle locations in site. Wet meadows along brook dominated by Lake Sedge and Blue-joint Grass.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 15

SITE NAME: Chub Lake 34

LEGAL LOCATION: T144n R27W parts of sections 32,33,34,35.

BRIEF SITE DESCRIPTION:

Organic soils with sandy uplands on Bena Dunes and Peatlands LTA. Between Leech River and Sixmile Brook southeast of Drumbeater Lake. Extensive Tamarack Swamp and associated wetlands. Recent timber harvest on most upland islands in swamp and on uplands surrounding wetland.

COUNTY PRIORITY RANK: High

SITE NUMBER: 17

SITE NAME: Drumbeater Lake

LEGAL LOCATION: T144N R28W parts of sections 23,24,25,26,35,36. T143N R28W part of section 1. T144N R27W sections 19,30.

BRIEF SITE DESCRIPTION

Large, mostly undisturbed wetland on organic soil on Bena Dunes and Peatlands LTA. Includes Drumbeater Lake, a state waterfowl refuge and an important staging lake for Ring-necked Ducks in fall. Lake surrounded by extensive Tamarack Swamp with occasional small upland forested islands (the accessible have been harvested recently). Drumbeater Creek (from Drumbeater Lake to Leech River) is not navigable its entire distance and is beaver-dammed. Site includes Wet Meadows along Leech Lake River. Primarily state land in site.

COUNTY PRIORITY RANK: High

SITE NUMBER: 18

SITE NAME: Hole-in-bog lake

LEGAL LOCATION: T144N R28W all or parts of sections 3,4,5,6,7,8,9,10,16,17.

BRIEF SITE DESCRIPTION:

Extensive patterned peatland on Bena Dunes and Peatlands LTA. Best example of patterned peatland in county. 10 M. tall Black Spruce dominate canopy with 25-75% cover. Infrequent tamarack. Abundant Labrador Tea with occasional Leatherleaf. Sphagnum continuous. Most of site has been incorporated into Hole-in-bog SNA. This is state's best known example of a basin-filled raised bog and is the only peatland of this type in the state protected as an SNA. Most land in site in state ownership; remainder primarily USFS. Hole-in-bog Lake, a shallow, winterkill lake, is a well-known fall staging lake for Ring-necked Ducks. (The lake is a State Waterfowl Game Refuge; hunting is prohibited.)

COUNTY PRIORITY RANK: HIGH

SITE NUMBER: 20

SITE NAME: Bena Bog

LEGAL LOCATION: T145N R29W parts of sections 23,14.

BRIEF SITE DESCRIPTION:

Small site on Bemidji Sand Plain. The most important community is a White Cedar Swamp that holds a population of Ram's-head Orchids (a listed species). The cedar swamp occurs along a creek that enters Portage Lake. This is a Registry Site; there is a memorandum of understanding re: management between USFS (the landowner) and DNR.

COUNTY PRIORITY RANK: High

SITE NUMBER: 26

SITE NAME: Diamond 28

LEGAL LOCATION: T144N R29W parts of Sections 15, 16,20,21,22,23,27,28,29,30.

BRIEF SITE DESCRIPTION :

Large site at top of Ottertail Peninsula between two bays of Leech Lake. Importance of site lies principally in extensive, mature to old, contiguous, intact Maple-basswood Forest; presence of Goblin Fern and Goldie's Fern populations; and red-shouldered hawk locations. Black Ash and White Cedar swales within maple-basswood forests, and scattered, small, coniferous wetlands among upland forests in site. Site includes Chippewa National Forest (CNF) candidate old growth stands. Site is potential candidate Research Natural Area for CNF Block of Forest Service ownership west half of site; county, Forest Service, private industrial, and other private ownership east half of site. Site is in Cass Lake District of CNF. Guthrie Till Plain LTA.

COUNTY PRIORITY RANK: High

SITE NUMBER: 28

SITE NAME: Ottertail Point West

LEGAL LOCATION: T144N R29W part of Section 31; T144N R30W part of Section 36; T143N R29W parts of Sections 5,6,7; T143N R30W parts of Sections 1,2,11,12.

BRIEF SITE DESCRIPTION:

Site on Ottertail Peninsula in Leech Lake. Essentially contiguous forest; primarily old and potential old-growth Maple-basswood Forest with cedar swamps and ash swamps. Site contains two of the largest known populations of Goblin Fern (the largest known, on Leech Lake

tribal land, contains 485+ plants). Several small populations of Goldie's Fern (a plant usually found only in south-east Minnesota and farther east and south in the U.S.) occur in this site. Mingan Moonwort and Pale Moonwort populations in site. Also locations for Red-shouldered Hawk, Bald Eagle, and Osprey. Ownership: Forest Service, state, and Leech Lake tribe; small amount of private land. Guthrie Till Plain LTA.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 29

SITE NAME: East Sucker Creek

LEGAL LOCATION: T144N R29W parts of Sections 18,19. T144N R30W parts of Sections 13, 24.

BRIEF SITE DESCRIPTION:

Site is east of Sucker Bay of Leech Lake. Large, old Maple-basswood Forest (made up of several stands in two Forest Service compartments) is important feature of site. Goblin Fern and Mingan Moonwort collections in site. On Guthrie Till Plain LTA.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 33

SITE NAME: West Sucker Creek

LEGAL LOCATION: T144N R30W parts of Sections 2,3,4,10,11

BRIEF SITE DESCRIPTION:

Site is southeast of Pike Bay. Part of MCBS Pike Bay Experimental Forest Macrosite. Importance of site lies in presence of more or less contiguous Maple-basswood Forest (CNF, Cass Lake District, Compartment 91, stands 1,4,32; Compartment 94, stand 3; Compartment 90, stand 36, 97. State stands 9 in Section 2 and 6 in Section 11) and presence of rare plants; Goblin Fern, (*Botrychium mormo*), Mingan Moonwort (*Botrychium minganense*), White Adder's-mouth (*Malaxis monophyllos* var. *brachypoda*) and animals; Bald Eagle, Osprey. Great Blue Heron colony in Section 10. Goblin Fern study plots (D. Farrar and C. Johnson-Groh) in Section 3. On Guthrie Till Plain LTA.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 35

SITE NAME: Life Raft Lake 08

LEGAL LOCATION: T144N R30W parts of Sections 5,8,9,16.

BRIEF SITE DESCRIPTION:

Site is that includes part of Pike Bay Experimental Forest

(North Central Forest Experiment Station, U.S Forest Service). Primarily Maple-basswood Forest, Aspen-birch Forest, and Red Pine Forest; large, essentially intact stands. This site and MCBS site 33 form a relatively unfragmented, primarily upland forest macrosite. Primary stands: Chippewa National Forest, Cass Lake District, Compartment 154, stands 24,106,29,25,31,93,32; Compartment 94, stands 61,3,46,1. Red-shouldered Hawk, Osprey locations in site. On Guthrie Till Plain LTA.

COUNTY PRIORITY RANK: High

SITE NUMBER: 37

SITE NAME: East Pike Bay

LEGAL LOCATION: T145N R30W parts of sections 19,20, 29.

BRIEF SITE DESCRIPTION:

Upland forest on east side of Pike Bay. The most important part of this site is the old (109 years) Red Pine Forest near the lake (naturally generated Red Pine Forest is rare in the county). The relatively large block of mature (60-90 years) upland deciduous forest dominated by Sugar Maple, Basswood, and Aspen is also unusual for its size.

On Guthrie Till Plain LTA.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 39

SITE NAME: Star Island South

LEGAL LOCATION: T145N R31W part of Section 2.

BRIEF SITE DESCRIPTION:

Small site on south part of Star Island in Cass Lake. Most of the island lies in Beltrami County. Old pine forests (Red Pine and White Pine) cover much of the island. Maple-basswood Forest occurs on points of the island. There is a sandy beach on the south side of the island. Lake Windigo is contained entirely within the island. Summer homes (U.S. Forest Service special use permits) line the lakeshore on the west, south, and east sides of the island. Several trails connect the summer home groups on the island. On Bemidji Sand Plain LTA.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 40

SITE NAME: Pike Bay 27

LEGAL LOCATION: T145N R31W parts of Sections 22,27,28,34.

BRIEF SITE DESCRIPTION:

Small site along west shore of Pike Bay. Old (77-156 years) red pine forest in Section 22 and N 1/4 of Section 23 and conifer swamp (including 86 year old cedar swamp) in Sections 27 and 28 are important features of site. Osprey locations and Ram's-head Orchid collection record in site. Moderately intact, mature (52-89 years), contiguous forests (Aspen-birch, Red Pine) in Section 34. Several roads to summer homes pass through site. On Guthrie Till Plain LTA.

COUNTY PRIORITY RANK: Low**SITE NUMBER:** 42**SITE NAME:** Lake Thirteen**LEGAL LOCATION:** T144N R31W parts of Sections 1,2,3. T145N R31W parts of Sections 34,35,36.**BRIEF SITE DESCRIPTION:**

Site is south of Pike Bay. Primarily Red Pine Forest and older Red Pine plantations surrounding Moss and Twin lakes. Few-flowered Spike-rush and St. Lawrence Grapefern collected in site. On Bemidji Sand Plain LTA.

COUNTY PRIORITY RANK: Low**SITE NUMBER:** 46**SITE NAME:** Steamboat River East**LEGAL LOCATION:** T143N R31W parts of Sections 2,3,4,10.**BRIEF SITE DESCRIPTION:**

Site is east of Steamboat River. Extensive graminoid wetland with small aspen islands between Steamboat Bay of Leech Lake and Crooked Lake and surrounding Swamp Lake. Yellow Rail locations. On Bemidji Sand Plain LTA.

COUNTY PRIORITY RANK: High**SITE NUMBER:** 50**SITE NAME:** Hardwood Point**LEGAL LOCATION:** T144N R30W parts of Sections 26,32,33,34. T143N R30W parts of Sections 3,4,5,6,7,8,9.**BRIEF SITE DESCRIPTION:**

Large site on Sucker Bay of Leech Lake. This site is important primarily because of the extensive, intact conifer swamp (Cedar swamp, Tamarack Swamp) but also because of the large Maple-basswood island and series of Maple-basswood points on Leech Lake, two of which hold known populations of Goblin Fern. Osprey and Bald Eagle locations in site. Dragon's-mouth collected in conifer swamp. On Bemidji Sand Plain LTA.

COUNTY PRIORITY RANK: Low**SITE NUMBER:** 54**SITE NAME:** Welshes Bay**LEGAL LOCATION:** T142N R31W part of Section 4. T143N R31W parts of Sections 33,34.**BRIEF SITE DESCRIPTION:**

Site is peninsula into Leech Lake separating Steamboat Bay and Welshes Bay from Walker Bay. Ice ridge along southeast shore with Bur Oak, Basswood, Red Oak, Green Ash, Paper Birch, and a few Cottonwood. Extensive graminoid wetland north/northwest of ice ridge. Sand Point, on northeast end of peninsula, is a popular unofficial boat landing. Bald Eagle location just west of site. Mild Purple Loosestrife infestation in wetland. On Guthrie Till Plain LTA.

COUNTY PRIORITY RANK: High**SITE NUMBER:** 55**SITE NAME:** Pine Point**LEGAL LOCATION:** T142N R31W parts of sections 1,2,11,12; T143N R31W part of section 36; T143N R30W part of section 31.**BRIEF SITE DESCRIPTION:**

Site includes all of Pine Point RNA (Chippewa National Forest). Sandy soils on peninsula of Itasca Moraine extending into Leech Lake. Part of original Ten Sections tract; reserved from logging after purchase in 1908 (reportedly logged only once and then only for dead and down trees); established as an RNA in 1932. Includes naturally generated stands of 100+ year old Red Pine with Jack Pine and White Pine. On north end also includes Lost Lake and surrounding graminoid wetland, where Yellow Rails and Wilson's Phalaropes have been observed. Bald Eagle nests and Great Blue Heron colony in site. Schoolcraft's expedition reportedly camped on Pine Point on its way to Lake Itasca in 1832. On Itasca Moraine, Hummocky LTA.

COUNTY PRIORITY RANK: High**SITE NUMBER:** 56**SITE NAME:** Sugar Point**LEGAL LOCATION:** T143N R29W parts of Sections 23,24,25,26,35,36.**BRIEF SITE DESCRIPTION:**

Site is in Battleground State Forest. Includes Sugar Point and Battle Point. Primarily old Maple-basswood Forest, but includes candidate old-growth Black Ash swamp. Tiny ash swales in Maple-basswood Forest. Mostly Leech

Lake tribal land, but also state, Forest Service, and county ownership. Private parcels along west edge of site. Site divided by county roads 73 and 136; houses both sides of roads, but disturbance doesn't usually extend far into stands. Several large wetlands in site. Goblin Fern population in site. Bald Eagle location just east of site. On Guthrie Till Plain.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 57

SITE NAME: Sugar Point Bog

LEGAL LOCATION: T143N R28W parts of sections 4,5,6,7,8,9,16,17,18. T143N R29W parts of sections 12,13.

BRIEF SITE DESCRIPTION:

Large wetland site between Federal Dam and Sugar and Battle Points. Primarily poor fen and black spruce swamp on Rosey Lake Plain LTA. In Black Spruce Swamp, interrupted canopy of Black Spruce; sparse to moderate cover of Labrador Tea, Blueberry, and Three-seeded Sedge; occasional Bog Laurel, Three-leaved False Solomon's Seal; interrupted moss cover dominated by sphagnum. Large cutover area in center of site. Poor Fen dominated by extensive Leatherleaf; Bog Rosemary common; Bog Laurel occasional. Infrequent, small hardwood knolls. Site includes Bobolink Lake. Nelson's Sharp-tailed Sparrow, Bald Eagle, and Wilson's Phalarope locations in site. Moderate level of disturbance, but size of this wetland complex makes it an important site.

COUNTY PRIORITY RANK: High

SITE NUMBER: 58

SITE NAME: Gould 22

LEGAL LOCATION: T143N R28W parts of sections 14,15,16,17,20,21,22,23,26,27,33,35.

BRIEF SITE DESCRIPTION:

Large peatland site on the Rosy Lake Plain LTA adjacent to Boy Bay of Leech Lake and the Boy River. Site boundaries drawn to include extensive graminoid wetlands, which provide important nesting habitat for rare species, including Yellow Rails and Nelson's Sharp-tailed Sparrows. This Boy Bay-Boy River area is the most important location in the county for Yellow Rails, with over 50% of the county's records, and is also one of the more important locations for this species in the state. Bald Eagle, Osprey, and Great Blue AHeron locations also in site. Primarily state-owned land.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 62

SITE NAME: Boy River Orchid Bog

LEGAL LOCATION: T143N R27W parts of sections 22,23,26,27.

BRIEF SITE DESCRIPTION:

Boy River Orchid Bog on organic soils of Rosey Lake Plain LTA. Northern White Cedar Swamp in NE section 23 is the "bog" in which a variety of orchid species, particularly Showy Lady's-slipper and including Dragon's-mouth, have been found. No official designation, but area was subject of research project in the 1970's (Wanek and Newman), and USFS and DNR (Nongame) cooperatively manage the area and deal with beaver problems. Site boundaries set to include Cedar Swamp and Tamarack Swamp into which it grades. Some recent cuts are included because of their proximity to the conifer swamp.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 63

SITE NAME: Boy River 10

LEGAL LOCATION: T143N R27W parts of sections 1,2,11,12,13,14,15; T144N R27W parts of sections 35,36.

BRIEF SITE DESCRIPTION:

Site is primarily an extensive tamarack swamp on organic soils of Rosey Lake Plain LTA south of the Leech Lake River. Also includes Wet Meadows dominated by Blue-joint Grass along Leech Lake River and some upland forested islands and upland forest adjacent to the swamp. A diagonal ditch in the southeast corner of the site leads from Little Bear Creek to the ditch along Co. 135 at the south edge of the site. Surrounding uplands heavily cut. U.S.F.S. and county ownership. Adder's-tongue collected in Wet Meadows along Leech Lake River.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 65

SITE NAME: Wahnena 32

LEGAL LOCATION: T143N R26W parts of sections 2,3,4,5,6,8,9,10,11,16. T144N R26W parts of sections 19,22,23,26,27,28,29,30,31,32,33,34,35. T144N R27W parts of sections 23,24,25,26.

BRIEF SITE DESCRIPTION:

Huge site on Rosey Lake Plain LTA. Extends into Bena Dunes and Peatlands LTA. Essentially covers Mud-Goose

WMA. Includes some recently cut areas because of location among other stands. Several extensive wetland complexes. Centerpiece of site: extensive Wet Meadows along Mud and Goose rivers and creeks as well as lowland conifer swamps. Site include areas managed for oak (DNR Wildlife, DNR Forestry, Leech Lake DRM) and Wet Meadows along the Leech Lake River being managed cooperatively (DNR, CNF, LLDRM) by burning.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 67

SITE NAME: Salem 21

LEGAL LOCATION: T143N R26W parts of sections 21,22,27,28.

BRIEF SITE DESCRIPTION:

Small site on silty soils in Sugar Hills Moraine LTA, (extends into Rosey Lake Plain LTA), along Bear River north of Lower Melton Lake and an unnamed drainage about 1 mile to the west. Important old communities in site are White Cedar Swamp, Maple-basswood Forest, and Black Ash Swamp. Site includes some recent clearcuts because of their position near old forest. Includes CNF old growth complex #66.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 70

SITE NAME: Tasher Islands

LEGAL LOCATION: T143N R25W parts of sections 4,5,6,7,8,9,16,17,18,20,21. T144N R25W parts of section 32,33.

BRIEF SITE DESCRIPTION:

A large site mostly on organic soils on the Rosy Lake Plain LTA in northeastern Cass County. Tasher Islands are the large upland islands in the swamp. They have been extensively cut, as have the uplands surrounding the site. Site boundaries have been redrawn to try to eliminate most of the aspen clearcuts yet retain the conifer swamp. Although some young aspen forest is still included in the site, the wetlands (conifer and surrounding Hardwood Swamps as well as Shrub Swamps) are the most important communities in the site. Some Cedar Swamps in site approach 200 years old. Part of Tasher Island Deer Wintering Area (a joint CNF-DNR-Cass Co. project).

COUNTY PRIORITY RANK: Med

SITE NUMBER: 71

SITE NAME: Wahkena 14

LEGAL LOCATION: T144N R25W parts of sections 10,11,12,13,14,15,16,21,22,23,24,25, 26.

BRIEF SITE DESCRIPTION:

Large site on organic and silty soils of Deer River Peatlands LTA. Extensive conifer swamp is centerpiece of site; various tree sizes and stand densities; primarily Tamarack but also areas that are predominantly Black Spruce or cedar. Several Black Spruce Swamps aged at 90+ years; some Cedar Swamps 130+ years old. Northern and eastern boundary of site in county formed by Mississippi River (channelized). Little apparent recent disturbance in conifer swamp except a few winter trails. Many adjacent upland forests (some of which are included in site boundaries) have been harvested recently.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 72

SITE NAME: Skunk Lake

LEGAL LOCATION: T143N R25W parts of sections 13,14,23,24.

BRIEF SITE DESCRIPTION:

Wetland site on silty soils on Rosey Lake Plain LTA. Site includes several communities that appear to be intact and to lack recent disturbance; included among these is an extensive Black Spruce Swamp (with incipient patterning on high level photography; some of "patterning" may be due to past cuts, esp. on east edge of swamp.) Several knolls on north side of Skunk Brook hold Maple-basswood Forest (with aspen clones), which might be inaccessible due to surrounding wetlands. The Skunk River (Brook) connects Skunk Lake, Little Skunk Lake, Camel Lake, and, in Itasca County, Leighton Lake, then enters the Mississippi River as Leighton Brook.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 77

COUNTY PRIORITY RANK:

SITE NAME: Shingle Mill Lake Swamp

LEGAL LOCATION: T142N R25W parts of sections 13,23,24,25,35,36.

BRIEF SITE DESCRIPTION:

Large wetland complex on organic and silty soils of the Hill City Till Plain lying approximately between and north of the north and south forks of the Willow River. The centerpiece of the site is an extensive lowland conifer wetland complex in sections 23,24,25,26, and 36 of T142N R25W. Includes part of the Willow River Deer Yard. Lowland conifer stands are part of CNF old growth

complex # 68 and are appx. 120 to 140 years old. Most of site is in USFS ownership. Includes large, recently cut aspen island (stand 6 in compartment 268) and several other recently cut stands among or adjacent to lowland conifer and Lowland Hardwood Swamps. Also includes areas sheared for deer browse.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 79

SITE NAME: Lima 4

LEGAL LOCATION: T141N R25W parts of sections 5,8,9.

BRIEF SITE DESCRIPTION:

Small primarily wetland site on organic and silty soils of Hill City Till Plain LTA. Some recently harvested stands included in site because of their location among less disturbed communities. Includes 120-130 year old Black Ash Swamps and Cedar Swamps. One of least disturbed sites on Hill City Till Plain LTA in Cass County.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 82

SITE NAME: Remer 10

LEGAL LOCATION: T141N R26W parts of sections 2,3,10,11.

BRIEF SITE DESCRIPTION:

Small site on Hill City Till Plain at edge of city of Remer. Extensive conifer swamp (primarily Tamarack) with aspen regen. on large upland island. Ditching, trails, and old cuts, especially at south end of swamp. Low priority site, but mapped because of relatively intact conifer swamp.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 83

SITE NAME: Oxbow Lake

LEGAL LOCATION: T141N R26W parts of sections 7,8,9,16,17,18. T141N R27W part of section 24.

BRIEF SITE DESCRIPTION:

Large site on organic and well-drained soils of Itasca Moraine LTA south of Big Sand Lake. Site includes a complex of conifer (Tamarack, Black Spruce, and White Cedar) swamps around Ododikossi, Oxbow, Bailey, and Peterson lakes and Maple-basswood Forests with Red Oak in canopy on knolls north of Bailey and Oxbow lakes. Some clearcutting and selective harvest of upland forest. Rose pogonia population on mat surrounding Peterson

Lake. Least Moonwort collected near small lake north-east of Ododikossi Lake. Several Osprey nests in site and Great Blue Heron colony near Bailey Lake.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 84

SITE NAME: Laura Lake North

LEGAL LOCATION: T141N R26W parts of sections 21,22,28,29,30. T141N R27W part of section 25.

BRIEF SITE DESCRIPTION:

Large site adjacent to Laura Lake on the north. Primarily wetlands on organic soils of Itasca Moraine LTA. Extends into Spring Brook Till Plain LTA. Includes conifer (cedar, Black Spruce) swamps and Ash swamps with some upland islands and graminoid wetland (dominated by Bluejoint grass) along lakeshore. Conifer swamps up to 120 years old. Includes Laura Brook and part of Trelipe Creek. Site includes knolls covered with 90+ year old hardwood forest in sections 21,28. Some uplands in site harvested recently. Mostly USFS and county ownership. Nelson's Sharp-tailed Sparrow and Yellow Rail locations in site. Laura Lake is an important ricing lake.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 85

SITE NAME: Inguadona 26

LEGAL LOCATION: T141N R27W parts of sections 21,22,27,28.

BRIEF SITE DESCRIPTION:

Small site northwest of Lower Trelipe Lake. Primarily on loamy, well-drained soils of Itasca Moraine LTA. Important plant communities in site include relatively large stands of Maple-basswood Forest and Oak Forest. Some of uplands in site have been cut recently and others are scheduled to be cut. Lost Girl Lake is in site. Lost Girl Snowmobile Trail runs through site.

Maple-basswood Forest continues south of site and county road nearly to Trelipe Creek.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 86

SITE NAME: Remer 6

LEGAL LOCATION: T141N R26W parts of sections 4,5,6,7,8. T142N R26W parts of sections 32,33.

BRIEF SITE DESCRIPTION:

Relatively small peatland site adjacent to Big Sand Lake. On organic soils on Itasca Moraine LTA.

Centerpiece of site is extensive conifer (Tamarack, Black Spruce, Cedar) swamp. Some upland islands clearcut recently. Bald Eagle nest locations in and near site.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 87

SITE NAME: Tobique SE

LEGAL LOCATION: T142N R26W parts of sections 17,18,19.

BRIEF SITE DESCRIPTION:

Small peatland site with a population of Ram's-head Orchids. On organic soils of Sugar Hills Moraine LTA. Extends into Itasca Moraine LTA. Primarily conifer (Black spruce, cedar) swamp with graminoid wetlands along lakes and creek and Maple-basswood Forest around Bebow Lake. Includes two small lakes (Grass, Bebow) and creek with several beaver dams. Soo Line Trail (formerly rail, now 4-wheelers/snowmobiles) forms south edge of site. Clearcuts common on surrounding uplands.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 91

SITE NAME: Boy Lake 23

LEGAL LOCATION: T142N R28W parts of sections 22,23,26,27.

BRIEF SITE DESCRIPTION:

Small site on organic soils of Itasca Moraine LTA southwest of Boy Lake. Site selected for extensive conifer swamp (cedar, Black Spruce). Site includes a few upland hardwood islands. Hwy. 8 forms western boundary of site. White Adder's-mouth and Dragon's-mouth collected in site.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 96

SITE NAME: Mad Dog Lake Bog

LEGAL LOCATION: T142N R28W parts of sections 21,22,27.

BRIEF SITE DESCRIPTION:

Wetland site on organic soils of the Itasca Moraine LTA. Includes Mad Dog and Iverson lakes and creek that connects them to Leech Lake. Bounded on east by Hwy. 8 and on west by Headquarters Bay of Leech Lake. Site selected for extensive conifer swamps, particularly those with cedar. Ram's-head Orchid locations in site. Several Osprey locations. Primarily state ownership. Extensive graminoid wetland (at least part is Wiregrass, surrounding Mad Dog Lake and between that lake and Leech

Lake is mostly in tribal and private ownership.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 97

SITE NAME: Boy Lake 9

LEGAL LOCATION: T142N R28W parts of sections 2,3,4,5,8,9,16,17. T143N R28W part of section 33.

BRIEF SITE DESCRIPTION:

Large site that includes Blackduck Lake and point separating Boy Bay and Headquarters Bay of Leech Lake. On organic and silt-loam soils of Guthrie Till Plain LTA. Focal plant communities are mature and old Maple-basswood Forest and extensive peatland complex (graminoid wetlands, Poor Fens, Tamarack Swamp). Privately owned but essentially undeveloped Maple-basswood Forest on shore of Leech Lake; one of largest holdings belongs to the Ah-Ke-Wenzie Club, Inc., a hunting club. Goblin Fern has been collected in Maple-basswood Forest northeast of Blackduck Lake. Several Bald Eagle and Osprey locations in site. Primarily county, USFS, and tribal land.

COUNTY PRIORITY RANK: High

SITE NUMBER: 102

SITE NAME: Bear Island

LEGAL LOCATION: 142N 29W parts of sections 2,11,12,13,14,23,24.

BRIEF SITE DESCRIPTION:

Bear Island is a linear, 1100 acre island in the southeastern part of Leech Lake. The north and south ends of the island are well-drained till, and organic soils are found in the center of the island. Old-growth Maple-basswood Forest and old-growth Oak Forest are found on the northern part of the island, an extensive graminoid wetland occupies organic soils in the center of the island, and upland knobs on the southern part of the island are oak forest with Sugar Maple and Basswood in the understory. Bald Eagle nests and a population of Goblin Fern have been found on the island. Numerous cultural resource sites on island.

COUNTY PRIORITY RANK: High

SITE NUMBER: 103

SITE NAME: Pelican Island

LEGAL LOCATION: T142N R29W parts of sections 16,17,20.

BRIEF SITE DESCRIPTION:

Several small islands (Little Pelican, Big Pelican, Gull) in

south central part of Leech Lake. On poorly drained loamy soils of Itasca Moraine. Site of long-term research on Spotted sandpipers (Dr. Lew Oring, Univ. of North Dakota). Important nesting islands for Common Terns. Private and tribal ownership.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 105

SITE NAME: Pine Lake 7

LEGAL LOCATION: T141N R29W parts of sections 7,8,17,18.

BRIEF SITE DESCRIPTION:

Site north of Pine Lake on loamy sand of Itasca Moraine. Focal communities of site are Maple-basswood Forests on knolls among Pine, Haynes, and Rat lakes interspersed with cedar and Black Ash Swamps. Relatively intact mature but not old forest on a landscape that has, in most other areas, been harvested intensively. Bald Eagle and Osprey locations in site. Mixed ownership: county, state, USFS, and private.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 109

SITE NAME: Wabegon Lake

LEGAL LOCATION: T142N R30W parts of sections 15,16,21,22,28.

BRIEF SITE DESCRIPTION:

Small site on poorly drained soils of Itasca Moraine, Hummocky LTA. On peninsula extending into Leech Lake. Mature and old Maple-basswood Forest covers knolls in matrix of Wet Meadow, Poor Fen, and conifer swamp. Includes several small lakes and a creek. Primarily USFS ownership, with some tribal and private land. Osprey and Matricary Grapefern locations in site.

COUNTY PRIORITY RANK: High

SITE NUMBER: 110

SITE NAME: Stony Point

LEGAL LOCATION: T142N R30W parts of sections 3,9,10,15,16.

BRIEF SITE DESCRIPTION:

Site on organic soils and poorly drained loamy soils of Itasca Moraine, Hummocky LTA. On end of peninsula extending into Leech Lake. Adjacent to Chippewa National Forest's (CNF) Stony Point Campground and CNF recreation residences on Leech Lake. Extensive wetland complex (including Poor Fen and Wet Meadow; part of each has holes blasted for waterfowl use) with

old Maple-basswood Forest and old Oak Forest on the uplands. Yellow rail locations in Wet Meadows and Goldie's Fern collected in Maple-basswood Forest. Several Bald Eagle locations in site. Nearly all in USFS ownership; small areas of private and tribal ownership.

COUNTY PRIORITY RANK: High

SITE NUMBER: 114

SITE NAME: Shingobee River

LEGAL LOCATION: T141N R31W parts of sections 8,17.

BRIEF SITE DESCRIPTION:

Small but important site on organic soils along the Shingobee River and sandy soils on the surrounding uplands. South of Walker on Itasca Moraine, Hummocky LTA. Focal community of site is Seepage Subtype of Northern White Cedar Swamp along the river. These are discharge wetlands, fed by seeps flowing from the steep ridges bordering the river. Part of CNF Old Growth Complex #81. Although only one listed species has been collected (White Adder's-mouth), the location supports a rich orchid flora. Almost entirely in USFS ownership. Includes Anoway Lake and part of Shingobee Recreation Area.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 119

SITE NAME: Deerfield 18

LEGAL LOCATION: T139N R31W parts of section 7

BRIEF SITE DESCRIPTION:

Small site on sandy soil of the Park Rapids Outwash Plain LTA. Most of site is Jack Pine Forest generated following 1959 Badoura Nursery fire. Fire-generated Jack Pine Forest extends into Cass County from Hubbard; most of Jack Pine generated by this fire is in Hubbard County. Many of these Jack Pine Forests have been harvested and converted into agricultural fields or plantations. Little disturbance apparent here except a minor trail system. Most of site is in county ownership.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 120

SITE NAME: McKinley 10

LEGAL LOCATION: T138N R32W parts of sections 9,10,15,16.

BRIEF SITE DESCRIPTION:

Site is on sandy outwash plain southwest of Backus. Part

of site is Jack Pine regenerated following 1976 fire and owned by Potlatch Corp. West part of site is part of county-owned WMA managed for Greater Prairie Chickens. On Beaver Creek Drumlin Plain LTA.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 121

SITE NAME: Bull Moose 17

LEGAL LOCATION: T138N R31W parts of sections 5,7,8,17,18,19,20.

BRIEF SITE DESCRIPTION:

Large site on west edge of St. Croix Moraine LTA. Kame and kettle end moraine topography-including sharp west edge of moraine. Frequent small clearcuts and occasional larger young pine plantations. Mostly in county ownership.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 122

SITE NAME: Deerfield 22

LEGAL LOCATION: T139N R31W parts of sections 10,11,12,13,14,15,21,22,23,26,27,28, 33,34,35.

BRIEF SITE DESCRIPTION:

Large site west of Backus on St. Croix Moraine LTA. Heavily clearcut (part is in Deerfield Forest Management Area, which is managed for game spp.) but with some large, intact Oak Forest. Includes naturally generated Red Pine Forests, that are thinned at regular intervals. Although young aspen stands occur throughout, this is probably the most striking example of the St. Croix Moraine in Cass County, and most of it is in state or county ownership.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 128

SITE NAME: Ponto Lake 06

LEGAL LOCATION: T139N R29W parts of sections 6,7; T139N R30W parts of sections 1,12.

BRIEF SITE DESCRIPTION:

Site is in Deep Portage Conservation Reserve near Hackensack. Many small clearcuts and aspen regeneration throughout most of Reserve, but mature aspen with Red Pine and Paper birch inclusions on hilly terrain in Wilderness Area of Reserve. On Itasca Moraine LTA.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 135

SITE NAME: Ponto Lake 25

LEGAL LOCATION: T139N R29W parts of sections 25,26,35.

BRIEF SITE DESCRIPTION:

Site is northeast of the city of Pine River. Includes Blind Lake Creek and several small lakes. On Itasca Moraine LTA. Riparian wetland complexes throughout site. Upland forests moderately fragmented; block of young Aspen Forest throughout.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 136

SITE NAME: Wabedo 04

LEGAL LOCATION: T140N R28W parts of sections 4,5,8,9,16,17.

BRIEF SITE DESCRIPTION:

Site is east of Woman Lake on Itasca Moraine LTA. Relatively intact upland mesic forest with scattered, small wetlands typical of the moraine. Most of site in private ownership; appears to be forest used for recreation.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 144

SITE NAME: Little Sand Lake

LEGAL LOCATION: T138N R29W parts of Sections 5,6,7,8.

BRIEF SITE DESCRIPTION:

Small site north of the city of Pine River. Pine River flows through site. Primarily Oak Forest, Jack Pine Forest, and mixed pine-hardwood forest. Fragmented forest on surrounding uplands. Bald eagle location in site. On Mildred Outwash Plain LTA; extends into Itasca Moraine LTA.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 151

SITE NAME: Blind Lake 11

LEGAL LOCATION: T139N R28W parts of sections 1,11,12.

BRIEF SITE DESCRIPTION:

Site is northeast of the city of Pine River and south of County Road 47. Includes Black Ash Swamps and Cedar Swamps along and near creeks in the site, with mesic forest, including Northern Hardwood Forest, on the uplands. Barren Strawberry location. On Spring Brook Till Plain LTA.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 154

SITE NAME: Inguadona 33

LEGAL LOCATION: T141N R27W parts of sections 27,28,33.

BRIEF SITE DESCRIPTION:

Small site on Spring Brook Till Plain LTA and extending into Itasca Moraine LTA. Separated from site 85 by a road; should be considered an extension of that site. Contiguous Maple-basswood Forests form centerpiece of site. Some fragmentation of forest (recent clearcuts). Snowmobile trail runs through site.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 159

SITE NAME: Thunder Lake 30

LEGAL LOCATION: T140N R26W parts of sections 18,19,28,29,30,31; T140N R27W parts of sections 24,25,36.

BRIEF SITE DESCRIPTION:

Large site northwest of Outing on Outing Moraine. Large, intact aspen, pine, and oak forests on sandy soil. Importance of site lies in its size and the relatively intact character of the contiguous upland forests. Bald Eagle locations in site near Lake George.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 162

SITE NAME: Trelpe 03

LEGAL LOCATION: T139N R27W parts of sections 2,3,4,9,10,11,15,16.

BRIEF SITE DESCRIPTION:

Large site northwest of Outing. On poorly drained loamy soils of Spring Brook Till Plain. Primarily relatively intact 60-70 year old Aspen Forest, with occasional Northern Hardwood Forests, Conifer Swamps, and Shrub Swamps. Importance of site lies in its size and the large, contiguous stands of relatively intact forest. Most is county-administered land. Great Blue Heron colony in site.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 163

SITE NAME: Blind Lake 29

LEGAL LOCATION: T139N R27W parts of sections 21,22,27,28.

BRIEF SITE DESCRIPTION:

Site is west of Outing on poorly drained, loamy soils of Spring Brook Till Plain. Important communities in site are oak forests dominated by Red Oak with Red Maple

and Sugar Maple in the understory and with scattered Butternuts. Osprey locations in site.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 168

SITE NAME: Thunder Lake 24

LEGAL LOCATION: T140N R26W parts of sections 13,23,24,25. T140N R25W parts of sections 18,19,30.

BRIEF SITE DESCRIPTION:

Site is on well-drained, loamy soils on Outing Moraine LTA north of Outing. Extensive 65-75 year old Oak Forest interspersed with aspen clearcuts.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 176

SITE NAME: Beulah 16

LEGAL LOCATION: T139N R25W parts of sections 8,9,10,16,17

BRIEF SITE DESCRIPTION:

Large wetland complex on organic soils on Outing Moraine. Includes large, 140-160 year old black ash swamp and White Cedar Swamp. Young forest on surrounding uplands.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 177

SITE NAME: Beulah 27

LEGAL LOCATION: T139N R25W parts of sections 26,27,34,35.

BRIEF SITE DESCRIPTION:

Large wetland complex on organic soils of Outing Moraine LTA east of Outing. Extensive Conifer Swamp (Tamarack mixed with cedar) and Ash Swamp.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 179

SITE NAME: Pine River 34

LEGAL LOCATION: T138N R30W parts of sections 27,34.

BRIEF SITE DESCRIPTION:

Small MCBS site on organic soils on Mildred Outwash Plain. Tamarack Swamp surrounding Tamarack Lake west of city of Pine River.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 184

SITE NAME: Bungo 22

LEGAL LOCATION: T137N R31W parts of sections 21,22,27,28.

BRIEF SITE DESCRIPTION:

Small site on St. Croix Moraine LTA (extends into Pine River Drumlin Area) on poorly to well-drained loamy soils. Primarily 50-70 year old Oak Forest and Aspen Forest with several small lakes and wetlands. County-administered land.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 185

SITE NAME: Bungo 07

LEGAL LOCATION: T137N R31W parts of sections 5,7,8,9,17. T137N R32W part of section 12.

BRIEF SITE DESCRIPTION:

Large upland site on well-drained soils on the St. Croix Moraine. Primarily 60-70 year old Aspen and Oak forests but includes large, 80+ year old Red pine forest in section 7. Young aspen stands are common in site. Numerous small lakes. Mixed White pine and Northern Hardwoods in several stands in sections 8 & 9. Spider Lake Forest Road runs through this site. Large, intact forest stands (particularly Oak Forest, Red Pine Forest, and mixed White Pine-hardwood Forest) are important in this site. There are also Red-shouldered Hawk locations here.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 187

SITE NAME: Bungo 29

LEGAL LOCATION: T137N R31W parts of sections 19,29,30,31,32.

BRIEF SITE DESCRIPTION:

Large site on well-drained soils of St. Croix Moraine southwest of Pine River. Primarily 60-70 year old Oak Forest and Aspen Forest with small lakes and diverse wetland types on kame and kettle landscape. Occasional recent clearcuts. Red-shouldered Hawk location in site. One of better examples of vegetation and topography of St. Croix Moraine.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 191

SITE NAME: Ansel 07

LEGAL LOCATION: T137N R32W parts of sections 5,6,7,8,18; T138N R32W part of section 31.

BRIEF SITE DESCRIPTION:

Large, low priority site on Beaver Creek Drumlin Plain LTA. Well-drained soils of drumlins separated by organic soils. Forest on uplands (drumlins) cut extensively. This

is one of a few MCBS sites on this landform. Drumlins continue to the west (and in better form) in Wadena County.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 195

SITE NAME: Byron 05

LEGAL LOCATION: T136 N R32W parts of sections 31,32; T135N R32W parts of sections 5,6.

BRIEF SITE DESCRIPTION:

Small site including Dry Sand Lake WMA (which extends into Wadena County) and some surrounding county land on Swan Creek Outwash Plain LTA. WMA is primarily Emergent Marsh; county land includes 50-60 year old Jack Pine Forests on sandy soil. Several Jack Pine plantations also included in site. Importance of site lies in locations for Blanding's turtles and Sandhill cranes and Jack Pine Forest on outwash.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 203

SITE NAME: Moose Lake 08

LEGAL LOCATION: T136N R30W parts of sections 6,7,18; T136N R31W parts of sections 1,2,11,12,13,14.

BRIEF SITE DESCRIPTION:

Site is on loamy, well-drained soils of the Pine River Drumlin Plain southwest of Pine River. Primarily Aspen Forest (including recent clearcuts) on drumlins, with Black Ash Swamps and Black Spruce Swamps on the organic soils between drumlins. Mayo Creek runs through the site. Osprey locations in site.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 204

SITE NAME: Meadowbrook 15

LEGAL LOCATION: T135N R31W parts of sections 15,16,21,22,28.

BRIEF SITE DESCRIPTION:

Large site on the Mosquito Creek Drumlin Plain LTA. Well-drained, loamy soils in drumlins interspersed with organic soils. Primarily 40-50 year old aspen on uplands, with Black Ash Swamp, Shrub Swamp, and other wetland types in lowlands. Small, recent clearcuts dispersed throughout on uplands. Meadowbrook WMA, in part. This appears to be the best remaining example of native vegetation on this LTA.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 213

SITE NAME: Fairview 05

LEGAL LOCATION: T134N R30W parts of sections 5,6,7,8; T134N R31W part of section 1; T135N R30W parts of sections 31,32. T135N R31W section 36.

BRIEF SITE DESCRIPTION:

Large site on St. Croix Moraine in the southern part of the county. Mostly 60 year old Aspen Forest and 70-90 year old Oak Forest. Includes large, 135+ year old Black Ash Swamp. Bald Eagle location in site. Site extends into Pine River Drumlin Plain LTA.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 214

SITE NAME: Fairview 35

LEGAL LOCATION: T134N R30W Section 35, W1/4 of Section 36. T133N R30W part of Section 2.

BRIEF SITE DESCRIPTION:

Small site between Gull Lake and Sylvan Lake. On St. Croix Moraine LTA. Mostly continuous canopy of hardwoods, primarily Oak Forest. Includes scattered small lakes and wetlands. Red-shouldered hawk, Bald eagle, and Osprey locations near site, as well as great Blue Heron colony.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 221

SITE NAME: Becker 02

LEGAL LOCATION: T133N R32W parts of Sections 2,10,11.

BRIEF SITE DESCRIPTION:

Small site along the Crow Wing River on the Pillager Outwash Plain LTA. Important features of the site include Lowland Hardwood Forest in old oxbows and Floodplain Forest (Silver Maple Subtype) in a narrow, intermittent band along the river. Some clearcuts and conifer plantations also fall within the boundaries of the site.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 223

SITE NAME: May 17

LEGAL LOCATION: T133N R31W parts of Sections 17,18,20.

BRIEF SITE DESCRIPTION:

Small site along Crow Wing River on the Pillager Outwash Plain LTA. The most important community

in the site is the Silver Maple Subtype of Floodplain Forest along the river. Lowland Hardwood Forest and Oak Forest forms a relatively closed canopy north (upland) of the Floodplain Forest. Other areas are included in site boundaries as buffer.

COUNTY PRIORITY RANK: low

SITE NUMBER: 226

SITE NAME: Tobique NW

LEGAL LOCATION: T142N R27W parts of sections 2,3,11,12,13; T143N R27W parts of 34,35.

BRIEF SITE DESCRIPTION:

Wetland site on organic soils of Rosey Lake Plain. Primarily conifer swamps (including Cedar Swamp). Forest surrounding uplands fragmented. Conifer swamps part of CNF old growth complex; stands aged at 145-155 years. Soo Line Trail (formerly a rail line, now an ATV/snowmobile trail) forms SW edge of site and separates it from site 227 (an extensive graminoid wetland complex). Osprey location in site.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 227

SITE NAME: Tobique NE

LEGAL LOCATION: T142N R27W parts of sections 3,4,5,8,9,10,11,15,16.

BRIEF SITE DESCRIPTION:

Extensive graminoid wetland along Boy River. On organic soils of Rosey Lake Plain. Yellow Rail, Nelson's Sharp-tailed Sparrow, and Bald Eagle locations in site. Soo Line Trail forms NE boundary of site and separates this site from site 226.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 229

SITE NAME: Gull Lake OG

LEGAL LOCATION: 134N 29W part of section 7.

BRIEF SITE DESCRIPTION:

Small site on well-drained soils of the St. Croix Moraine on the west shore of Gull Lake. Part of Pillsbury State Forest and designated as an old growth (White Pine and Red Pine) site.

COUNTY PRIORITY RANK: Med

SITE NUMBER: 230

SITE NAME: Woman Lake Peninsula

LEGAL LOCATION: T140N R28W part of section 6.

BRIEF SITE DESCRIPTION:

Small site on peninsula in Woman Lake. Includes George Cook Wildlife Management Area. Primarily Maple-basswood Forest. Goblin Fern population in site. On Itasca Moraine LTA.

COUNTY PRIORITY RANK: Low

SITE NUMBER: 232

SITE NAME: Sugar Lake

LEGAL LOCATION: T143N R25W parts of sections 33,34. T142N R25W parts of sections 3,4.

BRIEF SITE DESCRIPTION:

Small site on sandy loam soils on Sugar Hills Moraine south of Sugar Lake. Primarily Maple-basswood Forest; includes several old growth candidate stands. Primarily U.S.F.S. ownership. Includes part of the CNF Sugar Lake Trail System. Bald Eagle location in site. Some relatively small recent clearcut stands are included in the site because of their proximity to less disturbed communities. Surrounding forest fragmented.

5. Plant Communities

Brief Introduction to Plant Communities 5.1.1

A Key to Plant Communities

in Minnesota 5.2.1

Plant community descriptions are included in Minnesota's Native Vegetation: A Key to Natural Communities. Version 1.5. (Natural Heritage Program. 1993. MN DNR Biological Report No. 20. Minnesota Department of Natural Resources, St. Paul). A copy is included with this note book.

MCBS Procedures, Methods

and Results 5.3.1

Reclassification of Forest Inventory

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Relevés..... 5.6.1

Map showing location of MCBS relevés in Cass County 5.6.4

List of MCBS relevés by location 5.6.5

Map showing MCBS plant lists

in Cass County 5.7.1

List of MCBS plant lists by location 5.7.2

Examples of selected plant communities

in Cass County 5.8.1

Map showing locations of examples of plant communities described 5.8.2

Plant community examples:

Jack Pine Forest, White Cedar Swamp, Wet Meadow Northern Hardwood-conifer Forest, Floodplain forest, Black Spruce Swamp, Black Ash Swamp, Red pine Forest, Oak Forest, Maple-basswood Forest, Black Spruce Bog and others 5.8.3

Annotated bibliography:

plant communities 5.9.1

Brief Introduction to Plant Communities

A *plant community* is a group of plants growing together in the same area. The composition of a given plant community is determined by the response of individual plant species to the physical environment (soil, moisture, surficial geology, disturbance patterns), the biotic environment (competition from other plants species, predation by animals, and various symbiotic relationships with species such as mycorrhizal fungi), and ability of a plant species to colonize the site. Chance often plays a role in these factors. Thus, no two plant communities are identical. Nevertheless, plant ecologists recognize that similar associations or groups of plant species occur across the landscape, typically in areas where environmental conditions are similar. These identifiable associations of plant species are called *plant community types*.

Names of plant community types often include the name of a dominant plant species in the community type followed by a generic plant community name such as swamp, marsh, fen, forest, or prairie, (e.g., Maple-basswood Forest and White Cedar Swamp). Plant community types found in Cass County include Jack Pine Forest, Black Spruce Swamp, Rich Fen, Poor Fen, Aspen Forest, Black Spruce Bog, Black Ash Swamp, Floodplain Forest, Wet Meadow, and Alder Swamp.

Natural communities are groups of organisms (including animals, fungi, and microbes) that interact with each other and their environment (White and Madney 1978). In addition, as the term is used by MCBS and NHNRP, natural communities are not greatly altered by modern human activity or by introduced organisms. These communities are named for their most characteristic features, whether it is physiognomy, substrate, species composition, or topographic position. In practice, however, animals are seldom important in defining *natural community types*, and features of the abiotic environment are important primarily for how they influence the

species composition of a community type. Therefore, in this report, *natural community types* should be considered synonymous with *plant community types* that have not been greatly altered by modern humans or by introduced organisms. Thus, a heavily grazed pasture with a canopy of oaks, which lacks herb species characteristic of the Oak Forest plant community type, is not included in this report.

Vegetation is the mosaic of plant communities on a landscape (Kuchler 1967). The more heterogeneous the landforms in a landscape are, the greater the number of plant communities that will be found there. The combination of a biotic community (plants, animals, etc.) and its physical (abiotic) environment is called an *ecosystem*.

Key to Natural Communities in Minnesota

The DNR Natural Heritage and Nongame Research Program (NHNRP) has produced a book that describes the natural communities found in the state and provides a dichotomous key for use in identifying them in the field. *Minnesota's Native Vegetation: A Key to Natural Communities* is available from NHNRP and is also included with this notebook. A revision of *Minnesota's Native Vegetation* is in progress and should be available in 1999.

References Cited

- Kuchler, A.W. 1967. Vegetation mapping. The Ronald Press Company. New York, New York.
- White, J., and M. Madney. 1978. Classification of natural communities in Illinois. In Natural Areas Inventory Technical Report. Vol. 1. Ill. Natural Areas Inventory, Urbana, Ill.

A Key to Natural Communities

Plant community descriptions are included in Minnesota's Native Vegetation: A Key to Natural Communities, Version 1.5. (Natural Heritage Program. 1993. MN DNR Biological Report No. 20. Minnesota Department of Natural Resources, St. Paul). A copy is included with this notebook.

MCBS Procedures and Methods: Plant Communities

Although plant communities (with the exception of calcareous seepage fens) have no legal standing in Minnesota, the Natural Heritage and Nongame Research Program (NHNRP) considers the identification, protection, and management of plant communities and ecosystems a high priority. NHNRP has developed a classification and key to plant communities in the state (*Minnesota's Native Vegetation: A Key to Natural Communities*, DNR, Natural Heritage Program, 1993); a copy is included with this notebook. This key is used by MCBS field staff, along with a grading scale, to evaluate plant communities within MCBS sites.

NHNRP has also evaluated plant communities in the state for their relative rarity and endangerment throughout their range. Plant communities have been assigned a state rank on a scale of 1 to 5. Those ranked "1" are considered critically endangered in Minnesota, while those communities ranked "5" are considered secure under present conditions. Communities and their ranks are listed in Appendix 1 of the enclosed Key.

As part of the cooperative agreement between the DNR and the Chippewa National Forest, field work completed by the MCBS plant ecologist during the 1992 field season centered on the completion of vegetation plots (see the description of the releve method included later in this chapter; also see *A Handbook for Collecting Releve Data* by J.C. Almendinger) in and evaluations of wetland plant communities within the CNF. These relevés would contribute to the CNF's work on an ECS. About 30 of that year's wetland relevés were at locations selected by the ECS plant ecologist and the MCBS plant ecologist. Relevés at these sites were completed by the MCBS plant ecologist and Jan Janssens, a bryologist in the Department of Ecology and Evolutionary Biology at the University of Minnesota with whom the CNF had contracted for the completion of moss identification and other peatland work.

Beginning with the 1993 field season, all types of plant communities within MCBS sites on all ownerships throughout the county were evaluated (see the plant community evaluation guidelines included later in this chapter). Field work was completed in Cass County at the end of the 1995 field season.

In previously-surveyed counties, lines delineating plant communities within sites were drawn on topo-

graphic maps by the MCBS plant ecologist based on aerial photo interpretation and field survey; these lines were then digitized into an ARC/INFO GIS. The large size of Cass County and other northern forested counties, the land use in these counties, and the availability of field data collected by other agencies inspired the development of an alternative method for delineating plant communities within sites.

Norm Aaseng, MCBS plant ecologist, and Al Epp, NHNRP GIS specialist, developed a computer program called RECLASS that uses tabular forestry data collected by public land management agencies to determine the plant community name, as defined in the *Minnesota's Native Vegetation: A Key to Natural Communities*, for a given forest stand polygon. The combination of reclassified forestry tabular data, digitized forest stand polygons color coded by plant community type, and final MCBS site boundaries allows the production of GIS maps that show plant communities present within MCBS sites. (Areas within sites in private ownership will be digitized following aerial photo interpretation.) A brief description of RECLASS is included on page 5.4.1 of this notebook.

MCBS Results: Plant Communities

MCBS staff collected 194 relevés and 140 plant lists within 23 plant community types during the course of the Survey of Cass County from 1992 through 1995. Relevés and plant lists are listed by location in tables later in this chapter. Distribution maps also included in this chapter show the location of MCBS relevés and plant lists recorded during the Survey. We also include brief descriptions and copies of relevés and plants lists from selected plant community types in the county, along with a map and directions for finding each example.

Reclassification of Forest Inventory Stand Data (RECLASS)

RECLASS is a computer program developed by MCBS and NHNRP to assist in interpreting the vast amount of forest inventory data available in the northern part of the state. The program assigns a preliminary natural community type to a stand using existing forest inventory data, making it possible to produce maps showing forest inventory polygons color-coded to indicate community type. RECLASS serves two purposes. First, it provides a uniform classification of stands from different forest inventories that typically have incompatible cover types that cannot be crosswalked directly. Second, it provides a more detailed and ecological description of a stand than can be provided by a timber or product-oriented cover type.

The program has been developed for DNR's Cooperative Stand Assessment (CSA) Forest Inventory data but has been modified to be used on forest inventories of Cass County, USFS-Chippewa National Forest, and BIA-Leech Lake Indian Reservation. To the extent to which forest inventory data are available, RECLASS follows the keys described in *Minnesota's Native Vegetation - A Key to Natural Communities* (DNR 1993) in defining natural community types. Only stands 40 years or older of natural origin are classified. Percent tree species volume is the primary variable and is used in place of percent tree canopy. Additional variables are used to provide information on soil drainage and understory veg-

etation. The existence or usefulness of these ancillary data varies among the different inventories. Because of the limitations of the data, the RECLASS classification should be considered an approximation. Difficult to distinguish types may need to be reviewed individually. In some cases, these types cannot be separated and a more general class must be assigned.

Some caution should be exercised in the use of RECLASS. Using tree volume instead of crown cover may result in some differences in the classification of natural community types where large-diameter small-crowned tree species (e.g., Balsam fir) are a major component. The limited value of site data makes distinguishing between upland and lowland transitional types (e.g., upland white cedar vs. cedar swamp, lowland hardwood vs. northern hardwoods) difficult and should be viewed with caution. Finally, the lack of detailed understory species data other than shrubs also limits the detail at which types can be assigned. Inconsistency in tree species identification or site variables can also result in misclassification. Decisions on species groupings, threshold percentages, and other variables used are based on a preliminary assessment of CSA data and may need to be adjusted in different parts of the state.

For additional information about RECLASS, contact Norm Aaseng, MCBS Plant ecologist, at 612-297-7267.

Norm Aaseng
27 March 1997

Guidelines for Evaluating Plant Communities

These very general guidelines are based on a set prepared by Natural Heritage and Nongame Research Program and Minnesota County Biological Survey plant ecologists for their own field use. The original guidelines have been edited and condensed.

The guidelines are based primarily on the field experience of the Natural Heritage and Nongame Research Program and Minnesota County Biological Survey plant ecologists to date. The authors have a great deal of field experience in some plant communities and less in others. The original guidelines were designed for use by experienced plant ecologists who have some knowledge of the community across its entire range in the state.

These revised guidelines describe the characteristics that should be considered when a community is evaluated. To assess the quality of plant communities, plant ecologists consider primarily the presence or absence and timing of human-related disturbances such as logging, plowing, grazing, browsing, and development. In general, old stands rank higher than young stands; apparently undisturbed stands rank higher than those with a recent, unnatural disturbance; and larger stands rank higher than smaller stands.

Some Characteristics Used in Evaluating and Ranking Plant Communities

- **Age of the stand.** Older stands exhibit increased niche diversity and stand features expected in a particular community. Although attaining old growth age is not a requirement for a high quality community, older stands tend to be rarer on the landscape, and thus more in need of special management and consideration. The age at which communities are considered old growth varies with the community. Although the age is set at 120 years for most communities, those composed of shorter-lived species reach this stage at 90 years.
- **Disturbance.** In the highest quality stands, there is little or no recent anthropogenic disturbance. Human-induced disturbance includes logging, plowing, and grazing. Other common disturbances in Maple-basswood Forests, for example, include selective removal of oaks and a long history of maple sugaring. Evidence of past logging includes the obvious presence of stumps; however, high-cut stumps (indicating winter logging in the days before mechanized tree fellers) may have deteriorated enough to be mistaken for charred stumps. Evidence of grazing sometimes includes the presence of non-native or invasive herbaceous species and shrubs including Prickly Ash and Buckthorn, and low plant species diversity and abundance within the ground layer. Broad patches of one or two species can also indicate past disturbance. Communities devoid of human-induced disturbance are rare on the landscape; more often, it is a matter of looking for communities with the *least* disturbance (e.g., a few logs taken here and there in a stand for firewood vs. a clearcut).
- **Stand origin.** Stands should have originated following natural catastrophic disturbance (e.g., windstorm, fire) or should be composed primarily of species that succeed pioneer species following anthropogenic disturbances (e.g., second-growth forests following logging in the distant past). Old conifer plantations may resemble stands of natural origin; assessment of tree dispersion, species diversity, and land use records may be required to separate the two.
- **Regeneration.** In communities of shade-tolerant species (e.g., maple-basswood forests), there should be a complete distribution of tree size classes, from seedlings and saplings to advanced regeneration. The highest quality pine forests show evidence of ground fires and advanced regeneration of pine.
- **Ground flora.** This should consist of native species typical of the community. The highest quality hardwood communities should exhibit an abundant and diverse ground flora. In the case of forest communities with heavily shaded understories, this will usually include early flowering shade-adapted or later-flowering shade-tolerant species. Conifer swamps and bogs (with the exception of some white cedar swamps) exhibit a lower species diversity than hardwood communities, but the species are typical of the community and adapted to high water and low nutrient regimes.
- **Hydrologic regime.** In the highest quality plant communities, surface water flow is unimpeded by ditches, roads, dams, channelization, or tiles.

- **Coarse woody debris.** Large-diameter coarse woody debris is often present in the highest quality forested communities. (In some communities coarse woody debris deteriorates faster than in others, and fire may have consumed some of the coarse woody debris in other communities.)
- **Surrounding landscape.** Communities surrounded by a buffer of native vegetation receive less agricultural run-off and are less prone to invasion by non-native plant species than communities lacking such a buffer.

Relevés

Introduction

In the 1960's, C.R. Janssen, from the Botanical Museum and Herbarium at the State University in Utrecht, The Netherlands, came to the University of Minnesota at the invitation of Dr. Herbert Wright, Jr. (Pers. comm., John Almendinger). As a visiting professor at the University's Limnological Research Center, Dr. Janssen studied Minnesota's forests and bogs (Janssen 1967; Janssen 1984) and introduced Dr. Wright and his students to the applicability of relevés (pronounced *rell-ah-vay*) as a research tool. In the years since, relevés have been conducted for graduate research projects at the University, for environmental assessments, and to describe plant communities. Many of Minnesota's natural resource managers and field biologists were introduced to relevés in plant ecology courses taught by Dr. Ed Cushing, one of Dr. Wright's former graduate students who teaches at the University of Minnesota. The relevé manual now in use in Minnesota (Almendinger 1987) was based on forms and information provided in Dr. Cushing's courses.

Relevé is a French word with several meanings. One of the definitions, "raised, erect, uplifted", is the meaning *relevé* takes when used in ballet, where it refers to rising up and standing on tiptoe. Another meaning for *relevé* is "summary, survey, or list." Although the second is probably the intended meaning, the combination of the two gives an apt description of the technique: a botanist selects a plot, then stands up, looks around, and lists the plants present from the tallest trees to the shortest herbs.

History

During the late 1800s, two main approaches to the description of plant communities developed in Europe: the physiognomic (vegetation structure) and the floristic (species composition) approaches. The floristic approach, based on the idea that plant communities are units of classification and can be defined on the basis of species composition, was developed mainly by plant ecologists working in Zurich, Switzerland, or Montpellier, France. In the early 1900s, a Swiss scientist, Dr. J. Braun-Blanquet (pronounced *brawn-blunkay*), added some critical refinements to the floristic approach, making it the eminently practical and widely used technique we have today.

Technique

There are several steps involved in setting up and recording a relevé (Mueller-Dombois and Ellenberg 1974). The first is to select the location and establish boundaries of the plot. The second step is to list all plants present in each life form and height class and to estimate the percent cover contributed by each species within each stratum. The final step is to record and map the location of the relevé.

Selection of the location of a relevé is not a trivial matter. The objective of the study must be kept in mind (see *Uses of Relevés*, below). Often, the relevé is intended to describe a plant community; in that case, care must be taken to select a location that is representative of the plant community at that site.

The size of a relevé plot depends upon the type of plant community being surveyed. The smallest area in which nearly all of the species present in the community are represented, known as the minimal area, varies with the type of community. Plots may be smaller in those communities with lower species diversity. These minimal areas have been worked out, within broad limits, for most classes of plant communities (Mueller-Dombois and Ellenberg 1974). For example, plots of 400 square meters are usually sufficient to include all or nearly all species found in a temperate forest community; relevés in bogs and fens, communities that are usually less diverse than temperate forests, may be 100 square meters in size. The shape of relevés may vary, although they are usually square.

The height strata have been standardized and correspond roughly to supercanopy, canopy, subcanopy, shrub layer, herb layer, grass layer, and moss layer. Life-forms include broadleaf deciduous, needleleaf evergreen, graminoid, forb, and lichen/moss. On a standardized form, all plant species within each of these life-forms and layers are listed, along with an estimate of the percent cover (also divided into standardized ranges) that each species provides in that stratum (Almendinger 1987).

A thorough knowledge of the flora of an area and the ability to recognize plants not only in fruit or flower but also in vegetative and senescent conditions are required

skills for releve work. Most plant ecologists who collect releve data work constantly to improve their plant identification skills, not only to do a better job of describing plant communities but also to save time by reducing the number of plants that must be collected as "unknowns" and identified later in the lab.

Often other data are collected during a releve, including surface water pH in wetlands, soil descriptions, phenological information, tree diameters, amount of woody debris, symptoms of disease, and evidence of disturbance.

Analyses

Releve data are entered into a computerized database of the Minnesota Department of Natural Resources' (MN DNR) Natural Heritage and Nongame Research Program in St. Paul and are available to researchers for analyses. Currently, there are 5,622 relevés in the database.

The releve technique for gathering plant community data is semiquantitative in that the cover and abundance of plants are estimated visually rather than measured. Releve data lend themselves to particular types of analyses, including multivariate techniques that group relevés of similar species composition and techniques that sort species and order relevés by their listed species. Programs used for releve data analyses include TWINSpan (Hill 1979a), DECORANA (Hill 1979b), and CANOCO (Braak 1987). The advent of computers has increased markedly the number and types of analyses that can be conducted.

Uses of Relevés

The releve method is a relatively straightforward, convenient, standardized, efficient, and widely used method for describing and analyzing plant communities. The method may be used to study a particular plant community over its range, to study all plant communities within a particular area, to compare plant communities over a gradient, to study the effects of particular management practices, to describe high-quality examples of particular plant communities, to describe the habitat in which rare plants or rare animals are found, or to monitor changes after a natural disturbance. Many other applications exist as well.

Relevés form the basis for plant community descriptions found in The Vegetation of Wisconsin (Curtis 1959), The Canadian Vegetation Classification System (National Vegetation Working Group 1990), and The Ecological Classification and Inventory of the Huron-Manistee National Forests (Cleland et al. 1993). Numerous other studies in North America and throughout the world use the releve method (Almendinger, unpublished ms.).

In Minnesota, relevés have been used by a variety of researchers (Aaseng, unpublished ms.). Currently, Braun-Blanquet relevés are being used by the MN DNR's Natural Heritage and Nongame Research Program to describe plant communities found in the state; by MNDNR Wildlife Research to compare the effects of several treatments used to establish wildlife openings; by the Chippewa National Forest's (CNF) Deer River Ranger District to compare burned to unburned wet meadows; by the Natural Resources Research Institute in Duluth to compare old forests to old-growth forests; and by the MNDNR and CNF in the development of an Ecological Classification System. A cooperative project between MNDNR and CNF using relevés to describe the habitat in which a rare fern has been found is in progress.

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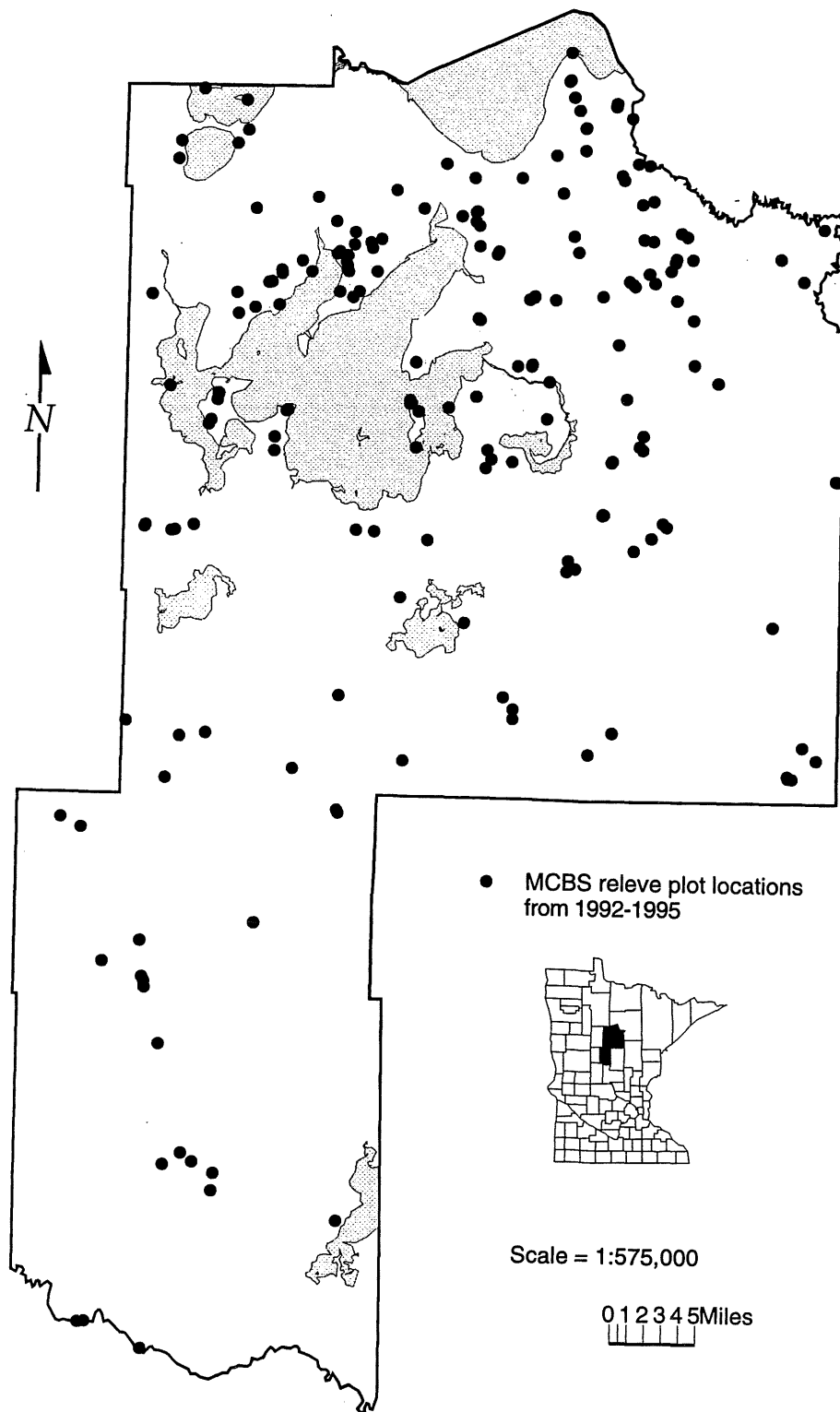
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CASS COUNTY

Releve Plot Locations



Data from the Natural Heritage Information System,
St. Paul.

List of MCBS Relaves by Location

TWPNO	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	CBSSITE	NATURAL COMMUNITY
133N	31W	SW	SW	17	4955	7	JUN	1995	223	Floodplain Forest
133N	32W	SE	NE	10	4956	6	JUN	1995	221	Floodplain Forest
133N	32W	SE	NW	11	4957	6	JUN	1995	221	Oak Forest (Central)
134N	29W	NE	NW	7	577	15	JUL	1991	229	Red Pine Forest
134N	29W	NE	NW	7	4414	9	JUN	1993	229	White Pine Forest (Central)
135N	31W	SE	SW	21	4432	21	JUL	1993	204	Oak Forest (Central)
135N	31W	SE	SE	22	4415	10	JUN	1993	204	Aspen-Birch Forest
135N	31W	NE	NW	22	4431	21	JUL	1993	204	Oak Forest (Central)
135N	31W	SW	NW	25	4846	16	JUN	1994	205	Oak Forest (Central) Mesic Subtype
135N	31W	SW	NW	36	4934	29	AUG	1995	213	Oak Forest (Central)
136N	31W	SE	SE	17	4845	14	JUN	1994	201	Aspen-Birch Forest Northern Hardwood Subtype
137N	30W	NW	SW	9	4884	8	SEP	1994	0	Red Pine Forest
137N	31W	NE	SW	17	4434	23	JUL	1993	185	Oak Forest (Central)
137N	31W	SW	SE	29	4433	22	JUL	1993	187	Oak Forest (Central)
137N	31W	NW	NE	32	4843	1	JUN	1994	187	Oak Forest (Central)
137N	31W	SW	NE	32	4847	21	JUN	1994	187	Oak Forest (Central) Mesic Subtype
137N	32W	SW	SW	24	4848	22	JUN	1994	188	Red Pine Forest
138N	29W	SW	SE	6	4416	15	JUN	1993	144	Jack Pine Forest (Central Outwash Plain) Hazel Subtype
138N	29W	NE	NE	7	4417	15	JUN	1993	138	Poor Fen Shrub Subtype
138N	32W	SW	NE	9	4458	9	SEP	1993	120	Dry Prairie (Central)
138N	32W	NE	NE	15	4418	16	JUN	1993	120	Jack Pine Forest (Central Outwash Plain) Blueberry Subtype
139N	25W	NE	SE	15	4943	3	AUG	1995	176	Oak Forest (Central)
139N	25W	SE	NE	23	4430	20	JUL	1993	177	Oak Forest (Central) Mesic Subtype
139N	25W	SW	NW	27	4420	29	JUN	1993	177	Black Spruce Bog
139N	25W	SW	NW	27	4421	29	JUN	1993	177	Black Spruce Bog
139N	25W	NE	SW	27	4429	20	JUL	1993	177	White Cedar Swamp
139N	27W	SE	SE	11	4883	7	SEP	1994	165	Lowland Hardwood Forest
139N	27W	SE	NW	22	4882	7	SEP	1994	163	Oak Forest (Central) Mesic Subtype
139N	28W	NE	SE	2	4856	5	JUL	1994	151	Black Ash Swamp
139N	28W	NE	NE	11	4855	5	JUL	1994	151	White Cedar Swamp
139N	29W	NW	NE	6	4864	15	JUL	1994	128	Aspen-Birch Forest
139N	29W	SE	SW	23	4857	6	JUL	1994	135	Mixed Pine-Hardwood Forest
139N	30W	NW	SW	26	4854	30	JUN	1994	0	Open Sphagnum Bog Intermediate Subtype
139N	31W	NE	SW	7	4852	24	JUN	1994	119	Jack Pine Forest (Central Outwash Plain) Blueberry Subtype
139N	31W	SE	NE	14	4447	16	AUG	1993	122	Red Pine Forest
139N	31W	NE	SW	15	4853	29	JUN	1994	122	Aspen-Birch Forest

List of MCBS Relays by Location

TWPNO	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	CBSSITE	NATURAL COMMUNITY
139N	31W	NW	NE	33	4448	19	AUG	1993	122	Oak Forest (Central)
140N	25W	NW	SW	9	4881	1	SEP	1994	173	Oak Forest (Central) Mesic Subtype
140N	28W	NE	SE	8	4459	10	SEP	1993	136	Maple-Basswood Forest (Northern)
140N	28W	SE	SW	35	4330	20	AUG	1993	150	Wet Meadow
140N	29W	SW	NW	2	4858	7	JUL	1994	131	Mixed Pine-Hardwood Forest
141N	26W	NW	SE	8	4422	1	JUL	1993	83	White Cedar Swamp
141N	26W	NE	SE	8	4838	30	AUG	1994	83	Maple-Basswood Forest (Northern)
141N	26W	NW	SW	17	1816	11	AUG	1992	83	Poor Fen
141N	26W	NW	SW	17	1817	11	AUG	1992	83	Black Spruce Swamp
141N	26W	SW	NW	17	1818	11	AUG	1992	83	Tamarack Swamp Minerotrophic Subtype
141N	26W	SW	NW	17	1819	11	AUG	1992	83	Alder Swamp
141N	26W	SW	NE	30	1820	12	AUG	1992	84	Black Ash Swamp
141N	26W	SE	NW	30	1821	12	AUG	1992	84	Black Ash Swamp
141N	26W	SE	NW	30	1822	12	AUG	1992	84	White Cedar Swamp
141N	27W	NW	NW	11	772	15	SEP	1992	86	Tamarack Swamp Minerotrophic Subtype
141N	27W	NW	NW	11	4879	1	SEP	1994	86	Poor Fen Shrub Subtype
141N	27W	NW	NW	11	4880	1	SEP	1994	86	Black Spruce Swamp
141N	27W	SW	SW	21	4842	31	AUG	1994	85	Aspen-Birch Forest
141N	27W	NE	NE	24	4839	30	AUG	1994	83	Maple-Basswood Forest (Northern)
141N	27W	SW	NE	28	4840	31	AUG	1994	85	Black Spruce Swamp
141N	27W	SW	NW	28	4841	31	AUG	1994	85	Poor Fen Sedge Subtype
141N	28W	SW	SW	18	4862	13	JUL	1994	99	Aspen-Birch Forest
141N	29W	SE	NE	16	4935	31	AUG	1995	100	Red Pine Plantation
141N	29W	SE	NW	17	4861	13	JUL	1994	105	Maple-Basswood Forest (Northern)
141N	31W	SE	NE	15	4891	12	JUN	1993	114	Black Spruce Swamp
141N	31W	NE	SE	16	1799	15	JUL	1992	114	Black Spruce Swamp
141N	31W	NW	SE	16	1805	15	JUL	1992	114	Poor Fen
141N	31W	SE	NW	17	1804	15	JUL	1992	114	White Cedar Swamp
141N	31W	SW	NW	17	4436	30	JUL	1993	114	White Cedar Swamp
142N	25W	SW	SE	25	4442	10	AUG	1993	77	White Cedar Swamp
142N	25W	SW	SE	25	4443	10	AUG	1993	77	White Cedar Swamp
142N	26W	NE	NW	19	4419	21	JUN	1993	87	White Cedar Swamp
142N	26W	NE	NW	19	4440	5	AUG	1993	87	Black Spruce Swamp
142N	27W	SE	NW	1	753	19	AUG	1992	0	Poor Fen
142N	27W	NE	SE	7	1810	28	JUL	1992	90	Black Spruce Swamp
142N	27W	SW	SE	23	756	26	AUG	1992	88	Black Spruce Swamp

List of MCBS Relays by Location

TWPNO	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	CBSSITE	NATURAL COMMUNITY
142N	27W	NW	NE	26	757	26	AUG	1992	88	Black Spruce Swamp
142N	28W	SE	NE	4	1823	13	AUG	1992	97	Tamarack Swamp Minerotrophic Subtype
142N	28W	NE	NW	8	4425	12	JUL	1993	97	Maple-Basswood Forest (Northern)
142N	28W	NE	SW	22	4435	29	JUL	1993	96	White Cedar Swamp
142N	28W	NE	NE	26	4450	25	AUG	1993	91	White Cedar Swamp
142N	28W	NW	NE	27	4449	25	AUG	1993	91	White Cedar Swamp
142N	28W	NE	SW	27	4878	25	AUG	1994	96	Poor Fen Sedge Subtype
142N	29W	SW	SE	2	4424	12	JUL	1993	102	Maple-Basswood Forest (Northern)
142N	29W	NE	SW	2	4849	23	JUN	1994	102	Oak Forest (Central) Mesic Subtype
142N	29W	SW	SE	2	4946	2	AUG	1995	102	Maple-Basswood Forest (Northern)
142N	29W	SE	NE	11	4850	23	JUN	1994	102	Oak Forest (Central) Mesic Subtype
142N	29W	SE	NE	23	4851	23	JUN	1994	102	Oak Forest (Central) Mesic Subtype
142N	30W	SE	NW	10	4859	12	JUL	1994	110	Lowland Hardwood Forest
142N	30W	NE	NW	10	4860	12	JUL	1994	110	Maple-Basswood Forest (Northern)
142N	30W	NW	SE	21	1806	16	JUL	1992	109	Tamarack Swamp Minerotrophic Subtype
142N	31W	NW	SW	1	1807	16	JUL	1992	55	Tamarack Swamp Sphagnum Subtype
142N	31W	SW	NW	1	4863	14	JUL	1994	55	Red Pine Forest
143N	26W	NE	SW	4	4887	16	AUG	1994	64	Wet Meadow
143N	26W	NE	SW	10	4890	17	AUG	1994	66	Wet Meadow
143N	26W	SE	NW	27	4837	15	AUG	1994	67	White Cedar Swamp
143N	26W	SW	NW	35	1824	13	AUG	1992	228	Poor Fen
143N	27W	SE	NE	3	4888	16	AUG	1994	63	Wet Meadow
143N	27W	NW	SW	5	4885	16	AUG	1994	0	Wet Meadow
143N	27W	NE	NE	23	4423	7	JUL	1993	62	White Cedar Swamp
143N	27W	SE	NE	31	4865	20	JUL	1994	61	White Cedar Swamp
143N	28W	NW	SE	1	4322	7	JUL	1993	17	Wet Meadow
143N	28W	SE	NE	1	4323	8	JUL	1993	17	Wet Meadow
143N	28W	SE	NE	1	4324	8	JUL	1993	17	Wet Meadow
143N	28W	SW	SE	9	758	1	SEP	1992	57	Black Spruce Bog
143N	28W	SE	SE	9	759	1	SEP	1992	57	Poor Fen
143N	28W	SE	NE	25	752	19	AUG	1992	60	Black Spruce Swamp
143N	28W	SE	NE	25	1827	25	AUG	1992	60	Alder Swamp
143N	28W	SE	NE	26	1828	25	AUG	1992	58	White Cedar Swamp
143N	29W	NW	NW	5	4445	12	AUG	1993	26	Maple-Basswood Forest (Northern)
143N	29W	NW	NW	6	4446	13	AUG	1993	28	Lowland Hardwood Forest
143N	29W	SW	NW	25	1809	28	JUL	1992	56	Black Ash Swamp

List of MCBS Releases by Location

TWPNO	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	CBSSITE	NATURAL COMMUNITY
143N	30W	SW	SE	4	4428	15	JUL	1993	50	Maple-Basswood Forest (Northern)
143N	30W	SW	SW	5	1802	9	JUL	1992	50	White Cedar Swamp
143N	30W	NW	NW	6	4867	26	JUL	1994	49	Black Ash Swamp
143N	30W	NE	NW	7	1803	9	JUL	1992	50	Black Ash Swamp
143N	31W	SE	NW	5	4932	13	JUL	1995	48	White Pine Forest (Central)
143N	31W	SW	SE	33	4944	4	AUG	1995	54	Rich Fen (Boreal)
144N	25W	NW	NE	14	4876	24	AUG	1994	71	RFBOSD
144N	25W	NW	SW	21	4844	2	JUN	1994	71	Maple-Basswood Forest (Northern)
144N	25W	NW	NE	34	4874	15	AUG	1995	70	White Cedar Swamp
144N	26W	SE	SE	6	765	10	SEP	1992	5	Poor Fen Sedge Subtype
144N	26W	NW	NW	7	766	10	SEP	1992	5	Alder Swamp
144N	26W	NE	SW	16	1812	29	JUL	1992	4	Tamarack Swamp Minerotrophic Subtype
144N	26W	NW	NW	19	4873	10	AUG	1994	5	Alder Swamp
144N	26W	NW	NW	27	4889	17	AUG	1994	65	Wet Meadow
144N	26W	SW	NW	28	4958	22	JUN	1995	65	Oak Forest (Central)
144N	26W	NW	NW	28	4959	22	JUN	1995	65	Lowland Hardwood Forest
144N	26W	SE	SE	29	4866	25	JUL	1994	65	Oak Forest (Central)
144N	26W	NE	SE	31	4327	9	JUL	1993	64	Wet Meadow
144N	26W	NW	NE	31	4328	9	JUL	1993	65	Wet Meadow
144N	27W	NW	NE	5	1825	25	AUG	1992	7	Tamarack Swamp Minerotrophic Subtype
144N	27W	NW	NE	5	1826	25	AUG	1992	7	Alder Swamp
144N	27W		SW	16	1811	29	JUL	1992	14	White Cedar Swamp
144N	27W	NE	SW	21	767	11	SEP	1992	15	Wet Meadow
144N	27W	NE	SE	36	4325	8	JUL	1993	63	Wet Meadow
144N	27W	SE	SE	36	4326	8	JUL	1993	63	Wet Meadow
144N	27W	SE	NW	36	4886	16	AUG	1994	15	Wet Meadow
144N	28W	SW	NE	8	4455	3	SEP	1993	18	Black Spruce Bog
144N	28W	SE	SW	9	1801	8	JUL	1992	18	Black Spruce Bog
144N	28W	NW	NE	9	4451	26	AUG	1993	18	Black Spruce Bog
144N	28W	SE	NW	9	4452	26	AUG	1993	18	Black Spruce Bog
144N	28W	NW	NE	16	1800	8	JUL	1992	18	Black Spruce Bog
144N	28W	SW	NE	21	4933	17	AUG	1995	0	Maple-Basswood Forest (Northern)
144N	28W	NE	SE	22	768	14	SEP	1992	17	Tamarack Swamp Minerotrophic Subtype
144N	28W	SE	SE	22	769	14	SEP	1992	17	Tamarack Swamp Minerotrophic Subtype
144N	29W	NW	NE	3	4929	14	JUL	1995	0	Maple-Basswood Forest (Northern)
144N	29W	NE	NW	12	4930	12	JUL	1995	24	White Cedar Swamp

List of MCBS Relaves by Location

TWPNO	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	CBSSITE	NATURAL COMMUNITY
144N	29W	SW	SW	19	4444	12	AUG	1993	29	Maple-Basswood Forest (Northern)
144N	29W	SE	SE	19	4947	1	AUG	1995	26	Maple-Basswood Forest (Northern)
144N	29W	SW	SE	19	4948	1	AUG	1995	26	Maple-Basswood Forest (Northern)
144N	29W	SE	SE	19	4952	28	JUL	1995	26	Maple-Basswood Forest (Northern)
144N	29W	SE	NW	20	4951	31	JUL	1995	26	Maple-Basswood Forest (Northern)
144N	29W	NE	NE	21	1808	28	JUL	1992	26	Tamarack Swamp Minerotrophic Subtype
144N	29W	NE	SW	21	4833	2	AUG	1994	26	Maple-Basswood Forest (Northern)
144N	29W	NE	NW	21	4950	31	JUL	1995	26	Maple-Basswood Forest (Northern)
144N	29W	SW	SE	28	4834	3	AUG	1994	26	Maple-Basswood Forest (Northern)
144N	29W	SW	SW	29	4954	27	JUL	1995	26	Maple-Basswood Forest (Northern)
144N	29W	NE	SE	30	4953	27	JUL	1995	26	Maple-Basswood Forest (Northern)
144N	30W	NE	SE	2	4441	6	AUG	1993	33	White Cedar Swamp
144N	30W	NW	NW	8	4835	3	AUG	1994	35	Maple-Basswood Forest (Northern)
144N	30W	SE	SE	12	4868	27	JUL	1994	29	White Cedar Swamp
144N	30W	SE	SW	26	4870	29	JUL	1994	0	Maple-Basswood Forest (Northern)
144N	30W	NE	NE	27	4869	29	JUL	1994	33	Maple-Basswood Forest (Northern)
144N	30W	SE	SE	28	763	10	SEP	1992	50	Black Ash Swamp
144N	30W	SW	SE	28	764	10	SEP	1992	50	White Cedar Swamp
144N	30W	SE	NE	32	4456	7	SEP	1993	50	White Cedar Swamp
144N	30W	SW	NW	33	4457	7	SEP	1993	50	White Cedar Swamp
145N	26W	SW	NE	30	770	14	SEP	1992	9	Alder Swamp
145N	27W	SW	SE	2	774	22	SEP	1992	10	Black Spruce Swamp
145N	27W	SW	SE	2	1815	30	JUL	1992	10	White Cedar Swamp
145N	27W	SW	NW	4	762	9	SEP	1992	11	Poor Fen Sedge Subtype
145N	27W	NE	NW	9	4836	9	AUG	1994	9	Black Spruce Bog
145N	27W	NW	SE	12	4877	24	AUG	1994	10	Wet Meadow
145N	27W	SE	NE	16	1813	30	JUL	1992	9	Poor Fen Scrub Tamarack Subtype
145N	27W	SE	NE	16	1814	30	JUL	1992	9	Tamarack Swamp Sphagnum Subtype
145N	27W	SW	SW	20	4872	4	AUG	1994	0	Poor Fen Sedge Subtype
145N	27W	NE	SE	21	754	26	AUG	1992	9	Poor Fen Scrub Tamarack Subtype
145N	27W	SE	NE	25	773	22	SEP	1992	9	Tamarack Swamp Minerotrophic Subtype
145N	27W	NE	NE	35	755	26	AUG	1992	8	Tamarack Swamp Minerotrophic Subtype
145N	27W	SW	NW	36	4871	4	AUG	1994	8	Mixed Pine-Hardwood Forest
145N	28W	SE	NE	30	4453	31	AUG	1993	19	Tamarack Swamp Sphagnum Subtype
145N	28W	SE	NW	33	4454	1	SEP	1993	19	Black Spruce Bog
145N	28W	SE	NW	36	771	22	SEP	1992	13	White Cedar Swamp

List of MCBS Relaves by Location

TWPNO	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	CBSSITE	NATURAL COMMUNITY
145N	29W	NE	SW	23	125	28	MAY	1987	20	White Cedar Swamp
145N	29W	NE	SW	23	126	27	MAY	1987	20	White Cedar Swamp
145N	29W	NE	SW	23	138	28	MAY	1987	20	White Cedar Swamp
145N	29W	NE	SW	23	139	28	MAY	1987	20	White Cedar Swamp
145N	29W	NE	SW	23	140	28	MAY	1987	20	Black Spruce Swamp
145N	30W	SE	SE	6	4426	14	JUL	1993	38	White Pine Forest (Central)
145N	30W	NW	SW	17	4438	3	AUG	1993	37	White Pine Forest (Central)
145N	30W	SE	NW	19	4437	3	AUG	1993	37	Red Pine Forest
145N	31W	SE	NW	2	4427	14	JUL	1993	39	Maple-Basswood Forest (Northern)
145N	31W	SW	NW	22	4931	13	JUL	1995	40	Red Pine Forest
145N	31W	SW	NW	27	4439	4	AUG	1993	40	Black Spruce Swamp
146N	27W	SW	SW	21	4875	18	AUG	1994	11	Paper Birch Forest
146N	27W	SW	NW	33	760	9	SEP	1992	11	Poor Fen
146N	27W	NW	SW	33	761	9	SEP	1992	11	Tamarack Swamp Minerotrophic Subtype
147N	31W	NW	NW	19	7439	24	MAY	1991	0	

Fields:

TWPNO = township;

RNGNO = range;

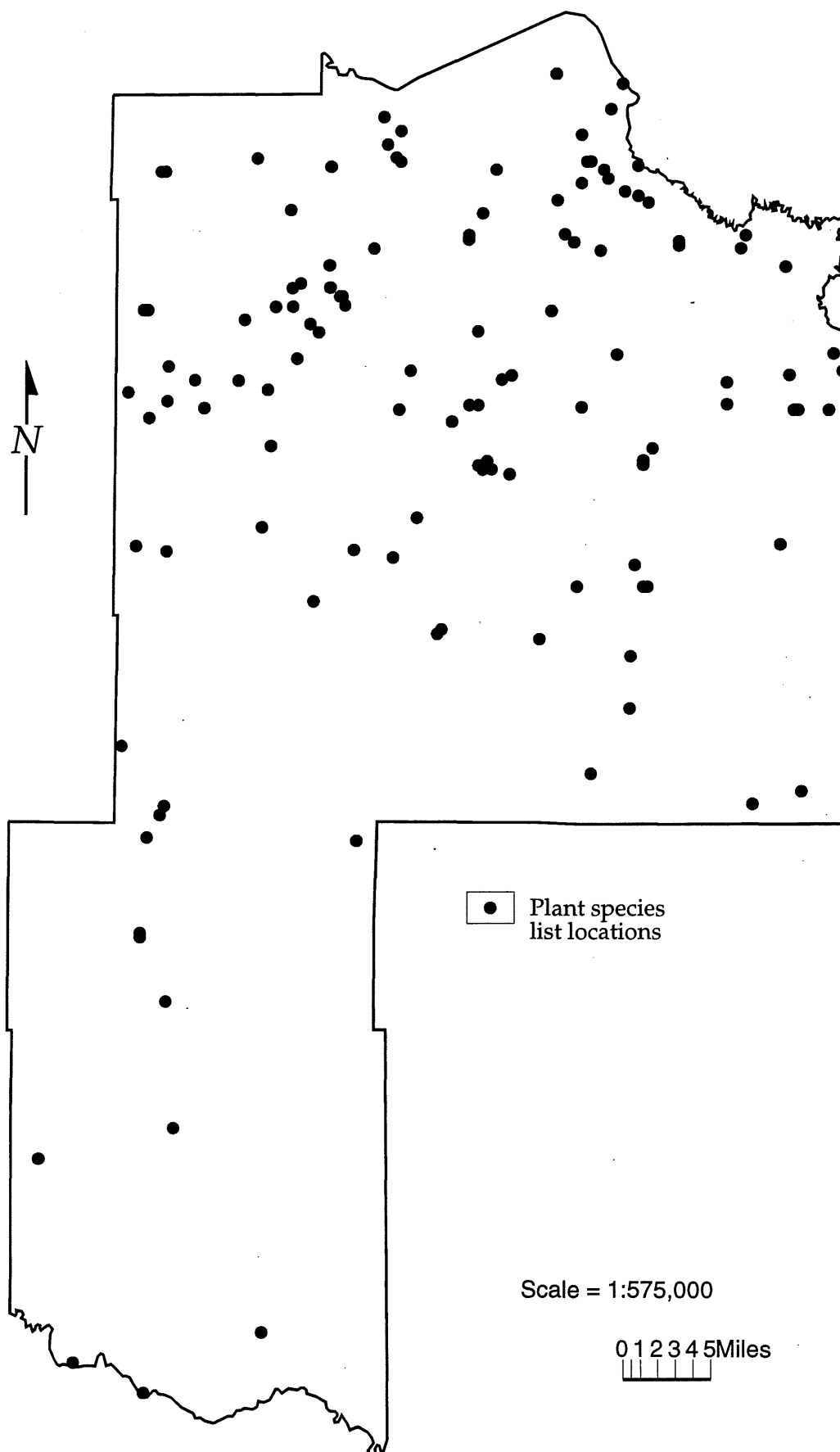
QQSECT = quarter quarter section;

QSECT = quarter section;

SECT = section;

RELNUMB = DNR releve number;

CBSSITE = MCBS site number



List of MCBS Plant Lists by Location

TWPNO	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	NATURAL COMMUNITY
133N	31W	SW	SW	17	9820	1	OCT	1993	Oak Forest
133N	32W	NW	NE	10	9818	1	OCT	1993	Oak Forest
134N	30W	SE	NE	32	9432	29	AUG	1995	Tamarack Swamp
134N	30W	SE	NE	32	9433	29	AUG	1995	Black Ash Swamp
134N	30W	SE	NE	32	9434	29	AUG	1995	Wet Meadow
135N	32W	SW	NE	8	9807	27	MAY	1993	Jack Pine Plantation
136N	31W	NE	SE	33	9493	1	SEP	1995	Oak Forest
137N	31W	NW	SE	5	9805	22	JUN	1992	Red Pine Forest
137N	31W	SW	NE	5	9806	22	JUN	1992	Poor Fen
137N	31W	SW	NW	27	9464	20	JUN	1994	Lowland Hardwood Forest
138N	29W			8	9819	19	JUL	1994	(river)
138N	31W	SE	SE	5	9456	24	JUN	1994	Mixed Pine-Hardwood Forest
139N	25W		NW	27	9804	29	JUN	1993	Tamarack Swamp
139N	25W	SW	SE	30	9803	30	JUN	1993	Black Spruce Swamp
139N	27W	NE	NW	22	9463	7	JUL	1994	Oak Forest
139N	31W	NE	SW	7	9455	24	JUN	1994	Jack Pine Forest
139N	31W		NE	33	9801	12	JUN	1992	Aspen-Birch Forest
139N	31W	NW	SE	33	9802	12	JUN	1992	Poor Fen
140N	27W	SE	NW	7	9458	8	JUN	1994	(wetland)
140N	27W	SE	NW	7	9459	8	JUN	1994	White Cedar Swamp
140N	27W	SW	NE	13	9460	6	SEP	1994	Alder Swamp
140N	27W	SW	NE	13	9461	6	SEP	1994	Black Spruce Swamp
140N	27W	SW	NE	36	9462	6	SEP	1994	Red Pine Forest
140N	28W	SW	SE	6	9565	19	MAY	1994	Maple-Basswood Forest
140N	28W	NE	NW	7	9466	19	MAY	1994	Maple-Basswood Forest
141N	25W	SW	SW	9	9472	26	JUN	1995	Black Ash Swamp
141N	25W	SW	SW	9	9473	26	JUN	1995	White Cedar Swamp
141N	26W	SE	NW	30	9786	5	AUG	1992	White Cedar Swamp
141N	26W	SW	NE	30	9787	5	AUG	1992	Black Ash Swamp
141N	27W	NE	NE	24	9474	7	JUL	1995	Alder Swamp
141N	27W	NE	NE	24	9475	7	JUL	1995	Black Spruce Swamp
141N	27W	NE	NE	24	9476	7	JUL	1995	Rich Fen
141N	27W	SW	NE	28	9448	31	AUG	1994	Maple-Basswood Forest
141N	29W	NW	SE	1	9488	28	AUG	1995	Maple-Basswood Forest
141N	29W	SW	SW	14	9451	25	AUG	1994	White Pine Forest
141N	29W	SW	NE	17	9453	11	MAY	1994	Maple-Basswood Forest
141N	30W	NE	NW	9	9437	14	JUN	1994	White Cedar Swamp
141N	30W	SE	NW	36	9457	5	JUL	1994	Aspen Forest
141N	31W	NE	SE	16	9798	17	JUN	1992	White Cedar Swamp
141N	31W	SW	NW	17	9504	2	JUN	1993	White Cedar Swamp
142N	25W		NE	2	9568	15	SEP	1995	Maple-Basswood Forest
142N	25W	NW	NW	3	9468	5	JUN	1995	Maple-Basswood Forest
142N	25W	NE	NE	4	9467	15	JUN	1995	Maple-Basswood Forest
142N	26W	SE	NE	18	9789	5	AUG	1992	White Cedar Swamp
142N	26W	NE	NW	19	9449	7	JUN	1994	White Cedar Swamp
142N	26W	SE	NW	19	9788	3	JUN	1993	Black Ash Swamp
142N	27W	NE	NE	4	9486	28	AUG	1995	Tamarack Swamp
142N	27W	NE	NE	4	9487	28	AUG	1995	Black Spruce Swamp
142N	28W	NW	NW	3	9799	13	MAY	1994	Northern Hardwood Forest
142N	28W	NW	NE	4	9797	4	AUG	1992	Poor Fen
142N	28W	NW	NE	8	9800	13	MAY	1994	Maple-Basswood Forest
142N	28W	SW	NE	22	9790	27	MAY	1992	White Cedar Swamp
142N	28W	NE	SW	22	9791	27	MAY	1992	White Cedar Swamp
142N	28W	NW	SW	22	9792	27	MAY	1992	Boreal Hardwood-Conifer Forest
142N	28W	S	S	22	9793	27	MAY	1992	Black Spruce Swamp
142N	28W	SE	SW	22	9794	4	JUN	1993	Black Spruce Swamp
142N	28W	NW	SE	22	9795	29	JUL	1993	White Cedar Swamp

List of MCBS Plant Lists by Location

TWPN0	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	NATURAL COMMUNITY
142N	28W	NE	NE	26	9450	7	JUN	1994	White Cedar Swamp
142N	29W	SE	NW	2	9452	12	MAY	1994	Maple-Basswood Forest
142N	30W	SE	NE	16	9454	11	MAY	1994	Maple-Basswood Forest
142N	31W		NE	2	9796	10	JUL	1992	Poor Fen
142N	31W	NW	SW	4	9483	4	AUG	1995	Rich Fen
143N	25W	SW	SW	13	9505	10	JUN	1994	Black Spruce Swamp
143N	25W	SW	SE	24	9471	26	JUN	1995	White Cedar Swamp
143N	25W	NW	NE	28	9436	10	JUN	1994	White Cedar Swamp
143N	26W	NW	SW	25	9469	5	JUN	1995	Maple-Basswood Forest
143N	26W	SW	SW	36	9492	31	AUG	1995	Maple-Basswood Forest
143N	27W	NW	SW	5	9438	16	AUG	1994	Wet Meadow
143N	27W	NE	NE	23	9784	5	JUN	1992	Tamarack Swamp
143N	27W	NE	NE	23	9785	6	JUN	1994	White Cedar Swamp
143N	28W	SE	SE	9	9553	27	MAY	1992	Open Sphagnum Bog
143N	28W	NE	SW	26	9551	24	AUG	1992	Black Ash Swamp
143N	28W	SE	NE	26	9552	24	AUG	1992	White Cedar Swamp
143N	29W	NE	NE	6	9810	13	AUG	1993	Maple-Basswood Forest
143N	29W	NW	NW	25	9554	1	AUG	1994	Maple-Basswood Forest
143N	30W			3	9557	21	MAY	1994	Maple-Basswood Forest
143N	30W			4	9556	21	MAY	1994	Maple-Basswood Forest
143N	30W	SW	SW	5	9559	6	JUL	1992	White Cedar Swamp
143N	30W	NE	NE	11	9494	19	SEP	1995	Maple-Basswood Forest
143N	30W	NE	SW	12	9813	25	MAY	1993	Black Ash Swamp
143N	30W	W	NW	23	9560	21	MAY	1994	Maple-Basswood Forest
143N	30W	SW	SE	28	9555	10	SEP	1992	White Cedar Swamp
143N	30W	SE	NE	30	9443	12	SEP	1994	Maple-Basswood Forest
143N	31W	SW	NE	5	9478	10	JUL	1995	Rich Fen
143N	31W	SE	NE	5	9479	10	JUL	1995	Rich Fen
143N	31W	NW	SW	22	9485	4	AUG	1995	Wet Meadow
143N	31W	SW	NE	26	9447	11	MAY	1994	Oak Forest
143N	31W	NE	NE	31	9477	10	JUL	1995	Oak Forest
143N	31W	NW	SW	34	9484	4	AUG	1995	Oak Forest
144N	25W	NW	NW	18	9491	30	AUG	1995	White Cedar Swamp
144N	25W	SE	SW	21	9549	15	SEP	1994	Maple-Basswood Forest
144N	26W	SW	NE	6	9577	6	JUL	1992	Black Spruce Swamp
144N	26W	SW	NE	6	9582	6	JUL	1992	Black Spruce Swamp
144N	26W	SE	SE	13	9470	22	JUN	1995	White Cedar Swamp
144N	26W	SE	SW	16	9578	24	JUL	1992	Black Spruce Swamp
144N	26W	NE	SW	16	9579	24	JUL	1992	Tamarack Swamp
144N	26W	NE	SW	16	9580	24	JUL	1992	Tamarack Swamp
144N	26W	NE	SW	16	9581	24	JUL	1992	Black Spruce Swamp
144N	27W	NE	NW	5	9817	9	JUN	1992	Tamarack Swamp
144N	27W		SW	16	9570	24	JUN	1992	White Cedar Swamp
144N	27W	NE	NE	17	9569	19	AUG	1992	Black Ash Swamp
144N	27W		NE	22	9441	23	AUG	1994	(stream)
144N	28W	SW	SW	3	9567	28	MAY	1992	Open Sphagnum Bog
144N	28W	NE	NW	16	9465	24	JUN	1992	Black Spruce Swamp
144N	28W	SE	NW	16	9566	24	JUN	1992	Tamarack Swamp
144N	29W	SE	SE	16	9562	27	JUL	1992	Black Spruce Swamp
144N	29W	SW	SW	19	9815	12	AUG	1993	Maple-Basswood Forest
144N	29W	NE	SE	31	9561	28	MAY	1992	White Cedar Swamp
144N	29W	NW	SE	31	9811	25	MAY	1993	Maple-Basswood Forest
144N	29W	NW	NW	31	9812	25	MAY	1993	Maple-Basswood Forest
144N	29W	NW	SE	31	9814	13	AUG	1993	Maple-Basswood Forest
144N	30W	NE	SE	3	9809	6	AUG	1997	Maple-Basswood Forest
144N	30W	SE	SW	26	9779	29	JUL	1994	Maple-Basswood Forest
144N	30W		E	34	9558	21	MAY	1994	Maple-Basswood Forest

List of MCBS Plant Lists by Location

TWPNO	RNGNO	QQSECT	QSECT	SECT	RELNUMB	DATE	MONTH	YEAR	NATURAL COMMUNITY
145N	26W	NW	NW	30	9575	23	JUN	1992	Black Ash Swamp
145N	26W	SW	SW	31	9576	6	JUL	1992	Black Spruce Swamp
145N	26W	SW	SW	31	9583	16	JUN	1992	Black Spruce Swamp
145N	27W	SW	SE	2	9547	23	JUN	1992	White Cedar Swamp
145N	27W	SE	NE	16	9545	29	JUL	1992	Poor Fen
145N	27W	SE	NE	16	9546	29	JUN	1992	Tamarack Swamp
145N	27W	SE	SW	22	9573	3	JUN	1992	Black Spruce Swamp
145N	27W	SW	SW	22	9574	3	JUN	1992	Tamarack Swamp
145N	27W	SW	NW	26	9440	4	AUG	1994	Poor Fen
145N	27W	SE	SW	26	9548	2	JUN	1992	Black Spruce Swamp
145N	27W			33	9439	22	AUG	1994	Tamarack Swamp
145N	27W	NE	SW	36	9544	6	JUL	1992	Black Spruce Swamp
145N	28W	SW	NW	26	9489	30	AUG	1995	Poor Fen
145N	28W	SW	NW	26	9490	30	AUG	1995	Black Spruce Swamp
145N	29W	SW	NE	10	9482	11	JUL	1995	Jack Pine Forest
145N	29W	W	NE	14	9808	6	AUG	1992	White Cedar Swamp
145N	29W	SE	SE	15	9442	22	AUG	1994	Open Sphagnum Bog
145N	29W	NE	SW	23	9563	6	JUN	1994	White Cedar Swamp
145N	29W	SW	SE	23	9564	30	MAY	1992	White Cedar Swamp
145N	29W	NW	NE	30	9480	11	JUL	1995	White Cedar Swamp
145N	29W	NW	NE	30	9481	11	JUL	1995	Black Spruce Swamp
145N	30W		SW	21	9816	29	SEP	1993	Boreal Hardwood-Conifer Forest
145N	31W	SW	NW	27	9446	3	JUN	1994	White Cedar Swamp
145N	31W	SE	NE	28	9445	8	AUG	1994	White Cedar Swamp
146N	27W	SW	SE	29	9571	18	AUG	1994	Red Pine Forest
146N	27W	SE	NW	36	9572	23	JUN	1992	Black Ash Swamp

Fields:

TWPNO = township;

RNGNO = range;

QQSECT = quarter quarter section;

QSECT = quarter section;

SECT = section;

RELNUMB = DNR releve number

Examples of Plant Communities in Cass County

The following are examples of some of the plant community types found in Cass County. These particular locations were chosen because they represent some of the county's best examples of the plant community type, because they are on land open to the public, and because they have reasonably easy access. They are all on publicly owned land or, in one case, on land owned by Potlatch Corporation. The map on the following page shows the location of each of the plant community examples.

Directions to a site are given in the text for each example. For a more thorough description of a given plant community, see the enclosed copy of *Minnesota's Native Vegetation: A Key to Natural Communities*. MCBS site numbers are given for each example; maps showing the location of sites can be found in Chapter 4 of this notebook.

One or more relevés or plant lists from the example location follows the description of each plant community.

*Examples of Selected Plant Communities in Cass County***Jack Pine Forest**

- ① 1. *1959 Fire* MCBS Site 119 Ownership: County
Legal Description: T139N R31W SW1/4 Sec. 7
- ② 2. *1976 Fire* MCBS Site 120 Ownership: Potlatch Corp.
Legal Description: T138N R32W E 1/2 Sec. 15

Wet Meadow

- ③ 1. *Leech River* (boat access) MCBS Site 17 Ownership: State, Federal
Legal Description: T143N R28W Sec. 1, T143N R27W Sec. 5,6
- ④ 2. *Boy River* MCBS Site 60 Ownership: State
Legal Description: T143N R28 Sec. 36

White Cedar Swamp

- ⑤ 1. *Shingobee River* MCBS Site 114 Ownership: Federal
Legal Description: T141N R31W Sec. 17
- ⑥ 2. *Camel Lake* MCBS Site 72 Ownership: County
Legal Description: T143N R25W SWSE Sec. 24

Maple-Basswood Forest

- ⑦ 1. *Ottertail Peninsula* MCBS Sites 26, 27 and 28 Ownership: State, Federal
Legal Description: T143N R30W Sec. 5,6
- ⑧ 2. *Stony Point* MCBS Site 110 Ownership: Federal, Private
Legal Description: T142N R30W Sec. 10
- ⑨ 3. *Bear Island* (boat access) MCBS Site 102 Ownership: Federal, Indian, Private
Legal Description: T142N R29W Sec. 2
- ⑩ 4. *George Cook Wildlife Management Area* (boat access) MCBS Site 230 Ownership: State
Legal Description: T140N R28W E1/2 Sec. 6 and W1/2 Sec. 5

Oak Forest

- ⑪ 1. *Bear Island* (boat access) MCBS Site 102 Ownership: County
Legal Description: T142N R27W Sec. 11
- ⑫ 2. *Pistol Lake* MCBS Site 163 Ownership: County
Legal Description: T139N R27W SENW Sec. 22
- ⑬ 3. *Foothills State Forest* MCBS Site 187 Ownership: County
Legal Description: T137N R31W NENW Sec. 32

Black Spruce Bog

- ⑭ 1. *Hole-in-the-bog Lake Peatland Scientific and Natural Area* MCBS Site 18
Ownership: State Legal Description: T144N R28W Sec. 9

Black Spruce Swamp

- ⑮ 1. *Skunk Lake* MCBS Site 72 Ownership: Federal, State, County
Legal Description: T143N R25W S1/4 Sec. 13 and N 1/4 Sec. 24

Black Ash Swamp

- ⑯ 1. *Steamboat Bay* MCBS Site 49 Ownership: State
Legal Description: T143N R30W NWNW Sec. 6
- ⑰ 2. *Birch Lake* MCBS Site 79 Ownership: State
Legal Description: T141N R25W SW1/4 Sec. 9

Northern Hardwood-Conifer Forest

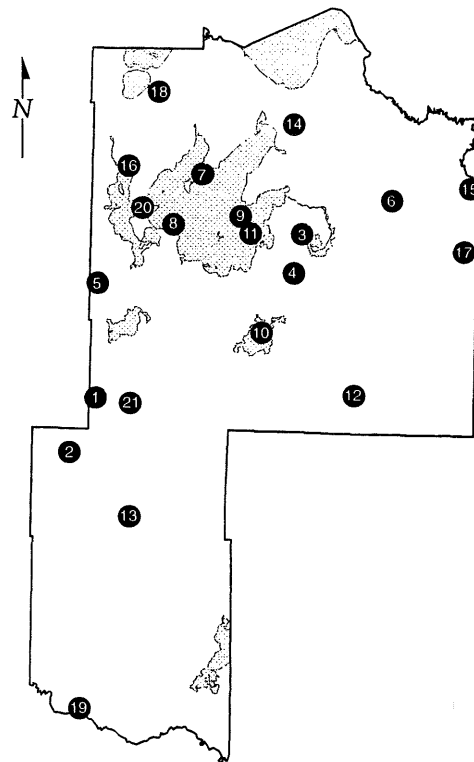
- ⑱ 1. *Cuba Hill* MCBS Site 36 Ownership: Federal
Legal Description: T145N R30W W1/2 Sec. 33

Floodplain Forest

- ⑲ 1. *Crow Wing River* MCBS Site 221 Ownership: County
Legal Description: T133N R32W NE 1/4 Sec. 10

Red Pine Forest

- ⑳ 1. *Pine Point Research Natural Area* MCBS Site 55 Ownership: Federal
Legal Description: T142N R31W SWNW Sec. 1
- ㉑ 2. *Deerfield* MCBS Site 122 Ownership: County
Legal Description: T139N R31W SENE Sec. 14



Jack Pine Forest

The two most recent severe fires in the county occurred on the sandy outwash plain that extends into Cass County from Hubbard and Wadena counties, reaching east of Badoura State Forest. The first of these took place in 1959, the second in 1976. The heat from both fires opened the serotinous cones of Jack Pine, and soon young Jack Pine Forests were coming up on the sandy soil where the fires had passed.

Jack Pine Forests generated by these fires remain a part of the landscape of Cass County today. Although not extensive even immediately after the fires (most of the burned area was in Hubbard and Wadena counties), today much of the burned land has been converted to agricultural uses. However, easily accessible examples of forests generated by each of these fires remain.

In the SW quarter of section 7 of Deerfield Township (T139N, R31W), a Jack Pine Forest generated by the 1959 fire occurs on land owned by Cass County. The forest is easily reached by turning east at the junction of highways 64 and 87 just east of Badoura State Nursery. Take the unnumbered and unnamed gravel road east for 3 miles until you enter Cass County. The forest is in MCBS Site 119 (See Chapter 4 in this notebook); it begins at the county line and extends east and north for about 1/2 mile. A few foot trails wind through the stand.

This forest is the blueberry subtype of Jack Pine Forest. Patches of Blueberry (*Vaccinium angustifolium*) and extensive mats of Feathermoss (*Pleurozium* sp.) cover the forest floor. Jack Pine forms a nearly complete canopy. Tall shrubs are not common, so the stand appears quite open beneath the pine.

Plants characteristic of sandy soils beneath Jack Pine are found here. Two species of Rice-grass (*Oryzopsis asperifolia* and *Oryzopsis pungens*) form part of the rather sparse graminoid (grasses and grass-like plants) layer in

the forest. Forbs include Moccasin Flower (*Cypripedium acaule*), Smooth Aster (*Aster laevis*), and Gray Goldenrod (*Solidago nemoralis*). The half-shrubs Wintergreen (*Gaultheria procumbens*) and Bearberry (*Arctostaphylos uva-ursi*) grow close to the ground. Shrubs here include Sandcherry (*Prunus pumila*) and Prairie Willow (*Salix humilis*).

The Jack Pine Forest generated by the 1976 fire is located in the east half of Section 15 in McKinley Township (T138N, R32W) on land owned by Potlatch Corporation. This forest occurs at the junction of Hwy. 64 and County 19 and is part of MCBS Site 120. Here, in this younger forest, "doghair" (thick as hair on a dog) Jack pine is growing. The ground layer is sparser here than in the older stand, in part because of the dense Jack Pine canopy which shades areas beneath it. Bracken (*Pteridium aquilinum*) is the most common forb, and Poverty Grass (*Danthonia spicata*) forms most of the very sparse graminoid layer.

- Characteristics of Jack Pine Forest are described on pages 23-24 of *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed).
- See the accompanying plant community map on page 5.5.2 for the approximate locations of these examples:
 - 1) 1959 Fire MCBS Site 119
 - 2) 1976 Fire MCBS Site 120
- See the Chapter 4 in this notebook for a description of MCBS sites 119 and 120 where these Jack Pine Forests are found.
- Relieves 4852 and 4418 and plant list 9455 were completed in these forests and are reproduced on the following pages.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVE #:4852

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVE REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Releve #: 94-09

EO Rec #: 18455

*Surveyor's ID Code: JSB (Janet S. Boe)

Date: 24 Month: JUN Year: 1994 (e.g. 04 JUL 1993)

CBS Site #: 119 or Site Name: DEERFIELD 18

DNR Ownership Code: (Owner Unknown)

*NC Code: JPCOBY (Jack Pine Forest (Central Outwash Plain) Blueberry Subtype)

Commun. Ranking in Releve: AB Stand typical of Commun. Type: _ Releve typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)

Quad Codes DNR: K11C Universal: 46094G6 (Oshawa)

Township: 139N (e.g. 143N) Range: 31W (e.g. 32W)

QQRT: NE QRT: SW of Section 7

Latitude: 46 degrees, 51 minutes, 58 seconds

LL/GPS registration:

Longitude: 94 degrees, 39 minutes, 16 seconds

*Accuracy: _ Marker: _

RELEVE INFORMATION

Releve Size (sq. m.): 400 Elev. (ft.): 1430 Slope: 00LV

Slope Position: _

*ECS Subsection: 9 (Pine Moraines & Outwash Plains)

Minnesota Soil Atlas Mapping Unit: SSWL

*Geomorphic Unit: 08 (Park Rapids-Staples Outwash Plain)

Remarks: County-owned stand originating from 1959 Badoura fire. Complete ground
cvt of Pleurozium. Occas sm diam blow-down & sm stumps. Little appar.
trimming. Trees dense in places; various dbhs. County st.#5.

OTHER DATA COLLECTED

Soils: N Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Releve Handbook)

Woody Needleleaf Evergreen, Height: 10-20m, Cover interrupted

4. Pinus banksiana (Jack pine)

Woody Needleleaf Evergreen, Height: 2-10m, Cover almost absent

+. Pinus banksiana DD (Jack pine)

Woody Needleleaf Evergreen, Height: .0-.5m, Cover almost absent

R. Pinus banksiana (Jack pine)

Woody Broadleaf Deciduous, Height: .0-2m, Cover patchy

1. Rubus strigosus (Red raspberry)

1. Vaccinium angustifolium FR (Blueberry)

+. Diervilla lonicera (Bush honeysuckle)

+. Populus tremuloides (Quaking aspen)

+. Prunus pumila (Sand cherry)

+. Prunus virginiana (Chokecherry)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

Woody Broadleaf Deciduous, Height: .0-2m, Cover patchy (continued)

- + . Rosa acicularis (Prickly rose)
- + . Rubus (Blackberry) (Bramble)
- + . Rubus cf. occidentalis (Black raspberry)
- + . Symphoricarpos albus (Snowberry)
- R. Amelanchier (Juneberry; Serviceberry; Saska)
- R. Cornus rugosa (Round-leaved dogwood)
- R. Corylus americana (American hazelnut)
- R. Quercus rubra (Northern red oak)
- R. Salix humilis (Prairie willow)

Climber, Height: .0-.5m, Cover almost absent

- R. Lonicera dioica (Wild Honeysuckle)

Graminoid, Height: .0-2m, Cover barely present

- + . Carex pensylvanica
- + . Oryzopsis asperifolia (Mountain rice-grass)
- + . Oryzopsis pungens (Rice-grass)
- + . Schizachne purpurascens (False melic grass)

Forb, Height: .0-2m, Cover interrupted

- 1. Aster macrophyllus (Large-leaved aster)
- 1. Lathyrus venosus (Veiny pea)
- 1. Maianthemum canadense (Canada mayflower)
- + . Achillea millefolium
- + . Anemone quinquefolia
- + . Antennaria neglecta (Pussytoes)
- + . Apocynum androsaemifolium (Spreading dogbane)
- + . Aster ciliolatus (Lindley's aster)
- + . Aster laevis (Smooth aster)
- + . Aster oolentangiensis (Sky-blue aster)
- + . Cypripedium acaule (Moccasin-flower, stemless lady)
- + . Fragaria virginiana (Common strawberry)
- + . Galium boreale (Northern bedstraw)
- + . Lathyrus ochroleucus (Pale vetchling)
- + . Lithospermum canescens (Hoary puccoon)
- + . Sanicula marilandica (Black snakeroot)
- + . Solidago cf. canadensis
- + . Solidago nemoralis (Gray goldenrod)
- + . Thalictrum dioicum (Early meadow rue)
- R. Dryopteris carthusiana OP (Spinulose shield fern)
- R. Senecio cf. pauperculus OP (Balsam ragwort)

Woody Broadleaf Evergreen, Height: .0-2m, Cover interrupted

- + . Arctostaphylos uva-ursi (Bearberry)
- + . Gaultheria procumbens (Wintergreen)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+ .2		Epigaea repens	L. var. glab.		Fern.	fl # #	!
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----									

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVE #:4418

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVE REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Releve #: 93-06 EO Rec #: 18454
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 16 Month: JUN Year: 1993 (e.g. 04 JUL 1993)
CBS Site #: 120 or Site Name: MCKINLEY 10
DNR Ownership Code: 91 (Other Non-Profit Organizations (Bsa, Ymca, Audubon, etc
*NC Code: JPCOBY (Jack Pine Forest (Central Outwash Plain) Blueberry Subtype)
Commun. Ranking in Releve: Stand typical of Commun. Type: _ Releve typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: K11C Universal: 46094G6 (Oshawa)
Township: 138N (e.g. 143N) Range: 32W (e.g. 32W)
QORT: NE QRT: NE of Section 15
Latitude: 46 degrees, 46 minutes, 27 seconds LL/GPS registration:
Longitude: 94 degrees, 42 minutes, 25 seconds *Accuracy: _ Marker: _

RELEVE INFORMATION

Releve Size (sq. m.): 400 Elev. (ft.): 1310 Slope: Slope Position: _
*ECS Subsection: 9 (Pine Moraines & Outwash Plains)
Minnesota Soil Atlas Mapping Unit: NP
*Geomorphic Unit: 08 (Park Rapids-Staples Outwash Plain)

Remarks: SOIL: SANDY HUMUS OVER COARSE (FEW PEBBLES) BROWNISH-RED SAND. GROUND
COVER OF PINE NEEDLES. 20% DEADFALL & LOGS/DEBRIS. SCANT MOSS
(COLLECTED).

OTHER DATA COLLECTED

Soils: N Forestry: N o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Releve Handbook)

Woody Needleleaf Evergreen, Height: 2-10m, Cover continuous

5. Pinus banksiana (Jack pine)

Woody Broadleaf Deciduous, Height: .0-.5m, Cover rare

1. Diervilla lonicera (Bush honeysuckle)
+. Vaccinium angustifolium (Blueberry)
R. Prunus pumila (Sand cherry)
R. Salix cf. discolor (Pussy willow)
R. Symphoricarpos albus (Snowberry)

Graminoid, Height: .0-.5m, Cover almost absent

- +. Danthonia spicata (Poverty grass)
+. cf. Panicum (Panic Grass)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

Forb, Height: .0-2m, Cover barely present

- 2. Pteridium aquilinum (Bracken)
- +. cf. Epilobium (Willow-Herb)
- +. Galium boreale (Northern bedstraw)
- +. Lathyrus ochroleucus (Pale vetchling)
- +. Lathyrus (Vetchling; Wild Pea)
- +. Maianthemum canadense (Canada mayflower)
- +. Senecio cf. pauperculus (Balsam ragwort)
- R. Anemone quinquefolia
- R. Aster cf. ciliolatus (Lindley's aster)
- R. Erigeron cf. philadelphicus (Philadelphia fleabane)
- R. Rubus pubescens (Dwarf blackberry)
- R. Solidago juncea (Early goldenrod)
- R. Trifolium OP (Clover; Trefoil)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+ .2		Epigaea repens	L. var. glab.		Fern.	fl # #	!
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----									

- FINAL RELEVÉ SPECIES LIST REPORT FORM, MINNESOTA VEGETATION DATABASE -

DNR RELEVÉ NUMBER: 9455
DATE: 24 JUN 1994
BY: Janet S. Boe
Cass County, MN
Oshawa (K11C)

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

Site Name: CBS #119
Location: NE of SW of S. 7, T. 139N, R. 31W
Ownership: County (other lands, including County Open Space lands)
Heritage Community Element: Jack Pine Forest (Central Outwash Plain)
Element Occurrence Size: 0 (acres), Rank: na, Sitesize: 0 (acres)
Soil Atlas Mapping Unit:
Other Data Collected:

----- PLOT CHARACTERISTICS -----

Jack pine forest generated following 1959 Badoura fire. Groundcover of
Pleurozium. JSB #PL94119. See also JSB relevé #94-09.
Plant list. County stand #5.

Achillea millefolium
Amelanchier (Juneberry; Serviceberry; Saskia)
Anemone canadensis (Canada anemone)
Anemone quinquefolia
Antennaria neglecta (Pussytoes)
Apocynum androsaemifolium (Spreading dogbane)
Aralia nudicaulis (Wild sarsaparilla)
Arctostaphylos uva-ursi (Bearberry)
Asclepias ovalifolia (Oval-leaved milkweed)
Aster ciliolatus (Lindley's aster)
Aster laevis (Smooth aster)
Aster oolentangiensis (Sky-blue aster)
Carex pensylvanica
Corylus cornuta (Beaked hazelnut)
Cypripedium acaule (Moccasin-flower, stemless lady)
Diervilla lonicera (Bush honeysuckle)
Fragaria virginiana (Common strawberry)
Galium boreale (Northern bedstraw)
Gaultheria procumbens (Wintergreen)
Hieracium (Hawkweed)
Lathyrus ochroleucus (Pale vetchling)
Lathyrus venosus (Veiny pea)
Linnaea borealis (Twin-flower)
Lithospermum canescens (Hoary puccoon)
Maianthemum canadense (Canada mayflower)
Melampyrum lineare (Cow-wheat)
Monotropa uniflora (Indian pipe)
Oryzopsis asperifolia (Mountain rice-grass)
Oryzopsis pungens (Rice-grass)
Panicum xanthophysum (Wide-leaved panic grass)
Phlox pilosa (Prairie phlox, downy phlox)
Phryma leptostachya (Lopseed)
Prunus pumila (Sand cherry)
Prunus virginiana (Chokecherry)
Pyrola chlorantha
Rosa acicularis (Prickly rose)

Releve Number 9455 Species List Continued, Page 2

Rubus cf. occidentalis (Black raspberry)
Rubus strigosus (Red raspberry)
Salix bebbiana (Bebb's willow)
Salix humilis (Prairie willow)
Sanicula marilandica (Black snakeroot)
Schizachne purpurascens (False melic grass)
Senecio cf. pauperculus (Balsam ragwort)
Solidago nemoralis (Gray goldenrod)
Symphoricarpos albus (Snowberry)
Thalictrum dioicum (Early meadow rue)
Vaccinium angustifolium (Blueberry)
Vicia americana (American vetch)
Zizia aptera (Heart-leaved alexanders)

White Cedar Swamp

White Cedar Swamps may occur in pure stands or may be a mixture of White Cedar with Black Spruce, Black Ash, Balsam Fir, or other species. They may occur on either mineral soils or peat and may or may not have a diverse moss layer.

In some uncommon White Cedar Swamps, ground-water flows from hillsides in areas called seeps. Two examples of this seepage subtype of White Cedar Swamp (see page 63 of *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed)) are reasonably accessible in Cass County.

The first, part of MCBS Site 114, is along the Shingobee River southeast of Walker in Section 17 of South Shingobee Township (T141N, R31W). It is part of the Shingobee Recreation Area of Chippewa National Forest and can be reached by walking established hiking and skiing trails. From the chalet at the Recreation Area, walk southeast on the trail system until you reach the white cedar swamp along the river. Maps showing the trail system at Shingobee Recreation Area are available at the Walker District Office or at the Supervisor's Office (in Cass Lake) of Chippewa National Forest.

The Shingobee Cedar Swamp is well-known for its wetland plants. Pitcher Plant (*Sarracenia purpurea*), Round-leaved Sundew (*Drosera rotundifolia*), Bog Buckbean (*Menyanthes trifoliata*), and Cranberry (*Vaccinium oxycoccus*) are found there. However, it is most well known for the abundance and variety of orchids it holds, including Fairy Slipper (*Calypso bulbosa*), Small Yellow Lady's-slipper (*Cypripedium calceolus* var. *parviflorum*), Small Northern Bog-orchid (*Platanthera obtusata*), Round-leaved orchis (*Amerorchis rotundifolia*), and Heart-leaved Twayblade (*Listera cordata*). The ground is moss-covered and wet with slowly moving seepage water.

A White Cedar Swamp in MCBS Site 72 is easily

accessible from Chippewa National Forest Road 2728 off of Highway 6 south of Deer River. It is DNR Forestry stand #6 in section 24 of Torrey Township (T143N, R25W) and can be reached by driving about .6 mile west on Forest Road 2728 to a gate. From there, walk north of the road to the ridge and the swamp.

Here, flowing water exits then disappears again into the steep hillside adjoining the cedar swamp; the ground is wet and spongy in areas between exit points on the hillside. The ground in the cedar stand itself is rather open and full of tip-ups (areas where cedar trees have tipped over, roots and all, leaving large depressions previously occupied by the root mass). Plants found beneath the cedar here include Bulblet Fern (*Cystopteris bulbifera*), Showy Lady's-slipper (*Cypripedium reginae*), Blunt-leaved Orchid (*Platanthera obtusata*), Labrador Tea (*Ledum groenlandicum*), Creeping Snowberry (*Gaultheria hispida*), and Goldthread (*Coptis groenlandica*).

- White Cedar Swamp is described on pages 62-63 of the *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed). This plant community type is one of the more species-rich types found in the county.
- See the Chapter 4 in this notebook for a description of MCBS sites 114 and 72 where these white cedar swamps are found.
- See the accompanying plant community map on page 5.5.2 for the locations of these examples:
 - 5) Shingobee River MCBS Site 114
 - 6) Camel Lake MCBS Site 72
- Relevés 4436 and 1804 and plant lists 9504 and 9471 were completed in these stands and are reproduced on the following pages.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4436

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 93-31
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 30 Month: JUL Year: 1993 (e.g. 04 JUL 1993)
CBS Site #: 114 or Site Name: SHINGOBEE RIVER
DNR Ownership Code: 02 (U.S. Forest Service (National Forest))
*NC Code: WCXXXX (White Cedar Swamp)
Commun. Ranking in Relevé: Stand typical of Commun. Type: _ Relevé typical of Stand: _

EO Rec #: 13388

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J11C Universal: 47094A6 (Akeley)
Township: 141N (e.g. 143N) Range: 31W (e.g. 32W)
QORT: SW QRT: NW of Section 17
Latitude: 47 degrees, 1 minutes, 57 seconds
Longitude: 94 degrees, 38 minutes, 16 seconds
LL/GPS registration:
*Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 100 Elev. (ft.): 1310 Slope: 06SE Slope Position: _
*ECS Subsection: 9 (Pine Moraines & Outwash Plains)
Minnesota Soil Atlas Mapping Unit: NP
*Geomorphic Unit: 11 (Itasca Moraine)

Remarks: RELEVÉ @ W EDGE CEDAR @ SEEPS--WHERE TAM BEGINS. GROUND:OLD MOSS-COV'D
LOGS;HOLLOWS/SEEPS CA 1/4 PLOT;FE-COLORED H2O;SPRINGY GROUND. PH 7.8.
CN7, WK DISTRICT, CAMP.89, STAND 20.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: Y Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Needleleaf Evergreen, Height: 10-20m, Cover continuous

4. Thuja occidentalis (White cedar, arbor vitae)
2. Abies balsamea (Balsam fir)
2. Picea mariana (Black spruce)

Woody Needleleaf Evergreen, Height: 2-10m, Cover patchy

3. Abies balsamea (Balsam fir)

Woody Needleleaf Evergreen, Height: .0-2m, Cover rare

2. Abies balsamea (Balsam fir)
- R. Abies balsamea DD (Balsam fir)
- R. Thuja occidentalis DD (White cedar, arbor vitae)

Woody Broadleaf Deciduous, Height: 10-20m, Cover rare

2. Betula papyrifera (Paper birch)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Woody Broadleaf Deciduous, Height: 2-10m, Cover barely present

- + . Acer spicatum (Mountain maple)
- + . Betula alleghaniensis

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare

- + . Acer spicatum (Mountain maple)
- + . Lonicera canadensis (Fly honeysuckle)
- R. Acer rubrum (Red maple)
- R. Betula cf. papyrifera (Paper birch)
- R. Diervilla lonicera (Bush honeysuckle)
- R. Populus tremuloides (Quaking aspen)
- R. Rhus radicans
- R. Ribes triste (Swamp red currant)

Climber, Height: .0-2m, Cover rare

- R. Lonicera hirsuta (Hairy honeysuckle)

Graminoid, Height: .0-.5m, Cover barely present

- + . Carex disperma
- + . Carex cf. pedunculata
- + . Cinna latifolia (Wood reedgrass)
- R. Glyceria striata (Fowl manna grass)
- R. Luzula (Wood-Rush)

Forb, Height: .5-2m, Cover almost absent

- R. Aralia racemosa (American spikenard)

Forb, Height: .0-.5m, Cover rare

- 1. Caltha palustris (Marsh marigold)
- 1. Circaea alpina (Small enchanter's nightshade)
- 1. Cystopteris bulbifera (Bulblet fern)
- 1. Mitella nuda (Miterwort, naked bishop's-cap)
- + . Aralia nudicaulis (Wild sarsaparilla)
- + . Aster ciliolatus (Lindley's aster)
- + . Aster macrophyllus (Large-leaved aster)
- + . Aster puniceus (Red-stemmed aster)
- + . Botrychium virginianum (Rattlesnake-fern)
- + . Cicuta maculata (Water-hemlock)
- + . Cirsium muticum (Swamp thistle)
- + . Clintonia borealis (Blue-bead lily)
- + . Coptis groenlandica (Goldthread)
- + . Cornus canadensis (Bunchberry)
- + . Cypripedium calceolus (Yellow lady-slipper)
- + . Epilobium coloratum (Purple-leaved willow-herb)
- + . Equisetum arvense (Field horsetail)
- + . Galium triflorum (Three-flowered bedstraw)
- + . Goodyera repens (Rattlesnake-plantain)
- + . Halenia deflexa (Spurred gentian)
- + . Impatiens capensis (Spotted touch-me-not, jewel-we)
- + . Maianthemum canadense (Canada mayflower)

----- EXAMPLE RECORD -----

! Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+ .2		Epigaea repens	L. var. glab.		Fern.	fl # #	!
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----								

Forb, Height: .0-.5m, Cover rare (continued)

- + . Moneses uniflora (One-flowered pyrola)
- + . Platanthera hyperborea (Tall northern orchid)
- + . Rubus pubescens (Dwarf blackberry)
- + . Streptopus roseus (Rose twisted-stalk)
- + . Thalictrum dasycarpum (Tall meadow rue)
- + . Thalictrum dioicum (Early meadow rue)
- + . Trientalis borealis (Starflower)
- + . Urtica dioica (Stinging nettle)
- + . Viola renifolia (Kidney-leaf violet)
- R. Actaea rubra (Red baneberry)
- R. Aster umbellatus (Flat-topped aster)
- R. Corallorhiza trifida (Early coral-root)
- R. Epilobium leptophyllum (Linear-leaved willow-herb)
- R. Fragaria virginiana (Common strawberry)
- R. Prenanthes alba (White rattlesnake-root)
- R. Viola macloskeyi (Northern white violet)

Woody Broadleaf Evergreen, Height: .0-.5m, Cover almost absent

- + . Ledum groenlandicum (Labrador tea)

----- EXAMPLE RECORD -----

!	Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+ .2		Epigaea repens L. var. glab.		Fern.	fl # #		!
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----								

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVE #:1804

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVE REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relve #: 1590AA EO Rec #: 0
*Surveyor's ID Code: SAJ (D. Sheridan and J. Janssens)
Date: 15 Month: JUL Year: 1992 (e.g. 04 JUL 1993)
CBS Site #: 114 or Site Name: Shingobee River
DNR Ownership Code: 02 (U.s. Forest Service (National Forest))
*NC Code: WCXXXX (White Cedar Swamp)
Commun. Ranking in Relve:A Stand typical of Commun. Type:_ Relve typical of Stand:_

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J11C Universal: 47094A6 (Akeley)
Township: 141N (e.g. 143N) Range: 31W (e.g. 32W)
QORT: SE QRT: NW of Section 17
Latitude: 47 degrees, 2 minutes, 3 seconds LL/GPS registration:
Longitude: 94 degrees, 38 minutes, 12 seconds *Accuracy: _ Marker: _

RELEVE INFORMATION

Relve Size (sq. m.): 100 Elev. (ft.): 1318 Slope: 00LV Slope Position: _
*ECS Subsection: 0
Minnesota Soil Atlas Mapping Unit: P6
*Geomorphic Unit: 11 (Itasca Moraine)

Remarks: Consult Dr. Jan Janssens for additional plot info in PARADOX system.
Vascular plant and moss collections with Janssens, DUPS at Deer River.
CNF Walker District, Compartment 89, Stand 20.

OTHER DATA COLLECTED

Soils: Y Forestry: N o=old growth Water Chemistry: Y Publication:
y=forestry

* = Variables with computerized code dictionaries (See Relve Handbook)

Woody Needleleaf Evergreen, Height: 10-20m, Cover interrupted

- 4.1 Thuja occidentalis (White cedar, arbor vitae)
- 1.1 Abies balsamea (Balsam fir)

Woody Needleleaf Evergreen, Height: .0-5m, Cover rare

- 2.1 Abies balsamea (Balsam fir)
- +1 Thuja occidentalis (White cedar, arbor vitae)

Woody Broadleaf Deciduous, Height: .0-2m, Cover barely present

- 1.1 Rhamnus alnifolia (Alder-leaved buckthorn)
- 1.1 Rubus pubescens (Dwarf blackberry)
- +1 Acer rubrum (Red maple)
- +1 Betula papyrifera (Paper birch)
- R.1 Lonicera canadensis (Fly honeysuckle)
- R.1 Ribes cf. hirtellum (Swamp gooseberry)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

Graminoid, Height: .0-2m, Cover barely present

- 2.3 Carex leptalea
- 1.1 Calamagrostis canadensis (Blue-joint)
- 1.2 Carex cf. paupercula
- + Carex cf. pedunculata

Forb, Height: .0-2m, Cover patchy

- 2.3 Impatiens capensis (Spotted touch-me-not, jewel-we)
- 1.1 Aralia nudicaulis (Wild sarsaparilla)
- 1.1 Circaea alpina (Small enchanter's nightshade)
- 1.1 Cornus canadensis (Bunchberry)
- 1.1 Mitella nuda (Miterwort, naked bishop's-cap)
- 1.1 Scutellaria galericulata (Marsh skullcap)
- 1.1 Smilacina trifolia (Three-leaved false Solomon's-s)
- +1 Botrychium virginianum (Rattlesnake-fern)
- +2 Caltha palustris (Marsh marigold)
- +1 Cicuta bulbifera (Bulb-bearing water-hemlock)
- +1 Corallorhiza trifida (Early coral-root)
- +1 Cypripedium calceolus (Yellow lady-slipper)
- +1 Galium cf. trifidum (Small bedstraw)
- +1 Galium triflorum (Three-flowered bedstraw)
- +2 Goodyera repens (Rattlesnake-plantain)
- +1 Halenia deflexa (Spurred gentian)
- +1 Lathyrus palustris (Marsh vetchling)
- +1 Lycopus uniflorus (Northern bugleweed)
- +1 Lysimachia thyrsiflora (Tufted loosestrife)
- +1 Maianthemum canadense (Canada mayflower)
- +1 Platanthera hyperborea (Tall northern orchid)
- +1 Platanthera orbiculata (Round-leaved orchid)
- +1 Saxifraga pensylvanica (Swamp saxifrage)
- +1 Stellaria longifolia (Long-leaved chickweed)
- +1 Thelypteris palustris (Northern marsh fern)
- +1 Trientalis borealis (Starflower)
- +1 Viola cf. macloskeyi (Northern white violet)
- R.1 Cystopteris bulbifera OP (Bulblet fern)
- R.1 Listera cordata (Heartleaf twayblade)

Woody Broadleaf Evergreen, Height: .0-2m, Cover barely present

- 1.3 Gaultheria hispidula (Creeping snowberry)
- 1.1 Linnaea borealis (Twin-flower)
- 1.2 Vaccinium macrocarpon (Large cranberry)
- +2 Ledum groenlandicum (Labrador tea)
- +1 Moneses uniflora (One-flowered pyrola)
- +1 Pyrola secunda (One-sided pyrola)
- R.1 Coptis groenlandica OP (Goldthread)
- R.1 Vaccinium angustifolium (Blueberry)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+2	Epigaea	repens	L.	var. glab.	Fern.	fl # #	!

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

Lichen/Moss, Height: .0-.1m, Cover continuous

- 3. Sphagnum centrale (moss)
- 3. Sphagnum warnstorffii (moss)
- 2. Drepanocladus aduncus (moss)
- 2. Plagiomnium ellipticum (moss)
- 2. Pleurozium schreberi (moss)
- 2. Thuidium delicatulum (moss)
- 1. Brachythecium rivulare (moss)
- 1. Climacium dendroides (moss)
- 1. Conocephalum conicum (moss)
- 1. Dicranum polysetum (moss)
- 1. Hypnum lindbergii (moss)
- 1. Marchantia polymorpha (moss)
- 1. Sphagnum teres (moss)

, Height: -m, Cover

no match in MNTaxa, MossTaxa, or LichTaxa

----- EXAMPLE RECORD -----

!	Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+.2		Epigaea repens	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

- FINAL RELEVÉ SPECIES LIST REPORT FORM, MINNESOTA VEGETATION DATABASE -

DNR RELEVÉ NUMBER: 9504
DATE: 2 JUN 1993
BY: Janet S. Boe
Cass County, MN
Akeley (J11C)

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

Site Name: Shingobee Site #114.
Location: SW of NW of S. 17, T. 141N, R. 31W
Ownership:
Heritage Community Element: White Cedar Swamp
Element Occurrence Size: 0 (acres), Rank: na, Sitesize: 0 (acres)
Soil Atlas Mapping Unit:
Other Data Collected:

----- PLOT CHARACTERISTICS -----

Combined plant list from June 2, June 22, July 30, and September 8, 1993. JSB #PL93114. CN7, Wk distinct, camp. 89, stand 20.

Amerorchis rotundifolia (Round-leaved orchis)
Aster borealis (Bog aster)
Aster macrophyllus (Large-leaved aster)
Aster puniceus (Red-stemmed aster)
Botrychium multifidum (Leathery grape-fern)
Botrychium virginianum (Rattlesnake-fern)
Caltha palustris (Marsh marigold)
Calypso bulbosa (Calypso)
Carex leptalea
Carex paupercula
Carex rosea
Coptis groenlandica (Goldthread)
Corallorhiza trifida (Early coral-root)
Cornus canadensis (Bunchberry)
Cypripedium reginae (Showy lady-slipper)
Cypripedium calceolus var. parviflorum (Yellow lady-slipper)
Cystopteris bulbifera (Bulblet fern)
Drosera rotundifolia (Round-leaved sundew)
Galium trifidum (Small bedstraw)
Galium triflorum (Three-flowered bedstraw)
Goodyera repens (Rattlesnake-plantain)
Gymnocarpium dryopteris (Oak fern)
Ledum groenlandicum (Labrador tea)
Listera cordata (Heartleaf twayblade)
Lonicera canadensis (Fly honeysuckle)
Lonicera hirsuta (Hairy honeysuckle)
Lonicera villosa (Mountain Fly-honeysuckle)
Luzula acuminata (Woodrush)
Menyanthes trifoliata (Buck-bean)
Mitella nuda (Miterwort, naked bishop's-cap)
Moneses uniflora (One-flowered pyrola)
Picea mariana (Black spruce)
Platanthera hyperborea (Tall northern orchid)
Platanthera obtusata (Blunt-leaved orchid)
Platanthera cf. orbiculata (Round-leaved orchid)
Pyrola asarifolia (Pink-flowered pyrola)

Releve Number 9504 Species List Continued, Page 2

Rhamnus alnifolia (Alder-leaved buckthorn)
Ribes glandulosum (Skunk currant)
Ribes triste (Swamp red currant)
Sarracenia purpurea (Pitcher-plant)
Saxifraga pensylvanica (Swamp saxifrage)
Smilacina stellata (Starry false Solomon's-seal)
Smilacina trifolia (Three-leaved false Solomon's-s)
Thuja occidentalis (White cedar, arbor vitae)
Trientalis borealis (Starflower)
Vaccinium oxycoccus (Small cranberry)
Viola macloskeyi ssp. *pallens* (Northern white violet)

- FINAL RELEVÉ SPECIES LIST REPORT FORM, MINNESOTA VEGETATION DATABASE -

DNR RELEVÉ NUMBER: 9471
DATE: 26 JUN 1995
BY: Janet S. Boe
Cass County, MN
Sugar Lake (J14A)

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

Site Name: MCBS #72
Location: SW of SE of S. 24, T. 143N, R. 25W
Ownership: Private Ownership
Heritage Community Element: White Cedar Swamp
Element Occurrence Size: 0 (acres), Rank: na, Sitesize: 0 (acres)
Soil Atlas Mapping Unit:
Other Data Collected:

----- PLOT CHARACTERISTICS -----

Canopy nearly all cedar. Tip-ups, pools (now mostly dry--occas standing water). Seeps just W of gate. State stand #6. JSB PL72-95-05.

Abies balsamea (Balsam fir)
Acer rubrum (Red maple)
Amelanchier (Juneberry; Serviceberry; Saskia)
Aralia nudicaulis (Wild sarsaparilla)
Aralia nudicaulis (Wild sarsaparilla)
Arisaema triphyllum (Jack-in-the-pulpit)
Aster macrophyllus (Large-leaved aster)
Athyrium angustum (Lady fern)
Botrychium virginianum (Rattlesnake-fern)
Botrychium cf. virginianum (Rattlesnake-fern)
Carex arctata
Carex deweyana
Carex disperma
Carex interior
Carex leptalea
Carex pedunculata
Carex trisperma
Circaea alpina (Small enchanter's nightshade)
Clintonia borealis (Blue-bead lily)
Coptis groenlandica (Goldthread)
Corallorhiza striata (Striped coral-root)
Corallorhiza trifida (Early coral-root)
Cornus canadensis (Bunchberry)
Cornus stolonifera (Red-osier dogwood)
Cypripedium reginae (Showy lady-slipper)
Cypripedium calceolus var. parviflorum (Yellow lady-slipper)
Cystopteris bulbifera (Bulblet fern)
Fragaria virginiana (Common strawberry)
Galium triflorum (Three-flowered bedstraw)
Gaultheria hispidula (Creeping snowberry)
Glyceria striata (Fowl manna grass)
Gymnocarpium dryopteris (Oak fern)
Impatiens capensis (Spotted touch-me-not, jewel-we)
Lathyrus ochroleucus (Pale vetchling)
Ledum groenlandicum (Labrador tea)
Linnaea borealis (Twin-flower)

Releve Number 9471 Species List Continued, Page 2

Listera cordata (Heartleaf twayblade)
Lonicera canadensis (Fly honeysuckle)
Lonicera hirsuta (Hairy honeysuckle)
Lycopodium annotinum (Bristly clubmoss)
Maianthemum canadense (Canada mayflower)
Mitella nuda (Miterwort, naked bishop's-cap)
Monotropa uniflora (Indian pipe)
Osmunda claytoniana (Interrupted fern)
Platanthera hyperborea (Tall northern orchid)
Platanthera obtusata (Blunt-leaved orchid)
Pyrola chlorantha
Pyrola secunda (One-sided pyrola)
Quercus rubra (Northern red oak)
Rhamnus alnifolia (Alder-leaved buckthorn)
Ribes americanum (Wild black currant)
Rubus pubescens (Dwarf blackberry)
Salix bebbiana (Bebb's willow)
Smilacina trifolia (Three-leaved false Solomon's-s)
Thelypteris palustris (Northern marsh fern)
Thuja occidentalis (White cedar, arbor vitae)
Trientalis borealis (Starflower)
Trientalis borealis (Starflower)
Unknown or Indeterminable Plant
Viola macloskeyi ssp. pallens (Northern white violet)

Wet Meadow

Wet Meadow is an open plant community on shallow peat that is dominated by Bluejoint Grass (*Calamagrostis canadensis*) or wide-leaved sedges such as Lake Sedge (*Carex lacustris*). Other plants often found in this community are Marsh bellflower (*Campanula aparinoides*) and Water Smartweed (*Polygonum amphibium* var. *stipulaceum*).

In Cass County, extensive Wet Meadows occur along some lakes and along the banks of the Boy River and the Leech River. Here, several bird species of special concern in Minnesota were found. One of the state's largest known populations of Yellow Rails and one of the state's largest known populations of Nelson's Sharp-tailed Sparrows was documented in the Wet Meadow along the Boy River as it enters Leech Lake northwest of the town of Boy River. Wilson's phalaropes were observed in Wet Meadows along the Leech River.

The Chippewa National Forest, the Department of Natural Resources, and the Leech Lake Division of Resources Management are cooperating in a program of prescribed burning of the Wet Meadows along the Boy and Leech rivers. In conjunction with this program, these agencies are making scientific comparisons of vegetation plots on burned vs. unburned sites. In addition, they have arranged to have peat cores extracted and analyzed to determine the development, vegetation, and fire history of the Wet Meadows there.

Wet Meadows along the Leech River can be seen by boat in Section 1 of East Gould Township (T143N, R28W) and Sections 5 and 6 of Boy River Township (T143N, R27W). Wet Meadows along the Boy River can be observed from County Road 172 southeast of the town of Boy River in Section 36 of East Gould Township; the meadows extend along the river to its mouth in Boy Bay of Leech Lake. Wet Meadows are also observable from Highway 8 as it crosses the Boy River about 5 miles south of Federal Dam.

- Wet Meadow is described in more detail on pages 74-75 of *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed).
- See the Chapter 4 in this notebook for a description of MCBS sites 17 and 60 where these Wet Meadows are found.
- See the accompanying plant community map on page 5.5.2 for the locations of these examples:
 - 3) Leech River MCBS Site 17
 - 4) Boy River MCBS Site 60
- Relaves 4322, 4323, and 4324 from Site 17 and releve 1179 from MCBS Site 60 are reproduced on the following pages.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVE #:4322

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVE REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relve #: 93-12 EO Rec #: 18504
*Surveyor's ID Code: AAB (J. Almendinger and J. Boe)
Date: 7 Month: JUL Year: 1993 (e.g. 04 JUL 1993)
CBS Site #: 17 or Site Name: Leech River #17
DNR Ownership Code: 02 (U.s. Forest Service (National Forest))
*NC Code: WMXXXX (Wet Meadow)
Commun. Ranking in Relve: Stand typical of Commun. Type: Relve typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J13B Universal: 47094B2 (Federal Dam)
Township: 143N (e.g. 143N) Range: 28W (e.g. 32W)
QORT: NW QRT: SE of Section 1
Latitude: 47 degrees, 13 minutes, 56 seconds LL/GPS registration:
Longitude: 94 degrees, 9 minutes, 52 seconds *Accuracy: _ Marker: _

RELEVE INFORMATION

Relve Size (sq. m.): 100 Elev. (ft.): 1290 Slope: 00LV Slope Position: _
*ECS Subsection: 6 (Chippewa Plains)
Minnesota Soil Atlas Mapping Unit: NP
*Geomorphic Unit:

Remarks: PLOT TYPICAL REVEG MEANDER SCARS.3/4" PVC ON SW & NE CORNERS. CA 40CM
STANDING H2O ON PLOT,BUT PLANTS SHOW TERRES. FORM.PLOT OUTSIDE C.LACU.
COLONIES. PEAT DEPTH 19" ON SAND LENSES. STATE STAND #4.

OTHER DATA COLLECTED

Soils: N Forestry: N o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relve Handbook)

Graminoid, Height: .0-2m, Cover continuous

5.5 Calamagrostis canadensis (Blue-joint)
1.1 Carex lacustris

Forb, Height: .0-.5m, Cover rare

2.1 Polygonum amphibium (Water smartweed)
1.1 Campanula aparinoides (Marsh Bellflower)
+.2 Aster cf. lanceolatus #2 (Panicled aster)
+.1 Galium trifidum #1 (Small bedstraw)
+.1 Lathyrus palustris #6 (Marsh vetchling)
+.2 Lycopus uniflorus (Northern bugleweed)
+.2 Ophioglossum pusillum #5 (Adder's-tongue)
+.1 cf. Scutellaria #3 (Skullcap)
+.2 Thelypteris palustris (Northern marsh fern)
R.1 Cirsium arvense (Canada thistle)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

DNR RELEVE #: 4322 continued, Page 2

Forb, Height: .0-.5m, Cover rare (continued)

R.1 *Potentilla norvegica* #4 (Rough cinquefoil)

R.1 *Stachys palustris* OP (Hedge-nettle)

----- EXAMPLE RECORD -----
! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4323

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 93-13
*Surveyor's ID Code: AAB (J. Almendinger and J. Boe)
Date: 8 Month: JUL Year: 1993 (e.g. 04 JUL 1993)
CBS Site #: 17 or Site Name: Leech River
DNR Ownership Code: 02 (U.S. Forest Service (National Forest))
*NC Code: WMXXXX (Wet Meadow)
Commun. Ranking in Relevé: Stand typical of Commun. Type: _ Relevé typical of Stand: _

EO Rec #: 18504

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J13B Universal: 47094B2 (Federal Dam)
Township: 143N (e.g. 143N) Range: 28W (e.g. 32W)
QORT: SE QRT: NE of Section 1
Latitude: 47 degrees, 14 minutes, 3 seconds
Longitude: 94 degrees, 9 minutes, 31 seconds
LL/GPS registration:
*Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 100 Elev. (ft.): 1290 Slope: 00LV Slope Position: _
*ECS Subsection: 6 (Chippewa Plains)
Minnesota Soil Atlas Mapping Unit: NP
*Geomorphic Unit:

Remarks: PLOT TYPICAL OF FORB-RICH AREAS BEING INVADED BY EXOTICS. 3/4" PIPES
AT NE & SW PLOT CORNERS. PEAT DEPTH 6"!
STATE STAND #4.

OTHER DATA COLLECTED

Soils: N Forestry: N o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Broadleaf Deciduous, Height: .0-.1m, Cover almost absent
R.1 Rubus strigosus (Red raspberry)

Graminoid, Height: .0-2m, Cover continuous
5.5 Calamagrostis canadensis (Blue-joint)
2.3 Phalaris arundinacea (Reed canary grass)
+.1 Carex lacustris
+.1 Carex cf. lasiocarpa

Forb, Height: .0-.5m, Cover patchy
2.3 Potentilla norvegica #1 (Rough cinquefoil)
1.1 Campanula aparinoides (Marsh Bellflower)
1.1 Galium trifidum #6 (Small bedstraw)
1.1 Mentha arvensis var. glabrata (Common mint)
1.1 Polygonum amphibium var. stipulaceum (Water smartweed)
1.1 Stachys palustris #4 (Hedge-nettle)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Forb, Height: .0-.5m, Cover patchy (continued)

- +1.1 *Cirsium arvense* (Canada thistle)
- +1.1 *Cirsium* (Common Thistle; Plumed Thistle)
- +1.1 *Crepis tectorum* (Yellow hawk's-beard)
- +1.1 *Epilobium glandulosum* #2
- +1.1 *Erysimum cheiranthoides* #5 (Wormseed mustard)
- +1.1 *Eupatorium maculatum* (Spotted Joe-pye weed)
- +1.1 *Lathyrus palustris* (Marsh vetchling)
- +1.1 *Lycopus americanus* (Cut-leaved bugleweed)
- +1.1 *Ophioglossum pusillum* (Adder's-tongue)
- +1.1 cf. *Scutellaria* #7 (Skullcap)
- +1.1 *Stellaria longifolia* (Long-leaved chickweed)
- +2.2 *Thelypteris palustris* (Northern marsh fern)
- +3.3 *Triadenum fraseri* (Marsh St. John's-wort)
- R.1 *Aster cf. lanceolatus* BR (Panicled aster)
- R.1 *Cirsium vulgare* (Bull thistle)
- R.1 *Iris versicolor* OP (Blue Flag)
- R.1 *Lycopus uniflorus* (Northern bugleweed)
- R.1 *Solidago* (Goldenrod)
- R.1 *Thalictrum dasycarpum* (Tall meadow rue)

----- EXAMPLE RECORD -----

!	Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+2		<i>Epigaea repens</i>	L. var. glab.		Fern.	fl # #	!
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----								

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4324

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 93-14
*Surveyor's ID Code: AAB (J. Almendinger and J. Boe)
Date: 8 Month: JUL Year: 1993 (e.g. 04 JUL 1993)
CBS Site #: 17 or Site Name: Leech River #17
DNR Ownership Code: 02 (U.S. Forest Service (National Forest))
*NC Code: WMXXXX (Wet Meadow)
Commun. Ranking in Relevé: Stand typical of Commun. Type: _ Relevé typical of Stand: _

EO Rec #: 18504

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J13B Universal: 47094B2 (Federal Dam)
Township: 143N (e.g. 143N) Range: 28W (e.g. 32W)
QORT: SE QRT: NE of Section 1
Latitude: 47 degrees, 14 minutes, 6 seconds
Longitude: 94 degrees, 9 minutes, 30 seconds
LL/GPS registration: _
*Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 100 Elev. (ft.): 1290 Slope: 00LV Slope Position: _
*ECS Subsection: 6 (Chippewa Plains)
Minnesota Soil Atlas Mapping Unit: NP
*Geomorphic Unit: _

Remarks: PLOT TYPICAL OF TALL, HUMMOCKY MEADOW. 3/4" PIPES AT NW & SE CORNERS.
IRON FLOCK IN 6" STANDING WATER, OBVIOUSLY FLOWING S TO CREEK FROM
CEDAR SWAMP TO MEADOW. PEAT DEPTH = 20". STATE STAND #4.

OTHER DATA COLLECTED

Soils: Y Forestry: N o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Graminoid, Height: .0-2m, Cover continuous

5.5 Calamagrostis canadensis (Blue-joint)
2.1 Carex lacustris
1.1 Carex aquatilis #1

Forb, Height: .0-.5m, Cover rare

1.1 Campanula aparinoides (Marsh Bellflower)
1.1 Galium trifidum #3 (Small bedstraw)
1.1 Impatiens capensis (Spotted touch-me-not, jewel-we)
1.1 Polygonum amphibium var. stipulaceum (Water smartweed)
1.1 Polygonum sagittatum (Arrow-leaved tearthumb)
+.2 Caltha palustris (Marsh marigold)
+.1 Epilobium leptophyllum #2 (Linear-leaved willow-herb)
+.1 Galium labradoricum #4 (Marsh bedstraw)
+.1 Lathyrus palustris (Marsh vetchling)
+.1 Rumex orbiculatus (Great water dock)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

DNR RELEVE #: 4324 continued, Page 2

Forb, Height: .0-.5m, Cover rare (continued)

+2 Thelypteris palustris (Northern marsh fern)
R.1 Cardamine (Bitter Cress)
R.1 Dryopteris cristata (Crested fern)
R.1 Equisetum fluviatile (Water horsetail)

----- EXAMPLE RECORD -----
! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:1179

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 1721AA EO Rec #: 0
*Surveyor's ID Code: JAJ (Jan A. Janssens)
Date: 30 Month: JUN Year: 1993 (e.g. 04 JUL 1993)
CBS Site #: 0 or Site Name: Chippewa National Forest
DNR Ownership Code: 02 (U.S. Forest Service (National Forest))
*NC Code: WMXXXX (Wet Meadow)
Commun. Ranking in Relevé: Stand typical of Commun. Type: _ Relevé typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J13B Universal: 47094B2 (Federal Dam)
Township: 143N (e.g. 143N) Range: 27W (e.g. 32W)
QORT: NW QRT: SE of Section 31
Latitude: 47 degrees, 9 minutes, 50 seconds LL/GPS registration:
Longitude: 94 degrees, 8 minutes, 54 seconds *Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 100 Elev. (ft.): 1299 Slope: 00LV Slope Position: _
*ECS Subsection: 0
Minnesota Soil Atlas Mapping Unit: P8
*Geomorphic Unit: 024

Remarks: Consult Dr. Jan Janssens for additional plot info in PARADOX system.
Vascular plant and moss collections with Janssens, DUPS at Deer River.

OTHER DATA COLLECTED

Soils: Y Forestry: N o=old growth Water Chemistry: Y Publication:
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Graminoid, Height: .1-2m, Cover patchy

3.3 Carex lasiocarpa
3.3 Carex stricta
2.3 Calamagrostis canadensis (Blue-joint)
2.3 Carex lacustris
+.2 Carex (Sedge)

Forb, Height: .0-.5m, Cover rare

2.3 Equisetum fluviatile (Water horsetail)
1.1 Utricularia intermedia (Flat-leaved bladderwort)
+.1 Cicuta bulbifera (Bulb-bearing water-hemlock)
+.2 Galium trifidum (Small bedstraw)
+.1 Polygonum amphibium (Water smartweed)
+.1 Potamogeton (Pondweed)
R.1 Aster OP
R.1 Viola (Violet)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

DNR RELEVE #: 1179 continued, Page 2

Lichen/Moss, Height: .0-.1m, Cover interrupted
4. Drepanocladus aduncus (moss)

----- EXAMPLE RECORD -----
! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

Northern Hardwood-Conifer Forest

Northern Hardwood-conifer Forest is a community that usually includes, in this area, Sugar Maple (*Acer saccharum*) and White Pine (*Pinus strobus*) as the dominant canopy plant species.

White Pine (*Pinus strobus*) was cut selectively from mixed stands in this area in the past, leaving mesic hardwood forests containing large pine stumps. In the Cuba Hill area, within the U.S.F.S. Pike Bay Experimental Forest, there remain areas of Northern Hardwood-conifer Forest interspersed with patches of Maple-basswood Forest.

In addition to White Pine and Sugar Maple, plants in the Northern Hardwood-conifer Forest here include Paper Birch (*Betula papyrifera*), Yellow Birch (*Betula alleghaniensis*), Ironwood (*Ostrya virginiana*), Leatherwood (*Dirca palustris*), Large-flowered Bellwort (*Uvularia grandiflora*), Pale Bellwort (*Uvularia sessilifolia*), and Hairy Solomon's-seal (*Polygonatum pubescens*).

This forest is located in the west half of section 33 of Unorganized Township 5 (T145N, R30W). It can be

reached by driving about 4 miles east of Cass Lake on Highway 2 to the junction with Chippewa National Forest Road 2133. Turn south on Forest Road 2133 and drive for about 2.5-3 miles until Chippewa National Forest Road 3917 is encountered. Walk west through the forest on road 3917.

- See page 29 in *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed) for a more detailed description of Northern Hardwood - conifer Forest in the Minnesota.
- See Chapter 4 in this notebook for a description of MCBS Site 36 where this forest is found.
- See the accompanying plant community map on page 5.5.2 for the location of this example:
18) Cuba Hill MCBS Site 36
- Releve 2032 was recorded in this forest and is reproduced on the following page.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:2032

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: LTA-EM13 EO Rec #: 0
*Surveyor's ID Code: JCA (John C. Almendinger)
Date: 7 Month: SEP Year: 1994 (e.g. 04 JUL 1993)
CBS Site #: 0 or Site Name: Chippewa National Forest
DNR Ownership Code: 02 (U.s. Forest Service (National Forest))
*NC Code: WFXXXX (** UNKNOWN COMMUNITY CODE **)
Commun. Ranking in Relevé: Stand typical of Commun. Type: Relevé typical of Stand:

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: I12C Universal: 47094C4 (Sucker Lakes)
Township: 144N (e.g. 143N) Range: 30W (e.g. 32W)
QORT: NW QRT: SE of Section 5
Latitude: 47 degrees, 18 minutes, 45 seconds LL/GPS registration:
Longitude: 94 degrees, 29 minutes, 51 seconds *Accuracy: Marker:

RELEVÉ INFORMATION

Relevé Size (sq. m.): 100 Elev. (ft.): 1403 Slope: 04SE Slope Position:
*ECS Subsection: 0
Minnesota Soil Atlas Mapping Unit: LSWL
*Geomorphic Unit: 48 (Guthrie Till Plain)

Remarks:

OTHER DATA COLLECTED

Soils: Y Forestry: N o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Needleleaf Evergreen, Height: 20-35m, Cover patchy
3.1 Pinus strobus (White pine)

Woody Needleleaf Evergreen, Height: .0-.5m, Cover barely present
+.1 Abies balsamea (Balsam fir)
+.1 Pinus strobus (White pine)
R.1 Picea glauca (White spruce)

Woody Broadleaf Deciduous, Height: 10-35m, Cover continuous
4.1 Acer saccharum (Sugar maple)
2.1 Betula alleghaniensis
2.1 Tilia americana (Basswood)

Woody Broadleaf Deciduous, Height: 2-10m, Cover rare
2.1 Acer saccharum (Sugar maple)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Woody Broadleaf Deciduous, Height: .0-2m, Cover continuous

- 4.3 *Acer saccharum* (Sugar maple)
- 2.1 *Dirca palustris* (Leatherwood)
- 1.1 *Acer spicatum* (Mountain maple)
- 1.1 *Prunus virginiana* (Chokecherry)
- +1.1 *Acer rubrum* SD (Red maple)
- +1.1 *Corylus cornuta* (Beaked hazelnut)
- +1.1 *Fraxinus nigra* GE (Black ash)
- +2.2 *Lonicera canadensis* (Fly honeysuckle)
- +1.1 *Ostrya virginiana* (Ironwood, hop hornbeam)
- +1.1 *Quercus macrocarpa* (Bur oak)
- +1.1 *Quercus rubra* (Northern red oak)
- +1.1 *Tilia americana* GE SD (Basswood)
- R.1 *Betula alleghaniensis*
- R.1 *Diervilla lonicera* (Bush honeysuckle)
- R.1 *Ribes cynosbati* (Prickly gooseberry, dogberry)

Graminoid, Height: .0-.5m, Cover rare

- 2.1 *Carex pensylvanica*
- 1.1 *Carex pedunculata*
- +2.2 *Luzula acuminata* (Woodrush)
- +1.1 *Oryzopsis asperifolia* (Mountain rice-grass)

Forb, Height: .0-.5m, Cover rare

- 1.1 *Lycopodium obscurum* (Groundpine)
- 1.1 *Trientalis borealis* (Starflower)
- +1.1 *Amphicarpaea bracteata* (Hog-peanut)
- +1.1 *Anemone quinquefolia*
- +2.2 *Arisaema triphyllum* (Jack-in-the-pulpit)
- +2.2 *Athyrium angustum* (Lady fern)
- +1.1 *Clintonia borealis* (Blue-bead lily)
- +1.1 *Hepatica americana* (Round-lobed hepatica)
- +1.1 *Maianthemum canadense* (Canada mayflower)
- +1.1 *Rubus pubescens* (Dwarf blackberry)
- +1.1 *Uvularia grandiflora* (Yellow bellwort)
- R.1 *Aster macrophyllus* (Large-leaved aster)
- R.1 *Botrychium virginianum* (Rattlesnake-fern)
- R.1 *Galium triflorum* (Three-flowered bedstraw)
- R.1 *Polygonatum pubescens* (Hairy Solomon's-seal)
- R.1 *Smilacina racemosa* (False Solomon's-seal)

----- EXAMPLE RECORD -----

!	Cover	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+2		<i>Epigaea repens</i>	L.	var.	glab.	Fern.	fl # # !

----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Floodplain Forest

Along the Crow Wing River, on the boundary of Cass County with Todd County, branches of Silver Maples hang over the river and its oxbows. This example of the Silver Maple subtype of Floodplain Forest is on land owned by Cass County in the northeast quarter of section 10 in Becker Township (T133N, R32W). From Highway 64 north of Motley, turn west on County Road 33. Travel west for 2 1/2 miles to the junction with County Road 31. Turn south here and drive about 1 mile to the end of the road. From there, follow the trail about 1/4 mile to the river.

Tree species growing on the alluvial soil of riverbanks tolerate the periodic flooding that comes with snowmelt and other high water episodes. In addition to Silver Maple (*Acer saccharinum*), Black Ash (*Fraxinus nigra*) also occurs in this forest. Plants on the forest floor here include several sedges (*Carex amphibola*, *Carex sprengelii*), Sensitive Fern (*Onoclea sensibilis*), Wood Nettle (*Laportea canadensis*), Nodding Trillium (*Trillium cernuum*), Wild Ginger (*Asarum canadense*), and Wild Iris (*Iris versicolor*).

- See pages 57-58 of *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed) for a description of Floodplain Forest.
- In Chapter 4 of this notebook there is a description of MCBS Site 221 where this Floodplain Forest is found.
- See the accompanying plant community map on page 5.5.2 for the location of this example:
19) Crow Wing River - MCBS Site 221
- Releve 4956 was recorded in this forest and is reproduced on the following pages.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4956

18:44 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 95-02
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 6 Month: JUN Year: 1995 (e.g. 04 JUL 1993)
CBS Site #: 221 or Site Name: BECKER 02
DNR Ownership Code: 70 (County Forest)
*NC Code: FFXXXX (Floodplain Forest)
Commun. Ranking in Relevé: AB Stand typical of Commun. Type: _ Relevé typical of Stand: _

EO Rec #: 18436

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: M11C Universal: 46094C6 (Motley)
Township: 133N (e.g. 143N) Range: 32W (e.g. 32W)
QORT: SE QRT: NE of Section 10
Latitude: 46 degrees, 21 minutes, 2 seconds
Longitude: 94 degrees, 41 minutes, 49 seconds
LL/GPS registration:
*Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 400 Elev. (ft.): 1220 Slope: Slope Position: _
*ECS Subsection: 9 (Pine Moraines & Outwash Plains)
Minnesota Soil Atlas Mapping Unit: SSWL
*Geomorphic Unit: 08 (Park Rapids-Staples Outwash Plain)

Remarks: Relevé adjacent to oxbow about 50 yards north of Crow Wing River.
Moderate amount of medium-diam coarse woody debris. Occasional fallen
snags. County Stand 3.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Broadleaf Deciduous, Height: 10-35m, Cover continuous

- 3. Acer saccharinum (Silver maple, soft maple)
- 3. Quercus macrocarpa (Bur oak)
- 3. Tilia americana (Basswood)

Woody Broadleaf Deciduous, Height: 2-10m, Cover interrupted

- 2. Acer negundo (Box elder)
- 2. Fraxinus nigra (Black ash)
- 2. Zanthoxylum americanum (Prickly-ash)
- 1. Viburnum lentago (Nannyberry)

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare

- 2. Zanthoxylum americanum (Prickly-ash)
- 1. Fraxinus nigra (Black ash)
- 1. Viburnum lentago (Nannyberry)
- 1. Viburnum rafinesquianum (Downy arrowwood)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare (continued)

- +. *Prunus virginiana* (Chokecherry)
- +. *Tilia americana* SD (Basswood)
- R. *Amelanchier* (Juneberry; Serviceberry; Saska)
- R. *Quercus macrocarpa* (Bur oak)
- R. *Rhus radicans* (Poison ivy)
- R. *Ribes americanum* (Wild black currant)

Climber, Height: .0-.5m, Cover almost absent

- +. *Parthenocissus inserta* (Virginia creeper)

Graminoid, Height: .0-2m, Cover rare

- 1. *Carex deweyana*
- 1. *Carex rosea*
- 1. *Carex sprengei*
- +. *Carex amphibola*
- +. *Carex blanda*
- +. *Carex intumescens*
- +. *Carex* cf. (Sedge)
- +. *Muhlenbergia mexicana* (Mexican satin grass)
- +. *Phalaris arundinacea* (Reed canary grass)

Forb, Height: .0-2m, Cover interrupted

- 4. *Laportea canadensis* (Wood nettle)
- 1. *Anemone quinquefolia*
- 1. *Heracleum lanatum* (Cow-parsnip)
- 1. *Matteuccia struthiopteris* (Ostrich fern)
- 1. *Onoclea sensibilis* (Sensitive fern)
- 1. *Sanguinaria canadensis* (Bloodroot)
- 1. *Smilax lasioneura* (Carrion-flower)
- +. *Amphicarpaea bracteata* (Hog-peanut)
- +. *Arenaria lateriflora* (Sandwort)
- +. *Asarum canadense* (Wild ginger)
- +. *Clematis virginiana* (Virgin's bower)
- +. *Corallorhiza trifida* (Early coral-root)
- +. *Equisetum pratense* (Meadow horsetail)
- +. *Eupatorium maculatum* (Spotted Joe-pye weed)
- +. *Galium triflorum* (Three-flowered bedstraw)
- +. *Iris versicolor* (Blue Flag)
- +. *Osmorhiza claytonii* (Sweet cicely)
- +. *Ranunculus abortivus* (Kidney-leaf buttercup)
- +. *Sanicula marilandica* (Black snakeroot)
- +. *Stachys palustris* (Hedge-nettle, woundwort)
- +. *Taraxacum officinale* (Common dandelion)
- +. *Thalictrum dioicum* (Early meadow rue)
- +. *Trillium cernuum*
- +. *Uvularia sessilifolia* (Pale bellwort)
- +. *Viola* (Violet)
- +. *Zizia aurea* OP (Golden alexanders)
- R. *Aralia racemosa* (American spikenard)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+.2		<i>Epigaea repens</i>	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Forb, Height: .0-2m, Cover interrupted (continued)

R. cf. Aster OP	
R. Botrychium virginianum	(Rattlesnake-fern)
R. Erigeron philadelphicus	(Philadelphia fleabane)
R. Fragaria virginiana	(Common strawberry)
R. Geranium maculatum	(Wild geranium)
R. Impatiens capensis	(Spotted touch-me-not, jewel-we)
R. Maianthemum canadense	(Canada mayflower)
R. Thelypteris palustris	(Northern marsh fern)

----- EXAMPLE RECORD -----

! Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
! +.2		Epigaea repens L. var. glab.		Fern.	fl # #	!	
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----							

Black Spruce Swamp

Black Spruce Swamps differs from Black Spruce Bogs in the nutrient content of their water supply. Swamps receive relatively nutrient-rich groundwater; bogs sit above the water table and depend primarily upon precipitation, which is low in nutrients.

An accessible Black Spruce Swamp is found near Skunk Lake in the south 1/4 of section 13 and the north 1/4 of section 24 in Torrey Township (T143N, R25W). From Highway 6 north of Remer, turn on Itasca County Road 28 (Cass County Road 65) and drive about 1 1/2 miles west to Chippewa National Forest Road 2709. Turn south here and drive or walk about a mile. The Black Spruce Swamp extends east of the road.

The list of vascular plant species found here and in other black spruce swamps in the county is more diverse and contains more minerotrophic species than the list of species found in bogs. Black Spruce Swamps often include Tamarack (*Larix laricina*) in the canopy. Ericaceous shrubs (shrubs in the family *Ericaceae*) are often found in the understory; these include Leatherleaf (*Chamaedaphne calyculata*), Creeping Snowberry (*Gaultheria hispidula*), Bog Laurel (*Kalmia polifolia*), Labrador Tea (*Ledum groenlandicum*), Blueberries (*Vaccinium angustifolium*, *V. myrtilloides*) and Cranberry

(*Vaccinium oxycoccus*). Forbs include three-leaved false Solomon's Seal (*Smilacina trifolia*), Northern White Violet (*Viola macloskeyi* ssp. *pallens*), Starflower (*Trientalis borealis*), Indian Pipe (*Monotropa uniflora*), Blunt-leaved Orchid (*Platanthera obtusata*), Miterwort (*Mitella nuda*), and Goldthread (*Coptis groenlandica*). Various species of sedges occur in these swamps; they include *Carex disperma*, *C. trisperma*, *C. leptalea*, and *C. paupercula*.

Sphagnum mosses blanket Black Spruce Swamps. The species and abundances of mosses also differ between swamps and bogs.

- See pages 64-65 in *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed) for a description of Black Spruce Swamp.
- In the Chapter 4 of this notebook there is a description of MCBS Site 72 where this Black Spruce Swamp is found.
- See the accompanying plant community map on page 5.5.2 for the location of this example: 15) Skunk Lake MCBS Site 72
- Plant list 9505, recorded in this stand, is on the following page.



- FINAL RELEVE SPECIES LIST REPORT FORM, MINNESOTA VEGETATION DATABASE -

DNR RELEVE NUMBER: 9505
DATE: 10 JUN 1994
BY: Janet S. Boe
Cass County, MN
Sugar Lake (J14A)

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

Site Name: MCBS #72
Location: SW of SW of S. 13, T. 143N, R. 25W
Ownership: Private Ownership
Heritage Community Element: Black Spruce Swamp
Element Occurrence Size: 0 (acres), Rank: CD, Sitesize: 2 (acres)
Soil Atlas Mapping Unit:
Other Data Collected:

----- PLOT CHARACTERISTICS -----

Picea mar (E5-6) w/various heights below. Dom by Ledum & Chamad w/Erio
spis & Smil trif. CNF DR Dist, Comp 233, Stand 7. 9/30/93 & 6/10/94.
JSB #PL729401.

Carex paupercula
Carex trisperma
Chamaedaphne calyculata (Leather-leaf)
Cypripedium acaule (Moccasin-flower, stemless lady)
Drosera rotundifolia (Round-leaved sundew)
Eriophorum spissum (Cotton-grass)
Gaultheria hispidula (Creeping snowberry)
Kalmia polifolia (Bog laurel)
Larix laricina (Tamarack, American larch)
Ledum groenlandicum (Labrador tea)
Monotropa uniflora (Indian pipe)
Picea mariana (Black spruce)
Smilacina trifolia (Three-leaved false Solomon's-s)
Sphagnum (moss)
Vaccinium angustifolium (Blueberry)
Vaccinium myrtilloides (Velvet-leaf blueberry)
Vaccinium oxycoccus (Small cranberry)

Black Ash Swamp

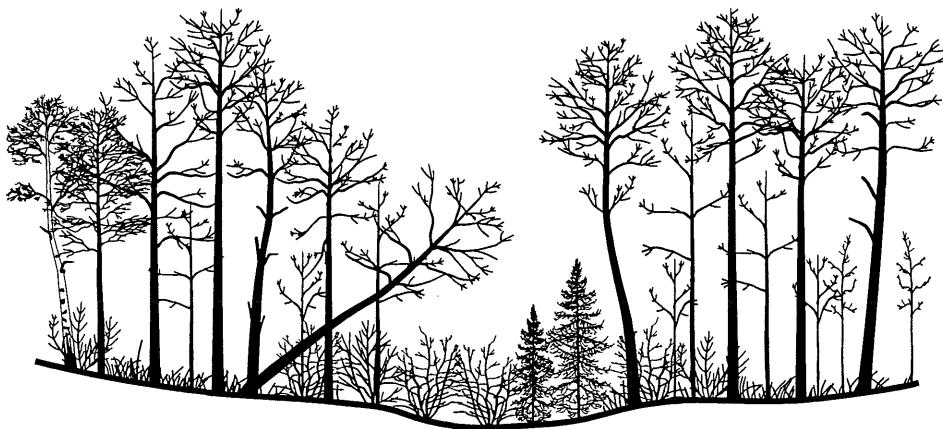
Black Ash Swamps are some of the most species-rich plant communities present in Cass County. Graminoids and forbs found in both of the following swamps include Fowl Manna Grass (*Glyceria striata*), several sedges (*Carex retrorsa* and *C. stipata*), Marsh Marigold (*Caltha palustris*), Jewel-weed (*Impatiens capensis*), and Marsh Skullcap (*Scutellaria galericulata*).

Two of the most accessible Black Ash Swamps in the county occur near Oak Point and in Lima Township. The first can be reached by taking Highway 371 south of Cass Lake about 7 miles to Oak Point Road. Turn east on Oak Point Road and drive about 6 miles to Chippewa National Forest Road 3740. Continue around the curve of Oak Point Road until the road straightens (about 1500 feet); walk west into the swamp, which abuts the road. This swamp, in MCBS Site 49, is in the NW quarter of section 6, in unorganized township 4 (T143, R30).

A second Black Ash Swamp, located in MCBS Site 79, is in the SW quarter of the SW quarter of section 9,

Lima Township (T141, R25). From Remer, take Highway 200 southeast about 2 1/2 miles to the junction with County Road 132. Travel east on Co. Rd. 132 about 1/2 mile and walk north to the Black Ash Swamp.

- See pages 59-60 in *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed) for a description of Black ash swamp.
- See the Sites chapter in this notebook for a description of MCBS sites 49 and 79 where these Black Ash Swamps are found.
- See the accompanying plant community map on page 5.5.2 for the locations of these examples:
 - 16) Steamboat Bay MCBS Site 49
 - 17) Birch Lake MCBS Site 79
- Releve 4867 recorded in Site 49 and plant list recorded in Site 79 are on the following pages.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4867

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 94-24 EO Rec #: 0
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 26 Month: JUL Year: 1994 (e.g. 04 JUL 1993)
CBS Site #: 49 or Site Name: WELSH LAKE 1
DNR Ownership Code: 20 (Mn Dnr Forestry (State Forest and Con-Con Land))
*NC Code: BAXXXX (Black Ash Swamp)
Commun. Ranking in Relevé: AB Stand typical of Commun. Type: _ Relevé typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J11A Universal: 47094B5 (Steamboat Bay)
Township: 143N (e.g. 143N) Range: 30W (e.g. 32W)
QORT: NW QRT: NW of Section 6
Latitude: 47 degrees, 14 minutes, 3 seconds LL/GPS registration:
Longitude: 94 degrees, 31 minutes, 47 seconds *Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 400 Elev. (ft.): 1300 Slope: 00LV Slope Position: _
*ECS Subsection: 6 (Chippewa Plains)
Minnesota Soil Atlas Mapping Unit: NP
*Geomorphic Unit: 48 (Guthrie Till Plain)

Remarks: Relevé in very wet swamp.
Deep (3-3 1/2 Ft.) pools of water cover 25-30% of plot.
State stand #5.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Broadleaf Deciduous, Height: 10-35m, Cover interrupted

4. Fraxinus nigra (Black ash)

Woody Broadleaf Deciduous, Height: 2-10m, Cover rare

+. Alnus incana (Speckled alder)
+. Cornus cf. stolonifera (Red-osier dogwood)
+. Fraxinus nigra (Black ash)

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare

+. Rhus radicans
+. Ribes americanum (Wild black currant)
+. Rubus cf. occidentalis (Black raspberry)

Climber, Height: 2-5m, Cover almost absent

+. Parthenocissus inserta (Virginia creeper)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Graminoid, Height: .0-2m, Cover patchy

- 2. *Glyceria striata* (Fowl manna grass)
- +. *Calamagrostis canadensis* (Blue-joint)
- +. *Carex cf. brunnescens*
- +. *Carex comosa*
- +. *Carex retrorsa*
- +. *Carex rosea*
- +. *Carex stipata*
- +. *Cinna latifolia* (Wood reedgrass)
- +. *Elymus virginicus* (Wild-rye)
- +. *Poa palustris* (Fowl meadow grass)

Forb, Height: .0-2m, Cover interrupted

- 1. *Iris versicolor* (Blue Flag)
- +. *Amphicarpaea bracteata* (Hog-peanut)
- +. *Aster lateriflorus* (Side-flowering aster)
- +. *Aster puniceus* (Red-stemmed aster)
- +. *Athyrium angustum* (Lady fern)
- +. *Bidens cf. connata* (European beggar-ticks)
- +. *Calla palustris* (Wild calla)
- +. *Caltha palustris* (Marsh marigold)
- +. *Cicuta bulbifera* (Bulb-bearing water-hemlock)
- +. *Circaea alpina* (Small enchanter's nightshade)
- +. *Equisetum arvense* (Field horsetail)
- +. *Galium trifidum* (Small bedstraw)
- +. *Galium triflorum* (Three-flowered bedstraw)
- +. *Impatiens capensis* (Spotted touch-me-not, jewel-we)
- +. *Lemna minor* (Lesser duckweed)
- +. *Mitella nuda* (Miterwort, naked bishop's-cap)
- +. *Rubus pubescens* (Dwarf blackberry)
- +. *Urtica dioica* (Stinging nettle)
- +. *Viola cf. macloskeyi* (Northern white violet)
- R. *Alisma triviale* (Water-plantain)
- R. *Aralia nudicaulis* (Wild sarsaparilla)
- R. *Dryopteris cristata* (Crested fern)
- R. *Geum aleppicum* (Yellow avens)
- R. *cf. Lactuca* (Tall blue lettuce)
- NON R. *Ranunculus cf. gmelini* (Yellow water-crowfoot)
- R. *Scutellaria galericulata* (Marsh skullcap)
- R. *Sium suave* (Water-parsnip)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+.2		<i>Epigaea repens</i>	L.	var. glab.	Fern.	fl # #	!
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----									

Red Pine Forest

Naturally generated stands of Red Pine are uncommon in Cass County; in most cases, stands have been planted. Of those naturally generated stands, most have been thinned or selectively cut.

Three examples of naturally generated Red Pine Forest in Cass County are relatively easy to visit. The first is in the southwest quarter of the northwest quarter of section 1, North Shingobee Township (T142N, R31W). Pine Point Research and Natural Area (RNA), on land owned by the U.S. Forest Service within Chippewa National Forest (CNF). This 1239 acre RNA was established in 1932 to protect and study the Red, Jack, and White pines found there. This forest is probably the least disturbed of any large upland tract within CNF. It was part of a 10 section tract purchased from the Ojibway in 1908 and was reserved from all but salvage logging. Anyone interested in visiting the RNA should first check with the Walker Ranger District office of CNF and familiarize themselves with the rules concerning visitation and use of RNAs. Red Pine Forest can be found in the northwest quarter of section 1, North Shingobee Township (T142N, R31W).

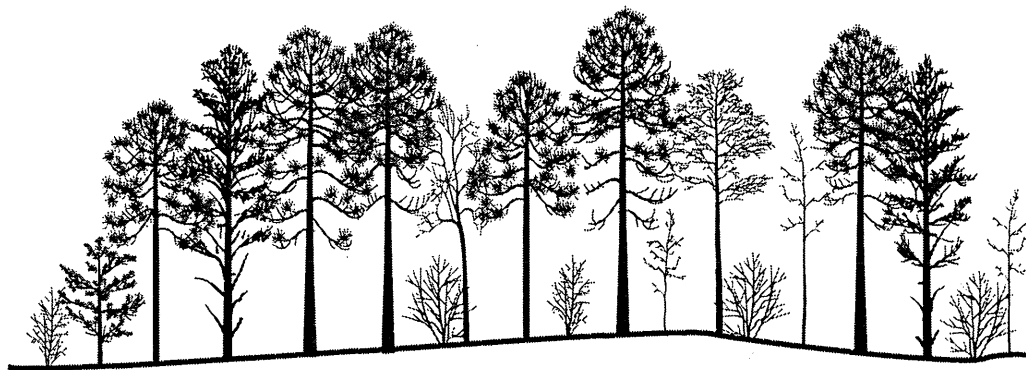
The second example of Red Pine Forest is on the St. Croix Moraine in Deerfield Township (T139N, R31W), in the southeast quarter of the northeast quarter of section 14. Take County Road 116 along the west side of Pine Mountain Lake west of Backus. Turn northwest on the Deerfield Trail at the northwest corner of the lake. A spur trail to the west leaves the main trail about 1 mile in

and follows the ridge on which the Red Pine Forest occurs.

Red Pine Forest can also be seen on the Bemidji Sand Plain around Pike Bay and Cass Lake. A stand designated as old growth Red Pine Forest by CNF is located on the west side of Pike Bay. Take Highway 371 south of Cass Lake and turn east on County Road 146. The forest is in section 22 of Pike Bay township (T145, R31).

Plants often found in Red Pine Forests in the county include Large-leaved Aster (*Aster macrophyllus*), Bracken (*Pteridium aquilinum*), Beaked Hazel (*Corylus cornuta*), Bush Honeysuckle, (*Diervilla lonicera*), Juneberry (*Amelanchier* spp.), Red Maple (*Acer rubrum*), Blue-bead Lily (*Clintonia borealis*), Mountain Rice-grass (*Oryzopsis asperifolia*), and Blueberry (*Vaccinium angustifolium*).

- See pages 22-23 of *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed) for a description of Red Pine Forest.
- See the Chapter 4 in this notebook for a description of MCBS sites 55 and 122.
- See the accompanying plant community map on page 5.5.2 for the locations of these examples:
 - 20) Pine Point RNA MCBS Site 55
 - 21) Deerfield MCBS Site 122
- Releve 4447, recorded in Site 122, and releve 4863, recorded in Site 55 are on the following pages.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVE #:4447

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVE REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relève #: 93-42

EO Rec #: 18450

*Surveyor's ID Code: JSB (Janet S. Boe)

Date: 16 Month: AUG Year: 1993 (e.g. 04 JUL 1993)

CBS Site #: 122 or Site Name: DEERFIELD 22

DNR Ownership Code: 99 (Owner Unknown)

*NC Code: RPXXXX (Red Pine Forest)

Commun. Ranking in Relève: Stand typical of Commun. Type: Relève typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)

Quad Codes DNR: K11D Universal: 46094G5 (Backus)

Township: 139N (e.g. 143N) Range: 31W (e.g. 32W)

QORT: SE QRT: NE of Section 14

Latitude: 46 degrees, 51 minutes, 24 seconds

LL/GPS registration:

Longitude: 94 degrees, 33 minutes, 23 seconds

*Accuracy: _ Marker: _

RELEVE INFORMATION

Relève Size (sq. m.): 400 Elev. (ft.): 1450 Slope: 12SE

Slope Position: _

*ECS Subsection: 9 (Pine Moraines & Outwash Plains)

Minnesota Soil Atlas Mapping Unit: XLWL

*Geomorphic Unit: 09 (St. Croix Moraine)

Remarks: RP STAND ALONG DEERFIELD TR. LARRY OLSON (CASS CTY LAND DEPT) REPORTS
THAT STAND IS THINNED CA EVERY 10 YRS. CSA 2: NP57. GROUND: ALL NEEDLE
DUFF. MOSS ON STUMPS. <5% BLOWDOWN (BRANCHES). COUNTY ST#5.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relève Handbook)

Woody Needleleaf Evergreen, Height: 10-35m, Cover interrupted

4. Pinus resinosa (Red pine, Norway pine)

Woody Broadleaf Deciduous, Height: 10-20m, Cover barely present

+. Populus tremuloides (Quaking aspen)

Woody Broadleaf Deciduous, Height: 2-10m, Cover patchy

2. Betula papyrifera (Paper birch)

2. Corylus cornuta (Beaked hazelnut)

+. Acer rubrum (Red maple)

+. Cornus rugosa (Round-leaved dogwood)

+. Prunus virginiana (Chokecherry)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

Woody Broadleaf Deciduous, Height: .0-2m, Cover patchy

- 2. *Corylus cornuta* (Beaked hazelnut)
- 1. *Diervilla lonicera* (Bush honeysuckle)
- +. *Acer rubrum* (Red maple)
- +. *Amelanchier* (Juneberry; Serviceberry; Saska)
- +. *Cornus rugosa* (Round-leaved dogwood)
- +. *Populus tremuloides* (Quaking aspen)
- +. *Prunus virginiana* (Chokecherry)
- +. *Quercus rubra* (Northern red oak)
- +. *Rhus radicans*
- +. *Rosa acicularis* (Prickly rose)
- +. *Rubus cf. pensilvanicus*
- +. *Salix humilis* (Prairie willow)
- +. *Symphoricarpos albus* (Snowberry)
- +. *Vaccinium angustifolium* (Blueberry)
- +. *Viburnum rafinesquianum* (Downy arrowwood)
- R. *Acer spicatum* (Mountain maple)
- R. *Prunus serotina* (Black cherry)

Climber, Height: .0-2m, Cover almost absent

- +. *Parthenocissus inserta* (Virginia creeper)

Graminoid, Height: .0-.5m, Cover barely present

- +. *Carex pensylvanica*
- +. *Oryzopsis asperifolia* (Mountain rice-grass)

Forb, Height: .0-2m, Cover interrupted

- 2. *Aster macrophyllus* (Large-leaved aster)
- 2. *Pteridium aquilinum* (Bracken)
- +. *Amphicarpaea bracteata* (Hog-peanut)
- +. *Anemone quinquefolia*
- +. *Apocynum androsaemifolium* (Spreading dogbane)
- +. *Aralia nudicaulis* (Wild sarsaparilla)
- +. *Aster ciliolatus* (Lindley's aster)
- +. *Athyrium angustum* (Lady fern)
- +. *Galium triflorum* (Three-flowered bedstraw)
- +. *Helianthus strumosus* (Woodland sunflower)
- +. *Lathyrus ochroleucus* (Pale vetchling)
- +. *Lathyrus venosus* (Veiny pea)
- +. *Maianthemum canadense* (Canada mayflower)
- +. *Melampyrum lineare* (Cow-wheat)
- +. *Pyrola cf. chlorantha*
- +. *Rubus pubescens* (Dwarf blackberry)
- +. *Uvularia sessilifolia* (Pale bellwort)
- R. *Aquilegia canadensis* (Columbine)
- R. *Clintonia borealis* (Blue-bead lily)
- R. *Fragaria virginiana* (Common strawberry)
- R. *Sanicula marilandica* (Black snakeroot)
- R. *Streptopus roseus* (Rose twisted-stalk)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+.2		Epigaea repens	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

DNR RELEVE #: 4447 continued, Page 3

Forb, Height: .0-2m, Cover interrupted (continued)

R. Vicia americana OP (American vetch)

R. Viola (Violet)

----- EXAMPLE RECORD -----

!	Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+2	Epigaea	repens	L.	var. glab.	Fern.	fl # #	!
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----								

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4863

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 94-20 EO Rec #: 294
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 14 Month: JUL Year: 1994 (e.g. 04 JUL 1993)
CBS Site #: 55 or Site Name: PINE POINT
DNR Ownership Code: 02 (U.s. Forest Service (National Forest))
*NC Code: RPXXXX (Red Pine Forest)
Commun. Ranking in Relevé: AB Stand typical of Commun. Type: _ Relevé typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J11A Universal: 47094B5 (Steamboat Bay)
Township: 142N (e.g. 143N) Range: 31W (e.g. 32W)
QORT: SW QRT: NW of Section 1
Latitude: 47 degrees, 8 minutes, 50 seconds LL/GPS registration:
Longitude: 94 degrees, 32 minutes, 57 seconds *Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 400 Elev. (ft.): 1360 Slope: 02SE Slope Position: _
*ECS Subsection: 9 (Pine Moraines & Outwash Plains)
Minnesota Soil Atlas Mapping Unit: SSWL
*Geomorphic Unit: 11 (Itasca Moraine)

Remarks: Relevé in pine (Pine Point RNA). Clusters of pine varying in density,
with red maple & trembling aspen. Medium diameter coarse woody debris
common. Soil 2" sandy loam over 16" fine tan sand.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Needleleaf Evergreen, Height: 10-20m, Cover interrupted

- 3. Pinus resinosa (Red pine, Norway pine)
- 2. Pinus strobus (White pine)
- R. Pinus banksiana (Jack pine)
- R. Pinus banksiana DD (Jack pine)

Woody Needleleaf Evergreen, Height: .0-2m, Cover almost absent

- +. Pinus strobus (White pine)

Woody Broadleaf Deciduous, Height: 10-20m, Cover patchy

- 2. Acer rubrum (Red maple)
- 2. Populus tremuloides (Quaking aspen)
- R. Populus tremuloides DD (Quaking aspen)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Woody Broadleaf Deciduous, Height: 2-10m, Cover rare

- 2. *Corylus cornuta* (Beaked hazelnut)
- +. *Populus tremuloides* (Quaking aspen)
- +. *Quercus macrocarpa* (Bur oak)
- R. *Corylus americana* (American hazelnut)

Woody Broadleaf Deciduous, Height: .0-2m, Cover patchy

- 2. *Corylus cornuta* (Beaked hazelnut)
- 2. *Diervilla* (Bush honeysuckle)
- 2. *Vaccinium angustifolium* (Blueberry)
- +. *Corylus americana* (American hazelnut)
- +. *Quercus rubra* (Northern red oak)
- +. *Rubus strigosus* (Red raspberry)
- R. *Acer rubrum* (Red maple)
- R. *Amelanchier DY* (Juneberry; Serviceberry; Saska)
- R. *Prunus virginiana* (Chokecherry)

Climber, Height: .0-2m, Cover almost absent

- +. *Lonicera dioica* (Wild Honeysuckle)
- R. *Parthenocissus inserta* (Virginia creeper)

Graminoid, Height: .0-2m, Cover barely present

- +. *Carex pensylvanica*
- +. *Oryzopsis asperifolia* (Mountain rice-grass)

Forb, Height: .0-2m, Cover interrupted

- 3. *Aster macrophyllus* (Large-leaved aster)
- 3. *Pteridium aquilinum* (Bracken)
- +. *Anemone quinquefolia*
- +. *Aquilegia canadensis* (Columbine)
- +. *Aralia nudicaulis* (Wild sarsaparilla)
- +. *Aster ciliolatus* (Lindley's aster)
- +. *Chimaphila umbellata* (Pipsissewa)
- +. *Clintonia borealis* (Blue-bead lily)
- +. *Fragaria virginiana* (Common strawberry)
- +. *Galium triflorum* (Three-flowered bedstraw)
- +. *Goodyera tessellata* ## (Rattlesnake-plantain)
- +. *Lathyrus ochroleucus* (Pale vetchling)
- +. *Lathyrus venosus* (Veiny pea)
- +. *Linnaea borealis* (Twin-flower)
- +. *Maianthemum canadense* (Canada mayflower)
- +. *Melampyrum lineare* (Cow-wheat)
- +. *Pyrola secunda* (One-sided pyrola)
- +. *Rubus pubescens* (Dwarf blackberry)
- +. *Solidago juncea* (Early goldenrod)
- +. *Streptopus roseus* (Rose twisted-stalk)
- +. *Thalictrum dioicum* (Early meadow rue)
- +. *Trientalis borealis* (Starflower)
- R. *Polygonatum pubescens* (Hairy Solomon's-seal)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+.2		Epigaea repens	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

DNR RELEVÉ #: 4863 continued, Page 3

Woody Broadleaf Evergreen, Height: .0-2m, Cover patchy
+. Gaultheria hispidula (Creeping snowberry)

Lichen/Moss, Height: .0-.5m, Cover barely present
+. Unknown or Indeterminable Plant

----- EXAMPLE RECORD -----

! Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
! +.2		Epigaea repens	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Oak Forest

In Cass County, Oak Forest occurs most often on sandy soil on outwash plains in the northern part of the county, or gravelly soil on morainic deposits in the southern part of the county. Plants often found in Mesic Oak Forests in the county include Wild Sarsaparilla (*Aralia nudicaulis*), Juneberry (*Amelanchier* spp.), Large-leaved Aster (*Aster macrophyllus*), Pennsylvania Sedge (*Carex pensylvanica*), Pagoda Dogwood (*Cornus alternifolia*), Beaked Hazelnut (*Corylus cornuta*), Bush Honeysuckle (*Diervilla lonicera*), Mountain Rice-grass (*Oryzopsis asperifolia*), Black Cherry (*Prunus serotina*), Chokecherry (*Prunus virginiana*), Bracken (*Pteridium aquilinum*), Black Snakeroot (*Sanicula marilandica*), False Solomon's-seal (*Smilacina racemosa*), and Rose Twisted-stalk (*Streptopus roseus*).

An old-growth Oak Forest (MCBS Site 102) occurs on Bear Island in Leech Lake; this forest is dominated by Bur and Red Oak (*Quercus macrocarpa*; *Q. rubra*), and has Sugar Maple (*Acer saccharum*), Basswood (*Tilia americana*), and Black Cherry (*Prunus serotina*) in the understory. The stand is in the SE quarter of the NE quarter of section 11 of Unorganized 4 Township (T142N, R29W) on land owned by Cass County and the U.S. Forest Service.

A county-owned Oak Forest in the SE quarter of the NW quarter of section 22, South Trelipe Township (T139N, R27W), is dominated by Red oak but also includes some Butternuts (*Juglans cinerea*). This stand is in MCBS Site 163 and is easily accessible. Drive north of Outing on Highway 6 for about 2 miles, then turn west on County Road 48. Travel on County Road 48 for about

6 1/2 miles. Park just west of the creek crossing and walk south on the trail.

A third Oak Forest (MCBS Site 187) is on the St. Croix Moraine east of Green Lake in Foothills State Forest. From Pine River, take Hwy. 2 west for 4 miles, then turn south on Co. Rd. 26 for 6 miles. At the junction with Co. Rd. 28, turn west and continue west for about 2 miles. Then turn north and follow the gravel road north to the public access on Green Lake. Oak Forest surrounds Green Lake.

- See pages 15-16 of *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed) for a description of Oak Forest.
- See the Chapter 4 in this notebook for a description of MCBS sites 163, 187, and 102, where these Oak Forests are found.
- See the accompanying plant community map on page 5.5.2 for the locations of these examples:
 - 11) Bear Island MCBS Site 102
 - 12) Pistol Lake MCBS Site 163
 - 13) Foothills State Forest MCBS Site 187
- Releve 4433 was recorded in Site 187; releves 4849, 4850, and 4851 were recorded in Site 102; and releve 4882 and plant list 9463 were recorded in Site 187. They are reproduced on the following pages.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4433

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 93-28

EO Rec #: 18440

*Surveyor's ID Code: JSB (Janet S. Boe)

Date: 22 Month: JUL Year: 1993 (e.g. 04 JUL 1993)

CBS Site #: 187 or Site Name: BUNGO 29

DNR Ownership Code: 99 (Owner Unknown)

*NC Code: OACEXX (Oak Forest (Central))

Commun. Ranking in Relevé: Stand typical of Commun. Type: _ Relevé typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)

Quad Codes DNR: L11B Universal: 46094F6 (Spider Lake)

Township: 137N (e.g. 143N) Range: 31W (e.g. 32W)

QRT: SW QRT: SE of Section 29

Latitude: 46 degrees, 38 minutes, 49 seconds

LL/GPS registration:

Longitude: 94 degrees, 37 minutes, 40 seconds

*Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 400 Elev. (ft.): 1540 Slope: 10W

Slope Position: _

*ECS Subsection: 9 (Pine Moraines & Outwash Plains)

Minnesota Soil Atlas Mapping Unit: XLWL

*Geomorphic Unit: 09 (St. Croix Moraine)

Remarks: CTY FOREST INVENTORY LISTS AS 054. OAK W/BIRCH. PLOT E OF GREEN LAKE,
ON HILL JUST E OF RD & CA 1ST CORNER S OF PUBLIC LANDING. GRND CVR:
DECID LF DUFF, SM BRANCHES. SM LOGS @ 5% CVR. County st.#26.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Broadleaf Deciduous, Height: 10-20m, Cover interrupted

4. Quercus rubra (Northern red oak)

Woody Broadleaf Deciduous, Height: 2-10m, Cover patchy

2. Acer rubrum (Red maple)
2. Cornus rugosa (Round-leaved dogwood)
+. Populus tremuloides (Quaking aspen)
+. Prunus serotina (Black cherry)
+. Viburnum rafinesquianum (Downy arrowwood)
R. Fraxinus pennsylvanica (Green ash)

Woody Broadleaf Deciduous, Height: .0-2m, Cover patchy

2. Cornus rugosa (Round-leaved dogwood)
2. Corylus cornuta (Beaked hazelnut)
2. Viburnum rafinesquianum (Downy arrowwood)
1. Acer rubrum (Red maple)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Woody Broadleaf Deciduous, Height: .0-2m, Cover patchy (continued)

- + . Amelanchier (Juneberry; Serviceberry; Saska)
- + . Diervilla lonicera (Bush honeysuckle)
- + . Prunus serotina (Black cherry)
- + . Prunus virginiana (Chokecherry)
- + . Quercus rubra (Northern red oak)
- + . Rubus cf. allegheniensis (Common blackberry)
- + . Vaccinium angustifolium (Blueberry)
- R. Lonicera canadensis (Fly honeysuckle)
- R. Rubus strigosus (Red raspberry)
- R. Tilia americana (Basswood)

Climber, Height: .0-2m, Cover almost absent

- + . Parthenocissus inserta (Virginia creeper)

Graminoid, Height: .0-.5m, Cover barely present

- + . Carex pensylvanica
- + . Oryzopsis asperifolia (Mountain rice-grass)
- R. Brachyelytrum erectum (Bearded short-husk)
- R. Calamagrostis canadensis (Blue-joint)

Forb, Height: .0-2m, Cover interrupted

- 2. Pteridium aquilinum (Bracken)
- + . Amphicarpaea bracteata (Hog-peanut)
- + . Aralia nudicaulis (Wild sarsaparilla)
- + . Aster macrophyllus (Large-leaved aster)
- + . Clintonia borealis (Blue-bead lily)
- + . Corallorhiza striata (Striped coral-root)
- + . Galium triflorum (Three-flowered bedstraw)
- + . Hepatica americana (Round-lobed hepatica)
- + . Lathyrus venosus (Veiny pea)
- + . Maianthemum canadense (Canada mayflower)
- + . Polygonatum pubescens (Hairy Solomon's-seal)
- + . Prenanthes alba (White rattlesnake-root)
- + . Smilacina racemosa (False Solomon's-seal)
- + . Streptopus roseus (Rose twisted-stalk)
- + . Thalictrum dioicum (Early meadow rue)
- + . Uvularia grandiflora (Yellow bellwort)
- + . Uvularia sessilifolia (Pale bellwort)
- R. Apocynum androsaemifolium (Spreading dogbane)
- R. Lathyrus ochroleucus (Pale vetchling)
- R. Monotropa hypopitys (Pinesap)
- R. Monotropa uniflora (Indian pipe)
- R. Osmorhiza claytonii (Sweet cicely)
- R. Sanicula marilandica (Black snakeroot)
- R. Trientalis borealis (Starflower)

Lichen/Moss, Height: .0-.1m, Cover almost absent

- + . Unknown or Indeterminable Plant

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+ .2	Epigaea	repens	L. var.	glab.	Fern.	fl # #	!

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4849

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 94-06 EO Rec #: 0
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 23 Month: JUN Year: 1994 (e.g. 04 JUL 1993)
CBS Site #: 102 or Site Name: BEAR ISLAND
DNR Ownership Code: (Owner Unknown)
*NC Code: OACEME (Oak Forest (Central) Mesic Subtype)
Commun. Ranking in Relevé: A Stand typical of Commun. Type: _ Relevé typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J12A Universal: 47094B3 (Sugar Point)
Township: 142N (e.g. 143N) Range: 29W (e.g. 32W)
QORT: NE QRT: SW of Section 2
Latitude: 47 degrees, 8 minutes, 41 seconds LL/GPS registration:
Longitude: 94 degrees, 18 minutes, 38 seconds *Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 400 Elev. (ft.): 1320 Slope: 00LV Slope Position: _
*ECS Subsection: 6 (Chippewa Plains)
Minnesota Soil Atlas Mapping Unit: LLWL
*Geomorphic Unit: 24 (Swatara Plain)

Remarks: Eryth alb site. Oak super canopy, sugar maple canopy.
Ground cover of decid leaf duff. Occas small-med diam coarse woody
Rnk=A/AB. Leech Lake Tribal Land NH41.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Broadleaf Deciduous, Height: 10-35m, Cover continuous

- 5. Acer saccharum (Sugar maple)
- 4. Quercus macrocarpa (Bur oak)

Woody Broadleaf Deciduous, Height: 5-10m, Cover almost absent

- R. Acer saccharum (Sugar maple)

Woody Broadleaf Deciduous, Height: .0-2m, Cover barely present

- +. Acer saccharum (Sugar maple)
- +. cf. Fraxinus SD (Ash)
- +. Prunus virginiana (Chokecherry)
- +. Quercus rubra SD (Northern red oak)
- +. Sambucus pubens (Red-berried Elder)
- R. Populus tremuloides DY (Quaking aspen)
- R. Prunus serotina (Black cherry)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Forb, Height: .0-2m, Cover continuous

- 2. *Hydrophyllum virginianum* FR (Virginia waterleaf)
- 1. *Asarum canadense* (Wild ginger)
- 1. *Sanguinaria canadensis* (Bloodroot)
- 1. *Smilacina racemosa* (False Solomon's-seal)
- +. *Actaea rubra* (Red baneberry)
- +. *Allium tricoccum* (Wild leek)
- +. *Athyrium angustum* (Lady fern)
- +. *Caulophyllum thalictroides* (Blue cohosh)
- +. *Osmorhiza claytonii* FR (Sweet cicely)
- +. *Osmorhiza longistylis* FR (Anise-root)
- +. *Polygonatum pubescens* (Hairy Solomon's-seal)
- +. *Streptopus roseus* (Rose twisted-stalk)
- +. *Thalictrum dioicum* (Early meadow rue)
- +. *Trillium cernuum*
- +. *Uvularia grandiflora* (Yellow bellwort)
- +. *Viola pubescens* (Smooth yellow violet)

----- EXAMPLE RECORD -----

!	Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+.2		<i>Epigaea repens</i>	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4850

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 94-07
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 23 Month: JUN Year: 1994 (e.g. 04 JUL 1993)
CBS Site #: 102 or Site Name: BEAR ISLAND
DNR Ownership Code: 00 (Private Ownership)
*NC Code: OACEME (Oak Forest (Central) Mesic Subtype)
Commun. Ranking in Relevé: A Stand typical of Commun. Type: _ Relevé typical of Stand: _

EO Rec #: 0

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J12A Universal: 47094B3 (Sugar Point)
Township: 142N (e.g. 143N) Range: 29W (e.g. 32W)
QORT: SE QRT: NE of Section 11
Latitude: 47 degrees, 8 minutes, 7 seconds
Longitude: 94 degrees, 18 minutes, 0 seconds
LL/GPS registration:
*Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 400 Elev. (ft.): 1320 Slope: 00LV Slope Position: _
*ECS Subsection: 6 (Chippewa Plains)
Minnesota Soil Atlas Mapping Unit: LLWL
*Geomorphic Unit: 24 (Swatara Plain)

Remarks: Relevé in oak-basswood stand at top of ridge on Bear Island. Occasnl
small-med diam coarse woody debris. Ground cover of decid leaf duff.
Relevé rep. of stand. Rank = A/AB. LEECH LK TRIBAL ALLOTS.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Broadleaf Deciduous, Height: 10-35m, Cover continuous

4. Quercus rubra (Northern red oak)
3. Tilia americana (Basswood)
2. Quercus macrocarpa (Bur oak)

Woody Broadleaf Deciduous, Height: 2-10m, Cover patchy

3. Tilia americana (Basswood)
1. Amelanchier (Juneberry; Serviceberry; Saskia)

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare

- +. Acer negundo (Box elder)
- +. Cornus alternifolia (Pagoda dogwood)
- +. Corylus cornuta (Beaked hazelnut)
- +. Prunus virginiana (Chokecherry)
- +. Quercus rubra (Northern red oak)
- +. Rhus radicans

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare (continued)

- + . Ribes cf. cynosbati (Prickly gooseberry, dogberry)
- + . Viburnum lentago (Nannyberry)
- R. Amelanchier (Juneberry; Serviceberry; Saska)
- R. Prunus serotina (Black cherry)
- R. Rubus strigosus (Red raspberry)

Climber, Height: .0-.5m, Cover almost absent

- + . Parthenocissus inserta (Virginia creeper)
- NON + . Vitis riparia (Wild grape)

Graminoid, Height: .0-.5m, Cover almost absent

- + . Carex pensylvanica
- R. Schizachne purpurascens (False melic grass)

Forb, Height: .0-2m, Cover continuous

- 2. Pteridium aquilinum (Bracken)
- + . Amphicarpaea bracteata (Hog-peanut)
- + . Anemone quinquefolia
- + . Aralia nudicaulis (Wild sarsaparilla)
- + . Aster macrophyllus (Large-leaved aster)
- + . Circaea lutetiana (Enchanter's nightshade)
- + . Cypripedium calceolus (Yellow lady-slipper)
- + . Hydrophyllum virginianum (Virginia waterleaf)
- + . Osmorhiza claytonii (Sweet cicely)
- + . Osmorhiza longistylis (Anise-root)
- + . Phryma leptostachya (Lopseed)
- + . Polygonatum pubescens (Hairy Solomon's-seal)
- + . Sanguinaria canadensis (Bloodroot)
- + . Smilax cf. lasioneura (Carrion-flower)
- + . Smilacina racemosa (False Solomon's-seal)
- + . Streptopus roseus (Rose twisted-stalk)
- + . Thalictrum dioicum (Early meadow rue)
- + . Uvularia grandiflora (Yellow bellwort)
- + . Viola canadensis (Rugulose violet)
- R. Actaea rubra (Red baneberry)
- R. Apocynum androsaemifolium (Spreading dogbane)
- R. cf. Aster
- R. Aster umbellatus (Flat-topped aster)
- R. Lathyrus ochroleucus (Pale vetchling)
- R. Sanicula marilandica (Black snakeroot)
- R. Trientalis borealis (Starflower)

----- EXAMPLE RECORD -----

!	Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+ .2	Epigaea	repens	L.	var. glab.	Fern.	fl # #	!
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----								

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:4851

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 94-08 EO Rec #: 0
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 23 Month: JUN Year: 1994 (e.g. 04 JUL 1993)
CBS Site #: 102 or Site Name: BEAR ISLAND
DNR Ownership Code: 00 (Private Ownership)
*NC Code: OACEME (Oak Forest (Central) Mesic Subtype)
Commun. Ranking in Relevé: AB Stand typical of Commun. Type: _ Relevé typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: J12D Universal: 47094A3 (Whipholt)
Township: 142N (e.g. 143N) Range: 29W (e.g. 32W)
QORT: SE QRT: NE of Section 23
Latitude: 47 degrees, 6 minutes, 16 seconds LL/GPS registration:
Longitude: 94 degrees, 18 minutes, 8 seconds *Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 400 Elev. (ft.): 1340 Slope: 08NW Slope Position: _
*ECS Subsection: 6 (Chippewa Plains)
Minnesota Soil Atlas Mapping Unit: LLWL
*Geomorphic Unit: 24 (Swatara Plain)

Remarks: On slope of 2nd knoll on west side of Bear Island. Occas coarse woody debris. 1 well-decayed log. Stand exposed to wind. Oak forest being replaced by MB forest. Rank = AB/B? Leech Lk tribal NH42.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Broadleaf Deciduous, Height: 10-35m, Cover continuous

- 3. Acer saccharum (Sugar maple)
- 3. Quercus macrocarpa (Bur oak)
- 3. Tilia americana (Basswood)

Woody Broadleaf Deciduous, Height: 2-10m, Cover patchy

- 3. Acer saccharum (Sugar maple)
- 2. Prunus virginiana (Chokecherry)
- R. Ostrya virginiana (Ironwood, hop hornbeam)

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare

- +. Acer saccharum (Sugar maple)
- +. Prunus virginiana (Chokecherry)
- R. Ribes lacustre (Swamp black currant)
- R. Tilia americana SD (Basswood)
- R. Ulmus americana (American elm)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Graminoid, Height: .0-.5m, Cover barely present

- 1. Carex sprengelii
- +. Carex pensylvanica
- +. Carex rosea
- +. Miliun effusum (Woodland millet grass)

Forb, Height: .0-2m, Cover continuous

- 4. Hydrophyllum virginianum (Virginia waterleaf)
- +. Aralia nudicaulis (Wild sarsaparilla)
- +. Caulophyllum thalictroides (Blue cohosh)
- +. Sanguinaria canadensis (Bloodroot)
- +. Smilacina racemosa (False Solomon's-seal)
- +. Smilacina stellata (Starry false Solomon's-seal)
- +. Streptopus roseus (Rose twisted-stalk)
- +. Thalictrum dioicum (Early meadow rue)
- +. Trillium cernuum
- +. Uvularia grandiflora (Yellow bellwort)
- +. Viola cf. canadensis (Rugulose violet)
- R. Arisaema triphyllum (Jack-in-the-pulpit)
- R. Osmorhiza claytonii (Sweet cicely)
- R. Solidago flexicaulis OP (Zig-zag goldenrod)

----- EXAMPLE RECORD -----

!	Cover.Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+2	Epigaea	repens	L. var. glab.	Fern.	fl # #	!	
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----								

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVE #:4882

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVE REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relve #: 94-49

EO Rec #: 0

*Surveyor's ID Code: JSB (Janet S. Boe)

Date: 7 Month: SEP Year: 1994 (e.g. 04 JUL 1993)

CBS Site #: 163 or Site Name: BLIND LAKE 29

DNR Ownership Code: 70 (County Forest)

*NC Code: OACEME (Oak Forest (Central) Mesic Subtype)

Commun. Ranking in Relve:AB Stand typical of Commun. Type:_ Relve typical of Stand:_

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)

Quad Codes DNR: K13D Universal: 46094G1 (Mitchell Lake)

Township: 139N (e.g. 143N) Range: 27W (e.g. 32W)

QORT: SE QRT: NW of Section 22

Latitude: 46 degrees, 50 minutes, 35 seconds

LL/GPS registration:

Longitude: 94 degrees, 4 minutes, 58 seconds

*Accuracy: _ Marker: _

RELEVE INFORMATION

Relve Size (sq. m.): 400 Elev. (ft.): 1400 Slope: 00LV

Slope Position: _

*ECS Subsection: 9 (Pine Moraines & Outwash Plains)

Minnesota Soil Atlas Mapping Unit: LLPL

*Geomorphic Unit: 12 (Stewart Lake Till Plain)

Remarks: County stand #16. Ground cover of deciduous leaf duff.

Occas medium diam coarse woody debris, including paper birch logs. Few well-decayd stumps. Undulatng grnd from stmps, tip-ups, logs

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relve Handbook)

Woody Broadleaf Deciduous, Height: 10-35m, Cover continuous

- 4. Quercus rubra (Common red oak)
- 2. Acer rubrum (Red maple)
- R. Quercus rubra DD (Common red oak)

Woody Broadleaf Deciduous, Height: 2-10m, Cover rare

- 2. Acer saccharum (Sugar maple)
- 2. Ostrya virginiana (Ironwood, hop hornbeam)
- +. Acer rubrum (Red maple)
- R. Betula papyrifera DD OP (Paper birch)

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare

- 1. Ostrya virginiana (Ironwood, hop hornbeam)
- 1. Quercus rubra SD (Common red oak)
- +. Acer rubrum (Red maple)
- +. Acer saccharum (Sugar maple)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

Woody Broadleaf Deciduous, Height: .0-2m, Cover rare (continued)

- + . Amelanchier (Juneberry; Serviceberry; Saska)
- + . Cornus alternifolia (Pagoda dogwood)
- + . Corylus cornuta (Beaked hazelnut)
- + . Diervilla lonicera (Bush honeysuckle)
- + . Lonicera canadensis (Fly honeysuckle)
- + . Rubus (Bramble)
- R. Dirca palustris (Leatherwood)
- R. Prunus serotina (Black cherry)
- R. Prunus virginiana (Chokecherry)
- R. Rosa cf. acicularis (Prickly rose)

Climber, Height: .0-2m, Cover almost absent

- + . Lonicera hirsuta (Hairy honeysuckle)

Graminoid, Height: .0-2m, Cover barely present

- + . Brachyelytrum erectum (Bearded short-husk)
- + . Carex pensylvanica
- + . Oryzopsis asperifolia (Mountain rice-grass)

Forb, Height: .0-2m, Cover rare

- 1. Aster macrophyllus (Large-leaved aster)
- 1. Pteridium aquilinum (Bracken)
- 1. Uvularia sessilifolia FR (Pale bellwort)
- + . Apocynum androsaemifolium (Spreading dogbane)
- + . Aralia nudicaulis (Wild sarsaparilla)
- + . Clintonia borealis (Blue-bead lily)
- + . Fragaria virginiana (Common strawberry)
- + . Lathyrus venosus (Veiny pea)
- + . Maianthemum canadense (Canada mayflower)
- + . Rubus pubescens (Dwarf blackberry)
- + . Uvularia grandiflora (Yellow bellwort)
- R. Amphicarpaea bracteata (Hog-peanut)
- R. Anemone quinquefolia
- R. Sanicula marilandica (Black snakeroot)
- R. Smilacina racemosa OP (False Solomon's-seal)
- R. Trientalis borealis (Starflower)
- R. Viola canadensis (Rugulose violet)

Woody Broadleaf Evergreen, Height: .0-2m, Cover barely present

- + . Gaultheria procumbens (Wintergreen)
- + . Vaccinium myrtilloides (Velvet-leaf blueberry)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+ .2		Epigaea repens	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

- FINAL RELEVÉ SPECIES LIST REPORT FORM, MINNESOTA VEGETATION DATABASE -

DNR RELEVÉ NUMBER: 9463
DATE: 7 JUL 1994
BY: Janet S. Boe
Cass County, MN
Mitchell Lake (K13D)

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

Site Name: MCBS #163
Location: NE of NW of S. 22, T. 139N, R. 27W
Ownership: County Forest
Heritage Community Element: Oak Forest (Central) Mesic Subtype
Element Occurrence Size: 0 (acres), Rank: na, Sitesize: 0 (acres)
Soil Atlas Mapping Unit:
Other Data Collected:

----- PLOT CHARACTERISTICS -----

Red oak with red maple and sugar maple. JSB #PL94163.
County stand #16.

Acer rubrum (Red maple)
Acer saccharum (Sugar maple)
Amelanchier (Juneberry; Serviceberry; Saskia)
Amphicarpaea bracteata (Hog-peanut)
Anemone quinquefolia
Apocynum androsaemifolium (Spreading dogbane)
Aralia nudicaulis (Wild sarsaparilla)
Aralia racemosa (American spikenard)
Aster macrophyllus (Large-leaved aster)
Aster puniceus (Red-stemmed aster)
Athyrium angustum (Lady fern)
Botrychium virginianum (Rattlesnake-fern)
Brachyelytrum erectum (Bearded short-husk)
Carex intumescens
Carex pedunculata
Carex pensylvanica
Clintonia borealis (Blue-bead lily)
Corallorhiza trifida (Early coral-root)
Cornus alternifolia (Pagoda dogwood)
Corylus cornuta (Beaked hazelnut)
Diervilla lonicera (Bush honeysuckle)
Dirca palustris (Leatherwood)
Galium triflorum (Three-flowered bedstraw)
Hepatica americana (Round-lobed hepatica)
SPC Juglans cinerea (Butternut)
Maianthemum canadense (Canada mayflower)
Oryzopsis asperifolia (Mountain rice-grass)
Osmorhiza claytonii (Sweet cicely)
Osmunda claytoniana (Interrupted fern)
Ostrya virginiana (Ironwood, hop hornbeam)
Phryma leptostachya (Lopseed)
Polygonatum pubescens (Hairy Solomon's-seal)
Populus grandidentata (Big-toothed aspen)
Populus tremuloides (Quaking aspen)
Prunus virginiana (Chokecherry)
Pteridium aquilinum (Bracken)

Releve Number 9463 Species List Continued, Page 2

Pyrola elliptica (Common pyrola)
Quercus rubra (Northern red oak)
Ribes triste (Swamp red currant)
Rubus pubescens (Dwarf blackberry)
Rubus strigosus (Red raspberry)
Sanicula marilandica (Black snakeroot)
Smilax (Greenbrier; Catbrier)
STREVALO no match in MNTaxa, MossTaxa, or LichTaxa
Thalictrum dioicum (Early meadow rue)
Tilia americana (Basswood)
Trientalis borealis (Starflower)
Trillium cernuum
Uvularia grandiflora (Yellow bellwort)
Uvularia sessilifolia (Pale bellwort)
Viburnum rafinesquianum (Downy arrowwood)
Viola canadensis var. rugulosa (Rugulose violet)

Black Spruce Bog

One of the most interesting Black Spruce Bogs in Cass County is in Hole-in-the-Bog Lake Peatland Scientific and Natural Area. This Black Spruce Bog is the best known example of a basin-filled raised bog in Minnesota. This relatively unusual type of bog can be open or forested. Three-fruited sedge (*Carex trisperma*), Velvet-leaf blueberry (*Vaccinium myrtilloides*), Cotton-grass (*Eriophorum spissum*), Three-leaved false Solomon's-seal (*Smilacina trifolia*), and several species of ericaceous shrubs, including Labrador tea (*Ledum groenlandicum*), Leather-leaf (*Chamaedaphne calyculata*), and Bog laurel (*Kalmia polifolia*), grow there beneath the stunted Black spruce. Sphagnum mosses blanket the bog. Hole-in-the-Bog Lake Peatland is the only Scientific and Natural Area in Cass County. A description of this bog can be found on pg. 5.22 in *A Guide to Minnesota's Scientific and Natural Areas* (Minnesota Dept. of Natural Resources, Scientific and Natural Areas Program, 1995).

This Black Spruce Bog, located in section 9 and parts of the surrounding sections of Unorganized 5 Township (T144N, R28W), is accessible from Highway 8 about 2

miles south of Bena. A road leaves Highway 8 and becomes, in the bog, a trail made by a leech dealer that continues over moss hummocks to the northeast shore of the lake. However, the trail in to the lake is a long and rigorous hike; the bog is perhaps best viewed from Highway 8 by looking west at several points 2-3 miles south of Bena.

- See page 54 in *Minnesota's Native Vegetation: A Key to Natural Communities* (enclosed) for a description of Black Spruce Bog.
- See the Chapter 4 in this notebook for a description of MCBS Site 18 where this Black Spruce Bog is located.
- See the accompanying plant community map on page 5.5.2 for the location of this example:
14) Hole-in-the-bog Lake SNA MCBS Site 18
- Four relevés (1800, 1801, 4451, and 4452) recorded in this bog are on the following pages. Note the species of sphagnum recorded in relevés 1800 and 1801.



MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:1800

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 1586AA EO Rec #: 0
*Surveyor's ID Code: SAJ (D. Sheridan and J. Janssens)
Date: 8 Month: JUL Year: 1992 (e.g. 04 JUL 1993)
CBS Site #: 18 or Site Name: Hole-in-the-Bog Lake
DNR Ownership Code: 02 (U.s. Forest Service (National Forest))
*NC Code: BBXXXX (Black Spruce Bog)
Commun. Ranking in Relevé: Stand typical of Commun. Type: Relevé typical of Stand:

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: I13C Universal: 47094C2 (Bena)
Township: 144N (e.g. 143N) Range: 28W (e.g. 32W)
QORT: NW QRT: NE of Section 16
Latitude: 47 degrees, 17 minutes, 41 seconds LL/GPS registration:
Longitude: 94 degrees, 13 minutes, 43 seconds *Accuracy: Marker:

RELEVÉ INFORMATION

Relevé Size (sq. m.): 100 Elev. (ft.): 1309 Slope: 00LV Slope Position:
*ECS Subsection: 0
Minnesota Soil Atlas Mapping Unit: P2
*Geomorphic Unit:

Remarks: Consult Dr. Jan Janssens for additional plot info in PARADOX system.
Vascular plant and moss collections with Janssens, DUPS at Deer River.
CNF Cass Lake District, Compartment 133, Stand 11.

OTHER DATA COLLECTED

Soils: Y Forestry: N o=old growth Water Chemistry: Y Publication:
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Needleleaf Evergreen, Height: 5-20m, Cover interrupted
4.1 Picea mariana (Black spruce)

Woody Needleleaf Evergreen, Height: .0-5m, Cover barely present
1.1 Picea mariana (Black spruce)

Graminoid, Height: .0-2m, Cover barely present
1.2 Carex trisperma
+.1 Carex oligosperma
+.2 Eriophorum spissum (Cotton-grass)
R.1 Carex pauciflora OP

Forb, Height: .0-2m, Cover rare
2.1 Smilacina trifolia (Three-leaved false Solomon's-s)
+.1 Drosera rotundifolia (Round-leaved sundew)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

Woody Broadleaf Evergreen, Height: .0-2m, Cover interrupted

- 4.3 *Ledum groenlandicum* (Labrador tea)
- 1.3 *Vaccinium macrocarpon* (Large cranberry)
- + .1 *Chamaedaphne calyculata* (Leather-leaf)
- + .3 *Gaultheria hispidula* (Creeping snowberry)
- + .1 *Kalmia polifolia* (Bog laurel)
- + .1 *Vaccinium angustifolium* (Blueberry)

Lichen/Moss, Height: .0-.1m, Cover continuous

- 5. *Sphagnum magellanicum* (moss)
- 2. *Sphagnum angustifolium* (moss)
- 2. *Sphagnum fuscum* (moss)
- 1. *Aulacomnium palustre* (moss)
- 1. *Dicranum ontariense* (moss)
- 1. *Dicranum polysetum* (moss)
- 1. *Pleurozium schreberi* (moss)
- 1. *Pohlia* (moss)
- 1. *Polytrichum strictum* (moss)
- 1. *Ptilidium pulcherrimum* (moss)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+ .2		<i>Epigaea repens</i>	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #:1801

18:55 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 1587AA EO Rec #: 0
*Surveyor's ID Code: SAJ (D. Sheridan and J. Janssens)
Date: 8 Month: JUL Year: 1992 (e.g. 04 JUL 1993)
CBS Site #: 18 or Site Name: Hole-in-the-bog Lake
DNR Ownership Code: 02 (U.S. Forest Service (National Forest))
*NC Code: BBXXXX (Black Spruce Bog)
Commun. Ranking in Relevé: AB Stand typical of Commun. Type: _ Relevé typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: I13C Universal: 47094C2 (Bena)
Township: 144N (e.g. 143N) Range: 28W (e.g. 32W)
QORT: SE QRT: SW of Section 9
Latitude: 47 degrees, 17 minutes, 54 seconds LL/GPS registration:
Longitude: 94 degrees, 13 minutes, 59 seconds *Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 100 Elev. (ft.): 1309 Slope: 00LV Slope Position: _
*ECS Subsection: 0
Minnesota Soil Atlas Mapping Unit: P2
*Geomorphic Unit:

Remarks: Consult Dr. Jan Janssens for additional plot info in PARADOX system.
Vascular plant and moss collections with Janssens, DUPS at Deer River.

OTHER DATA COLLECTED

Soils: Y Forestry: N o=old growth Water Chemistry: Y Publication:
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Needleleaf Evergreen, Height: 5-20m, Cover patchy
3.1 Picea mariana (Black spruce)

Woody Needleleaf Evergreen, Height: .0-5m, Cover rare
2.1 Picea mariana (Black spruce)

Woody Needleleaf Evergreen, Height: .0-.5m, Cover almost absent
+.1 Larix laricina (Tamarack, American larch)

Graminoid, Height: .0-2m, Cover rare
2.2 Eriophorum spissum (Cotton-grass)
+.1 Carex pauciflora
+.2 Carex trisperma

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !
----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

DNR RELEVÉ #: 1801 continued, Page 2

Forb, Height: .0-2m, Cover rare

- 2.1 *Smilacina trifolia* (Three-leaved false Solomon's-s)
- +1.1 *Drosera rotundifolia* (Round-leaved sundew)

Woody Broadleaf Evergreen, Height: .0-2m, Cover interrupted

- 4.3 *Ledum groenlandicum* (Labrador tea)
- 1.1 *Chamaedaphne calyculata* (Leather-leaf)
- 1.1 *Kalmia polifolia* (Bog laurel)
- 1.3 *Vaccinium macrocarpon* (Large cranberry)

Lichen/Moss, Height: .0-.1m, Cover continuous

- 4. *Sphagnum magellanicum* (moss)
- 3. *Sphagnum angustifolium* (moss)
- 1. *Aulacomnium palustre* (moss)
- 1. *Pleurozium schreberi* (moss)
- 1. *Pohlia* (moss)
- 1. *Polytrichum strictum* (moss)
- 1. *Sphagnum fuscum* (moss)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!		+2		<i>Epigaea repens</i>	L. var. glab.		Fern.	fl # #	!

----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVE #:4451

18:57 Wednesday, MAY 13, 1998

----- FINAL RELEVE REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relve #: 93-47
*Surveyor's ID Code: JSB (Janet S. Boe)
Date: 26 Month: AUG Year: 1993 (e.g. 04 JUL 1993)
CBS Site #: 18 or Site Name: HOLE-IN-BOG LAKE
DNR Ownership Code: 99 (Owner Unknown)
*NC Code: BBXXXX (Black Spruce Bog)
Commun. Ranking in Relve: Stand typical of Commun. Type: Relve typical of Stand:

EO Rec #: 15360

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)
Quad Codes DNR: I13C Universal: 47094C2 (Bena)
Township: 144N (e.g. 143N) Range: 28W (e.g. 32W)
QORT: NW QRT: NE of Section 9
Latitude: 47 degrees, 18 minutes, 25 seconds
Longitude: 94 degrees, 13 minutes, 54 seconds

LL/GPS registration:
*Accuracy: Marker:

RELEVE INFORMATION

Relve Size (sq. m.): 100 Elev. (ft.): 1310 Slope: 00LV Slope Position:
*ECS Subsection: 6 (Chippewa Plains)
Minnesota Soil Atlas Mapping Unit: NP
*Geomorphic Unit: 25

Remarks: VERY HUMMOCKY. 10% BLOWDOWN. NO POOLS; NO WATER ACCUMULATION. USNEA ON
BLACK SPRUCE. RELEVE IN HOLE-IN-BOG SNA N OF TRAIL TO LAKE IN DENSEST
BS SEEN. BLK SPR DBH(CM): 6.5 TO 14.75. STATE STAND #2.

OTHER DATA COLLECTED

Soils: N Forestry: N o=old growth Water Chemistry: N Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relve Handbook)

Woody Needleleaf Evergreen, Height: 10-20m, Cover rare

2. Picea mariana (Black spruce)

Woody Needleleaf Evergreen, Height: 2-10m, Cover patchy

3. Picea mariana (Black spruce)

Woody Needleleaf Evergreen, Height: .0-2m, Cover rare

2. Picea mariana (Black spruce)

Woody Broadleaf Deciduous, Height: .0-.5m, Cover barely present

+. Vaccinium angustifolium (Blueberry)

Graminoid, Height: .0-2m, Cover patchy

2. Carex trisperma

2. Eriophorum spissum (Cotton-grass)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

DNR RELEVE #: 4451 continued, Page 2

Forb, Height: .0-.5m, Cover almost absent

- +. *Drosera rotundifolia* (Round-leaved sundew)
- R. *Smilacina trifolia* OP (Three-leaved false Solomon's-s)

Woody Broadleaf Evergreen, Height: .0-2m, Cover continuous

- 4. *Ledum groenlandicum* (Labrador tea)
- 2. *Chamaedaphne calyculata* (Leather-leaf)
- 1. *Gaultheria hispidula* (Creeping snowberry)
- +. *Kalmia polifolia* (Bog laurel)
- +. *Vaccinium oxycoccus* (Small cranberry)

Lichen/Moss, Height: .0-.5m, Cover continuous

- 5.5 *Sphagnum* (moss)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+.2		<i>Epigaea</i>	<i>repens</i>	L. var. glab.	Fern.	fl # #	!	
----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----									

MINNESOTA NATURAL HERITAGE PROGRAM
Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4007
(612) 296-2835

DNR RELEVÉ #: 4452

18:57 Wednesday, MAY 13, 1998

----- FINAL RELEVÉ REPORT FORM, MINNESOTA VEGETATION DATABASE -----

GENERAL INFORMATION

Surveyor's Relevé #: 93-48

EO Rec #: 15360

*Surveyor's ID Code: JSB (Janet S. Boe)

Date: 26 Month: AUG Year: 1993 (e.g. 04 JUL 1993)

CBS Site #: 18 or Site Name: HOLE-IN-BOG LAKE

DNR Ownership Code: 99 (Owner Unknown)

*NC Code: BBXXXX (Black Spruce Bog)

Commun. Ranking in Relevé: Stand typical of Commun. Type: _ Relevé typical of Stand: _

LOCATIONAL INFORMATION

State Code: MN *County Code: 11 (Cass)

Quad Codes DNR: I13C Universal: 47094C2 (Bena)

Township: 144N (e.g. 143N) Range: 28W (e.g. 32W)

QORT: SE QRT: NW of Section 9

Latitude: 47 degrees, 18 minutes, 22 seconds

LL/GPS registration:

Longitude: 94 degrees, 13 minutes, 59 seconds

*Accuracy: _ Marker: _

RELEVÉ INFORMATION

Relevé Size (sq. m.): 100 Elev. (ft.): 1310 Slope: 00LV

Slope Position: _

*ECS Subsection: 6 (Chippewa Plains)

Minnesota Soil Atlas Mapping Unit: NP

*Geomorphic Unit: 25

Remarks: FARTHER W OF 93-47; S OF TRAIL. WITHIN SIGHT OF HOLE-IN-BOG LAKE.

GROUND COVER: 100% MOSS (90% SPHAGNUM, 10% BRYALES). SOIL: SAT PEAT.

PH 3.8. DBH(CM): 6.75 TO 10. STATE STAND #2.

OTHER DATA COLLECTED

Soils: Y Forestry: Y o=old growth Water Chemistry: Y Publication: N
y=forestry

* = Variables with computerized code dictionaries (See Relevé Handbook)

Woody Needleleaf Evergreen, Height: 10-20m, Cover rare

2. Picea mariana (Black spruce)

Woody Needleleaf Evergreen, Height: 2-10m, Cover patchy

3. Picea mariana (Black spruce)

Woody Needleleaf Evergreen, Height: .0-2m, Cover rare

2. Picea mariana (Black spruce)

Graminoid, Height: .0-2m, Cover rare

2. Eriophorum spissum (Cotton-grass)

+. Carex pauciflora

+. Carex trisperma

+. Eriophorum viridi-carinatum (Cotton-grass)

----- EXAMPLE RECORD -----

! Cover.Sociability Genus Species Author Variety Author Remark !
! +.2 Epigaea repens L. var. glab. Fern. fl # # !

----- FOR CODES, SEE RELEVÉ CODE SHEET OR RELEVÉ MANUAL -----

DNR RELEVE #: 4452 continued, Page 2

Forb, Height: .0-.5m, Cover barely present

+ . Smilacina trifolia (Three-leaved false Solomon's-s)

Woody Broadleaf Evergreen, Height: .0-.5m, Cover continuous

3. Chamaedaphne calyculata (Leather-leaf)

3. Ledum groenlandicum (Labrador tea)

2. Kalmia polifolia (Bog laurel)

+ . Andromeda glaucophylla (Bog-rosemary)

+ . Gaultheria hispidula (Creeping snowberry)

+ . Vaccinium oxycoccus (Small cranberry)

Lichen/Moss, Height: .0-.1m, Cover continuous

5.5 Sphagnum (moss)

----- EXAMPLE RECORD -----

!	Cover.	Sociability	Genus	Species	Author	Variety	Author	Remark	!
!	+	.2	Epigaea	repens	L. var.	glab.	Fern.	fl # #	!

----- FOR CODES, SEE RELEVE CODE SHEET OR RELEVE MANUAL -----

Annotated Bibliography: Plant Communities

General

Curtis, J.T. 1959. The vegetation of Wisconsin. University of Wisconsin Press, Madison.

Curtis gives detailed descriptions of the plant communities that make up the vegetation of Wisconsin. This book has been called an ecological classic.

Daubenmire, R. 1966. Vegetation: identification of typical communities. Science 151:291-298.

Describes the concept of plant communities.

Daubenmire, R. 1968. Plant communities. Harper and Row Pub., New York, NY.

Describes plant associations (named using scientific names of the several dominant plant species), stands, habitat types. Extensive discussion of plant succession.

Kuchler, A.W. 1967. Vegetation mapping. Ronald Press Co., New York, NY.

Classic that describes Kuchler's life forms, the Braun-Blanquet method, and the use of aerial photography in vegetation mapping.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and sons, New York.

A text that covers vegetation ecology and patterns, methods of vegetation sampling, and description and sampling of plant communities.

Natural Heritage Program. 1993. Minnesota's native vegetation: a key to natural communities. Version 1.5. Draft. Minnesota Department of Natural Resources.

A work-in-progress that describes plant communities in the state and includes a dichotomous key.

Nelson, P. W. 1985. The terrestrial natural communities of Missouri. Missouri Natural Areas Committee, Missouri Department of Conservation, Jefferson City.

Includes descriptions (including characteristic plants) and photographs of plant communities.

Pickett, S.T.A., and P.S. White, eds. 1985. The ecology of natural disturbance and patch dynamics. Academic Press, San Diego, Calif.

Includes chapters on responses of forest herbs and woody plants to disturbance and disturbance regimes in temperate forests.

Spurr, S.H., and B.V. Barnes. 1980. Forest ecology. Third edition. John Wiley and Sons, New York.

Plant (forest) communities discussed in chapter 17. The American forest since 1600 is discussed in chapter 20.

Wovcha, D., B.C. Delaney, and G.E. Nordquist. 1995. Minnesota's St. Croix River Valley and Anoka Sandplain: a guide to native habitats. University of Minnesota Press, Minneapolis.

Includes fact sheets on various plant communities including Maple-basswood Forest, Lowland Hardwood Forest, Black Ash Swamp, Tamarack Swamp, and White Cedar Swamp.

Wetlands

Boelter, D.H., and G.E. Close. 1974. Pipelines in forested wetlands: cross drainage needed to prevent timber damage. Journal of Forestry 72(9):561-563.

Tree mortality and reduced growth caused by waterlogging when large pipelines impede drainage can be prevented by providing cross drainage during pipeline construction.

Clymo, R.S. 1991. Peat growth. Pages 76-112. In Quaternary landscapes, L.C.K. Shane and E.J. Cushing, eds. University of Minnesota Press, Minneapolis.

Describes conditions required for peat accumulation and bog development.

Grigal, D.F., and P.S. Homann. 1994. Nitrogen mineralization, groundwater dynamics, and forest growth on a Minnesota outwash landscape. Biogeochemistry 27(3):171-185.

Found that positive relationship between aboveground productivity and measured in situ nitrogen in upland forests doesn't necessarily hold for landscapes that include wetland forests.

Mitsch, W. J., and J. G. Gosselink. 1986. Wetlands. Van Nostrand Reinhold, New York.

Defines wetlands, gives overview of status of wetlands in U.S., and includes chapters on wetland ecosystem development, freshwater marshes, northern peatlands and bogs, and riparian wetlands.

Pielou, E.C. 1988. The world of northern evergreens. Cornell Univ. Press, Ithaca, New York.

Includes chapters on life history and biology of lowland and upland conifer species as well as ecology of conifer forests.

Toliver, J. 1993. What are wetlands? Journal of Forestry 91(5):12-14.

Defines wetlands, discusses riparian zones. Gives historical overview of wetland delineation.

Weller, M.W. 1987. Freshwater marshes. Second edition. University of Minnesota Press, Minneapolis.

Includes chapters on substrate and vegetation structure and habitat dynamics. Focus is on marsh ecology and wildlife management.

Wright, H.E., Jr., B. A. Coffin, and N. E. Aaseng, eds. 1992. The patterned peatlands of Minnesota. University of Minnesota Press, Minneapolis.

Includes chapters on peatland development, hydrology, mosses, and rare vascular plants.

Old Forests

Dahir, S.E., and C.G. Lorimer. 1996. Variation in canopy gap formation among developmental stages of northern hardwood stands. Canadian Journal of Forest Research 26(10):1875-1892.

Study in western upper Michigan. Even in old-growth forests, most gaps were small, created by single trees.

Davis, M.B. (Ed.) 1996. Eastern old-growth forests: prospects for rediscovery and recovery. Island Press, Washington, DC.

Includes chapter on identification and protection of old-growth forest on state-owned land in Minnesota.

Frelich, L.E., R.R. Calcote, M.B. Davis, and J. Pastor. 1993. Patch formation and maintenance in an old-growth hemlock-hardwood forest. Ecology 74(2):513-527.

Sylvania Wilderness Area, Upper Michigan.

Patch structure and distribution explained by interactions between Sugar Maple and Hemlock, not by soil differences or disturbance history.

Frelich, L. 1995. Old forests in the lake states today and before European settlement. Natural Areas Journal 15(2): 157-167.

Prior to European settlement, old and old-growth forests occupied 68% of the landscape; today, old and old-growth forests occupy 5.2-8.3% of the landscape.

Nowacki, G. J., and P.A. Trianosky. 1993. Literature on old-growth forests of eastern North America. Natural Areas Journal 13(2):87-107.

Literature citations (749) listed alphabetically by author.

Hunter, M. 1989. What constitutes an old-growth stand? Journal of Forestry 87(8):33-35.

Discusses seven age and disturbance criteria that should be considered when evaluating forests. Includes table showing age of decay and oldest known age for 13 tree species.

Lorimer, C.G., and L.E. Frelich. 1994. Natural disturbance regimes in old-growth northern hardwoods: implications for restoration efforts. Journal of Forestry 92(1):33-38.

Summarizes current knowledge about natural disturbance, stand structure, and landscape age-class mosaics in hardwood forests.

Mladenoff, D.J., M.A. White, T.R. Crow, and J. Pastor. 1994. Applying principles of landscape design and management to integrate old-growth forest enhancement and commodity use. Conservation Biology 8(3):752-762.

Landscape design to maintain old-growth forest patches while using surrounding forest for commodity production. Suggests buffer patches around old-growth forest and linking old-growth remnants.

Rebertus, A.J., S.R. Shifley, R.H. Richares, and L.M. Roovers. 1997. Ice storm damage to an old-growth oak-hickory forest in Missouri. *American Midland Naturalist* 137(1):48-61.

Reports on effects of December 1994 severe ice storm in northern Missouri. Damage and woody debris inventoried in 30 permanent plots.

Schmidt, T.L., J.S. Spencer, Jr., and M.H. Hansen. 1996. Old and potential old forest in the Lake States, USA. *Forest Ecology and Management* 86:81-96.

Existing and potential old forests. Minnesota information based on 1977 and 1990 inventories.

Shifley, S.R., and R.C. Schlesinger. 1994. Sampling guidelines for old-growth forests in the Midwest, USA. *Natural Areas Journal* 14(4): 258-268.

Inventoried old-growth forests to study sampling intensity and plot size required to detect change. Practical aspects of inventorying midwestern old-growth forests are discussed.

Tester, J.R., A.M. Starfield, and L.E. Frelich. 1997. Modeling for ecosystem management in Minnesota pine forests. *Biological Conservation* 80(3):313-324.

Relatively easy to maintain forest in early successional stages (by burning or clearcutting) and late stages (by fire suppression and control of cutting). Establishment of mid-successional stages (e.g., Red Pine, White Pine) much more difficult.

Tyrell, L.E., and T.R. Crow. 1994. Dynamics of dead wood in old-growth hemlock-hardwood forests of northern Wisconsin and northern Michigan. *Canadian Journal of Forest Research* 24(8):1672-1683.

White, M.A., and D.J. Mladenoff. 1994. Old-growth forest landscape transitions from pre-European settlement to present. *Landscape Ecology* 9(3):191-205.

Used General Land Office survey notes, 1931 cover from the Wisconsin Land Economic Inventory, and 1989 color infrared photography to study change in northern Wisconsin. Over 120 year period, forest cover changed from landscape dominated by old-growth Hemlock and hardwood forests to mostly second-growth hardwoods and conifers.

Relevés

Almendinger, J.C. 1987. A handbook for collecting releve data in Minnesota. Draft. Minnesota Natural Heritage Program.

An unpublished guide intended as an instruction book for anyone conducting relevés in Minnesota. Includes descriptions of codes used, examples of relevés, and directions for laying out a plot.

Benninghoff, W.S. 1966. The releve method for describing vegetation. *The Michigan Botanist* 5:109-114.

An overview of the releve method, noting its application to biogeography, ecology, and land management.

Braun-Blanquet, J. 1932. Plant sociology: a study of plant communities. Stechert-Hafner, New York.

Although not called a releve, the technique is described in chapters 3 and 4.

Mueller-Dombois, D., and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York.

Chapter 5 (Community Sampling: The Releve Method) consists of a well-written and easily understood explanation of the releve system.

Westhoff, V., and E. van der Maarel. 1973. The Braun-Blanquet approach. In 619-737 Whittaker, R.H., ed. *Ordination and classification of plant communities*. Dr. W. Junk, Pub. The Hague.

Includes history and scientific foundations of the technique.

6. Rare Plant Survey

<i>MCBS Procedures, Methods and Results</i>	<i>6.1.1</i>	<i>Management/monitoring of rare plant species: Element Stewardship Abstracts</i>	<i>6.6.1</i>
<i>Map of state endangered, threatened, and special concern plants collected in Cass County</i>	<i>6.2.1</i>	<i>Chippewa National Forest Sensitive Species: A Guide to Potential Habitats</i>	<i>6.7.1</i>
<i>List of state endangered, threatened, and special concern plants collected in Cass County</i>	<i>6.3.1</i>	<i>DNR SONARs</i>	<i>6.8.1</i>
<i>DNR Natural Heritage Information System complete record printout of collections of listed, tracked, and formerly tracked plant species collected in Cass County</i>	<i>6.4.1</i>	<i>Information about slides of rare plants collected in Cass County.....</i>	<i>6.9.1</i>
<i>Rare plant information sheets for collected listed species.</i>	<i>6.5.1</i>	<i>Rare plant collecting guidelines, reporting forms, and permit requirements (Natural Heritage and Nongame Research Program, MN DNR)</i>	<i>6.10.1</i>
		<i>Annotated bibliography: rare plants</i>	<i>6.11.1</i>

MCBS Procedures and Methods: Rare Plant Searches

Karen Myhre, MCBS botanist, searched for rare plants in Cass County from April to October 1992. Prior to beginning field work, she compiled a list of rare plants previously recorded from the county, then added to the list other rare plants recorded from nearby counties or with potential for occurring in Cass County. She then studied previous collections and the literature to determine the plant communities in which each species was likely to occur. Karen searched within the MCBS sites delineated by the MCBS plant ecologist and also searched outside MCBS sites in areas that seemed like potential habitat for a particular species.

Rare plant searches during the 1993-1995 field seasons were not as extensive as those in 1992. However, Janet Boe, MCBS plant ecologist, led rare plant searches during the 3 remaining years of the Survey in selected areas as time permitted. In addition, personnel from other agencies continued to search for and find rare plants.

MCBS staff documented rare plant locations by preparing pressed, dried voucher specimens, which were submitted to the herbarium of the University of Minnesota (see *Documenting Rare Plant Locations for the Minnesota Natural Heritage Database* later in this chapter).

Botanists completed a standard rare plant location form for each rare plant collection (see *MN Natural Heritage Database Rare Plant Report Form* later in this chapter) and submitted the form to the Natural Heritage and Nongame Research Program where data managers entered the information into the Rare Features Database. Data managers also recorded all points of rare plant locations digitally as geographic coordinates. These points are available as a GIS layer by contacting the Natural Heritage Information System Database Manager (see information on MCBS Products in the Introduction).

Rare Plant Survey Results

During the course of the Survey in Cass County, MCBS staff and cooperators made 138 collections of 22 listed or tracked (rare) plants. Fifteen of these species had not been collected in the county previously, and one species had not been collected in Minnesota before. Later in this chapter we include an information sheet for each listed or tracked species that was collected in the county as well as complete collection records from the NHIS database for each species.

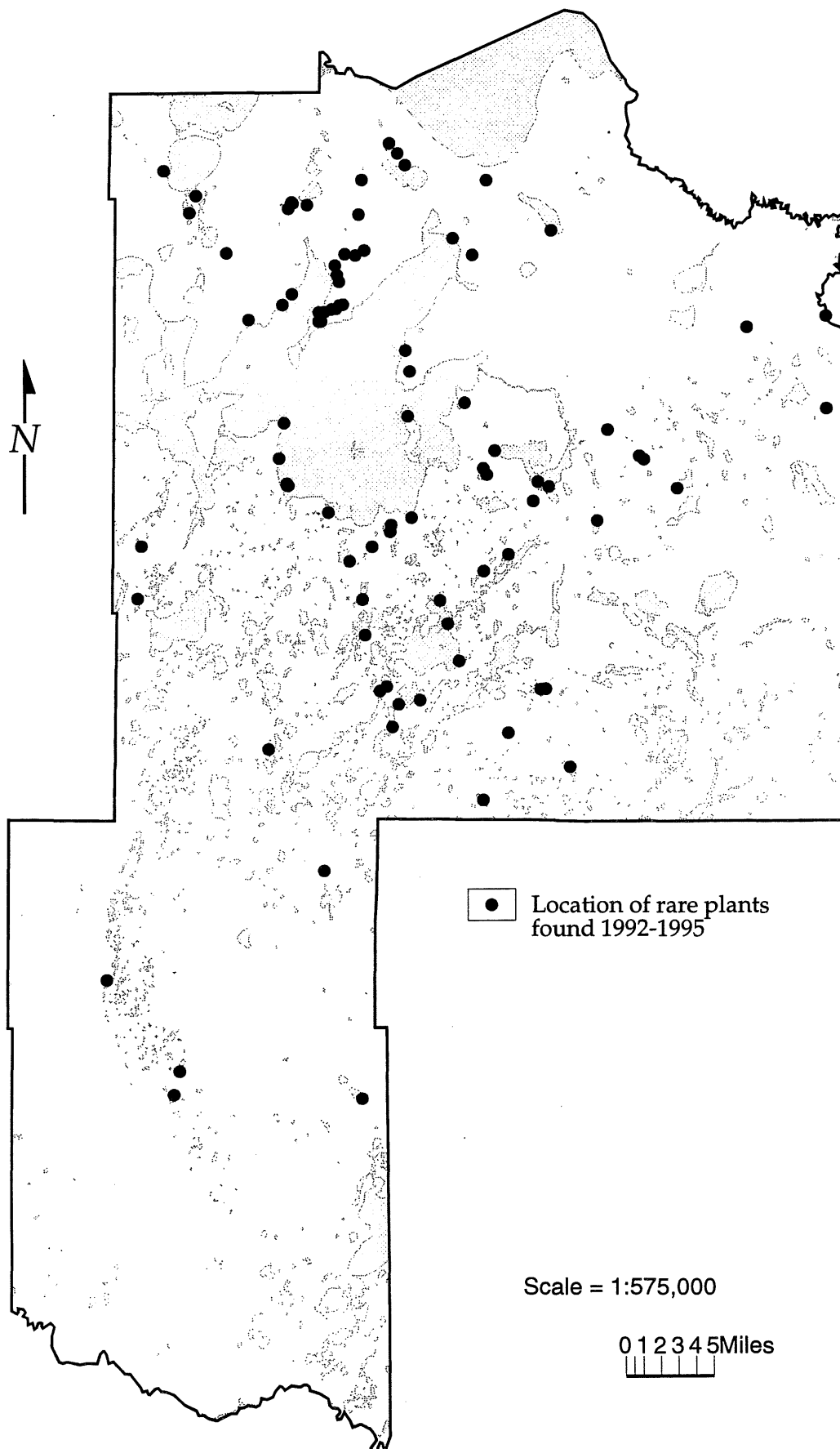


Table 1. Summary of rare plants in Cass County that are tracked by the Natural Heritage Information System.

Federal Status	MN (legal) Status	Old MN (legal) Status (pre-96)	Last Observed	Number of Occurrences	Element Name (Common Name)
	NS	SC	1995	10	<i>Arethusa bulbosa</i> (Dragon's mouth)
	T	NS	1997	6	<i>Botrychium lanceolatum</i> (Triangle moonwort)
	NS	NS	1996	27	<i>Botrychium matricariifolium</i> (Matricary grapefern)
	SC	NS	1997	12	<i>Botrychium minganense</i> (Mingan moonwort)
	SC	SC	1997	36	<i>Botrychium mormo</i> (Goblin fern)
	E	—	1992	1	<i>Botrychium oneidense</i> (Blunt-lobed grapefern)
	E	—	1997	4	<i>Botrychium pallidum</i> (Pale moonwort)
	T	—	1997	7	<i>Botrychium rugulosum</i> (St. Lawrence grapefern)
	SC	—	1997	3	<i>Botrychium simplex</i> (Least moonwort)
	T	T	1994	7	<i>Cypripedium arietinum</i> (Ram's-head lady's-slipper)
	SC	SC	1992	6	<i>Dryopteris goldiana</i> (Goldie's fern)
	T	T	1992	1	<i>Eleocharis olivacea</i> (Olivaceous spikerush)
	SC	—	1992	2	<i>Eleocharis quinqueflora</i> var. <i>fernaldii</i> (Few-flowered spikerush)
	SC	—	1994	1	<i>Juglans cinerea</i> (Butternut)
	SC	NC	1993	5	<i>Malaxis monophyllos</i> var. <i>brachypoda</i> (White adder's-mouth)
	NS	NS	1995	11	<i>Myriophyllum tenellum</i> (Water milfoil)
	SC	NS	1995	8	<i>Najas gracillima</i> (Slender naiad)
	SC	SC	1997	1	<i>Orobancha uniflora</i> (One-flowered broom-rape)
	SC	E	1996	3	<i>Sparganium glomeratum</i> (Clustered bur-reed)
	NS	SC	1995	10	<i>Utricularia gibba</i> (Humped bladderwort)
	SC	—	1992	2	<i>Utricularia purpurea</i> (Purple-flowered bladderwort)
	SC	SC	1994	3	<i>Waldsteinia fragarioides</i> (Barren strawberry)

Federal Status: Status of species under the Federal Endangered Species Law. Codes are E=endangered, T=threatened, C=species which have been proposed for federal listing due to sufficient information on biological vulnerability and threat(s), but which have not yet been official designated as endangered or threatened.

MN (legal) status: Minnesota ;legal status of plant and animal species under the state endangered species law. Codes for status are as follows: E=endangered, T=threatened, SC=special concern. The code, NS=no status, is applied to those species with no current legal status for which occurrence records are maintained. These species are (1) rare and may become listed if they decline further, or (2) species that had legal status prior to 1996.

Last observed: Indicates the date of the most recent record. This field can be used as an indicator of the likelihood that the element still exists in the area searched.

Number of Occurrences: The number of element occurrence records in the Minnesota Natural Heritage database for each element still within area searched.

Element Name (Common Name): For plant species this is the scientific name with the common name in parentheses.

*DNR Natural Heritage Information System complete record printout
of collections of listed, tracked, and formerly tracked plant species collected
in Cass County*

Listed species are those on the current or previous state list of endangered, threatened, or special concern species. Tracked species (listed as NON) are not listed but are collected by MCBS botanists when encountered to gather more information about the species' biology and distribution.

Indexes by species and by legal description precede the records.

COUNTY NAME	TWP	RNG	SECTION	FED STATUS	MINN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
CASS	T143N	R27W	NENE23		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #1	CHIPPEWA NATIONAL FOREST
CASS	T142N	R28W	22		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #42	CHIPPEWA NATIONAL FOREST
CASS	T142N	R27W	NESW11		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #51	CHIPPEWA NATIONAL FOREST
CASS	T142N	R28W	SWSW14		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #52	CHIPPEWA NATIONAL FOREST
CASS	T143N	R30W	SWSW05		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #57	BOWSTRING STATE FOREST
CASS	T142N	R26W	NENW19		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #63	CHIPPEWA NATIONAL FOREST
CASS	T143N	R27W	SENE04		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #77	CHIPPEWA NATIONAL FOREST
CASS	T143N	R27W	NWNW23		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #78	CHIPPEWA NATIONAL FOREST
CASS	T143N	R27W	NWNE23		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #79	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	SW36		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #80	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	NESE33		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #26	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	NWNW20		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #36	LEECH LAKE RESERVATION
CASS	T144N	R30W	NENW03		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #39	LEECH LAKE RESERVATION
CASS	T141N	R30W	SESW20		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #40	CHIPPEWA NATIONAL FOREST
CASS	T141N	R31W	SWNW10		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #41	CHIPPEWA NATIONAL FOREST
CASS	T141N	R30W	SENE25		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #42	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	NENW19		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #11	BOWSTRING STATE FOREST
CASS	T144N	R28W	SENW17		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #12	BOWSTRING STATE FOREST
CASS	T144N	R29W	NWNW09		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #13	BOWSTRING STATE FOREST
CASS	T145N	R29W	SESW28		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #14	BOWSTRING STATE FOREST
CASS	T144N	R27W	NWNW17		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #15	BOWSTRING STATE FOREST
CASS	T143N	R29W	NENE23		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #16	BATTLEGROUND STATE FOREST
CASS	T143N	R29W	NWNE06		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #17	BOWSTRING STATE FOREST
CASS	T142N	R30W	NENW22		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #18	LEECH LAKE RESERVATION
CASS	T141N	R29W	NESW01		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #19	LEECH LAKE RESERVATION
CASS	T142N	R27W	NESW30		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #20	LEECH LAKE RESERVATION
CASS	T142N	R27W	SWSW29		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #21	LEECH LAKE RESERVATION
CASS	T136N	R31W	SESE21		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #22	
CASS	T142N	R25W	NWNE02		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #69	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	SENE03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #78	BOWSTRING STATE FOREST
CASS	T145N	R28W	NWNE34		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #79	BOWSTRING STATE FOREST
CASS	T144N	R29W	SENE20		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #89	BOWSTRING STATE FOREST
CASS	T144N	R29W	NENW21		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #90	BOWSTRING STATE FOREST
CASS	T143N	R30W	NENE11		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #93	BOWSTRING STATE FOREST
CASS	T144N	R29W	SWSW29		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #94	BOWSTRING STATE FOREST
CASS	T144N	R30W	NENE03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #103	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	NWSE03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #104	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	NENW03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #105	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	NWNW04		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #106	CHIPPEWA NATIONAL FOREST
CASS	T145N	R31W	SESW35		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #113	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	NESE35		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #115	BOWSTRING STATE FOREST
CASS	T144N	R30W	SWNE03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #118	BOWSTRING STATE FOREST
CASS	T143N	R29W	SENW06		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #153	BOWSTRING STATE FOREST
CASS	T143N	R30W	NWNW12		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #171	LEECH LAKE RESERVATION
CASS	T144N	R29W	SENW20		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #173	BOWSTRING STATE FOREST
CASS	T141N	R25W	SENW02		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #175	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	19		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #1	BOWSTRING STATE FOREST
CASS	T143N	R30W	NWSE01		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #6	BOWSTRING STATE FOREST

COUNTY NAME	TWP	RNG	SECTION	FED STATUS	MINN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
CASS	T143N	R29W	SWNW06		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #7	BOWSTRING STATE FOREST
CASS	T142N	R30W	NWSE27		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #8	LEECH LAKE RESERVATION
CASS	T144N	R30W	SENE03		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #16	BOWSTRING STATE FOREST
CASS	T144N	R30W	SWNW02		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #17	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	SWSW29		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #18	BOWSTRING STATE FOREST
CASS	T145N	R30W	SENW22		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #20	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	SESW25		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #23	LEECH LAKE RESERVATION
CASS	T144N	R30W	SWNW04		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #25	LEECH LAKE RESERVATION
CASS	T145N	R30W	NWSW25		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #26	LEECH LAKE RESERVATION
CASS	T144N	R29W	19		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #2	BOWSTRING STATE FOREST
CASS	T143N	R29W	SWNW25		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #8	LEECH LAKE RESERVATION
CASS	T142N	R28W	NENW04		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #9	LEECH LAKE RESERVATION
CASS	T144N	R30W	NESE03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #10	BOWSTRING STATE FOREST
CASS	T144N	R30W	SENE03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #11	BOWSTRING STATE FOREST
CASS	T143N	R29W	NENE06		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #12	BOWSTRING STATE FOREST
CASS	T144N	R30W	NESE34		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #13	BOWSTRING STATE FOREST
CASS	T143N	R29W	NWNE06		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #14	BOWSTRING STATE FOREST
CASS	T143N	R29W	SENW06		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #15	BOWSTRING STATE FOREST
CASS	T143N	R29W	SWNW06		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #16	BOWSTRING STATE FOREST
CASS	T143N	R30W	NENW03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #17	BOWSTRING STATE FOREST
CASS	T144N	R29W	SWSW29		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #24	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	NESE30		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #25	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	SWSE19		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #26	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	NENW21		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #27	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	SENW20		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #28	CHIPPEWA NATIONAL FOREST
CASS	T143N	R25W	NESW07		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #46	CHIPPEWA NATIONAL FOREST
CASS	T140N	R28W	NESE06		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #47	GEORGE COOK WMA
CASS	T144N	R28W	SWNE21		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #49	BOWSTRING STATE FOREST
CASS	T143N	R30W	SE02NENE11		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #50	BOWSTRING STATE FOREST
CASS	T142N	R29W	SWSE02		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #51	LEECH LAKE RESERVATION
CASS	T144N	R30W	SWNW03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #56	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	NWSW15		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #76	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	SWNE03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #77	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	NWNW20		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #89	BOWSTRING STATE FOREST
CASS	T145N	R30W	SWSW35		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #90	BOWSTRING STATE FOREST
CASS	T144N	R29W	NENE30		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #91	BOWSTRING STATE FOREST
CASS	T144N	R29W	NWNE30		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #92	BOWSTRING STATE FOREST
CASS	T144N	R29W	SENE30		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #93	BOWSTRING STATE FOREST
CASS	T144N	R30W	NENW03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #94	BOWSTRING STATE FOREST
CASS	T145N	R30W	SESW25		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #95	BOWSTRING STATE FOREST
CASS	T144N	R28W	NENE06		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #96	BOWSTRING STATE FOREST
CASS	T141N	R31W	SWSE22		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #101	CHIPPEWA NATIONAL FOREST
CASS	T143N	R30W	NESW01		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #102	BOWSTRING STATE FOREST
CASS	T143N	R30W	NWNW12		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #103	BOWSTRING STATE FOREST
CASS	T141N	R31W	NWSE27		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #104	CHIPPEWA NATIONAL FOREST
CASS	T143N	R29W	SESE24		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #114	LEECH LAKE RESERVATION
CASS	T140N	R29W	SWNW35		END		BOTRYCHIUM ONEIDENSE (BLUNT-LOBED GRAPEFERN) #1	
CASS	T142N	R30W	NENW22		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #7	CHIPPEWA NATIONAL FOREST

COUNTY NAME	TWP	RNG	SECTION	FED STATUS	MINN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
CASS	T144N	R30W	NENW03		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #10	LEECH LAKE RESERVATION
CASS	T141N	R27W	SESE14		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #11	CHIPPEWA NATIONAL FOREST
CASS	T141N	R27W	NWNE23		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #12	CHIPPEWA NATIONAL FOREST
CASS	T145N	R28W	NWNE34		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #14	BOWSTRING STATE FOREST
CASS	T143N	R30W	NENE11		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #15	BOWSTRING STATE FOREST
CASS	T145N	R31W	SESE35		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #1	LEECH LAKE RESERVATION
CASS	T142N	R30W	NWSE27		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #2	LEECH LAKE RESERVATION
CASS	T143N	R25W	SWSE02		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #3	SCHOOLCRAFT STATE PARK
CASS	T140N	R29W	SNNW35		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #4	
CASS	T138N	R29W	NNNW19		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #5	
CASS	T141N	R29W	NESW16		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #23	LEECH LAKE RESERVATION
CASS	T142N	R26W	SENW30		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #24	CHIPPEWA NATIONAL FOREST
CASS	T141N	R26W	SWNE08		SPC		BOTRYCHIUM SIMPLEX (LEAST MOONWORT) #3	
CASS	T142N	R30W	NENW22		SPC		BOTRYCHIUM SIMPLEX (LEAST MOONWORT) #5	CHIPPEWA NATIONAL FOREST
CASS	T141N	R31W	SENW10		SPC		BOTRYCHIUM SIMPLEX (LEAST MOONWORT) #8	CHIPPEWA NATIONAL FOREST
CASS	T145N	R28W	NWNE34		SPC		BOTRYCHIUM SIMPLEX (LEAST MOONWORT) #34	BOWSTRING STATE FOREST
CASS	T145N	R29W	NESW23		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #11	BOWSTRING STATE FOREST
CASS	T142N	R28W	NESW22		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #21	CHIPPEWA NATIONAL FOREST
CASS	T140N	R29W	SNNW09		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #29	
CASS	T140N	R29W	SENW27		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #32	
CASS	T142N	R28W	SESW22		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #46	CHIPPEWA NATIONAL FOREST
CASS	T145N	R31W	SNNW27		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #52	CHIPPEWA NATIONAL FOREST
CASS	T142N	R26W	NENW19		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #53	CHIPPEWA NATIONAL FOREST
CASS	T143N	R30W	NESW01		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #1	LEECH LAKE RESERVATION
CASS	T144N	R29W	NNNW32		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #6	LEECH LAKE RESERVATION
CASS	T142N	R30W	NWNE10		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #20	LEECH LAKE RESERVATION
CASS	T143N	R30W	NWNE12		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #21	LEECH LAKE RESERVATION
CASS	T143N	R30W	NENW12		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #22	LEECH LAKE RESERVATION
CASS	T144N	R29W	NNNW32		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #50	CHIPPEWA NATIONAL FOREST
CASS	T139N	R29W	NESE03		THR		ELEOCHARIS OLIVACEA (OLIVACEOUS SPIKE-RUSH) #4	
CASS	T144N	R31W	NESW02		SPC		ELEOCHARIS QUINQUEFLORA (FEW-FLOWERED SPIKE-RUSH) #15	WELSH LAKE STATE FOREST
CASS	T139N	R30W	SWSW09		SPC		ELEOCHARIS QUINQUEFLORA (FEW-FLOWERED SPIKE-RUSH) #16	
CASS	T139N	R27W	SWSW16		SPC		JUGLANS CINEREA (BUTTERNUT) #5	LAND O'LAKES STATE FOREST
CASS	T141N	R31W	SENW17		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #10	CHIPPEWA NATIONAL FOREST
CASS	T141N	R29W	SNNW06		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #11	LEECH LAKE RESERVATION
CASS	T142N	R27W	SWSW31		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #12	CHIPPEWA NATIONAL FOREST
CASS	T142N	R28W	SWNE27		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #17	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	SENE02		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #18	BOWSTRING STATE FOREST
CASS					NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #3	
CASS	T141N	R29W	NENW20		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #14	LEECH LAKE RESERVATION
CASS	T141N	R27W	SESE03		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #15	CHIPPEWA NATIONAL FOREST
CASS	T142N	R26W	0ESW28		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #16	CHIPPEWA NATIONAL FOREST
CASS	T141N	R29W	SNNW33		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #17	CHIPPEWA NATIONAL FOREST
CASS	T140N	R28W	SESE17		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #18	
CASS	T140N	R27W	NESW30		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #19	
CASS	T137N	R32W	0NNE24		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #20	FOOT HILLS STATE FOREST
CASS	T136N	R29W	NWNE29		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #21	
CASS	T141N	R29W	NNNW11		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #36	CHIPPEWA NATIONAL FOREST

Minnesota Natural Heritage Database
Element Occurrence Records

RARE PLANT LOCATIONS IN CASS COUNTY
SORTED BY SPECIES NAME
MnDNR, Natural Heritage and Nongame Research Program

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COUNTY NAME	TWP	RNG	SECTION	FED STATUS	MINN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
CASS	T145N	R29W	152223SW14		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #47	BOWSTRING STATE FOREST
CASS	T140N	R29W	NWSW27		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #5	
CASS	T140N	R28W	SESE17		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #6	
CASS	T141N	R28W	NESW22		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #7	CHIPPEWA NATIONAL FOREST
CASS	T141N	R29W	NENW20		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #8	LEECH LAKE RESERVATION
CASS	T140N	R27W	NESW30		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #9	
CASS	T139N	R28W	SWSW27		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #10	
CASS	T141N	R29W	SWNW11		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #24	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	SE14		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #32	LEECH LAKE RESERVATION
CASS	T144N	R29W	SENW06		SPC		OROBANCHE UNIFLORA (ONE-FLOWERED BROOMRAPE) #13	LEECH LAKE RESERVATION
CASS	T142N	R30W	SESE27		SPC		SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #6	LEECH LAKE RESERVATION
CASS	T144N	R30W	SENE03		SPC		SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #55	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	NWNW11		SPC		SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #57	CHIPPEWA NATIONAL FOREST
CASS	T141N	R29W	NENW20		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #11	LEECH LAKE RESERVATION
CASS	T140N	R29W	NWSW27		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #12	
CASS	T139N	R29W	NESE03		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #13	
CASS	T140N	R29W	NENW36		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #14	
CASS	T141N	R28W	SWNE31		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #15	CHIPPEWA NATIONAL FOREST
CASS	T140N	R27W	NWSE30		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #16	
CASS	T136N	R31W	SWNW15		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #17	
CASS	T141N	R31W	SENW32		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #34	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	SE14		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #35	LEECH LAKE RESERVATION
CASS	T141N	R28W	NWSE31		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #84	CHIPPEWA NATIONAL FOREST
CASS	T140N	R29W	NENW36		SPC		UTRICULARIA PURPUREA (PURPLE-FLOWERED BLADDERWORT) #1	
CASS	T140N	R27W	NWSE30		SPC		UTRICULARIA PURPUREA (PURPLE-FLOWERED BLADDERWORT) #2	
CASS	T145N	R29W	NENE26		SPC		WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #15	BOWSTRING STATE FOREST
CASS	T141N	R29W	NW17SENE16		SPC		WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #16	LEECH LAKE RESERVATION
CASS	T139N	R28W	SWSE02		SPC		WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #17	

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Minnesota Natural Heritage Database
Element Occurrence Records

RARE PLANT LOCATIONS IN CASS COUNTY
SORTED BY LEGAL DESCRIPTION
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COUNTY NAME	TWP	RNG	SECTION	FED STATUS	MINN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
CASS					NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #3	
CASS	T136N	R29W	NWNE29		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #21	
CASS	T136N	R31W	SWNW15		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #17	
CASS	T136N	R31W	SESE21		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #22	
CASS	T137N	R32W	ONNE24		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #20	FOOT HILLS STATE FOREST
CASS	T138N	R29W	NWNW19		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #5	
CASS	T139N	R27W	SWSW16		SPC		JUGLANS CINEREA (BUTTERNUT) #5	LAND O' LAKES STATE FORES
CASS	T139N	R28W	SWSE02		SPC		WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #17	
CASS	T139N	R28W	SWSW27		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #10	
CASS	T139N	R29W	NESE03		THR		ELEOCHARIS OLIVACEA (OLIVACEOUS SPIKE-RUSH) #4	
CASS	T139N	R29W	NESE03		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #13	
CASS	T139N	R30W	SWSW09		SPC		ELEOCHARIS QUINQUEFLORA (FEW-FLOWERED SPIKE-RUSH) #16	
CASS	T140N	R27W	NESW30		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #19	
CASS	T140N	R27W	NESW30		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #9	
CASS	T140N	R27W	NWSE30		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #16	
CASS	T140N	R27W	NWSE30		SPC		UTRICULARIA PURPUREA (PURPLE-FLOWERED BLADDERWORT) #2	
CASS	T140N	R28W	NESE06		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #47	GEORGE COOK WMA
CASS	T140N	R28W	SESE17		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #18	
CASS	T140N	R28W	SESE17		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #6	
CASS	T140N	R29W	SWNW09		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #29	
CASS	T140N	R29W	SENE27		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #32	
CASS	T140N	R29W	NWSW27		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #5	
CASS	T140N	R29W	NWSW27		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #12	
CASS	T140N	R29W	SWNW35		END		BOTRYCHIUM ONEIDENSE (BLUNT-LOBED GRAPEFERN) #1	
CASS	T140N	R29W	SWNW35		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #4	
CASS	T140N	R29W	NENW36		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #14	
CASS	T140N	R29W	NENW36		SPC		UTRICULARIA PURPUREA (PURPLE-FLOWERED BLADDERWORT) #1	
CASS	T141N	R25W	SENE02		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #175	CHIPPEWA NATIONAL FOREST
CASS	T141N	R26W	SWNE08		SPC		BOTRYCHIUM SIMPLEX (LEAST MOONWORT) #3	
CASS	T141N	R27W	SESE03		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #15	CHIPPEWA NATIONAL FOREST
CASS	T141N	R27W	SESE14		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #11	CHIPPEWA NATIONAL FOREST
CASS	T141N	R27W	NWNE23		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #12	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	NWNW11		SPC		SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #57	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	SE14		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #32	LEECH LAKE RESERVATION
CASS	T141N	R28W	SE14		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #35	LEECH LAKE RESERVATION
CASS	T141N	R28W	NESW22		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #7	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	SWNE31		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #15	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	NWSE31		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #84	CHIPPEWA NATIONAL FOREST
CASS	T141N	R28W	SW36		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #80	CHIPPEWA NATIONAL FOREST
CASS	T141N	R29W	NESW01		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #19	LEECH LAKE RESERVATION
CASS	T141N	R29W	SWNW06		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #11	LEECH LAKE RESERVATION
CASS	T141N	R29W	NWNW11		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #36	CHIPPEWA NATIONAL FOREST
CASS	T141N	R29W	SWNW11		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #24	CHIPPEWA NATIONAL FOREST
CASS	T141N	R29W	NESW16		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #23	LEECH LAKE RESERVATION
CASS	T141N	R29W	NW17SENE16		SPC		WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #16	LEECH LAKE RESERVATION
CASS	T141N	R29W	NENW20		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #14	LEECH LAKE RESERVATION
CASS	T141N	R29W	NENW20		SPC		NAJAS GRACILLIMA (SLENDER NAIAD) #8	LEECH LAKE RESERVATION
CASS	T141N	R29W	NENW20		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #11	LEECH LAKE RESERVATION

COUNTY NAME	TWP	RNG	SECTION	FED STATUS	MINN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
CASS	T141N	R29W	SNNW33		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #17	CHIPPEWA NATIONAL FOREST
CASS	T141N	R30W	SESW20		THR		BOTRYCHUM LANCEOLATUM (TRIANGLE MOONWORT) #40	CHIPPEWA NATIONAL FOREST
CASS	T141N	R30W	SENE25		THR		BOTRYCHUM LANCEOLATUM (TRIANGLE MOONWORT) #42	CHIPPEWA NATIONAL FOREST
CASS	T141N	R31W	SNNW10		THR		BOTRYCHUM LANCEOLATUM (TRIANGLE MOONWORT) #41	CHIPPEWA NATIONAL FOREST
CASS	T141N	R31W	SENN10		SPC		BOTRYCHUM SIMPLEX (LEAST MOONWORT) #8	CHIPPEWA NATIONAL FOREST
CASS	T141N	R31W	SENN17		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #10	CHIPPEWA NATIONAL FOREST
CASS	T141N	R31W	SWSE22		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #101	CHIPPEWA NATIONAL FOREST
CASS	T141N	R31W	NWSE27		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #104	CHIPPEWA NATIONAL FOREST
CASS	T141N	R31W	SENN32		NON		UTRICULARIA GIBBA (HUMPED BLADDERWORT) #34	CHIPPEWA NATIONAL FOREST
CASS	T142N	R25W	NWNE02		NON		BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #69	CHIPPEWA NATIONAL FOREST
CASS	T142N	R26W	NENW19		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #63	CHIPPEWA NATIONAL FOREST
CASS	T142N	R26W	NENW19		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #53	CHIPPEWA NATIONAL FOREST
CASS	T142N	R26W	SESW28		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #16	CHIPPEWA NATIONAL FOREST
CASS	T142N	R26W	SENN30		THR		BOTRYCHUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #24	CHIPPEWA NATIONAL FOREST
CASS	T142N	R27W	NESW11		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #51	CHIPPEWA NATIONAL FOREST
CASS	T142N	R27W	SWSW29		NON		BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #21	LEECH LAKE RESERVATION
CASS	T142N	R27W	NESW30		NON		BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #20	LEECH LAKE RESERVATION
CASS	T142N	R27W	SWSW31		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #12	CHIPPEWA NATIONAL FOREST
CASS	T142N	R28W	NENW04		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #9	LEECH LAKE RESERVATION
CASS	T142N	R28W	SWSW14		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #52	CHIPPEWA NATIONAL FOREST
CASS	T142N	R28W	22		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #42	CHIPPEWA NATIONAL FOREST
CASS	T142N	R28W	NESW22		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #21	CHIPPEWA NATIONAL FOREST
CASS	T142N	R28W	SESW22		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #46	CHIPPEWA NATIONAL FOREST
CASS	T142N	R28W	SWNE27		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #17	CHIPPEWA NATIONAL FOREST
CASS	T142N	R29W	SWSE02		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #51	LEECH LAKE RESERVATION
CASS	T142N	R30W	NWNE10		SPC		DRYOPTERIS GOLDFIANA (GOLDIE'S FERN) #20	LEECH LAKE RESERVATION
CASS	T142N	R30W	NENW22		NON		BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #18	LEECH LAKE RESERVATION
CASS	T142N	R30W	NENW22		END		BOTRYCHUM PALLIDUM (PALE MOONWORT) #7	CHIPPEWA NATIONAL FOREST
CASS	T142N	R30W	NENW22		SPC		BOTRYCHUM SIMPLEX (LEAST MOONWORT) #5	CHIPPEWA NATIONAL FOREST
CASS	T142N	R30W	NWSE27		SPC		BOTRYCHUM MINGANENSE (MINGAN MOONWORT) #8	LEECH LAKE RESERVATION
CASS	T142N	R30W	NWSE27		THR		BOTRYCHUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #2	LEECH LAKE RESERVATION
CASS	T142N	R30W	SESE27		SPC		SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #6	LEECH LAKE RESERVATION
CASS	T143N	R25W	SWSE02		THR		BOTRYCHUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #3	SCHOOLCRAFT STATE PARK
CASS	T143N	R25W	NESW07		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #46	CHIPPEWA NATIONAL FOREST
CASS	T143N	R27W	SENE04		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #77	CHIPPEWA NATIONAL FOREST
CASS	T143N	R27W	NENE23		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #1	CHIPPEWA NATIONAL FOREST
CASS	T143N	R27W	NWNE23		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #78	CHIPPEWA NATIONAL FOREST
CASS	T143N	R27W	NWNE23		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #79	CHIPPEWA NATIONAL FOREST
CASS	T143N	R29W	NWNE06		NON		BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #17	BOWSTRING STATE FOREST
CASS	T143N	R29W	SENN06		NON		BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #153	BOWSTRING STATE FOREST
CASS	T143N	R29W	SNNW06		SPC		BOTRYCHUM MINGANENSE (MINGAN MOONWORT) #7	BOWSTRING STATE FOREST
CASS	T143N	R29W	NENE06		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #12	BOWSTRING STATE FOREST
CASS	T143N	R29W	NWNE06		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #14	BOWSTRING STATE FOREST
CASS	T143N	R29W	SENN06		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #15	BOWSTRING STATE FOREST
CASS	T143N	R29W	SNNW06		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #16	BOWSTRING STATE FOREST
CASS	T143N	R29W	NENE23		NON		BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #16	BATTLEGROUND STATE FOREST
CASS	T143N	R29W	SESE24		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #114	LEECH LAKE RESERVATION
CASS	T143N	R29W	SNNW25		SPC		BOTRYCHUM MORMO (GOBLIN FERN) #8	LEECH LAKE RESERVATION

COUNTY NAME	TWP	RNG	SECTION	FED STATUS	MINN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
CASS	T143N	R30W	NWSE01		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #6	BOWSTRING STATE FOREST
CASS	T143N	R30W	NESW01		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #102	BOWSTRING STATE FOREST
CASS	T143N	R30W	NESW01		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #1	LEECH LAKE RESERVATION
CASS	T143N	R30W	NENW03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #17	BOWSTRING STATE FOREST
CASS	T143N	R30W	SWSW05		NON		ARETHUSA BULBOSA (DRAGON'S-MOUTH) #57	BOWSTRING STATE FOREST
CASS	T143N	R30W	NENE11		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #93	BOWSTRING STATE FOREST
CASS	T143N	R30W	SE02NENE11		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #50	BOWSTRING STATE FOREST
CASS	T143N	R30W	NENE11		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #15	BOWSTRING STATE FOREST
CASS	T143N	R30W	NWNW12		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #171	LEECH LAKE RESERVATION
CASS	T143N	R30W	NWNW12		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #103	BOWSTRING STATE FOREST
CASS	T143N	R30W	NWNE12		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #21	LEECH LAKE RESERVATION
CASS	T143N	R30W	NENW12		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #22	LEECH LAKE RESERVATION
CASS	T144N	R27W	NWNW17		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #15	BOWSTRING STATE FOREST
CASS	T144N	R28W	NENE06		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #96	BOWSTRING STATE FOREST
CASS	T144N	R28W	SENW17		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #12	BOWSTRING STATE FOREST
CASS	T144N	R28W	SWNE21		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #49	BOWSTRING STATE FOREST
CASS	T144N	R29W	SENW06		SPC		OROBANCHE UNIFLORA (ONE-FLOWERED BROOMRAPE) #13	LEECH LAKE RESERVATION
CASS	T144N	R29W	NWNW09		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #13	BOWSTRING STATE FOREST
CASS	T144N	R29W	19		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #1	BOWSTRING STATE FOREST
CASS	T144N	R29W	19		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #2	BOWSTRING STATE FOREST
CASS	T144N	R29W	SWSE19		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #26	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	SENE20		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #89	BOWSTRING STATE FOREST
CASS	T144N	R29W	SENW20		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #173	BOWSTRING STATE FOREST
CASS	T144N	R29W	SENW20		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #28	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	NENW21		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #90	BOWSTRING STATE FOREST
CASS	T144N	R29W	NENW21		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #27	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	SWSW29		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #94	BOWSTRING STATE FOREST
CASS	T144N	R29W	SWSW29		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #18	BOWSTRING STATE FOREST
CASS	T144N	R29W	SWSW29		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #24	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	NESE30		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #25	CHIPPEWA NATIONAL FOREST
CASS	T144N	R29W	NENE30		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #91	BOWSTRING STATE FOREST
CASS	T144N	R29W	NWNE30		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #92	BOWSTRING STATE FOREST
CASS	T144N	R29W	SENE30		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #93	BOWSTRING STATE FOREST
CASS	T144N	R29W	NWNW32		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #6	LEECH LAKE RESERVATION
CASS	T144N	R29W	NWNW32		SPC		DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #50	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	SWNW02		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #17	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	SENE02		SPC		MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #18	BOWSTRING STATE FOREST
CASS	T144N	R30W	NENW03		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #39	LEECH LAKE RESERVATION
CASS	T144N	R30W	SENE03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #78	BOWSTRING STATE FOREST
CASS	T144N	R30W	NENE03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #103	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	NWSE03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #104	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	NENW03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #105	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	SWNE03		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #118	BOWSTRING STATE FOREST
CASS	T144N	R30W	SENE03		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #16	BOWSTRING STATE FOREST
CASS	T144N	R30W	NESE03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #10	BOWSTRING STATE FOREST
CASS	T144N	R30W	SENE03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #11	BOWSTRING STATE FOREST
CASS	T144N	R30W	SWNW03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #56	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	SWNE03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #77	CHIPPEWA NATIONAL FOREST

Minnesota Natural Heritage Database
Element Occurrence Records

RARE PLANT LOCATIONS IN CASS COUNTY
SORTED BY LEGAL DESCRIPTION
MnDNR, Natural Heritage and Nongame Research Program

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COUNTY NAME	TWP	RNG	SECTION	FED STATUS	MINN STATUS	S RANK	ELEMENT and OCCURRENCE NUMBER	MANAGED AREA
CASS	T144N	R30W	NENW03		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #94	BOWSTRING STATE FOREST
CASS	T144N	R30W	NENW03		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #10	LEECH LAKE RESERVATION
CASS	T144N	R30W	SENE03		SPC		SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #55	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	NWNW04		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #106	CHIPPEWA NATIONAL FOREST
CASS	T144N	R30W	SWNW04		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #25	LEECH LAKE RESERVATION
CASS	T144N	R30W	NENW19		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #11	BOWSTRING STATE FOREST
CASS	T144N	R30W	NESE34		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #13	BOWSTRING STATE FOREST
CASS	T144N	R31W	NESW02		SPC		ELEOCHARIS QUINQUEFLORA (FEW-FLOWERED SPIKE-RUSH) #15	WELSH LAKE STATE FOREST
CASS	T145N	R28W	NWNE34		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #79	BOWSTRING STATE FOREST
CASS	T145N	R28W	NWNE34		END		BOTRYCHIUM PALLIDUM (PALE MOONWORT) #14	BOWSTRING STATE FOREST
CASS	T145N	R28W	NWNE34		SPC		BOTRYCHIUM SIMPLEX (LEAST MOONWORT) #34	BOWSTRING STATE FOREST
CASS	T145N	R29W	152223SW14		NON		MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #47	BOWSTRING STATE FOREST
CASS	T145N	R29W	NESW23		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #11	BOWSTRING STATE FOREST
CASS	T145N	R29W	NENE26		SPC		WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #15	BOWSTRING STATE FOREST
CASS	T145N	R29W	SESW28		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #14	BOWSTRING STATE FOREST
CASS	T145N	R30W	NWSW15		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #76	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	NWNW20		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #36	LEECH LAKE RESERVATION
CASS	T145N	R30W	NWNW20		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #89	BOWSTRING STATE FOREST
CASS	T145N	R30W	SENW22		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #20	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	SESW25		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #23	LEECH LAKE RESERVATION
CASS	T145N	R30W	NWSW25		SPC		BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #26	LEECH LAKE RESERVATION
CASS	T145N	R30W	SESW25		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #95	BOWSTRING STATE FOREST
CASS	T145N	R30W	NESE33		THR		BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #26	CHIPPEWA NATIONAL FOREST
CASS	T145N	R30W	NESE35		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #115	BOWSTRING STATE FOREST
CASS	T145N	R30W	SWSW35		SPC		BOTRYCHIUM MORMO (GOBLIN FERN) #90	BOWSTRING STATE FOREST
CASS	T145N	R31W	SWNW27		THR		CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #52	CHIPPEWA NATIONAL FOREST
CASS	T145N	R31W	SESW35		NON		BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #113	CHIPPEWA NATIONAL FOREST
CASS	T145N	R31W	SESE35		THR		BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #1	LEECH LAKE RESERVATION

RECORDS PRINTED = 172

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #3

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: site not named or no record

Ownership: Owner unknown

Managed Area(s): not managed or no record

Source: ROSENDAHL AND BUTTERS (6834)

ALONG SHORES OF PFREMME'S L, NW OF WOMAN L. NOT MAPPED.

Location: CASS COUNTY, MN

Legal :

Quad Map:

Latitude: 0 0' 0" Long: 0 0' 0"

Precision: not mappable

DNR Region: 3

Wildlife Area: 301

Forestry District:

Last Obs.: August 1937

Voucher: 365072 MIN Verification:

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #21

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: LOON LAKE 19

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM3415)

LOCATED ALONG THE EXTREMELY SHALLOW, FINE SAND-BOTTOMED SOUTHEAST BAY OF LOON LAKE. PLANTS OCCUR AT 10 METERS INTO THE LAKE, BEYOND THE WIDE, REEF-LIKE BAND OF VERY SHALLOW, CLEAR WATER. THIS IS AN AREA OF NEARLY PURE SAND WITH VALLISNERIA AMERICANA BEING THE ONLY OTHER VEGETATION.

Location: CASS COUNTY, MN

Legal : T136N R29W SWNE29

Quad Map: NISSWA (L12D)

Latitude: 46 34' 18" Long: 94 21' 35"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 323

Last Obs.: 05 October 1992

Voucher: MIN Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #17

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: MOOSE LAKE 15

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM2866)

LOCATED ON THE SOUTHEAST SHORE OF MOOSE LAKE. PLANTS OCCUR IN SMALL MASSES SNAGGED ON DEAD BRANCHES AND SCIRPUS AT THE SURFACE OF THE WATER, AND WADDED IN TIGHT MASSES THAT ARE STRANDED AMONG THE SMALL SHORE ROCKS. ASSOCIATES INCL: ELEOCHARIS, SCIRPUS, ISOETES, PULICNIUM, BRASENIA, AND ESPECIALLY UTRICULARIA MINOR WITH WHICH IT IS FOUND ENTANGLED.

Location: CASS COUNTY, MN

Legal : T136N R31W SWNW15

Quad Map: GRAFF (L11D)

Latitude: 46 35' 40" Long: 94 34' 45"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 323

Last Obs.: 27 July 1992

Voucher: MIN Verification: verified

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #22

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: BUNGO 29

Ownership: County (Tax Forfeit)

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM2136)

LOCATED ONE HALF MILE NORTHEAST OF CROOKED LAKE IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM, TILIA AMERICANA, AND QUERCUS RUBRA; AND ALSO INCLUDES: OSTRYA VIRGINIANA, FRAXINUS PENNSYLVANIA, AND ACER SPICATUM. THE PLANTS ARE GROWING ALONG THE EDGE OF A LOW, MOIST AREA THAT WAS A SPRINGTIME POOL. ASSOCIATED SPECIES INCLUDE: BOTRYCHUM VIRGINIANUM, VIBURNUM RAFINESQUIANUM, ONOCLEA SENSIBILIS, AND THALICTRUM DIOICUM.

Location: CASS COUNTY, MN

Legal : T136N R31W SESE21

Quad Map: GRAFF (L11D)

Latitude: 46 34' 29" Long: 94 35' 9"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 323

Last Obs.: 08 June 1992

Voucher: MIN Verification: verified

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #20

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: ANSEL 25 CBS Site #: 188
Ownership: County Forest
Managed Area(s): FOOT HILLS STATE FOREST
Source: MYHRE, K. (KMM3238)

Location: CASS COUNTY, MN DNR Region: 3
Legal : T137N R32W 0NNE24 Wildlife Area: 301
Quad Map: SPIDER LAKE (L11B) Forestry District: 321
Latitude: 46 40' 14" Long: 94 40' 1" Last Obs.: 31 August 1992
Precision: within 0.25 mile, confirmed

Voucher: MIN Verification: verified

PLANTS FORM AN EXTREMELY DENSE, PURE, SOD-LIKE BORDER ALONG THE WEST SHORE OF SPIDER LAKE. WATER LEVEL WAS LOW AT THE TIME OF THIS OBSERVATION LEAVING PLANTS STRANDED AND EXPOSED ABOVE THE WATER LINE. MANY 1000'S OF PLANTS BLOOMING, AND MANY TOSSED UP IN PILES ALONG THE SHORE. ASSOCIATES INCLUDE: SPARGANIUM, JUNCUS, CYPERUS, POLYGONUM, ELEOCHARIS, CICUTA, AGALINIS, DULICHIMUM, AND SCIRPUS.

Element: BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #5

State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: BARCLAY 19
Ownership: Private
Managed Area(s): not managed or no record
Source: MYHRE, K.M. (KMM3413A)

Location: CASS COUNTY, MN DNR Region: 3
Legal : T138N R29W NWNW19 Wildlife Area: 301
Quad Map: MILDRED (K12C) Forestry District: 323
Latitude: 46 45' 43" Long: 94 24' 23" Last Obs.: 05 October 1992
Precision: within 0.25 mile, confirmed

Voucher: 824532 MIN Verification: verified

LOCATED 1.5 MILES NORTH OF NORWAY LAKE. PLANTS OCCUR IN A MOSSY, SLOPING STAND OF PINUS BANKSIANA. ASSOCIATED SPECIES INCLUDE: EPIGAEA REPENS, AGASTACHE FOENICULUM, ASTER MACROPHYLLUS, QUERCUS MACROCARPA, AND BOTRYCHIUM MULTIFIDUM. THIS IDENTIFICATION VERIFIED BY W.H. WAGNER JR. 10/27/92.

Element: JUGLANS CINEREA (BUTTERNUT) #5

State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: TRELIPE 3 CBS Site #: 162
Ownership: Owner unknown
Managed Area(s): LAND O' LAKES STATE FOREST
Source: BOE, J.; OLSON, L. (CASS CO LAND DEPT) (94070701)

Location: CASS COUNTY, MN DNR Region: 3
Legal : T139N R27W SWSW16 Wildlife Area: 301
Quad Map: MITCHELL LAKE (K13D) Forestry District: 323
Latitude: 46 50' 56" Long: 94 6' 36" Last Obs.: 07 July 1994
Precision: within 0.25 mile, confirmed

Voucher: MIN Verification: verified

LARRY OLSON & OTHERS FROM CCLD FOUND TREES WHILE PUTTING IN A TRAIL ALONG CO RD 160 DURING LATE 1970'S; 3-4 TREES FOUND ALONG 160 & 10-12 TREES ALONG TRAIL SYSTEM & SCATTERED IN SURROUNDING OAK FOREST. 7/7/94: WE OBSERVED 1 10-12" CUT STUMP WITH SEVERAL 3-4" STUMP SUCKERS ON ROADSIDE. SEE PLANT LIST PL94163 FOR PLANTS, INCLUDING BUTTERNUT, IN RED OAK FOREST S OF CO RD 160. COLLECTION MADE FROM RDSIDE TREE GROWING W/Q. RUBRA, A. RUBRUM & P. TREMULOIDES. FRUITS PRESENT.

Element: WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #17

State Status: SPECIAL CONCERN
EO Size: EO Rank: SC Current Status: Intended Status:
Site: BLIND LAKE 11 CBS Site #: 151
Ownership: Private
Managed Area(s): not managed or no record
Source: BOE, J. (94070501)

Location: CASS COUNTY, MN DNR Region: 3
Legal : T139N R28W SWSW02 Wildlife Area: 301
Quad Map: LONGVILLE (K13B) Forestry District: 323
Latitude: 46 52' 39" Long: 94 11' 4" Last Obs.: 05 July 1994
Precision: within 0.25 mile, confirmed

Voucher: MIN Verification: verified

ASPEN FOREST: POPULUS TREMULOIDES. FEW METERS INSIDE GATE TO TOM MEYERS PROPERTY. WITH ORYZOPSIS ASPERIFOLIA. MANY PLANTS WEST SIDE OF TRAIL. NEEDS FURTHER SEARCH IN MAY WHEN IN BLOOM TO DETERMINE EXTENT OF POPULATION.

Element: NAJAS GRACILLIMA (SLENDER NAIAD) #10

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: BLIND LAKE 27

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K.M. (KMM3284)

LOCATED IN THE SOUTHEAST BAY OF BLIND LAKE. PLANTS OCCUR ALONG THE SHALLOW, SANDY SHORELINE, CAUGHT ON SCIRPUS. VERY FEW PLANTS OBSERVED AT THIS LOCATION.
ASSOCIATES INCLUDE: MYRIOPHYLLUM, POTAMOGETON, AND ACORUS.

Location: CASS COUNTY, MN

Legal : T139N R28W SWSW27

Quad Map: STEWART LAKE (K13C)

Latitude: 46 49' 17" Long: 94 12' 52"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 323

Last Obs.: 08 September 1992

Voucher: MIN

Verification: verified

Element: ELEOCHARIS OLIVACEA (OLIVACEOUS SPIKE-RUSH) #4

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: PONTO LAKE 3

Ownership: Owner unknown

Managed Area(s): not managed or no record

Source: MYHRE, K.M. (KMM2894)

LOCATED ONE QUARTER MILE NORTHEAST OF PONTO LAKE. PLANTS GROWING ON THE FLOATING MAT SURROUNDING A SMALL, 10 ACRE LAKE. PLANTS OBSERVED INFREQUENTLY ALONG THE EDGES OF SMALL BOG POOLS OR OPENINGS IN THE MAT. UTRICULARIA GIBBA WAS ALSO FOUND AT THIS SITE.

Location: CASS COUNTY, MN

Legal : T139N R29W NESE03

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 52' 57" Long: 94 19' 29"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 321

Last Obs.: 31 July 1992

Voucher: MIN

Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #13

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: PONTO LAKE 3

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM2896)

LOCATED ALONG THE EDGE OF THE FLOATING BOG SURROUNDING THE SMALL (8 ACRE) LAKE NORTHEAST OF PONTO LAKE. UTRICULARIA GIBBA'S CLOSEST ASSOCIATES ARE THE OTHER UTRICULARIAS: VULGARIS, INTERMEDIA, AND MINOR. OBSERVED INFREQUENTLY AT THIS LOCATION.

Location: CASS COUNTY, MN

Legal : T139N R29W NESE03

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 52' 57" Long: 94 19' 29"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 321

Last Obs.: 31 July 1992

Voucher: MIN

Verification: verified

Element: ELEOCHARIS QUINQUEFLORA (FEW-FLOWERED SPIKE-RUSH) #16

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: POWERS 9

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM3445)

LOCATED ON THE SOUTHWEST SHORE OF CROOKED LAKE. PLANTS GROWING ALONG A NARROW, FLAT, SANDY STRIP OF BEACH THAT MAY BE AFFECTED BY FLUCTUATING WATER LEVELS. SEVERAL HUNDRED PLANTS OBSERVED AT THIS POINT ALONG THE SHORE.

Location: CASS COUNTY, MN

Legal : T139N R30W SWSW09

Quad Map: MILDRED (K12C)

Latitude: 46 51' 50" Long: 94 28' 28"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 321

Last Obs.: 07 October 1992

Voucher: MIN

Verification: verified

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #19

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: TRELIPE 30 CBS Site #: 140

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE,K.(KMM3256)

LOCATED ON THE NORTHEAST SHORE OF CAMP LAKE. PLANTS OCCUR ALONG THE SANDY SHORE-LINE IN AN AREA 1 TO 4 METERS FROM THE WATER'S EDGE, AT A WATER DEPTH OF 0.3 TO 1.0 METER. ASSOCIATES INCLUDE NAJAS, POTOMOGETON, ISOETES, SCIRPUS, UTRICULARIA, VALISNERIA, SPARGANIUM, ELEOCHARIS, AND CLOSELY INTERMINGLED WITH JUNCUS. VERY FEW PLANTS STILL SHOWING EVIDENCE OF BLOOM.

Location: CASS COUNTY, MN

Legal : T140N R27W NESW30

Quad Map: LONGVILLE (K13B)

Latitude: 46 54' 50" Long: 94 8' 20"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 323

Last Obs.: 02 September 1992

Voucher: MIN

Verification: verified

Element: NAJAS GRACILLIMA (SLENDER NAIAD) #9

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: TRELIPE 30 CBS Site #: 140

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE,K.(KMM3258)

LOCATED ALONG THE SHALLOW, SANDY NORTH SHORE OF CAMP LAKE. MANY SMALL (5 TO 15 CMS IN LENGTH) SEGMENTS AND A FEW LARGE (1.5 TO 4.5 DCM IN LENGTH), BRANCHED SEGMENTS OBSERVED FREE-FLOATING ALONG THE SHORELINE. MYRIOPHYLLUM TENELLUM ALSO OCCURS ALONG THIS SHORELINE, AND UTRICULARIA GIBBA AND U. PURPUREA ARE PRESENT IN THE BAY ALONG THE NORTHWEST SHORE OF THE LAKE.

Location: CASS COUNTY, MN

Legal : T140N R27W NESW30

Quad Map: LONGVILLE (K13B)

Latitude: 46 54' 50" Long: 94 8' 20"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 323

Last Obs.: 02 September 1992

Voucher: MIN

Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #16

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: TRELIPE 30 CBS Site #: 140

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE,K.(KMM3257)

LOCATED IN THE SHALLOW, SANDY-BOTTOMED, NW BAY OF CAMP LAKE. THE SHORELINE IS A BOGGY AREA WITH LARIX LARICINA AND PICEA MARIANA. THE PLANTS OCCUR FLOATING UNDER NUPHAR LUTEUM, AND INTERMINGLED WITH OTHER UTRICULARIAS INCLUDING THE ALSO VERY RARE UTRICULARIA PURPUREA.

Location: CASS COUNTY, MN

Legal : T140N R27W NWSE30

Quad Map: LONGVILLE (K13B)

Latitude: 46 54' 49" Long: 94 8' 42"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 323

Last Obs.: 02 September 1992

Voucher: MIN

Verification: verified

Element: UTRICULARIA PURPUREA (PURPLE-FLOWERED BLADDERWORT) #2

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: TRELIPE 30 CBS Site #: 140

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE,K.(KMM3259)

LOCATED IN THE SHALLOW, SAND-BOTTOMED, NORTHWEST BAY OF CAMP LAKE. THE SHORELINE IS A BOGGY AREA WITH LARIX LARICINA AND PICEA MARIANA. THE PLANTS OCCUR FLOATING BENEATH THE NUPHAR LUTEUM WITH OTHER UTRICULARIAS INCLUDING THE ALSO RARE UTRICULARIA GIBBA. NO PLANTS OBSERVED IN BLOOM.

Location: CASS COUNTY, MN

Legal : T140N R27W NWSE30

Quad Map: LONGVILLE (K13B)

Latitude: 46 54' 49" Long: 94 8' 42"

Precision: within 0.25 mile, confirmed

DNR Region: 3

Wildlife Area: 301

Forestry District: 323

Last Obs.: 02 September 1992

Voucher: MIN

Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #47

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: WOMAN LAKE PEN.

CBS Site #: 230

Ownership: MN DNR Wildlife (Wildlife Management Area)

Managed Area(s): GEORGE COOK WMA

Source: BOE, J. (94091301)

Location: CASS COUNTY, MN

Legal : T140N R28W NESE06

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 58' 6" Long: 94 15' 29"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 323

Last Obs.: 13 September 1994

MAPLE-BASSWOOD WITH YELLOW BIRCH. 11 PLANTS. WITH CAREX PENDUNCULATA, ARALIA RACEMOSA, UVULARIA GRANDIFLORA, TILIA SEEDLINGS, ARALIA NUDICAULIS, POLYGONATUM PUBESCENS. PLANTS LOCATED JUST NORTH OF PLANTED RED PINE ALONG GRAVEL ROAD. (VERIFIED BY W.H. WAGNER 1998).

Voucher: 459204 MIN Verification: verified

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #18

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: WABEDO 17

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM3405)

Location: CASS COUNTY, MN

Legal : T140N R28W SESE17

Quad Map: LONGVILLE (K13B)

Latitude: 46 56' 15" Long: 94 14' 39"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 323

Last Obs.: 02 October 1992

LOCATED ON THE NORTHWEST SHORE OF HEFFRON LAKE, WHICH IS A SHALLOW, SAND-BOTTOMED 75 ACRE LAKE. THE PLANTS OCCUR FROM THE SHORELINE IN SOME AREAS, TO 8 METERS INTO THE LAKE AT AN AVERAGE WATER DEPTH OF 0.5 METER. ASSOCIATED SPECIES INCLUDE: POTAMOGETON PECTINATUS, NAJAS FLEXILIS, AND JUNCUS SP.

Voucher: MIN Verification: verified

Element: NAJAS GRACILLIMA (SLENDER NAIAD) #6

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: WABEDO 17

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM3406)

Location: CASS COUNTY, MN

Legal : T140N R28W SESE17

Quad Map: LONGVILLE (K13B)

Latitude: 46 56' 15" Long: 94 14' 39"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 323

Last Obs.: 02 October 1992

LOCATED ALONG THE NORTHWEST SHORE OF HEFFRON LAKE. PLANTS OBSERVED FLOATING ALONG THE SHALLOW, SANDY SHORELINE ASSOCIATED WITH NAJAS FLEXILIS AND MYRIOPHYLLUM TENELLUM. INFREQUENT OCCURRENCE AT THIS LOCATION.

Voucher: MIN Verification: verified

Element: CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #29

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: SUNSET BAY CAMP

Ownership: Private

Managed Area(s): not managed or no record

Source: SMITH, W.R. (18616)

Location: CASS COUNTY, MN

Legal : T140N R29W SWNW09

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 57' 33" Long: 94 21' 29"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 321

Last Obs.: 1993

1991: ABOUT 30 PLANTS IN MESIC DECIDUOUS FOREST COLLECTED BY W. SMITH ON MAY 25. DOMINATED BY POST-MATURE POPULUS TREMULOIDES WITH LARGE AMOUNTS OF ACER SACCHARUM IN UNDERSTORY. ALSO WITH OSTRYA, CARPINUS, BETULA, CORNUS. 1993: THE DEBOERS REPORTED AT LEAST 3 DOZEN PLANTS, MOST WITH FLOWERS. APPEAR TO BE SPREADING BACK INTO THE WOODS.

Voucher: MIN Verification: verified

Element: CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #32

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: WOODROW 27

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM2055)

403 PLUS PLANTS OCCUR IN A 4 METER BY 10 METER AREA. IT IS AN UPLAND SITE WITH ONE DOMINANT PINUS STROBUS, MATURE THUJA OCCIDENTALIS, AND YOUNG ABIES BALSAMEA. PLANTS ARE MAINLY VERY VISIBLE IN NEEDLE DUFF WITH MINIMAL ASSOCIATED SPECIES: MAIANTHEMUM CANADENSIS, TRIENTALIS BOREALIS. 31 PLANTS OBSERVED IN BLOOM.

Location: CASS COUNTY, MN

Legal : T140N R29W SENW27

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 54' 58" Long: 94 19' 54"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 321

Last Obs.: 01 June 1992

Voucher: MIN

Verification: verified

Element: NAJAS GRACILLIMA (SLENDER NAIAD) #5

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: WOODROW 27

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM3197)

LOCATED ALONG THE SHALLOW, ALTERNATELY SAND AND SILTY NORTH SHORE OF SAND LAKE. MANY SMALL (LESS THAN 10CMS IN LENGTH) SEGMENTS OBSERVED FLOATING, AND A VERY FEW OBSERVED SUBMERGED AND ROOTED IN THE SAND; ALSO A FEW BRANCHED SEGMENTS PRESENT. UTRICULARIA GIBBA AND POTAMOGETON SPIRILLUS OCCUR AT THIS LOCATION.

Location: CASS COUNTY, MN

Legal : T140N R29W NWSW27

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 54' 45" Long: 94 20' 23"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 321

Last Obs.: 26 August 1992

Voucher: MIN

Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #12

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: WOODROW 27

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM3199)

LOCATED ONE QUARTER MILE SOUTHWEST OF WIDOW LAKE ALONG THE SANDY, MUCKY NORTH SHORE OF SAND LAKE. PLANTS OCCUR FLOATING AMONG THE SHORELINE SEDGES AND STRANDED ON THE MUCK AND ON PURE SAND. EXTREMELY ABUNDANT, 1000+ PLANTS IN BLOOM. ASSOCIATES INCLUDE: SCIRPUS, ELEOCHARIS, NAJAS, POTAMOGETON, ISOETES, AND BRASENIA.

Location: CASS COUNTY, MN

Legal : T140N R29W NWSW27

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 54' 45" Long: 94 20' 23"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 321

Last Obs.: 26 August 1992

Voucher: MIN

Verification: verified

Element: BOTRYCHIUM ONEIDENSE (BLUNT-LOBED GRAPEFERN) #1

State Status: ENDANGERED

EO Size: EO Rank: Current Status: Intended Status:

Site: WOODROW 35

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K.M. (KMM3400)

1/4 MILE SW OF BLACK WATER LAKE. ABUNDANT (MANY 100'S VARIOUSLY-SIZED PLANTS WITH FERTILE FRONDS) IN SHALLOW DEPRESSIONS BETWEEN SMALL RISES IN GENTLY UNDU-LATING LANDSCAPE. PLANTS OCCUR IN SECOND-GROWTH FOREST OF FRAXONUS NIGRA, POPULUS TREMULOIDES, ACER SACCHARUM & QUERCUS RUBRA. B ONEIDENSE ARE RED-TINGED (POS-SIBLY FROM FROST) ON EDGES, IN CONTRAST TO B MULTIFIDUM SPECIMENS WHICH APPEAR UNAFFECTED. ID VERIFIED BY W.H. WAGNER JR. 10/27/92. B RUGULOSUM ALSO PRESENT.

Location: CASS COUNTY, MN

Legal : T140N R29W SWNW35

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 54' 5" Long: 94 19' 2"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 321

Last Obs.: 01 October 1992

Voucher: 824525 MIN

Verification: verified

Element: BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #4

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: WOODROW 35

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K.M. (KMM3401)

LOCATED ONE QUARTER MILE SOUTHWEST OF BLACK WATER LAKE. 3 SPECIES OF BOTRYCHIUM SUBGENUS SCEPTRIDIUM OBSERVED AT THIS LOCATION: B. MULTIFIDUM, B. RUGULOSUM AND B. ONEIDENSE. THE TWO FORMS OF B. DISSECTUM WOULD BE LIKELY POSSIBILITIES FOR FUTURE SEARCHES IN THIS AREA OF SMALL RISES AND SHALLOW, LEVEL LOW AREAS WITH FRAXINUS NIGRA, POPULUS TREMULOIDES, ACER SACCHARUM, AND TILIA AMERICANA. THIS IDENTIFICATION CONFIRMED BY W.H. WAGNER JR. 10/27/92.

Location: CASS COUNTY, MN

Legal : T140N R29W SWNW35

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 54' 5" Long: 94 19' 2"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 321

Last Obs.: 02 October 1992

Voucher: 824531 MIN Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #14

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: WOODROW 36

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM2888)

LOCATED ONE MILE SOUTHEAST OF BLACK WATER LAKE ON A SMALL, 10 ACRE LAKE THAT IS SURROUNDED BY FLOATING BOG WITH CHAMAEDAPHNE CALYCVLATA AND CAREX LASIOCARPA. THE PLANTS ARE BLOOMING AND OCCUR STRANDED IN DENSE MATS ON THE EXPOSED SURFACE OF THE BOG NEAR SMALL POOLS. ASSOCIATES ON THE BOG EDGE INCLUDE: UTRICULARIA INTERMEDIA, BRASENIA SHREBERI, SCIRPUS SUBTERMINALIS, AND UTRICULARIA PURPUREA.

Location: CASS COUNTY, MN

Legal : T140N R29W NENW36

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 54' 17" Long: 94 17' 29"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 321

Last Obs.: 28 July 1992

Voucher: MIN Verification: verified

Element: UTRICULARIA PURPUREA (PURPLE-FLOWERED BLADDERWORT) #1

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: WOODROW 36

Ownership: Private

Managed Area(s): not managed or no record

Source: MYHRE, K. (KMM2867)

LOCATED 1/3 MI SE OF BLACK WATER LAKE ON A SMALL (10 ACRE) LAKE SURROUNDED BY FLOATING BOG DOMINATED BY CHAMAEDAPHNE CALYCVLATA AND CAREX LASIOCARPA. UTRICULARIA PURPUREA IS EXTREMELY ABUNDANT AT THIS LOCATION, EXTENDING AS MUCH AS 30 FT INTO THE CENTER OF THE LAKE AND FORMING A NEARLY CONTINUOUS COLONY JUST BEYOND THE EDGE OF THE BOG ALONG ALMOST THE ENTIRE LAKE. MANY 100'S OF STRIKING PURPLE BLOOMS OBSERVED, AS WELL AS BRIGHT FUSCHIA-COLORED BUDS.

Location: CASS COUNTY, MN

Legal : T140N R29W NENW36

Quad Map: WOMAN LAKE (K12A)

Latitude: 46 54' 17" Long: 94 17' 29"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 321

Last Obs.: 28 July 1992

Voucher: MIN Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #175

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: LIMA 2

Ownership: Owner unknown

Managed Area(s): CHIPPEWA NATIONAL FOREST

Source: BOE, J. (94071101)

LOCATED NEAR CHIPPEWA NF ECS TRANSECT LTA B-03. MAPLE-BASSWOOD FOREST. ACER SACCHARUM & TILIA AMERICANA. ASSOCIATED WITH CAREX PEDUNCULATA, C. PENSYLVANICA, ORYZOPSIS ASPERIFOLIA, DIRCA PALUSTRIS, OSTRYA VIRGINIANA.

Location: CASS COUNTY, MN

Legal : T141N R25W SENW02

Quad Map: SHINGLE MILL LAKE (J14D)

Latitude: 47 3' 30" Long: 93 48' 33"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 220

Forestry District: 221

Last Obs.: 11 July 1994

Voucher: 459054 MIN Verification: verified

Element: BOTRYCHIMUM SIMPLEX (LEAST MOONWORT) #3
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: OXBOW LAKE CBS Site #: 83
Ownership: Owner unknown
Managed Area(s): not managed or no record
Source: BOE, J. (93070101)
IN WHITE CEDAR SWAMP WITH COPTIS GROENLANDICA, RUBUS PUBESCENS, RIBES TRISTE, CAREX LEPTALEA, MITELLA NUDA, CICUTA MACULATA. 4 PLANTS OBSERVED. IDENTIFIED BY W.H. WAGNER (AS OF 10/07/1996, SPECIMEN REMAINS WITH HIS COLLECTIONS).

Location: CASS COUNTY, MN
Legal : T141N R26W SWNE08
Quad Map: REMER (J14C)
Latitude: 47 2' 26" Long: 93 59' 58"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 01 July 1993

Voucher: Verification: verified

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #15
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: INGUADONA 3
Ownership: County Forest
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MYHRE, K. (KMM2746)
LOCATED ON THE NORTH SHORE OF MABEL LAKE. PLANTS FORM AN ALMOST CONTINUOUS MAT 1 TO 2 METERS FROM THE SHORELINE AT .5 TO 1.0 METERS WATER DEPTH. VERY FEW PLANTS BLOOMING RELATIVE TO THE VERY LARGE POPULATION. ASSOCIATED SPECIES INCLUDE VALISNERIA AMERICANA, POTOMOGETON ILLINOENSIS, CERATOPHYLLUM DEMERSUM AND CHARA VULGARIS.

Location: CASS COUNTY, MN
Legal : T141N R27W SESE03
Quad Map: TOBIQUE (J13D)
Latitude: 47 3' 16" Long: 94 4' 37"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 09 July 1992

Voucher: MIN Verification: verified

Element: BOTRYCHIMUM PALLIDUM (PALE MOONWORT) #11
State Status: ENDANGERED
EO Size: EO Rank: Current Status: Intended Status:
Site: INGUADONA 14
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MCCARTNEY, R. (RM97010)
3 PLANTS LOCATED ALONG THE SHORELINE OF EAST TWIN LAKE. LAKESHORE HAS LARGE WHITE PINE & CEDAR. HABITAT ALSO INCLUDES RED PINE, POA SPP & HAZEL. FLAT SLOPE. ASSOCIATED SPECIES: SARSAPARILLA & WILD STRAWBERRY. COMPARTMENT 191, STAND 13, WALKER RANGER DISTRICT. CHIPPEWA NF TES# 5002. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T141N R27W SESE14
Quad Map: TOBIQUE (J13D)
Latitude: 47 1' 18" Long: 94 3' 7"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 24 July 1997

Voucher: MIN Verification: verified

Element: BOTRYCHIMUM PALLIDUM (PALE MOONWORT) #12
State Status: ENDANGERED
EO Size: EO Rank: Current Status: Intended Status:
Site: INGUADONA 23
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MCCARTNEY, R. (RM97011)
2 PLANTS LOCATED APPROX 100-150M FROM FR 3579F. RED PINE STAND WITH PINE NEEDLE GROUND COVER. OPEN UNDERSTORY WITH SPARSE MAPLE SAPLINGS. FLAT SLOPE. ASSOCIATED SPP: CINNAMON FERN & MAPLE. COMPARTMENT 191, STAND 17, WALKER RANGER DISTRICT. CHIPPEWA NF TES# 5003. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T141N R27W NWNE23
Quad Map: TOBIQUE (J13D)
Latitude: 47 1' 14" Long: 94 3' 23"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 24 July 1997

Voucher: MIN Verification: verified

Element: SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #57

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: KEGO 11

Ownership: Private

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: TOWNSEND, D. (SIGHT RECORD)

COMPARTMENT 54 STAND 3 OF WALKER DISTRICT-CHIPPEWA. TES #5001. IN WETLAND JUST SOUTH OF HWY 200 AT RD INTERSECTION.

Location: CASS COUNTY, MN

Legal : T141N R28W NWNW11

Quad Map: TOWN LINE LAKE (J13C)

Latitude: 47 3' 2" Long: 94 12' 3"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 22 August 1992

Voucher: Verification: sight or sound rec.

Element: NAJAS GRACILLIMA (SLENDER NAIAD) #32

State Status: SPECIAL CONCERN

EO Size: 82 acres EO Rank: Current Status: Intended Status:

Site: KEGO 14

Ownership: Owner unknown

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: ESTES-MORTENSEN, C. (LL1150)

FOUND DURING TREATMENT OF PURPLE LOOSESTRIPE (LYTHRUM SALICARIA) ON NORTH END OF KEGO LAKE. LAKE ALSO SUPPORTS UTRICULARIA GIBBA, POTAMOGETON SPP, DULICHIMUM ARUNDINACEUM, NYMPHAEA TUBEROSA, BRASENIA SCHREBERI, LEERSIA ORYZOIDES. IN ITASCA MORaine LTA. SOME OF LAKESHORE IS DEVELOPED ON NORTH END, LESS ON SOUTH END. 1 DUP AT LEECH LAKE HERBARIUM.

Location: CASS COUNTY, MN

Legal : T141N R28W SE14

Quad Map: TOWN LINE LAKE (J13C)

Latitude: 47 1' 35" Long: 94 11' 5"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 29 August 1995

Voucher: MIN Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #35

State Status: No Legal Status

EO Size: 82 acres EO Rank: Current Status: Intended Status:

Site: KEGO 14

Ownership: Owner unknown

Managed Area(s): LEECH LAKE RESERVATION

Source: ESTES-MORTENSEN, C. (LL1154)

FOUND DURING TREATMENT OF PURPLE LOOSESTRIPE (LYTHRUM SALICARIA) ON NORTH END OF KEGO LAKE. LAKE ALSO SUPPORTS NAJAS GRACILLIMA, POTAMOGETON SPP, DULICHIMUM ARUNDINACEUM, NYMPHAEA TUBEROSA, BRASENIA SCHREBERI, LEERSIA ORYZOIDES. IN ITASCA MORaine LTA. SOME OF LAKESHORE IS DEVELOPED ON NORTH END, LESS ON SOUTH END. (1 DUP AT LEECH LAKE HERBARIUM)

Location: CASS COUNTY, MN

Legal : T141N R28W SE14

Quad Map: TOWN LINE LAKE (J13C)

Latitude: 47 1' 35" Long: 94 11' 5"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 29 August 1995

Voucher: MIN Verification: verified

Element: NAJAS GRACILLIMA (SLENDER NAIAD) #7

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: KEGO 22

Ownership: County Forest

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: MYHRE, K. (KMM3450)

LOCATED ON THE SOUTHEAST SHORE OF TADPOLE LAKE. MANY VERY LARGE (1-2 FEET IN LENGTH) MASSES OF PLANTS OBSERVED FLOATING ALONG EDGE OF SANDY, GRAVELLY, SILTY SHORELINE. THESE EXTREMELY LARGE, MANY BRANCHED PLANTS ARE VERY FRAGILE, AND BREAK INTO MUCH SMALLER (1-2D CM) SEGMENTS AT THE SLIGHTEST TOUCH. SUBSTANTIAL POPULATION AT THIS LOCATION.

Location: CASS COUNTY, MN

Legal : T141N R28W NESW22

Quad Map: TOWN LINE LAKE (J13C)

Latitude: 47 0' 45" Long: 94 12' 51"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 09 October 1992

Voucher: MIN Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #15

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: KEGO 31
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MYHRE, K. (KMM2669)

Location: CASS COUNTY, MN
Legal : T141N R28W SWNE31
Quad Map: WOMAN LAKE (K12A)
Latitude: 46 59' 16" Long: 94 16' 3"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 09 July 1992

Voucher: MIN Verification: verified

LOCATED ON A SMALL (7 ACRE) LAKE SURROUNDED BY FLOATING BOG WITH LARIX LARICINA AND CHAMAEDAPHNE CALYCVLATA. THE PLANTS (THIN, THREAD-LIKE SEGMENTS) OCCUR FLOATING IN AN ENTANGLED MASS CLOSE TO THE EDGE OF THE BOG WITH UTRICULARIA VULGARIS, U. INTERMEDIA, AND LEMNA MINOR; LIPARIS LOESELLII OCCURS ON THE TUFTS OF VEGETATION CLOSEST TO THE WATER'S EDGE. APPROXIMATELY SIX MASSES OF UTRICULARIA GIBBA OBSERVED ALONG THE EDGE OF THE BOG.

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #84

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: KEGO 31
Ownership: Private
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (SIGHT RECORD)
COMPARTMENT 64 OF THE WALKER DISTRICT-CHIPPEWA NF. TES #5002. IN SMALL POND NEXT TO ROAD.

Location: CASS COUNTY, MN
Legal : T141N R28W NWSE31
Quad Map: WOMAN LAKE (K12A)
Latitude: 46 59' 5" Long: 94 16' 12"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 09 July 1992

Voucher: Verification: sight or sound rec.

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #80

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: KEGO 36
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: STEELE, W. (SIGHT RECORD)

Location: CASS COUNTY, MN
Legal : T141N R28W SW36
Quad Map: LONGVILLE (K13B)
Latitude: 46 58' 53" Long: 94 10' 22"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 18 June 1995

Voucher: Verification: sight or sound rec.

COMPARTMENT 61 OF WALKER DISTRICT. 100+ PLANTS. SITE REPORTED BY DR. WILLIAM STEELE, VACATIONING IN MN. SITE IS SPHAGNUM BOG, 1.5 E OF LONGVILLE ON NORTH SIDE CO RD 7. BOG IS ALONG SE SHORE OF TAMARACK LAKE. PLANTS DISPERSED OVER MANY ACRES.

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #19

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: DIAMOND POINT
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (KMM3163)

Location: CASS COUNTY, MN
Legal : T141N R29W NESW01
Quad Map: WHIPHOLT (J12D)
Latitude: 47 3' 26" Long: 94 18' 8"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 19 August 1992

Voucher: 824600 MIN Verification: verified

LOCATED ONE HALF MILE SOUTHEAST OF BUNGY BAY IN LEECH LAKE IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. PLANTS GROWING IN A LOW DEER-TRAIL, AND VERY FAINT OLD ROAD WITH OSTRYA VIRGINIANA, DIRCA PALUSTRIS, UVULARIA GRANDIFLORA, THALICTRUM DIOICUM, AND VIOLA PUBESCENS. (VERIFIED BY W.H. WAGNER 10/97).

Element: MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #11
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: ROGERS POINT CBS Site #: 104
Ownership: Private
Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K. (KMM2822)
Voucher: MIN Verification: verified
LOCATED IN THE CEDAR SPRINGS LODGE WILDLIFE REFUGE. PLANTS OCCUR IN AND AROUND POOLS IN A SWAMP FOREST DOMINATED BY THUJA OCCIDENTALIS. ASSOC SPECIES INCLUDE:
PLATANThERA ORBICULATA, P. OBTUSATA, P. HYPERBOREA, CORALLORHIZA TRIFIDA, GOODYERA REPENS VAR. OPHIOIDES, HALENIA DEFLEXA, BOTRYCHUM VIRGINIANUM AND
CYPRIPIEDUM CALCEOLUS VAR. PARVIFLORUM. TREMENDOUS VARIATION IN THE SIZE OF FLOWERING PLANTS WHICH WERE OBSERVED IN ONLY FOUR OF THE MANY POOLS IN THIS BOG.
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 24 July 1992

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #36
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: PINE LAKE 10 CBS Site #: 100
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: GUSTAFSON, J. AND ROERICK, G.
Voucher: Verification: verified
COLLECTED FROM PRIVATE DOCK NEAR ACCESS. FOUND DURING TRANSECT SEARCH FOR NAJAS GRACILLIMA AROUND HORSESHOE LAKE.
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 16 August 1993

Element: NAJAS GRACILLIMA (SLENDER NAIAD) #24
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: PINE LAKE 10 CBS Site #: 100
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: GUSTAFSON, J. AND ROERICK, G.
Voucher: MIN Verification: verified
COLLECTED IN HORSESHOE LAKE. FOUND & COLLECTED IN 6 OF 10 TRANSECTS AROUND THE LAKE IN 6 TO 11 FEET OF WATER, ALWAYS WITH OTHER BUSHY PONDWEED. SUBSTRATE: SAND
WITH DETRITIS. SAMPLES ALSO COLLECTED IN NWNW11, NESE10, NE10, & SWSE03.
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 16 August 1993

Element: BOTRYCHUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #23
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: PINE LAKE 16
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: WESTFIELD, C., GUNDALE, M. & MCCARTNEY, R. (CW97007)
Voucher: MIN Verification: verified
50-100 PLANTS LOCATED SOUTH OF WHIPHOLT ON FR 2312, JUST EAST OF HAGEN LAKE. PLANTS FOUND IN TRANSITION ZONE BETWEEN RED PINE PLANTATION & BORDERING WETLAND,
GROWING ON W-FACING GENTLE SLOPE IN SLIGHTLY MOIST SOIL. BOTRYCHUM MULTIFIDUM ALSO FOUND AT SITE. COMPARTMENT 70, STAND 26, WALKER RANGER DISTRICT. CHIPPEWA
NF TES# 5003.
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 12 August 1997

Element: WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #16

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: PINE LAKE 16

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: GUSTAFSON, J. & MOEN, D. (USFS)

20-100 PLANTS LOCATED IN RED PINE PLANTATION SLATED FOR THINNING. PLANTS OCCUR IN SMALL OPENINGS & UNDER HAZEL, NEVER IN FULL SUNLIGHT. ASSOC SPP: ASTER MACRO, MAIANthemum CAN, GOODYERA TES. LARGE POP LOC NEAR WAWA LAKE IN BUR OAK & BIRCH STAND. ASSOC SPP: ASTER MAC, PTERIDIUM AQUIL, APOCYNUM & RHUS RAD. PLANTS FOUND W/IN 10 FT OF EDGE OF TREES; OPENS TO SEDGES & CATTAILS NEAR LAKE EDGE. EST POP 10,000 STEMS IN 100 AC AREA; DOM GRND COVER IN MANY PLACES. CHIPPEWA NF #5001.

Location: CASS COUNTY, MN

Legal : T141N R29W NW17SENE16

Quad Map: WHIPHOLT (J12D)

Latitude: 47 1' 59" Long: 94 21' 0"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 29 July 1994

Voucher: CNF

Verification: verified

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #14

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: PINE LAKE 7

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K. (KMM3340)

LOCATED ON THE SANDY SOUTHEAST SHORE OF PINE LAKE. LARGE SPECIMENS OBSERVED IN DEBRIS AT PUBLIC BOAT ACCESS, AND UPROOTED, FLOATING PIECES OCCASIONALLY OBSERVED AT VARIOUS LOCATIONS ON THE LAKE, SUGGESTING A HEALTHIER POPULATION ON SOME OTHER SHORELINE OF THE LAKE. THE ROOTED PLANTS AT THIS LOCATION WERE VERY DIFFICULT TO DISCERN OCCURRING ON THE SANDY SHORE WITH ONLY 1-2 CM POINTS VISIBLE ABOVE THE SAND INTERSPERSED WITH JUNCUS.

Location: CASS COUNTY, MN

Legal : T141N R29W NENW20

Quad Map: JACK LAKE (J12C)

Latitude: 47 1' 14" Long: 94 22' 38"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 22 September 1992

Voucher: MIN

Verification: verified

Element: NAJAS GRACILLIMA (SLENDER NAIAD) #8

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: PINE LAKE 7

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K. (KMM3342)

LOCATED ON THE SOUTHEAST SHORE OF PINE LAKE. PLANTS FREE-FLOATING ALONG THE SHALLOW, SANDY SHORELINE, AND SOUTHEAST BAY OF THE LAKE. MYRIOPHYLLUM TENELLUM, UTRICULARIA GIBBA, U. INTERMEDIA, U. VULARIS, BRASENIA SHREBERI, NAJAS FLEXILIS, NUPHAR LUTEUM, AND NYMPHAEA TUBEROSA ARE ASSOCIATED SPECIES. VERY FEW PLANTS OBSERVED IN LIMITED SEARCH, MUCH POTENTIAL HABITAT.

Location: CASS COUNTY, MN

Legal : T141N R29W NENW20

Quad Map: JACK LAKE (J12C)

Latitude: 47 1' 14" Long: 94 22' 38"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 22 September 1992

Voucher: MIN

Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #11

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: PINE LAKE 7

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K. (KMM3341)

LOCATED ALONG THE SANDY SOUTHEAST SHORE OF PINE LAKE. PLANTS OCCUR STRANDED ON THE SANDY SHORE IN DENSE MATS, 20 FRESH BLOOMS. ONE PLANT OBSERVED ROOTED, WITH STRANDS FLOATING IN 1-2 DCM OF WATER. "BIRD'S NESTS" OF FREE-FLOATING, ENTANGLED COLONIES (25+ STRANDS AVG. 1 DCM IN LENGTH) CONSISTENTLY OBSERVED IN A SHALLOW BAY DOMINATED BY NUPHAR LUTEUM AND NYMPHAEA TUBEROSA. ASSOCIATED SPECIES ARE THE OTHER UTRICULARIS: U. VULGARIS, U. INTERMEDIA AND U. MINOR.

Location: CASS COUNTY, MN

Legal : T141N R29W NENW20

Quad Map: JACK LAKE (J12C)

Latitude: 47 1' 14" Long: 94 22' 38"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 22 September 1992

Voucher: MIN

Verification: verified

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #17
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: PINE LAKE 33
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MYHRE, K. (KMM2635)
LOCATIONED ALONG THE SANDY SOUTHEAST SHORE OF MOCCASIN LAKE. PLANTS OCCUR IN 0.5 TO 1.5 METERS OF WATER. FIVE DENSE MATS (APPROX. 1 METER SQUARE) OBSERVED ALONG THE SHORELINE. PLANTS IN ONE OF THE MATS WERE BEGINNING TO BLOOM WITH A SUCCULENT, PINK-TINGED FLOWER. ASSOCIATES INCLUDE: ELEOCHARIS, JUNCUS, SCIRPUS, EPILOBIUM, AND SPARGANIUM.

Location: CASS COUNTY, MN
Legal : T141N R29W SWNW33
Quad Map: WOMAN LAKE (K12A)
Latitude: 46 59' 20" Long: 94 21' 40"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 09 July 1992
Voucher: MIN Verification: verified

Element: BOTRYCHIMUM LANCEOLATUM (TRIANGLE MOONWORT) #40
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: TURTLE LAKE 20
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: GUNDALE, M. & MCCARTNEY, R. (MG97011)
2 PLANTS LOCATED OFF OF DIRT ROAD APPROX 1.1 MILES NORTH OF FR 3759. HABITAT IS MATURE MAPLE-BASSWOOD & OAK NEXT TO WETLAND AREA. OPEN UNDERSTORY. HEAVILY SHADED AREA WITH SLIGHT SLOPE AND VERY RICH SOIL. ASSOCIATED SPP: YOUNG MAPLES, JACK-IN-THE-PULPIT, SARSAPARILLA & LARGE-LEAFED ASTER. COMPARTMENT 88, STAND 18, WALKER RANGER DISTRICT. CHIPPEWA NF TES# 5002.

Location: CASS COUNTY, MN
Legal : T141N R30W SENE20
Quad Map: WALKER (J11D)
Latitude: 47 0' 43" Long: 94 30' 22"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 10 September 1997
Voucher: MIN Verification: verified

Element: BOTRYCHIMUM LANCEOLATUM (TRIANGLE MOONWORT) #42
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: TURTLE LAKE 25
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: GUNDALE, M. (MG97010)
1 PLANT LOCATED APPROX 3/4 MILE WEST OF FR 2108. AREA IS MOSTLY FLAT WITH A VERY RICH WET SOIL. SITE IS WELL SHADED WITH A SPARSE UNDERSTORY. ACER IS DOMINANT TREE SPECIES. OTHER ASSOCIATED SPP INCLUDE LARGE-LEAF ASTER & SOLOMON'S-SEAL. COMPARTMENT 85, STAND 46, WALKER RANGER DISTRICT. CHIPPEWA NF TES# 5003.

Location: CASS COUNTY, MN
Legal : T141N R30W SENE25
Quad Map: JACK LAKE (J12C)
Latitude: 47 0' 13" Long: 94 24' 34"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 08 September 1997
Voucher: MIN Verification: verified

Element: BOTRYCHIMUM LANCEOLATUM (TRIANGLE MOONWORT) #41
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: SHINGOBBEE 10
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MCCARTNEY, R., GUNDALE, M. & WESTFIELD, C. (RM97003)
5 PLANTS LOCATED APPROX 75M NORTH OF FR 2810, FOLLOWING A DRAINAGE TO A WET DEPRESSION AREA. HABITAT IS MATURE ASPEN, MAPLE-BASSWOOD & ASH STAND. WET DEPRESSION DOMINATED BY OSMUNDA CLAYTONIANA. OTHER ASSOCIATED SPECIES INCLUDE YOUNG MAPLES & BOTRYCHIMUM MATRICARIIFOLIUM. COMPARTMENT 100, STAND 35, WALKER RANGER DISTRICT. CHIPPEWA NF TES# 5001.

Location: CASS COUNTY, MN
Legal : T141N R31W SWNW10
Quad Map: WALKER (J11D)
Latitude: 47 2' 53" Long: 94 35' 40"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 25 June 1997
Voucher: MIN Verification: verified

Element: BOTRYCHIUM SIMPLEX (LEAST MOONWORT) #8
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: SHINGOBEE 10
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MCCARTNEY,R.(RM97001)
2 PLANTS LOCATED NORTH OF FR 2817 & 25M EAST OF CO RD 50. PLANTS ARE GROWING ON UPHILL SIDE OF A W-FACING SLOPE AT THE BASE OF A LARGE RED PINE. HABITAT IS MAPLE-BASSWOOD STAND WITH PAPER BIRCH & SOME RED PINE. ASSOCIATED SPP: HAZEL, WILD LILY-OF-THE-VALLEY, LARGE-LEAF ASTER & POISON IVY. COMPARTMENT 23, STAND 1, WALKER RANGER DISTRICT. CHIPPEWA NF TES# 5002. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T141N R31W SENW10
Quad Map: WALKER (J11D)
Latitude: 47 2' 47" Long: 94 35' 21"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 12 June 1997
Voucher: MIN Verification: verified

Element: MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #10
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: SHINGOBEE RIVER
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MYHRE,K.(KMM2751)
LOCATED ON THE SOUTH BANK OF THE SHINGOBEE RIVER AT THE BOTTOM OF A VERY STEEP DECLINE TO AN IRON-SPRING BOG DOMINATED BY THUJA OCCIDENTALIS. PLANTS OCCUR IN AND AROUND THE FIRST POOLS ENCOUNTERED AT THE BASE OF THE SLOPE. 20 PLANTS OBSERVED IN THE VICINITY OF 5 POOLS, AND 1 PLANT OBSERVED DEEPER IN THE SWAMP. ASSOC SPECIES INCL: BOTRYCHIUM VIRGINIANUM, MONESES UNIFLORA, SAXIFRAGA PENSYL-VANICA, GOODYERA REPENS VAR. OPHIOIDES, AND PLATANATHERA OBTUSATA.

Location: CASS COUNTY, MN
Legal : T141N R31W SENW17
Quad Map: AKELEY (J11C)
Latitude: 47 1' 58" Long: 94 37' 45"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 16 July 1992
Voucher: MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #101
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: SHINGOBEE 22
Ownership: Owner unknown
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: GUNDALE,M.(USFS)(MG97007)
3 PLANTS LOCATED ON TRAIL WEST OF END OF FR 2815. HABITAT IS ASPEN STAND WITH BASSWOOD, OAK & BIRCH MIXED IN. WELL SHADED AREA WITH FLAT SLOPE & RICH, WET SOIL. ASSOC SPP: LARGE-LEAF ASTER, SOLOMON'S SEAL, YOUNG OAKS WITH MANY MOSSES & POISON IVY. COMPARTMENT 103, STAND 57, WALKER RANGER DISTRICT. CHIPPEWA NF TES #5003.

Location: CASS COUNTY, MN
Legal : T141N R31W SWSE22
Quad Map: WALKER (J11D)
Latitude: 47 0' 43" Long: 94 35' 5"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 18 July 1997
Voucher: MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #104
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: SHINGOBEE 27
Ownership: Owner unknown
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: GUNDALE & MCCARTNEY (USFS) (MG97006)
1 PLANT LOCATED 200M FROM CO ROAD 71. HABITAT IS MAPLE-BASSWOOD STAND WITH OCCASIONAL OAK & PINE. SITE IS SHADED, WITH FLAT SLOPE & VERY WET, RICH ORGANIC SOIL. ASSOC SPP: SOLOMON'S SEAL, CINNAMON FERN & LARGE-LEAFED ASTER. COMPARTMENT 103, STAND 25, WALKER RANGER DISTRICT. CHIPPEWA NF TES #5002.

Location: CASS COUNTY, MN
Legal : T141N R31W NWSE27
Quad Map: HACKENSACK (K11A)
Latitude: 46 59' 55" Long: 94 35' 9"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 15 July 1997
Voucher: MIN Verification: verified

Element: UTRICULARIA GIBBA (HUMPED BLADDERWORT) #34

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: SHINGOBEE 32

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST

Source: FITZLOFF-WESTFIELD, C. (95001)

ALONG NORTH SHORE OF LITTLE BASS LAKE IN SMALL BAY ADJACENT TO CLEARCUT UNIT (HOWARD EAST SALE). SEVERAL PLANTS FOUND ALONG SHALLOW SHORE WITH SANDY BOTTOM.
ASSOC SPECIES: CAREX SP, CATTAILS, WATERSHIELD, SAGITTARIA SP & OTHER BLADDERWORTS.

Location: CASS COUNTY, MN

Legal : T141N R31W SENW32

Quad Map: CRYSTAL LAKE (K11B)

Latitude: 46 59' 20" Long: 94 37' 59"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 06 July 1995

Voucher: Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #69

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: DIRTY NOSE LAKE 2

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST

Source: BOE, J. (94091504)

ALONG ECS TRANSECT 09 IN MAPLE-BASSWOOD FOREST SOUTH OF SCHOOLCRAFT STATE PARK. ASSOCIATED SPP: ASTER MACROPHYLLUS, BOTRYCHIUM VIRGINIANUM, UVULARIA GRANDIFLORA, CAREX PENNSYLVANICA, CAREX PEDUNCULATA. OCCASIONAL IN AREA. (VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN

Legal : T142N R25W NWNE02

Quad Map: SUGAR LAKE (J14A)

Latitude: 47 8' 50" Long: 93 48' 4"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 220

Forestry District: 221

Last Obs.: 15 September 1994

Voucher: 516196 MIN Verification: verified

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #63

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: TOBIQUE SOUTHEAST

CBS Site #: 87

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST

Source: BOE, J., AASENG, N., OLSON, L., WADMAN, M. AND LIND, S.

1994: 13 PLANTS OBSERVED DURING SEARCH FOR CYPRIPEDIUM ARIETINUM. 1993: 18 PLANTS IN BLOOM. CEDAR SWAMP. ASSOC SPP: CYPRIPEDIUM ACAULE, LEDUM GROENLANDICUM, CYPRIPEDIUM REGINAE, SMILACINA TRIFOLIA, AMERORCHIS ROTUNDIFOLIA.

Location: CASS COUNTY, MN

Legal : T142N R26W NENW19

Quad Map: TOBIQUE (J13D)

Latitude: 47 6' 19" Long: 94 1' 16"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 220

Forestry District: 221

Last Obs.: 07 June 1994

Voucher: Verification: sight or sound rec.

CEDAR SWAMP. ASSOC SPP: CYPRIPEDIUM ACAULE, LEDUM

Element: CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #53

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: TOBIQUE SOUTHEAST

CBS Site #: 87

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST

Source: BOE, J.; LIND, S., OLSON, L. AND WADMAN, M. (CASS CO LAND DEPT)

IN WHITE CEDAR SWAMP WITH BALSAM FIR. WITH RHAMNUS ALNIFOLIA, MENYANTHES TRIFOLIATA, LEDUM GROENLANDICUM, SMILACINA TRIFOLIA, MITELLA NUDA. 44 PLANTS.

Location: CASS COUNTY, MN

Legal : T142N R26W NENW19

Quad Map: TOBIQUE (J13D)

Latitude: 47 6' 29" Long: 94 1' 35"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 220

Forestry District: 221

Last Obs.: 07 June 1994

Voucher: MIN Verification: verified

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #16
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: SLATER 28
Ownership: Private
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MYHRE, K. (KMM3323)
Location: CASS COUNTY, MN
Legal : T142N R26W 0ESW28
Quad Map: REMER (J14C)
Latitude: 47 4' 52" Long: 93 58' 50"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 21 September 1992
Voucher: MIN Verification: verified
LOCATED ALONG SANDY SW SHORE OF LITTLE SAND LAKE. PLANTS MOST VISIBLE UPROOTED & FLOATING IN WATER. ROOTED PLANTS LESS OBVIOUS DUE TO SHORT STATURE (AVG 3CM) & VERY THIN INTERSPERSING IN MAT DOM BY TALLER (AVG 6CM) JUNCUS. ROOTED PLANTS MOST VISIBLE WHERE THEY EXTEND BEYOND JUNCUS MAT, BUT PLANTS VERY TINY (AVG 1CM TIP VISIBLE ABOVE SAND). NO PLNTS OBSERVED IN BLOOM. PLANTS ARE INTERMITTENT ALONG SHORELINE AT WATER DEPTH OF 0.5-1.5M, APPROX 2 METERS FROM WATER'S EDGE.

Element: BOTRYCHIMUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #24
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: SLATER 30
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MCCARTNEY, R. (RM97018A)
Location: CASS COUNTY, MN
Legal : T142N R26W SENW30
Quad Map: TOBIQUE (J13D)
Latitude: 47 5' 19" Long: 94 1' 15"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 07 August 1997
Voucher: MIN Verification: verified
25+ PLANTS LOCATED APPROX 1/4 MILE NORTH OF FR 2117 & 100M WEST OF FR 2084. GROWING IN WETLAND DRAINAGE WITH RED PINE MIXED WITH ASPEN, ASH AND ELM. GROUND COVER DOMINATED BY RUBUS SPP & BOTRYCHIMUM MULTIFIDUM (100'S OF PLANTS). OTHER ASSOC SPP INCLUDE BOTRYCHIMUM DISSECTUM F. DISSECTUM & OBLIQUUM, POA SPP, SEDGE SPP, WILD STRAWBERRY, OSTRICH & INTERRUPTED FERNS. COMPARTMENT 157, STAND 27, WALKER RANGER DIST. CHIPPEWA NF TES# 5002. (VERIFIED BY W.H. WAGNER 10/97).

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #51
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: SKELLY LAKE
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MYHRE, K. (KMM2231)
Location: CASS COUNTY, MN
Legal : T142N R27W NESW11
Quad Map: BOY RIVER (J13A)
Latitude: 47 7' 48" Long: 94 3' 52"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 11 June 1992
Voucher: MIN Verification: verified
CBS Site #: 61
GROWING IN A SWAMP FOREST DOMINATED BY THUJA OCCIDENTALIS AND ABIES BALSAMEA. PLANTS TUCKED DOWN AMONG THE STEMS OF LEDUM GROENLANDICA ON SPHAGNUM HUMMOCKS IN A BRUSHY, SUNNIER AREA CREATED BY A BREAK IN THE CANOPY. OTHER ASSOC SPECIES INCLUDE LISTERA CORDATA, CORNUS CANADENSIS, AND GAUTHERIA HISPIDULA.

Element: BOTRYCHIMUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #21
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: ROGERS 31
Ownership: Private
Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (KMM3424)
Location: CASS COUNTY, MN
Legal : T142N R27W SWSW29
Quad Map: TOWN LINE LAKE (J13C)
Latitude: 47 4' 58" Long: 94 8' 8"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 06 October 1992
Voucher: MIN Verification: verified
LOCATED ON THE UPLAND BETWEEN BOY LAKE AND LOMISH LAKE ALONG THE EDGE OF A LOW AREA IN A DECIDUOUS FOREST WITH FRAXINUS NIGRA, TILIA AMERICANA, ACER SACCHARUM, AND ULMUS AMERICANA. ASSOCIATED SPECIES INCLUDE ATHYRIUM ANGUSTUM, SCUTELLARIA LATERIFLORA, IMPATIENS CAPENSIS, BOTRYCHIMUM MULTIFIDUM, AND BOTRYCHIMUM DISSECTUM F. DISSECTUM. THESE PLANTS WERE YELLOW IN COLOR, BUT STILL STANDING. (1 DUP: (#3428), 824602 MIN). (VERIFIED BY W.H. WAGNER 10/97).

Element: BOTRYCHIMUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #20

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: ROGERS 31 CBS Site #: 92

Ownership: Private

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM2398)

THE SITE IS A MATURE, DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA LOCATED ON THE SOUTH SHORE OF BOY LAKE. THE PLANTS OCCUR ALONG THE EDGE OF A WOODLAND POOL IN SUBSTANTIAL NUMBERS (25+ PLANTS OBSERVED). ASSOCIATED SPECIES INCLUDE BOTRYCHIMUM MULTIFIDUM, BOTRYCHIMUM VIRGINIANUM, ACTAEA RUBRA, SMILACINA RACEMOSA, AND CORALLORHIZA STRIATA. (2 DUPS: (#2400AB), 824593 & 506713 MIN). (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T142N R27W NESW30
Quad Map: TOWN LINE LAKE (J13C)
Latitude: 47 5' 13" Long: 94 8' 55"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 25 June 1992

Voucher: MIN Verification: verified

Element: MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #12

State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: ROGERS 31 CBS Site #: 92

Ownership: Private

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: MYHRE, K. (KMM2425)

INFREQUENT IN A SWAMP FOREST DOMINATED BY FRAXINUS NIGRA, ABIES BALSAMEA AND THUJA OCCIDENTALIS. PLANTS GROWING IN NEEDLE DUFF UNDER BALSAMS & ALONG EDGE OF THE POOLS UNDER ASH. THIS SWAMP IS IN A POCKET SURROUNDED BY HIGH GROUND ON ALL SIDES, VERY MOIST. PLANTS IN MID-BLOOM. ASSOC SPP INCL: PLATANATHERA OBTUSATA, P. HYPERBOREA, CYPRIPEDIUM CALCEOLUS VAR. PARVIFLORUM, GOODYERA REPENS VAR. OPHIOIDES, CYPRIPEDIUM REGINAE, AND CORALLORHIZA TRIFIDA.

Location: CASS COUNTY, MN
Legal : T142N R27W SWSW31
Quad Map: TOWN LINE LAKE (J13C)
Latitude: 47 4' 15" Long: 94 9' 15"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 26 June 1992

Voucher: MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #9

State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: BOY LAKE 9 CBS Site #: 97

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K. (PHOTO RECORD) (KMM001PH)

LOCATED ONE MILE SOUTHEAST OF BLACKDUCK POINT IN LEECH LAKE. PLANTS GROWING IN A MATURE DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. SPARSE HERB LAYER WITH SUBSTANTIAL LEAF MOLD. ASSOC. SP. INCLUDE: ATHERIUM ANGUSTUM, UVULARIA GRANDIFLORA, BOTRYCHIMUM VIRGINIANUM, AND THALICTRUM DIOICUM. ONE PLANT DISCOVERED AND PHOTO-DOCUMENTED BY JIM WELCH IN A DNR-USFS SEARCH. MUCH POTENTIAL HABITAT UNSEARCHED.

Location: CASS COUNTY, MN
Legal : T142N R28W NENW04
Quad Map: FEDERAL DAM (J13B)
Latitude: 47 9' 11" Long: 94 14' 16"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 161
Last Obs.: 09 September 1992

Voucher: Verification: photo rec.

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #52

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: BOY LAKE 23 CBS Site #: 91

Ownership: Native American land

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: MYHRE, K. (KMM2409)

GROWING IN A SWAMP FOREST DOMINATED BY THUJA OCCIDENTALIS AND ABIES BALSAMEA. PLANTS EMBEDDED IN HUMMOCKS OF SPHAGNUM AND LEDUM GROENLANDICA WHICH OCCUR IN A MORE OPEN, SUNNY AREA OF THE BOG DUE TO A CANOPY GAP. ADDITIONAL ASSOC SPECIES INCLUDE: ALNUS INCANA SSP. RUGOSA, CORNUS STOLONIFERA, GAULTHERIA HISPIDULA, THELYPTERIS PALUSTRIS, RUBUS PUBESCENS, VACCINIUM ANGUSTIFOLIUM, SMILACINA TRIFOLIATA, TRIENTALIS BOREALIS AND CORNUS CANADENSIS.

Location: CASS COUNTY, MN
Legal : T142N R28W SWSW14
Quad Map: TOWN LINE LAKE (J13C)
Latitude: 47 6' 47" Long: 94 12' 5"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 25 June 1992

Voucher: MIN Verification: verified

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #42
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: MAD DOG LAKE BOG CBS Site #: 96
Ownership: Owner unknown
Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: USFS COMPARTMENT RECORD (SIGHT RECORD)
REPORTED IN N.F. SENSITIVE SPECIES LOG FROM COMPARTMENT RECORD, TO BE PRESENT IN "BOG:" IN SECTIONS 15, 21, 22, 23, 28 IN COMPARTMENT 42 (WALKER DISTRICT). NEEDS
CONFIRMATION. DATE OF INFO IS DATE REPORTED. BELIEVED TO BE IN SECT 22 FROM COMPARTMENT FILE NOTES.

Location: CASS COUNTY, MN
Legal : T142N R28W 22
Quad Map: TOWN LINE LAKE (J13C)
Latitude: 47 6' 15" Long: 94 12' 56"
Precision: within one mile

DNR Region: 1
Wildlife Area: 709
Forestry District: 161
Last Obs.: 30 March 1981

Voucher: Verification: sight or sound rec.

Element: CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #21
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: MAD DOG LAKE BOG CBS Site #: 96
Ownership: Owner unknown
Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: USFS COMPARTMENT RECORD (SIGHT RECORD)
MAD DOG LAKE BOG, COMPARTMENT 42. NO FURTHER INFORMATION. NO MORE EXACT LOCATION. NEEDS CONFIRMATION. REPORTED FROM SECTIONS 15, 21, 22, 23 AND 28.
FOREST OWNERSHIP DISCONTINUOUS. BELIEVED TO BE IN SECTION 22 FROM COMPARTMENT NOTES. NOT RELOCATED IN 1991 BY SATHER AND DAHLE OR IN 1992 BY SHERIDAN AND
MYHRE. CHIPPEWA NF TES #5001.

Location: CASS COUNTY, MN
Legal : T142N R28W NESW22
Quad Map: TOWN LINE LAKE (J13C)
Latitude: 47 6' 10" Long: 94 13' 0"
Precision: within 0.25 mile, confirmed

DNR Region: 1
Wildlife Area: 709
Forestry District: 161
Last Obs.: January 1976

Voucher: Verification: sight or sound rec.

Element: CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #46
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: MAD DOG LAKE BOG CBS Site #: 96
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: BOE, J. (93060401)
FOUND ON SEARCH OF MAD DOG LAKE BOG WITH S. MORTENSON, C. ESTES, J. HINES, & C. SLACKMAN. 5 PLANTS FOUND: 2 WITH LAST YEARS CAPSULES, 1 BARELY EMERGED, 1 WITH
FLOWER BUD, 1 (COLLECTED) WITH FLOWER JUST STARTING TO OPEN. PLANTS AT BASE OF WHITE CEDAR IN DENSE STAND OF BLACK SPRUCE WITH CEDAR AND TANARACK. ASSOC SPP:
SMILACINA TRIFOLIA, LEDUM GROENLANDICUM, & LONICERA VILLOSA. RELEVÉ 93-30 SAME STAND, DIFFERENT TIME AND LOCATION.

Location: CASS COUNTY, MN
Legal : T142N R28W SESW22
Quad Map: TOWN LINE LAKE (J13C)
Latitude: 47 5' 54" Long: 94 12' 53"
Precision: within 0.25 mile, confirmed

DNR Region: 1
Wildlife Area: 709
Forestry District: 161
Last Obs.: 04 June 1993

Voucher: MIN Verification: verified

Element: MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #17
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: BOY LAKE 23 CBS Site #: 91
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: BOE, J. (93082501)
IN CEDAR SWAMP WEST OF RELEVÉ 93-45. ASSOC SPECIES: PLATANThERA ORBICULATA, LYCOPODIUM LUCIDULUM.

Location: CASS COUNTY, MN
Legal : T142N R28W SWNE27
Quad Map: TOWN LINE LAKE (J13C)
Latitude: 47 5' 35" Long: 94 12' 38"
Precision: within 0.25 mile, confirmed

DNR Region: 1
Wildlife Area: 709
Forestry District: 161
Last Obs.: 25 August 1993

Voucher: MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #51

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:
Site: BEAR ISLAND CBS Site #: 102

Ownership: Native American land

Managed Area(s): LEECH LAKE RESERVATION

Source: ESTES-MORTENSEN, C., MORTENSEN, S. & BOE, J. (LL1074)

FOUND 23 STEMS ON BEAR ISLAND IN LEECH LAKE IN RICH, OLD-GROWTH MAPLE-BASSWOOD FOREST. SLIGHT SLOPE DOWN TO NW. CANOPY DOMINATED BY ACER SACCHARUM, WITH TILIA AMERICANA, FRAXINUS NIGRA, QUERCUS MACROCARPUS; HERBS - UVULARIA GRANDIFLORA, HYDROPHYLLUM VIRGINIANUM, SANGIUNARIA CANADENSIS, ARISAEMA TRIPHYLLUM. ERYTHRONIUM ALBIDUM FOUND IN AREA IN 1994 BY J. BOE & ESTES-MORTENSEN. (1 DUP AT LEECH LAKE HERBARIUM.) DNR RELEVÉ #4946. (VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN

Legal : T142N R29W SWSE02

Quad Map: SUGAR POINT (J12A)

Latitude: 47° 8' 30" Long: 94° 18' 26"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 02 August 1995

Voucher: 458784 MIN Verification: verified

Element: DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #20

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:
Site: STONY POINT CBS Site #: 110

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K. (KMM3430)

LOCATED IN THE NATIONAL FOREST CAMPGROUND ON STONY POINT IN LEECH LAKE. 5-6 PLANTS GROWING IN A ONE METER SQUARE AREA LESS THAN 100 FEET WEST INTO THE WOODS FROM THE PICNIC TABLE IN CAMPSITE 41. THE PLANTS ARE GROWING IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. ASSOC. SPECIES INCLUDE: LAPORTEA CANADENSIS, MATTEUCCIA STRUTHIOPTERIS, DRYOPTERIS CARTHUSIANA, ATERIUM ANGUSTUM, AND ONOCLEA SENSIBILIS.

Location: CASS COUNTY, MN

Legal : T142N R30W NWN10

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47° 8' 10" Long: 94° 27' 27"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 07 October 1992

Voucher: MIN Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #18

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:
Site: WABEGON LAKE CBS Site #: 109

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM3986)

PLANTS GROWING ON PLATEAU ABOVE ICE-THRUST SHELF ON W SHORE OF HEADQUARTERS BAY, LEECH LAKE. 15 PLANTS OBS IN A 2M SQ AREA. FOREST IS DECIDUOUS, DOM BY ACER SACC & TILIA AMER. ASSOC SPP: LAPORTEA CAN, BOTRYCHIUM VIRG, B. MULT, & MONOTROPA HYPO. 2 EXTREMELY SMALL PLANTS OBSERVED; 1 PLANT W/3 SPORE CAPSULES ON FERTILE FROND. POSSIBLY B. HESPERIUM AT SITE. (PREV COLL: MYHRE, K. (#3241), 824559 MIN & (#3241A), 824601 MIN 9/1/92). (ALL SPECIMENS VERIFIED BY W.H. WAGNER).

Location: CASS COUNTY, MN

Legal : T142N R30W NENW22

Quad Map: JACK LAKE (J12C)

Latitude: 47° 6' 24" Long: 94° 27' 48"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 07 July 1993

Voucher: 518849 MIN Verification: verified

Element: BOTRYCHIUM PALLIDUM (PALE MOONWORT) #7

State Status: ENDANGERED

EO Size: EO Rank: Current Status: Intended Status:
Site: WABEGON LAKE CBS Site #: 109

Ownership: Owner unknown

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: MYHRE, K.M. (KMM3988A)

LOCATED 5 MILES NORTHEAST OF THE TOWN OF WALKER ALONG THE SOUTHWEST SHORE OF LEECH LAKE. PLANTS OCCUR IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM. ASSOCIATED WITH BOTRYCHIUM MINGANENSE, B. MATRICARIIFOLIUM, B. SIMPLEX, B. MULTIFIDUM, B. VIRGINIANUM.

Location: CASS COUNTY, MN

Legal : T142N R30W NENW22

Quad Map: JACK LAKE (J12C)

Latitude: 47° 6' 24" Long: 94° 27' 48"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 07 July 1993

Voucher: MIN Verification: verified

Element: BOTRYCHIMUM SIMPLEX (LEAST MOONWORT) #5

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: WABEGON LAKE CBS Site #: 109

Ownership: Owner unknown

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: MYHRE, K.M. (KMM3987)

LOCATED 5 MILES NORTHEAST OF THE TOWN OF WALKER ALONG THE SOUTHWEST SHORE OF LEECH LAKE. NUMEROUS SPECIMENS OBSERVED. PLANTS OCCUR IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM. ASSOCIATED WITH BOTRYCHIMUM MINGANENSE, B. MATRICARIIFOLIUM, B. PALLIDUM, B. MULTIFIDUM, B. VIRGINIANUM. GROWING CLOSE TO LAKESHORE ON A SMALL PLATEAU ABOVE THE LAKE.

Location: CASS COUNTY, MN

Legal : T142N R30W NENW22

Quad Map: JACK LAKE (J12C)

Latitude: 47 6' 24" Long: 94 27' 48"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 07 July 1993

Voucher: MIN

Verification: verified

Element: BOTRYCHIMUM MINGANENSE (MINGAN MOONWORT) #8

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: ROGERS POINT CBS Site #: 104

Ownership: Native American land

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. AND CONVERSE, C. (KMM2777)

LOCATED ON POINT ONE HALF MILE N OF URAM BAY. PLANTS OCCUR IN A SECOND-GROWTH DECIDUOUS FOREST DOM BY ACER SACCHARUM & TILIA AMERICANA. ON A PLATEAU ABOVE THE STEEP, SOUTH SHORE OF LEECH LAKE. 4 PLANTS OBSERVED; SLIGHTLY PALE & DECUMBENT, APPEARING TO APPROACH DIE-BACK. ASSOC SPP INCLUDE: UVULARIA GRANDIFLORA, SANGUINARIA CANADENSIS, BOTRYCHIMUM VIRGINIANUM, B. MULTIFIDUM, & MONOTROPA HYPOPITHYS. IDENTIFICATION CONFIRMED BY W.H. WAGNER JR. 10/27/92.

Location: CASS COUNTY, MN

Legal : T142N R30W NWSE27

Quad Map: JACK LAKE (J12C)

Latitude: 47 5' 8" Long: 94 27' 12"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 21 July 1992

Voucher: 824536 MIN

Verification: verified

Element: BOTRYCHIMUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #2

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: ROGERS POINT CBS Site #: 104

Ownership: Native American land

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. & CONVERSE, C. (KMM2778)

LOCATED ON POINT ABOVE URAM BAY IN LEECH LAKE. PLANT OBSERVED ON A SMALL MOUND ON THE EDGE OF A SMALL LOW AREA IN A SECOND-GROWTH DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM & TILIA AMERICANA. THIS FOREST OCCURS ON A PLATEAU ABOVE STEEP SOUTH SHORE OF THE LAKE. ASSOC SPP INCLUDE: UVULARIA GRANDIFLORA, SANGUINARIA CANADENSIS, MONOTROPA HYPOPITHYS, BOTRYCHIMUM MINGANENSE, B. MULTIFIDUM & B. VIRGINIANUM. THIS IDENTIFICATION WAS VERIFIED BY W.H. WAGNER JR. 10/27/92.

Location: CASS COUNTY, MN

Legal : T142N R30W NWSE27

Quad Map: JACK LAKE (J12C)

Latitude: 47 5' 3" Long: 94 27' 12"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 21 July 1992

Voucher: 824529 MIN

Verification: verified

Element: SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #6

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: ROGERS POINT CBS Site #: 104

Ownership: Private

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. & CONVERSE, C. (KMM2782)

LOCATED ON THE POINT NORTH OF URAM BAY IN LEECH LAKE. THE PLANTS ARE GROWING ALONG THE EDGE OF A LOW, MARSHY AREA BETWEEN TWO AREAS OF HIGH GROUND ADJACENT TO THE LAKE. THE LOW, MARSHY AREA IS SEPARATED FROM THE LAKE BY A LOW, NARROW BEACH RIDGE OF SAND AND SHRUBS. BOTRYCHIMUM MINGANENSE AND B. RUGULOSUM WERE FOUND ON THE HIGH GROUND AT THIS LOCATION.

Location: CASS COUNTY, MN

Legal : T142N R30W SESE27

Quad Map: JACK LAKE (J12C)

Latitude: 47 5' 2" Long: 94 27' 6"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 161

Last Obs.: 21 July 1992

Voucher: MIN

Verification: verified

Element: BOTRYCHIUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #3

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHOOLCRAFT STATE PARK

Ownership: County Forest

Managed Area(s): SCHOOLCRAFT STATE PARK

Source: MYHRE, K.M. (KMM3385A)

LOCATED ALONG EDGE OF CAMPGROUND NEAR MISSISSIPPI RIVER IN SCHOOLCRAFT STATE PARK. PLANTS OCCUR IN MOSS SURROUNDING SEVERAL LARGE WHITE SPRUCE, & EXTEND INTO SOMEWHAT OPEN, GRASSY AREA OF SUMAC, ASPEN, MAPLE, RED PINE AND JACK PINE. ASSOC SPP INCL: RHUS RADICANS, GALIUM TRIFLORUM, BOTRYCHIUM MULTIFIDUM & B. DISSECTUM F. OBLIQUUM. SUBSTANTIAL POPULATION OF BOTRYCHIUMS OBSERVED IN AREA BTWEEN CAMP-GROUND & GROUP CAMP, & SURROUNDING AREA. ID VERIFIED BY W.H.WAGNER JR. 10/27/92.

Location: CASS COUNTY, MN

Legal : T143N R25W SWSE02

Quad Map: SUGAR LAKE (J14A)

Latitude: 47 13' 28" Long: 93 48' 6"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 220

Forestry District: 221

Last Obs.: 01 October 1992

Voucher: 824530 MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #46

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: TORREY 7

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST

Source: SUDDENDORF, T. (95090701)

EAST OF CO RD 158, SOUTH OF FR 2771, IN COMPARTMENT 228, STAND 20. 8 PLANTS GROWING 15 FT NORTH OF NATURAL, SEASONAL DRAINAGE DITCH IN DECIDUOUS FOREST WITH TILIA AMERICANA, ACER SACCHARUM, BETULA PAPYRIFERA & OSTRYA VIRGINIANA. ASSOC SPECIES: UVULARIA GRANDIFLORA, U. SESSILIFOLIA, MAIANTHEMUM CANADENSE, OSMORHIZA CLAYTONI, ASARUM CANADENSE, PYROLA & BOTRYCHIUM VIRGINIANUM. CHIPPEWA NF TES # 3005. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R25W NESW07

Quad Map: GOOSE LAKE (J14B)

Latitude: 47 12' 55" Long: 93 53' 38"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 220

Forestry District: 221

Last Obs.: 07 September 1995

Voucher: 842516 MIN Verification: verified

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #77

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: ROGERS 4

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: MYHRE, K. (SIGHT RECORD)

IN CEDAR SWAMP.

Location: CASS COUNTY, MN

Legal : T143N R27W SENE04

Quad Map: BOY RIVER (J13A)

Latitude: 47 14' 2" Long: 94 5' 47"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 220

Forestry District: 221

Last Obs.: 11 June 1992

Voucher: Verification: sight or sound rec.

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #1

State Status: No Legal Status

EO Size: EO Rank: Current Status: 1 Intended Status: 6

Site: BOY RIVER ORCHID BOG

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST

Source: RATHBUN, E. AND RATHBUN, W.

BOY RIVER BOG 3 MILES E. OF BOY RIVER N1/2 NE1/4 SEC 23 T143N R27W (PREV COLL JUNE 1963 T MORLEY (1004) MODERATELY COMMON IN SPHAGNUM HUMMOCKS OF CEDAR SWAMP WITH MENYANTHES, RUBUS ACAULIS, PICEA MARIANA, THUJA).

Location: CASS COUNTY, MN

Legal : T143N R27W NENE23

Quad Map: BOY RIVER (J13A)

Latitude: 47 11' 39" Long: 94 3' 23"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 220

Forestry District: 221

Last Obs.: 23 May 1972

Voucher: 623331 MIN Verification: verified

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #78

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: BOY RIVER 23
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MATHISEN, J. (SIGHT RECORD)
COMP 120 OF WALKER RANGER DIST. BOY RIVER ORCHID BOG, PLANTS THROUGHOUT AREA.

Location: CASS COUNTY, MN
Legal : T143N R27W NWNW23
Quad Map: BOY RIVER (J13A)
Latitude: 47 11' 41" Long: 94 4' 12"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 1992
Voucher: Verification: sight or sound rec.

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #79

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: BOY RIVER 23
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST
Source: MATHISEN, J. (SIGHT RECORD)
COMP 120 OF WALKER RANGER DIST. BOY RIVER ORCHID BOG, PLANTS THROUGHOUT AREA.

Location: CASS COUNTY, MN
Legal : T143N R27W NWNW23
Quad Map: BOY RIVER (J13A)
Latitude: 47 11' 41" Long: 94 3' 36"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 1992
Voucher: Verification: sight or sound rec.

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #17

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: OTTERTAIL POINT EAST
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (KMM3363)
LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE. ONE PLANT OBSERVED; VERY PALE, SENESCING, BUT STILL STANDING UPRIGHT. BOTRYCHUM MORMO ALSO FOUND AT THE BASE OF THIS SMALL SLOPE IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. ASSOCIATED SPECIES INCLUDE UVULARIA GRANDIFLORA, ARALIA RACEMOSA AND ATHYRIUM ANGUSTUM. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T143N R29W NWNE06
Quad Map: OTTERTAIL POINT (J12B)
Latitude: 47 14' 3" Long: 94 23' 26"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 28 September 1997
Voucher: 824604 MIN Verification: verified

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #153

State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: OTTERTAIL POINT EAST
Ownership: Owner unknown
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (KMM2892)
LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE. INFREQUENT ON THE VERY EDGE OF STAND. IN LEAF MOLD IN A MATURE, DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM & TILIA AMERICANA. ASSOC WITH ANEMONE QUINQUEFOLIA VAR. BIFOLIA, BETULA ALLEGHEN. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T143N R29W SENW06
Quad Map: OTTERTAIL POINT (J12B)
Latitude: 47 13' 53" Long: 94 23' 39"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 31 July 1992
Voucher: 824558 MIN Verification: verified

Element: BOTRYCHIMUM MINGANENSE (MINGAN MOONWORT) #7

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM2897)

GROWING IN A MATURE, DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. ASSOCIATED SPECIES INCLUDE BOTRYCHIMUM MORMO, B. VIRGINIANUM, ARALIA RACEMOSA, UVULARIA GRANDIFLORA, AND DIRCA PALUSTRIS. SPECIMEN WAS DECUMBENT AND DYING BACK AT THE TIME OF COLLECTION. IDENTIFICATION CONFIRMED BY W.H. WAGNER JR. 10/27/92.

Location: CASS COUNTY, MN

Legal : T143N R29W SWNW06

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 51" Long: 94 24' 0"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 03 August 1992

Voucher: 824535 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #12

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT EAST CBS Site #: 27

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM3466)

LOCATED ON BOTH SIDES OF SUCKER BAY ROAD ON OTTERTAIL PENINSULA IN LEECH LAKE. PLANTS OCCUR VERY SPORADICALLY, AND AS INDIVIDUALS OR IN SMALL COLONIES (2-25 PLANTS). AREA IS UPLAND WITH ACER SACC, TILIA AMER & OCCASIONAL UPLAND THUJA OCCID & BETULA ALLEGAN. PLANTS PIERCE DEEP LEAF MOLD IN AREAS OF LIMITED UNDERSTORY & SPARSE HERB LAYER OF UVULARIA GRAND, ARALIA RACE, BOTRYCHIMUM VIRG & ATHYRIUM ANGUSTUM. 150 PLANTS OBSERVED. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R29W NENE06

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 14' 5" Long: 94 23' 10"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 08 October 1992

Voucher: 824542 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #14

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT EAST CBS Site #: 27

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM3467)

LOCATED ALONG THE SUCKER BAY ROAD ON OTTERTAIL PENINSULA IN LEECH LAKE. PLANTS OCCUR IN BOTH SLOPING & LEVEL AREAS WITH ACER SACCHARUM, TILIA AMERICANA, AND LESSER AMOUNTS OF ABIES BALSAMEA. ASSOC SPP INCLUDE: UVULARIA GRANDIFLORA, ARALIA RACEMOSA, BOTRYCHIMUM VIRGINIANUM, B. MATRICARIIFOLIUM, & ATERIUM ANGUSTUM. ONE PLANT OBSERVED GROWING IN A FAINT DEER TRAIL; OTHERS AT THE BASE OF THE SLOPE. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R29W NWNE06

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 14' 3" Long: 94 23' 26"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 08 October 1992

Voucher: 824544 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #15

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT EAST CBS Site #: 27

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM2891)

LOCATED ALONG SUCKER BAY RD ON OTTERTAIL PENINSULA IN LEECH LAKE. PLANTS OCCUR IN A LEVEL, DECIDUOUS FOREST DOM BY ACER SACC & TILIA AMER. SEVERAL SMALL, TIGHT COLONIES OF VERY LARGE PLANTS OBS IN DEEP LEAF LITTER. BRIGHT YELLOW-GREEN COLOR OF SPOROPHORE CONTRASTS W/LIGHT BROWN OF CRUST OF LEAF LITTER MAKING PLANTS MORE VISIBLE, DESPITE APPEARANCE OF ONLY PORTION OF PLANT ABOVE LEAF MOLD. (VERIFIED BY W.H. WAGNER 10/97). (ADDL COLL (#3034A), 832974 MIN MADE ON 8/13/1992).

Location: CASS COUNTY, MN

Legal : T143N R29W SENW06

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 53" Long: 94 23' 39"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 08 October 1992

Voucher: 829374 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #16

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM3468)

LOCATED ON BOTH SIDES OF SUCKER BAY ROAD ON OTTERTAIL PENINSULA IN LEECH LAKE. PLANTS OCCUR IN DEEP LEAF LITTER WITH ACER SACCHARUM, TILIA AMERICANA, AND THUJA OCCIDENTALIS. ASSOC. SP. INCL: BOTRYCHIMUM MINGANENSE, B. VIRGINIANUM, ARALIA RACEMOSA, UVULARIA GRANDIFLORA & DIRCA PALUSTRIS. A FEW VERY LARGE INDIVIDUALS (WITH SPORE CAPSULES NUMBERING OVER 75) OBSERVED AT THIS LOCATION, AS WELL AS SMALL AND AVERAGE-SIZED SPECIMENS. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R29W SWNW06

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 51" Long: 94 24' 0"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 08 October 1992

Voucher: 824541 MIN Verification: verified

Element: BOTRYCHIMUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #16

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: SUGAR POINT CBS Site #: 56

Ownership: Native American land

Managed Area(s): BATTLEGROUND STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM2332)

LOCATED TWO MILES NORTH OF SUGAR POINT ON LEECH LAKE IN A MATURE, DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. SEVERAL PLANTS OBSERVED IN BARE SOIL BETWEEN THE TRUNKS OF TWO LARGE (40 CM DBH) BASSWOOD TREES IN AN AREA OTHERWISE ENGULFED IN LAPORTEA CANADENSIS, WITH OCCASIONAL ACTAEA RUBRA, OSMORHIZA CLAYTONII, MATTEUCCIA STRUTHIOPTERIS, AND TAXUS CANADENSIS. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R29W NENE23

Quad Map: SUGAR POINT (J12A)

Latitude: 47 11' 48" Long: 94 18' 37"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 23 June 1992

Voucher: 824586 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #114

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SUGAR POINT CBS Site #: 56

Ownership: Native American land

Managed Area(s): LEECH LAKE RESERVATION BATTLEGROUND STATE FOREST CHIPPEWA NATIONAL FOREST

Source: MORTENSEN, S. (LL1300)

TRIBAL LAND. NORTHERN HARDWOOD FOREST DOM BY ACER SACCHARUM, TILIA AMERICANA. SITE OF TIMBER STAND IMPROVEMENT IN PAST. LARGE TILIA & BETULA ALLEG (30-36 IN DBH) OBSERVED. ASSOC SPP INCL USUAL HERBACEOUS PLANTS INCLUDING B. VIRGINIANUM. SITE WAS INITIALLY SURVEYED AS POTENTIAL HOUSING LOCATION. LAND ACROSS ROAD TO SOUTH ALSO SURVEYED & FOUND TO BE LACKING DUFF LAYER DUE TO EXOTIC EARTHWORMS. B. MORMO LIKELY TO BE LOST TO INFESTATION IN FUTURE. (VERIFIED BY WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R29W SESE24

Quad Map: SUGAR POINT (J12A)

Latitude: 47 11' 5" Long: 94 17' 17"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 17 June 1996

Voucher: LLDRM Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #8

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SUGAR POINT CBS Site #: 56

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION BATTLEGROUND STATE FOREST CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM3297)

LOCATED 1 MILE NE OF SUGAR POINT ON BATTLEGROUND PENINSULA IN LEECH LAKE. PLANTS GROWING IN MATURE DECIDUOUS FOREST DOM BY ACER SACCHARUM & TILIA AMERICANA, WITH ABIES BALSAMEA, OSTRYA VIRGINIANA & DIRCA PALUSTRIS. ASSOCIATES INCLUDE UVULARIA GRAND, ARALIA NUD, A. RACEMOSA AND ATHYRIUM ANGUSTUM. SEVERAL COLONIES OF FEW INDIVIDUALS. 4 VERY TALL, SLENDER PLANTS (8 CM ABOVE LEAF LITTER) OBSERVED. LOCATED BY J. GUSTAFSON IN DNR-USFS SEARCH. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R29W SWNW25

Quad Map: SUGAR POINT (J12A)

Latitude: 47 10' 45" Long: 94 18' 17"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 09 September 1992

Voucher: 824540 MIN Verification: verified

Element: BOTRYCHIMUM MINGANENSE (MINGAN MOONWORT) #6

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: Private

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM2488)

INFREQUENT ALONG THE UPPER EDGE OF A SMALL BUT FAIRLY STEEP, BOWL-LIKE HOLLOW IN A MATURE, DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA.

ASSOCIATED SPECIES INCLUDE: ACTAEA RUBRA, DIRCA PALUSTRIS, UVULARIA GRANDIFLORA, ARALIA NUDICAULIS AND BOTRYCHIMUM MORMO. IDENTIFICATION CONFIRMED W.H. WAGNER JR 10/27/92.

Location: CASS COUNTY, MN

Legal : T143N R30W NWSE01

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 43" Long: 94 24' 31"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 01 July 1992

Voucher: 824537 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #102

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: MAPLE POINT 1

Ownership: Private

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: ESTES-MORTENSEN, C. (SIGHT RECORD)

AREA HEAVILY INFESTED BY WORMS. CHIPPEWA NF TES #2034.

Location: CASS COUNTY, MN

Legal : T143N R30W NESW01

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 40" Long: 94 25' 1"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: September 1997

Voucher: Verification: sight or sound rec.

Element: DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #1

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: MN DNR Forestry (State Forest and Con-Con Land)

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM1870)

300+ PLANTS OBSERVED IN DECIDUOUS FOREST DOM BY ACER SACCHARUM & TILIA AMERICANA. ASSOC SPP: LAPORTEA CANADENS, MATTEUCCIA STRUTHIOPTER, ACTAEA RUBRA, BOTRYCHIMUM VIRGINIANUM, CORALLORHIZA TRIFIDA & TAXUS CANADENS. PLANTS APPEAR NATIVE. LAKE-SHORE RD BUILT THROUGH MIDDLE OF POP & LAKESHORE LOTS PLOTTED IN N PART OF POP. IN AREA WHERE HOME OWNERS HAVE NOT CLEARED & MOWED 100+ PLANTS PERSIST IN LAKE LOTS. S PART OF THE POP NOT YET DEVEL. (PREV COLL: OWNBEY, G.B. (6061) 7/11/1978)

Location: CASS COUNTY, MN

Legal : T143N R30W NESW01

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 42" Long: 94 25' 3"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 20 May 1992

Voucher: MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #17

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: HARDWOOD POINT CBS Site #: 50

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. AND MEADE, S. (KMM3190A)

LOCATED ON ISLAND-LIKE POINT NE OF HARDWOOD POINT ON WEST SIDE OF SUCKER BAY IN LEECH LAKE. POINT IS ISOLATED FROM THE MAIN BODY OF SQUAW PENINSULA DUE TO BEING SURROUNDED BY LOWLANDS. IT IS FORESTED WITH ACER SACCH, TILIA AMER, & OCCASIONAL THUJA OCCIDENTALIS. PLANTS ARE GROWING IN VERY DEEP SHADE, IN A SLIGHTLY LOWER, MOIST AREA OF THIN LEAF LITTER & WOODY DEBRIS. HERB LAYER IS VERY SPARSE. SOME OF THE PLANTS OBSERVED ARE EXTREMELY TINY. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R30W NENW03

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 14' 5" Long: 94 27' 35"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 25 August 1992

Voucher: 824545 MIN Verification: verified

Element: ARETHUSA BULBOSA (DRAGON'S-MOUTH) #57

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: HARDWOOD POINT CBS Site #: 50

Ownership: MN DNR Forestry (State Forest and Con-Con Land)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: SHERIDAN, D. (S.N.)

APPROX 0.5 MILE SW ON USFS ROAD #3741 TO DEAD END; APPROX 3/4 MILE EAST THROUGH CUTOVER THEN THRU CEDAR SWAMP. FOUND ABOUT 1-200M WEST OF CREEK IN CEDAR SWAMP
LIGHT GAPS OF CEDAR SWAMP. FOUR FLOWERING PLANTS FOUND ALONG A 400FT EAST-WEST TRANSECT LINE. ASSOC SPP: PYROLLOIDA ASARIFOLIA, CALTHA PALUSTRIS, LEDUM GROENLAND, SARRACENIA PURPUREA.

Location: CASS COUNTY, MN

Legal : T143N R30W SWSW05

Quad Map: STEAMBOAT BAY (J11A)

Latitude: 47 13' 19" Long: 94 30' 3"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 06 July 1992

Voucher: MIN

Verification: verified

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #93

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: Native American land

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: ESTES-MORTENSEN, C. (SIGHT RECORD)

TRIBAL LAND, OTTERTAIL POINT. ON SLIGHT RIDGE IN MESIC HARDWOOD FOREST DOM BY ACER SACCH & TILIA AMER, WITH FRAXINUS PENN & BETULA PAPY. GROWING IN AREA:
BOTRYCHUM MORMO, B. MINGANENSE, B. VIRGINIANUM, UVULARIA GRANDIFLORA, LAPORTEA, ARISAEMA, HYDROPHYLLUM.

Location: CASS COUNTY, MN

Legal : T143N R30W NENE11

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 11" Long: 94 25' 37"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 01 July 1996

Voucher:

Verification: sight or sound rec.

Element: BOTRYCHUM MORMO (GOBLIN FERN) #50

State Status: SPECIAL CONCERN

EO Size: 1 acres EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: Native American land

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: ESTES-MORTENSEN, C. (LL1315)

LARGE POP; BNDRY NOT FIRMLY ESTABLISHED. 485+ STEMS, MORE NEARBY IN UNSURVEYED AREA. RICH MAPLE-BASSWOOD, SOME LOGGING EVIDENCE. DENSE ACER SAC CANOPY. ASSOC:
UVULARIA GRAND, ALLIUM TRIC, HYDROPHYLLUM, SANGUINARIA, LAPORTEA; PROB DICENTRA, TOO LATE TO OBS. LEAF LITTER MATTED, LIGHT BROWN. 1 DUP. (PREV COLL: ESTES-MORTENSEN & MORTENSEN, S. (LL1185), 518956 MIN, 1 DUP). 1997: POP EXTENDS INTO SESE02. 100'S OF PLANTS. AREA HEAVILY INFESTED W/WORMS. CHIPPEWA NF TES #2033.

Location: CASS COUNTY, MN

Legal : T143N R30W SE02NENE11

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 11" Long: 94 25' 37"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: September 1997

Voucher: MIN

Verification: verified

Element: BOTRYCHUM PALLIDUM (PALE MOONWORT) #15

State Status: ENDANGERED

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: Native American land

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: ESTES-MORTENSEN, C. (LL1318)

TRIBAL LAND, OTTERTAIL POINT. IN MESIC HARDWOOD FOREST DOMINATED BY ACER SACCHARUM & TILIA AMERICANA. ABOUT 20 FT FROM WETLAND. ASSOCIATED WITH ARALIA RACEMOSA, OCCASIONAL LAPORTEA, HYDROPHYLLUM, ARISAEMA, UVULARIA GRANDIFLORA, EQUISETUM FLUVIATILE; ALSO IN AREA, B. VIRGINIANUM, B. MORMO, B. MATRICARIIFOLIUM. DEEP LEAF LITTER. ORIGINALLY IDENTIFIED AS B. MINGANENSE. (VERIFIED BY W.H. WAGNER 10/97 AS PALLIDUM).

Location: CASS COUNTY, MN

Legal : T143N R30W NENE11

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 11" Long: 94 25' 37"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 09 July 1996

Voucher: LLDRM

Verification: verified

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #171

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: Owner unknown

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST SUPERIOR NATIONAL FOREST

Source: MORTENSEN, S. (LL1317)

LOCATED IN NORTHERN HARDWOOD FOREST DOMINATED BY ACER SACCHARUM & TILIA AMERICANA. ADJACENT TO TRIBAL LAND CONTAINING LARGE POPULATION OF B. MORMO. SITE IS WITHIN LARGER AREA OF POTENTIALLY SUITABLE HABITAT. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T143N R30W NWNW12

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 13" Long: 94 25' 19"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 09 July 1996

Voucher: LLDRM Verification: verified

Element: BOTRYCHUM MORMO (GOBLIN FERN) #103

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: MAPLE POINT 12

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: ESTES-MORTENSEN, C.

PART OF LARGE POPULATION ASSOCIATED WITH DNR OCCURANCE #50. 100'S OF PLANTS, EXOTIC WORMS PRESENT. POPULATION EXTENDS INTO NWNW, NENW & SWNW SECTION 12. CHIPPEWA NF TES #2030, 2031 & 2032.

Location: CASS COUNTY, MN

Legal : T143N R30W NWNW12

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 13" Long: 94 25' 19"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: September 1997

Voucher: MIN Verification: verified

Element: DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #21

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT EAST CBS Site #: 27

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST

Source: MYHRE, K. (KMM3374)

SEVERAL HUNDRED OBSERVED IN DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM & TILIA AMERICANA. ASSOC SPP INCLUDE MATTEUCCIA STRUTHIOPTERIS, HYDROPHYLLUM VIRGINIANUM & LAPORTEA CANADENSIS. LAPORTEA IS OFTEN SLIGHTLY TALLER THAN D. GOLDIANA BUT IT HAS BEEN CUT DOWN BY FROST IN ALL BUT LOW AREAS, MAKING D. GOLDIANA, WHICH IS MORE FROST-HARDY, MORE VISIBLE. DARK GREEN OF D. GOLDIANA FORMS A STRIKING CONTRAST TO YELLOW-ORANGE MAPLE LEAVES. REPEATEDLY OBSERVED IN LOW, DRY AREAS.

Location: CASS COUNTY, MN

Legal : T143N R30W NWNW12

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 15" Long: 94 24' 45"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 30 September 1992

Voucher: MIN Verification: verified

Element: DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #22

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: OTTERTAIL POINT WEST CBS Site #: 28

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST

Source: MYHRE, K. (KMM2483AB)

OBSERVED 200 PLUS PLANTS BLENDING INTO A SEA OF LAPORTEA CANADENSIS PUNCTUATED BY MATTEUCCIA STRUTHIOPTERIS IN A MATURE, DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. THE ADJACENT PIECE OF THIS FOREST WAS CUT AND SOME OF THE PLANTS OCCUR AMONG THE OLD LOG PILES ALONG THE EDGE OF THE STAND. ADDITIONAL PLANTS SURVIVING IN THE CUT AREA??

Location: CASS COUNTY, MN

Legal : T143N R30W NWNW12

Quad Map: OTTERTAIL POINT (J12B)

Latitude: 47 13' 15" Long: 94 24' 57"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 01 July 1992

Voucher: MIN Verification: verified

Element: BOTRYCHIMUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #15
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: CHUB LAKE 17
Ownership: Native American land
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (KMM2913)
GROWING IN A DECIDUOUS SECOND-GROWTH FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. ASSOCIATED SPECIES INCLUDE: BOTRYCHIMUM VIRGINIANUM, B. MULTIFIDUM, MONOTROPA HYPOPITHYS, VIOLA PUBESCENS AND TRILLIUM GRANDIFLORUM. BOTRYCHIMUMS FAIRLY FREQUENT ALONG THE EDGE OF THE STAND. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T144N R27W NWNW17
Quad Map: BENA (I13C)
Latitude: 47 17' 48" Long: 94 8' 0"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 220
Forestry District: 221
Last Obs.: 04 August 1992
Voucher: 824596 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #96
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DRUM BEAT 6
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MORTENSEN, S. (LLDRM) (LL1431)
PLANT ACCIDENTLY UPROOTED WHILE SAMPLING FOR EXOTIC EARTHWORMS. CANOPY DOMINATED BY ACER SACCHARUM & TILIA AMERICANA, WITH QUERCUS MACROCARPA & BETULA PAPPYRIFERA. ASSOCIATED WITH UVULARIA GRANDIFLORA, ARALIA NUDICAULIS & BOTRYCHIMUM VIRGINIANA. NO EXOTIC EARTHWORMS FOUND. POSSIBLY SOME LOGGING IN PAST 50 YEARS. CHIPPEWA NF TES #2025. (VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN
Legal : T144N R28W NENE06
Quad Map: PORTAGE LAKE (I12D)
Latitude: 47 19' 25" Long: 94 15' 56"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 25 June 1997
Voucher: 519018 MIN Verification: verified

Element: BOTRYCHIMUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #12
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: DRUM BEAT 17
Ownership: Private
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (KMM2391)
THE SITE IS A MATURE, DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA LOCATED ON THE NORTHEAST SHORE OF LEECH LAKE. THE PLANTS OCCUR VERY CLOSE TO THE LAKESIDE EDGE OF THE STAND IN ASSOCIATION WITH ASARUM CANADENSIS, HYDROPHYLLUM VIRGINIANUM, UVULARIA GRANDIFLORA AND TRILLIUM GRANDIFLORUM. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T144N R28W SENW17
Quad Map: PORTAGE LAKE (I12D)
Latitude: 47 17' 25" Long: 94 15' 11"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 24 June 1992
Voucher: 824597 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #49
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DRUM BEAT 21
Ownership: Native American land
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: ESTES-MORTENSEN, C. & MORTENSEN, S. (LL1086)
5 STEMS FOUND IN SUGARBUSH. CANOPY LARGELY ACER SACCHARUM, WITH TILIA, POPULUS TREM, BETULA PAPPYR, ABIES BALSAM, OSTRYA, FRAXINUM; ARALIA NUD, UVULARIA, ASARUM, CAREX PENSYL, ASTER MAC. MORMOS IN AREA OF LESS-DENSE HERBACEOUS VEGETATION, NOT OVERTOPPED BY ASTER LEAVES. DNR RELEVÉ #4933. (VERIFIED BY WAGNER 1998). 1996: NO MORMO FOUND ON 7/25 OR 8/1 BY C. ESTES-MORTENSEN. 1997: NO PLANTS OBS. SITE INFESTED WITH EXOTIC EARTHWORMS; LITTER & DUFF LAYER DESTROYED.

Location: CASS COUNTY, MN
Legal : T144N R28W SWNE21
Quad Map: BENA (I13C)
Latitude: 47 16' 36" Long: 94 13' 45"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 709
Forestry District: 111
Last Obs.: 1997
Voucher: 458782 MIN Verification: verified

Element: OROBANCHE UNIFLORA (ONE-FLOWERED BROOMRAPE) #13

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 6

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST

Source: ESTES-MORTENSEN, C., MORTENSEN, S., NIXON, B., ET AL (LL1416)

TWO CLUMPS OBSERVED IN TRANSITION ZONE BETWEEN WETLAND DOMINATED BY NORTHERN WHITE CEDAR & NORTHERN HARDWOOD FOREST. ASSOCIATED WITH ARALIA NUDICAULIS, RHUS RADICANS & ASARUM CANADENSE. LOCATED DURING SURVEY FOR GREAT LAKES PIPELINE RIGHT-OF-WAY EXPANSION. NO FURTHER SEARCH WAS MADE FOR MORE PLANTS. (1 DUP AT LEECH LAKE HERBARIUM #LL1416).

Location: CASS COUNTY, MN

Legal : T144N R29W SENW06

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 7" Long: 94 24' 5"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 18 June 1997

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #13

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 9

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM3151)

LOCATED FOUR MILES WEST OF WABOOSE BAY IN LEECH LAKE IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. PLANTS GROWING ALONG THE EDGE OF A LOW AREA IN DARK LEAF MOLD. ASSOCIATED SPECIES: OSTRYA VIRGINIANA, DIRCA PALUSTRIS, ASARUM CANADENSIS, UVULARIA GRANDIFLORA, BOTRYCHUM VIRGINIANUM, DRYOPTERIS CARTHUSIANA, AND VIBURNUM RAFINESQUIANUM. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T144N R29W NWNW09

Quad Map: PORTAGE LAKE (I12D)

Latitude: 47 18' 37" Long: 94 22' 3"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 19 August 1992

Element: BOTRYCHUM MINGANENSE (MINGAN MOONWORT) #1

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: 0 Intended Status: 6

Site: EAST SUCKER CREEK CBS Site #: 29

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: TRANA, T. (75614)

OTTERTAIL PENINSULA, N. SIDE OF LEECH LAKE, BETWEEN SUCKER BAY AND WABOOSE BAY. COLL. THOMAS TRANA NE1/4 SECTION 19, T143N, R30W. LABEL LEGAL DESCRIPTION PLACES COLLECTION IN SUCKER BAY. THE ONLY SECTION 19 ON OTTERTAIL POINT IS T144N R29W. NE 1/4 IS CUT OVER. MAY BE IN NESE SEC 19.

Location: CASS COUNTY, MN

Legal : T144N R29W 19

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 16' 43" Long: 94 23' 39"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: August 1975

Element: BOTRYCHUM MORMO (GOBLIN FERN) #2

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: 0 Intended Status: 6

Site: EAST SUCKER CREEK CBS Site #: 29

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: TRANA, T. (75615)

OTTERTAIL PENINSULA, NORTH SIDE OF LEECH LAKE, BETWEEN SUCKER BAY AND WABOOSE BAY. COLL BY THOMAS TRANA NE1/4 SECTION 19, T143N, R30W. LABEL LEGAL DESCRIPTION PLACES COLLECTION IN SUCKER BAY. THE ONLY SECTION 19 ON OTTERTAIL POINT IS T144N R29W. NE 1/4 IS CUT OVER. MAY BE IN NESE SEC 19. (SPECIMEN VERIFIED BY W.H. WAGNER).

Location: CASS COUNTY, MN

Legal : T144N R29W 19

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 16' 43" Long: 94 23' 39"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 09 August 1975

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #26

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 19

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: MYHRE, K.M. (KMM5251)

1994: LOCATED BY K. MYHRE ON OTTERTAIL PENINSULA IN LEECH LAKE, 1.3 MILES NORTH OF THE ROAD TO TWO POINTS. 25+ PLANTS OBSERVED IN A 100 X 50 METER AREA IN VERY BRIEF SEARCH IN DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA WITH ACER UNDERSTORY OF 4-5" DBH TREES. (VERIFIED BY WAGNER 1998). DNR RELEVES 4947, 4948, 4951. 1997: PLANTS OBSERVED BY USFS PERSONNEL DURING FIELD SEARCH. PART OF LARGER POPULATION. EXOTIC WORMS IN AREA. CHIPPEWA NF TES #2029.

Location: CASS COUNTY, MN

Legal : T144N R29W SWSE19

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 16' 3" Long: 94 23' 45"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: August 1997

Voucher: 519109 MIN Verification: verified

Element: BOTRYCHIMUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #89

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 20

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM5256)

LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE. INFREQUENT. PLANTS OCCUR IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. ASSOC WITH BOTRYCHIMUM VIRGINIANUM, B. MULTIFIDUM, B. MINGANESE, UVULARIA GRANDIFLORA. (VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN

Legal : T144N R29W SENE20

Quad Map: PORTAGE LAKE (I12D)

Latitude: 47 16' 33" Long: 94 22' 18"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 02 August 1994

Voucher: 518856 MIN Verification: verified

Element: BOTRYCHIMUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #173

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 28

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM5258)

LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE; 0.1 MILE EAST ON FOREST RD 2342. INFREQUENT. PLANTS OCCUR IN DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM & TILIA AMERICANA. ASSOCIATED WITH MONOTROPA HYPOPITYS, BOTRYCHIMUM VIRGINIANUM, HEPATICA AMERICANA, ARISAEMA TRIPHYLLUM.

Location: CASS COUNTY, MN

Legal : T144N R29W SENW20

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 16' 37" Long: 94 23' 4"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 02 August 1994

Voucher: 518857 MIN Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #28

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 28

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: MYHRE, K.M. (KMM5259)

LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE; 0.1 MILE EAST OF THE SUCKER BAY ROAD ON FS ROAD 2342. 5 PLANTS OBSERVED IN BRIEF SEARCH IN DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA WITH BOTRYCHIMUM MATRICARIIFOLIUM AND B. VIRGINIANUM. (VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN

Legal : T144N R29W SENW20

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 16' 37" Long: 94 23' 4"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 01 August 1994

Voucher: 458620 MIN Verification: verified

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #90

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 28 CBS Site #: 26

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM5253)

LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE; 1.3 MI EAST ON FS RD 2342. INFREQUENT PLANTS OCCUR IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM & TILIA AMERICANA. ASSOC WITH UVULARIA GRANDIFLORA, ARALIA RACEMOSA, ATHYRIUM ANGUSTUM, BOTRYCHUM VIRGINIANUM. SUGAR MAPLE UNDERSTORY AS WELL AS OVERSTORY. (VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN

Legal : T144N R29W NENW21

Quad Map: PORTAGE LAKE (I12D)

Latitude: 47 16' 48" Long: 94 21' 39"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 02 August 1994

Voucher: 457260 MIN Verification: verified

Element: BOTRYCHUM MORMO (GOBLIN FERN) #27

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 28 CBS Site #: 26

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: MYHRE, K.M. (KMM5252)

LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE; 1.3 MILES EAST OF THE SUCKER BAY ROAD ON FS ROAD 2342. PLANTS OCCUR IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA WITH ACER UNDERSTORY ALSO. VERY RARELY OBSERVED AT THIS SITE DESPITE MUCH POTENTIAL HABITAT. (ALSO COLLECTED BY J. BOE ON 8/2/94; (#94080201), 459049 MIN. BOTH SPECIMENS VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN

Legal : T144N R29W NENW21

Quad Map: PORTAGE LAKE (I12D)

Latitude: 47 16' 48" Long: 94 21' 39"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 02 August 1994

Voucher: 458619 MIN Verification: verified

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #94

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 28 CBS Site #: 26

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (SIGHT RECORD)

LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE, 0.1 MILE EAST ON FS ROAD 2904, NORTH (LEFT) SIDE OF USFS 2904. PLANTS GROWING IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. ASSOCIATED WITH BOTRYCHUM MINGANENSE, B. VIRGINIANUM, UVULARIA GRANDIFLORA, ATHYRIUM ANGUSTUM.

Location: CASS COUNTY, MN

Legal : T144N R29W SWSW29

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 15' 14" Long: 94 23' 27"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 01 August 1994

Voucher: Verification: sight or sound rec.

Element: BOTRYCHUM MINGANENSE (MINGAN MOONWORT) #18

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: DIAMOND 28 CBS Site #: 26

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM5246)

LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE, 0.1 MI EAST ON FS RD 2904, NORTH (LEFT) SIDE OF USFS 2904. INFREQUENT. PLANTS GROWING IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. ASSOC WITH BOTRYCHUM MATRICARIIFOLIUM, B. VIRGINIANUM, UVULARIA GRANDIFLORA, ATHYRIUM ANGUSTUM. (VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN

Legal : T144N R29W SWSW29

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 15' 14" Long: 94 23' 27"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 01 August 1994

Voucher: 458621 MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #24
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DIAMOND 28 CBS Site #: 26
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION
Source: MYHRE, K.M. (KMM5248)
Voucher: 516115 MIN Verification: verified
LOCATED ON OTTERTAIL PENINSULA IN LEECH LAKE. PLANTS OCCUR IN A DECIDUOUS FOREST DOM BY ACER SACCHARUM & TILIA AMERICANA WITH BOTRYCHIUM MING, B. MAT, & B. VIRG. GROWING SINGLY, IN PAIRS, & IN LOOSE GROUPINGS OF A FEW PLANTS SCATTERED THROUGH STAND. 100+ PLANTS OBSERVED IN BRIEF SEARCH. 0.1 MILE EAST OF SUCKER BAY ROAD ON FS 2904, BOTH SIDES OF ROAD. DNR RELEVÉ #4954. (1 DUP, 458622 MIN COLLECTED ON SAME DAY. BOTH SPECIMENS VERIFIED BY W.H. WAGNER).

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #25
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DIAMOND 30
Ownership: Private
Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION
Source: BOE, J. (95072701)
Voucher: 458726 MIN Verification: verified
6 PLANTS OBS AT DNR RELEVÉ 4953; MAPLE-BASSWOOD FOREST ON GUTHRIE TILL PLAIN. (VERIFIED BY W.H. WAGNER 1998).

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #91
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DIAMOND 30
Ownership: Private
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: CASSON, J. & WESTFIELD, C. (SIGHT RECORD)
Voucher: Verification: sight or sound rec.
ONE PLANT FOUND IN ASPEN REGENERATION (APPROX 22 YRS OLD). CHIPPEWA NF TES #2028.

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #92
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DIAMOND 30
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: CASSON, MYHRE & MORTENSEN (SIGHT RECORD)
Voucher: Verification: sight or sound rec.
PART OF LARGER POPULATION. EXOTIC WORMS IN THE AREA. CHIPPEWA NF TES #2027.

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #93
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DIAMOND 30
Ownership: Owner unknown
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (KMM5250)
1997: OBS BY MYHRE, CASSON, GROH ET AL AS PART OF A LARGER POPULATION. BEING INFESTED WITH WORMS. CHIPPEWA NF TES #2014. 1994: LOCATED ON OTTERTAIL PENINSULA ON LEECH LAKE, 0.8 MI N OF ROAD TO TWO POINTS. 100+ PLANTS OBSERVED IN 100 X 100 METER AREA. PLANTS OCCUR IN A DECIDUOUS FOREST DOM BY ACER SACCHARUM & TILIA AMERICANA. ASSOC WITH ATHYRIUM ANGUSTUM, ULMUS AMERICANA, UVULARIA GRANDIFLORA. UNDERSTORY 2-4" DBH ACER & ULMUS THICKET; PAST CUTTING.
Location: CASS COUNTY, MN
Legal : T144N R29W SENE30
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 15' 40" Long: 94 23' 35"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: August 1997
Voucher: 458623 MIN Verification: verified

Element: DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #6
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DIAMOND 28
Ownership: Native American land
Managed Area(s): LEECH LAKE RESERVATION
Source: TRANA, T.
OTTERTAIL PENINSULA, LEECH L. S SIDE OF RD, 0.3 MI E OF JCT OF CHIPPEWA NF RTE 2132 WITH CROSSROAD FROM 2132 TO TWO POINTS RD. OPEN, RAISED RIDGE THROUGH WET THUJA SWAMP, N-FACING SL. VERY RARE, ONLY 1 PLANT SEEN. 1 DUP.
Location: CASS COUNTY, MN
Legal : T144N R29W NWNW32
Quad Map: OTTERTAIL POINT (J12B)
Latitude: 47 14' 56" Long: 94 23' 14"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: September 1975
Voucher: 662960 MIN Verification: verified

Element: DRYOPTERIS GOLDIANA (GOLDIE'S FERN) #50
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: DIAMOND 32
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION
Source: TRANA, T. (SIGHT RECORD)
(OLD RECORD IN CHIPPEWA NATIONAL FOREST TES DATA BASE). FOUND 0.3 MI EAST OF OTTERTAIL ROAD, SOUTH SIDE OF FR2904.
Location: CASS COUNTY, MN
Legal : T144N R29W NWNW32
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 15' 3" Long: 94 23' 22"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: September 1975
Voucher: Verification: sight or sound rec.

Element: BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #17
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 2
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: FITZLOFF-WESTFIELD, C. & J. CASSON (95003)
EAST OF FR 2135 & S OF PIPELINE. 6+ PLANTS FOUND IN HARDWOODS, MAPLE-BASSWOOD WITH CEDAR COMPONENT. COMPARTMENT 90, STAND 36 IN CASS LAKE RANGER DISTRICT. (1 DUP). (VERIFIED BY W.H. WAGNER 10/97).
Location: CASS COUNTY, MN
Legal : T144N R30W SWNW02
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 10" Long: 94 26' 53"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 25 July 1995
Voucher: 842519 MIN Verification: verified

Element: MALAXIS MONOPHYLLOS VAR. BRACHYPODA (WHITE ADDER'S-MOUTH) #18
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: WEST SUCKER CREEK CBS Site #: 33
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: BOE, J. (93080601)
IN RELEVÉ 93-36. IN CEDAR SWAMP WITH BALSAM FIR. ASSOC SPECIES: COPTIS GROEN-LANDICA, ASTER PUNICEUS, SMILACINA TRIFOLIA, ASTER BOREALIS, LONICERA VILLOSA, AND LYSIMACHIA THYRSIFLORA. 1 PLANT IN RELEVÉ, ON SPHAGNUM AT BASE OF CEDAR. DNR RELEVÉ #4441.
Location: CASS COUNTY, MN
Legal : T144N R30W SENE02
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 5" Long: 94 25' 50"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 06 August 1993
Voucher: MIN Verification: verified

Element: BOTRYCHUM LANCEOLATUM (TRIANGLE MOONWORT) #39
State Status: THREATENED
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 3
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST
Source: MCCARTNEY, R. & WESTFIELD, C. (PHOTO RECORD)
1 PLANT LOCATED 200M NORTH OF PIPELINE ALONG EDGE OF WET DEPRESSION NEAR A WELL-DEFINED DEER TRAIL. HABITAT IS MAPLE-BASSWOOD FOREST WITH YELLOW BIRCH. BOTRYCHUM MATRICARIIFOLIUM ALSO PRESENT AT SITE. ASSOCIATED SPP: YOUNG MAPLE, SOLOMON'S-SEAL, GRASS SPP, WILD LILY-OF-THE-VALLEY, JACK-IN-THE-PULPIT, OSTRICH FERN & EQUISETUM SPP. WET AREA WITH MODERATE HUMUS CONTENT. COMPARTMENT 91, STAND 7, CASS LAKE RANGER DISTRICT. CHIPPEWA NF TES# 2002.
Location: CASS COUNTY, MN
Legal : T144N R30W NENW03
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 20" Long: 94 27' 43"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 30 June 1997
Voucher: Verification: photo rec.

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #78
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 3
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: FITZLOFF-WESTFIELD, C. & J. GALLAGHER (95004)
WEST SIDE OF FR 2135, SOUTH OF PIPELINE. 1 PLANT FOUND IN MAPLE-BASSWOOD FOREST WITH FAIRLY HEAVY UNDERSTORY COMPONENT. COMPARTMENT 91, STAND 4, CASS LAKE RANGER DISTRICT.
Location: CASS COUNTY, MN
Legal : T144N R30W SENE03
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 10" Long: 94 27' 0"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 25 July 1995
Voucher: Verification: verified

Element: BOTRYCHUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #103
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 3
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION
Source: CASTANEDA, W. (USFS) (96WC007)
4 PLANTS LOCATED IN MAPLE DOMINANT FOREST WITH BASSWOOD, WHITE CEDAR, & PAPER BIRCH. COMPARTMENT 91, STAND 30, CASS LAKE DISTRICT. (PREV COLL: FITZLOFF-WESTFIELD, C. & GALLAGHER, J. (95004), 842518 MIN, 7/25/1995). BOTH SPECIMENS VERIFIED BY W.H. WAGNER).
Location: CASS COUNTY, MN
Legal : T144N R30W NENE03
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 20" Long: 94 27' 4"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 16 September 1996
Voucher: 518958 MIN Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #104
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 3
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION
Source: CASTANEDA, W. (USFS) (96WC002)
12 PLANTS LOCATED NW OF FOREST RD 2135 NEAR STAND 35 IN DAMP AREA NEAR DRAINAGE. ASSOC SPP: ACER SACCHARUM, TILIA AMERICANA, BETULA Papyrifera, FRAXINUS SP & PICEA SP. COMPARTMENT 91, STAND 1, CASS LAKE DISTRICT. (VERIFIED BY W.H. WAGNER 1998).
Location: CASS COUNTY, MN
Legal : T144N R30W NWSE03
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 18' 54" Long: 94 27' 23"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 16 September 1996
Voucher: 518961 MIN Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #105
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 3
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION
Source: CASTANEDA, W. (USFS) (96WC008)
90 PLANTS LOCATED NORTH OF PIPELINE & SOUTH OF FOREST RD IN MAPLE-BASSWOOD FOREST. COMPARTMENT 91, STAND 7, CASS LAKE DISTRICT. SITES FLAGGED. (VERIFIED BY W.H. WAGNER 1998).
Location: CASS COUNTY, MN
Legal : T144N R30W NENW03
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 20" Long: 94 27' 43"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 16 September 1996
Voucher: 518963 MIN Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #118
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 3
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: MCCARTNEY, R. & CASTANEDA, W. (96WC003)
2 PLANTS IN MAPLE-BASSWOOD STAND ON EDGE OF ASH DRAINAGE. COMPARTMENT 91, STAND 34 OF CASS LAKE DISTRICT.
Location: CASS COUNTY, MN
Legal : T144N R30W SWNE03
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 8" Long: 94 27' 23"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 16 September 1996
Voucher: CNF Verification: verified

Element: BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #16
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 3
Ownership: Owner unknown
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: DAHLE, R.M. (95013)
ON EAST SIDE OF FOREST RD 2135, 5.4 MI SOUTH OF HWY 2. WITHIN CHIPPEWA NATIONAL FOREST & LEECH LAKE RESERVATION. HARDWOOD FOREST, PREDOMINANTLY MAPLE BASSWOOD, W/ SEVERAL LARGE CEDAR IN IMMEDIATE VICINITY. ASSOC SPP: CAREX PENS, BOTRYCHIUM MORMO, B. VIRG, ARALIA RACE, STREPTOPUS ROSE. (PREV COLL: ESTES, C. (LL0674), 458793 MIN, SENE SEC 3, 8/11/94. 2 PLANTS LYING ON GROUND SW OF LOWER SUCKER LAKE. ASSOC SPP: UVULARIA GLAND, DIRCA PAL). (BOTH SPECIMENS VERIFIED BY WAGNER)
Location: CASS COUNTY, MN
Legal : T144N R30W SENE03
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 13" Long: 94 26' 58"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 25 July 1995
Voucher: 842891 MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #10

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: WEST SUCKER CREEK CBS Site #: 33

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. AND MEADE, S. (KMM3174A)

LOCATED ONE MILE SOUTHEAST OF LOWER SUCKER LAKE ALONG USFS 2135. PLANTS OCCUR IN LEAF LITTER ALONG THE EDGE OF A LOG IN AN UPLAND WITH THUJA OCCIDENTALIS, ACER SACCHARUM, BETULA ALLEGHANIENSIS, TILIA AMERICANA, AND ULMUS AMERICANA. ASSOC. SP. INCL: ATHERIUM ANGUSTUM, THALICTRUM DIOICUM, ARISAEMA TRIPHYLLUS, STREPTOPUS ROSEUS, GYMNOCARPUM DRYOPTERIS, AND SMALL ACER SEEDLINGS. THESE PLANTS WERE FOUND BY SONIA MEADE. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T144N R30W NESE03

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 18' 54" Long: 94 27' 12"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 25 August 1992

Voucher: 824543 MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #11

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: LIFE RAFT LAKE 3

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM3174)

LOCATED 0.5 MILE SOUTHEAST OF SUCKER LAKES ALONG USFS 2135. PLANTS OBSERVED ON BOTH SIDES OF THE ROAD IN A MATURE REGROWTH FOREST OF ACER SACCHARUM, TILIA AMERICANA, BETULA ALLEGANIENSIS, THUJA OCCIDENTALIS, OSTRYA VIRGINIANA AND DIRCA PALUSTRIS. MODERATE HERB LAYER OF ARALIA RACEMOSA, UVULARIA GRANDIFLORA, BOTRYCHIUM VIRGINIANUM, TAXUS CANADENSIS, AND ATHYRIUM ANGUSTUM. OFTEN ONLY SPORE CAPSULES VISIBLE ABOVE DEEP LEAF LITTER. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T144N R30W SENE03

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 13" Long: 94 26' 58"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 25 August 1992

Voucher: 824538 MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #56

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: LIFE RAFT LAKE 3

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: CASTANEDA, W. (USFS) (96WC009)

20 PLANTS LOCATED SOUTH OF PIPELINE IN MAPLE-DOMINANT FOREST WITH BASSWOOD & BIRCH. ASSOCIATED SPP: THALICTRUM SP, LRG BELLWORT, SM REGEN IRONWOOD & CAREX SP. COMPARTMENT 91, STAND 22, CASS LAKE DISTRICT.

Location: CASS COUNTY, MN

Legal : T144N R30W SWNW03

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 8" Long: 94 28' 3"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 16 September 1996

Voucher: MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #77

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: LIFE RAFT LAKE 3

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: MCCARTNEY, R. & CASTANEDA, W. (96WC004)

32 PLANTS OBSERVED IN SEVERAL GROUPS IN COMPARTMENT 91, STAND 4 OF CASS LAKE DISTRICT. HABITAT IS SUGAR MAPLE/BASSWOOD STAND (SOME PLANTS MAY BE B. MATRICARIA-FOLIUM).

Location: CASS COUNTY, MN

Legal : T144N R30W SWNE03

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 7" Long: 94 27' 23"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 16 September 1996

Voucher: CNF Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #94

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: LIFE RAFT LAKE 3

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MCCARTNEY, R. (SIGHT RECORD)

2 PLANTS IN MAPLE-BASSWOOD FOREST. OTHER PLANTS PRESENT INCLUDE JACK-IN-THE PULPIT, WILD LILLY-OF-THE VALLEY, NUMEROUS BOTRYCHIUM MATRICARIIFOLIUMS, ALSO SPRUCE & YELLOW BIRCH. COMPARTMENT 91, STAND 7 OF CASS LAKE DISTRICT. CHIPPEWA NF TES #2023.

Location: CASS COUNTY, MN

Legal : T144N R30W NENW03

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 20" Long: 94 27' 43"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 30 June 1997

Voucher:

Verification: sight or sound rec.

Element: BOTRYCHIUM PALLIDUM (PALE MOONWORT) #10

State Status: ENDANGERED

EO Size: EO Rank: Current Status: Intended Status:

Site: LIFE RAFT LAKE 3

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST

Source: MCCARTNEY, R. & WESTFIELD, C. (RM97004)

1 PLANT LOCATED 200M NORTH OF PIPELINE ALONG EDGE OF WET DEPRESSION NEAR WELL-DEFINED DEER TRAIL. MAPLE-BASSWOOD FOREST WITH YELLOW BIRCH. BOTRYCHIUM MATRICARIIFOLIUM ALSO PRESENT AT SITE. ASSOC SPP: SOLOMON'S-SEAL, YOUNG MAPLE, GRASS SPP, WILD LILY-OF-THE-VALLEY, JACK-IN-THE-PULPIT, OSTRICH FERN & EQUISETUM SPP. WET AREA WITH MODERATE HUMUS CONTENT. COMPARTMENT 91, STAND 7, CASS LAKE RANGER DISTRICT. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T144N R30W NENW03

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 20" Long: 94 27' 43"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 30 June 1997

Voucher: MIN

Verification: verified

Element: SPARGANIUM GLOMERATUM (CLUSTERED BUR-REED) #55

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: LIFE RAFT LAKE 3

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: FITZLOFF-WESTFIELD, C. (USFS) (96CW006)

20+ PLANTS FOUND ALONG PIPELINE WHERE IT INTERSECTS WITH DRAINAGE ON SOUTH EDGE. HABITAT: EDGE OF OPEN (PIPELINE) & MAPLE-BASSWOOD STAND; INTERMITTENT FLOWAGE; ASH SWALE. ASSOCIATED SPP: CATTAILS & NETTLES. COMPARTMENT 91, STAND 34, CASS LAKE DISTRICT. (1 DUP).

Location: CASS COUNTY, MN

Legal : T144N R30W SENE03

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 7" Long: 94 27' 5"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 25 July 1996

Voucher: MIN

Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #106

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: LIFE RAFT LAKE 4

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: CASTANEDA, W. (USFS) (96WC006)

67 PLANTS FOUND ON BOTH SIDES OF ROAD IN MAPLE-BASSWOOD FOREST. COMPARTMENT 91, STAND 20, CASS LAKE DISTRICT. (VERIFIED BY W.H. WAGNER 1998).

Location: CASS COUNTY, MN

Legal : T144N R30W NWNW04

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 18" Long: 94 29' 17"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 16 September 1996

Voucher: 518960 MIN

Verification: verified

Element: BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #25
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 4
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST
Source: WESTFIELD, C., MCCARTNEY, R. & GUNDALE, M. (CW97001)
1 PLANT LOCATED ON EAST SIDE OF FR 2133 NEAR THE ROAD, JUST NORTH OF PIPELINE IN MAPLE/BASSWOOD STAND. LARGE POPULATION OF B. MATRICARIIFOLIUM PRESENT AT SITE.
COMPARTMENT 91, STAND 20, CASS LAKE RANGER DISTRICT. CHIPPEWA NF TES# 2011. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T144N R30W SWNW04
Quad Map: SUCKER LAKES (I12C)
Latitude: 47 19' 6" Long: 94 29' 20"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 30 June 1997
Voucher: MIN Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #11
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: LIFE RAFT LAKE 19
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. (KMM2981)
GROWING ALONG THE EDGE OF A LOW, MOIST AREA IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM AND TILIA AMERICANA. ASSOCIATED SPECIES INCLUDE DIRCA PALUSTRIS, BOTRYCHIUM VIRGINIANUM, BOTRYCHIUM MULTIFIDUM, MONOTROPA HYPOPITHYS, CYPRIPIEDUM CALCEOLUS PUBESCENS, ACTEA RUBRA AND UVULARIA GRANDIFLORA. THIS AREA BORDERED BY NEAR CLEAR CUTS. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T144N R30W NENW19
Quad Map: PIKE BAY (I11D)
Latitude: 47 16' 40" Long: 94 31' 43"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 10 August 1992
Voucher: 824598 MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #13
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: HARDWOOD POINT
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MYHRE, K.M. AND MEADE, S. (KMM3190)
LOCATED ON 2ND POINT NE OF HARDWOOD POINT ON W SIDE OF SUCKER BAY IN LEECH LAKE, FAIRLY CLOSE TO LAKESHORE ON LEVEL AREA ABOVE A BRIEFLY STEEP BANK. PLANTS OCCUR IN A BORDER BETWEEN DENSE SHORE VEGETATION & A SEA OF LAPORTEA CANADEN BENEATH VERY WIDELY SPACED MATURE ACER SACC. BORDER OF HERBS INCL: ATHYRIUM ANGUSTUM, UVULARIA GRAND, STREPTOPUS ROSEUS, & ARALIA RACEMOSA. MANY SMALL PLANTS AT THIS LOCATION, AS WELL AS SOME LARGE SPECIMENS. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN
Legal : T144N R30W NESE34
Quad Map: OTTERTAIL POINT (J12B)
Latitude: 47 14' 37" Long: 94 26' 54"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 25 August 1992
Voucher: 824539 MIN Verification: verified

Element: ELEOCHARIS QUINQUEFLORA (FEW-FLOWERED SPIKE-RUSH) #15
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: LAKE THIRTEEN
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): WELSH LAKE STATE FOREST CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: MYHRE, K. (KMM3345)
LOCATED ALONG THE THINLY MOSS-COVERED, SANDY SOUTH-SOUTHEAST SHORELINE OF MOSS LAKE. PLANTS OCCUR AT THE WATERS EDGE IN A FEW INTERMITTENT AREAS, AND IN SEVERAL MOUNDS OF ENTANGLED PLANTS THAT APPEAR TO HAVE BEEN TORN LOOSE, TOSSED BY WAVES, AND DEPOSITED ON THE SHORE. ASSOCIATED WITH BIDENS CERNUA, CICUTA BULBIFERA, AGALINIS PAUPERCULA.

Location: CASS COUNTY, MN
Legal : T144N R31W NESW02
Quad Map: PIKE BAY (I11D)
Latitude: 47 18' 50" Long: 94 34' 13"
Precision: within 0.25 mile, confirmed
DNR Region: 1
Wildlife Area: 125
Forestry District: 111
Last Obs.: 22 September 1997
Voucher: MIN Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #79
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: BENA 34
Ownership: Native American land
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: ESTES-MORTENSEN, C. (LL0980)
(BENA DUNES LTA.) PLANTS GROWING IN SLIGHT DEPRESSION W/THICK REED CANARY GRASS. SOIL GENERALLY SANDY, SCMEWHAT PEATY IN DEPRESSION. AREA PREV A HORSE PASTURE, NOW TRIBAL HOUSING. ASSOC: PHALARIS ARUND, EUPHORBIA ESULA, (E.PODPERAE), ASTER SP, BOTRYCHIUM SIMP. NEARBY: PRUNUS SPP, PINUS BANKS, FESTUCA SP, SOLIDAGO SP. SPECIMENS HAVE ENLARGED BASAL PINNAE. WILL CONTINUE MONITORING. (VERIFIED BY W.H. WAGNER 1998). 1 DUP (#LL0963) AT LEECH LAKE HERBARIUM.
Location: CASS COUNTY, MN
Legal : T145N R28W NWNE34
Quad Map: BENA (I13C)
Latitude: 47 20' 20" Long: 94 12' 43"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 709
Forestry District: 111
Last Obs.: 06 June 1995
Voucher: 519111 MIN Verification: verified

Element: BOTRYCHIUM PALLIDUM (PALE MOONWORT) #14
State Status: ENDANGERED
EO Size: EO Rank: Current Status: Intended Status:
Site: BENA 34
Ownership: Native American land
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: ESTES-MORTENSEN, C. (LL1294)
LOCATED IN LOT IN TRIBAL HOUSING DEVELOPMENT, BENA. DOMINATED BY WEEDY SPECIES INCLUDING EUPHORBIA PODPERAE. COLLECTED FROM SLIGHT DEPRESSION AREA DOMINATED MAINLY BY PHALARIS ARUNDINACEA & ASSOCIATED WITH B. MATRICARIIFOLIUM & B.SIMPLEX SPECIMEN ORIGINALLY IDENTIFIED AS B. SIMPLEX. (VERIFIED BY W.H. WAGNER 10/97 AS PALLIDUM).
Location: CASS COUNTY, MN
Legal : T145N R28W NWNE34
Quad Map: BENA (I13C)
Latitude: 47 20' 20" Long: 94 12' 43"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 709
Forestry District: 111
Last Obs.: 17 June 1996
Voucher: LLDRM Verification: verified

Element: BOTRYCHIUM SIMPLEX (LEAST MOONWORT) #34
State Status: SPECIAL CONCERN
EO Size: EO Rank: Current Status: Intended Status:
Site: BENA 34
Ownership: Native American land
Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST
Source: MORTENSEN, C. (LL0964)
NUMEROUS STEMS LOCATED IN AND AROUND EDGES OF SLIGHT DEPRESSION IN WEEDY, SANDY AREA BEING EXPERIMENTALLY TREATED FOR LEAFY SPURGE. BENA HOUSING DEVELOPMENT IN LEECH LAKE RESERVATION.
Location: CASS COUNTY, MN
Legal : T145N R28W NWNE34
Quad Map: BENA (I13C)
Latitude: 47 20' 20" Long: 94 12' 43"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 709
Forestry District: 111
Last Obs.: 06 June 1995
Voucher: 518957 MIN Verification: verified

Element: MYRIOPHYLLUM TENELLUM (WATER MILFOIL) #47
State Status: No Legal Status
EO Size: EO Rank: Current Status: Intended Status:
Site: PORTAGE LAKE 14
Ownership: U.S. Forest Service (National Forest)
Managed Area(s): BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION
Source: FITZLOFF-WESTFIELD, C. & J.DAVIS(95005)
IN LITTLE PORTAGE LAKE, 5 MILES WEST OF BENA ON NORTH SIDE OF HWY 2. NUMEROUS PLANTS FOUND. LAKE HAS MUCK BOTTOM WITH SAND IN SHALLOW SHORE WATERS. COMPARTMENT 115, CASS LAKE DISTRICT.
Location: CASS COUNTY, MN
Legal : T145N R29W 152223SW14
Quad Map: PORTAGE LAKE (I12D)
Latitude: 47 22' 11" Long: 94 19' 51"
Precision: within 0.25 mile, confirmed
DNR Region: 2
Wildlife Area: 709
Forestry District: 907
Last Obs.: 26 July 1995
Voucher: Verification: verified

Element: CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #11

State Status: THREATENED

EO Size: EO Rank: B Current Status: 6 Intended Status: 6

Site: BENA BOG CBS Site #: 20

Ownership: MN DNR Forestry (State Forest and Con-Con Land)

Managed Area(s): BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: SMITH, W.R.; BOE, J., FITZLOFF-WESTFIELD, C. AND MOOTY, J. (2435)

1980: SMITH FOUND 7 PLANTS IN SPHAGNUM UNDER THUJA, PICEA MARIANA & BETULA PAPYRIFERA. GROWING IN DEEP SHADE. WITH CORNUS CANADENSIS, LINNAEA, LEDUM, SMILACINA TRIFOLIA. REPORTED BY RUNDELL TO EXTEND ONTO CHIPPEWA NF. 1994: BOE VISITED SITE TO COUNT PLANTS & CHECK EXTENT OF POPULATION. POP IS CONCENTRATED CLOSE TO W SIDE OF TRAIL. SEE TOPO FOR AREA SEARCHED. 75 PLANTS OBSERVED. CALYPSO BULBOSA (24 PLANTS) & AMENORCHIS ROTUNDIFOLIA (64 PLANTS) ALSO PRESENT.

Location: CASS COUNTY, MN

Legal : T145N R29W NESW23

Quad Map: PORTAGE LAKE (I12D)

Latitude: 47 21' 41" Long: 94 19' 15"

Precision: within 0.25 mile, confirmed

DNR Region: 2

Wildlife Area: 709

Forestry District: 111

Last Obs.: 06 June 1994

Voucher: Verification: verified

Element: WALDSTEINIA FRAGARIOIDES (BARREN STRAWBERRY) #15

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: PORTAGE LAKE 26

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: BOE, J.; CASSON, J. (USFS) AND ALMENDINGER, J. (94052701)

1994 BOE: IN CONIFER FOREST DOM BY PINUS RESINOSA WITH DECIDUOUS UNDERSTORY OF BT ASPEN, RED MAPLE, RED OAK, BUR OAK. GROWING BOTH SIDES OF RIGHT FORK OF ROAD & EXTENDING ONTO ROAD GRADE. 1000'S OF PLANTS DOMINATE LOW HERB LAYER AT SITE. ASSOC SPP: ARALIA NUDICAULIS, ANEMONE QUINQUEFOLIA, ORYZOPSIS ASPERIFOLIA, ASTER MACROPHYLLUS, VACCINIUM ANGUSTIFOLIUM. 1993: CASSON LOCATED, ALMENDINGER COLLECTED. 100'S OF PLANTS IN 50 YD STRETCH ALONG ROAD. CHIPPEWA NF TES #2001.

Location: CASS COUNTY, MN

Legal : T145N R29W NENE26

Quad Map: PORTAGE LAKE (I12D)

Latitude: 47 21' 6" Long: 94 18' 42"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 27 May 1994

Voucher: MIN Verification: verified

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #14

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: PORTAGE LAKE 28

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM3153)

LOCATED ONE HALF MILE SOUTH OF BUD LAKE ON OTTERTAIL PENINSULA IN LEECH LAKE IN A DECIDUOUS FOREST DOMINATED BY ACER SACCHARUM, QUERCUS RUBRA, AND TILIA AMERICANA. PLANTS GROWING IN A LOW AREA WITH DIRCA PALUSTRIS, BOTRYCHIUM VIRGINIANUM, THALICTRUM DIOICUM AND SANICULA MARILANDICA. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T145N R29W SESW28

Quad Map: PORTAGE LAKE (I12D)

Latitude: 47 20' 21" Long: 94 21' 50"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 19 August 1992

Voucher: 824594 MIN Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #76

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 15

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: MOEN, D. (96WC001)

PLANTS LOCATED IN COMPARTMENT 57, STAND 12 OF CASS LAKE DISTRICT. HABITAT CONTAINS SUGAR MAPLE, IRONWOOD, BUR OAK, AND ASH IN PROCESS OF DIE BACK 9/10/96.

Location: CASS COUNTY, MN

Legal : T145N R30W NWSW15

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 22' 22" Long: 94 28' 36"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 16 July 1996

Voucher: CNF Verification: verified

Element: BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #36

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 30

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST

Source: MCCARTNEY, R. & GUNDALE, M. (PHOTO RECORD)

PLANTS LOCATED IN 2 AREAS IN NE-CENTRAL PART OF MAPLE-BASSWOOD STAND TYPE. FIRST AREA IN HAZEL BRUSH, SITE FURTHER TO THE WEST IN CINNAMON FERN. FOUND ON NORTH SIDE OF LARGE WETLAND, APPROX 25M NORTH OF WETLAND EDGE. NORTH BOUNDARY OF WETLAND DOMINATED BY CINNAMON FERN. ASSOC SPP: SARSAPARILLA, SOLOMON'S-SEAL, LARGE LEAF ASTER & HAZEL. COMPARTMENT 64, STAND 13, CASS LAKE RANGER DISTRICT. CHIPPEWA NF TES# 2003.

Location: CASS COUNTY, MN

Legal : T145N R30W NWNW20

Quad Map: PIKE BAY (I11D)

Latitude: 47 21' 59" Long: 94 31' 7"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 08 July 1997

Voucher: Verification: photo rec.

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #89

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 20

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MCCARTNEY, R. & GUNDALE, M. (USFS) (RM97007)

6 PLANTS LOCATED IN 2 AREAS NORTH OF LARGE WETLAND. ONE SITE IN HAZEL BRUSH, SECOND SITE FURTHER WEST IN CINNAMON FERN. NORTH BOUNDARY OF WETLAND DOMINATED BY CINNAMON FERN. MAPLE-BASSWOOD STAND TYPE WITH SOLOMON'S SEAL ABUNDANT. OTHER ASSOC SPP: SARSAPARILLA, LARGE-LEAF ASTER & HAZEL. LOCATED IN COMPARTMENT 64, STAND 13, CASS LAKE DISTRICT. CHIPPEWA NF TES #2021.

Location: CASS COUNTY, MN

Legal : T145N R30W NWNW20

Quad Map: PIKE BAY (I11D)

Latitude: 47 21' 59" Long: 94 31' 7"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 08 July 1997

Voucher: CNF Verification: verified

Element: BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #20

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 22

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: WESTFIELD, C. (USFS) (96CW012)

PLANTS LOCATED IN SOUTHERN POINT OF STAND 4 (COMPARTMENT 62) ASSOCIATED SPP INCLUDE SUGAR MAPLE, BASSWOOD, OPEN ASH, IRONWOOD & ASPEN. VOUCHER VERIFIED BY H. WAGNER.

Location: CASS COUNTY, MN

Legal : T145N R30W SENW22

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 21' 43" Long: 94 28' 18"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 25 September 1996

Voucher: MIN Verification: verified

Element: BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #23

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 25

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST

Source: JACOBSON, J. (JJ97001)

1 PLANT LOCATED 2/3 KM EAST OF FR 2930; DUE WEST OF SOUTHERN-MOST POINT OF MIDDLE SUCKER LAKE. HABITAT IS UPLAND DECIDUOUS MIX OF MAPLE-BASSWOOD TYPE WITH SPORADIC BALSAM FIR & ASPEN. OPEN OVERSTORY, DAMP SOIL WITH MODERATE PLANT COVER. SITE WITHIN 20M OF RECENT CUT-OVER. ASSOC SPP: ARALIA NUDICAULIS, ACER SACCHARUM SEEDLINGS, SANGUINARIA CANADENSIS. COMPARTMENT 67, STAND 22, CASS LAKE RANGER DISTRICT. CHIPPEWA NF TES# 2010. (VERIFIED BY W.H. WAGNER 10/97).

Location: CASS COUNTY, MN

Legal : T145N R30W SESW25

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 20' 31" Long: 94 25' 50"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 01 July 1997

Voucher: MIN Verification: verified

Element: BOTRYCHIUM MINGANENSE (MINGAN MOONWORT) #26

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 25

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST

Source: WESTFIELD, C. (CW97002)

2 PLANTS LOCATED AT EDGE OF VERNAL POOLS IN NW FINGER OF MAPLE-BASSWOOD STAND WEST OF SUCKER LAKES. MOIST SOIL WITH A RICH ORGANIC LAYER. ASSOCIATED WITH POPULATIONS OF BOTRYCHIUM MATRICARIIFOLIUM WITH B. VIRGINIANUM, TRILLIUM, ASH, LADY FERNS & LILY-OF-THE-VALLEY. COMPARTMENT 67, STAND 22, CASS LAKE RANGER DISTRICT. CHIPPEWA NF TES# 2012. (VERIFIED BY W.H. WAGNER 10/97). (1 DUP, COLL # CW97003).

Location: CASS COUNTY, MN

Legal : T145N R30W NWSW25

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 20' 37" Long: 94 25' 58"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 30 June 1997

Voucher: MIN

Verification: verified

Element: BOTRYCHIUM MORMO (GOBLIN FERN) #95

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 25

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: GUNDALE & MCCARTNEY (SIGHT RECORD)

20 PLANTS FOUND IN MAPLE-BASSWOOD WITH SPARSE SHRUB LAYER. OTHER SPECIES PRESENT INCLUDE JACK-IN-THE PULPIT, GINGER, BLOODROOT. COMPARTMENT 67, STAND 22 OF CASS LAKE DISTRICT. CHIPPEWA NF TES #2024.

Location: CASS COUNTY, MN

Legal : T145N R30W SESW25

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 20' 31" Long: 94 25' 50"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 30 June 1997

Voucher:

Verification: sight or sound rec.

Element: BOTRYCHIUM LANCEOLATUM (TRIANGLE MOONWORT) #26

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 33

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST BOWSTRING STATE FOREST LEECH LAKE RESERVATION

Source: ENGELHARD, M. (SIGHT RECORD)

1 PLANT FOUND IN COMPARTMENT 66, STAND 25 OF CASS LAKE DISTRICT. LOCATED IN ASH, ELM, MAPLE, WITH BALSAM, MAPLE UNDERSTORY. LOW AREA, PROBABLY WET IN SPRING. IDENTIFICATION PRETTY CERTAIN, SHOULD VERIFY WITH PHOTO IN 1997.

Location: CASS COUNTY, MN

Legal : T145N R30W NESE33

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 46" Long: 94 28' 58"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 06 September 1996

Voucher:

Verification: sight or sound rec.

Element: BOTRYCHIUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #115

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 35

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): BOWSTRING STATE FOREST CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: WESTFIELD, C. (USFS) (96CW009)

COMPARTMENT 67 STAND 21 OF CASS LAKE DISTRICT IN LOW SWALE W/MIXED ASPEN, HARDWOOD AND BALSAM. B. MULFIFIDUMS PRESENT. 8+ PLANTS.

Location: CASS COUNTY, MN

Legal : T145N R30W NESE35

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 44" Long: 94 26' 25"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 09 September 1996

Voucher: CNF

Verification: verified

Element: BOTRYCHIMUM MORMO (GOBLIN FERN) #90

State Status: SPECIAL CONCERN

EO Size: EO Rank: Current Status: Intended Status:

Site: SCHLEY 35

Ownership: Owner unknown

Managed Area(s): BOWSTRING STATE FOREST LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: GUNDALE, M. & MCCARTNEY, R. (USFS) (MG97005)

20+ PLANTS LOCATED IN 2 AREAS. HABITAT IS OLD-GROWTH MAPLE-BASSWOOD, YELLOW BIRCH, & CEDAR. SOME UNDERSTORY GROWTH OF SUGAR MAPLE. ASSOC SPP: SOLOMON'S SEAL JACK-IN-THE-PULPIT & GINGER. SITE IS MOSTLY FLAT WITH VERY RICH, WET SOIL. COMPARTMENT 67, STAND 14, CASS LAKE DISTRICT. CHIPPEWA NF TES #2022. POPULATION EXTENDS INTO T144N R30W NWNE03. CHIPPEWA NF TES #2035.

Location: CASS COUNTY, MN

Legal : T145N R30W SWSW35

Quad Map: SUCKER LAKES (I12C)

Latitude: 47 19' 30" Long: 94 27' 24"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 02 July 1997

Voucher: MIN

Verification: verified

Element: CYPRIPEDIUM ARIETINUM (RAM'S-HEAD LADY'S-SLIPPER) #52

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: PIKE BAY 27

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: BOE, J. MORTENSON, S., ESTES, C., FITZLOFF-WESTFIELD, C., BEZANSON, C., ET AL (9406030)

CONIFER SWAMP: WHITE CEDAR WITH BLACK SPRUCE. CONTINUOUS SPHAGNUM COVER. AT BASE OF WHITE CEDAR. WITH TRIENTALIS BOREALIS, COPTIS GROENLANDICA, LUZULA ACUMINATA, CAREX LEPTALEA, ARALIA NUDICAULIS, MITELLA NUDA, PYROLA SECUNDA, IRIS VERSICOLOR, STREPTOPUS ROSEUS, LONICERA CANADENSIS. ONE FLOWERING STEM, JUST COMING INTO BLOOM.

Location: CASS COUNTY, MN

Legal : T145N R31W SWNW27

Quad Map: PIKE BAY (I11D)

Latitude: 47 20' 47" Long: 94 36' 17"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 03 June 1994

Voucher: MIN

Verification: verified

Element: BOTRYCHIMUM MATRICARIIFOLIUM (MATRICARY GRAPEFERN) #113

State Status: No Legal Status

EO Size: EO Rank: Current Status: Intended Status:

Site: PIKE BAY 35

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): CHIPPEWA NATIONAL FOREST LEECH LAKE RESERVATION

Source: ESTES-MORTENSEN, C. & S. (LL0552)

COMPARTMENT 50 OF CASS LAKE DISTRICT. ASH SWALE, NORTH SIDE OF FR 2137 EAST OF CONTROL STRUCTURE ON MOSS LAKE. FOUND NUMEROUS B. MULTIFIDUMS 8/12/94 NEARBY, ALONG PATH BESIDE STREAM.

Location: CASS COUNTY, MN

Legal : T145N R31W SESW35

Quad Map: PIKE BAY (I11D)

Latitude: 47 19' 24" Long: 94 34' 41"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 29 June 1994

Voucher: LLDRM

Verification: verified

Element: BOTRYCHIMUM RUGULOSUM (ST. LAWRENCE GRAPEFERN) #1

State Status: THREATENED

EO Size: EO Rank: Current Status: Intended Status:

Site: PIKE BAY 35

Ownership: U.S. Forest Service (National Forest)

Managed Area(s): LEECH LAKE RESERVATION CHIPPEWA NATIONAL FOREST

Source: MYHRE, K.M. (KMM2994)

LOCATED ONE THIRD MILE SOUTHEAST OF PIKE BAY IN CASS LAKE. PLANTS OCCUR IN A MOSSY, UPLAND STAND DOMINATED BY PINUS BANKSIANA AND PINUS RESINOSA. ASSOCIATED SPECIES INCLUDE: THALICTRUM DIOICUM, PYROLA SECUNDA, ANEMONE QUINQUEFOLIA, BOTRYCHIMUM VIRGINIANUM, BOTRYCHIMUM MULTIFIDUM, GOODYERA TESSELATA, AND LIPARIS LOESELII. THIS IDENTIFICATION VERIFIED BY W.H. WAGNER JR. 10/27/92.

Location: CASS COUNTY, MN

Legal : T145N R31W SESE35

Quad Map: PIKE BAY (I11D)

Latitude: 47 19' 32" Long: 94 33' 57"

Precision: within 0.25 mile, confirmed

DNR Region: 1

Wildlife Area: 125

Forestry District: 111

Last Obs.: 11 August 1992

Voucher: 824528 MIN

Verification: verified

DRAGON'S-MOUTH

Arethusa bulbosa L.

Family: **Orchidaceae** Orchid Family

Official 1996 Minnesota Legal Status: None

CASS COUNTY OCCURRENCE:

The Cass County populations occur in Lowland Conifer Swamps dominated by Northern White Cedar (*Thuja occidentalis*) or Black Spruce (*Picea mariana*) with Balsam Fir (*Abies balsamea*). The plants are present on hummocks of Sphagnum and Labrador Tea (*Ledum groenlandicum*) in canopy gaps, where sunlight reaches the forest floor. Populations are sparse at each location.

HABITAT:

Dragon's-mouth is found in Lowland Conifer Swamps and on open floating bog mats. This species was first collected in Minnesota by T.S. Roberts in Hennepin County in 1885.

FIELD CHARACTERISTICS:

Dragon's-mouth is distinguished from Minnesota's two other single-flowered, rose-purple orchids that have yellow bristles on the lip by the *apparent* absence of leaves at the time it blooms (the leaf is present but elongates later). Smith (1993) includes a key to Minnesota's orchids.

BEST TIME TO SEARCH:

Dragon's-mouth is easiest to find during its blooming period, from late May into July.

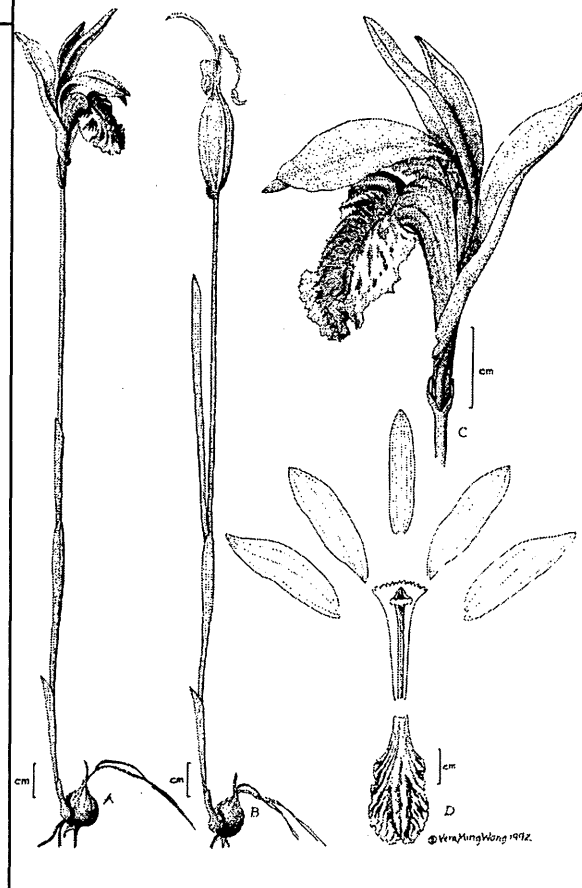
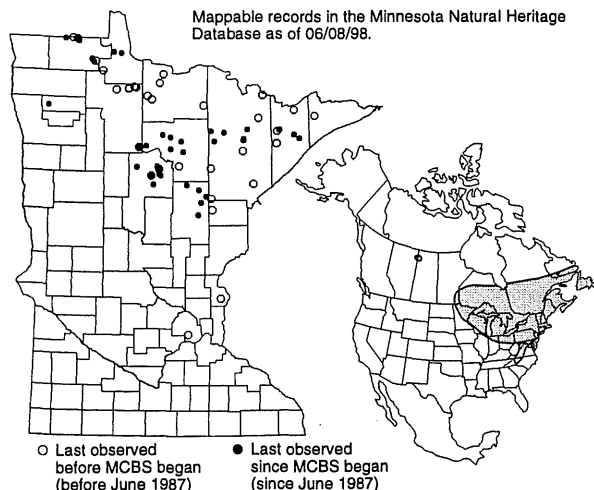


Illustration by Vera Ming Wong ©1993 State of Minnesota, Department of Natural Resources

SELECTED REFERENCES:

Case, F.W., Jr. 1987. Orchids of the western Great Lakes region. Bulletin 48. Cranbrook Institute of Science, Bloomfield Hills, Michigan.

Gawler, S.C. 1982. *Arethusa* (*A. bulbosa*), a rare orchid in Maine. Planning Report No. 76. Maine State Planning Office, Portland.

Reddoch, J.M., and A.H. Reddoch. 1997. The orchids in the Ottawa District: floristics, phytogeography, population studies, and historical review. *Canadian Field-Naturalist* 111:1-186.

Smith, W. 1993. *Orchids of Minnesota*. Univ. of Minnesota Press, Minneapolis.

The Nature Conservancy, Conservation Science Division, in association with the Network of Natural Heritage Programs and Conservation Data Centers. 1984. *Arethusa bulbosa*, Element Stewardship Abstract Report. Arlington, Virginia.

MINGAN MOONWORT

Botrychium minganense Vict.

Family: **Ophioglossaceae**

Adder's-tongue Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

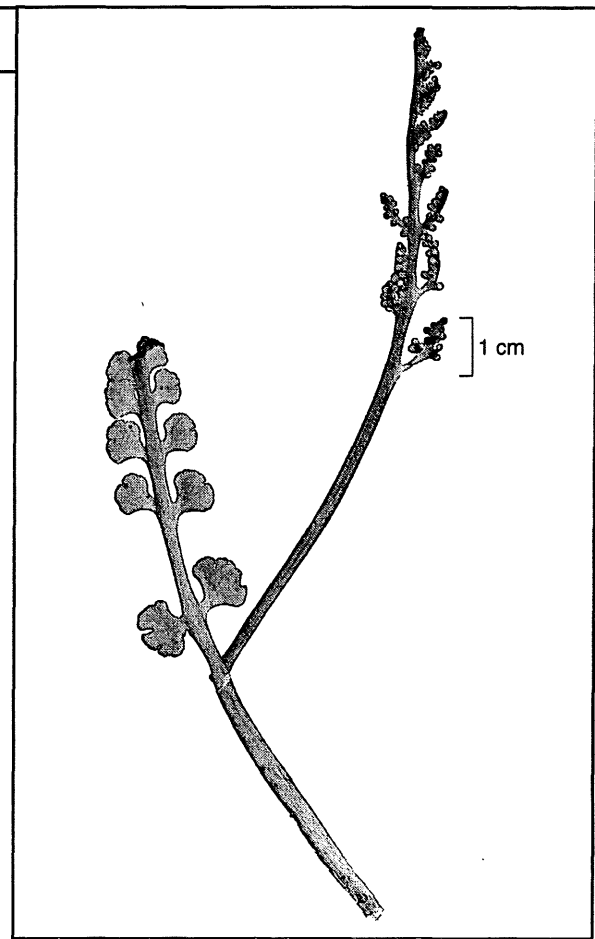
Mingan Moonwort was first collected in Cass County by Thomas Trana and W.H. Wagner, Jr. on Ottertail Point in 1975. In 1992 and 1994, the plant was collected at four sites in the Leech Lake area. Additional collections were made in 1995, 1996, and 1997 by Chippewa National Forest and Leech Lake Division of Resources Management staff and Minnesota County Biological Survey volunteer Rolf Dahle. All Cass County collections are from Maple-basswood forests.

HABITAT:

Mingan moonwort was first collected in Minnesota in 1894 by E.P. Sheldon and C. Mac-Millan on Garden Island in Lake of the Woods County. This species has a broad range in North America but is uncommon throughout its range. Most Minnesota collections are from mesic, deciduous forests with Sugar Maple (*Acer saccharum*) as an important component.

FIELD CHARACTERISTICS:

The stem of all moonworts is underground; the single, above-ground leaf consists of a sporophore (the spore-bearing or fertile portion of the leaf), a trophophore (the sterile, flat blade),



and the stalk to which both are connected. Sporangia (spore capsules) appear as tiny, round structures on the sporophore and contain the spores. Mingan Moonwort has up to 10 pairs of narrowly fan-shaped pinnae on its trophophore. The branches of the sporophore are simple. A similar, and also rare, species, Common Moonwort (*Botrychium lunaria*), has up to nine pairs of broadly fan-shaped pinnae. There is an illustrated key to *Botrychium* species in vol. 2 of the Flora of North America (Wagner and Wagner, 1993).

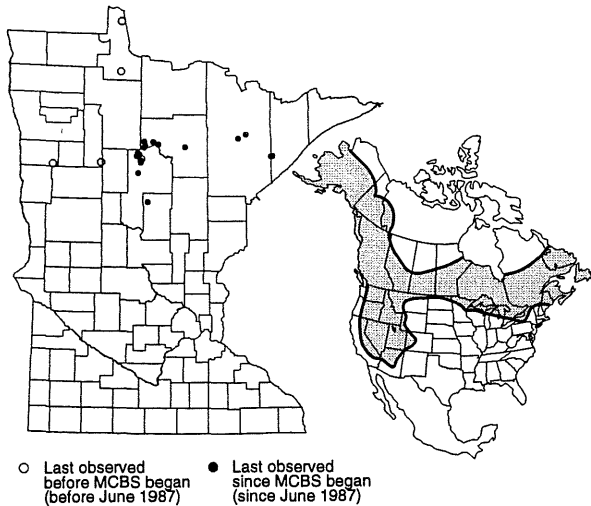
BEST TIME TO SEARCH:

Leaves appear in early spring and last through midsummer. The five Cass County collections were made in July and early August, although those collected late in that period were showing signs of senescence. The best time to search is from May through early July.

SELECTED REFERENCES:

Hauk, W.D., C.H. Haufler, and P.A. Gegenheimer. 1989. Systematics of the genus *Botrychium*: the molecular story. American Journal of Botany 76 (6 Suppl.):204. (Abstract of conference paper).

Mappable records in the Minnesota Natural Heritage Database as of 06/08/98.



continued on next page

MINGAN MOONWORT *continued*

SELECTED REFERENCES *continued*

Wagner, W.H., Jr., and F.S. Wagner. 1990. Notes on the fan-leaflet group of moonworts in North America, with descriptions of two new members. *American Fern Journal* 80:73-81.

Wagner, W.H., Jr., and F.S. Wagner. 1993. Ophioglossaceae, pg. 85-106. *In* *Flora of North America* Editorial Committee, eds. *Flora of North America*. Vol. 2. Pteridophytes. Oxford Univ. Press, New York.

GOBLIN FERN

Botrychium mormo Wagner

Family: **Ophioglossaceae**

Adder's-tongue Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

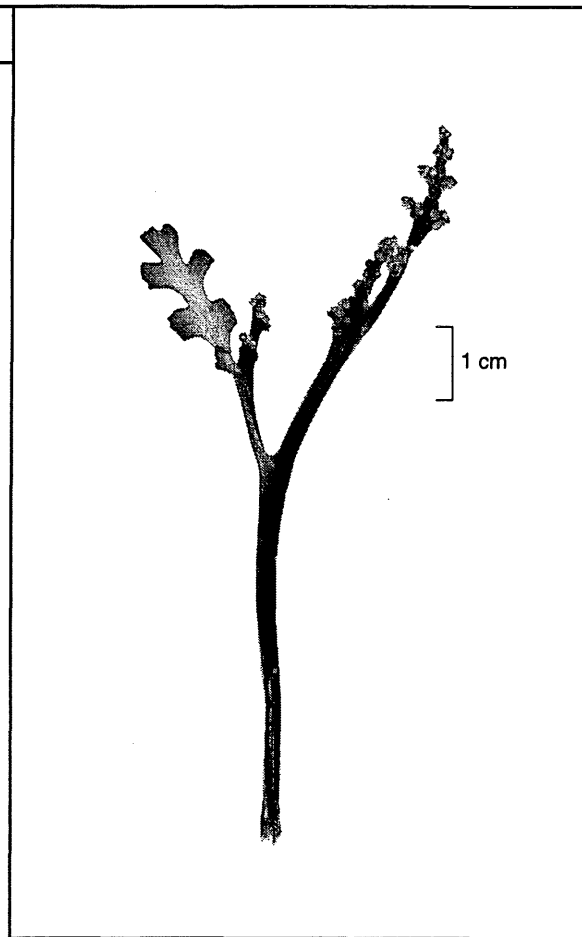
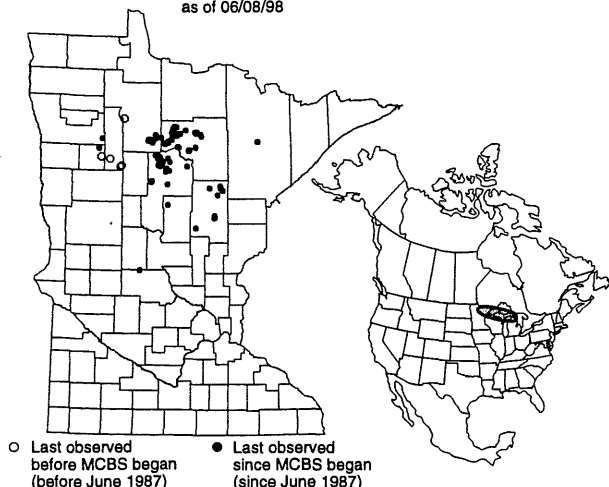
In 1975, Thomas Trana located one plant on Ottertail Peninsula in Leech Lake. In the 17 years that followed, there were no additional collections. Intensive searching from 1992 through 1995 by Minnesota County Biological Survey staff and others revealed a substantial population on Ottertail Peninsula. Pteridologist W. H. Wagner, Jr., speculated that this was "possibly the largest population known." Additional, widely separated, smaller populations were found at other locations in northern Cass County during the years of the Survey.

In Cass County, this small fern is found in deciduous forests with a significant Maple component. Some sites have a forest canopy of Northern White Cedar (*Thuja occidentalis*), Yellow Birch (*Betula alleghaniensis*), Balsam Fir (*Abies balsamea*), or Trembling Aspen (*Populus tremuloides*). Nearly all sites observed have sparse shrub, forb, and graminoid layers. There is often a deep layer of leaf litter.

HABITAT:

Goblin fern was first collected in Minnesota in 1929 by C.O. Rosendahl. He found it in a hardwood forest in Itasca State Park. Range-wide, this species occurs sporadically in rich forests dominated by Basswood, Beech, or Sugar Maple.

Mappable records in the Minnesota Natural Heritage Database
as of 06/08/98



FIELD CHARACTERISTICS:

The goblin fern is a short (1-10 cm), stocky, yellow-green, succulent fern. Its succulence makes it appear somewhat like a fungus. The fern's stem is underground; the single, above-ground leaf consists of a stalk that separates into a sporophore (the spore-bearing or fertile portion), and a trophophore (the sterile, flat blade). The sporophore often remains close to the trophophore, elongating less than in other species. The sporangia (spore capsules) are embedded in the broad, succulent sporophore. There is a key to *Botrychium* species in vol. 2 of the Flora of North America (Wagner and Wagner, 1993).

BEST TIME TO SEARCH:

Researchers have observed this species emerging as early as June 2nd. However, most plants are not fully above-ground until later in the summer. This fern can be confused with lesser moonwort (*Botrychium simplex*), a species that emerges earlier and senesces by early August. Since goblin fern senesces later, searching from August to leafdrop in the fall may help eliminate confusion. If searches are conducted too late in

continued on next page

GOBLIN FERN *continued*

BEST TIME TO SEARCH *continued*

the season, however, Goblin Fern may also have begun to senesce, making detection difficult.

SELECTED REFERENCES:

Berlin, N., P. Miller, J. Borovansky, U.S. Seal, and O. Byers (eds.) 1998. Population and habitat viability assessment (PHVA) for the Goblin Fern (*Botrychium mormo*): Final Report. CBSG, Apple Valley, MN.

Casson, J., J. Mathisen, and P. Strong. 1994. A conservation strategy for the Goblin Fern (*Botrychium mormo*) on the Chippewa National Forest. Chippewa National Forest, Cass Lake, MN.

Conservation Breeding Specialist Group (SSC/IUCN). 1997. Population and habitat viability for the Goblin Fern (*Botrychium mormo*): Briefing Book. CBSG, Apple Valley, MN.

Sather, N. 1996. Inventory, monitoring genetics, and life history of *Botrychium mormo*: 1995. Minnesota Natural Heritage and Nongame Research Program, St. Paul, MN.

The Nature Conservancy, Conservation Science Division, in association with the Network of Natural Heritage Programs and Conservation Data Centers. 1990. *Botrychium mormo*, Element Stewardship Abstract Report. Arlington, Virginia.

Wagner, W. H., Jr., and F. S. Wagner. 1981. New species of moonworts, *Botrychium* subgenus *Botrychium* (Ophioglossaceae), from North America. American Fern Journal 71:20-30.

Wagner, W.H., Jr., and F.S. Wagner. 1993. Ophioglossaceae, pg. 85-106. In Flora of North America Editorial Committee, eds. Flora of North America. Vol. 2. Pteridophytes. Oxford Univ. Press, New York.

BLUNT-LOBED GRAPEFERN

Botrychium oneidense (Gilb.) House

Family: **Ophioglossaceae**

Adder's-tongue Family

Official 1996 Minnesota Legal Status: Endangered

CASS COUNTY OCCURRENCE:

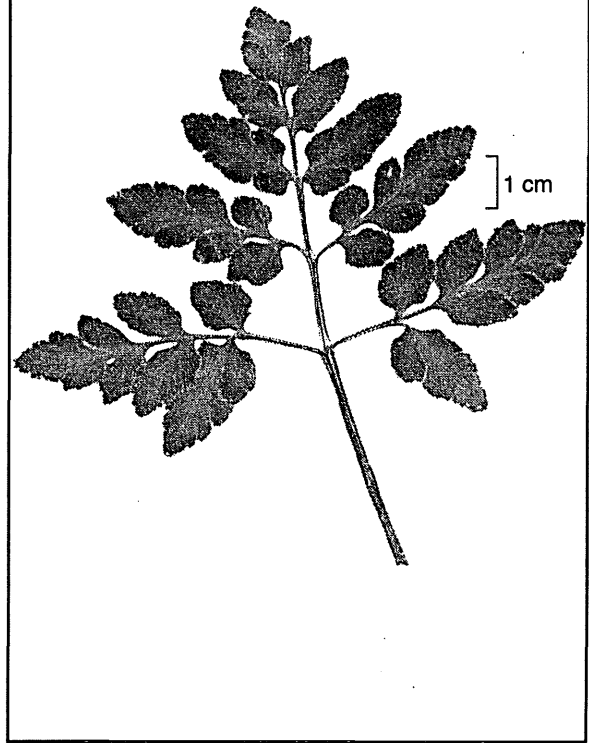
Karen Myhre (Minnesota County Biological Survey) found Blunt-lobed Grapefern in Cass County in 1992. The plant was present in a shallow trough between two small, gently rolling hills in a deciduous forest, whose canopy layer is composed of Black Ash (*Fraxinus nigra*), Trembling Aspen (*Populus tremuloides*), Sugar Maple (*Acer saccharum*), and Red Oak (*Quercus rubra*). St. Lawrence Grapefern (*Botrychium rugulosum*) is also present at this site.

HABITAT:

This species was first found in Minnesota in 1991 by Karen Myhre and Welby Smith in a small Maple-basswood Forest on the northeast corner of Mille Lacs Lake. The few collections of this species are from Maple-basswood Forests in areas with locally high water tables. Range-wide, Blunt-lobed Grapefern is found in moist, shady, acidic forests and swamps.

FIELD CHARACTERISTICS:

The blunt-lobed grapefern is a member of the leather-leaved evergreen grapefern group (*Botrychium* subgenus *Sceptridium*). The evergreen grapeferns have a triangular sterile blade (the trophophore) which may or may not be accompanied by a fertile (spore-bearing) stalk (the sporophore). The blunt-lobed grapefern can be distinguished from other species by having a solid (rather than divided)spade-shaped terminal



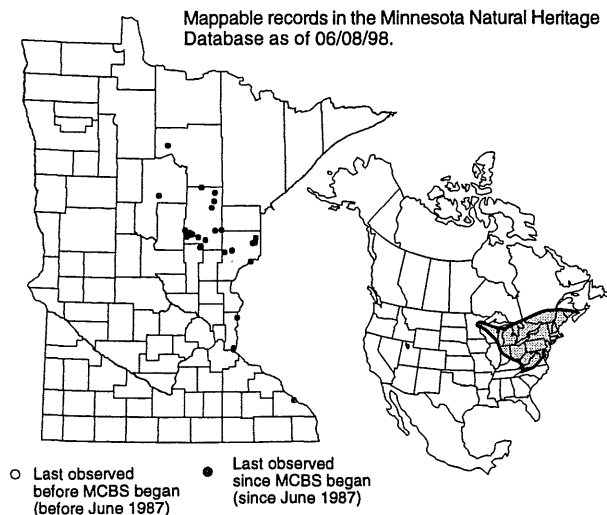
pinnae (lobes) in its trophophore. It can be further separated from similar species by its short, blunt, rounded (not sharp or serrate) teeth. There is a key to *Botrychium* species in vol. 2 of the Flora of North America (Wagner and Wagner, 1993).

BEST TIME TO SEARCH:

Late summer to early fall, before leaf-drop, is an ideal time to search for this dark green fern. At this time, its new leaf is fully unfurled and fresh. Because of the fern's evergreen nature, it is also visible in early spring after snowmelt.

SELECTED REFERENCES:

Wagner, W.H., Jr., and F.S. Wagner. 1993. Ophioglossaceae, pg. 85-106. In Flora of North America Editorial Committee, eds. Flora of North America. Vol. 2. Pteridophytes. Oxford Univ. Press, New York.



PALE MOONWORT

Botrychium pallidum Wagner

Family: **Ophioglossaceae**

Adder's-tongue Family

Official 1996 Minnesota Legal Status: Endangered

CASS COUNTY OCCURRENCE:

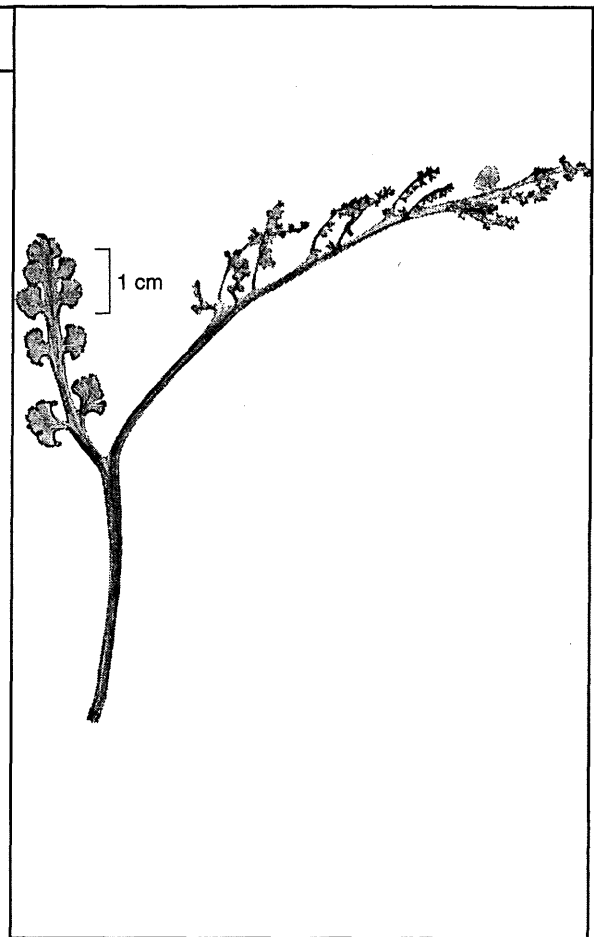
Pale Moonwort was first collected in Cass County in 1993 by Karen Myhre, a botanist with the Minnesota County Biological Survey. The plant was growing along the southwest shore of Leech Lake. Other collections followed in 1996 and 1997, when staff of the Leech Lake Division of Resources Management and Chippewa National Forest collected specimens from five more populations on sandy soil near Bena, in Maple-basswood Forests on Ottertail Peninsula and southwest of Sucker Lake, on the shore of East Twin Lake, and in a Red Pine stand south of Twin Lakes.

HABITAT:

This species was first discovered in Minnesota by Lynden Gerdes in the Superior National Forest in 1992, where it was growing in full sun on sandy soil. Subsequent collections from Lake, Itasca, Cass, and Aitkin counties have been from diverse habitats, including deciduous forests near lakes or streams and conifer forests on sandy soil. Rangewide, this species occurs sporadically in both shaded areas and open fields.

FIELD CHARACTERISTICS:

The stem of all moonworts is underground; the single, above-ground leaf consists of a sporophore (the spore-bearing or fertile portion of the leaf), a trophophore (the sterile, flat blade), and the stalk to which both are connected. Sporangia (spore capsules) appear as tiny, round



rangia (spore capsules) appear as tiny, round structures on the sporophore and contain the spores. This moonwort, when growing in sunny locations, has a glaucous, pale green blade; hence the specific epithet *pallidum* and the common name Pale Moonwort. It is most easily confused with small specimens of *Botrychium minganense* (Mingan Moonwort). One difference between the two species lies in the attachment of the pinnae to the stalk of the trophophore: the attachment of *B. pallidum* is narrower than that of *B. minganense*, giving Pale Moonwort pinnae a kidney shape. There is a key to *Botrychium* species in vol. 2 of the Flora of North America (Wagner and Wagner, 1993).

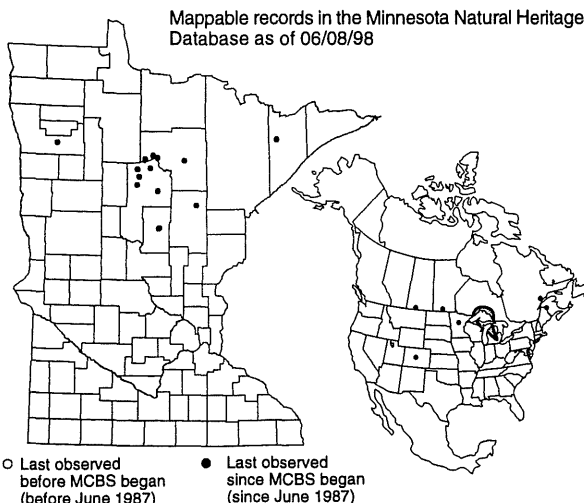
BEST TIME TO SEARCH:

The leaves appear in late spring and early summer. All collections from Minnesota were made in June or July.

SELECTED REFERENCES:

Wagner, W.H., Jr., and F.S. Wagner. 1993. Ophioglossaceae, pg. 85-106. In *Flora of North America* Editorial Committee, eds. *Flora of North America*. Vol. 2. Pteridophytes. Oxford Univ. Press, New York.

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PALE MOONWORT *continued*

SELECTED REFERENCES *continued*

Wagner, W.H., Jr., and F.S. Wagner. 1994. Another widely disjunct, rare, and local North American moonwort (Ophioglossaceae: Botrychium subg. Botrychium). American Fern Journal 84(1):5-10.

Wagner, W.H., Jr., and F.S. Wagner. 1990. Notes of the fan-leaflet group of moonworts in North America with descriptions of two new members. American Fern Journal 80(3):73-81.

ST. LAWRENCE GRAPEFERN

Botrychium rugulosum Wagner
Family: **Ophioglossaceae**
Adder's-tongue Family

Official 1996 Minnesota Status: Threatened

CASS COUNTY OCCURRENCE:

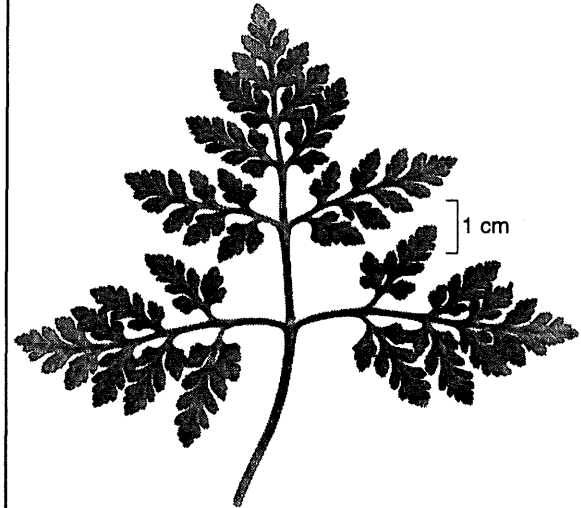
This evergreen grapefern has been documented in several forest communities in Cass County. A few of the collection sites are in Maple-basswood Forests and several are in pine forests. Karen Myhre (Minnesota County Biological Survey) first found St. Lawrence Grapefern in Cass County in 1992.

HABITAT:

Karen Lustig first found this species in Minnesota in 1978 at Sand Dunes State Forest in Sherburne County. Within its range in Minnesota, this plant has been collected in various habitats, including a Jack Pine Forest, a Red Pine plantation, an opening adjacent to a White Pine plantation, a brushy field and a mesic deciduous forest.

FIELD CHARACTERISTICS:

The evergreen grapeferns have a triangular blade (the tropophore) which may or may not be accompanied by a fertile (spore-bearing) stalk (the sporophore). The specific epithet *rugulosum*, which means roughened, refers to the irregular surface texture of the leaf. The St. Lawrence Grapefern has proven to be a difficult species to identify for anyone who has not had the opportunity to study specimens and habitat first-hand. The primary characteristic that separates this from other similar grapefern species is the angular dissection of the blade; pinnae



(lobes) are significantly smaller than those of similar species. A secondary characteristic is the regular, dentate (not sharp or serrate) teeth. A sporophore, the fertile spore-bearing part of the plant, may or may not be present. There is a key to *Botrychium* species in vol. 2 of the Flora of North America (Wagner and Wagner, 1993).

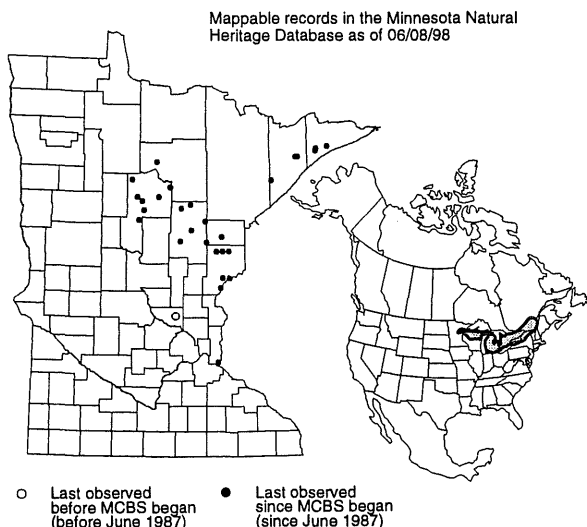
BEST TIME TO SEARCH:

Leaves of this small fern overwinter and are identifiable in the spring following snowmelt. It produces a new leaf in late spring or early summer. By early fall, this leaf is fully unfurled. Populations typically experience relatively little predation by fall, making fall another good time to search for this plant.

SELECTED REFERENCES:

The Nature Conservancy, Conservation Science Division, in association with the Network of Natural Heritage Programs and Conservation Data Centers. 1990. *Botrychium rugulosum*, Element Stewardship Abstract Report. Arlington, Virginia.

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ST. LAWRENCE GRAPEFERN

continued

SELECTED REFERENCES: *continued*

Wagner, W.H., Jr., and F.S. Wagner. 1982. *Botrychium rugulosum* (Ophioglossaceae), a newly recognized species of evergreen grapefern in the Great Lakes area of North America. *Contrib. Univ. Mich. Herb.* 15:315-324.

Wagner, W.H., Jr., and F.S. Wagner. 1993. Ophioglossaceae, pg. 85-106. In *Flora of North America* Editorial Committee, eds. *Flora of North America*. Vol. 2. Pteridophytes. Oxford Univ. Press, New York.

LEAST MOONWORT

Botrychium simplex (A.A. Eat.) Clausen
Family: **Ophioglossaceae**,
Adder's-tongue Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

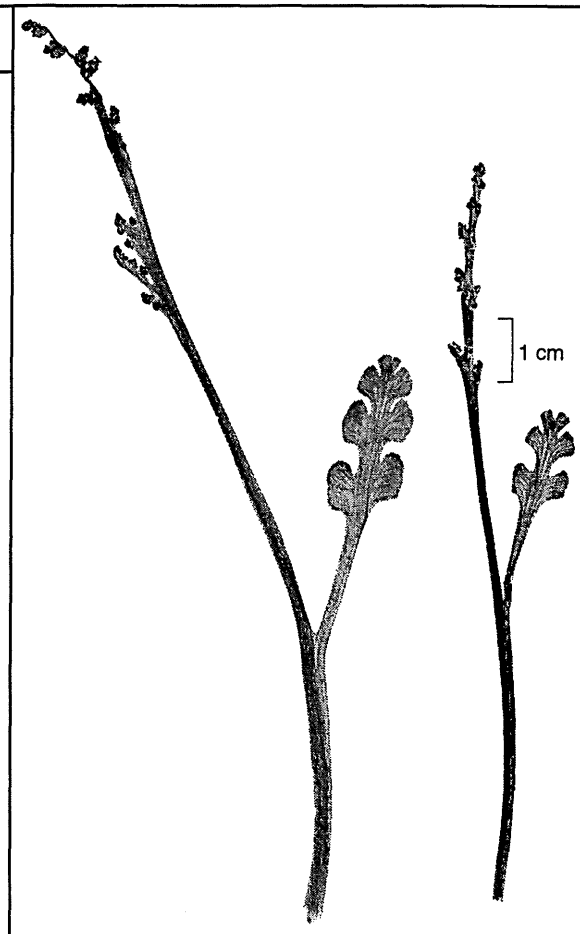
Janet Boe, a Minnesota County Biological Survey botanist, first collected this plant in Cass County in a Cedar Swamp near Oxbow Lake in 1993. Other collections of this plant in Cass County are from Maple-basswood Forests near Leech Lake.

HABITAT:

Least moonwort was first collected in Minnesota by H.L. Lyon in 1904 at Pine Tree Lake near St. Paul. Throughout its range, Least Moonwort occurs in damp, shady forests and is sometimes found growing beneath leaves.

FIELD CHARACTERISTICS:

All moonwort species have underground stems; the single, above-ground leaf consists of a sporophore (the spore-bearing or fertile portion of the leaf), a trophophore (the sterile, flat blade), and the stalk to which both are connected. Sporangia (spore capsules) appear as tiny, round structures on the sporophore and contain the spores. The small form of this plant looks very much like Goblin Fern; it is difficult to distinguish the two. Among the differences are: Goblin Fern is fleshier and stockier than Least Moonwort, the sporophore and trophophore of



Goblin Fern has a shorter common stalk than Least Moonwort; and the sporangia of Goblin Fern are imbedded in the stalk while in Least moonwort they stand out. There is a key to *Botrychium* species in vol. 2 of the Flora of North America (Wagner and Wagner, 1993).

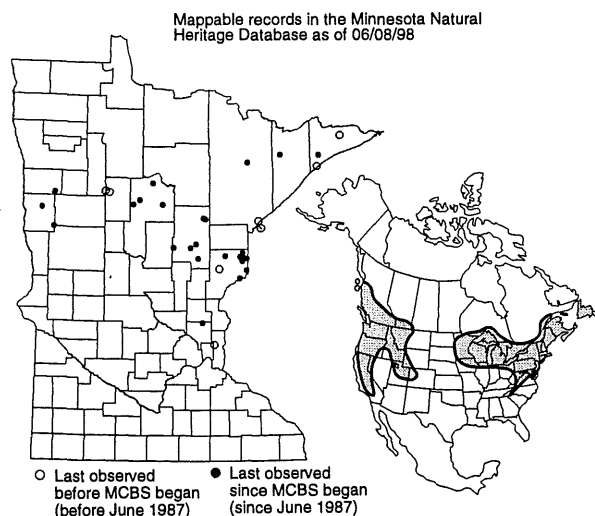
BEST TIME TO SEARCH:

Least Moonwort emerges in June and senesces by early August, making mid-June through July the best time to search.

SELECTED REFERENCES:

Johnson-Groh, C.L and D. R. Farrar. 1993. Population dynamics of prairie moonworts *Botrychium* subgenus *Botrychium* in Iowa and Minnesota. *American Journal of Botany* 80 (6 Suppl.): 109. (Abstract of conference paper).

Wagner, W.H., Jr., and F.S. Wagner. 1993. Ophioglossaceae, pg. 85-106. In *Flora of North America* Editorial Committee, ed. *Flora of North America*. Vol. 2. Pteridophytes. Oxford Univ. Press, New York.



RAM'S-HEAD LADY'S-SLIPPER

Cypripedium arietinum R. Br.
Family: **Orchidaceae** Orchid Family

Official 1996 Minnesota Legal Status: Threatened

CASS COUNTY OCCURRENCE:

Until recently, there was a single known location for this orchid in Cass County. This population near Bena was found by E. Ferrel Creech, a Chippewa National Forest employee in the early 1960s in a White Cedar Swamp known as Bena Bog. Since 1991, five new populations have been found. Three of the recent discoveries are also from cedar swamps. An unusual collection site in central Cass County occurs in a mesic deciduous forest. Another recent record is from an upland cedar stand with small Balsam Fir and mature White Pine.

HABITAT:

Ram's-head Lady's-slipper has been found in a variety of forest communities, including Jack Pine Forests and deciduous forests. However, it is most frequently found in lowland conifer swamps. Ram's-head Lady's-slipper was first collected in Minnesota in 1897 by J.M. Holzinger in Cook County.

FIELD CHARACTERISTICS:

The Ram's-head Lady's-slipper receives its name from its triangular, white-fringed, purple-veined pouch, which is said to resemble the lowered head of a charging ram. The free rather than fused sepals are unique among lady's-slipper orchids (the genus *Cypripedium*). See Smith (1993) and Case (1987).

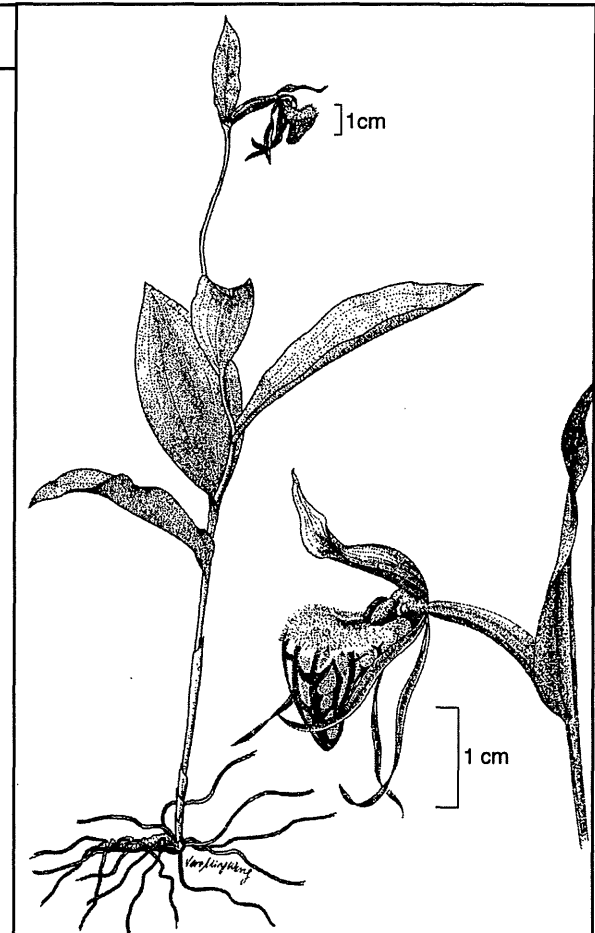


Illustration by Vera Ming Wong ©1998 State of Minnesota, Department of Natural Resources

BEST TIME TO SEARCH:

Late May to early June, when the plants are in bloom, is the optimum time to search. Identification of non-blooming plants can be problematic, because of their similarity in foliage and habitat to Small Yellow Lady's-slipper, (*Cypripedium calceolus* var. *parviflorum*).

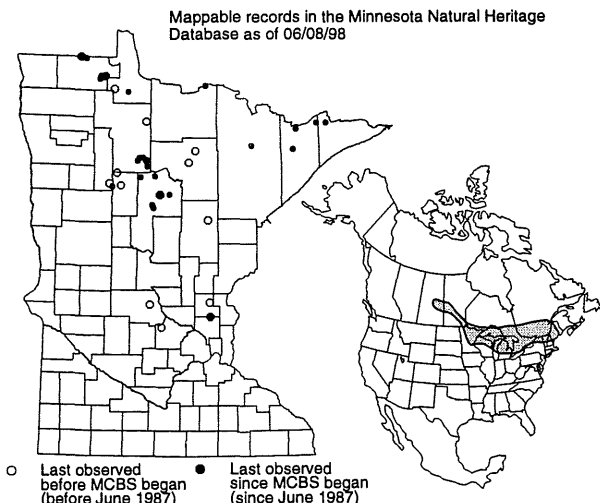
SELECTED REFERENCES:

Bornbusch, A.H., L.A. Swender, and D.L. Hoogerwerf. 1994. Genetic variation in Massachusetts populations of *Cypripedium arietinum*. *Rhodora* 96: 354-369.

Buker, W. 1980. Population explosions among orchids. *Castanea* 45 (2): 144-145.

Case, F. W., Jr. 1987. Orchids of the western Great Lakes region. Bull. 48. Cranbrook Institute of Science, Bloomfield Hills, Michigan.

Case, M.A. 1994. Extensive variation in the levels of genetic diversity and degree of relatedness among five species of *Cypripedium* (Orchidaceae). *Amer. J. of Botany*: 81(2): 175-184.



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RAM'S-HEAD LADY'S-SLIPPER*continued***SELECTED REFERENCES** *continued*

Reddoch, J.M., and A.H. Reddoch 1997. The orchids in the Ottawa District: floristics, phytogeography, population studies, and historical review. *Canadian Field-Naturalist* 111:1-186.

Smith, W. R. 1993. *Orchids of Minnesota*. Univ. of Minnesota Press, Minneapolis.

Smith, W.R. 1988. Vascular plants, pg. 34-217. In B. Coffin and L. Pfannmuller, eds. *Minnesota's endangered flora and fauna*. Univ. of Minnesota Press, Minneapolis.

The Nature Conservancy, Conservation Science Division, in association with the Network of Natural Heritage Programs and Conservation Data Centers. 1990. *Cypripedium arietinum*, Ram's Head Lady-Slipper Element Stewardship Abstract Report. Arlington, Virginia

GOLDIE'S FERN

Dryopteris goldiana (Hook.) Gray
Family: **Polypodiaceae** Polypody Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

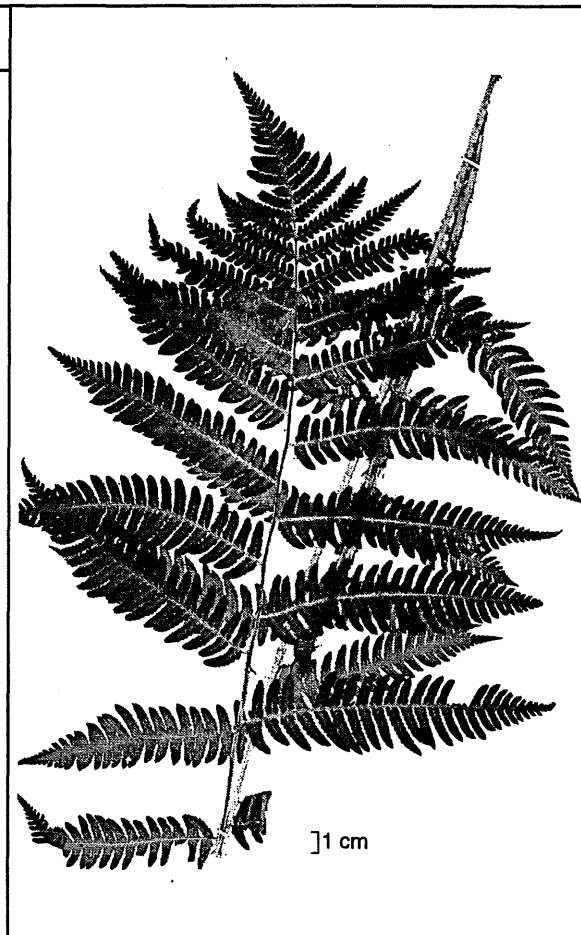
This fern was first found in Cass County on a rise in a Cedar Swamp on Ottertail Peninsula by Thomas Trana in 1975. Another, larger population on Ottertail Peninsula found by Karen Myhre (Minnesota County Biological Survey) in 1992 occurs in a fairly level, maturing Maple-basswood Forest. Karen also found this species growing near a campground on a point on the south shore of Leech Lake.

HABITAT:

With the notable exception of the Leech Lake area, Goldie's Fern is confined primarily to the southeastern counties of Minnesota where it is most often found on moist, wooded slopes.

FIELD CHARACTERISTICS:

This dark green fern stands out among Minnesota's northern ferns because of its size (nearly the tallest), the width of the pinnules (lobes), and the span of its fronds. These characters combine to give Goldie's Fern a large, dense appearance. Broad lower pinnae contrast with the tapering lower pinnae of the other large ferns.



BEST TIME TO SEARCH:

Goldie's Fern is a rare and eye-catching member of the northern flora. It may be identified (see Tryon, 1988) throughout the growing season. In areas with Wood Nettles (*Laportea canadensis*), the best time to search for the plants is after the nettles have been cut down by frost since Goldie's Fern withstands frost longer.

SELECTED REFERENCES:

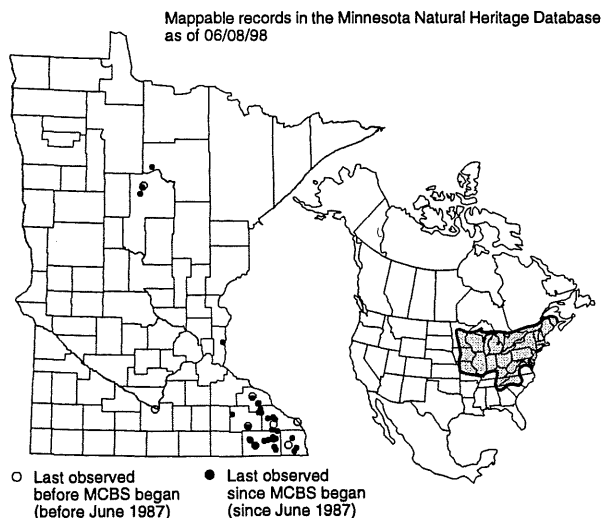
Carlson, T.M., and W.H. Wagner, Jr. 1982. The North American distribution of the genus *Dryopteris*. Contrib. Univ. Mich. Herb. 15:141-162.

Iffrig, G.F. 1979. The distribution of *Dryopteris goldiana* and *Dryopteris marginalis* (Pteridophyta) in Missouri. Amer. Fern Jour. 69(1): 29-30.

Smith, Alan R. 1993. Dryopteridaceae, pg. 246-308. In Flora of North America Editorial Committee, eds. Flora of North America. Vol. 2. Pteridophytes. Oxford Univ. Press, New York.

Smith, W. 1988. Vascular plants, pg. 34-217. In B.Coffin and L. Pfannmuller, eds. Minnesota's endangered flora and fauna. Univ. of Minnesota Press, Mpls.

Tryon, R. 1980. Ferns of Minnesota. Univ. of Minn. Press, Minneapolis.



OLIVACEOUS SPIKE-RUSH

Eleocharis olivacea Torr.

Family: **Cyperaceae** Sedge Family

Official 1996 Minnesota Legal Status:
Threatened

CASS COUNTY OCCURRENCE:

The single record from Cass County, collected by Karen Myhre (Minnesota County Biological Survey) in 1992, is one of only eight recorded occurrences of the plant in Minnesota. The Cass County population occurs along the edges of small bog pools and openings in the floating mat surrounding a small lake northeast of Ponto Lake.

HABITAT:

Because of the few collection locations, little is known about the habitat preferences of this small spike-rush. Collectors of Minnesota plants have described some collection sites as the "mucky shore habitats of bog lakes." Olivaceous spike-rush was first collected in Minnesota in Todd County by Hotchkiss and Jones in 1930.

FIELD CHARACTERISTICS:

The Olivaceous Spike-rush derives its name from its olive-colored achene (one-seeded fruit). Its general appearance is short and sturdy with loose, whitish, scarious culm-sheaths. The upturned, saucer-shaped tubercle (top cap) of the achene is distinctive under magnification and is a valuable character for identification.

BEST TIME TO SEARCH:

Specimens have been collected from July through October; a well-developed achene is useful for positive identification.

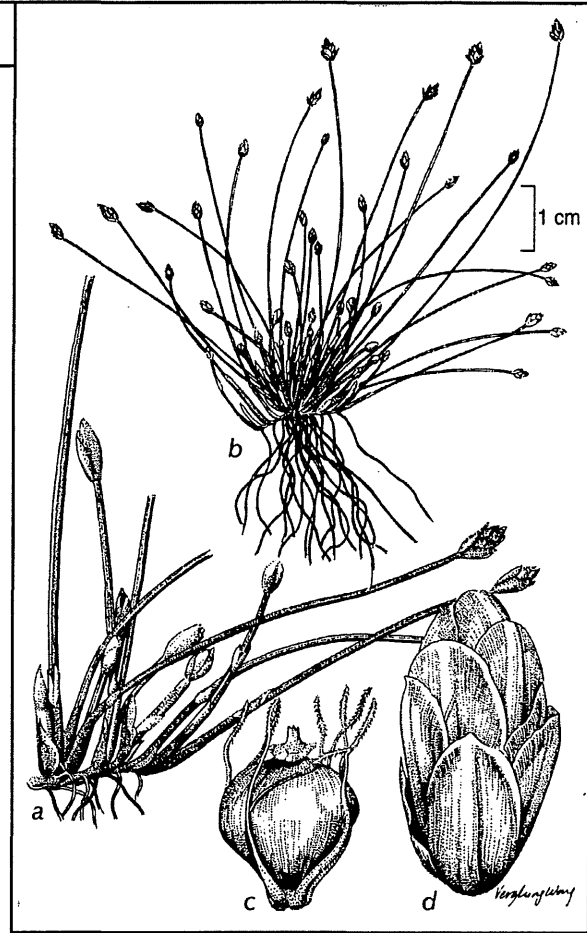


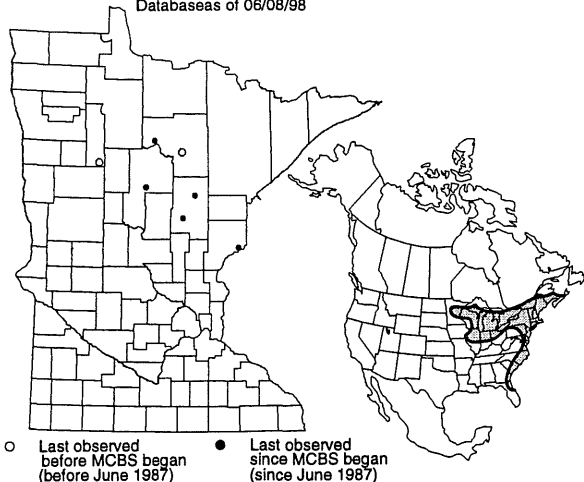
illustration by Vera Ming Wong©1988 State of Minnesota, Department of Natural Resources

SELECTED REFERENCES:

Morgan, M.D., and K.R. Philipp. 1986. The effect of agriculture and residential development on aquatic macrophytes in the New Jersey USA Pine Barrens. Biol. Conserv. 35(2): 143-158.

Smith, W. 1988. Vascular plants, pg. 34-217. In B. Coffin and L. Pfannmuller, eds. Minnesota's endangered flora and fauna. Univ. of Minnesota Press, Minneapolis.

Mappable records in the Minnesota Natural Heritage
Databases of 06/08/98



FEW-FLOWERED SPIKE-RUSH

Eleocharis quinqueflora (Lightf.) Lank var.
fernaldii Sv.

Family: **Cyperaceae** Sedge Family

Official 1996 Minnesota Legal Status: Special
Concern

CASS COUNTY OCCURRENCE:

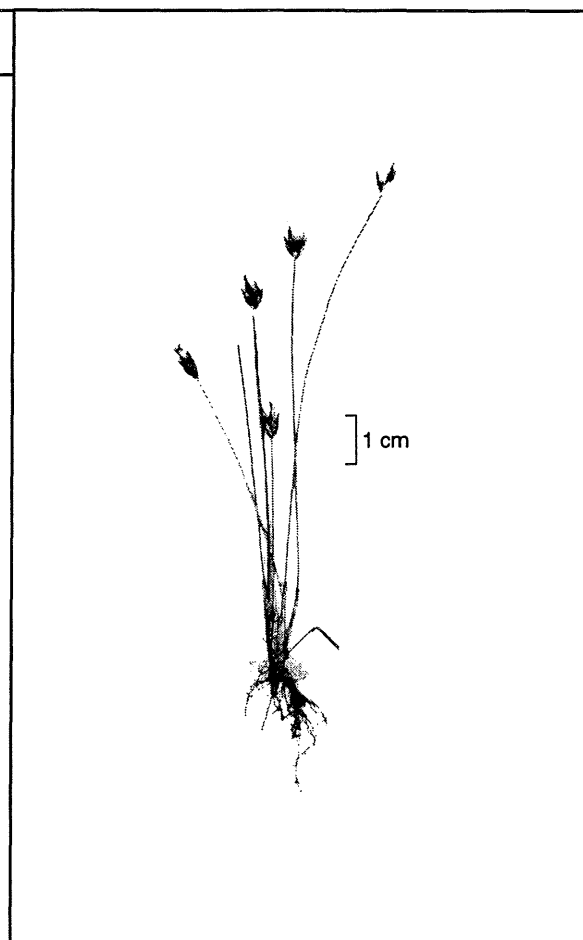
In 1992, Karen Myhre (Minnesota County Biological Survey) found two small populations of Few-flowered Spike-rush in Cass County. Unlike records from the northwestern counties of Minnesota, where Few-flowered Spike-rush is associated with Calcareous seepage fens, the new records from Cass County are from shallow, sandy lakeshores. These small populations occur intermittently along the narrow, sandy beaches of small (100-200 acre) lakes. Plants occur in loose colonies at the water's edge where they are subject to fluctuating water levels. Some specimens were observed torn loose by wave action and deposited on the shore as mounds of entangled plants.

HABITAT:

These small plants may be found on wet calcareous shores and in diverse wetland types including floating sedge mats and the banks of rivers. Few-flowered Spike-rush was first collected in Minnesota by H.E. Stork in 1925 in Itasca County.

FIELD CHARACTERISTICS:

Few-flowered Spike-rush is a rare and inconspicuous member of the beach community. Its indistinctive appearance and short stature (culms can be just a few inches tall) make it a



challenge to locate. The head of the spike-rush is small, loosely flowered, and few-flowered as its name suggests. Colonies of plants are not densely matted or clumped. Mature achenes (single-seeded fruits) are very helpful in the positive identification of this species.

BEST TIME TO SEARCH:

The specimens from Cass County were collected in September and October, when achenes are mature.

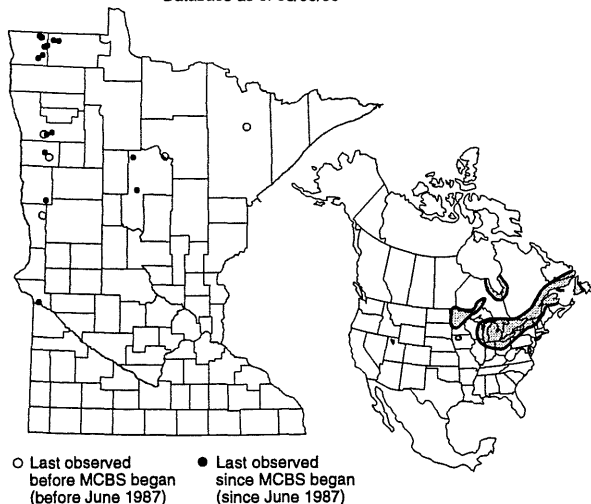
SELECTED REFERENCES:

Hulten, E. 1958. The amphi-Atlantic plants. Almquist & Wiksell, Stockholm.

Smith, W. 1988. Vascular plants, pg. 34-217. In B. Coffin and L. Pfannmuller, eds. Minnesota's endangered flora and fauna. Univ. of Minnesota Press, Minneapolis.

Stohlgren, T. J., S. H. De Benedetti, and D.J. Parsons. 1991. Effects of herbage removal on productivity of selected High Sierra meadow community types. Environmental Management 13 (4): 485-491.

Mappable records in the Minnesota Natural Heritage
Database as of 06/08/98



BUTTERNUT

Juglans cinerea L.

Family: **Juglandaceae** Walnut Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

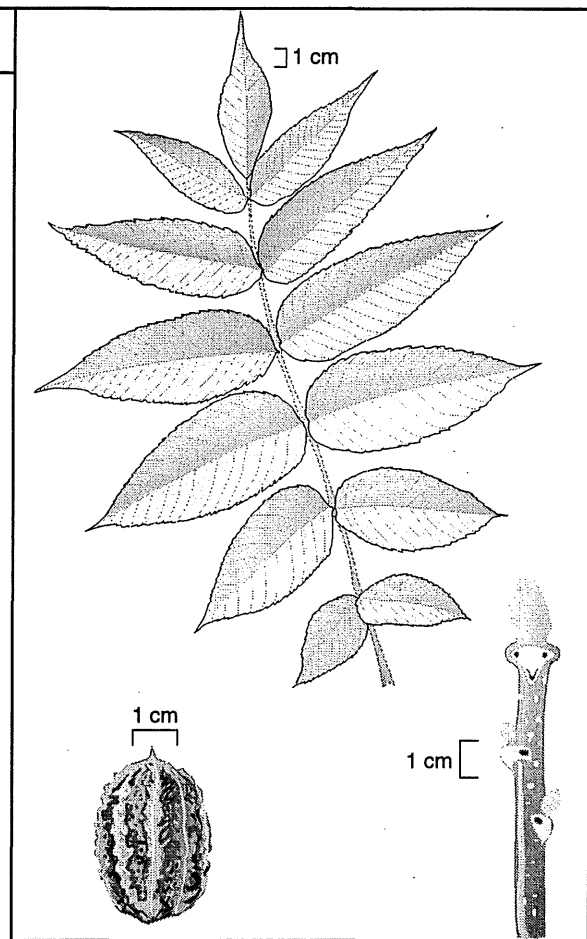
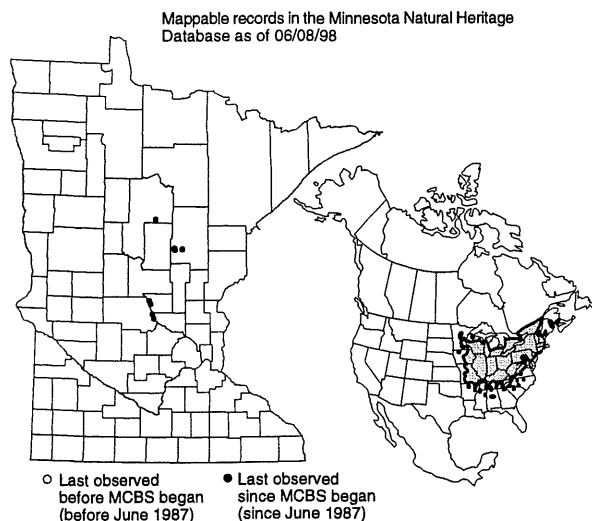
Larry Olson and others from the Cass County Land Department found 10-12 Butternut trees while putting in a trail along County Road 160 in 1979. In 1994, a collection of leaves and fruit was deposited in the herbarium of the University of Minnesota to document the occurrence. These trees are growing in an Oak forest dominated by Red Oak (*Quercus rubra*), Red Maple (*Acer rubrum*), and Trembling Aspen (*Populus tremuloides*). They are the northwesternmost locations known for the species in North America.

HABITAT:

In the northeastern U.S., Butternut is a component of deciduous forests, but it is not common anywhere in its range. Its survival is threatened in the United States by Butternut canker (*Sirococcus clavigignenti-juglandacearum*), a fungus that causes multiple stem and branch cankers. The first infected Butternuts were found in 1967, and, since then, the number of infected trees has increased steadily.

FIELD CHARACTERISTICS:

Leaves of this tree have more leaflets (11-17) than either Black Ash (*Fraxinus nigra*) or Green Ash (*Fraxinus pennsylvanica*). Butternut has viscid-hairy (sticky) twigs and foliage, and the fruit (also viscid-hairy) is ovoid. This tree may be up to 90 feet tall. It has grayish-brown bark with smooth ridges and a dark brown pith.



BEST TIME TO SEARCH:

This tree is most easily identified from flowering and leaf-out in May, through October, when the fruit ripens and leaves fall.

SELECTED REFERENCES:

Burns, R.M., and B.H. Honkala. 1990. Silvics of North America. Vol. 2. Hardwoods. Agriculture handbook 654. U.S. Forest Service, U.S. Department of Agriculture, Washington, DC.

Ostry, M.E., M.E. Mielke, and D.D. Skilling. 1994. Butternut-strategies for managing a threatened tree. General technical report NC-165. U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, St. Paul, MN.

Ostry, M.E., M.E. Mielke, and R.L. Anderson. 1996. How to identify butternut canker and manage butternut trees. U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, St. Paul, MN. (brochure).

Rosendahl, C.O. 1955. Trees and shrubs of the upper Midwest. Univ. of Minnesota Press, Minneapolis.

Stolzenburg, W. 1993. A few good butternuts. The Nature Conservancy magazine, July/August: 7

WHITE ADDER'S-MOUTH

Malaxis monophyllos (L.) Sw. var. *brachypoda*
(Gray) Morris & Eames

Family: **Orchidaceae** Orchid Family

Official 1996 Minnesota Legal Status: Special
Concern

CASS COUNTY OCCURRENCE:

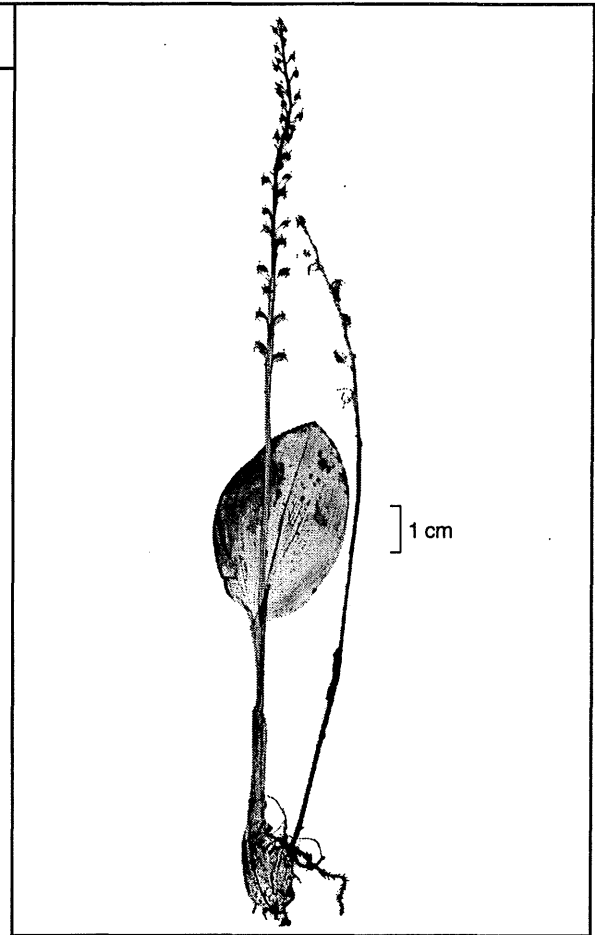
White Adder's-mouth was first found in Cass County by Karen Myhre (Minnesota County Biological Survey) in 1992. Five fairly dispersed sites were located in the northern part of the county. All of the Cass County collections are from Cedar swamps. Some of the swamps include Black Ash (*Fraxinus nigra*) or Balsam Fir (*Abies balsamea*) along with the cedar. Plants have been observed in and around the edges of pools and in Balsam Fir needle duff. In one of the Cedar swamps, plants were found in pools located at the base of a steep incline surrounding the swamp.

HABITAT:

White Adder's-mouth is usually found on sphagnum hummocks in lowland conifer swamps. It was first collected in Minnesota in 1891 in Crow Wing County by J.H. Sandberg.

FIELD CHARACTERISTICS:

This small-flowered orchid blends with its wetland environment. The White Adder's-mouth varies from small, sterile, single-leaved specimens under 2 inches (5 centimeters) in height to large, blooming specimens as tall as 8 inches (20 centimeters). This orchid is distinguished by the combination of these characters: the presence of a bulb; a many-flowered spike rather than an umbel; a single yellow-green leaf; and



divergence of the leaf well above the base of the stem.

BEST TIME TO SEARCH:

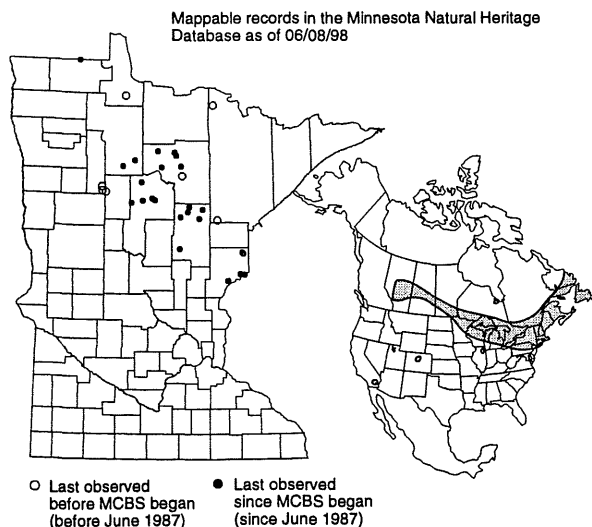
Distinguishing characteristics are evident in many specimens as early as May, when the previous year's spike of capsules (fruits) may be seen (see illustration above). However, the plant is most easily found during its blooming period in late June and throughout July. In August, newly formed capsules are much larger than the flowers.

SELECTED REFERENCES:

Case, F. W., Jr. 1987. Orchids of the western Great Lakes region. Bull. 48. Cranbrook Institute of Science, Bloomfield Hills, Michigan.

Reddoch, J.M., and A.H. Reddoch 1997. The orchids in the Ottawa District: floristics, phytogeography, population studies, and historical review. Canadian Field-Naturalist 111:1-186.

Smith, W. R. 1993. Orchids of Minnesota. Univ. of Minnesota Press, Minneapolis.



SLENDER NAIAD

Najas gracillima (A. Br.) Magnus
Family: **Najadaceae** Naiad Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

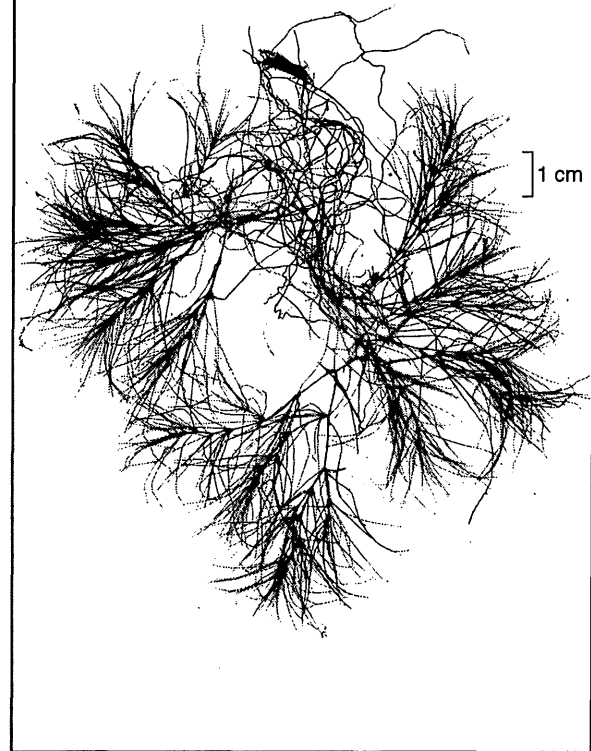
Slender Naiad was first collected in Cass County by Karen Myhre (Minnesota County Biological Survey) in 1992. Most of Cass County's eight records are from shallow, sandy-shorelines. On two occasions the plants were found rooted in sand; otherwise they were found free-floating along shallow shores and bays. Slender Water Milfoil (*Myriophyllum tenellum*) and Humped Bladderwort (*Utricularia gibba*) were also found at several of the sites.

HABITAT:

This aquatic species had not been documented in Minnesota since 1936 until Anita Cholewa collected it in two small Aitkin County lakes in 1988. Slender Naiad is considered to be an Atlantic Coastal Plain species, and the seven new sites in Cass County represent the current northwestern extent of the plant's range in North America. It is believed to be rare and declining because of habitat degradation throughout its range. Previous records in Minnesota were from soft-water lakes and ponds with mud or silt bottoms.

FIELD CHARACTERISTICS:

The Slender Naiad is similar in form to, and sometimes found with, the more common Flexuous Naiad (*Najas flexilis*), but it has a finer, longer leaf. The abruptly auricled leaf-sheaths



of Slender Naiad, with their elongated teeth, contrast with the rounded, short-toothed leaf-sheaths of Flexuous Naiad. The seeds of the two species are distinct (dull in Slender Naiad, glossy in Flexuous Naiad).

BEST TIME TO SEARCH:

Cass County specimens were collected from July through October. Mature achenes (fruits) are helpful in the identification of this species.

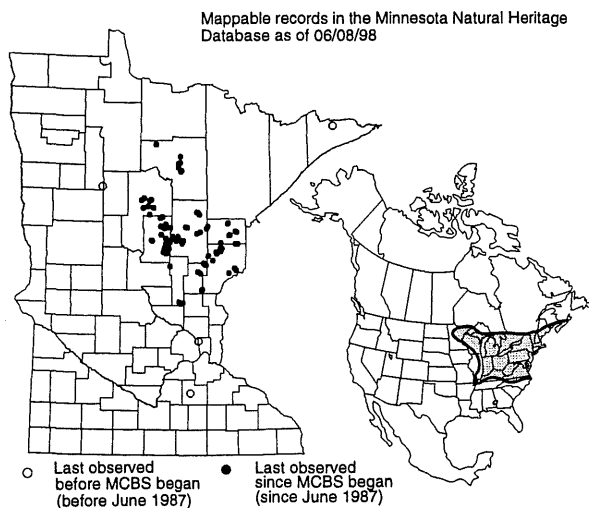
SELECTED REFERENCES:

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Haynes, R.R. 1979. Revision of North American and Central American *Najas* (Najadaceae) Sida 8: 34-56.

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ONE-FLOWERED BROOM-RAPE

Orobanche uniflora L.

Family: **Orobanchaceae** Broom-rape Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

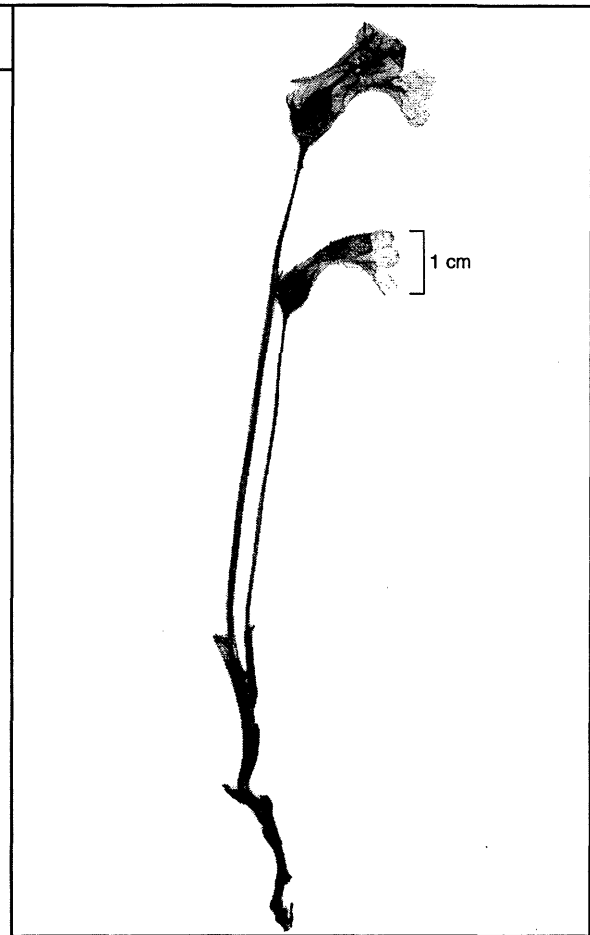
Carol and Steve Mortensen and Beth Nixon found a small population of this species on 18 June 1997 in a transition zone between a White cedar swamp and northern hardwood forest southeast of Lower Sucker Lake. The plants were associated with Wild Sarsaparilla (*Aralia nudicaulis*), Wild Ginger (*Asarum canadense*), and Poison Ivy (*Rhus radicans*). The discovery was made during a rare plant survey prior to a pipeline right-of-way expansion. This collection extends the known range of the plant in the state to the northwest; the few earlier collections in the state were from the southeast and the metro region.

HABITAT:

Orobanche uniflora is parasitic on many plant species (including *Aster macrophyllus* in the eastern U.S.) and is one of three species (all rare) of *Orobanche* found in Minnesota. This species occurs in moist woods, along stream-banks, and in bluff prairies in the southeast; it is the only Minnesota *Orobanche* species found in woodlands. One-flowered Broom-rape was first collected in Minnesota in 1878 by T.S. Roberts in an area of south Minneapolis.

FIELD CHARACTERISTICS:

Lack of green color; a white, brittle subterranean stem; and a single, low-growing flower that can



open under leaf litter characterize this species. Its white to violet flower, borne on a glandular-pubescent pedicel arising at or below ground level, appears for only a short time in the spring.

BEST TIME TO SEARCH:

With one July exception, all collections in the University of Minnesota herbarium were made in June.

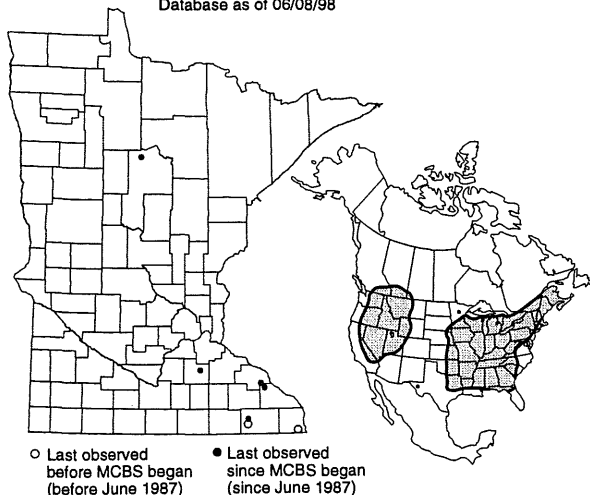
SELECTED REFERENCES:

Musselman, L.J. 1982. The Orobanchaceae of Virginia. *Castanea* 47:266-275.

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Tatina, R. 1994. *Orobanche uniflora* L. (Orobanchaceae) - new to the flora of South Dakota. *Prairie Naturalist* 26(2): 172.

Mappable records in the Minnesota Natural Heritage Database as of 06/08/98



CLUSTERED BUR-REED

Sparganium glomeratum Laestad.

Family: **Sparganiaceae** Bur Reed Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

There are two known occurrences of Clustered Bur-reed in Cass County, both found in 1992. One is along the edge of a wetland separated from Leech Lake by a beach ridge. The second occurrence in Cass County is in a moat surrounding a wetland.

HABITAT:

In general, Clustered Bur-reed inhabits areas characterized by gradually fluctuating water levels. These habitats include ditches, wetlands influenced by beaver activity, detached floating mats of marsh vegetation and moat-like areas of open water that encircle wetlands.

FIELD CHARACTERISTICS:

Compared to other Bur-reed species, clustered bur-reed is relatively short and upright. The very small (approximately 1/2 inch (1cm)) clustered burs or pistillate heads are the source of the name clustered bur-reed. These pistillate heads are composed of distinctly short-beaked fruits. The single (usually) short-stalked staminate head distinguishes this species from the more common, longer-stalked, multi-headed species. Walton (1995) includes a key to the *Sparganium* species of Minnesota.

BEST TIME TO SEARCH:

Plants have been found throughout the growing season, but July and August are the best times to observe the single staminate head.

Mappable records in the Minnesota Natural Heritage Database as of 06/08/98

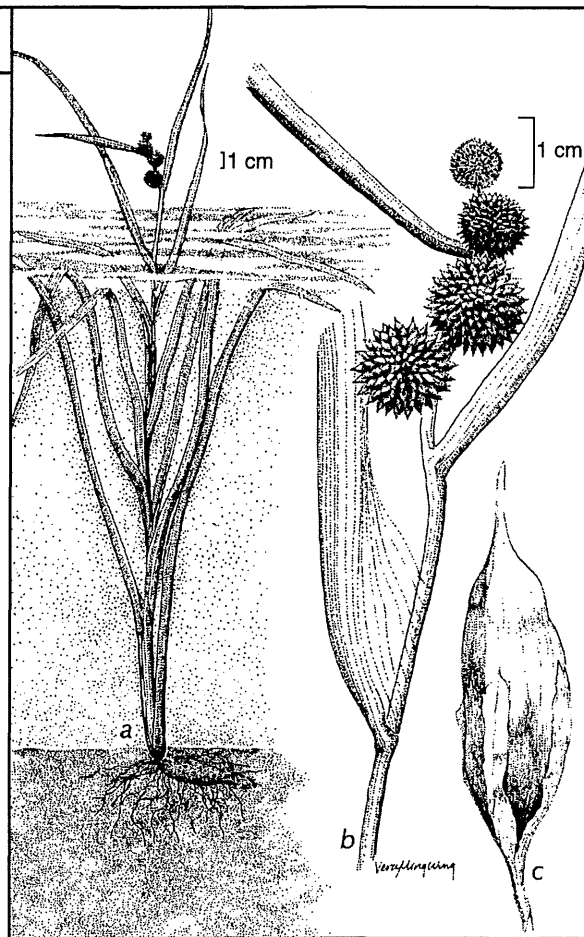
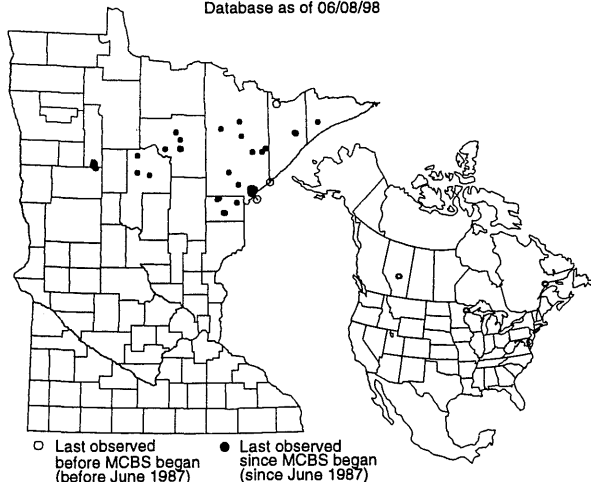


Illustration by Vera Ming Wong © 1998 State of Minnesota, Department of Natural Resources

More mature specimens have firm, well-developed burs or pistillate heads and may include enough of a remnant of the male head(s) to aid in identification.

SELECTED REFERENCES:

Lakela, O. 1941. *Sparganium glomeratum* in Minnesota. *Rhodora* 43:83-85.

Sather, N., and K. Van Norman. 1988. Results of a survey for *Sparganium glomeratum* (Clustered Bur-reed) in Chippewa National Forest. Biol. Report No. 2. Minnesota Department of Natural Resources, St. Paul.

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Walton, G. 1995. Status survey for *Sparganium glomeratum* (Clustered Bur-reed) in Minnesota. Unpublished report submitted to Minnesota Department of Natural Resources' Natural Heritage and Nongame Research Program, St. Paul.

HUMPED BLADDERWORT

Utricularia gibba L.

Family: **Lentibulariaceae** Bladderwort Family

Official 1996 Minnesota Legal Status: None

CASS COUNTY OCCURRENCE:

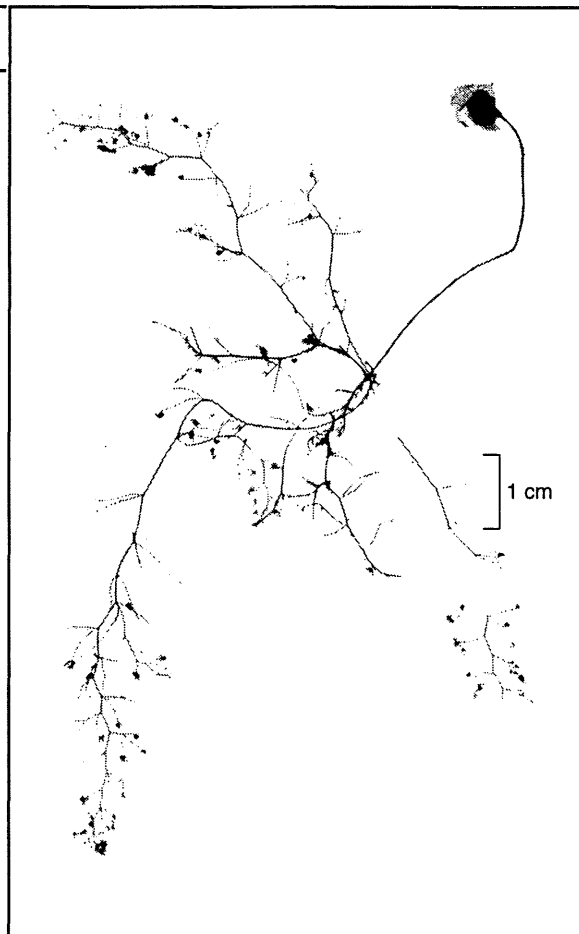
This bladderwort, the smallest of Minnesota's aquatic species of *Utricularia*, was first collected in Cass County by Karen Myhre (Minnesota County Biological Survey) in 1992. In that year, it was collected on the shores of seven lakes in the county. Chippewa National Forest and Leech Lake Division of Resources Management staff have since made several additional collections in the county.

HABITAT:

Humped Bladderwort occurs in shallow water. It has been found along the shore of small lakes and protected bays, in peatland pools, and at the edge of sedge mats. It has also been collected along sandy lakeshores and at the edges of floating bogs ringing the perimeters of small lakes. It often occurs with other species of *Utricularia*. Humped Bladderwort was first collected in Minnesota by R. Lindeman at Itasca State Park in 1936.

FIELD CHARACTERISTICS:

This species floats in the water and usually has singly-forked leaves. The upper lip and lower lip of the yellow corolla are about the same length, but the lower lip is much longer than the spur. These characteristics, combined with a slender scape and stem, separate this species



from other bladderworts. Smith (1988) provides a key to the identification of Minnesota's bladderworts.

BEST TIME TO SEARCH:

Although this plant may be identified without flowers, it is easier to find and identify during the blooming period. Humped Bladderwort blooms in late summer; flowering plants have been collected in late July and late August.

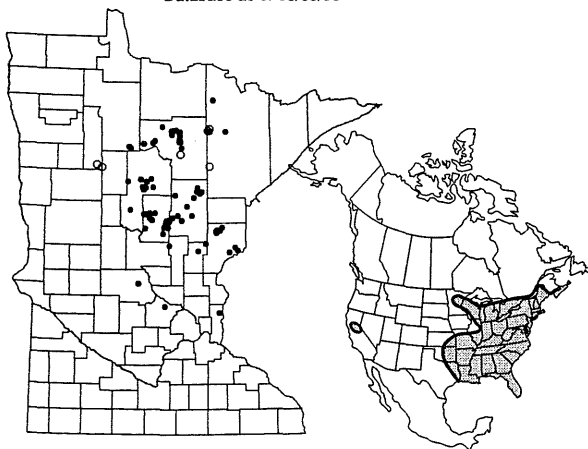
SELECTED REFERENCES:

Fasset, N.C. 1975. A manual of aquatic plants. Univ. of Wisconsin Press, Madison.

Smith, W. 1988. A new bladderwort in Minnesota. *Minnesota Plant Press* 7(3):1-4.

Smith, W. 1988. Vascular plants, pg. 34-217. In B. Coffin and L. Pfannmuller, eds. *Minnesota's endangered flora and fauna*. Univ. of Minnesota Press, Minneapolis.

Mappable records in the Minnesota Natural Heritage
Database as of 06/08/98



○ Last observed before MCBS ● Last observed since MCBS
began (before June 1987) began (since June 1987)

PURPLE-FLOWERED BLADDERWORT

Utricularia purpurea Walt.

Family: **Lentibulariaceae** Bladderwort Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

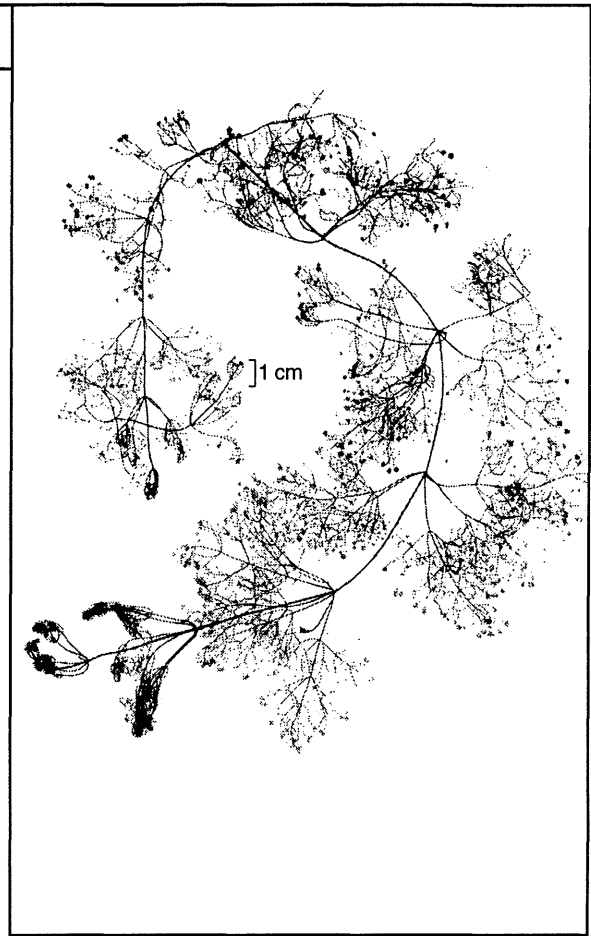
This large, aquatic species was first collected in the state in Cass County by Karen Myhre (Minnesota County Biological Survey) in 1992. It had been reported for Minnesota previously, but no specimen had been collected. This species was collected from two somewhat different habitats in the county. The first and largest population nearly encircled a small (10 acre) lake just beyond its boggy edge. The colony extended as much as 30 feet into the center of the lake and had many hundreds of purple flowers and fuschia-colored buds. The second population occurred in a sand-bottomed bay of a 90 acre lake.

HABITAT:

Throughout its range in eastern North America, Purple-flowered Bladderwort is found in quiet water. Since its discovery in Cass County in 1992, Purple-flowered Bladderwort has also been found along boggy or sandy shorelines in Crow Wing and Pine counties.

FIELD CHARACTERISTICS:

There are only two species of bladderworts in Minnesota with purple flowers. The other purple-flowered species, *Utricularia resupinata*, is a small, semiterrestrial plant with simple leaves. That species is not easily mistaken for Purple-flowered bladderwort, which is one of



the largest of Minnesota's bladderworts and has large, whorled, divided leaves.

BEST TIME TO SEARCH:

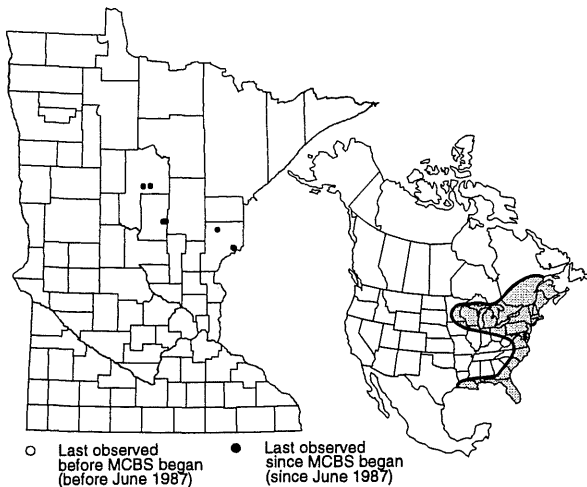
This plant blooms and is most noticeable in July and August. Its whorled leaves are distinctive throughout the summer in the shallow bays in which bladderwort colonies occur.

SELECTED REFERENCES:

Fassett, N.C. 1975. A manual of aquatic plants. Univ. of Wisconsin Press, Madison.

Smith, W. 1988. A new bladderwort for Minnesota. Minnesota Plant Press 7 (3):1-4.

Mappable records in the Minnesota Natural
Heritage Database as of 06/08/98



NEW ENGLAND VIOLET

Viola novae-angliae House
Family: **Violaceae** Violet Family

Official 1996 Minnesota Legal Status: None
(formerly Special Concern)

CASS COUNTY OCCURRENCE:

The only collection of New England Violet from Cass County was made in 1995 by Don Moen, a contractor with the Chippewa National Forest. Moen found a population of over 1000 plants about 4 miles east of Leech Lake. The plants were growing in a 25-year-old White spruce plantation on fine sandy loam.

HABITAT:

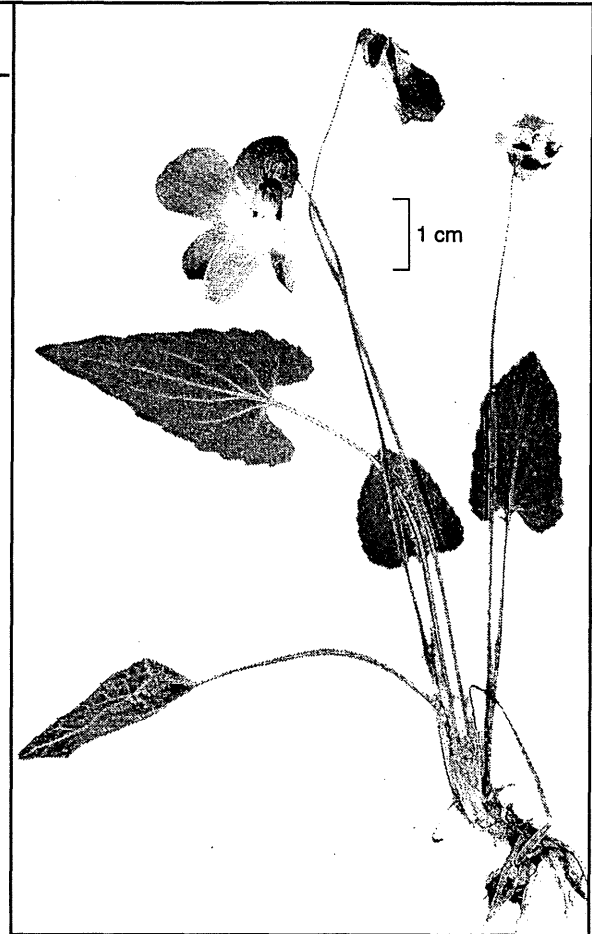
New England Violet is most common in the northeastern part of the state, where it usually grows on thin soil over bedrock or on sandy or gravelly soil, sometimes along streams or rivers.

FIELD CHARACTERISTICS:

Viola novae-angliae is a "stemless", blue-flowered violet with triangular leaves that are longer than broad. The petioles and leaf blades are hairy, the bases of the blades are cordate, and the blade margins are toothed.

BEST TIME TO SEARCH:

Minnesota specimens have been collected from May 15 to September 15, when flowers or fruits are present.



SELECTED REFERENCES:

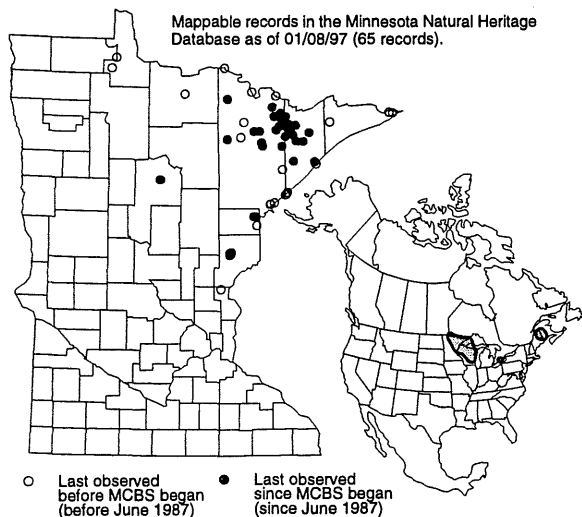
Ballard, H.E., Jr., and S.C. Gawler. 1994. Distribution, habitat, and conservation of *Viola novae-angliae*. Michigan Botanist 33:35-52.

Ballard, H.E., Jr. 1994. Violets of Michigan. Michigan Botanist 33:131-199.

Russell, N.H. 1958. The violets of Minnesota. Proceedings, Minnesota Academy of Science 25-26: 126-191.

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Smith, W. 1988. Vascular plants, pg. 34-217. In B. Coffin and L. Pfannmuller, eds. Minnesota's endangered flora and fauna. Univ. of Minnesota Press, Minneapolis.



BARREN STRAWBERRY

Waldsteinia fragarioides (Michx.) Tratt.

Family: **Rosaceae** Rose Family

Official 1996 Minnesota Legal Status: Special Concern

CASS COUNTY OCCURRENCE:

John Casson and other Chippewa National Forest personnel first found Barren Strawberry in Cass County in 1993. This population occurred near Portage Lake West of Bena. Two additional sites in the county were found in 1994. All populations were on sandy soil. Two were in Red Pine (*Pinus resinosa*) stands, and one was in an Aspen Forest.

HABITAT:

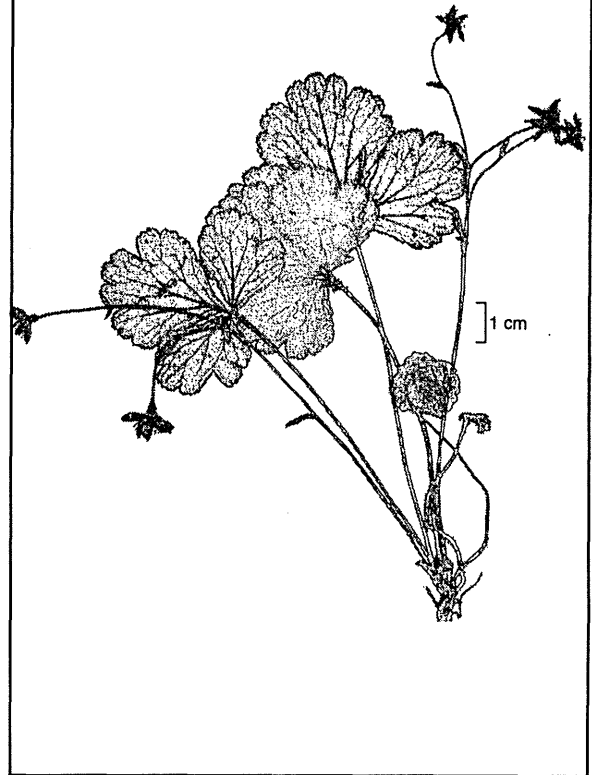
Throughout its range, the species often occurs on sandy or rocky substrates.

FIELD CHARACTERISTICS:

The three-parted leaves resemble those of some sterile Wood Anemone (*Anemone quinquefolia*) plants, but the leaflet bases of Barren Strawberry are more wedge-shaped. Barren strawberry's yellow flowers, positioned above the leaves, distinguish it from Wood Anemone and Common Strawberry (*Fragaria virginiana*), both of which have white flowers.

BEST TIME TO SEARCH:

Although Barren Strawberry can be recognized by the trained observer throughout the growing season, the best time to search for this species is in late May or early June, when it is blooming.



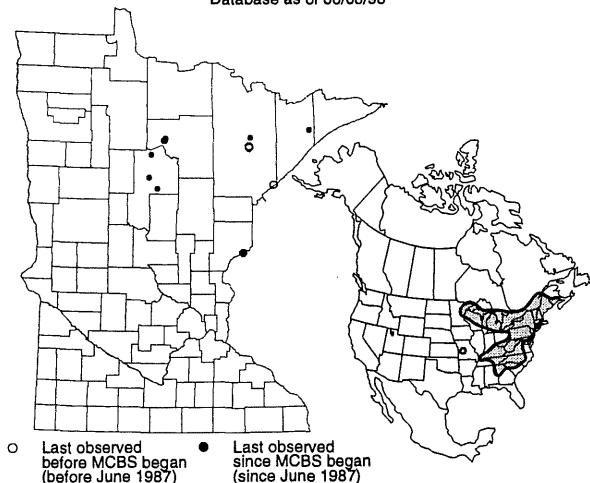
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Mappable records in the Minnesota Natural Heritage Database as of 06/08/98



Management / monitoring of Rare Plant Species: Element Stewardship Abstracts

Element Stewardship Abstracts (ESAs) are species reports compiled by The Network of Natural Heritage Programs and Conservation Data Centers and The Nature Conservancy. The term "element" comes from the phrase "elements of natural diversity" and as used here is synonymous with "species". ESAs are not yet available for all species. Those available for rare plant species that occur in Cass County are included here: *Arethusa bulbosa*, *Botrychium mormo*, *Botrychium rugulosum*, *Cypripedium arietinum*, *Viola novae-angliae*, and *Waldsteinia fragarioides*. A list of all species for which ESAs are available is also included following the abstracts. Note that ESAs have also been prepared for some pest species. To request copies contact the ESA coordinator at the Midwest Regional office of TNC (612) 331-0700.

ELEMENT STEWARDSHIP ABSTRACT
for
ARETHUSA BULBOSA -- DRAGON'S MOUTH

To the User:

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PMORC04010

>= 12 STEWARDSHIP ABSTRACT RESPONSIBILITY

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BARBARA VICKERY

THE NATURE CONSERVANCY

20 FEDERAL STREET

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(207) 729-5181

>= 16 PREPARER

S. C. ROONEY

>= 20 NAME

ARETHUSA BULBOSA

>= 50 COMMON NAME

DRAGON'S MOUTH

>= 100 DESCRIPTION

A small (6-40 cm) scapose, perennial orchid with a solitary (rarely two) magenta flower (bluish and white flower forms also occur), arising from a bulb-like (rarely double) tuber. Lateral sepals erect, middle sepal and side petals forming a hood over the lip. Lip oblong, pale pink, streaked with magenta-crimson and with distinctive "hairs". Leaf solitary, lanceolate, developing after the flower fades. The column is elongate, flattened with lateral wings, erose at the apex, pink 2-3.5 x 7-10 mm; anther on the front below the apex with two pairs of soft yellow-green pollinia. The fruit is an ellipsoid, erect capsule, 2.5 x 1.5 cm, (Luer 1975, Brackley pers. comm., Gawler 1982, Fernald 1950).

>= 1000 HABITAT

Most frequently, this species grows in open wet sphagnum bogs, in full sunlight. It is most abundant in coastal raised bogs. In Crystal Bog Preserve, the large *Arethusa* population is restricted to the fen area, growing in close association with bog rosemary (*Andromeda glaucophylla* - a minerotrophic member of the heath family (Ericaceae)). According to Vickery (pers. comm.) and Gawler (1982), *Arethusa* also grows around the shores of ponds and in wet meadows. Gawler (1982) reports that *Arethusa* prefers minerotrophic habitats. The author recently discovered this element growing in an alder (*Alnus rugosa*) lagg near a fen and again in the summer of 1983 in a wet portion of Chemo Bog, a large open ombrotrophic peatland in central Maine. Both of these sites were extremely minerotrophic.

>= 2000 BIOLOGY-ECOLOGY

Arethusa flowers during the first 2 weeks of June (rarely in May). This species propagates by seed, although Thien and Marcks (1972) report that only 16% of the flowers observed developed into mature capsules. *Arethusa* is pollinated by bumblebees (of the genus *Bombus* (Apidae)). Thien and Marcks (1972) reported that 95% of *Arethusa* yielded seeds with embryos when hand-pollinated. It would appear that pollination in the wild does not occur frequently.

According to Case (1964) *Arethusa* reproduces vegetatively very slowly by spreading from the bulb-like tuber. However, Gawler and Vickery (pers. comm.) found evidence that many *Arethusa* at the Great Heath (Washington Co., ME) spread vegetatively by tubers.

This element is an early successional species, disappearing as its habitat becomes invaded by shrubs. *Arethusa* is commonly associated with such minerotrophs as alder, sweet gale (*Myrica gale*), several sedges (*Carex* spp.), bog rosemary and leather leaf (*Chamaedaphne calyculata*). Although this species has traditionally been classified as a plant of "sphagnum bogs", it actually occupies a variety of habitats, which exhibit a wide variety of minerotrophic conditions.

>= 3000 THREATS

Alteration of the hydrologic regime of this species is likely the worst threat. Collecting is a problem wherever sites are easily accessible and/or widely known. Shrub invasion is another threat according to Gawler (1983).

>= 3500 PRESERVE SELECTION & DESIGN CONSIDERATIONS

Attempts to protect this element must include enough buffer zone to protect the hydrological integrity of the habitat.

>= 4000 RECOVERY POTENTIAL

A search of the literature provides no specific information on this subject. However, knowledge of the habitat requirements combined with sound management practices might accomplish a recovery over a long period of time. Given *Arethusa*'s generally poor incidence of setting fruit in the wild and slow vegetative spread (Case 1964), recovery would be slow at best.

>= 5000 MONITORING NEEDS

Populations of *Arethusa* at Crystal Bog Preserve should be monitored on a long term basis, as shrub invasion is occurring on the fringes of the habitat. Presently, the population appears to be fairly stable, with some evidence of increase (Rooney 1983).

When long-term monitoring of *Arethusa* is carried out the following should be considered:

1. On-the-site updating of the demography of the populations during anthesis.
2. Water chemistry--specifically calcium ions.
3. Effects of shrub invasion on the population.
4. Acid rain levels.
5. Water drainage patterns.

>= 5400 MONITORING PROGRAMS

S. C. Rooney, B. St. J. Vickery and S. C. Gawler know of extant populations in Maine. S. C. Rooney and C. S. McKellar have been conducting general monitoring in the fen at Crystal Bog Preserve, Maine, since 1978.

>= 6010 RESEARCH NEEDS

1. How long-lived is *Arethusa bulbosa*?
2. How specifically adapted is *Arethusa bulbosa* to competition from shrubs and fluctuations in the hydrologic regime?

3. Do early and late frosts damage the tubers significantly?
4. What is the rate of vegetative outgrowth of the tubers?
5. What conditions promote germination?
6. What is the length of time from germinated seed to flowering individual?

>= 7010 MANAGEMENT NEEDS

Habitat maintenance through cutting of shrubs invading *Arethusa* habitat.

>= 7400 MANAGEMENT PROCEDURES

Cutting of shrubs during winter to reduce possible harmful effects of trampling *Arethusa* tubers.

>= 8000 SUMMARY -- STEWARDSHIP NEEDS

1. Demographic studies of *Arethusa* populations on Nature Conservancy Preserves.
2. Establish permanent cutting plots to reduce shrub invasion of *Arethusa* habitat.
3. Water chemistry and hydrology studies (acid rain may be a threat) on all Nature Conservancy Preserves.

>= 9000 BIBLIOGRAPHY

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>= 9900 UPDATE

84-07-19

ELEMENT STEWARDSHIP ABSTRACT
for
BOTRYCHUM MORMO -- GOBLIN FERN

To the User:

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MIDWEST REGIONAL OFFICE

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MINNEAPOLIS, MN 55414

612/379-2207

>= 0016 PREPARER

WAYNE R. OSTLIE (1990)

>= 0020 NAME

BOTRYCHIUM MORMO

>= 0050 COMMON NAME

GOBLIN FERN

>= 0100 DESCRIPTION

Wagner and Wagner (1981) described the goblin fern (*Botrychium mormo*) as follows:

"Gametophyte commonly persisting at the bases of even the largest plants; leaf 8.6 (7-12.5) cm tall, very succulent, yellow-green, shiny; the common stalk making up 50 (20-70) % of the total length; sterile segment linear, 2 (1.3-4.1) cm long, 5 (3-7) cm wide, the stalk 1 (0.5-1.6) cm long; lobes 2 (1-3) pairs, round-pointed to truncate, the distal margins entire or shallowly crenate, not sharply dentate or irregularly lacerate, and with no tendency for exaggerated basal lobes; the tip usually with 2-4 angular triangular or squarish lobes; fertile segment 4.5 (2.4-7.5) cm tall, commonly branched in the lower third, the branches 1/3 to 2/3 as long as the main axis; sporangia large, sunken, not opening until late September and October, the aperture narrow, only 15-30 degrees; spores 49 (45-53) μ m in diameter; chromosomes $2n=90$."

>= 1000 HABITAT

Botrychium mormo, apparently very rare, is known from only three states (Michigan, Wisconsin and Minnesota), although extensive surveys have been made in some areas (Smith 1988). Wagner and Wagner (1981) estimated that only one in fifty apparently suitable sites yield this species, although environmental factors (i.e., drought) may have skewed his analysis. The usual habitat of *B. mormo* is shaded forest floors under mature deciduous forest trees. Plants grow in the rich leaf mold of maple or maple-basswood (*Acer saccharum* and *Tilia americana*) forests of the north-central states. East of Marquette, Michigan, these hardwood forest dominants are joined by beech (*Fagus grandifolia*) (Peck pers. comm., Wagner and Wagner 1981). Other habitats may exist, but due to very limited periods of surveys, other potential habitats have not been searched (Peck pers. comm.).

In Minnesota, *B. mormo* is known to be extant in the north-central portion of the state, restricted to Clearwater, Cass, Becker, Beltrami, Cook and Mahnomen Counties (MN NHP 1990). The best known extant sites for *B. mormo* occur in the vicinity of Lake Itasca in north-central Minnesota, including Bearpaw Point, Itasca Biological Station (Wagner pers. comm.).

In Wisconsin, Peck (pers. comm.) found plants growing in pure maple woodlands. One site was characterized as having a wind-throw swell/swale relief. Very little woody understory occurred at the site. Habitats are typically north-facing hillsides, possessing moist, mineral-rich soils (Peck pers. comm.).

>= 2000 BIOLOGY-ECOLOGY

Plants emerge from the ground in late July and frequently persist into the winter if rodents do not eat them (Peck pers. comm.). Since *B. mormo* is a mycorrhizal species, it is extremely dependent upon moisture availability, going through cycles of boom or bust years. Years with good snow fall followed by spring and summer rains will yield abundant crops of *B. mormo* at extant sites. In any given year, plants may push their way through the leaf litter or lie dormant, depending upon seasonal moisture availability (Wagner and Wagner 1981). Often, very small plants will dominate a population. In drought years, even the large plants will fail to send up a leaf, or they appear whitish (achlorophilous) beneath the forest litter. Roughly half of all individuals retain the gametophyte at their bases. The reason for this is unclear (Wagner and Wagner 1981).

As a mycorrhizal species, *Botrychium mormo* can remain underground for many years until habitat conditions improve. The species is particularly sensitive to drought due to its late-season emergence in July (Wagner pers. comm.). In Michigan, Wagner (pers. comm.) stated that he had only observed three individuals of the species in the last decade due to continued drought conditions.

Reproduction in *B. mormo* is not well understood. Sporangia produced by the species are closed and spores are not wind-dispersed as they are in all other species within the genera (Peck pers. comm.). Rodents that feed on the plants may serve as primary dispersal agents, or sporangia may simply rot in the ground, thereby dispersing their spores (Peck pers. comm.).

>= 2500 ELEMENT OCCURRENCE QUALITY DETERMINATIONS

This field is designed to help the field worker determine the quality (A=excellent, B=good, C=marginal, D=poor) of an occurrence of this element. These ranks (A-D) are based on size and productivity of the population, vitality and vigor of individuals within the population, and size and quality of the habitat in which the species occurs. Headings (Habitat, Population Size and Vigor) should be considered separately in determining the overall rank of the element occurrence.

A-Ranked Occurrence

Habitat: Large areas of mature maple-basswood or maple-basswood-beech forests that are managed for the maintenance of this forest habitat. Exact habitat requirements are unknown.

Population Size and Vigor: A population exceeding 50 individuals.

B-Ranked Occurrence

Habitat: Moderate-sized acreage of mature maple-basswood or maple-basswood-beech forests that are managed for the maintenance of this habitat type.

Population Size and Vigor: A population of 25-49 individual plants.

C-Ranked Occurrence

Habitat: Small acreage of mature maple-basswood or maple-basswood-beech forests that are managed for the maintenance of this habitat type; OR, larger forest tracts of this habitat type that show moderate levels of degradation.

Population Size and Vigor: A population of 10-24 individual plants.

D-Ranked Occurrence

Habitat: Highly disturbed maple-basswood or maple-basswood-beech forests of any size; Or, acreage of immature maple-basswood or maple-basswood-beech forests.

Population Size and Vigor: A population of less than 10 plants.

>= 3000 THREATS

Potential threats to *B. mormo* include logging and associated physical disruption of the mature maple-basswood or maple-basswood-beech forest habitat. Other means of deforestation are also a threat. According to Wagner and Wagner (1981), *B. mormo* is sensitive to the effects of drought due to the lateness of its emergence (late September to October). Any activity that opens the forest canopy and increases the effects of desiccation may be detrimental to the species. At present, due in part to the infrequent observations of the species, these threats are merely speculative.

Grazing serves to compact the forest soil, remove or damage existing plants, and damage the forest trees under which *B. mormo* grows. Continued grazing will undoubtedly destroy populations of the species, if not through immediate physical disruption, then through the destruction of its habitat.

General forestry activities such as the planting of monocultural pine plantations and ground-layer herbicide application are other threats to the goblin fern.

>= 3500 LAND PROTECTION

Protection of *B. mormo* requires the protection of mature mesic (maple-basswood-beech or maple-basswood) deciduous forest. Adequate buffer should be acquired to protect existing *B. mormo* populations from outside influences (herbicide drift, fragmentation effects of logging, etc.). Logging of areas containing high-quality *B. mormo* populations should not be undertaken.

>= 4000 RECOVERY POTENTIAL

The recovery potential of *B. mormo* is largely unknown. At present, there exists little information pertaining to even the most basic of life-history information.

>= 5000 MONITORING NEEDS

Basic monitoring needs include all aspects of population maintenance (recruitment, reproduction, population maintenance, etc.). Although there is a strong need to monitor existing populations of *B. mormo*, the practicality in doing so may make monitoring impossible or very difficult. Due to the periodical emergence of this species (perhaps once per decade or so), monitoring would not be able to provide information pertaining to the trends of a given population.

>= 5200 MONITORING PROCEDURES

Monitoring of this species is very difficult since plants may not emerge during periods of drought (Wagner pers. comm., Penskar pers. comm.). Consequently, the absence of the species in any given year should not be construed as the death of the plant. Wagner (pers. comm.) stated that he has only seen three individuals in Michigan in the last decade due to extremely dry conditions.

>= 5400 MONITORING PROGRAMS

No monitoring programs are currently in place for *B. mormo*.

>= 6010 RESEARCH NEEDS

A further inventory of the species needs to be undertaken throughout its range (Ballard pers. comm., Peck pers. comm.). Due to the periodical emergence of this species, many populations may have been overlooked during inventory attempts. Peck (pers. comm.) stated that most of Wisconsin has never been searched for the species. At present, only a handful of people have been "trained" to search for the species, so inventories will not likely be undertaken in any broad sense in the near future (Peck pers. comm.).

Research pertaining to all aspects of the life history of *B. mormo* is needed (eg., specific habitat requirements, reason for the retention of the gametophyte in adult plants). At present, even the most basic of information on which to base management decisions is absent.

Methodologies for monitoring the condition of extant populations and providing appropriate management should also be developed. The effects of current forest management regimes (logging, etc.) on *B. mormo* should be assessed. What happens to populations when the soil is disturbed? What happens when the forestry canopy is removed?

Isozyme analysis of this species should further the understanding of the systematics of this species. *Botrychium mormo* may be part of a complex of fern species, many of which have been recently described.

>= 6410 RESEARCH PROGRAMS

Herb Wagner, Robert Preston and Don Drife, of the University of Michigan, Alpena Community College and Detroit metro area, respectively, are currently working on publishing the Pteridophyte flora of the Upper Great Lakes region. It should be completed within the next three

years. Contact: Herb Wagner, Herbarium, University of Michigan, Ann Arbor, MI 48109. Telephone No. (313) 764-1484.

Warren Hauk, a doctoral candidate under Dr. Chris Haufler, University of Kansas, is currently working on the systematics of Botrychium subgenus Botrychium, which includes B. mormo. Contact: Warren Hauk or Dr. Chris Haufler, Department of Botany, Haworth Hall, University of Kansas, Lawrence, KS 66045. Telephone No. (913) 864-3255.

>= 7010 MANAGEMENT NEEDS

Management needs for B. mormo are poorly known. In order to prescribe appropriate management procedures, precise ecological requirements of B. mormo must first be assessed. It is known that maintenance of mature maple, maple-basswood and maple-basswood-beech forests along the eastern deciduous/northern hardwood forest ecotone is a primary need. Extensive deforestation or physical disruption of the soil layers may be detrimental to the goblin fern. The extent to which the species can tolerate these disturbances is not known.

>= 7400 MANAGEMENT PROCEDURES

Management procedures are unknown and are contingent upon the identification of the management needs of B. mormo.

>= 7710 MANAGEMENT PROGRAMS

No management programs specifically designed for B. mormo are currently in place.

>= 8000 SUMMARY -- STEWARDSHIP NEEDS

Monitoring needs include the determination of the status of extant populations. Recruitment success, population maintenance and viable spore production should also be monitored. Research should be centered around the life history (habitat requirements, retention of gametophytes in adults, growth rate, etc.) of the species. Monitoring and management methodologies should be developed. The effects of current forest management practices on B. mormo should be assessed. Management needs are poorly known but may likely require the maintenance of mature beech-maple-basswood forests through logging restrictions.

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>= 9900 UPDATE

90-10-31

ELEMENT STEWARDSHIP ABSTRACT
for
BOTRYCHIUM RUGULOSUM - AMERICAN TERNATE GRAPEFERN

To the User:

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> == 0020 NAME

BOTRYCHIUM RUGULOSUM
(= BOTRYCHIUM TERNATUM)

> == 0050 COMMON NAME

AMERICAN TERNATE GRAPEFERN

> == 0100 DESCRIPTION

Botrychium rugulosum, according to Wagner and Wagner (1982), is a distinct species. The combination of its geographical range, periodicity, blade cutting, segment shapes, laminar contours and marginal teeth set it apart from all other species within the subgenus *Sceptridium*. The characters used to define the *B. rugulosum* are constant over the entire range of the species. Wagner and Wagner (1982), in describing *B. rugulosum*, stated:

"In habit resembling *B. dissectum* and *B. multifidum* with which it usually grows, its fronds emerging from the ground before the former and after the latter. Sterile blades deltoid, the stalk more or less the same length as the blade (shorter in sun forms, longer in shade forms), the stalk and blade together of mature, fertile plants averaging 8-16 cm (3 cm in sun to 30 in shade), the blade itself averaging 4-8 (2-16) cm long. Sterile blades 3-(2-4) -pinnate, divided to the pinna tips with regular reduction in symmetry. Lateral and basal pinnae ovate-deltoid, the pinnules rhomboidal, ovate, or oblong, usually strongly angled, 0.2-0.5 cm wide, the laminar surface in the living state convex above and more or less coarsely rugulose. Pinnule margins with nearly regular, somewhat rounded, wide teeth (except in rare subentire forms). Lateral veins mainly somewhat spreading rather than nearly parallel. Chromosomes $n = 45$."

Botrychium rugulosum closely resembles its Asiatic counterpart, *B. ternatum*, to such an extent that they were considered the same species until 1982, when Wagner and Wagner (1982) determined that true *B. ternatum* did not occur in North America. North American specimens, long attributed to *B. ternatum*, differed from their Asiatic counterparts in a number of characters.

Botrychium rugulosum is closely related to two more common species in the genera that usually occur along with it, *B. multifidum* and *B. dissectum* (Wagner and Wagner 1982). In the southern part of its range, *B. dissectum* is its common associate, while in the northern areas, *B. multifidum* is a common associate. *Botrychium oneidense* is sometimes associated with *B. rugulosum* as well. For a key to identify individuals within the *Botrychium* subgenus *Sceptridium* (which includes *B. oneidense*, *B. multifidum* and *B. rugulosum* and both forms of *B. dissectum*) see Wagner and Wagner (1982).

> == 1000 HABITAT

Botrychium rugulosum is known from Ontario and Quebec in Canada, and Connecticut, Michigan, Minnesota, New York, Vermont and Wisconsin in the United States (Wagner and Wagner 1982). The substratum in all localities is characteristically composed of sand or silt with which is mixed varying amounts of black organic matter (Wagner and Wagner 1982). Soil pH ranges from circumneutral to acidic at these sites.

In the southern portion of its range, *B. rugulosum* is found most frequently in low, swampy areas, particularly in old second-growth, grassy places and along paths (Wagner and Wagner 1982). These sites are typically richer than those farther north. Past grazing apparently stimulates the formation of populations. Old apple orchards that have been abandoned for over 20 years, brushy old fields and second-growth upland woods provide the best sites. Associates include *Acer rubrum*, *Cornus drummondii*, *C. racemosa*, *C. stolonifera*, *Corylus americanus*, *Populus tremuloides*, *Sassafras albidum*, *Ulmus americana*, *Vitis riparia* and species of *Anemone*, *Aster*, *Desmodium*, *Equisetum*, *Fragaria*, *Solidago* and *Viola* (Wagner and Wagner 1982).

In Vermont and New York, actively pastured open fields and meadows are ideal for *B. rugulosum* (Wagner and Wagner 1982). Grazing does not appear to cause any serious harm to the populations, although some individuals apparently appear trampled or dwarfed. These actively grazed sites possess associates that include *Dennstaedtia punctilobula*, *Pteridium aquilinum*, *Rubus idaeus*, *Comptonia peregrina*, *Spiraea alba*, *S. tomentosa*, *Juniperus virginiana* and species of *Achillea*, *Antennaria*, *Danthonia*, *Fragaria*, *Gnaphalium*, *Hieracium*, *Lycopodium*, *Panicum*, *Plantago*, *Poa*, *Polygonum*, *Polytrichum*, *Prunella*, *Rumex* and *Viola* (Wagner and Wagner 1982).

In northern localities, common associates include the haircap moss (*Polystichium* spp.), *Gaultheria procumbens*, *Rubus hispidus*, *Acer rubrum*, *Betula papyrifera*, *Hamamelis virginiana*, *Populus tremuloides*, *Prunus serotina*, *Salix* spp., *Spiraea alba* and *Vaccinium angustifolium* (Wagner and Wagner 1982). Additional associates include species within the genera *Antennaria*, *Fragaria*, *Hieracium*, *Lycopodium*, *Osmunda*, *Pteridium* and *Solidago*.

> == 2000 BIOLOGY-ECOLOGY

Leaf development in *Botrychium* is extremely slow, taking 3-4 months from the time of appearance of young fronds above ground in May or June to the maturation of the frond and sporangia in September and October (Wagner and Wagner 1982).

In the range of *B. rugulosum*, there exists a seasonal sequence in leaf development among several species of *Botrychium*. Seasonal development is in the order: (1) *B. multifidum*, (2) *B. oneidense*, (3) *B. rugulosum* and (4) *B. dissectum* (Wagner 1961). During June or July, for example, new leaves of *B. rugulosum* average 1.3-1.8 times as developed with respect to those of *B. dissectum*. Leaves of *B. multifidum* are 2-4 times more developed than those of *B. rugulosum* at the same time of year (Wagner and Wagner 1982).

>= 2500 ELEMENT OCCURRENCE QUALITY DETERMINATIONS

This field is designed to help the field worker determine the overall quality (A=excellent, B=good, C=marginal, D=poor) of an occurrence of this element. These ranks (A-D) are based on the size and productivity of the population, vitality and vigor of individuals within the population, and size and quality of habitat in which the species occurs. Headings (Habitat, Population Size and Vigor) should be considered separately in determining the overall quality of the element occurrence.

A-Ranked Occurrence

Habitat: Large areas of open, low, swampy habitat and uplands in old second-growth forest, old orchards or brushy old fields are of this rank. Soil substrates are typically composed of sand mixed with varying amounts of humus, with pH levels being circumneutral to acidic. Past disturbance by cattle grazing, logging, etc., has created open areas within forests that appear ideal for the species.

Population Size and Vigor: A population consisting of over 100 individuals is of this rank. Individuals apparently may remain subterranean for many years at a time before emerging during favorable conditions. Assessment of population size and vigor may be very difficult.

B-Ranked Occurrence

Habitat: Moderate-sized areas of open, lowlands and uplands in old second-growth forests, old orchards or brushy old fields are of this rank. Soil substrates are typically composed of sand mixed with varying amounts of humus, with pH levels being circumneutral to acidic. Past disturbances have created open areas within forests that appear ideal for the species.

Population Size and Vigor: A population of 50-99 individuals is of this rank. Individuals may remain subterranean for years at a time before emerging during favorable conditions. Assessment of population size and vigor may be difficult.

C-Ranked Occurrence

Habitat: Small or isolated pockets of open, low, old second-growth forests within otherwise unsuitable habitat; OR, large to moderate-sized, actively pastured meadows are of this rank. Soil substrates are typically composed of sand mixed with varying

amounts of humus, with pH levels being circumneutral to acidic. Disturbance by cattle grazing, logging, etc., has created open areas within forests that appear ideal for the species. Current pasturing at some sites does not appear to inflict harm on the existing populations, but may reduce germination success. habitat disturbance regimes in which habitats are largely non-existent and have not remained relatively open are of this rank.

Population Size and Vigor: A population consisting of 25-49 individuals is of this rank. Individuals may remain subterranean for years at a time before emerging during favorable conditions. Population size and vigor may be difficult to assess.

D-Ranked Occurrence

Habitat: Degraded, overgrazed meadows, pastures or woodlands of any size; Or, small, actively-pastured, non-degraded sites are of this rank. Soil substrates are typically composed of sand mixed with varying amounts of humus, with pH levels being circumneutral to acidic. Disturbance by excessive grazing, or road and home construction may have isolated populations or destroyed available habitat.

Population Size and Vigor: A population consisting of less than 25 individuals is of this rank. Individuals may remain subterranean for years at a time before emerging during favorable conditions. Population size and vigor may be difficult to assess.

> == 3000 THREATS

The largest populations of *B. rugulosum* occur in the sandy lakes area of north-central Wisconsin and Traverse County, Michigan (Wagner pers. comm.). These sites are threatened by potential development of lakeshore lots. An excellent quality population occurring in Monroe County, Michigan was destroyed by a housing development in the recent past (Wagner pers. comm.). Similar destruction of woodland habitat by logging activities, road construction, etc. has undoubtedly occurred in the past.

Excessive over-grazing of pasture land is another threat to existing populations, particularly in New York and Vermont. Destruction of existing populations and germination sites can easily occur under such conditions. Even at sites where adequate grazing pressure retains or even enhances existing populations (through vegetative reproduction) of *B. rugulosum*, germination sites for spores may be destroyed or negatively affected. Population within such habitats should be closely monitored and grazing management plans worked out with the private landowners.

>== 3500 LAND PROTECTION

Land protection must take into account the immediate area surrounding the *B. rugulosum* populations. In addition, adequate buffer to fully protect the population from potential threats and to allow for expansion is also needed.

> == 4000 RECOVERY POTENTIAL

The recovery potential of this species has not been determined. Since the species appears to inhabit disturbed areas, it appears likely that transplantation or introduction of the species into new sites with appropriate habitat is not excessively difficult. Transplantation should only be considered if research warrants the action, however.

> == 5000 MONITORING NEEDS

Population stability, and consequently the true status of this species, needs to be assessed through time. Such a methodology would provide detailed information pertaining to basic life-history information needs, including measurements of population stability, seed set, population maintenance, etc.

Habitat monitoring is also a need for the species. Correlations between changes in habitat and reproductive success can give strong recommendations toward future management activities. Such monitoring will also indicate the appropriate time to initiate management activities.

> == 5200 MONITORING PROCEDURES

In small populations, individual counts of the entire group should be made. In large populations, a representative sample of the population should be monitored through a randomized, permanent plot methodology. Individuals within each plot should be mapped as an aid to tracking, possibly providing detailed information pertaining to life span, dormancy, recruitment, etc.

Habitat monitoring should also be considered at selected sites. Perhaps the easiest and most effective way of monitoring habitat would be through permanent photo-points. Although photo-points may not provide the detailed information pertaining to species composition within a given site, rough changes in habitat should be observable. Photo-point analysis of canopy cover, and shrub and ground layer competition with respect to population trends would provide useful information for possible management procedures. Other more time-intensive procedures designed to statistically track changes in composition of the ground-layer associates at each site may be installed and monitored along with the methodology designed to track population trends, as discussed above.

> == 5400 MONITORING PROGRAMS

Due to the apparent periodicity and relative newness of this species, no active monitoring programs have been established.

> == 6010 RESEARCH NEEDS

Basic life history information (germination requirements, preferred growth conditions, life span, etc.) is sorely needed for this species. Due to the scarcity of individuals during long stretches of time, research may be difficult to initiate.

Habitat requirements need to be determined past the level of which they are currently known. In addition, appropriate management techniques also need to be developed for long term *B. rugulosum* population maintenance. Although much of this information cannot be specifically

formulated without prior knowledge of the numerous aspects of life history that are as-of-yet unknown, specific areas on which to concentrate research efforts are known. What is the optimal level of canopy cover for the species? Does grazing actively prevent spore germination and growth through trampling? Which forest management activity is more beneficial, selective forest logging or clear-cutting? How frequently can disturbance be tolerated for long-term population maintenance?

> == 6410 RESEARCH PROGRAMS

No research programs are underway for *Botrychium rugulosum*.

> == 7010 MANAGEMENT NEEDS

Management needs are largely unknown. The preference of *B. rugulosum* towards open areas within forests suggests that it may require periodic disturbance regimes that create forest openings. Currently, old pastures, second-growth forests, old orchards, brushy old fields and path edges appear to provide the most appropriate habitats. Basic management information such as percent canopy preference or level of competition tolerated are major needs in order to implement appropriate management programs.

> == 7400 MANAGEMENT PROCEDURES

Management procedures are dependent upon the assessment of management needs. At present, these have not been specifically formulated. Producing a mosaic of successional habitat patches within preferred habitat may provide long-term population maintenance capabilities in a given area. Mosaics of this sort might be created through grazing, logging or other mechanical methodologies. In any case, such a program should be considered experimental and should not be implemented on a large scale until evidence suggests that this is a viable management tool.

> == 7710 MANAGEMENT PROGRAMS

No management programs are in place for *Botrychium rugulosum*.

> == 8000 SUMMARY -- STEWARDSHIP NEEDS

Monitoring needs include an assessment of population stability and the tracking of habitat changes through time. Research should be centered around most every aspect of *B. rugulosum*. These areas include basic life history information (germination requirements, growth requirements, life span, etc.), habitat requirements, and management needs. Management needs are still largely unknown for the species, but there is some indication that the habitat in which *B. rugulosum* grows requires some levels of disturbance.

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> == 9900 UPDATE

90-06-30

ELEMENT STEWARDSHIP ABSTRACT
for
CYPRIPEDIUM ARIETINUM -- RAM'S-HEAD LADY'S-SLIPPER

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WAYNE OSTLIE (1990)

>= 0020 NAME

CYPRIPEDIUM ARIETINUM

>= 0050 COMMON NAME

RAM'S-HEAD LADY'S-SLIPPER

>= 0100 DESCRIPTION

Case (1964) described the ram's-head lady's-slipper as follows:

"Plant small, inconspicuously glandular-pubescent, 0.7-3 dm tall. Leaves 3-5; where many, lowermost and uppermost often reduced in size; elliptic-lanceolate, noticeably bluish-green, spiraled around stem, not 2-ranked as in our other *Cypripediums*. Floral bract ovate-lanceolate, acute, 3-5 cm long, 1-1.5 cm wide. Flower solitary or rarely 2; lateral sepals free entirely to base, madder-purple or brownish, green-streaked, 1-2 cm long, 2-5 mm wide, linear. Upper sepal lanceovate, subacuminate, concave. Petals much like sepals in all respects, undulate. Lip saccate, floor prolonged downward into a conical pouch. Mouth of sac rather densely long-pubescent. Base color of pouch white, netted and reticulated with madder-purple, crimson, or sometimes with some green. General aspect of lip color white above, madder below. Lip pouch about 1.5-2.5 cm long, 1-2 cm wide; but overall size of plant and all parts vary considerably with type of habitat; those of wet soils usually much larger. Staminode suborbicular and concave. Seed capsule linear-ellipsoid, distinctly less erect when ripe than that of most Lady's-slippers."

>=1000 HABITAT

Cypripedium arietinum is found from Quebec to Manitoba, south to New England, New York, Michigan, Wisconsin and Minnesota, and Saskatchewan (Cook 1982). According to Case (1964), *Cypripedium arietinum* occurs in two basically different habitats, (1) cool, dense, balsam-cedar-spruce swamps or (2) uplands of nearly pure sand, mulched with pine or cedar needles. Populations are known from both mineral-rich and mineral-poor sites, with soils of clay, loam (Smith 1981) or sand (Case 1964) in upland sites and nutrient-poor peat in lowland sites. *Cypripedium arietinum* is generally restricted to areas possessing cool sub-acid or neutral soils

(Brackley 1985, Case 1964). Although *C. arietinum* grows to its largest size in swamps or bogs, it is most commonly found in such habitats as a single stalk. The species is most abundant in the drier upland habitat, commonly growing in multi-stalk clumps (Case 1964).

The species occupies the southern portion of Quebec (Bouchard et al. 1983), reaching its northern limit in the Clay Belt of northern Quebec and Ontario (Baldwin 1953). Within the Clay Belt the species is rare, with a single record coming from a wet clay bank in pine woods near Lake Timiskaming. Within other portions of Quebec, the species inhabits rocky slopes, mixed and conifer woodlands (Rosseau 1974, Bouchard et al. 1983).

In Minnesota, the species occurs in forested sites of Sphagnum bogs and swamps or dry sand forests. Sphagnum swamps are typically dominated by *Thuja occidentalis*, *Larix laricina* and *Picea mariana*, with other associates including *Cornus canadensis*, *Ranunculus lapponicus*, *Rubus acaulis*, *Platanthera obtusata*, *Sarracenia purpurea*, *Orchis rotundifolia*, *Smilacina trifolia* and *Cypripedium acaule* (MN NHP 1990). In lowland habitats, plants typically occur on hummocks of Sphagnum moss (Smith 1988). Dry sand forests, dominated by *Pinus resinosa*, *Pinus banksiana* (Smith 1981) and *Pinus strobus* (Smith 1988), possess associates including *Lithospermum canescens*, *Gaultheria* sp., *Vaccinium angustifolium*, *Arctostaphylos uva-ursi*, *Cypripedium acaule* and lichens (MN NHP 1990).

In Michigan, *C. arietinum* occupies both of the habitats described by Case (1964). Associates in old dune habitats along the Great Lakes included *Thuja occidentalis*, *Abies balsamifera*, *Picea glauca*, *Pinus banksiana*, *Betula papyrifera*, *Arctostaphylos uva-ursi*, *Prunus virginiana*, *Iris lacustris*, *Polygala paucifolia*, *Aster* sp. and *Tsuga canadensis* (MI NFI 1990, Garlitz and Garlitz 1989). At dry inland sites, *Pinus strobus*, *Pinus resinosa*, *Pinus banksiana*, *Populus tremuloides*, *Pyrola* spp., *Cladonia* spp., *Pteridium* spp., *Cypripedium acaule*, *C. calceolus*, *Goodyera* spp., *Corallorhiza* spp., *Chamaephila umbellata*, *Epigaea repens*, *Fragaria* spp., *Maianthemum canadense*, *Rhus radicans*, *Vaccinium* spp., *Linnaea borealis* and *Calypso bulbosa*. Associates in bog habitats include *Habenaria dilatata*, *Platanthera flava* var. *herbiola*, *Arethusa bulbosa*, *Spiranthes romanzoffiana*, *Pyrola rotundifolia*, *Utricularia intermedia*, *Gentiana andrewsii*, *Polygonum amphibium*, *Polygala paucifolia* and *Potentilla palustris* (MI NFI 1990). Along Lake Huron, the plant is abundant, growing beneath the branches of juniper and cedar trees and under the last fringe of trees before the open Lake Huron beaches (Case 1964).

In Isle Royale National Park, Michigan, Slavick and Janke (1984) listed its habitat as boreal forest clearings. On South Manitou Island within the Sleeping Bear Dunes National Lakeshore in Michigan, *Cypripedium arietinum* occurs on the border between coastal forest and dune communities. The canopy in this transition zone is composed primarily of balsam fir, white cedar, red pine, white pine, and aspen (Hazlett and van de Koppel 1983). On the mainland, the species is found frequently in jack pine stands and, to a lesser extent, coastal forest. Common associates within the jack pine stands on drier sites include *Andropogon scoparius*, *Arctostaphylos uva-ursi*, *Lithospermum carolinense*, *Shepherdia canadensis* and *Zigadenus glaucus*. In moister, more dense stands of jack pine, *Carex eburnea*, *Chamaephila umbellata*, *Corallorhiza striata*, *Cypripedium acaule*, *Goodyera oblongifolia*, *Linnaea borealis* and *Pyrola secunda* are common associates (Hazlett 1986).

At Pictured Rocks National Lakeshore in Michigan, *C. arietinum* populations are fairly abundant (Loope pers. comm.). Plants typically occur in an understory of jack pine in "pocket forests" of the Grand Sable Dunes. At present, jack pine is becoming increasingly abundant in the dune area, as evidenced through aerial photos. *Cypripedium arietinum* will invade these newly-created jack pine forests within 20-30 years (Loope pers. comm.). At a successional-advanced site thought to represent the prime *C. arietinum* habitat at Pictured Rocks, associates included *Pinus banksiana*, *Betula alleghaniensis*, *Fagus grandifolia*, *Ostrya virginiana*, *Acer pensylvanicum*, *Acer saccharum* and *Abies balsamea* (Schultz 1988). For an in-depth list of associates, see Schultz (1988).

In Wisconsin, extant and historic populations were known from a variety of habitats. Habitats included: (1) moist sandy ridges with *Juniperus horizontalis*, *J. communis*, *Abies balsamea* and *Pinus strobus*, (2) a dry, upland, west-facing slope in an open understory beneath red and white pines and white birch, (3) an alkaline second-growth wooded swamp dominated by white cedar, (4) a tamarack swamp associated with numerous *Cypripedium acaule*, (5) a white cedar swamp with a pH of 4.5, growing with *Sphagnum* and *Thuja*, (6) a northern hardwood forest with a strong white cedar component, and (7) stabilized dunes/mounds in a dense *Thuja occidentalis* forest, associated with abundant *Aster macrophyllus* (WI NHP 1990). At the Ridges Sanctuary in Wisconsin, plants typically occur in partial to full shade with associates including *Thuja occidentalis*, *Picea glauca* and *Abies balsamifera*. Understory species include *Aster macrophyllus*, *Iris lacustris* and *Primula mistassinica* (Bender 1989). The largest concentrations of individuals occur in areas having moderately open canopies.

New Hampshire populations occur in cool, partially to fully shaded areas in acidic soils of mesic, wooded hillsides. It typically grows under pines and hemlocks or red oak, white pine, hemlock, moosewood and witch hazel (NHHP 1989). Brackley (1985) stated that the species is known principally from wet *Thuja occidentalis* woods and well-drained, ledgy slopes under deciduous trees.

Maine populations are known from mixed hardwood/conifer forests, sometimes under nearly pure stands of hemlock (Brower 1977). Associates include *Trientalis* sp., *Pyrola* sp., *Uvularia grandiflora*, *Linnaea borealis*, *Cornus* sp. and ferns. *Sarracenia* sp. and shrubby heaths are associates in well-drained *Larix* bog habitats (Brower 1977).

Numerous historical Vermont localities are known for this species, but extant populations number less than 15 (Thompson 1989). The species occurs in habitats of limy woods and swamps (Thompson 1989, VT NHP 1989). Associates in a west-facing woods of second-growth pine and hardwoods (formerly a pasture) include *Pinus strobus*, *Acer saccharum*, *Fraxinus americana*, *Fagus grandifolia*, *Ranunculus acris*, *Erigeron philadelphica* and *Oxalis europea* (VT NHP 1989). A second site is described as a second-growth mesic to xeric forest and includes associates of sugar maple, yellow birch, white birch, white ash, poplar, and scattered fir and hemlock (VT NHP 1989). Two other sites list *Thuja* sp., *Ceanothus americanum*, *Waldsteinia* sp., *Abies balsamea*, *Acer saccharum*, *Maianthemum canadense* and *Taraxacum officinale* as associates (VT NHP 1989).

A single extant site is known from Massachusetts, growing in a woods of red oak, white oak, hemlock, sugar maple, white ash and black birch (MA NHP 1989). The site is seasonally moist. Historic sites in Massachusetts are known from the west slope of Wilbraham Mountain (Clark 1929) and Mount Toby (Elwell 1902).

In New York, the species is most abundant, in terms of sheer numbers, growing on hummocks in calcareous swamp-forests. In such instances, however, colonies are very small. Colonies reach their greatest size in open coniferous or mixed forests and scrub over limestone, but such populations are less frequent than those in the swamps (Mitchell and Sheviak 1981).

Erskine (1954) located a population growing in the broken country of gypsum sinkholes and thin poplar scrub in Nova Scotia.

The species appears to be extirpated from Connecticut (Metzler pers. comm., Cook 1982). A single historic site existed for the species in the vicinity of North Haven, based on a literature report and voucher specimen (Metzler pers. comm, Bishop 1901).

>= 2000 BIOLOGY-ECOLOGY

Largely, the ram's-head lady's-slipper appears to reproduce asexually, via offshoots from parental plants (Brower 1977). The flowers appear in late May and early June and last only a short time. Within a given population, the percentage of flowering plants within a population may vary greatly. Bender (1989, 1988, 1987) found that, in Wisconsin, flowering occurred in 22% to 44% of the entire population.

As an attractant to potential pollinators, a light sweet odor is produced by the lateral petals and sepals and labellum (Stoutamire 1967). The labellum plays a greater role in odor production in *C. arietinum* than any other local species within the genera (Stoutamire 1967). Known pollinators of *C. arietinum* are small bees, including species in the *Dialictus* (Halictidae) (Stoutamire 1967) and *Megachile* (Megachilidae) genera (van der Pijl and Dodson 1966). Apparently mosquitoes are not attracted to the scent given off by the ram's-head and play no role in pollination (Stoutamire 1967). As soon as the flower is fertilized, the over-arching sepal lowers to close the orifice and exclude the entrance of additional insects. Minute seeds produced by the plants are probably not dispersed a great distance from the parental plants, as most populations occur in habitats dense with vegetation (Brower 1977). Stoutamire (1964) stated that seed capsules from this species are often observed on the plant well into the spring of the following year, which may be another agent in hindering the dispersal of seeds over large distances.

Plant size is not a reliable indicator of age or maturity within this species (Bender 1989). In a study of *C. arietinum* in Wisconsin, Bender tracked individual plants over three years. Results showed that plants do not reach a "mature size" and flower every year. Instead, plants frequently flower one year and remain vegetative the next. Bender (1989) has shown that individual plants will flower only upon reaching a minimum size of 11 cm in height. While plants smaller than 11 cm regardless of age, do not flower, all plants taller than that height were observed to flower. Plants that become damaged by herbivores (both insect and mammal) frequently do not appear above ground the following year (Bender 1989, 1988, 1987).

>= 2500 ELEMENT OCCURRENCE QUALITY DETERMINATIONS

This field is designed to help the field worker determine the quality (A=excellent, B=good, C=marginal, D=poor) of an occurrence of this element. These ranks are based on size and productivity of the population, vitality and vigor of the individuals within the population, and size and quality of the habitat in which the element occurs. Headings (habitat, and population size and vigor) should be considered separately in determining the quality of the element occurrence.

A-Ranked Occurrence

Habitat: Large jack pine forest habitats; OR, Sandy, forested old dune habitats of pine, and/or aspen/jack pine/oak forests; OR, Bogs/swamps with thin Sphagnum undercarpet. Old dune habitats within the Great Lakes region are typically somewhat open and possess ground cover of thick litter duff. Such habitats possess the largest populations known for the species. All habitats of this rank are not subject to logging, manipulations of water tables, or other unnatural destructive events, and are surrounded by sufficient buffer to adequately protect the site.

Population Size and Vigor: A population of more than 1000 plants with sufficient numbers of both juvenile and adult individuals to indicate population maintenance.

B-Ranked Occurrence

Habitat: Moderate-sized bogs, jack pine forest or old dune habitat (as described above). Such habitats may show low levels of unnatural disturbance, but are largely untouched.

Population Size and Vigor: A population of 100-999 plants with sufficient numbers of both juvenile and adult individuals to indicate population maintenance.

C-Ranked Occurrence

Habitat: Small-sized bogs, jack pine forest or old dune habitats. Shady, acidic, sandy habitats in oak woods are of this rank. Although such habitats once supported small populations of *C. arietinum*, this was marginal habitat. At present, few if any extant populations are known from such historical habitats in southern Michigan and the Lake Erie region of Ontario. Habitats that show signs of moderate levels of disturbance are of this rank. Although apparently not detrimental to populations, light and selective logging (except as a management procedure designed for the species), will cause a given habitat to fall to this rank. The increased threat brought on by this activity, particularly to smaller populations, necessitates this rank.

Population Size and Vigor: A population of 10-99 plants showing sufficient numbers of both juvenile and adult individuals to indicate population maintenance.

D-Ranked Occurrence

Habitat: Habitats that have been clear-cut but retain populations of *C. arietinum* are of this rank. It is unlikely that populations existing in such habitats will be able to withstand the effects of full sun and habitat destruction. Habitats that have become severely fragmented by development pressure, occur in indefensible areas (rights-of-way, etc.), or have been affected by water table manipulations (bog drainage, etc.) are also of this rank.

Population Size and Vigor: A population less than 10 plants. Populations of this size are not likely to withstand adverse conditions (successional change, etc.) and may likely become extirpated over time.

>= 3000 THREATS

Clear-cutting is a major threat to this species. In this practice, the ground is customarily disked after the removal of all vegetation. This practice would unquestionably destroy the populations of ram's-head lady's-slipper (Reznicek pers. comm., Smith 1981). In addition, *C. arietinum* plants are apparently unable to tolerate the increased sunlight that reaches the soil following clear-cut logging.

Removal of plants through illegal collection is a major threat to this species (Smith 1981). Mitchell and Sheviak (1981) stated that the rarity of the species coupled with its strange flowers make it a favorite plant among wildflower gardeners. Apparently, the species is commercially exploited within some New England states (Mitchell and Sheviak 1981). Because the species is often difficult to find and is easily overlooked, this threat is not believed to be a major threat in New York.

Development of forest lands is another serious problem in portions of the species' range (WI NHP 1990, NH NHP 1989). Mining operations pose a threat to some populations in Minnesota (Smith 1988, Smith 1981). Erskine (1954) stated that extension of the gypsum mines threatened and would probably destroy the only known population in Nova Scotia.

Encroaching residential development and grazing pose continual threats to populations in Minnesota (Smith 1988, Smith 1981). Within the Great Lakes regions of Michigan, trails are known to bisect extant populations of *C. arietinum*. These and other habitat disturbances by man pose the greatest threat to the species (Brower 1977).

Lack of appropriate management may be a serious threat to some populations. At the Ridges Sanctuary in Wisconsin, the *C. arietinum* population was once estimated at over 1000 plants. Current estimates place population numbers at roughly 150 individuals (WI NHP 1990). Management, including the partial opening of canopy, may be necessary to prevent further population declines.

Water level manipulations may have profound impacts on *C. arietinum* populations occurring in lowland situations. In Wisconsin, two known sites have been largely destroyed by drainage and/or construction of impoundments (WI NHP 1990).

>= 3500 LAND PROTECTION

Land protection for this species is dependant on the type of habitat that is occupied by the species. In all habitats, protection of the immediate population plus sufficient buffer is necessary. In bogs, land protection must include the entire system in which the species occurs. Ditching and other destructive actions within any portion of the bog system can have major impacts on water tables and, consequently, *C. arietinum*. Jack pine forest habitats must be protected by clear-cut logging practices with sufficient buffer to guarantee protection of prime habitat conditions. Sandy, old dune habitats, similarly should provide protection from logging. Extensive habitats provide the best possibilities of long-term survival and such areas should be designated as of the highest priority for protection.

>= 4000 RECOVERY POTENTIAL

The recovery potential of this species is largely unknown at this time. The species has not been successfully propagated from seed, and transplantation is largely unsuccessful.

>= 5000 MONITORING NEEDS

Monitoring programs should be directed at assessing the population stability over time, determining the longevity of individual plants as well as determining the conditions favorable for seed germination and establishment (Ewert pers. comm.).

Pollinator availability should also be monitored at extant sites. Although populations may be able to expand at any given site through vegetative reproduction, long-term success of the species may depend partially on the abundance of potential pollinators. Without such pollinators, gene flow between populations and establishment of new populations through seed production may not occur.

Thompson (pers. comm.) suggested that monitoring of populations in successional habitats be conducted in order to determine whether succession is a threat and whether management would be helpful.

>= 5200 MONITORING PROCEDURES

See Bender (1987-1990) for specific methodologies that have been used for the species in Wisconsin. Populations and individual plants have been tracked over time through permanent plots in order to learn more about the life-history of the species. Canopy photos have also been taken in order to provide information on how *C. arietinum* responds to varying levels of light.

Observations of potential pollinators should be made at *C. arietinum* population over a set span of time, with a series of observations made during different portions of the day (morning, afternoon, evening). Meteorological notes should be made at each observation period to reflect conditions that may alter foraging behavior.

>= 5400 MONITORING PROGRAMS

The Massachusetts Natural Heritage Program is currently monitoring the state's sole extant population on an annual basis, noting the percent of the individuals flowering, fruiting or in a vegetative state (Sorrie pers. comm.). The general location of individuals and changes in habitat (if any) are also noted. Contact: Bruce Sorrie, Massachusetts Natural Heritage and Endangered

Species Program, Division of Fisheries and Wildlife, 100 Cambridge St., Boston, MA 02202. Telephone No. (617) 727-9194.

The Michigan Chapter of The Nature Conservancy conducts casual counts of this species at its Grass Bay Preserve (Ewert pers. comm.). Outside of that, no monitoring is done. Contact: Dave Ewert, Michigan Land Steward, Michigan Field Office, The Nature Conservancy, 2840 E. Grand River, Suite 5, East Lansing, MI 44823. Telephone No. (517) 332-1741. The species is apparently locally common in Michigan, so not much emphasis has been placed on monitoring in that state (Penskar pers. comm.).

Joyce Bender of the Kentucky Natural Heritage Program is in the midst of an annual monitoring project at The Ridges Sanctuary in Bailey's Harbor, Wisconsin. Begun in the summer of 1986, four years of data have been obtained relative to the life history of the species at this site. Permanent plots have been established at 4 sites, with canopy cover photographed as part of a canopy thinning study. In addition, populations were assessed throughout The Ridges Sanctuary. Contact: Joyce Bender, Kentucky Natural Heritage Program, Kentucky Nature Preserves commission, 407 Broadway, Frankfort, KY 40601. Telephone No. (502) 564-2886.

Welby Smith of the Minnesota Natural Heritage Program is currently conducting a monitoring program on a population in Minnesota. He has been able to acquire information pertinent to the life history of the species since 1983, when the annual monitoring program began. Contact: Welby Smith, Minnesota Natural Heritage Program, Department of Natural Resources, 500 Lafayette Rd., St. Paul, MN 55155. Telephone No. (612) 297-3733.

Susan Hayward has been conducting an annual monitoring program for *C. arietinum* at two sites in Maine, one owned by The Nature Conservancy and the other by the New England Wildflower Society. The New England Wildflower Society population occurs in a bog, while The Nature Conservancy population occurs in dry, deciduous woodlands. Monitoring began in 1988, with methodologies very similar to that of Bender (1989, 1988, 1987). Individual plants are followed through time in some subplots, while the number of stems, number of leaves per stem, height, presence of flowers and fall fruit are also noted. Contact: Susan Hayward, 107 Nichols St., Lewiston, ME 04240. Telephone No. (207) 782-5238.

The Pictured Rocks National Lakeshore in Michigan is currently monitoring populations of *C. arietinum* within the Grand Sable Dunes unit. A number of permanent plots were installed in 1988 by Janet Schultz to monitor population changes over time. Populations are expected to be monitored again this coming year (1990). Contact: Walter Loope, National Park Service, Pictured Rocks National Lakeshore, P.O. Box 40, Munising, MI 49862-0040. Telephone No. (906) 387-2607.

>= 6010 RESEARCH NEEDS

Alverson (1981) stated that there is a great need for research on germination and mycorrhizal involvement within this species, as well as the life-history of *C. arietinum*. Such information is essential in order to determine the appropriate management practices for the species.

Hayward (pers. comm.) noted that research needs to determine what, in terms of vegetative reproduction in *C. arietinum*, is going on beneath the ground. Plants appear to move around within particular subplots, often appearing in unexpected areas. It is not currently known how frequently vegetative reproduction occurs. In addition, plants frequently remain dormant for periods of several years before appearing again. In such situations, it is sometimes impossible to determine if recruitment has occurred or if the newly appearing plants are those that have been dormant (Bender, 1989).

Hayward (pers. comm.) also stated that there exists a need to determine whether fruit set can occur without pollination. Apparently, many seed capsules are found not to contain seeds. Estimates of seed set within a population may be too high if fruit set does occur without pollination and consequent seed production.

>= 6410 RESEARCH PROGRAMS

Welby Smith of the Minnesota Natural Heritage Program is currently monitoring populations in Minnesota in order to learn more about the species' life history and habitat needs. Contact: Welby Smith, Minnesota Natural Heritage Program, DNR, 500 Lafayette Road, St. Paul, MN 55155. Telephone No. (612) 297-3733.

Pictured Rocks National Lakeshore is currently investigating the dynamic dune processes of the Lake Michigan shoreline. Information obtained from this study will have direct management implications for *C. arietinum* populations. Contact: Walter Loope, Pictured Rocks National Lakeshore, P.O. Box 40, Munising, MI 49862-0040. Telephone No. (906) 387-2607.

>= 7010 MANAGEMENT NEEDS

Brackley (pers. comm.) stated that one population in New Hampshire needs to have the habitat manipulated so that more sunlight reaches the forest floor. Thompson (pers. comm.) stated that although it appears that the species prefers successional habitats, it is not known how to manage for the species, or whether active management would actually benefit the species. It is known that clear-cutting of forests is deadly to the species. Bender (pers. comm.) has been experimenting with partial canopy removal at a site in Wisconsin.

Ewert (pers. comm.) suggested that foot traffic should be eliminated from the vicinity of known colonies and that no development should take place.

>= 7400 MANAGEMENT PROCEDURES

Thinning of tree canopies might be considered at sites that are, through natural succession, becoming too closed. Excessive thinning or logging can have detrimental effects on *C. arietinum* populations by overexposing and drying out habitats and individual plants. It is too early to know how on-going artificial thinning programs are working at The Ridges Sanctuary in Wisconsin. If research suggests that artificial thinning of canopies is having a beneficial impact on populations of this species, such procedures should be implemented in shaded habitats. Clear-cut logging practices should be replaced by selective logging in areas containing populations of *C. arietinum*.

>= 7710 MANAGEMENT PROGRAMS

The Pictured Rocks National Lakeshore is working to control visitor access to *C. arietinum* populations. Largely, current management is to let natural events run their course. Contact: Walter Loope, Pictured Rocks National Lakeshore. Telephone No. (906) 387-2607.

>= 8000 SUMMARY -- STEWARDSHIP NEEDS

Monitoring needs include the assessment of *C. arietinum* and pollinator population stability over time, as well as the determination of whether succession is a significant threat to the species. Research needs include studies on the germination of the species and its mycorrhizal relationships. Additional research needs include information pertaining to the general life history of the species and vegetative reproduction. Habitat maintenance through partial canopy thinning and rerouting of trails appear to be the primary management needs.

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>= 9900 UPDATE

90-05-01

ELEMENT STEWARDSHIP ABSTRACT
for
VIOLA NOVAE-ANGLIAE -- NEW ENGLAND VIOLET

To the User:

Element Stewardship Abstracts (ESAs) are prepared to provide The Nature Conservancy's Stewardship staff and other land managers with current management related information on those species and communities that are most important to protect, or most important to control. The abstracts organize and summarize data from numerous sources including literature and researchers and managers actively working with the species or community.

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The sources from which the information in the abstract comes are dependant upon the research and observations of many scientists and individuals. In most cases, this information is not the result of comprehensive site-specific field surveys, and may not be confirmed by Nature Conservancy staff. Many areas of the United States have never been thoroughly surveyed, and new plants and animals are still being discovered. Information in this abstract should never be regarded as a final statement or substituted for on-site surveys required for environmental assessments. Views expressed in the abstract are those of the author and not of The Nature Conservancy. They represent the best assessment of the author in light of the information available.

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>= 0016 PREPARER

WAYNE OSTLIE (1990)

>= 0020 NAME

VIOLA NOVAE-ANGLIAE

>= 0050 COMMON NAME

NEW ENGLAND VIOLET

>= 0100 DESCRIPTION

Ballard (1988) described the New England violet as follows:

"The midwestern representative, at least in flower, typically has one crown from which 2 or 3 leaves and 1 flower arise. At flowering time most fertile and many sterile plants have begun producing young cleistogamous (closed, self-fertilizing) capsules on short (8-20 mm long), villous peduncles which are erect at the very base but arch horizontally near the middle. The earliest, smallest leaves are ovate, cordate or subcordate at the base, and obtuse or broadly rounded at the apex. Upon flowering, plants produce 1 or 2 long-triangular leaves that are truncate to unlobed and dentate-serrate (shallowly so near the apex, more conspicuously at the base). Petioles are densely clothed with long (1-2 mm long) whitish hairs at least at the base and often along the entire length. The underside of the leaves are similarly typically pubescent, with slightly shorter, dense hairs; whereas the upper surface is less pubescent with even shorter hairs, varying from nearly glabrous to uniformly but sparsely pubescent above; leaves are usually ciliate along their margins.

Peduncles of chasmogamous (open, outcrossing) flowers surpass the tips of the erect leaves early on but later are equalled or surpassed by the leaf tips. Chasmogamous peduncles are commonly sparsely to densely villous at base (like the petioles) but vary from nearly glabrous to sparsely villous above the middle. The flower has lance-ovate sepals which are rounded at the apex and vary from glabrous and eciliate to heavily ciliate and hirsutulous on the lamina. Sepal auricles are short (<1 mm) and vary in pubescence like the sepals themselves. The corolla has ovate upper and lateral petals, these light to medium blue-violet. The corolla is non-ocellate--it lacks a darker eyespot around its

throat. The lateral and spurred (=bottom) petals are densely clothed with fine parallel-sided hairs."

According to Ballard (1988), *V. novae-angliae* can be distinguished from other violets with which it shares its range, by its stemless, non-stoloniferous habit, blue flowers with bearded lateral and spurred petals, lance-ovate, rounded sepals, and villous, long-triangular, unlobed leaves.

>= 1000 HABITAT

There was a belief in the past that *V. novae-angliae* grew best in rock crevices along the shores of the lakes or beside cold, rapidly flowing streams (Smith 1988; McGuire 1985; Alverson and Iltis 1979; Russell 1965, 1957-1958), indicating a requirement of cool clear water (Cook, et al. 1987) or humid conditions for growth. It is probable that this conception was entirely based on Russell's (1957-1958) monograph on the violets of Minnesota.

Recent work by Ballard (1989a) in the Great Lakes region suggested a different scenario. Ballard (1989a) stated:

"The natural, undisturbed habitat for the taxon was clearly acidic, xeric or xeromesic rock or sand substrates, under partially or totally closed-canopy dry northern forest of mixed hardwoods and conifers. Soil moisture varied slightly in natural situations but was virtually always low over most of the growing season. Plant density was low in natural settings, with plants scattered singly throughout an area of uniform habitat. Plant density and frequency was found to be high only in sites where extensive natural or artificial disturbance opened the canopy, and more so where lichens and other native ground-layer species were largely scraped away or mowed. The taxon reached its greatest abundance in such sites as fallow meadows and roadside clearings adjacent to granitic outcrops. Interestingly, the taxon was always found to be virtually absent (or not vigorous or in high frequency where found) in otherwise similar situations where timber management had favored high percentages of acidic, long-leaved pines (*Pinus resinosa* in particular). The taxon's presence in a number of unmanaged areas adjacent to such managed areas, where it was conspicuously absent, suggests that *V. novae-angliae* does not grow well either in strongly acidic soils or soils heavily covered with pine needle duff.

Published accounts of its habitat notwithstanding, the taxon was found near bodies of water **not** due to strong moisture preference, but evidently due to greater exposure of xeric rock and sand substrates, less shading, and less competition from native ground-layer species. The apparently acidic nature of the substrate occupied by the taxon is dramatically different in pH than the strongly calcareous rock substrates it has been found on in Maine. Presumably, pH is not the limiting factor; but shade levels, substrate moisture, and competition from native ground-layer species are."

Ballard (1988) stated that the species is only found where forest openings have been maintained, either naturally or artificially. Areas with seemingly appropriate habitat, but managed for pine regeneration, were found to never possess the plant. Apparently, *V. novae-angliae* is not able to

withstand the pine needle duff accumulation brought on by the forestry practice favoring monocultural pine regeneration (Ballard 1988).

In conditions where the optimal natural conditions are exaggerated (as in a road cut enlarging a natural clearing), the New England violet is able to invade the areas at densities, numbers of individuals and fecundity rates far exceeding those found in all natural conditions (Ballard 1989a, 1988). Apparently, this is a rather common phenomenon throughout the genus *Viola*. Ballard (1988) additionally stated that the largest populations were located within a shrub-free, upland, power-line clearing across the top of large bedrock domes, and in gravelly, grassy ditches adjacent to bedrock knobs cleaved by county roads or campground entrance trails.

V. novae-angliae is a dry-land plant which apparently prefers dry to mesic-dry, circumneutral or slightly acidic substrates, being partial to very thin soil over bedrock (Ballard 1988), particularly on top of or around the bases of granite knobs (Ballard 1989a). Such habitats are typical of Upper Midwestern sites. In Wisconsin, the species is found occurring along rivers, in cold, boggy soils, dry sandy soils in upland woods and on gravelly or sandy stream banks (WI DNR 1981). For a detailed list of historical and new sites found by Ballard (which includes most of the sites outside of Maine), see Ballard (1989a).

In New York State (Mitchell and Sheviak 1981) and other New England states (Cook 1982), the plant is apparently restricted to sandy and gravelly pockets among cobbles along water courses. Since the species is apparently restricted to open areas, which are rare along water courses, available habitat is scarce.

Maine populations are restricted to calcareous slate ledges of the lower Penobscot, St. John and Allagash Rivers. At one site, the plants occur well-below the spring high-water mark, although they are above water during the entire growing season (Gawler 1982). Seasonal flooding via intense summer rains may periodically immerse plants, however.

>= 2000 BIOLOGY-ECOLOGY

Very little is known with respect to the biology or ecology of *V. novae-angliae*. This taxon has never been studied to any large extent and even its distribution and habitat preferences were largely unknown prior to 1988.

Ballard (pers. comm., 1989a) stated that he has reduced the status of *V. novae-angliae* to a subspecific rank under *Viola sororia* Willd. The taxon should be listed as *V. sororia* ssp. *novae-angliae* (House) H. E. Ballard, Jr. (Ballard pers. comm.).

>= 2500 ELEMENT OCCURRENCE QUALITY DETERMINATIONS

This field is designed to help the field worker determine the overall quality (A=excellent, B=good, C=marginal, D=poor) of an occurrence of this element. These ranks (A-D) are based on size and productivity of the population, vitality and vigor of individuals within the population, and size and quality of habitat in which the element occurs. Headings (Habitat, Population Size and Vigor) should be considered separately in determining the overall quality of the element occurrence.

A-Ranked Occurrence

Habitat: Natural openings in dry, mixed hardwood/conifer forests, xeric sand and lakeshore/stream/river margins. Natural openings in boreal forests are typically small (<2 acres) and usually associated with granite outcrops. Linear lakeshore/stream margin habitats also tend to have little canopy. Competition from plant species in habitats of this rank is low. Accumulations of needle duff have not occurred.

Population Size and Vigor: A population exceeding 1000 individuals in which adequate numbers are represented in all cohorts, indicating successful population maintenance.

B-Ranked Occurrence

Habitat: Artificial habitats maintained by simple, infrequent clearing of forests along the periphery of natural *Viola* habitat (granite knobs, stream margins, etc.). Such habitats often yield the largest populations and are frequently associated with roadside ditches, trails, tracks and other unnatural clearings. These habitats are maintained by activities that eliminate shrub and tree growth and reduce competition from exotic weeds. Ground layers are sparsely populated by native species including *Danthonia spicata*, *Fragaria*, *Potentilla* and other xeric herbs.

Population Size and Vigor: A population of 100-1000 individuals in which adequate numbers are represented in all cohorts, indicating successful population maintenance.

C-Ranked Occurrence

Habitat: Artificial habitats in which excessive disturbance has occurred through frequent and intense forest clearing, scraping and ditching. Alien plant species such as spotted knapweed and Kentucky bluegrass provide stiff competition for available resources.

Population Size and Vigor: A population of 10-100 individuals in which adequate numbers are represented in all cohorts, indicating successful population maintenance.

D-Ranked Occurrence

Habitat: Monocultures of conifers that yield thick layers of needle duff and excessively shaded forests are of this rank. Other plant species tend to out-compete *V. novae-angliae* in mesic to moist areas and such areas are also of this rank. Rights-of-way habitats (roadside ditches and power-line) that are indefensible from herbicide application and other maintenance activities are of this rank. Although populations of *V. novae-angliae* may reseed disturbed area vigorously, long-term maintenance of such populations may be impossible.

Population Size and Vigor: A population of less than 10 individuals; OR, populations larger than 10 individuals which show problems in maintenance as indicated by anomalies in age structure.

>= 3000 THREATS

Viola novae-angliae is a species of open, xeric-mesic sites, yet there appear to be few threats to its occurrence at a site containing suitable habitat. In fact, destructive activities that would tend to eliminate other rare plant species (disturbed fields, road building, etc.) tend to enhance the species survival. The natural habitat of *V. novae-angliae*, as explained above, is mimicked by such disturbance regimes (opening of the canopy and reduction of soil thickness and fertility). Such action reduces competition by other plant species.

Quarry activities within the granite outcrops could ultimately lead to the extirpation of extant occurrences. This activity should be monitored over the long run in order to properly assess its significance with respect to the New England violet.

In New England, the species appears to be largely restricted to open sandy areas along rivers (Mitchell and Sheviak 1981). These areas tend to overgrow quickly with shrubs and other vegetation and may require renewal by frequent flooding or ice scouring. It is interesting to point out that Mitchell and Sheviak list ice rafting as a threat to the species in the state. In fact, this type of action may very well sustain the open habitat that is required of the species. Alterations of stream flow by damming may prove harmful to sites containing this species through the elimination of flooding and ice rafting.

>= 3500 LAND PROTECTION

At river/stream corridor sites, protection efforts must take into account the entire watershed within which the element occurs. Excessive flooding may be detrimental to the stability of habitat and element occurrences. On the other hand, manipulation of natural flooding regimes by dam construction or water diversion may cause excessive habitation of sites by other competing plant species. Such competition is detrimental to *V. novae-angliae*. In shallow soil sites associated with uplands, land protection must ensure survivability of the immediate site as well as sufficient buffer to allow for adequate management and to reduce the risk of pesticide drift.

>= 4000 RECOVERY⁹POTENTIAL

Apparently, *V. novae-angliae* is more common than previously believed. Ballard (1989a) in his status survey and taxonomic study of the species, stated that the species was:

"widespread and locally common--not in any way endangered for reasons of rarity or dysfunctional population biology--throughout much of its northwestern Great Lakes range in suitable habitat, and is hardly less frequent in occurrence than the other two common stemless blue violets of the region, *V. cucullata* and *V. septentrionalis*. Field observations suggested strongly that the taxon was overlooked and therefore very much uncollected over its Great Lakes distribution; this concept was supported by active field workers searching for the violet in Maine, where it is under consideration for delisting."

Ballard (pers. comm.) has stated that he will recommend that *V. novae-angliae* be delisted within the United States, as well as in Minnesota.

It is also widely known that the species is able to invade disturbed situations that exhibit its requirements of shallow soils and open canopies. Ballard (1989a) stated that the species is able to invade such areas at numbers significantly higher than found in natural settings. Such evidence suggests that the habitat is highly recoverable with respect to this species, and that *V. novae-angliae* is a species that may be dependant on moderate levels of disturbance.

>= 5000 MONITORING NEEDS

Cook (1982) suggested that New England populations should be periodically monitored as an indicator of how each is thriving. Recent work in the Midwest has vastly increased the known occurrences of the species, indicating that the plant is fairly common. Although individual states may see a need in monitoring the species within their state, there is not an apparent need for a range-wide monitoring program.

>= 5200 MONITORING PROCEDURES

If monitoring is to be done, complete individual counts should be made of small populations. In the case of large populations, randomized transects designed to sample a portion of the population should suffice. Flower production, seed production and habitat conditions should also be monitored in order to provide information pertaining to the life-history of the species.

>= 5400 MONITORING PROGRAMS

There are no monitoring programs in place for this species.

>= 6010 RESEARCH NEEDS

Ballard (pers. comm.) suggested that a more-detailed survey of the Upper Peninsula in Michigan needs to be undertaken in order to identify additional *V. novae-angliae* populations in that state. Similar surveys may need to be conducted in portions of the Northeast and adjacent Canada.

Research centered around the long-term management of the species with regard to current forest management practices is also needed. How does *V. novae-angliae* respond to fire? Is selective cutting of forests more beneficial to the species than clear-cut tracts? Under what management regimes does *V. novae-angliae* respond most vigorously?

>= 6410 RESEARCH PROGRAMS

Harvey Ballard, Preserve Design Ecologist for the Michigan Chapter of The Nature Conservancy, is currently finishing up taxonomic work on the species. He has also done extensive field-work on the species throughout the Upper Midwest and New England. Ballard (pers. comm.) also stated that he is finishing up a treatment on Michigan violets which will feature taxonomic keys coupled with detailed information on the identification, taxonomy and ecology of violets in that state. Contact: Harvey Ballard, Jr., Preserve Design Ecologist, Michigan Field Office, The Nature Conservancy, 2840 E. Grand River, Suite 5, East Lansing, MI 48823. Telephone No. (517) 332-1741.

>= 7010 MANAGEMENT NEEDS

Protection and enhancement of habitats may lead to an abundance of *V. novae-angliae* in appropriate areas. Proper methodologies for the management of this habitat should be honed in order to determine the effects each imposes on the species.

>= 7400 MANAGEMENT PROCEDURES

Maintenance of moderately open woodlands via selective logging is probably the most beneficial method for long-term survival of the species at a given site (Ballard pers. comm.). Ballard (1988) suggested that certain human disturbances, if they do not disturb the soil chemistry of the substrate or strongly shade sites, may enhance the vigor and viability of a given violet population. The largest populations that have been found have been associated with areas of past, low-level disturbance: old meadows, disturbed roadsides and power-line rights-of-way. Methodologies that do not form dense monocultures of conifers should be implemented following logging, particularly if clear-cut tracts are being reforested. Build-up of needle duff is apparently detrimental to *V. novae-angliae*.

>= 7710 MANAGEMENT PROGRAMS

Apparently, there is no active management program in place for this species within its range.

>= 8000 SUMMARY -- STEWARDSHIP NEEDS

Monitoring should be conducted in portions of its range, particularly where the species is peripheral and presumed scarce. Detailed surveys within the Northeast U.S. and adjacent Canada need to be implemented in order to determine the range-wide abundance and distribution of the species. Research centered on determining the optimal management regimes needs to be implemented. Protection and enhancement of *V. novae-angliae* habitat is the prime management need for the species.

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>= 9900 UPDATE

90-05-01

ELEMENT STEWARDSHIP ABSTRACT
for
Waldsteinia fragarioides
barren strawberry

draft

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«ELCODE»
PDROS1S010

«GNAME»
WALDSTEINIA FRAGARIOIDES

«GCOMNAME»
BARREN STRAWBERRY

«GRANK»
G5

«TECHDESC»

"Petioles elongate; leaflets broadly cuneate-obovate, serrate and usually shallowly lobed, the lateral ones asymmetrical; peduncles about equaling the leaves, with few to several flowers. The widespread var. *fragarioides*, with obovate to broadly elliptic petals, tends to give way in the southern Appalachian mountains (at least southward) to var. *parviflora* (Small) Fern., with lance-elliptic or narrowly elliptic petals mostly 2.5-5 mm long, less than half as wide, often acute, and shorter than to barely exceeding the sepals" (Gleason and Cronquist 1991).

«EOSPECS»

The following rank specifications are designed to help the field worker determine the overall quality (A = excellent, B = good, C = marginal, D = poor) of an occurrence of this element. These ranks are based on size and productivity of the population, vitality and vigor of individuals within the population, and size and quality of the habitat in which the element occurs. Headings (Habitat, Population Size and Vigor) should be considered separately in determining the overall quality of the element occurrence.

Waldsteinia fragarioides often occurs in small clones, and each plant may consist of several shoots arising from a creeping underground stem. Element occurrences are presumably tracked as delimited colonies of plants, which may in effect constitute metapopulations or clusters of clones. Element rank specifications are primarily based on the extent of occurrences and estimated populations in the northern portion of the range.

«ARANKSPECS»

Population Size and Vigor: At least 10,000 plants or more, with abundant flowering occurring and production of seedlings evident.

Habitat: At least 100 acres or more of intact, at least moderately mature forest, or a similar extent of thicket, clearings, or outcrop and slope habitat. The habitat receives little visitation and is protected from identifiable threats.

«BRANKSPECS»

Population Size and Vigor: About 2,000-10,000 plants, actively flowering and reproducing.

draft

«GHABCOM»

Waldsteinia fragarioides occurs in a wide variety of habitats over its relatively large range, including coniferous, deciduous, and mixed forest types in both moist and dry sandy woods, barrens, thickets and clearings, steep mountain talus slopes, rocky bluffs, and in alluvial substrates along stream banks (Gleason and Cronquist 1991, Scoggan 1978, Fassett 1976, Steyermark 1963, Fernald 1950).

In Maine, *Waldsteinia fragarioides* occurs along a roadside in an unspecified habitat type, and within a mature roadside woods (recently cut) composed of red maple, beech, red oak, ash, tilia, and eastern hemlock. In the latter locality, plants were growing in drier areas in the woods and in the border between the woods and the road (Thomas 1993).

In New Hampshire, *Waldsteinia* occurs in mixed mesic forests with about 70 percent canopy; collection data also indicate such habitats as borders of woods, meadows, grassy places, and wet woods (Moore 1993).

In Minnesota, this species occurs in a variety of coniferous and deciduous forest types. Associates include such typical species as *Pinus banksiana* (Pack pine), *Betula papyrifera* (Paper birch), *Ostrya virginiana* (Hophornbeam), *Populus tremuloides* (Trembling aspen), *Clintonia borealis* (Bluebead lily), *Cornus canadensis* (Bunchberry), *Aster macrophyllus* (Bigleaf aster), *Aralia nudicaulis* (Sarsaparilla), *Mitella diphylla* (Bishop's cap), *Osmunda cinnamomea* (Cinnamon fern), and numerous other herbs (Smith 1993b, Coffin and Pfannmuller 1988).

Dry sandy woods and barrens are noted as the habitats in Wisconsin by Fassett (1976).

In Michigan, where *Waldsteinia* is not tracked, it occurs in a number of forest types, including open oak woods, coniferous forest, spruce-aspen woodland, hemlock-paper birch woods, and occasionally in tamarack swamp (Voss 1985; Penskar 1993, pers. obs).

Indiana populations occur on the ledges of limestone cliffs, in thin soil areas above limestone cliffs, and on the crests of narrow, rocky ("hogback") ridges; occasionally, plants have also been found growing in sandstone. Associated species include *Aesculus glabra* (Buckeye), *Acer saccharum* (Sugar maple), *Zanthoxylum americanum* (Prickly ash), *Crataegus* sp. (Hawthorne), *Vaccinium* spp. (Blueberry), *Geranium maculatum* (Cranes-bill), *Trillium sessile* (Toadshade), and *Thaspium trifoliatum* (Mustard) (Homoya 1993).

Plants in Missouri occur on moist, shaded humus of steep, forested, principally north-facing slopes and ledges, often near the base of or on the upper sections of bluffs of Roubidoux sandstone or cherty limestone exposures (Steyermark 1963). Typical associates include such species as *Vaccinium vacillans* (Low early blueberry), *Quercus alba* (White oak), *Pinus echinata* (Shortleaf pine), and various bryophytes (Smith 1993a).

In Great Smoky Mountains National Park, *Waldsteinia* is found at low elevations in moist woods and thickets (Finton and Rock 1993).

There are no threats at this time to populations in Great Smoky Mountains National Park, and no populations have sustained damage (Finton and Rock 1993).

In North Carolina, populations tend to be protected from threats due to their relative inaccessibility in steep areas; potential threats in some sites include residential development and clear cutting (Weakley 1993).

In Arkansas, both Logan (1993) and Hyatt (1993) cite the only threat as natural landslides.

«GSTATCOM»

Waldsteinia fragarioides is a wide ranging species of eastern North American and is demonstrably secure. In the northern portion of its distribution, it occurs as a common herb in a variety of forest types, thickets, and clearings, becoming rare and disjunct in the southern regions of its range.

Two occurrences are noted for Maine, where this species is ranked S1 (critically imperiled). One occurrence consists of a roadside woods that has been recently cut, where the colony extends across private land and a Department of Transportation right-of-way. The other occurrence, comprised of a large and thriving population, occurs along a road, with the ownership unspecified (Thomas 1993).

Eight occurrences are known for New Hampshire, where this species is ranked S1 (critically imperiled). The status of most records (derived from herbarium specimens) is unknown, although at least two populations have been observed since 1991 (Moore 1993).

Thirteen occurrences are currently being tracked for Minnesota, where *Waldsteinia* is ranked S3 (rare). Four populations, some of which are large, occur within a state park; one large population occurs on state forest land, and one large population occurs on private land. Although the range includes most of the northeastern region of the state, the species is considered rare.

In Michigan, where this common species is not tracked, *Waldsteinia* is a widespread herb, occurring throughout both peninsulas. Although often local, it is frequently abundant when encountered (Voss 1985), and becomes more common in the northern portion of the state.

Eighteen occurrences are tracked in Indiana, where this species is ranked S2 (imperiled). Of these populations, two occurrences are within Hoosier National Forest, three occurrences lie within state forest land, one occurrence is within a Nature Conservancy preserve, and one occurrence is within a DNR nature preserve (Homoya 1993).

In Missouri, where this species is ranked S2 (imperiled), 11 occurrences are currently known. Five occurrences are known within National Forest, and two occurrences are known within the Ozark National Scenic Riverways system (Smith 1993).

In Great Smoky Mountains National Park, where this species is ranked "P1" (a local rank for the park), three localities are known (Finton and Rock 1993).

Michigan, Indiana, Great Smoky Mountains National Park, North Carolina (Homoya 1993, Finton and Rock 1993, Weakley 1993; Penskar 1993 pers. obs.).

«MGMT.PROG»

There are no known management programs for this species.

«MONIT.REQS»

Long-term monitoring is desirable in portions of the range where this species occurs as a rare and isolated disjunct. Such monitoring should entail permanent plots or censuses of delineated areas to determine population trends, viability, and responses to disturbance and other abiotic conditions.

«MONIT.PROG»

The only known monitoring program for this species is being conducted by the U.S. Forest Service in Arkansas.

«MGMT.RSRCH.PROG»

There are no known management research programs for this species.

«GRSRCHNEED»

There are relatively few research needs at the present for this species. In portions of the range where *Waldsteinia* is presumed to be rare, a fundamental research need is simply to conduct additional inventories to determine this species' specific range and status (Moore 1993, Smith 1993b). For isolated disjunct populations, research needs include understanding the breeding system (i.e., sexual versus asexual reproduction) and determining if these isolated populations are relatively low in diversity (genetically depauperate) and consist of clones or few individual plants (Hyatt 1993, Smith 1993a). Logan (1993) suggests that propagation research would be useful, with the aim of establishing more populations in suitable habitat.

«MGMT.RSRCH.NEED»

The principal management research need appears to be understanding the role of disturbance, particularly in portions of this species' range where it is rare.

«ADDTL.TOPICS»

Pharmacological research on *Waldsteinia fragarioides* has resulted in the isolation and characterization of a previously unknown antiviral flavonoid (Abou-Karam and Shier 1992).

«TOPIC.KEYWORDS»

Waldsteinia fragarioides, Barren strawberry.

«ACKNOWLEDGEMENTS»

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«EDITION»

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«UPDATE»

95-08-14 MICHAEL R. PENSKAR (MI NFI)

LIST OF AVAILABLE ELEMENT STEWARDSHIP ABSTRACTS		
SCIENTIFIC NAME	COMMON NAME	ELCODE
ANIMALS		
ACCIPITER COOPERII	COOPER'S HAWK	ABNKC12040
ACCIPITER STRIATUS	SHARP-SHINNED HAWK	ABNKC12020
ACIPENSER FULVESCENS	LAKE STURGEON	AFCAA01020
AEGOLIUS ACADICUS	NORTHERN SAW-WHET OWL	ABNSB15020
AGOSIA CHRYSOGASTER	LONGFIN DACE	AFCJB02010
AIMOPHILA AESTIVALIS	BACHMAN'S SPARROW	ABPBX91050
ALASMIDONTA MARGINATA	ELKTOE	IMBIV02040
ALASMIDONTA VARICOSA	BROOK FLOATER	IMBIV02100
ALLIGATOR MISSISSIPPIENSIS	AMERICAN ALLIGATOR	ARABA01010
AMMODRAMUS BAIRDII	BAIRD'S SPARROW	ABPBXA0010
AMMODRAMUS HENSLOWII	HENSLOW'S SPARROW	ABPBXA0030
ANHINGA ANHINGA	ANHINGA	ABNFE01010
ANTHUS SPRAGUEII	SPRAGUE'S PIPIT	ABPBM02060
APPALACHIA ARCANA	MICHIGAN BOG GRASSHOPPER	IIORT11010
AQUILA CHRYSAETOS	GOLDEN EAGLE	ABNKC22010
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER	ABNNF06010
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN	ABNGA01020
BUTEO LINEATUS	RED-SHOULDERED HAWK	ABNKC19030
CAECIDOTEA CANNULUS	AN ISOPOD	ICMAL01250
CAECIDOTEA HOLSINGERI	HOLSINGER'S CAVE ISOPOD	ICMAL01030
CAMBARUS CHASMODACTYLUS	NEW RIVER CRAYFISH	ICMAL07130
CARETTA CARETTA	LOGGERHEAD TURTLE	ARAAA01010
CASTOR CANADENSIS	AMERICAN BEAVER	AMAFE01010
CATOSTOMUS CLARKI	DESERT SUCKER	AFCJC02040
CATOSTOMUS INSIGNIS	SONORA SUCKER	AFCJC02100
CHARADRIUS ALEXANDRINUS	SNOWY PLOVER	ABNNB03030
CHARADRIUS MELODUS	PIPING PLOVER	ABNNB03070
CHLIDONIAS NIGER	BLACK TERN	ABNNM10020
CICINDELA MARGINIPENNIS	COBBLESTONE TIGER BEETLE	IICOL02060
CIRCUS CYANEUS	NORTHERN HARRIER	ABNKC11010
CONTROPUS BOREALIS	OLIVE-SIDED FLYCATCHER	ABPAE32010
CORAGYPS ATRATUS	BLACK VULTURE	ABNKA01010
CULICIDAE	MOSQUITO FAMILY	IIDIP00000
CUMBERLANDIA MONODONTA	SPECTACLECASE	IMBIV08010
CYNOMYS LUDOVICIANUS	BLACK-TAILED PRAIRIE DOG	AMAFB06010
CYPRINUS CARPIO	COMMON CARP	AFCJB08010
DENDRAGAPUS CANDENSIS	SPRUCE GROUSE	ABNLC09010
DRYOCOPUS PILEATUS	PILEATED WOODPECKER	ABNYF12020
ELAPHRUS VIRIDIS	DELTA GREEN GROUND BEETLE	IICOL36010
ELLIPTIO FOLLICULATA	POD LANCE	IMBIV14130
ELLIPTIO SPINOSA	ALTAMAHA SPINYMUSSEL	IMBIV14260
ELLIPTIO STEINSTANSANA	TAR RIVER SPINYMUSSEL	IMBIV14270
EPIOBLASMA FLORENTINA CURTISI	CURTIS PEARLYMUSSEL	IMBIV16061
EPIOBLASMA OBLIQUATA	CATSPAW	IMBIV16110
EPIOBLASMA TORULOSA	TUBERCLED BLOSSOM	IMBIV16180
EPIOBLASMA TORULOSA GUBERNACULUM	GREEN BLOSSOM	IMBIV16181
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	IMBIV16184

LIST OF AVAILABLE ELEMENT STEWARDSHIP ABSTRACTS		
SCIENTIFIC NAME	COMMON NAME	ELCODE
EUCHLAENA MILNEI	A GEOMETRID MOTH	IILEU2F150
EUDERMA MACULATUM	SPOTTED BAT	AMACC07010
FONTIGENS TARTAREA	ORGAN CAVESNAIL	IMGASG5060
FUSCONAIA MASONI	ATLANTIC PIGTOE	IMBIV17090
GENERAL UNIONID MUSSELL		IMBIV00000
GILA INTERMEDIA	GILA CHUB	AFCJB13160
GILA ROBUSTA	ROUNDTAIL CHUB	AFCJB13150
GRUS CANADENSIS PRATENSIS	FLORIDA SANDHILL CRANE	ABNMK01012
HALIAEETUS LEUCOCEPHALUS LEUCOCEPHALUS	SOUTHERN BALD EAGLE	ABNKC10010
HELMITHEROS VERMIVORUS	WORM-EATING WARBLER	ABPBX08010
HYLOCICHLA MUSTELINA	WOOD THRUSH	ABPBJ19010
KINOSTERNON FLAVESCENS	YELLOW MUD TURTLE	ARAAE01020
KINOSTERNON FLAVESCENS SPOONERI	ILLINOIS MUD TURTLE	ARAAE01022
LAMPSILIS ABRUPTA	PINK MUCKET PEARLY MUSSEL	IMBIV21110
LAMPSILIS CARIOSA	YELLOW LAMP MUSSEL	IMBIV21050
LAMPSILIS FULLERKATI	WACCAMAW FATMUCKET	IMBIV21080
LAMPSILIS HIGGINSII	HIGGINS EYE	IMBIV21100
LANIUS LUDOVICIANUS	LOGGERHEAD SHRIKE	ABPBR01030
LASMIGONA SUBVIRIDIS	GREEN FLOATER	IMBIV22060
LEPIDOMEDA MOLLISPINIS PRATENSIS	BIG SPRING SPINEDACE	AFCJB20032
LYMANTRIA DISPAR	GYPSY MOTH	IILEY3X010
MEDA FULGIDA	SPIKEDACE	AFCJB22010
MOLOTHRUS ATER	BROWN-HEADED COWBIRD	ABPBXB7030
MOXOSTOMA VALENCIENNESI	GREATER REDHORSE	AFCJC10170
MYCTERIA AMERICANA	WOOD STORK	ABNGF02010
MYIARCHUS CRINITUS	GREAT CRESTED FLYCATCHER	ABPAE43070
MYOTIS AUSTRORIPARIUS	SOUTHEASTERN MYOTIS	AMACC01030
MYOTIS GRISESCENS	GRAY MYOTIS	AMACC01040
MYOTIS SODALIS	INDIANA OR SOCIAL MYOTIS	AMACC01100
NEOFIBER ALLENI	ROUND-TAILED MUSKRAT	AMAFF14010
NEOTOMA FLORIDANA	EASTERN WOODRAT	AMAFF08010
NEOTOMA MAGISTER	ALLEGHENY WOODRAT	AMAFF08100
NERODIA ERYTHROGASTER NEGLECTA	COPPERBELLY WATER SNAKE	ARADB22023
NORTH AMERICAN SHOREBIRDS		
NOTROPIS TOPEKA	TOPEKA SHINER	AFCJB28960
OBOVARIA RETUSA	RING PINK	IMBIV31030
OPORORNIS FORMOSUS	KENTUCKY WARBLER	ABPBX11010
ORCONECTES KENTUCKIENSIS	A CRAYFISH	ICMAL11050
PELECANUS OCCIDENTALIS	BROWN PELICAN	ABNFC01020
PHALACROCORAX AURITUS FLORIDANUS	DOUBLE-CRESTED CORMORANT	ABNFD01024
PIRANGA OLIVACEA	SCARLET TANAGER	ABPBX45040
PLEGADIS FALCINELLUS	GLOSSY IBIS	ABNGE02010
PLEUROBEMA CLAVA	CLUBSHELL	IMBIV35060
PLEUROBEMA RUBRUM	PYRAMID PIGTOE	IMBIV35250
PORPHYRULA MARTINICA	PURPLE GALLINULE	ABNME12010
PROTONOTARIA CITREA	PROTHONOTARY WARBLER	ABPBX07010
PSEUDANOPHTHALMUS MONTANUS	DRY FORK VALLEY CAVE BEETLE	IICOL4E080
PYRGUS WYANDOT	SOUTHERN GRIZZLED SKIPPER	IILEP38090

LIST OF AVAILABLE ELEMENT STEWARDSHIP ABSTRACTS		
SCIENTIFIC NAME	COMMON NAME	ELCODE
REGULUS SATRAPA	GOLDEN-CROWNED KINGLET	ABPBJ05010
RHINICHTHYS CHRYSOGASTER	LONGFIN DACE	AFCJB37150
RHINICHTHYS OSCULUS	SPECKLED DACE	AFCJB37050
RYNCHOPS NIGER	BLACK SKIMMER	ABNNM14010
SCELOPORUS WOODI	FLORIDA SCRUB LIZARD	ARACF14160
SCIURUS NIGER SHERMANI	SHERMAN'S FOX SQUIRREL	AMAFB07043
SETOPHAGA RUTICILLA	AMERICAN REDSTART	ABPBX06010
SIMPSONAIAS AMBIGUA	SALAMANDER MUSSEL	IMBIV41010
SPEYERIA IDALIA	REGAL FRITILLARY	IILEPJ6040
STERNA ANTILLARUM	LEAST TERN	ABNNM08100
STERNA CASPIA	CASPIAN TERN	ABNNM08020
STERNA DOUGALLII	ROSEATE TERN	ABNNM08060
STERNA NILOTICA	GULL-BILLED TERN	ABNNM08010
STYGOBROMUS PIZZINII	PIZZINI'S CAVE AMPHIPOD	ICMAL05030
STYGOBROMUS SUBTILIS	SUBTLE CAVE AMPHIPOD	ICMAL05610
THRYOMANES BEWICKII	BEWICK'S WREN	ABPBG07010
TIAROGA COBITIS	LOACH MINNOW	AFCJB42010
TOXOLASMA LIVIDUS	PURPLE LILLIPUT	IMBIV43030
TRICHOPETALUM KREKELERI	WEST VIRGINIA BLIND CAVE MILLIPEDE	ITUNI05010
VENUSTACONCHA ELLIPSIFORMIS	ELLIPSE	IMBIVA4010
VILLOSA FABALIS	RAYED BEAN	IMBIV47050

LIST OF AVAILABLE ELEMENT STEWARDSHIP ABSTRACTS

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>ELCODE</u>
PLANTS		
ACACIA MELANOXYLON	BLACKWOOD ACACIA	PDFAB020M0
ACONITUM NOVEBORACENSE	NORTHERN WILD MONKSHOOD	PDRAN01070
AESCHYNOMENE VIRGINICA	SENSITIVE JOINT-VETCH	PDFAB04080
AGALINIS ACUTA	SANDPLAIN GERARDIA	PDSCR01010
AGALINIS AURICULATA	EARLEAF FOXGLOVE	PDSCR01130
AGALINIS GATTINGERI	ROUNDSTEM FOXGLOVE	PDSCR010B0
AGALINIS OBTUSIFOLIA	TEN-LOBE FALSE-FOXGLOVE	PDSCR010L0
AGALINIS SKINNERIANA	PALE FALSE FOXGLOVE	PDSCR010T0
AGRIMONIA INCISA	INCISED GROOVEBUR	PDROS03040
AILANTHUS ALTISSIMA	TREE-OF-HEAVEN	PDSIM01010
ALETES HUMILIS	LARIMER ALETES	PDAP103040
ALLIARIA PETIOLATA	GARLIC MUSTARD	PDBRA01010
ALLIUM OXYPHILUM	LILLYDALE ONION	PMLIL022N0
AMMOPHILA ARENARIA	EUROPEAN BEACHGRASS	PMPOA08010
AMORPHA NITENS	SHINING INDIGO-BUSH	PDFAB080A0
AMPHIANTHUS PUSILLUS	LITTLE AMPHIANTHUS	PDSCR02010
AMSONIA GRANDIFLORA	ARIZONA SLIMPOD	PDAP003060
ANTHOXANTHUM ODORATUM	SWEET VERNAL GRASS	PMPOA0F020
APIOS PRICEANA	PRICE'S POTATO-BEAN	PDFAB0D020
ARABIS MISSOURIENSIS VAR DEAMII	DEAM'S ROCKCRESS	PDBRA06171
ARABIS SEROTINA	SHALE-BARREN ROCKCRESS	PDBRA06320
ARETHUSA BULBOSA	SWAMP-PINK	PMORC04010
ARISTIDA STRICTA	PINELAND THREE-AWN GRASS	PMPOA0K130
ARMORACIA LACUSTRIS	LAKE CRESS	PDBRA0010
ARTEMISIA ABSINTHIUM	COMMON WORMWOOD	PDAST0S020
ARUNDO DONAX	GIANT REED	PMPOA0R010
ASCLEPIAS CURTISSII	CURTISS' MILKWEED	PDASC020E0
ASCLEPIAS MEADII	MEAD'S MILKWEED	PDASC02150
ASPLENIUM BRADLEYI	BRADLEY'S SPLEENWORT	PPASP02050
ASPLENIUM SCOLOPENDRIUM VAR AMERICANUM	HART'S-TONGUE FERN	PPASP021E1
ASTER FURCATUS	FORKED ASTER	PDAST0T170
ASTER LAEVIS VAR CONCINNUS	SMOOTH BLUE ASTER	PDAST0T1N1
ASTRAGALUS HYPOXYLUS	HUACHUCA MILK-VETCH	PDFAB0F470
ASTRAGALUS ROBBINSII VAR JESUPII	JESUP'S MILK-VETCH	PDFAB0F7P4
BASSIA HYSSOPIFOLIA	FIVE-HORN SMOTHER-WEED	PDCH06020
BESSEYA BULLII	KITTEN TAILS	PDSCR09030
BETULA PUMILA	SWAMP BIRCH	PDBET020H0
BIGELOWIA NUTTALLII	NUTTALL'S RAYLESS GOLDENROD	PDAST19020
BONAMIA GRANDIFLORA	LARGE-FLOWERED BONAMIA	PDCON03010
BOTRYCHIUM MORMO	GOBLIN FERN	PPOPH010N0
BOTRYCHIUM RUGULOSUM	RUGULOSE GRAPE-FERN	PPOPH010P0
BROMUS INERMIS	AWNLESS BROME	PMPOA150L0
BROMUS RUBENS	FOXTAIL BROME	PMPOA15190
BUCHNERA AMERICANA	BLUEHEARTS	PDSCR0B010
CALAMINTHA DENTATA	TOOTHED SAVORY	PDLAM08050
CALYPSO BULBOSA	FAIRY SLIPPER	PMORC0D010

LIST OF AVAILABLE ELEMENT STEWARDSHIP ABSTRACTS		
SCIENTIFIC NAME	COMMON NAME	ELCODE
CARDUUS NUTANS	MUSK THISTLE	PDAST1S040
CARDUUS PYNOCOPHALUS	ITALIAN THISTLE	PDAST1S050
CAREX DECOMPOSITA	CYPRESS-KNEE SEDGE	PMCYP033K0
CAREX LUPULIFORMIS	FALSE HOP SEDGE	PMCYP037T0
CAREX POLYMORPHA	VARIABLE SEDGE	PMCYP03AW0
CAREX WIEGANDII	WIEGAND'S SEDGE	PMCYP03ES0
CASTANEA PUMILA VAR OZARKENSIS	OZARK CHINQUAPIN	PDFAG01042
CASUARINA EQUISETIFOLIA	HORSETAIL CASUARINA	PDCAS01030
CENTAUREA BIEBERSTEINII	SPOTTED STARCHISTLE	PDAST1Y0W0
CHIONANTHUS PYGMAEUS	PYGMY FRINGE-TREE	PDOL01010
CHRYSOSPLENIUM IOWENSE	GOLDEN SAXIFRAGE	PDSAX07030
CIRSIUM ARVENSE	CREeping THISTLE	PDAST2E090
CIRSIUM HILLII	HILL'S THISTLE	PDAST2E1C0
CIRSIUM PITCHERI	DUNE THISTLE	PDAST2E2A0
CLEMATIS SOCIALIS	ALABAMA LEATHER FLOWER	PDRAN08130
CLIDEMIA HIRTA	KOSTER'S CURSE	PDMLS04020
CLINTONIA ALLEGHANIENSIS	HARNED'S CLINTONIA	PMLILOH050
CLITORIA FRAGRANS	PIGEON WINGS	PDFAB0Z010
COLUBRINA ASIATICA	ASIAN SNAKEWOOD	PDRHA05020
CONIUM MACULATUM	POISON-HEMLOCK	PDAP10Q010
CONRADINA GLABRA	APALACHICOLA ROSEMARY	PDLAM0D030
CONVOLVULUS ARVENSIS	FIELD BINDWEED	PDCON05020
CORNUS SPP.	NORTH AMERICAN INVASIVE DOGWOODS	
CORTADERIA JUBATA	PAMPAS GRASS	PMPOA1P040
CROOMIA PAUCIFLORA	CROOMIA	PMSTE01010
CROTALARIA AVONENSIS	AVON PARK RABBIT-BELLS	PDFAB160Q0
CYNODON DACTYLON	BERMUDA GRASS	PMPOA1W020
CYPERUS HOUGHTONII	HOUGHTON'S UMBRELLA-SEDE	PMCYP061L0
CYPRIPEDIUM ARIETINUM	RAM'S-HEAD LADY'S-SLIPPER	PMORC0Q020
CYPRIPEDIUM CANDIDUM	SMALL WHITE LADY'S-SLIPPER	PMORC0Q050
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	PMORC0Q0D0
CYTISUS SCOPARIUS	SCOTCH BROOM	PDFAB18060
DAUCUS CAROTA	WILD CARROT	PDAP10X010
DICERANDRA FRUTESCENS	SCRUB MINT	PDLAM0F020
DIOSCOREA BULBIFERA	AIR YAM	PMDIO01040
DODECATHEON FRENCHII	FRENCH'S SHOOTINGSTAR	PDPRI03060
DRABA APRICA	OPEN-GROUND WHITLOW-GRASS	PDBRA11060
ELAEAGNUS UMBELLATA	AUTUMN OLIVE	PDELG01060
ELLIOTTIA RACEMOSA	GEORGIA PLUME	PDERIO0C10
ERIOGONUM PELINOPHILUM	CLAY-LOVING WILD BUCKWHEAT	PDPFN084P0
ERYTHRONIUM PROPULLANS	MINNESOTA TROUT LILY	PMLILOU0D0
EUCALYPTUS GLOBULUS	TASMANIAN BLUE GUM	PDMRT02020
EUPHORBIA ESULA	LEAFY SPURGE	PDEUP0Q0L0
EUPHORBIA PURPUREA	GLADE SPURGE	PDEUP0Q1T0
FIMBRISTYLIS PERPUSILLA	DWARF FIMBRY	PMCYP0B0F0
FOENICULUM VULGARE	SWEET FENNEL	PDAP112010
FRANGULA ALNUS	GLOSSY BUCKTHORN	PDRHA0H010
FRAXINUS UHDEI	TROPICAL ASH	PDOL040J0

LIST OF AVAILABLE ELEMENT STEWARDSHIP ABSTRACTS		
SCIENTIFIC NAME	COMMON NAME	ELCODE
GENTIANA PENNELLIANA	WIREGRASS GENTIAN	PDGEN060K0
GEOCARPON MINIMUM	GEOCARPON	PDCAR15010
HEDYCHUM CORONARIUM	WHITE GINGER	PMZIN04010
HELIUM VIRGINICUM	VIRGINIA SNEEZEWEED	PDAST4L0K0
HELIANTHEMUM DUMOSUM	BUSHY ROCKROSE	PDCIS02060
HIERACIUM PILOSELLA	MOUSE-EAR HAWKWEED	PDAST4W130
HOLCUS LANATUS	COMMON VELVET GRASS	PMPOA37010
HORDEUM MURINUM SSP LEPORINUM	WILD BARLEY	PMPOA380A2
HOTTONIA INFLATA	FEATHERFOIL	PDPRI06010
ILIAMNA REMOTA	KANKAKEE MALLOW	PDMAL0K060
ILEX COLLINA	LONG-STALKED HOLLY	PDAQU01080
ILEX CUMULICOLA	SCRUB HOLLY	PDAQU01080
IRIS LACUSTRIS	DWARF LAKE IRIS	PMIRI090H0
ISOTRIA MEDEOLOIDES	SMALL WHORLED POGONIA	PMORC1F010
JUNIPERUS VIRGINIANA	EASTERN RED CEDAR	PGCUP050E0
LACHNOCAULON DIGYNUM	PINELAND BOGBUTTON	PMERI02030
LEGENERE LIMOSA	LEGENERE	PDCAM0C010
LESPEDeza LEPTOSTACHYA	PRAIRIE BUSH-CLOVER	PDFAB27090
LESQUERELLA PRUINOSA	FROSTY BLADDERPOD	PDBRA1N1D0
LIATRIS TURGIDA	TURGID GAY-FEATHER	PDAST5X0Y0
LILAEOPSIS SCHAFFNERIANA VAR RECURVA	CIENEGA FALSE-RUSH	PDAPI19051
LILIUM PARRYI	LEMON LILY	PMLIL1A0J0
LINUM ARENICOLA	SAND FLAX	PDLIN02020
LISTERA AURICULATA	AURICLED TWAYBLADE	PMORC1N010
LITHOSPERMUM LATIFOLIUM	AMERICAN GROMWELL	PDBOR0L080
LOMATOGONIUM ROTATUM	MARSH FELWORT	PDGEN0C010
LONICERA ELEMENT MANAGEMENT GROUP	SHRUBBY HONEYSUCKLES	
LONICERA JAPONICA	JAPANESE HONEYSUCKLE	PDCPR030G0
LYTHRUM SALICARIA	PURPLE LOOSESTRIPE	PDLYT090B0
MARSHALLIA RAMOSA	SOUTHERN MARSHALLIA	PDAST68060
MATELEA ALABAMENSIS	ALABAMA ANGLEPOD	PDASC0A010
MELILOTUS ALBUS	WHITE SWEET-CLOVER	PDFAB2H010
MIMULUS GLABRATUS VAR MICHIGANENSIS	MICHIGAN MONKEY-FLOWER	PDSCR1B1A3
NAPAEA DIOICA	GLADE MALLOW	PDMAL0X010
NEOPARRYA LITHOPHILA	ROCK-LOVING ALETES	PDAPI1E010
NEYRAUDIA REYNAUDIANA	SILK REED	PMPOA4D010
NOLINA BRITTONIANA	BRITTON'S BEAR-GRASS	PMAGA08040
OENOTHERA ARGILLICOLA	SHALE-BARREN EVENING-PRIMROSE	PDONA0C020
OENOTHERA PILOSELLA SSP SESSILIS	PRAIRIE EVENING PRIMROSE	PDONA0C112
OPUNTIA SPINOSISSIMA	SEMAPHORE CACTUS	PDCAC0D1A0
OXYPOLIS CANBYI	CANBY'S DROPWORT	PDAPI1L010
OXYTROPIS CAMPESTRIS VAR CHARTACEA	FASSETT'S LOCOWEED	PDFAB2X041
PANICUM ABSCISSUM	CUTTHROAT GRASS	PMPOA4K010
PASPALUM DISSECTUM	WALTER PASPALUM	PMPOA4P0E0
PASTINACA SATIVA	WILD PARSNIP	PDAPI1M010
PENSTEMON HAYDENII	BLOWOUT PENSTEMON	PDSCR1L300

LIST OF AVAILABLE ELEMENT STEWARDSHIP ABSTRACTS		
SCIENTIFIC NAME	COMMON NAME	ELCODE
PHACELIA ARGILLACEA	CLAY PHACELIA	PDHYD0C080
PHALARIS AQUATICA	HARDING GRASS	PMPOA4R020
PHASEOLUS SUPINUS	SUPINE BEAN	PDFAB330L0
PHLOX BIFIDA SSP STELLARIA	CLEFT PHLOX	PDPLM0D0A2
PHLOX CAROLINA SSP CAROLINA	CAROLINA PHLOX	PDPLM0D0E3
PHRAGMITES AUSTRALIS	COMMON REED	PMPOA4V010
PHYLLITIS SCOLOPENDRIUM VAR AMERICANA	AMERICAN HART'S-TONGUE	PPASP021E0
PLANTAGO CORDATA	HEART-LEAF PLANTAIN	PDPLN02090
PLATANThERA FLAVA VAR FLAVA	SOUTHERN REIN ORCHID	PMORC1Y081
PLATANThERA LEUCOPHAEA	PRAIRIE FRINGED ORCHID	PMORC1Y0F0
POA COMPRESSA	CANADA BLUEGRASS	PMPOA4Z1W0
POA PALUDIGENA	BOG BLUEGRASS	PMPOA4Z1W0
POA PRATENSIS	KENTUCKY BLUEGRASS	PMPOA4Z210
POLEMONIUM VANBRUNTIAE SSP VANBRUNTIAE	EASTERN JACOB'S LADDER	PDPLM0E0L0
POLYCTENIUM WILLIAMSAE	WILLIAMS' COMBLEAF	PDBRA23020
POLYGALA LEWTONII	LEWTON'S POLYGALA	PDPGL020S0
POLYMNIA LAEVIGATA	TENNESSEE LEAF CUP	PDAST7G020
POPULUS BALSAMIFERA	BALSAM POPLAR	PDSAL01030
POPULUS GRANDIDENTATA	LARGE-TOOTHED ASPEN	PDSAL01060
POPULUS TREMULOIDES	QUAKING ASPEN	PDSAL010B0
POTAMOGETON HILLII	HILL'S PONDWEED	PMPO030F0
POTENTILLA ROBBINSIANA	ROBBINS' CINQUEFOIL	PDROS1B1N0
PRENANTHES BOOTTII	BOOTT'S RATTLESNAKE-ROOT	PDAST7K070
PRENANTHES CREPIDINEA	NODDING RATTLESNAKE-ROOT	PDAST7K080
PRIMULA LAURENTIANA	BIRD'S-EYE PRIMROSE	PDPRI080Z0
PRUNUS GENICULATA	SCRUB PLUM	PDROS1C0H0
PSIDIUM CATTLEIANUM	PURPLE STRAWBERRY GUAVA	PDMRT0E020
PTEROGLOSSASPIS ECRISTATA	CRESTED FRINGED ORCHID	PMORC27010
PYCNANTHEMUM TORREI	TORREY'S MOUNTAIN MINT	PDLAM1N0G0
PYRGULOPSIS THOMPSONI	HUACHUCA SPRINGSNAIL	IMGASJ0230
RANUNCULUS ACRIFORMIS VAR AESTIVALIS	AUTUMN BUTTERCUP	PDRAN0L022
RHAMNUS CATHARTICA	BUCKTHORN	PDRHA0C050
RHAMNUS FRANGULA	GLOSSY BUCKTHORN	PDRHA0C080
RHUS GLABRA	SMOOTH SUMAC	PDANA08030
RHYNCHOSIA CINEREA	BROWN-HAIRED SNOUTBEAN	PDFAB3F030
RIBES ECHINELLUM	MICCOSUKEE GOOSEBERRY	PDGRO020G0
ROBINIA PSEUDOACACIA	BLACK LOCUST	PDFAB3G080
RORIPPA COLUMBIAE	COLUMBIA YELLOW-CRESS	PDBRA27060
RORIPPA GAMBELII	GAMBEL'S WATERCRESS	PDBRA270V0
ROSA MULTIFLORA	RAMBLER ROSE	PDROS1J0P0
RUBUS ARGUTUS	PRICKLY FLORIDA BLACKBERRY	PDROS1K0P0
RUBUS CENTRALIS	DEAM'S DEWBERRY	PDROS1K1F0
RUBUS DISCOLOR	HIMALAYA-BERRY	PDROS1K1Y0
SALIX BEBBIANA	BEBB'S WILLOW	PDSAL020E0
SARRACENIA OREOPHILA	GREEN PITCHER PLANT	PDSAR02050
SARRACENIA RUBRA SSP JONESII	MOUNTAIN SWEET PITCHER-PLANT	PDSAR02082

LIST OF AVAILABLE ELEMENT STEWARDSHIP ABSTRACTS		
SCIENTIFIC NAME	COMMON NAME	ELCODE
SCHINUS TEREBINTHIFOLIUS	BRAZILIAN PEPPER-TREE	PDANA09030
SCHWALBEA AMERICANA	CHAFFSEED	PDSCR1Q010
SCIRPUS ANCISTROCHAETUS	NORTHEASTERN BULRUSH	PMCYP0Q030
SCIRPUS ETUBERCULATUS	CANBY BULRUSH	PMCYP0Q0L0
SCIRPUS HALLII	HALL'S BULRUSH	PMCYP0Q0R0
SCIRPUS VERECUNDUS	BASHFUL BULRUSH	PMCYP0Q1L0
SCUTELLARIA MONTANA	LARGE-FLOWERED SKULLCAP	PDLAM1U0U0
SCUTELLARIA SAXATILIS	ROCK SKULLCAP	PDLAM1U150
SEDUM GLAUCOPHYLLUM	CLIFF STONECROP	PDCRA0A0C0
SEDUM PUSILLUM	GRANITE ROCK STONECROP	PDCRA0A130
SENECIO JACOBAEA	TANSY RAGWORT	PDAST8H1U0
SILENE REGIA	ROYAL CATCHFLY	PDCAR0U1G0
SILENE VIRGINICA VAR ROBUSTA	ROBUST FIREPINK	PDCAR0U222
SILYBUM MARIANUM	BLESSED MILK-THISTLE	PDAST8M010
SISYRINCHIUM PALLIDUM	PALE BLUE-EYE-GRASS	PMIRI0D1B0
SOLIDAGO ARGUTA VAR HARRISSI	HARRIS' GOLDENROD	PDAST8P034
SOLIDAGO HOUGHTONII	HOUGHTON'S GOLDENROD	PDAST8P0W0
SPIGELIA GENTIANOIDES	GENTIAN PINKROOT	PDLOG08020
SPIRANTHES DELITESCENS		PMORC2B140
SULLIVANTIA RENIFOLIA, S. SULLIVANTII	RENIFORM SULLIVANTIA	PDSAX0X040
SYMPHORICARPOS ALBUS	SNOWBERRY	PDCPR05020
TAENIDIA MONTANA	MOUNTAIN PARSLEY	PDAP126020
TANACETUM HURONENSE	LAKE HURON TANSY	PDAST92060
TOMANTHERA AURICULATA	EARLEAFED FOXGLOVE	PDSCR1X010
TORREYA TAXIFOLIA	FLORIDA TORREYA	PGTXA02020
TRIFOLIUM STOLONIFERUM	RUNNING BUFFALO CLOVER	PDFAB40250
TRIFOLIUM VIRGINICUM	KATE'S-MOUNTAIN CLOVER	PDFAB402D0
TRIPSACUM FLORIDANUM	FLORIDA GAMA GRASS	PMPOA68020
TROLLIUS LAXUS SSP LAXUS	SPREADING GLOBE FLOWER	PDRAN0P022
TYPHA SPP.	NORTH AMERICAN CATTAILS	
ULEX EUROPAEUS	GORSE	PDFAB42010
VACCINIUM CRASSIFOLIUM SSP SEMPERVIRENS	RAYNER'S BLUEBERRY	PDERI180A2
VALERIANA ULIGINOSA	MARSH VALERIAN	PDVAL030J0
VERBASCUM THAPSUS	GREAT MULLEIN	PDSCR1Z080
VINCA MAJOR	LARGE-LEAF PERIWINKLE	PDAP00T020
VIOLA APPALACHIENSIS	APPALACHIAN BLUE VIOLET	PDVIO04030
VIOLA NOVAE-ANGLIAE	NEW ENGLAND VIOLET	PDVIO04180
XANTHIUM SPINOSUM	SPINY COCKLEBUR	PDAST9Z010
XANTHIUM STRUMARIUM	ROUGH COCKLE-BUR	PDAST9Z020
ZIZIA APTERA	GOLDEN ALEXANDERS	PDAP12F010

*Chippewa National Forest Sensitive Species
A Guide to Potential Habitats*

Nancy Sather, Botanist
Minnesota Natural Heritage Program
December, 1992

CHIPPEWA NATIONAL FOREST SENSITIVE SPECIES A GUIDE TO POTENTIAL HABITATS

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INTRODUCTION

The work included this report is Part 2 of a cooperative cost-share agreement between the Minnesota Natural Heritage Program and the Chippewa National Forest. Part 2 of this project is the preparation of sensitive plant/habitat preference matrices that can be used by Forest Service personnel to target forest stands within which sensitive plants may occur.

Twenty-four plant species comprise the 1991 revision of the Chippewa National Forest Sensitive Plant list (Sather and Smith, 1991). Included on the list are all species known or suspected to be on the Forest that are candidates for federal listing, officially listed as Endangered or Threatened in Minnesota or tracked by the Minnesota Natural Heritage Program as elements of special concern. Not included on the list are species on the USFS Regional Sensitive Species list that are not believed to be on the forest and species that are tracked by the Minnesota Natural Heritage Program but have no official status.

METHODS

Habitat preference matrices were generated for all but one of the sensitive species. Ginseng (*Panax quinquefolium*) was omitted from the matrices because there are no collections from Cass and Itasca counties and only 4 of the nearly 100 Minnesota collections are from nearby counties. The 2 Crow Wing county specimens, and single occurrences from Aitkin and Mille Lacs Counties are all late summer collections from mixed hardwood or maple-basswood stands.

The matrices were generated from information in the Minnesota Natural Heritage Program database, after a review of all collections of each of the sensitive species at the University of Minnesota herbarium (MIN), with the exception of ginseng, for which there were too many collections. Although label information is retained in the Heritage database, Program botanists believed this review was necessary to determine the phenological condition of the plants, a variable not included in that database. A table was prepared from the herbarium review reflecting all habitat as described by the collector, phenological condition, and dates of collection in two week intervals. This table was refined to consolidate and reduce the number of habitat types into a collection frequency table showing the number of vegetative, flowering and fruiting specimens for each species in each of three phenological periods: spring (May 1- June 15), midsummer (June 15- August 15), and late summer (after August 15). Collections listing only the month of collection were allocated to spring if collected in June, midsummer if collected in July, and late summer if collected in August or later. This draft table was updated with recent collection information and reviewed by staff botanist Welby Smith and County Biological Survey staff for Cass County to produce Table 1.

Information from Table 1 was used to create the shaded matrices. Although old specimens were included wherever there was adequate data, the lack of habitat data or dates of collection often resulted in omission of collections made prior to around 1930. Also omitted were specimens collected within city limits, in cultivation, or in road rights-of-way. The number of occurrences in Table 1 therefore reflects only the usable subset of all occurrences in the Heritage database or all specimens at the University of Minnesota Herbarium, which were used in the preparation of Ownbey and Morley's Checklist and Atlas (1991).

Shaded Matrix 1 was generated by assigning a percent of shading to each of three classes of collection frequency: dark shading for more than 10 collections within a time interval. Collection frequency is based on flowering and fruiting specimens of all species that can only be definitively recognized in flower or fruit. In those cases where nonflowering material is sufficient for taxonomic determination, the frequency of all collections was taken into account.

Matrix 2 was prepared by summarizing all collection dates within each habitat for each species and presenting the data with species listed in alphabetical order and habitats ranged from wetland to upland. The darkest shading represents those habitats supporting 20 or more collections, the second darkest shading those with more than 10 collections, medium shading from 6-10 collections and light shading 1-5 collections.

DISCUSSION

Matrix 1 should be most useful for users planning work in a particular forest type at a given time of year. The matrix is organized by habitat type and date of collection (reflecting dates at which the species is most easily identified). Matrix 2 arranges the plant and habitat information in a presentation more useful to those who are targeting a particular species and want to know which habitats it prefers. The same habitat types are used in both matrices.

There are too few collections of most of the sensitive species from the Chippewa National Forest and immediate area to generate useful matrices just for this region of the state. Habitats listed in the matrix are those within which the species are to be anticipated on the forest. The habitat preferences of all species included in these matrices are described more accurately in Coffin and Pfannmuller (1988). By their very nature rare species are known from few locations, thus making it difficult to determine their habitat preferences. The fewer the known stations for a plant the more difficult it is to generalize its habitat preferences. It cannot be overstated that the attached matrices reflect the current state of knowledge and should serve only as a guide in choosing areas to search for the plants, not as a final statement of communities in which they will or will not occur.

Habitat types used in the matrices conform neither with the Chippewa National Forest ECS system nor the Minnesota Natural Heritage Program community classification. This is because collection information provided on specimen labels is inadequate to assign collections to types as narrowly defined as those in either classification. The habitats listed on the left side of the matrices are in large part described by physiognomy (unforested wetlands) or species dominance (pine). Although these criteria for defining habitats will facilitate identification on aerial

photography or correlation with forest type maps they do not reflect differences in substrate chemistry or microhabitat that may be more important to the species than the prevailing cover type of the stand.

Aquatic communities include open water of lakes, ponds, and streams. This habitat type would require an investigator to use diving equipment or a boat for sampling. Littoral aquatic communities include lakeshores and shallow water in which sunlight penetrates to the bottom and rooted emergent plants are present. An investigator could sample these habitats by wading. Such communities include marshes, pools in wetlands outside of peatlands, ditches, shores, and moats surrounding floating mats. Label information was sometimes inadequate to separate those specimens attributed to "shore" into those that were truly in the littoral zone and those that may have been in bands of adjoining wetlands.

The division of wetland habitats by physiognomy into forested and unforest wetland habitats makes no provision for the differentiation between swamp (i.e. minerotrophic) or bog (i.e. ombrotrophic). However, it does provide the ability to detect the types on aerial photography or to relate them stand types.

The unforest wetland habitat type includes a wide range of wetlands outside of large patterned peatland complexes. Although the species included under this heading may occur in a range of habitats in other regions of the state their common feature is that within the Chippewa National Forest they can be expected to occur in open wetland habitats. Several of the species included in this type require fairly specific microhabitat conditions not reflected in the broad habitat heading. Included in this category are species that grow in leatherleaf "bogs" and sedge meadows, on floating sedge mats (such as Arethusa bulbosa), spring fens and calcareous fens (Cladium mariscoides), and even in wet prairies outside of the forest region (Eleocharis pauciflora). Only 3 of the 19 occurrences of the latter species are from the Chippewa National Forest, two from the 1992 collections of the County Biological survey from sandy lakeshores, one old collection with a label too general to determine the habitat. Twelve of the remaining collections are from the prairie region north and west of the Forest, 5 from rich fens, 2 from calcareous fens and 5 from other wet prairie habitats. Labels for 6 of the 9 occurrences of Platanthera flava are too general to determine habitat preferences and the remaining 3 collections are from wet meadow and prairie. In some cases (such as Arethusa) the affinity for open areas appears to be related to a need for higher light levels. In other cases (such as Cladium) the microhabitat preference is more likely related to water chemistry. For this reason it is important that the matrices be used in conjunction with Coffin and Pfannmuller (1988).

The peatland habitat type used in the matrices refers exclusively to large patterned peatland complexes, such as the Red lake Peatland, the Myrtle Lake Peatland, the Lost Lake Peatland, and the Sand Lake Peatland. None of these peatland complexes occurs on the Chippewa National Forest. The habitat type includes all microhabitats within these peatland complexes but in fact the species listed all prefer the more open watertracks and spring fen areas. Those species that occur both within the peatland complexes and in isolated open wetlands exhibit similar microhabitat preferences in both types of wetlands. These species include: Cladium mariscoides, which typically occurs in minerotrophic watertracks in the peatlands, in spring fens and in

calcareous fens outside the big peatlands; Drosera anglica, in watertracks and spring fens; and xyris montana, which occurs in watertracks in the patterned peatlands and in open pool margins in other unforested wetlands.

The conifer wetland type used in the habitat matrices combines all black spruce, tamarack, and white cedar swamps and “bogs” (as in common parlance) outside large contiguous patterned peatlands. Specimen labeling was too inconsistent to ascribe all species of conifer wetlands to one canopy cover type of another. However, there were cases where labels indicated a decided preference for one canopy over another. Seventeen of 23 wetland conifer occurrences of Cypripedium arietinum were in white cedar stands, with 3 in tamarack stands, 2 in black spruce- cedar stands and 1 in black spruce-tamarack. Likewise, the majority of sites for Ranunculus lapponicus and Polemonium occidentals var. Lacustre are in cedar swamps. Although it is a candidate for federal listing, the latter species is not presently on the Regional sensitive species list because it is recognized for its rarity at the varietal level. It is not included in Coffin and Pfanmuller (1988) because at the time the book was prepared it had no state status. Recent fieldwork confirms the native status and rarity of the species in Minnesota and Wisconsin. The collection frequencies reflected in the habitat matrices adequately reflect the broad habitat types within which it has been found, but do not reflect its preference for fairly open microhabitats in cedar swamps.

Upland habitats used in the matrix can be related easily to stand types and include: upland white cedar, spruce-fir, pine, aspen-birch, and maple-basswood. Upland white cedar described on collection labels includes cedar as a dominant, with mention of birch as fir as additional canopy components. Specimens attributed to the spruce-fir habitat type had labels that specifically mentioned these species as codominants. The pine habitat type may be dominated by any species of pine, but in the cases of both Cypripedium arietinum and Waldsteinia fragariodes this type reflects collections in jack pine stands. Most labels attributed to the aspen-birch habitat type listed aspen as the dominant but included birch and fir. Collections attributed to maple-basswood included both those that specifically mentioned these species and those whose labels imply stated “hardwood stand”. The strong preference of botrychium mormo for this habitat type reflects 1992 County Biological Survey collections in Cass County. Habitat information on previous collections of the species is inadequate to ascribe them to any habitat type.

REFERENCES

- Coffin, B.A. and L. A. Pfannmuller, eds. 1988. Minnesota's Endangered Flora and Fauna. University of Minnesota Press, Minneapolis. 473 pp.
- Ownbey, G. B. And T. Morley. Vascular Plants of Minnesota: a Checklist and Atlas. 1991. University of Minnesota Press, Minneapolis. 307 pp.
- Sather, N.P. and W. R. Smith. 1991. A revision of the Sensitive species List of the Chippewa National Forest. Report submitted to Chippewa National Forest, Cass Lake, Minnesota.

TABLE 1A. Chippewa National Forest. Collection frequency of flowering species during each phenological period.

AQUATIC		5/1-6/15	6/15-8/15	8/16-10/1
Open Water				
	<i>Nymphaea tetragona</i>		7	8
	<i>Potamogeton vaseyi</i>		7	6
Littoral aquatic				
	<i>Cladium mariscoides</i>			2
	<i>Eleocharis olivacea</i>		1	
	<i>Eleocharis pauciflora</i>		1	2
	<i>Najas gracillima</i>		3	7
	<i>Sparganium glomeratum</i>		3	5
	<i>Utricularia gibba</i>		8	9

TABLE 1B. Chippewa National Forest. Collection frequency of flowering species during each phenological period.

UNFORESTED WETLANDS		5/1-6/15	6/16-8/15	8/16-10/1
	<i>Arethusa bulbosa</i>	31	6	1
	<i>Cladium mariscoides</i>	1	6	10
	<i>Drosera anglica</i>	1	2	
	<i>Eleocharis olivacea</i>		1	
	<i>Eleocharis pauciflora</i>	1	4	4
	<i>Platanthera clavellata</i>		5	1
	<i>Platanthera flava</i>	1	2	
	<i>Xyris montana</i>	2	2	5
PEATLANDS				
	<i>Cladium mariscoides</i>		10	3
	<i>Drosera anglica</i>	5	19	2
	<i>Drosera linearis</i>	3	9	1
	<i>Juncus stygius</i>		1	10
	<i>Xyris montana</i>		1	4

TABLE 1C. Chippewa National Forest. Collection frequency of flowering species during each phenological period.

CONIFER WETLANDS		5/1-6/15	6/15-8/15	8/16-10/1
	<i>Arethusa bulbosa</i>	15	4	1
	<i>Cypripedium arietinum</i>	25	7	8
	<i>Malaxis paludosa</i>		4	2
	<i>Platanthera clavellata</i>	1	2	none
	<i>Polemonium occidentale</i>		4	
	<i>Ranunculus lapponicus</i>	12	2	1
HARDWOOD WETLANDS			1	2
	<i>Platanthera clavellata</i>	1		
SHRUB WETLANDS				
	<i>Listera auriculata</i>	1		1

TABLE 1D. Chippewa National Forest. Collection frequency of flowering species during each phenological period.

CONIFER UPLANDS		5/1-6/15	6/15-8/15	8/16-10/1
White Cedar forest				
	<i>Botrychium minganense</i>		1	
	<i>Cypripedium arietinum</i>	2		
Spruce-fir forest				
	<i>Cypripedium arietinum</i>	1		
	<i>Listera auriculata</i>			1
Pine forest				
	<i>Cypripedium arietinum</i>	4		
	<i>Waldsteinia fragarioides</i>	1	5	

TABLE 1E. Chippewa National Forest. Collection frequency of flowering species during each phenological period.

DECIDUOUS UPLANDS		5/1-6/15	6/15-8/15	8/16-10/1
Aspen-birch				
	<i>Cypripedium arietinum</i>	5		
	<i>Waldsteinia fragarioides</i>	1		
Maplewood-basswood				
	<i>Botrychium minganense</i>	1		3
	<i>Botrychium mormo</i>	1	11	
	<i>Cypripedium arietinum</i>	1	5	
	<i>Waldsteinia fragarioides</i>	1	3	

MATRIX 1A

Chippewa National Forest

Collection Frequency of Flowering Species during each Phenological Period.

AQUATIC		5/1-6/15	6/15-8/15	8/26-20/2
Open water	<i>Nymphaea tetragona</i>			
	<i>Potamogeton vaseyi</i>			
Littoral aquatic	<i>Cladium mariscoides</i>			
	<i>Eleocharis olivacea</i>			
	<i>Eleocharis pauciflora</i>			
	<i>Najas gracillima</i>			
	<i>Sparganium glomeratum</i>			
	<i>Utricularia gibba</i>			



1-5 occurrences



6-10 occurrences

Aquatic communities include lakes, ponds, rivers and streams.

Littoral communities include lakeshores and shallow waters in which sunlight penetrates to the bottom and rooted emergent plants are present, marshes, pools on nonforested wetlands (see definition below), and moats surrounding such mats.

See Coffin and Pfannmuller (1988) for more information on habitat requirements of the individual species.

MATRIX 1B
Chippewa National Forest
Collection Frequency of Flowering Species during each Phenological Period

UNFORESTED WETLANDS		5/1 - 6/15	6/15-8/15	8/16-10/1
Open wetlands	<i>Aethusa bulbosa</i>			
	<i>Cladium mariscoides</i>			
	<i>Drosera anglica</i>			
	<i>Eleocharis olivacea</i>			
	<i>Eleocharis pauciflora</i>			
	<i>Platanthera clavellata</i>			
	<i>Platanthera flava</i>			
	<i>Xyris montana</i>			
Peatlands	<i>Juncus stygius</i>			
	<i>Cladium mariscoides</i>			
	<i>Drosera linearis</i>			
	<i>Drosera anglica</i>			
	<i>Xyris montana</i>			

 1-5 occurrences
  6-10 occurrences
  more than 10 occurrences

Unforested wetlands include open floating mats, sedge meadows, and fens as well as wet prairies and fens in the prairie and transition zones of the state.

Peatlands include all microhabitats within large peatland complexes, but do not include small "bogs" surrounding lakes or in isolated basins, the latter are included in sedge meadows, mats or in conifer wetlands.

See Coffin and Pfannmuller (1988) for more information on habitat requirements of the individual species.

MATRIX 1C

Chippewa National Forest

Collection Frequency of Flowering Species during each Penological Period

FORESTED WETLANDS		5/1-6/15	6/15-8/15	8/16-10/1
Conifer wetlands	<i>Arethusa bulbosa</i>			
	<i>Cypripedium arietinum</i>			
	<i>Malaxis paludosa</i>			
	<i>Platanthera clavellata</i>			
	<i>Polemonium occidentale</i>			
	<i>Ranunculus lapponicus</i>			
Lowland hardwoods	<i>Platanthera clavelletta</i>			
Shrub wetlands (Alder, dogwood, etc.)	<i>Listera auriculata</i>			



1-5 occurrences



ore than 10 occurrences

MATRIX 1D
Chippewa National Forest
Collection Frequency of Flowering Species during each Phenological Period

CONIFER UPLANDS		5/1-6/15	6/15-8/15	8/16-10/1
White Cedar forest	<i>Botrychium minganense</i>			
<i>Cypripedium arietinum</i>				
Spruce-fir forest	<i>Cypripedium arietinum</i>			
	<i>Listera auriculata</i>			
Pine forest	<i>Cypripedium arietinum</i>			
	<i>Waldsteinia fragarioides</i>			
DECIDUOUS UPLANDS		5/1-6/15	6/15-8/15	8/16-10/1
Aspen-birch	<i>Cypripedium arietinum</i>			
	<i>Waldsteinia fragarioides</i>			
Maple-basswood	<i>Botrychium minganense</i>			
	<i>Botrychium mormo</i>			
	<i>Cypripedium arietinum</i>			
	<i>Waldsteinia fragarioides</i>			



1-5 occurrences



6-10 occurrences



more than 10 occurrences

MATRIX
Chippewa National Forest
Sensitive Plant Habitat Preferences

WETLAND COMMUNITIES							
SPECIES	OPEN WATER	AQUATIC LITTORAL	PEATLAND (ALL MICRO-HABITATS)	SEDGE MEADOW, WET PRAIRIE MATS, FENS	CONIFER BOGS AND SWAMPS	LOWLAND HARDWOODS	shrub wetlands
<i>Arethusa bulbosa</i>							
<i>Cladium mariscoides</i>							
<i>Cypripedium arietinum</i>							
<i>Drosera anglica</i>							
<i>Drosera linearis</i>							
<i>Eleocharis olivacea</i>							
<i>Eleocharis pauciflora</i>							
<i>Juncus stygius</i>							
<i>Listera auriculata</i>							
<i>Malaxis paludosa</i>							
<i>Najas gracillima</i>							
<i>Nymphaea tetragona</i>							
<i>Platanthera clavellata</i>							
<i>Platanthera flava</i>							
<i>Polemonium occidentale</i>							
<i>Potamogeton vaseyi</i>							
<i>Ranunculus lapponicus</i>							
<i>Sparganium glomeratum</i>							
<i>Utricularia gibba</i>							
<i>Xyris montana</i>							



1-5 occurrences



6-10 occurrences



11-20 occurrences



more than 20 occurrences

MATRIX 2B
Chippewa National Forest
Sensitive Plant Habitat Preferences

UPLAND COMMUNITIES					
SPECIES	WHITE CEDAR	SPRUCE-FIR	PINE	ASPEN- BIRCH	MAPLE- BASSWOOD
<i>Botrychium minganese</i>					
<i>Botrychium mormo</i>					
<i>Cypripedium arietinum</i>					
<i>Listera auriculata</i>					
<i>Waldsteinia fragaroides</i>					

1-5 occurrences

6-10 occurrences

more than 10 occurrences

DNR Statements of Need and Reasonableness (SONARs) for rare species undergoing status change in 1996 list revision

Prepared as part of the recent revision of the state endangered, threatened, and special concern list. A status sheet was prepared for each species for which a change in status was proposed (see *1996 State List of Endangered, Threatened and Special Concern Species* on page 1.7.3). Similar information for listed species that did not undergo a change in status is available in *Minnesota's Endangered Flora and Fauna* (1988; B. Coffin and L. Pfannmuller; University of Minnesota Press, Minneapolis). A status sheet was prepared for *Arethusa bulbosa*, *Botrychium minganense*, *Botrychium oneidense*, *Botrychium pallidum*, *Botrychium rugulosum*, *Botrychium simplex*, *Cypripedium arietinum*, *Juglans cinerea*, *Malaxis monophyllos* var. *brachypoda*, *Najas gracillima*, *Sparganium glomeratum*, *Utricularia gibba*, *Utricularia purpurea*, and *Viola novae-angliae*.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Arethusa bulbosa* L.

FAMILY: Orchidaceae

COMMON NAME: Dragon's-mouth

CURRENT MINNESOTA STATUS: Special Concern

PROPOSED MINNESOTA STATUS: None

BASIS FOR PROPOSED MINNESOTA STATUS: *Arethusa bulbosa* is an orchid of temperate and boreal North America with the geographic center of its range in the Great Lakes region. Concern arising from a decline of species in other parts of its United States' range, led to its designation as Special Concern in 1984. However, Minnesota populations appear to have a stronghold in the large peatlands and conifer swamps in the northern part of the state, extending roughly from Roseau County in the northwest to Carlton County in the southeast. Over 70 locations are now known from this area. A recent DNR survey discovered *A. bulbosa* in nearly every peatland complex studied. Some populations appear to be small, but most extend over several square kilometers and contain thousands of individuals. The majority of these populations are probably secure considering applicable state and federal land-management guidelines. Several populations occur on sites that have a high level of protection. Although other populations in small, outlying peatlands are experiencing local extirpations because of loss of habitat, it is now known to be sufficiently distributed in the state to no longer need Special Concern status.

SELECTED REFERENCES:

- Aaseng, N.E. and R.I. Djupstrom. 1992. Peatland Protection, pp. 301-315 in Wright, H.E. et.al. The Patterned Peatlands of Minnesota. University of Minnesota Press, Minneapolis. 327pp.
- Coffin, B.A. and L.A. Pfannmuller, eds. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis. 460pp.
- Luer, C. A. 1975. The native orchids of the United States and Canada excluding Florida. New York Botanical Garden. 361pp.
- Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.
- Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.
- Smith, W.R. 1993. Orchids of Minnesota. University of Minnesota Press. Minneapolis. 172pp.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Botrychium minganense* Victorin

FAMILY: Ophioglossaceae

COMMON NAME: Mingan moonwort

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Special Concern

BASIS FOR PROPOSED MINNESOTA STATUS: There are very few reliable records of this species from Minnesota, and recent botanical surveys conducted within its preferred habitat (northern hardwood forests) show it to be very rare. However, there is still too little information available to detect population trends, and there are portions of its range that have not yet been adequately surveyed. For these reasons Special Concern status is considered reasonable and necessary at this time, although further research may show it to be in need of a higher degree of protection.

SELECTED REFERENCES:

- Farrar, D.R., W.H. Wagner, N.R. Lersten, and C.L. Johnson-Groh. 1986. Subterranean sporophytic gemmae in *Botrychium* subgenus *Botrychium*. *American Journal of Botany* 73 (5): 735-736.
- Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.
- Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.
- Wagner, W.H. and F.S. Wagner. 1993. Ophioglossaceae C.Agardh. *in* Flora of North America Editorial Committee, eds. Flora of North America, North of Mexico. Volume 2. pp 85-106.
- Wheeler, G.A., R.P. Dana, and C. Converse. 1991. Contribution to the vascular (and moss) flora of the Great Plains: A floristic survey of six counties in western Minnesota. *Michigan Botanist* 30(3):75-129.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Botrychium oneidense* (Gilbert) House

FAMILY: Ophioglossaceae

COMMON NAME: Blunt-lobed grape fern

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Endangered

BASIS FOR PROPOSED MINNESOTA STATUS: This is a very rare species throughout the region, and was first discovered in Minnesota in Cass County in 1992. The species appears to prefer moist depressions in hardwood forests in the central part of the state. After four years of surveys in potentially suitable habitat, only five colonies have been documented, none of which occurs on a protected site. Endangered status is needed and reasonable to reflect the vulnerability of these few populations to disturbance or destruction.

SELECTED REFERENCES:

Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.

Wagner, W.H. and F.S. Wagner. 1993. Ophioglossaceae C.Agardh. *in* Flora of North America Editorial Committee, eds. Flora of North America, North of Mexico. Volume 2. pp 85-106.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Botrychium pallidum* W.H. Wagner

FAMILY: Ophioglossaceae

COMMON NAME: Pale moonwort

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Endangered

BASIS FOR PROPOSED MINNESOTA STATUS: This cryptic species is probably the rarest moonwort in North America. It was discovered in Minnesota in 1992, and is currently known to exist at only two locations in transitional habitat in Lake County, with a combined population of only 18 individuals. Because of these low numbers, the species is susceptible to extirpation and a status of Endangered is considered reasonable and necessary at this time.

SELECTED REFERENCES:

Wagner, W.H. and F.S. Wagner. 1993. Ophioglossaceae C.Agardh. *in* Flora of North America Editorial Committee, eds. Flora of North America, North of Mexico. Volume 2. pp 85-106.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Botrychium rugulosum* W.H. Wagner

FAMILY: Ophioglossaceae

COMMON NAME: Ternate grape fern

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Threatened

BASIS FOR PROPOSED MINNESOTA STATUS: Like several of the other species of *Botrychium*, our level of knowledge of this plant has only recently become adequate enough known to propose a protection status. This species now appears to be very rare in northern Minnesota and apparently throughout its range. Its habitat requirements are still not thoroughly understood, but most of the twelve known locations are either in pine forests or in forested wetland margins. Another population is currently threatened by the construction of a golf course. Because of these concerns, Threatened status is needed and reasonable.

SELECTED REFERENCES:

Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.

Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.

Wagner, W.H. Jr. and F.S. Wagner. 1982. *Botrychium rugulosum*, Ophioglossaceae, a newly-recognized species of evergreen grapefern in the Great Lakes area of North America (Pteridophyta). Contributions from the University of Michigan Herbarium 15: 315-324.

Wagner, W.H. and F.S. Wagner. 1993. Ophioglossaceae C.Agardh. in Flora of North America Editorial Committee, eds. Flora of North America, North of Mexico. Volume 2. pp 85-106.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Botrychium simplex* E. Hitchcock

FAMILY: Ophioglossaceae

COMMON NAME: Least moonwort

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Special Concern

BASIS FOR PROPOSED MINNESOTA STATUS: This is possibly the smallest fern in Minnesota and one of the least understood. The majority of the known populations have been found in the course of searches for *Botrychium mormo*. Based on the information at hand, this appears to be a very rare species in Minnesota that can be found in both hardwood forests and prairies and is possibly dependent on a specialized microhabitat. It is hoped that additional field data will help define its habitat needs, and identify any potential threats to its survival, but at present, Special Concern status is needed and reasonable.

SELECTED REFERENCES:

Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.

Wagner, W.H. and F.S. Wagner. 1993. Ophioglossaceae C.Agardh. in Flora of North America Editorial Committee, eds. Flora of North America, North of Mexico. Volume 2. pp 85-106.

Wheeler, G.A., R.P. Dana, and C. Converse. 1991. Contribution to the vascular (and moss) flora of the Great Plains: A floristic survey of six counties in western Minnesota. Michigan Botanist 30 (3): 75-129.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Cypripedium arietinum* R. Br.

FAMILY: Orchidaceae

COMMON NAME: Ram's-head lady's-slipper

CURRENT MINNESOTA STATUS: Endangered

PROPOSED MINNESOTA STATUS: Threatened

BASIS FOR PROPOSED MINNESOTA STATUS: This species has always been considered uncommon in Minnesota and its geographical range in the state appears to have been reduced during this century. Populations in Hennepin and Wright counties have not been verified since 1911 and 1927 respectively, and are believed to have been destroyed by residential development. The often-reported population at Cedar Creek Natural History Area may have been transplanted there from another location. Recent intensive surveys of potential habitat in the northern Twin Cities metropolitan area have failed to document any extant populations south of Aitkin County. When *Cypripedium arietinum* was designated as Endangered in 1984, it was known from fewer than 20 locations. Today there are more than 50 known sites from a variety of forested habitats. Although the species is believed to be more widespread and abundant than was previously believed, Threatened status for this unusual and attractive orchid is deemed reasonable and necessary because several of the known populations have been severely depleted from illicit removal by orchid fanciers.

SELECTED REFERENCES:

- Aaseng, N.E. and R.I. Djupstrom. 1992. Peatland Protection, pp. 301-315 in Wright, H.E. et al. The Patterned Peatlands of Minnesota. University of Minnesota Press, Minneapolis. 327pp.
- Coffin, B. and L.A. Pfannmuller, eds. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis. 460 pp.
- Luer, C. A. 1975. The Native Orchids of the United States and Canada Excluding Florida. New York Botanical Garden.
- Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.
- Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.
- Smith, W.R. 1993. Orchids of Minnesota. University of Minnesota Press. Minneapolis. 172pp.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Juglans cinerea*

FAMILY: Juglandaceae

COMMON NAME: Butternut

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Special Concern

BASIS FOR PROPOSED MINNESOTA STATUS: Butternut is a forest tree that occurs widely in the northeastern United States. In Minnesota it is found scattered throughout much of the southeastern one-third of the state. In 1967 the fungus *Sirococcus clavigignenti-juglandacearum* was discovered on a butternut tree in Wisconsin. The disease is generally fatal to butternut trees, and there is no known cure. The fungus is spread by wind and rain, and has now reached all parts of butternut's range. Butternut populations are plummeting. Some states report losses as high as 80%, and expect all remaining trees to die within the next 20 years. The situation in Minnesota is not well documented, but it appears that the state could provide nearly the only stronghold for uninfected populations, either because of climatic conditions or genetic factors. The species' original range in the state extended from the southeastern corner of the state west to the Mankato area and northeast toward Duluth. Living trees continue to be documented throughout this range at the present time. A status of Special Concern is necessary and reasonable at this time because of the severe decline of this species across nearly its entire range and the global significance of Minnesota's surviving populations

SELECTED REFERENCES:

Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.

U.S. Forest Service, 1992. Forest Service News, North Central Forest Experiment Station, St. Paul, Minnesota.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Malaxis monophyllos* (L.) Sw. var. *brachypoda* (Gray) Morris & Eames

FAMILY: Orchidaceae

COMMON NAME: White malaxis

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Special Concern

BASIS FOR PROPOSED MINNESOTA STATUS: This is one of the rarer native orchids that occur in Minnesota. It inhabits conifer swamps in the northern half of the state. Recently, intensive surveys of suitable habitat within the heart of its range discovered only 18 small, widely scattered colonies in six counties (Pine, Cass, Clearwater, Itasca, Roseau and Lake of the Woods). A historic population decline cannot be documented from the available data, but it is vulnerable to wetland drainage, logging and land conversion. Given these concerns, Special Concern status is appropriate at this time.

SELECTED REFERENCES:

- Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.
- Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.
- Smith, W.R. 1993. Orchids of Minnesota. University of Minnesota Press. 172pp.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Najas gracillima* (A. Braun ex Engelm.) Magnus

FAMILY: Najadaceae

COMMON NAME: Slender naiad

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Special Concern

BASIS FOR PROPOSED MINNESOTA STATUS: This species was proposed as Endangered in 1984 because there were only four known historical records and a recent population decline was suspected. It was not listed because there was too little current information regarding the species. Since that time an intensive search for this species has begun (but is not yet completed), and 20 previously unknown populations have been found. Although the species does not appear to be as rare as previously believed, it is reported to be sensitive to the increased turbidity, warming, and eutrophication of lakes and streams that results from industrial and agricultural pollution. For these reasons a status of Special Concern is needed and reasonable.

SELECTED REFERENCES:

- Clausen, R. T. 1936. Studies in the genus *Najas* in the northern United States. *Rhodora* 38:333-45.
- Coffin, B. and L.A. Pfannmuller, eds. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis. 460pp.
- Haynes, R. R. 1979. Revision of north and central American *Najas*. *Sida* 8: 34-56.
- Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.
- Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.
- Rosendahl, C. O. 1935. The genus *Najas* in Minnesota. *Rhodora* 37:345-48.
- Wentz, W. A., and R. L. Stuckey. 1971. The changing distribution of the genus *Najas* (Najadaceae) in Ohio. *Ohio Journal of Science* 71 :292-302.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Sparganium glomeratum* Laest.

FAMILY: Sparganiaceae

COMMON NAME: Clustered bur reed

CURRENT MINNESOTA STATUS: Endangered

PROPOSED MINNESOTA STATUS: Special Concern

BASIS FOR PROPOSED MINNESOTA STATUS: The distribution of this species in the western hemisphere is not well understood. When it was originally designated as Endangered in 1984, its disjunct North American locations appeared to be limited to northeastern Minnesota and Saguenay County, Quebec. Recent inventory efforts have confirmed that it extends into northwest Wisconsin. Habitat descriptions on the original three Minnesota collections were somewhat misleading, implying it might be found in sphagnum bogs or floating bogs as well as marshes. New data suggest that its preferred habitat is actually minerotrophic wetlands such as shrub swamps and woodland marshes. Recent intensive searches have been conducted at a number of sites of this type, and several new populations have been found within miles of each other, suggesting that the species may be much more common than was heretofore believed. The number of known Minnesota populations has increased tenfold since 1984, and its Minnesota range is now known to extend from the Duluth and Hibbing area as far west as southwestern Clearwater County. While Endangered status is no longer needed, Special Concern status remains reasonable because, despite the high rate of return on recent surveys, its known centers of population are concentrated in a few widely-separated small areas, and it is subject to potential habitat loss.

SELECTED REFERENCES:

- Coffin, B. and L.A. Pfannmuller, eds. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis. 460pp.
- Cook, C.D.K. and M.S. Nicholls, 1987. A monographic study of the genus *Sparganium* (Sparganiaceae) Part 2. subgenus *Sparganium*. Bot. Helv. 97:1-44.
- Lakela, O. 1941. *Sparganium glomeratum* in Minnesota. Rhodora 43:83-85.
- Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.
- Sather, N.P. and K. Van Norman. 1988. Results of a survey for *Sparganium glomeratum* (Clustered bur reed) in the Chippewa National Forest. Minnesota Natural Heritage Program, Minnesota DNR. Biological Report No. 2. St Paul. 27pp.
- Walton, G.B. 1994. Report for field season 1994. Status survey for *Caltha natans* and *Sparganium glomeratum* in Minnesota. University of Minnesota, Duluth. Report submitted to Minnesota Natural Heritage and Nongame Research Program, Minnesota Department of Natural Resources. 9pp.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Utricularia gibba* L.

FAMILY: Lentibulariaceae

COMMON NAME: Humped bladderwort

CURRENT MINNESOTA STATUS: Special Concern

PROPOSED MINNESOTA STATUS: None

BASIS FOR PROPOSED MINNESOTA STATUS: This is a very small and delicate aquatic plant that grows in pools and shallow areas in bogs. When it was listed as Special Concern in 1984, there were only five records from Minnesota. There are now over thirty documented locations from six counties. It appears that this species has probably been overlooked in the past because of its small size. Based on this information, it seems that a status of special concern is no longer reasonable or necessary.

SELECTED REFERENCES:

Coffin, B. and L.A. Pfannmuller, eds. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis. 460pp.

Fassett, N.C. 1957. A manual of aquatic plants. Univ. of Wisconsin Press, Madison. 405 pp.

Lloyd, F. E. 1942. The carnivorous plants. The Cronica Botanica Company, Waltham, Mass. 352pp.

Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.

Ownbey, G.B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press. 306pp.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Utricularia purpurea* Walt.

FAMILY: Lentibulariaceae

COMMON NAME: Purple bladderwort

CURRENT MINNESOTA STATUS: None

PROPOSED MINNESOTA STATUS: Special concern

BASIS FOR PROPOSED MINNESOTA STATUS: This small aquatic plant is easily recognized by its purple flowers when it is in bloom, but just as easily overlooked when it is not in flower because of its small size and tendency to grow in mats with other, more noticeable, species of bladderwort. It was apparently overlooked in Minnesota until 1992, when it was discovered for the first time. Since that time four additional occurrences have been found, all in small shallow lakes in Pine and Cass counties. It appears to prefer open water in shallow lakes surrounded by boggy floating mats. These shorelines are generally unsuitable for shoreline development, and do not currently attract much recreational use. Although its rarity indicates that protection is needed Special Concern status is reasonable for this species because its habitat appears to be at little risk.

SELECTED REFERENCES:

Fassett, N.C. 1957. A manual of aquatic plants. Univ. of Wisconsin Press, Madison. 405pp.

Myhre, K.M. 1992. Minnesota County Biological Survey. Results of a rare plant search in Cass County, 1992. 6pp.

SPECIES STATUS SHEET

SCIENTIFIC NAME: *Viola novae-anglia* House

FAMILY: Violaceae

COMMON NAME: New England violet

CURRENT MINNESOTA STATUS: Special Concern

PROPOSED MINNESOTA STATUS: None

BASIS FOR PROPOSED MINNESOTA STATUS: At the time it was placed on the Special Concern list in 1984, New England Violet was considered quite rare outside of Minnesota, although there were nearly 40 documented collections from within the state. Its apparent rarity in other parts of its range was the basis for its 1984 listing as Special Concern in Minnesota. Since that time an intensive survey has been conducted in Minnesota, Wisconsin, and Michigan and the species was found to be more common than had been believed in all three of these states. There are now over 90 records from 10 Minnesota counties. Minnesota appears to be the strong hold of this species, and it seems to be secure here at the present time. Therefore, a status of special concern is no longer necessary or reasonable.

SELECTED REFERENCES:

Ballard, H.E. and Gawler, S.C. 1991. Distributional Status, Ecology and Endangerment of *Viola Novae-Angliae* House. Draft Report to Minnesota Natural Heritage Program. St. Paul.

Coffin, B. and L.A. Pfannmuller, eds. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis. 460 pp.

Monson, P.H. 1988. Endangered, Threatened, and Special Concern Plants. Grand Portage National Monument. Grand Portage, Minnesota. Olga Lakela Herbarium, University of Minnesota, Duluth. Unpublished report submitted to National Park Service. Grand Portage. 15pp.

Ownbey, G.B. and T. Morley. 1991. Vascular Plants of Minnesota, A Checklist and Atlas. University of Minnesota Press. 306pp.

Russell, N. H. 1966. Violets of central and eastern United States: an introductory survey. Sida 2:1-111.

Slides of Rare Plants

A set of slides of rare plants collected in Cass County is archived by the Minnesota County Biological Survey at the state offices of the Department of Natural Resources in St. Paul. A copy set of these slides will be made

upon request and at cost for anyone interested in obtaining one. Contact Carol Hall, Minnesota County Biological Survey, Section of Ecological Services, Minnesota DNR, 500 Lafayette Rd., Box 25, St. Paul, MN 55155, (612) 282-2681, carol.hall@dnr.state.mn.us.

Rare Plant Collecting Guidelines, Reporting Forms, and Permit Requirements

(Natural Heritage and Nongame Research Program, MN DNR)

DOCUMENTING RARE PLANT LOCATIONS FOR THE MINNESOTA NATURAL HERITAGE DATABASE

Natural Heritage and Nongame Research Program, Minnesota Department of Natural Resources

Plant species of interest (Contact: Natural Heritage Asst. Database Manager, 612/296-8324).

- Secure the current list of the species tracked by the database so you will know which species are of interest. Both listed and non-listed (rare) species are tracked by the database.
- Check the Natural Heritage Database or records of other public land managers to see if there are known occurrences of rare plants within your work or study area.

Permits for taking listed plants (Contact: Bonita Eliason, 612/297-2276).

- MN Statute 84.0985 provides for designation of species as endangered, threatened and special concern, and prohibits taking of endangered and threatened species except under specified conditions
- A permit is required to collect state endangered or threatened species. Permits for taking endangered or threatened species may be issued only to named individuals. Your written application should include your name, agency or institution with which you are affiliated (if any), a summary of your formal training or field experience in plant taxonomy, area of the state in which you will be collecting, and taxonomic groups for which permit is desired. Send to: Bonita Eliason, MNDNR, 500 Lafayette Rd., Box 25, St. Paul, MN 55155.
- If you have unintentionally collected an endangered or threatened plant without a permit, the specimen should be submitted as soon as is practical following procedures described below, with a brief note attached that explains the circumstances.
- Some public lands such as Scientific and Natural Areas and State Parks require an additional permit from the land management unit.

General collection guidelines to avoid impacts to rare plant populations

- Familiarize yourself with critical identifying features of likely species to be collected.
- Collect to document new locations; in general, make no more than one collection of a particular species per 40 acres of habitat.
- For known populations, only make a new collection if the most recent collection was before 1970.
- For any given species, collect only when distinguishing characters are present (usually flowers and/or fruits are necessary); if key characters are not present, it may be necessary to return to the site at the appropriate time.
- For vascular plants, collect a complete specimen (which includes roots) only when the population has more than 100 individuals.
- For populations of vascular plants with fewer than 100 individuals, collect only the distinguishing portion of the plant (usually a flower or fruit but in some species it may be a single leaf).
- For non-vascular plants, collect plants such that viability of population is maintained.

Data to record, and proper collection techniques to assure the specimen is usable (contact: Natural Heritage Asst. Database Manager: (612) 296-8324).

- Obtain MN Natural Heritage Database Rare Plant Report Form.
- Consult *Techniques for Collecting and Preserving Plant Specimens*.

Submitting rare plant collection information.

- Send specimen with herbarium label (see *Techniques for Collecting and Preserving Plant Specimens*) and report form to **Welby Smith, Minnesota Department of Natural Resources, Section of Ecological Services, 500 Lafayette Rd., Box 25, St. Paul, MN 55155.**

Respect for property owners' rights

- Always determine land ownership and get permission to 1) go on the land, and 2) to collect plants, from the private landowner or public land manager.

Questions: Contact program botanists at (612) 297-3733 or 297-4963, or the program coordinator at 297-2276.

MN NATURAL HERITAGE DATABASE RARE PLANT REPORT FORM
(to be filled out in field)

Species name _____ County: _____

Legal description of location: Twp. _____ Rg. _____ Quarter/Quarter _____ Section _____

IF POSSIBLE, ATTACH A MAP, PREFERABLY A COPY OF A 7.5 MINUTE QUAD, SHOWING LOCATION.

Collector's name, address and phone: _____

Collection # _____ Date of collection ____/____/____

Land ownership (Be as specific as possible. Please secure permission before entering private land).

Description of location (distance from permanent landmark, forest stand #, etc.):

Habitat (for example, dominant vegetation, associated species, extent of suitable habitat, threats, microhabitat: (soil, pH, slope, exposure, aspect, moisture, shade, local topographic features)).

(CONTINUED ON REVERSE)

If possible, provide plant population information: estimate abundance, density & patchiness; sketch boundaries of population on topo map or on reverse; assess health (e.g. evidence of reproduction, herbivory, disease, etc).

Please send specimen, label and form to: Welby Smith, MNDNR, 500 Lafayette Rd., Box 25, St. Paul, MN 55155-4001
Questions? Contact Welby Smith at 612/297-3733 or welby.smith@dnr.state.mn.us

Annotated Bibliography: Rare Plants

Argus, G.W., and D.J. White, eds. 1982. Atlas of the rare vascular plants of Ontario. National Museum of Natural Sciences, Ottawa.

Rare sedges, lilies, and orchids in this first volume.

Range and distribution maps, habitat, and status.

Includes extensive reference section.

Coffin, B., and L. Pfannmuller, eds. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis.

Species profiles and line drawings for species listed as endangered, threatened, or special concern in the state in 1984.

Fertig, W., Refsdal, C., and J. Whipple. 1994. Wyoming rare plant field guide. Wyoming Rare Plant Technical Committee, Cheyenne.

Description, line drawing, and color photograph for each species. Includes state, USFS, BLM, and NPS lists; reference section; definitions of ranks; and list of species by habitat.

Goldsmith, F.B., ed. 1991. Monitoring for conservation and ecology. Chapman and Hall, London.

Includes chapters on plant population monitoring, remote sensing techniques for monitoring land cover, and vegetation monitoring.

Morse, L.E., and M.S. Henifin, eds. 1981. Rare plant conservation: geographical data organization. The New York Botanical Garden, Bronx, New York.

Includes sections on information needs and priorities, information sources (including the literature, specimen labels, and volunteers), and examples of projects.

Appendices include guidelines for conducting field work and preparing status reports on rare species; policies of USFS, BLM, and NPS relating to rare species; and a review of the Endangered Species Act of 1973.

White, D.J., and K.L. Johnson. 1980. The rare vascular plants of Manitoba. National Museum of Natural Sciences, Ottawa.

Overview of rare plant distribution in province, list of rare plants, and distribution maps. Extensive reference section.

Wisconsin Department of Natural Resources. 1993. Guide to Wisconsin's endangered and threatened plants. Publication PUBL-ER-0667, Bureau of Endangered Resources.

Habitat information and state distribution map for the 118 threatened or endangered plants of Wisconsin. Organized by habitat. Some line drawings. Includes list of rare plants occurring in each county.

7. County Flora

<i>Introduction, Methods and Results</i>	7.1.1	<i>Annotated bibliography: plant collection and identification, including keys to Minnesota groups</i>	7.4.1
<i>Checklist of County Plants</i>	7.2.1		
<i>Plant collection and identification guidelines (Natural Heritage and Nongame Research Program, MNDNR)</i>	7.3.1		

Introduction

Flora

The floristic composition of an area refers to the plant species present, without regard to distribution or abundance. A list of species present in a given area is sometimes called a flora.

The list of plants present is an important prerequisite to the study of an ecosystem; the presence or absence of a species for which tolerances and requirements are known can give important information about an area. In addition, the accumulated presence-absence information contributes to a better understanding of plant geography.

The recently published book, Vascular Plants of Minnesota: A Checklist and Atlas (G. Ownbey and T. Morley; 1991; University of Minnesota Press, Minneapolis), includes a list of plants collected in the state (a state flora) and species distribution maps that show the locations of plant collections throughout the state. A list of plant species collected in each Minnesota county is available from the Natural Heritage and Nongame Research Program of the Minnesota Department of Natural Resources and from the herbarium of the University of Minnesota.

Information about the University of Minnesota Herbarium (in the Department of Plant Biology) is available via the internet (<http://www.biosci.cbs.umn.edu/herbarium/>). Access to the herbarium database, which includes label information for each collection, requires the use of a password. This password may be obtained by contacting herbarium curator Dr. Anita Cholewa at 612-625-0215.

Plant Names

Each plant has a unique, unambiguous Latin or Latinized scientific name (genus and species)*. A plant may have more than one common name, however, and a given common name may refer to several species of plants. There are no "official" common names for plants.

Many people are unfamiliar with the scientific names of plants. Therefore, to make the following list of plants collected in the county (the county flora) more meaningful to users, a common name is given for each species. In some cases, no common name was available in literature and we resorted to translating the scientific name into English.

Methods

MCBS botanists and plant ecologists focused plant searches on rare plants. However, plants encountered during the course of our work here but not yet recorded from the county were also collected and voucher specimens submitted to the herbarium of the University of Minnesota. See *Techniques for Collecting and Preserving Vascular Plant Specimens* later in this chapter for a description of collecting techniques.

Results

During the Survey of Cass County, 1323 voucher specimens from the county were deposited in the herbarium of the University of Minnesota by MCBS botanists and plant ecologists. MCBS botanists and other DNR staff, as well as staff from other agencies, including the Chippewa National Forest and Leech Lake Reservation Division of Resources Management, collected 336 plant species that hadn't been found previously in the county.

The checklist found in this chapter lists all vascular plant species found in Minnesota, and columns indicate which plants have been collected in Cass or adjacent counties. To date, 872 of Minnesota's 2024 vascular plant species have been collected in Cass County.

* The scientific name may change from time to time as specialists dispute the authenticity or appropriateness of one name over another.

Checklist of County Plants

Listed by scientific name. Includes information on collection status of plants in surrounding counties.

Minnesota Vascular Plants County Checklist

June 1, 1998

The following is a list of counties included in this checklist and the abbreviations used for them:

<u>Abbr.</u>		<u>County Name</u>
Ait	=	AITKIN
Bel	=	BELTRAMI
CrW	=	CROW WING
Hub	=	HUBBARD
Ita	=	ITASCA
Mor	=	MORRISON
Tod	=	TODD
Wad	=	WADENA
Cass	=	CASS

Minnesota Legal Status Codes and Definitions (as of 7/1/1996):

END = Endangered	NON = no status, but tracked
THR = Threatened	blank = no status, not tracked
SPC = Special Concern	

Map Number is from Ownbey G.B. and Morley, T. 1991. *Vascular Plants of Minnesota: a checklist and atlas*. University of Minnesota Press Minneapolis.

Map number = 9000 indicates that species was discovered in the state since publication.

* = Non-native species

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
THR	104		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Abies balsamea</i>	Balsam fir
	1295	*											<i>Abutilon theophrasti</i>	Velvet-leaf
	849												<i>Acalypha rhomboidea</i>	Three-seeded mercury
	114		Ait	Bel	CrW		Ita	Mor	Tod	Cass	Cass		<i>Acer negundo</i>	Box elder
	115										Cass		<i>Acer nigrum</i>	Black maple
	116		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Acer rubrum</i>	Red maple
	117		Ait	Bel	CrW		Ita	Mor	Tod		Cass		<i>Acer saccharinum</i>	Silver maple
	118		Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Acer saccharum</i>	Sugar maple
	119		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Acer spicatum</i>	Mountain maple
	327		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Achillea millefolium</i>	Yarrow
NON	328	*					Ita				Cass		<i>Achillea ptarmica</i>	Sneezeweed
	329												<i>Achillea sibirica</i>	Siberian yarrow
	154		Ait		CrW		Ita	Mor	Tod	Wad	Cass		<i>Acorus calamus</i>	Sweet flag
	1525												<i>Actaea pachypoda</i>	White baneberry
	1526		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Actaea rubra</i>	Red baneberry
	48		Ait	Bel	CrW		Ita	Mor			Cass		<i>Adiantum pedatum</i>	Maidenhair fern
	869												<i>Adlumia fungosa</i>	Allegheny-vine
	120												<i>Adoxa moschatellina</i>	Moschatel
	1739												<i>Agalinis aspera</i>	Rough gerardia
	1740												<i>Agalinis auriculata</i>	Eared gerardia
SPC	1741												<i>Agalinis gattereri</i>	Round-stemmed gerardia
	1742			Bel			Ita	Mor			Cass		<i>Agalinis paupercula</i>	Poor gerardia
	1743												<i>Agalinis purpurea</i>	Purple gerardia
	1774		Ait					Mor					<i>Agalinis tenuifolia</i>	Slender-leaved gerardia
	1132		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Agastache foeniculum</i>	Blue giant-hyssop
	1133												<i>Agastache nepetoides</i>	Yellow giant-hyssop
	1134												<i>Agastache scrophulariaefolia</i>	Purple giant-hyssop
	330			Bel		Hub	Ita						<i>Agoseris glauca</i>	False dandelion
	1575		Ait	Bel	CrW	Hub		Mor			Cass		<i>Agrimonia gryposepala</i>	Stickweed
	1576		Ait		CrW		Ita		Tod		Cass		<i>Agrimonia striata</i>	Roadside agrimony
NON	890												<i>Agrohordeum X macounii</i>	Macoun's barley
	891					Hub	Ita			Wad			<i>Agropyron pectiniforme</i>	Crested wheatgrass
	892	*	Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Agropyron repens</i>	Quack grass
	893				CrW								<i>Agropyron smithii</i>	Western wheatgrass
	894		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Agropyron trachycaulum</i>	Slender wheatgrass
	258	*		Bel							Cass		<i>Agrostemma githago</i>	Purple cockle
	895												<i>Agrostis geminata</i>	Twin bent-grass
	896		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Agrostis hyemalis</i>	Ticklegrass
	897				CrW			Mor			Cass		<i>Agrostis perennans</i>	Autumn bentgrass
	898		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Agrostis scabra</i>	Rough bent-grass
SPC	899	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad			<i>Agrostis stolonifera var. major</i>	Redtop
	900												<i>Agrostis stolonifera var. palustris</i>	Redtop
	122		Ait		CrW	Hub					Cass		<i>Alisma gramineum</i>	Narrow-leaf water-plantain
	123		Ait	Bel			Ita	Mor			Cass		<i>Alisma subcordatum</i>	Heart-leaved water-plantain
	124		Ait	Bel	CrW		Ita	Mor	Tod		Cass		<i>Alisma triviale</i>	Ordinary water-plantain
	9000	*									Cass		<i>Alliaria petiolata</i>	Garlic-mustard
	1246		Ait						Tod				<i>Allium burdickii</i>	Burdick's leek
	1247						Ita						<i>Allium canadense</i>	Wild garlic
	1248												<i>Allium cernuum</i>	Nodding wild onion
	1249	*				Hub							<i>Allium schoenoprasum var. sibiricum</i>	Chives
THR	1250			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Allium stellatum</i>	Prairie wild onion
	1251												<i>Allium textile</i>	White wild onion
	1252		Ait	Bel	CrW		Ita	Mor			Cass		<i>Allium tricoccum</i>	Wild leek
	184		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Alnus incana ssp. rugosa</i>	Speckled alder
	185					Hub	Ita		Tod		Cass		<i>Alnus viridis ssp. crispa</i>	Green alder
	901		Ait	Bel	CrW		Ita	Mor	Tod		Cass		<i>Alopecurus aequalis</i>	Short-awn foxtail
	902												<i>Alopecurus carolinianus</i>	Carolina foxtail
	903	*											<i>Alopecurus pratensis</i>	Meadow foxtail
	132	*				Hub	Ita	Mor					<i>Amaranthus albus</i>	Tumbleweed
	133	*	Ait					Mor					<i>Amaranthus blitoides</i>	Prostrate pigweed
NON	134	*											<i>Amaranthus hybridus</i>	Smooth pigweed
	135	*			CrW								<i>Amaranthus powellii</i>	Powell's amaranth

MN	Map	N	COUNTY									Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		
THR	136	*			CrW		Ita					<i>Amaranthus retroflexus</i>	Redroot
	137		Ait		CrW							<i>Amaranthus tamariscinus</i>	Tamarisk water-hemp
	138		Ait	Bel		Hub		Mor			Cass	<i>Amaranthus tuberculatus</i>	Tall water-hemp
	331				CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Ambrosia artemisiifolia</i>	Common ragweed
	332						Ita	Mor				<i>Ambrosia coronopifolia</i>	Western ragweed
	333			Bel			Ita					<i>Ambrosia trifida</i>	Great ragweed
	1577				CrW			Mor	Tod			<i>Amelanchier alnifolia</i>	Saskatoon
	1578											<i>Amelanchier arborea</i>	Downy serviceberry
	1579						Ita					<i>Amelanchier bartramiana</i>	Northern juneberry
	1580		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Amelanchier humilis</i>	Low juneberry
	1581		Ait				Ita				Cass	<i>Amelanchier huronensis</i>	Huron juneberry
	1582			Bel	CrW	Hub	Ita				Cass	<i>Amelanchier interior</i>	Inland juneberry
	1583				CrW	Hub		Mor			Cass	<i>Amelanchier intermedia</i>	Intermediate juneberry
	1584		Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Amelanchier laevis</i>	Smooth juneberry
	1585						Ita					<i>Amelanchier mucronata</i>	Needle-tipped juneberry
	1586		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Amelanchier sanguinea</i>	Round-leaved juneberry
	1587											<i>Amelanchier stolonifera</i>	Creeping juneberry
	1588										Cass	<i>Amelanchier wiegandii</i>	Wiegand's juneberry
	1350			Bel		Hub					Cass	<i>Amerorchis rotundifolia</i>	Round-leaved orchis
	1289											<i>Ammannia coccinea</i>	Ammannia
	904											<i>Ammophila breviligulata</i>	Beach-grass
	1164			Bel	CrW	Hub		Mor	Tod	Wad	Cass	<i>Amorpha canescens</i>	Lead-plant
	1165							Mor			Cass	<i>Amorpha fruticosa</i>	False indigo
	1166				CrW				Tod			<i>Amorpha nana</i>	Fragrant false indigo
	1167		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass	<i>Amphicarpaea bracteata</i>	Hog-peanut
	334		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Anaphalis margaritacea</i>	Pearly everlasting
	832		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Andromeda glaucophylla</i>	Bog-rosemary
	905			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Andropogon gerardii</i>	Big bluestem
	906											<i>Andropogon hallii</i>	Sand bluestem
	SPC	1501						Mor					<i>Androsace occidentalis</i>
1502												<i>Androsace septentrionalis</i> ssp. <i>puberulent</i>	Northern androsace
1527			Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Anemone canadensis</i>	Canada anemone
NON	1528											<i>Anemone caroliniana</i>	Thimbleweed
	1529		Ait		CrW	Hub		Mor	Tod	Wad	Cass	<i>Anemone cylindrica</i>	Long-headed thimbleweed
	1530											<i>Anemone multifida</i>	Cut-leaved anemone
	1531		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Anemone quinquefolia</i> var. <i>bifolia</i>	Wood-anemone
	1532		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Anemone riparia</i>	Tall thimbleweed
	1533		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Anemone virginiana</i>	Virginia thimbleweed
	1534		Ait									<i>Anemonella thalictroides</i>	Rue-anemone
	1811										Cass	<i>Angelica atropurpurea</i> var. <i>occidentalis</i>	Angelica
	335											<i>Antennaria microphylla</i>	Tiny-leaved pussytoes
	336		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Antennaria neglecta</i>	Field pussytoes
SPC	337		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Antennaria neodioica</i>	Variable pussytoes
	338					Hub	Ita	Mor	Tod			<i>Antennaria parlinii</i>	Parlin's pussytoes
	339											<i>Antennaria parvifolia</i>	Small-leaved pussytoes
	340				CrW	Hub	Ita	Mor	Tod		Cass	<i>Antennaria plantaginifolia</i>	Plantain-leaved pussytoes
	341	*					Ita	Mor				<i>Anthemis cotula</i>	Dog-fennel
	342	*			CrW							<i>Anthemis tinctoria</i>	Golden marquerite
	1168			Bel	CrW				Tod			<i>Apios americana</i>	Groundnut
	1351											<i>Aplectrum hyemale</i>	Putty-root
	148		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Apocynum androsaemifolium</i>	Spreading dogbane
	149		Ait	Bel	CrW	Hub						<i>Apocynum cannabinum</i>	American hemp
THR	150							Mor				<i>Apocynum medium</i>	Intermediate dogbane
	151		Ait		CrW		Ita	Mor	Tod		Cass	<i>Apocynum sibiricum</i>	Clasping dogbane
	1535		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Aquilegia canadensis</i>	Columbine
	554											<i>Arabis canadensis</i>	Sicklepod
	555		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Arabis divaricarpa</i>	Spreading rock-cress
	556					Hub					Cass	<i>Arabis drummondii</i>	Drummond's rock-cress
	557			Bel	CrW	Hub		Mor		Wad		<i>Arabis glabra</i>	Tower mustard
	558		Ait		CrW	Hub		Mor				<i>Arabis hirsuta</i>	Hairy rock-cress
	559											<i>Arabis holboellii</i> var. <i>retrofracta</i>	Holboell's rock-cress
	560				CrW				Tod		Cass	<i>Arabis laevigata</i>	Smooth rock-cress

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
SPC	561				CrW		Ita	Mor	Tod	Wad	Cass	<i>Arabis lyrata</i>	Lyre-leaved rock-cress	
	562											<i>Arabis perstellata</i> var. <i>shortii</i>	Stellate rock-cress	
	159		Ait	Bel			Ita				Cass	<i>Aralia hispida</i>	Bristly sarsaparilla	
	160		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Aralia nudicaulis</i>	Wild sarsaparilla	
	161		Ait	Bel	CrW		Ita	Mor	Tod		Cass	<i>Aralia racemosa</i>	American spikenard	
	1288		Ait	Bel		Hub	Ita					<i>Arceuthobium pusillum</i>	Dwarf mistletoe	
	343	*	Ait		CrW	Hub	Ita		Tod		Cass	<i>Arctium minus</i>	Common burdock	
	344	*										<i>Arctium tomentosum</i>	Hairy burdock	
	833		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Arctostaphylos uva-ursi</i>	Bearberry	
	259											<i>Arenaria dawsonensis</i>	Rock sandwort	
THR	260		Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Arenaria lateriflora</i>	Side-flowering sandwort	
	261											<i>Arenaria macrophylla</i>	Large-leaved sandwort	
NON	1352		Ait	Bel			Ita				Cass	<i>Arethusa bulbosa</i>	Dragon's-mouth	
	155											<i>Arisaema dracontium</i>	Green dragon	
SPC	156		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	
	907				CrW			Mor				<i>Aristida basiramea</i>	Base-branched three-awn	
	908											<i>Aristida dichotoma</i> var. <i>curtissii</i>	Church-mouse three-awn	
	909											<i>Aristida oligantha</i>	Prairie three-awn	
	910											<i>Aristida purpurea</i> var. <i>longiseta</i>	Red three-awn	
THR	911											<i>Aristida tuberculosa</i>	Sea-beach needle-grass	
	563	*			CrW							<i>Armoracia rusticana</i>	Horse-radish	
SPC	345											<i>Arnica lonchophylla</i>	Arnica	
	1589		Ait	Bel			Ita		Tod		Cass	<i>Aronia melanocarpa</i>	Black chokeberry	
	912	*										<i>Arrhenatherum elatius</i>	Oat-grass	
	346	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad		<i>Artemisia absinthium</i>	Absinthe wormwood	
	347	*			CrW		Ita					<i>Artemisia biennis</i>	Biennial wormwood	
	348		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Artemisia campestris</i>	Tall wormwood	
	349											<i>Artemisia dracunculus</i>	Estragon	
	350				CrW			Mor			Cass	<i>Artemisia frigida</i>	Prairie sagewort	
	351				CrW	Hub	Ita	Mor		Wad	Cass	<i>Artemisia ludoviciana</i>	Western mugwort	
	352		Ait					Mor			Cass	<i>Artemisia serrata</i>	Leafy mugwort	
THR	164		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Asarum canadense</i>	Wild ginger	
	165											<i>Asclepias amplexicaulis</i>	Blunt-leaved milkweed	
END	166		Ait		CrW			Mor	Tod		Cass	<i>Asclepias exaltata</i>	Poke milkweed	
	167											<i>Asclepias hirtella</i>	Prairie milkweed	
	168		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Asclepias incarnata</i>	Swamp milkweed	
	169								Tod			<i>Asclepias lanuginosa</i>	Woolly milkweed	
	170			Bel	CrW	Hub		Mor	Tod	Wad	Cass	<i>Asclepias ovalifolia</i>	Oval-leaved milkweed	
THR	171				CrW		Ita	Mor			Cass	<i>Asclepias speciosa</i>	Showy milkweed	
	172											<i>Asclepias stenophylla</i>	Narrow-leaved milkweed	
SPC	173				CrW							<i>Asclepias sullivantii</i>	Sullivant's milkweed	
	174		Ait		CrW		Ita	Mor	Tod	Wad	Cass	<i>Asclepias syriaca</i>	Common milkweed	
	175				CrW			Mor			Cass	<i>Asclepias tuberosa</i>	Butterfly-weed	
	176											<i>Asclepias verticillata</i>	Whorled milkweed	
	177							Mor				<i>Asclepias viridiflora</i>	Green milkweed	
	1253	*	Ait		CrW	Hub	Ita	Mor			Cass	<i>Asparagus officinalis</i>	Asparagus	
	49											<i>Asplenium platyneuron</i>	Ebony spleenwort	
	50											<i>Asplenium trichomanes</i>	Maidenhair spleenwort	
	353		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Aster borealis</i>	Bog aster	
	354				CrW							<i>Aster brachyactis</i>	Short-rayed aster	
THR	355		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Aster ciliolatus</i>	Lindley's aster	
	356											<i>Aster cordifolius</i>	Heart-leaved aster	
	358											<i>Aster drummondii</i>	Drummond's aster	
	359					Hub		Mor	Tod		Cass	<i>Aster ericoides</i>	Heath aster	
	360											<i>Aster falcatus</i> ssp. <i>commutatus</i>	Sickle-shaped aster	
	361		Ait		CrW		Ita				Cass	<i>Aster hesperius</i>	Panicked aster	
	362			Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Aster laevis</i>	Smooth aster	
	363		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Aster lanceolatus</i>	Panicked aster	
	364		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Aster lateriflorus</i>	Side-flowering aster	
	365											<i>Aster X longulus</i>	Long aster	
366		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Aster macrophyllus</i>	Large-leaved aster		
367											<i>Aster modestus</i>	Modest aster		

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
NON	368							Mor					<i>Aster novae-angliae</i>	New England aster
	369												<i>Aster oblongifolius</i>	Aromatic aster
	370				CrW			Mor			Cass		<i>Aster ontarionis</i>	Ontario aster
	371				CrW	Hub		Mor		Wad	Cass		<i>Aster oolentangiensis</i>	Sky-blue aster
	372												<i>Aster pilosus</i>	Awl aster
	373												<i>Aster prenanthoides</i>	Crooked-stemmed aster
	374			Bel	CrW		Ita						<i>Aster puniceus ssp. firmus</i>	Red-stemmed aster
	375			Bel	CrW	Hub	Ita	Mor			Cass		<i>Aster puniceus ssp. puniceus</i>	Red-stemmed aster
	376					Hub		Mor	Tod		Cass		<i>Aster sericeus</i>	Silky aster
	377												<i>Aster shortii</i>	Short's aster
THR	378		Ait	Bel		Hub	Ita	Mor	Tod	Wad	Cass		<i>Aster umbellatus</i>	Flat-topped aster
	357				CrW			Mor	Tod	Wad	Cass		<i>Aster urophyllus</i>	Tail-leaved aster
	1169												<i>Astragalus adsurgens var. robustior</i>	Standing milk-vetch
END	1170					Hub							<i>Astragalus agrestis</i>	Field milk-vetch
	9000												<i>Astragalus alpinus</i>	Alpine milk-vetch
	1171		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Astragalus canadensis</i>	Canada milk-vetch
SPC	1172												<i>Astragalus crassicaupus</i>	Buffalo-bean
	1173												<i>Astragalus flexuosus</i>	Slender milk-vetch
	1174												<i>Astragalus lotiflorus</i>	Lotus milk-vetch
NON	1175												<i>Astragalus missouriensis</i>	Missouri milk-vetch
NON	1176			Bel									<i>Astragalus neglectus</i>	Cooper's milk-vetch
NON	1177												<i>Astragalus racemosus</i>	Racemose milk-vetch
NON	1178												<i>Astragalus tenellus</i>	Loose-flowered milk-vetch
THR	51		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Athyrium angustum</i>	Lady-fern
	52												<i>Athyrium pycnocarpon</i>	Narrow-leaved spleenwort
	53												<i>Athyrium thelypteroides</i>	Silvery spleenwort
NON	297												<i>Atriplex patula</i>	Spearscale
	1745												<i>Aureolaria grandiflora var. pulchra</i>	Large-flowered false foxglove
	1746												<i>Aureolaria pedicularia</i>	Fernleaf false foxglove
NON	913	*		Bel			Ita				Cass		<i>Avena fatua</i>	Wild oats
	914	*			CrW								<i>Avena sativa</i>	Cultivated oats
	298	*											<i>Axyris amaranthoides</i>	Russian pigweed
SPC	97												<i>Azolla mexicana</i>	Mosquito-fern
	1747												<i>Bacopa rotundifolia</i>	Water-hyssop
	1179												<i>Baptisia alba var. macrophylla</i>	White wild indigo
SPC	1180												<i>Baptisia bracteata var. glabrescens</i>	Plains wild indigo
END	564										Cass		<i>Barbarea orthoceras</i>	Winter-cress
	565	*		Bel	CrW		Ita	Mor	Tod		Cass		<i>Barbarea vulgaris</i>	Yellow rocket
	875												<i>Bartonia virginica</i>	Yellow bartonia
THR	915			Bel	CrW					Wad			<i>Beckmannia syzigachne var. baicalensis</i>	American slough-grass
	379	*											<i>Bellis perennis</i>	European daisy
	180	*											<i>Berberis thunbergii</i>	Japanese barberry
NON	566	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Berteroa incana</i>	Hoary alyssum
	1812												<i>Berula pusilla</i>	Stream-parsnip
	1748							Mor					<i>Besseyia bullii</i>	Kitten-tails
NON	186		Ait		CrW		Ita	Mor	Tod		Cass		<i>Betula alleghaniensis</i>	Yellow birch
	187												<i>Betula cordifolia</i>	Heart-leaved birch
	188		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Betula glandulifera</i>	Bog-birch
NON	189												<i>Betula nigra</i>	River-birch
	190		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Betula papyrifera</i>	Paper-birch
	191												<i>Betula X purpusii</i>	Purpus' birch
NON	192												<i>Betula X rosendahlil</i>	Rosendahl's birch
	193		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Betula X sandbergii</i>	Sandberg's birch
	380		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Bidens cernua</i>	Nodding bur-marigold
NON	381				CrW			Mor			Cass		<i>Bidens comosa</i>	Tufted begar-ticks
	382	*	Ait	Bel	CrW	Hub	Ita						<i>Bidens connata</i>	Swamp beggar-ticks
	383												<i>Bidens coronata</i>	Northern tickseed
NON	384		Ait										<i>Bidens discoidea</i>	Discoid beggar-ticks
	385		Ait		CrW		Ita	Mor	Tod		Cass		<i>Bidens frondosa</i>	Leafy beggar-ticks
	386				CrW		Ita	Mor	Tod				<i>Bidens vulgata</i>	Common beggar-ticks
NON	1135												<i>Blephilia hirsuta</i>	Wood-mint
	1839							Mor			Cass		<i>Boehmeria cylindrica</i>	False nettle

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
SPC	387												<i>Boltonia asteroides</i> var. <i>recognita</i>	Boltonia
	33												<i>Botrychium campestre</i>	Prairie moonwort
	34		Ait		CrW				Tod		Cass		<i>Botrychium dissectum</i>	Dissected grapefern
THR	35		Ait		CrW								<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>	Lance-leaved grapefern
	36												<i>Botrychium lunaria</i>	Common moonwort
SPC	37		Ait	Bel	CrW		Ita				Cass		<i>Botrychium matricariifolium</i>	Matricary grapefern
	38										Cass		<i>Botrychium minganense</i>	Mingan moonwort
END	39		Ait	Bel			Ita				Cass		<i>Botrychium mormo</i>	Goblin fern
	40		Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Botrychium multifidum</i>	Leathery grapefern
END	9000		Ait								Cass		<i>Botrychium oneidense</i>	Blunt-lobed grapefern
THR	9000												<i>Botrychium pallidum</i>	Pale moonwort
	41		Ait								Cass		<i>Botrychium rugulosum</i>	St. Lawrence grapefern
SPC	42		Ait			Hub					Cass		<i>Botrychium simplex</i>	Small grapefern
	43		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Botrychium virginianum</i>	Rattlesnakefern
	916				CrW			Mor					<i>Bouteloua curtipendula</i>	Side-oats grama
	917				CrW			Mor					<i>Bouteloua gracilis</i>	Blue grama
	918				CrW			Mor					<i>Bouteloua hirsuta</i>	Hairy grama
	919		Ait		CrW		Ita	Mor	Tod				<i>Brachyelytrum erectum</i>	Bearded shorthusk
	1317		Ait	Bel	CrW		Ita	Mor			Cass		<i>Brasenia schreberi</i>	Water-shield
	567	*				Hub	Ita						<i>Brassica juncea</i>	Indian mustard
	568	*		Bel			Ita			Wad			<i>Brassica kaber</i>	Wild mustard
	569	*											<i>Brassica nigra</i>	Black mustard
	570	*					Ita	Mor					<i>Brassica rapa</i>	Field mustard
	920		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Bromus ciliatus</i>	Fringed brome
	921	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Bromus inermis</i>	Smooth brome
	922	*					Ita						<i>Bromus japonicus</i>	Japanese brome
	923			Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Bromus kalmii</i>	Kalm's brome
	924							Mor	Tod		Cass		<i>Bromus latiglumis</i>	Broad-glumed brome
	925				CrW								<i>Bromus pubescens</i>	Hairy brome
	926	*											<i>Bromus secalinus</i>	Rye brome
SPC	927	*				Hub		Mor	Tod		Cass		<i>Bromus tectorum</i>	Cheatgrass
	928												<i>Buchloe dactyloides</i>	Buffalo-grass
	606												<i>Bulbostylis capillaris</i>	Bulbostylis
	218	*											<i>Butomus umbellatus</i>	Flowering rush
NON	388												<i>Cacalia muhlenbergii</i>	Great Indian-plantain
	389												<i>Cacalia plantaginea</i>	Tuberous Indian-plantain
THR	390												<i>Cacalia suaveolens</i>	Sweet smelling Indian-plantain
END	929		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Calamagrostis canadensis</i>	Bluejoint
	930			Bel	CrW	Hub					Cass		<i>Calamagrostis inexpansa</i> var. <i>brevior</i>	Bog reed-grass
SPC	931												<i>Calamagrostis lacustris</i>	Marsh reed-grass
	932												<i>Calamagrostis montanensis</i>	Plains reed-grass
SPC	933			Bel							Cass		<i>Calamagrostis neglecta</i>	Narrow reed-grass
	934												<i>Calamagrostis purpurascens</i>	Purple reed-grass
	935			Bel	CrW			Mor					<i>Calamovilfa longifolia</i>	Sand reed-grass
	157		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Calla palustris</i>	Wild calla
SPC	222												<i>Callitriche hermaphroditica</i>	Autumn water-starwort
	223												<i>Callitriche heterophylla</i>	Diverse-leaved water-starwort
	224		Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Callitriche verna</i>	Spring water-starwort
	1353		Ait	Bel		Hub	Ita	Mor			Cass		<i>Calopogon tuberosus</i>	Grass-pink
END	1536						Ita						<i>Caltha natans</i>	Floating marsh-marigold
	1537		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Caltha palustris</i>	Swamp marsh-marigold
	1327					Hub		Mor	Tod				<i>Calypso bulbosa</i> var. <i>americana</i>	Toothed evening primrose
	1354		Ait	Bel							Cass		<i>Camelina bulbosa</i> var. <i>americana</i>	Fairy slipper
	571	*											<i>Camelina microcarpa</i>	Small-seeded false flax
	225												<i>Campanula americana</i>	Tall bellflower
	226		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Campanula aparinoides</i>	Marsh bellflower
	227	*	Ait				Ita				Cass		<i>Campanula rapunculoides</i>	European bellflower
	228		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Campanula rotundifolia</i>	Harebell
	54												<i>Camptosorus rhizophyllus</i>	Walking fern
	1304	*			CrW		Ita						<i>Cannabis sativa</i>	Marijuana
	572	*	Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Capsella bursa-pastoris</i>	Shepherd's purse
END	573			Bel	CrW	Hub		Mor		Wad	Cass		<i>Cardamine bulbosa</i>	Spring cress

MN	Map	N	COUNTY										Scientific Name	Common Name	
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass				
NON	574										Cass	<i>Cardamine parviflora</i> var. <i>arenicola</i>	Small-flowered bitter cress		
	575		Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Cardamine pensylvanica</i>	Pennsylvania bitter cress		
	576											<i>Cardamine pratensis</i> var. <i>palustris</i>	Cuckoo-flower		
	391	*							Tod	Wad		<i>Carduus acanthoides</i>	Plumeless thistle		
	392	*										<i>Carduus nutans</i>	Nodding thistle		
	607		Ait									<i>Carex abdita</i>	Hidden sedge		
	608					Hub	Ita				Cass	<i>Carex adusta</i>	Browned sedge		
	609						Ita					<i>Carex aenea</i>	Bronzy sedge		
	610											<i>Carex albursina</i>	White bear-sedge		
	611			Bel				Ita		Tod		Cass	<i>Carex alopecoidea</i>	Fox-tail sedge	
SPC	612										Cass	<i>Carex amphibola</i> var. <i>turgida</i>	Ambiguous sedge		
	613		Ait	Bel	CrW			Ita	Mor			<i>Carex angustior</i>	Slender sedge		
	614							Ita	Mor			<i>Carex annectens</i>	Connecting sedge		
	615		Ait	Bel			Hub		Mor		Cass	<i>Carex aquatilis</i>	Water sedge		
	616						Hub	Ita	Mor			<i>Carex arcta</i>	Northern clustered sedge		
	617		Ait	Bel	CrW			Ita			Cass	<i>Carex arctata</i>	Drooping wood-sedge		
	618		Ait	Bel				Ita	Mor		Cass	<i>Carex assiniboinensis</i>	Assiniboine sedge		
	619		Ait	Bel					Ita		Cass	<i>Carex atherodes</i>	Sugar-grass sedge		
	620		Ait	Bel			Hub	Ita	Mor		Cass	<i>Carex aurea</i>	Golden fruited sedge		
	621						Hub					<i>Carex backii</i>	Back's sedge		
NON	622		Ait	Bel	CrW	Hub		Ita	Mor	Tod	Wad	Cass	<i>Carex bebbii</i>	Bebb's sedge	
	623								Mor	Tod	Wad		<i>Carex bicknellii</i>	Bicknell's sedge	
	624		Ait						Mor	Tod		Cass	<i>Carex blanda</i>	Charming sedge	
	625		Ait		CrW				Ita	Mor	Wad	Cass	<i>Carex brevior</i>	Short sedge	
	626		Ait						Mor			Cass	<i>Carex bromoides</i>	Brome-like sedge	
	627		Ait	Bel	CrW	Hub		Ita	Mor	Tod	Wad	Cass	<i>Carex brunnescens</i> var. <i>sphaerostachya</i>	Brownish sedge	
	628		Ait	Bel				Hub	Mor	Tod		Cass	<i>Carex buxbaumii</i>	Buxbaum's sedge	
	629		Ait	Bel	CrW	Hub		Ita	Mor	Tod		Cass	<i>Carex canescens</i>	Silvery sedge	
	630			Bel				Hub					<i>Carex capillaris</i> var. <i>major</i>	Hair-like sedge	
	9000												<i>Carex careyana</i>	Carey's sedge	
THR	631			Bel									<i>Carex castanea</i>	Chestnut-colored sedge	
	632		Ait	Bel					Ita	Mor		Cass	<i>Carex cephalantha</i>	Bunched sedge	
	633		Ait										<i>Carex cephaloidea</i>	Thin-leaf sedge	
	634												<i>Carex cephalophora</i>	Oval-headed sedge	
	635		Ait	Bel	CrW	Hub			Ita	Mor		Cass	<i>Carex chordorrhiza</i>	Creeping sedge	
	636								Ita			Cass	<i>Carex communis</i>	Colonial sedge	
	637		Ait	Bel	CrW	Hub			Ita	Mor	Tod	Cass	<i>Carex comosa</i>	Bristly sedge	
	638												<i>Carex conjuncta</i>	Joined sedge	
	639								Mor	Tod			<i>Carex conoidea</i>	Field sedge	
	640		Ait		CrW				Mor	Tod		Cass	<i>Carex convoluta</i>	Rolled-up sedge	
SPC	641												<i>Carex crawei</i>	Crawe's sedge	
	642		Ait		CrW	Hub			Ita	Mor	Tod	Cass	<i>Carex crawfordii</i>	Crawford's sedge	
	643		Ait						Ita	Mor			<i>Carex crinita</i>	Fringe sedge	
	644			Bel						Ita	Mor	Tod	Cass	<i>Carex cristatella</i>	Crested sedge
	645												<i>Carex crus-corvi</i>	Crow-spur sedge	
	646			Bel				Hub				Cass	<i>Carex cryptolepis</i>	Secretive sedge	
	647												<i>Carex davisii</i>	Davis' sedge	
	648								Ita				<i>Carex debilis</i> var. <i>rudgei</i>	Weak sedge	
	649		Ait	Bel									<i>Carex deflexa</i>	Northern sedge	
	650		Ait	Bel	CrW	Hub			Ita	Mor	Tod	Wad	Cass	<i>Carex deweyana</i>	Dewey's sedge
SPC	651		Ait	Bel	CrW	Hub			Ita	Mor		Cass	<i>Carex diandra</i>	Lesser-panicled sedge	
	652		Ait	Bel	CrW	Hub			Ita	Mor	Tod	Wad	Cass	<i>Carex disperma</i>	Soft-leaved sedge
	653												<i>Carex eburnea</i>	Ivory sedge	
	654							Hub		Mor		Cass	<i>Carex eleocharis</i>	Nerveless sedge	
	655				CrW					Ita		Tod		<i>Carex emoryi</i>	Emory's sedge
	656			Bel									<i>Carex exilis</i>	Meager sedge	
	657												<i>Carex festucacea</i>	Fescue-like sedge	
	658												<i>Carex filifolia</i>	Thread-leaf sedge	
	659												<i>Carex flava</i>	Yellow sedge	
	660		Ait	Bel	CrW	Hub			Ita	Mor	Tod	Wad	Cass	<i>Carex foenea</i>	Hay sedge
END	661												<i>Carex formosa</i>	Handsome sedge	
THR	662												<i>Carex garberi</i>	Garber's sedge	

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
NON	663		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex gracillima</i>	Graceful sedge
	664			Bel		Hub			Tod				<i>Carex granularis</i> var. <i>haleana</i>	Granular sedge
	665		Ait										<i>Carex gravida</i>	Heavy sedge
	666												<i>Carex grayi</i>	Gray's sedge
	667												<i>Carex gynandra</i>	Nodding sedge
SPC	668			Bel		Hub	Ita			Wad	Cass		<i>Carex gynocrates</i>	Feminine sedge
	669												<i>Carex hallii</i>	Hall's sedge
	670		Ait		CrW			Mor					<i>Carex haydenii</i>	Hayden's sedge
	671		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex heliophila</i>	Sunshine sedge
	672							Mor					<i>Carex hirtifolia</i>	Hairy-leaved sedge
THR	673												<i>Carex hitchcockiana</i>	Hitchcock's sedge
	674					Hub	Ita						<i>Carex houghtoniana</i>	Houghton's sedge
	675		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Carex hystericina</i>	Porcupine sedge
	676		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex interior</i>	Inland sedge
	677		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Carex intumescens</i> var. <i>fernaldii</i>	Bladder sedge
THR	678												<i>Carex jamesii</i>	James' sedge
	679												<i>Carex katahdinensis</i>	Katahdin sedge
	9000												<i>Carex X knieskemii</i>	Knieskern's sedge
	680		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Carex lacustris</i>	Lake-sedge
	681				CrW			Mor					<i>Carex laeviconica</i>	Smooth-cone sedge
THR	682												<i>Carex laevivaginata</i>	Smooth-sheathed sedge
	683		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Carex lanuginosa</i>	Woolly sedge
	684		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Carex lasiocarpa</i> var. <i>americana</i>	Wire-sedge
	685												<i>Carex laxiculmis</i> var. <i>copulata</i>	Loose-culmed sedge
	686												<i>Carex lenticularis</i>	Lenticular sedge
NON	687		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex leptalea</i>	Bristle-stalked sedge
	688		Ait		CrW		Ita	Mor			Cass		<i>Carex leptoneuria</i>	Fine-nerved sedge
	689		Ait	Bel		Hub	Ita				Cass		<i>Carex limosa</i>	Candle-lantern sedge
	690			Bel									<i>Carex livida</i> var. <i>radiculis</i>	Lead-colored sedge
	691		Ait	Bel			Ita	Mor			Cass		<i>Carex lupulina</i>	Hop-sedge
NON	692												<i>Carex lurida</i>	Sallow sedge
	693												<i>Carex meadii</i>	Mead's sedge
	694												<i>Carex media</i>	Intermediate sedge
	695						Ita				Cass		<i>Carex merritt-fernaldii</i>	Fernald's sedge
	696												<i>Carex michauxiana</i>	Michaux's sedge
NON	697										Cass		<i>Carex molesta</i>	Troublesome sedge
	698										Cass		<i>Carex muhlenbergii</i>	Muhlenberg's sedge
	699							Mor	Tod				<i>Carex muskingumensis</i>	Muskingum sedge
	700		Ait					Mor			Cass		<i>Carex normalis</i>	Right-angle sedge
	701							Mor					<i>Carex obtusata</i>	Obtuse sedge
NON	702												<i>Carex oligocarpa</i>	Few-fruited sedge
	703		Ait	Bel	CrW		Ita				Cass		<i>Carex oligosperma</i>	Few-seeded sedge
	704						Ita						<i>Carex ormostachya</i>	Necklace-sedge
	705												<i>Carex pallescens</i> var. <i>neogaea</i>	Pale sedge
	706		Ait	Bel			Ita	Mor			Cass		<i>Carex pauciflora</i>	Few-flowered sedge
END	707		Ait	Bel		Hub	Ita	Mor		Wad	Cass		<i>Carex paupercula</i>	Poor sedge
	708		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Carex peckii</i>	Peck's sedge
	709		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex pedunculata</i>	Long-stalked sedge
	710		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex pennsylvanica</i>	Pennsylvania sedge
	711								Tod				<i>Carex plantaginea</i>	Plantain-leaved sedge
SPC	712				CrW								<i>Carex praegracilis</i>	Very-slender sedge
	713		Ait	Bel		Hub	Ita	Mor		Wad	Cass		<i>Carex prairiea</i>	Prairie sedge
	714												<i>Carex praticola</i>	Prairie-dweller sedge
	715		Ait	Bel		Hub	Ita	Mor			Cass		<i>Carex projecta</i>	Projecting sedge
	716		Ait	Bel	CrW		Ita	Mor			Cass		<i>Carex pseudocyperus</i>	Cyperus-like sedge
NON	717		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex retrorsa</i>	Retorse sedge
	718				CrW	Hub	Ita				Cass		<i>Carex richardsonii</i>	Richardson's sedge
	719		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Carex rosea</i>	Stellate sedge
	720												<i>Carex rossii</i>	Ross' sedge
	721		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex rostrata</i> var. <i>utriculata</i>	Beaked sedge
	722			Bel	CrW	Hub		Mor	Tod		Cass		<i>Carex sartwellii</i>	Sartwell's sedge
	723												<i>Carex saximontana</i>	Rocky Mountain sedge

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Alt	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
SPC	724												<i>Carex scirpiformis</i>	Scirpus-like sedge
	725		Ait		CrW	Hub	Ita	Mor	Tod		Cass		<i>Carex scoparia</i>	Pointed-broom sedge
	726												<i>Carex sparganioides</i>	Sparganium-like sedge
	727		Ait	Bel			Ita	Mor		Wad	Cass		<i>Carex sprengeii</i>	Sprengel's sedge
THR	728												<i>Carex sterilis</i>	Sterile sedge
	729		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Carex stipata</i>	Awl-fruited sedge
SPC	730		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex stricta</i>	Tussock-sedge
	731												<i>Carex supina</i> var. <i>spaniocarpa</i>	Weak arctic sedge
	732		Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Carex sychnocephala</i>	Many-headed sedge
	733		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Carex tenera</i>	Marsh-straw sedge
	734			Bel		Hub	Ita				Cass		<i>Carex tenuiflora</i>	Sparse-flowered sedge
	735			Bel				Mor	Tod				<i>Carex tetanica</i>	Wood-sedge
	736										Cass		<i>Carex tonsa</i>	Shaved sedge
	737									Wad			<i>Carex torreyi</i>	Torrey's sedge
SPC	738		Ait				Ita	Mor					<i>Carex tribuloides</i>	Blunt-broom sedge
	739												<i>Carex trichocarpa</i>	Hairy-fruited sedge
	740		Ait	Bel		Hub	Ita	Mor		Wad	Cass		<i>Carex trisperma</i>	Three-fruited sedge
	741		Ait		CrW		Ita	Mor			Cass		<i>Carex tuckermanii</i>	Tuckerman's sedge
	742												<i>Carex typhina</i>	Cattail-sedge
	743		Ait		CrW	Hub	Ita	Mor			Cass		<i>Carex umbellata</i>	Umbel sedge
	744			Bel		Hub	Ita				Cass		<i>Carex vaginata</i>	Sheathed sedge
	745				CrW	Hub	Ita	Mor	Tod		Cass		<i>Carex vesicaria</i>	Inflated sedge
	746			Bel	CrW		Ita				Cass		<i>Carex viridula</i>	Green sedge
	747		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Carex vulpinoidea</i>	Fox-sedge
SPC	748												<i>Carex woodii</i>	Wood's sedge
	749												<i>Carex xerantica</i>	Dry sedge
END	1813	*			CrW			Mor	Tod	Wad	Cass		<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	Blue beech
	1098		Ait		CrW		Ita						<i>Carya cordiformis</i>	Bitternut hickory
	1099												<i>Carya ovata</i>	Shagbark hickory
	1749		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Castilleja coccinea</i>	Indian paintbrush
	1750												<i>Castilleja septentrionalis</i>	Northern paintbrush
NON	1751												<i>Castilleja sessiliflora</i>	Downy paintbrush
	181		Ait	Bel		Hub	Ita	Mor	Tod		Cass		<i>Caulophyllum thalictroides</i>	Blue cohosh
	1570		Ait	Bel	CrW		Ita	Mor	Tod		Cass		<i>Ceanothus americanus</i>	American New Jersey tea
	1571			Bel	CrW	Hub	Ita			Wad	Cass		<i>Ceanothus herbaceus</i>	Oval-leaved New Jersey tea
	293		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Celastrus scandens</i>	Climbing bittersweet
	1806		Ait	Bel	CrW						Cass		<i>Celtis occidentalis</i>	Hackberry
	936		Ait	Bel	CrW			Mor			Cass		<i>Cenchrus longispinus</i>	Sandbur
	393	*		Bel		Hub		Mor	Tod		Cass		<i>Centaurea biebersteinii</i>	Spotted knapweed
	876	*											<i>Centaureum pulchellum</i>	Beautiful centauray
	1673												<i>Cephalanthus occidentalis</i>	Buttonbush
NON	262				CrW	Hub		Mor	Tod	Wad			<i>Cerastium arvense</i>	Field chickweed
	263												<i>Cerastium brachypodum</i>	Short-stalked chickweed
NON	264	*	Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Cerastium fontana</i>	Mouse-ear chickweed
	265		Ait	Bel					Tod		Cass		<i>Cerastium nutans</i>	Nodding chickweed
	295		Ait	Bel			Ita	Mor	Tod		Cass		<i>Ceratophyllum demersum</i>	Coontail
	296												<i>Ceratophyllum echinatum</i>	Hornwort
	1752	*											<i>Chaenorhinum minus</i>	Dwarf snapdragon
NON	1181												<i>Chamaecrista fasciculata</i>	Partridge-pea
	834		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Chamaedaphne calyculata</i> var. <i>angustifolia</i>	Leather-leaf
	1590												<i>Chamaerhodos nuttallii</i>	Little ground-rose
	1786		Ait	Bel	CrW		Ita			Wad	Cass		<i>Chamaesaracha grandiflora</i>	Dwarf ground-chervil
	394	*			CrW			Mor					<i>Chamomilla reculta</i>	Wild chamomile
END	395	*	Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Chamomilla suaveolens</i>	Pineapple-weed
	55								Tod				<i>Cheilanthes feei</i>	Slender lip-fern
	56												<i>Cheilanthes lanosa</i>	Hairy lip-fern
	1753		Ait	Bel	CrW			Mor			Cass		<i>Chelone glabra</i>	White turtlehead
	299	*		Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Chenopodium album</i>	White lamb's quarters
END	300		Ait	Bel		Hub	Ita			Wad	Cass		<i>Chenopodium capitatum</i>	Strawberry blite
	301			Bel				Mor		Wad	Cass		<i>Chenopodium desiccatum</i>	Narrow-leaved lamb's quarters
	302	*			CrW								<i>Chenopodium glaucum</i>	Oak-leaved goosefoot

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Alt	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
END	303										Cass	<i>Chenopodium rubrum</i>	Alkali-blite	
	304			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Chenopodium simplex</i>	Maple-leaved goosefoot	
	305				CrW							<i>Chenopodium standleyanum</i>	Woodland goosefoot	
	1515		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Chimaphila umbellata</i> var. <i>cisatlantica</i>	Pipsissewa	
	396	*	Ait		CrW	Hub	Ita	Mor			Cass	<i>Chrysanthemum leucanthemum</i>	Ox-eye daisy	
	1714		Ait									<i>Chrysosplenium americanum</i>	Water-mat	
	1715											<i>Chrysosplenium iowense</i>	Golden saxifrage	
	397	*	Ait									<i>Cichorium intybus</i>	Chicory	
	1814		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Cicuta bulbifera</i>	Bulb-bearing water-hemlock	
	1815		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Cicuta maculata</i>	Spotted water-hemlock	
	937											<i>Cinna arundinacea</i>	Stout woodreed	
	938		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Cinna latifolia</i>	Drooping woodreed	
	1328		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Circaea alpina</i>	Small enchanter's nightshade	
	1329		Ait	Bel	CrW		Ita	Mor	Tod		Cass	<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	Canada enchanter's nightshade	
	SPC	398				CrW					Wad	Cass	<i>Cirsium altissimum</i>	Tall thistle
399		*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Cirsium arvense</i>	Canada thistle	
400								Mor	Tod	Wad	Cass	<i>Cirsium discolor</i>	Field thistle	
401						Hub		Mor			Cass	<i>Cirsium flodmani</i>	Prairie thistle	
402								Mor				<i>Cirsium hillii</i>	Hill's thistle	
403			Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Cirsium muticum</i>	Swamp thistle	
404		*	Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Cirsium vulgare</i>	Bull thistle	
750				Bel								<i>Cladium mariscoides</i>	Twig-rush	
1469												<i>Claytonia caroliniana</i>	Carolina spring-beauty	
1470			Ait		CrW		Ita	Mor				<i>Claytonia virginica</i>	Virginia spring-beauty	
1538				Bel			Ita				Cass	<i>Clematis occidentalis</i>	Clematis	
1539								Mor	Tod			<i>Clematis virginiana</i>	Virgin's bower	
1254			Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Clintonia borealis</i>	Bluebead lily	
1355			Ait	Bel		Hub		Mor			Cass	<i>Coeloglossum viride</i> var. <i>virescens</i>	Long-bracted orchid	
1412			Ait		CrW	Hub	Ita			Wad		<i>Collomia linearis</i>	Linnear-leaved collomia	
SPC	1711		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Comandra umbellata</i>	Bastard toad-flax	
	322	*									Cass	<i>Commelina communis</i>	Asiatic dayflower	
	323											<i>Commelina erecta</i>	Slender dayflower	
	1308		Ait		CrW	Hub	Ita				Cass	<i>Comptonia peregrina</i>	Sweet fern	
	531	*										<i>Convolvulus arvensis</i>	Field bindweed	
	532		Ait		CrW		Ita	Mor	Tod		Cass	<i>Convolvulus sepium</i>	Hedge bindweed	
	533		Ait	Bel	CrW	Hub	Ita				Cass	<i>Convolvulus spithameus</i>	Upright bindweed	
	405		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Conyza canadensis</i>	Horseweed	
	406											<i>Conyza ramosissima</i>	Spreading fleabane	
	1540		Ait	Bel	CrW	Hub	Ita			Wad	Cass	<i>Coptis groenlandica</i>	Goldthread	
	1356		Ait		CrW	Hub	Ita				Cass	<i>Corallorhiza maculata</i>	Spotted coral-root	
	1357											<i>Corallorhiza odontorhiza</i>	Autumn coral-root	
	1358		Ait	Bel		Hub	Ita				Cass	<i>Corallorhiza striata</i>	Striped coral-root	
	1359		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Corallorhiza trifida</i>	Early coral-root	
	END	407											<i>Coreopsis lanceolata</i>	Lance-leaved coreopsis
408								Mor	Tod			<i>Coreopsis palmata</i>	Stiff tickseed	
409												<i>Coreopsis tinctoria</i>	Plains coreopsis	
306			Ait		CrW		Ita	Mor				<i>Corispermum hyssopifolium</i>	Hyssop-leaf bugseed	
307			Ait	Bel			Ita					<i>Corispermum nitidum</i>	Neat bugseed	
308		*					Ita					<i>Corispermum orientale</i>	Eastern bugseed	
543			Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Cornus alternifolia</i>	Pagoda dogwood	
544								Mor			Cass	<i>Cornus amomum</i> ssp. <i>obliqua</i>	Silky dogwood	
545			Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Cornus canadensis</i>	Bunchberry	
546			Ait	Bel	CrW	Hub		Mor	Tod	Wad	Cass	<i>Cornus foemina</i> ssp. <i>racemosa</i>	Gray dogwood	
547			Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Cornus rugosa</i>	Round-leaved dogwood	
548			Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Cornus stolonifera</i>	Red-osier dogwood	
1182			Ait				Ita	Mor			Cass	<i>Coronilla varia</i>	Crown-vetch	
870			Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Corydalis aurea</i>	Golden corydalis	
871												<i>Corydalis micrantha</i>	Slender fumewort	
872		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Corydalis sempervirens</i>	Pale corydalis		
195		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Corylus americana</i>	American hazelnut		
196		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Corylus cornuta</i>	Beaked hazelnut		
END	219					Ita						<i>Coryphantha vivipara</i>	Ball cactus	

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
THR	1591				CrW		Ita	Mor					<i>Crataegus calpodendron</i>	Pear-hawthorn
	1592		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Crataegus chrysocarpa</i>	Fireberry hawthorn
	1593												<i>Crataegus douglasii</i>	Black hawthorn
	1594					Hub			Tod				<i>Crataegus faxoni</i>	Faxon's hawthorn
	1595												<i>Crataegus faxoni var. praetermissa</i>	Faxon's hawthorn
	1596									Wad			<i>Crataegus irrasa</i>	Unshorn hawthorn
	1597								Tod				<i>Crataegus laurentiana var. brunetiana</i>	St. Lawrence hawthorn
	1598						Ita						<i>Crataegus macracantha var. macracantha</i>	Large-thorned hawthorn
	1599												<i>Crataegus macracantha var. pertomentosa</i>	Large-thorned hawthorn
	1600												<i>Crataegus mollis</i>	Downy hawthorn
	1601												<i>Crataegus pedicellata var. albicans</i>	Pedicelled hawthorn
	1602		Ait			Hub				Tod	Wad	Cass	<i>Crataegus punctata</i>	Dotted hawthorn
	1603												<i>Crataegus roanensis var. fluviatilis</i>	Roan Mountain hawthorn
	1604												<i>Crataegus roanensis var. roanensis</i>	Roan Mountain hawthorn
	1605												<i>Crataegus scabrida var. asperifolia</i>	Rough-leaved hawthorn
	1606				CrW	Hub	Ita						<i>Crataegus succulenta</i>	Fleshy hawthorn
	410												<i>Crepis runcinata</i>	Incised hawk's-beard
	411	*	Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Crepis tectorum</i>	Yellow hawk's-beard
	1183												<i>Crotalaria sagittalis</i>	Rattlebox
	9000												<i>Croton glandulosus</i>	Northern croton
	57												<i>Cryptogramma stelleri</i>	Slender cliff-brake
NON	1816		Ait		CrW		Ita	Mor	Tod		Cass		<i>Cryptotaenia canadensis</i>	Honewort
	534										Cass		<i>Cuscuta campestris</i>	Field dodder
	535							Mor		Wad			<i>Cuscuta cephalanthi</i>	Buttonbush dodder
	536												<i>Cuscuta coryli</i>	Hazel dodder
	537												<i>Cuscuta glomerata</i>	Aster dodder
	538										Cass		<i>Cuscuta gronovii</i>	Swamp dodder
	539												<i>Cuscuta obtusiflora var. glandulosa</i>	Southern dodder
	540				CrW								<i>Cuscuta pentagona</i>	Bur-clover dodder
	541										Cass		<i>Cuscuta polygonorum</i>	Smartweed dodder
	542			Bel							Cass		<i>Cuscuta umbrosa</i>	Large-fruit dodder
SPC	309		Ait		CrW		Ita						<i>Cycloloma atriplicifolium</i>	Winged pigweed
	1817												<i>Cymopterus acaulis</i>	Wild parsley
	198		Ait		CrW		Ita	Mor			Cass		<i>Cynoglossum boreale</i>	Wild comfrey
	199	*											<i>Cynoglossum officinale</i>	Hound's-tongue
THR	759				CrW			Mor					<i>Cyperus lupulinus X c. schweinitzii</i>	Hybrid cyperus
	751												<i>Cyperus acuminatus</i>	Tapering cyperus
	752		Ait		CrW		Ita	Mor			Cass		<i>Cyperus aristatus</i>	Bearded cyperus
	753				CrW		Ita	Mor					<i>Cyperus diandrus</i>	Sedge galingale
	754				CrW		Ita	Mor			Cass		<i>Cyperus engelmannii</i>	Engleman's cyperus
	755							Mor					<i>Cyperus erythrorhizos</i>	Red-rooted cyperus
	756		Ait				Ita	Mor			Cass		<i>Cyperus esculentus</i>	Cocoa cyperus
	757			Bel	CrW	Hub			Tod		Cass		<i>Cyperus houghtonii</i>	Houghton's cyperus
	758		Ait		CrW			Mor	Tod	Wad	Cass		<i>Cyperus lupulinus</i>	Hop-like cyperus
	760				CrW		Ita	Mor			Cass		<i>Cyperus odoratus</i>	Fragrant cyperus
THR	761				CrW			Mor			Cass		<i>Cyperus rivularis</i>	Shining cyperus
	762												<i>Cyperus rotundus</i>	Purple nut-sedge
	763		Ait		CrW	Hub	Ita	Mor		Wad	Cass		<i>Cyperus schweinitzii</i>	Schweinitz' cyperus
	764				CrW			Mor			Cass		<i>Cyperus strigosus</i>	Straw-colored cyperus
	1360		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Cypripedium acaule</i>	Stemless lady-slipper
	1361		Ait	Bel		Hub	Ita				Cass		<i>Cypripedium arietinum</i>	Ram's-head orchid
	1362		Ait	Bel		Hub	Ita	Mor	Tod		Cass		<i>Cypripedium calceolus var. parviflorum</i>	Yellow lady-slipper
	1363		Ait		CrW	Hub	Ita	Mor			Cass		<i>Cypripedium calceolus var. pubescens</i>	Yellow lady-slipper
	1364												<i>Cypripedium candidum</i>	Small white lady-slipper
	1365		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Cypripedium reginae</i>	Showy lady-slipper
SPC	58		Ait	Bel		Hub	Ita				Cass		<i>Cystopteris bulbifera</i>	Bulblet bladder-fern
	59		Ait				Ita	Mor	Tod		Cass		<i>Cystopteris fragilis</i>	Fragile bladder-fern
	60												<i>Cystopteris X laurentiana</i>	Hybrid bladder-fern
	61												<i>Cystopteris protrusa</i>	Protruding bladder-fern
	62												<i>Cystopteris X tennesseensis</i>	Tennessee bladder-fern
	63					Hub		Mor					<i>Cystopteris tenuis</i>	Delicate bladder-fern
	939	*					Ita				Cass		<i>Dactylis glomerata</i>	Orchard grass

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
SPC	1184												<i>Dalea leporina</i>	Foxtail dalea
	940		Ait		CrW	Hub	Ita	Mor			Cass		<i>Danthonia spicata</i>	Poverty grass
	1818	*				Hub							<i>Daucus carota</i>	Queen Anne's lace
	1290		Ait										<i>Decodon verticillatus</i> var. <i>laevigatus</i>	Water-willow
	1541				CrW	Hub		Mor	Tod		Cass		<i>Delphinium virescens</i>	Prairie larkspur
SPC	577							Mor					<i>Dentaria laciniata</i>	Cut-leaved toothwort
	941												<i>Deschampsia cespitosa</i> var. <i>glauca</i>	Tufted hair-grass
	942												<i>Deschampsia flexuosa</i>	Slender hair-grass
	578								Tod		Cass		<i>Descurainia pinnata</i> var. <i>brachycarpa</i>	Pinnate tansy-mustard
	579												<i>Descurainia richardsonii</i>	Richardson's tansy-mustard
SPC	580	*											<i>Descurainia sophia</i>	Herb-Sophia
SPC	1185												<i>Desmanthus illinoensis</i>	Prairie mimosa
	1186		Ait		CrW	Hub	Ita	Mor	Tod		Cass		<i>Desmodium canadense</i>	Canadian tick-trefoil
SPC	1187												<i>Desmodium cuspidatum</i> var. <i>longifolium</i>	Large-bracted tick-trefoil
SPC	1188		Ait		CrW		Ita	Mor	Tod	Wad	Cass		<i>Desmodium glutinosum</i>	Pointed-leaved tick-trefoil
	1189												<i>Desmodium illinoense</i>	Illinois tick-trefoil
	1190												<i>Desmodium nudiflorum</i>	Stemless tick-trefoil
SPC	266	*	Ait			Hub	Ita				Cass		<i>Dianthus armeria</i>	Deptford pink
	873								Tod				<i>Dicentra canadensis</i>	Squirrel-corn
NON	874		Ait	Bel			Ita				Cass		<i>Dicentra cucullaria</i>	Dutchman's-breeches
	1291												<i>Didiplis diandra</i>	Water-purslane
	239		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Diervilla lonicera</i>	Bush honeysuckle
	1754	*											<i>Digitalis lanata</i>	Foxglove
	943	*	Ait		CrW		Ita	Mor	Tod	Wad	Cass		<i>Digitaria ischaemum</i>	Smooth crabgrass
NON	944							Mor					<i>Digitaria sanguinalis</i>	Hairy crabgrass
	818												<i>Dioscorea villosa</i>	Wild yam
	945												<i>Diplachne fascicularis</i>	Sprangletop
	1802		Ait		CrW		Ita	Mor	Tod		Cass		<i>Dirca palustris</i>	Leatherwood
	946												<i>Distichlis stricta</i>	Salt-grass
	1503												<i>Dodecatheon amethystinum</i>	Jeweled shooting star
	1504												<i>Dodecatheon meadia</i>	Prairie shooting star
	581												<i>Draba arabisans</i>	Arabian whitlow-grass
	582	*											<i>Draba nemorosa</i>	Yellow whitlow-grass
	583												<i>Draba norvegica</i>	Norwegian draba
SPC	584												<i>Draba reptans</i>	Carolina whitlow-grass
	1136		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Dracocephalum parviflorum</i>	Dragonhead
	820			Bel									<i>Drosera anglica</i>	English sundew
	821		Ait	Bel			Ita				Cass		<i>Drosera intermedia</i>	Spatulate-leaved sundew
	822			Bel									<i>Drosera linearis</i>	Slender-leaved sundew
SPC	823		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Drosera rotundifolia</i>	Round-leaved sundew
SPC	64												<i>Dryopteris X bootii</i>	Boott's shield-fern
	65		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Dryopteris carthusiana</i>	Spinulose shield-fern
	66		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Dryopteris cristata</i>	Crested fern
	67												<i>Dryopteris expansa</i>	Spreading wood-fern
	68												<i>Dryopteris fragrans</i>	Fragrant fern
	69										Cass		<i>Dryopteris goldiana</i>	Goldie's fern
	70										Cass		<i>Dryopteris intermedia</i>	Glandular wood-fern
	71												<i>Dryopteris marginalis</i>	Marginal shield-fern
	72										Cass		<i>Dryopteris X triploidea</i>	Triploid shield-fern
	73			Bel		Hub					Cass		<i>Dryopteris X uliginosa</i>	Swamp shield-fern
NON	765		Ait	Bel	CrW		Ita	Mor			Cass		<i>Dulichium arundinaceum</i>	Three-way sedge
	412												<i>Dyssodia papposa</i>	Fetid marigold
	413								Tod				<i>Echinacea angustifolia</i>	Purple coneflower
	947	*			CrW		Ita				Cass		<i>Echinochloa crusgalli</i>	Cock's-spur grass
	948		Ait		CrW		Ita	Mor	Tod				<i>Echinochloa muricata</i>	Muricate barnyard-grass
NON	949												<i>Echinochloa walteri</i>	Walter's barnyard-grass
	604		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Echinocystis lobata</i>	Wild cucumber
	9000												<i>Echinops sphaerocephalus</i>	Globe-thistle
	200	*											<i>Echium vulgare</i>	Blue weed
	414	*											<i>Eclipta alba</i>	Yerba-de-tajo
NON	824	*											<i>Elaeagnus angustifolia</i>	Russian olive
	825												<i>Elaeagnus commutata</i>	Silver berry

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
NON	828				CrW						Cass	<i>Elatine minima</i>	Small waterwort	
	829											<i>Elatine triandra</i>	Three-stamened waterwort	
	766		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Eleocharis acicularis</i>	Needle spike-rush	
	767			Bel				Mor				<i>Eleocharis compressa</i>	Flattened spike-rush	
	768											<i>Eleocharis elliptica</i>	Elliptic spike-rush	
	769											<i>Eleocharis engelmanni</i>	Engleman's spike-rush	
	770			Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Eleocharis erythropoda</i>	Red-stalked spike-rush	
	771				CrW	Hub	Ita	Mor		Wad	Cass	<i>Eleocharis intermedia</i>	Intermediate spike-rush	
	772		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Eleocharis macrostachya</i>	Large-spiked spike-rush	
	THR	773											<i>Eleocharis nitida</i>	Neat spike-rush
	774				CrW		Ita	Mor	Tod		Cass	<i>Eleocharis obtusa</i>	Blunt spike-rush	
THR	775						Ita		Tod		Cass	<i>Eleocharis olivacea</i>	Olivaceous spike-rush	
	776		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Eleocharis ovata</i>	Ovoid spike-rush	
SPC	777											<i>Eleocharis parvula</i> var. <i>anachaeta</i>	Dwarf spike-rush	
SPC	778						Ita				Cass	<i>Eleocharis pauciflora</i> var. <i>feraldii</i>	Few-flowered spike-rush	
THR	779											<i>Eleocharis rostellata</i>	Beaked spike-rush	
END	780		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Eleocharis smallii</i>	Small's spike-rush	
	781											<i>Eleocharis wolffii</i>	Wolf's spike-rush	
	1082		Ait									<i>Ellisia nyctelea</i>	Ellisia	
	1079		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Elodea canadensis</i>	Canadian elodea	
	1080		Ait		CrW		Ita				Cass	<i>Elodea nuttallii</i>	Nuttall's elodea	
	950		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Elymus canadensis</i>	Canada wild rye	
	951				CrW	Hub					Cass	<i>Elymus diversiglumis</i>	Interrupted wild rye	
	952		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass	<i>Elymus hystrix</i>	Bottlebrush grass	
	953											<i>Elymus junceus</i>	Russian wild rye	
	954											<i>Elymus racemosus</i>	Clustered wild rye	
	955								Tod		Cass	<i>Elymus villosus</i>	Downy wild rye	
	956			Bel	CrW		Ita	Mor	Tod		Cass	<i>Elymus virginicus</i>	Virginia wild rye	
	957		Ait				Ita	Mor				<i>Elymus wiegandii</i>	Weigand's wild rye	
END	830											<i>Empetrum atropurpureum</i>	Purple crowberry	
END	831											<i>Empetrum nigrum</i>	Black crowberry	
	835		Ait	Bel		Hub	Ita				Cass	<i>Epigaea repens</i> var. <i>glabrifolia</i>	Trailing arbutus	
	1330		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Epilobium angustifolium</i>	Fireweed	
	1331		Ait	Bel	CrW		Ita	Mor			Cass	<i>Epilobium ciliatum</i>	American willow-herb	
	1332		Ait		CrW		Ita	Mor			Cass	<i>Epilobium coloratum</i>	Purple-leaved willow-herb	
	1333		Ait	Bel		Hub		Mor			Cass	<i>Epilobium glandulosum</i>	Northern willow-herb	
	1334		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Epilobium leptophyllum</i>	Linear-leaved willow-herb	
	1335		Ait	Bel		Hub	Ita					<i>Epilobium palustre</i>	Marsh willow-herb	
	1336			Bel		Hub		Mor				<i>Epilobium strictum</i>	Downy willow-herb	
	1		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Equisetum arvense</i>	Field horsetail	
	2			Bel	CrW	Hub		Mor	Tod	Wad		<i>Equisetum X ferrissii</i>	Ferriss' scouring-rush	
	3		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Equisetum fluviatile</i>	Water horsetail	
	4		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Equisetum hyemale</i> var. <i>affine</i>	Tall scouring-rush	
	5		Ait			Hub		Mor	Tod	Wad	Cass	<i>Equisetum laevigatum</i>	Smooth scouring-rush	
	6											<i>Equisetum X litorale</i>	Shallow-water horsetail	
	7					Hub			Tod			<i>Equisetum X nelsonii</i>	Nelson's scouring-rush	
	8		Ait		CrW	Hub	Ita				Cass	<i>Equisetum palustre</i>	Marsh horsetail	
	9		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Equisetum pratense</i>	Meadow horsetail	
	10		Ait	Bel	CrW	Hub	Ita				Cass	<i>Equisetum scirpoides</i>	Dwarf scouring-rush	
	11		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Equisetum sylvaticum</i>	Wood horsetail	
	12			Bel								<i>Equisetum X trachyodon</i>	Hybrid scouring-rush	
	13		Ait	Bel		Hub						<i>Equisetum variegatum</i>	Variegated scouring-rush	
	958	*		Bel	CrW		Ita	Mor	Tod			<i>Eragrostis ciliaris</i>	Stink grass	
	959											<i>Eragrostis frankii</i>	Frank's lovegrass	
	960		Ait		CrW			Mor				<i>Eragrostis hypnoides</i>	Creeping lovegrass	
	961		Ait		CrW	Hub	Ita	Mor			Cass	<i>Eragrostis pectinacea</i>	Tufted lovegrass	
	962				CrW			Mor			Cass	<i>Eragrostis spectabilis</i>	Purple lovegrass	
	963											<i>Eragrostis trichodes</i>	Sand lovegrass	
	415	*	Ait		CrW			Mor	Tod		Cass	<i>Erechtites hieracifolia</i>	Pilewort	
	416											<i>Erigeron acris</i> var. <i>asteroides</i>	Aster-like fleabane	
SPC	417		Ait				Ita	Mor			Cass	<i>Erigeron annuus</i>	Daisy fleabane	
	418			Bel		Hub						<i>Erigeron glabellus</i> var. <i>pubescens</i>	Smooth fleabane	

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Status	No.	N	Alt	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		
SPC	419											<i>Erigeron lonchophyllus</i>	Spear-leaved fleabane
	420		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Erigeron philadelphicus</i>	Philadelphia fleabane
	421		Ait				Ita					<i>Erigeron pulchellus</i>	Poor-Robin's fleabane
	422		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Erigeron strigosus</i>	Daisy fleabane
	848		Ait		CrW		Ita				Cass	<i>Eriocaulon septangulare</i>	Pipewort
	964											<i>Eriochloa villosa</i>	Cup-grass
	1425											<i>Eriogonum annuum</i>	Annual erigonum
	782			Bel		Hub	Ita		Tod	Wad	Cass	<i>Eriophorum angustifolium</i>	Narrow-leaved cotton-grass
	783			Bel				Mor			Cass	<i>Eriophorum chamissonis</i>	Chamisso's cotton-grass
	784		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Eriophorum gracile</i>	Slender cotton-grass
	785		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Eriophorum spissum</i>	Tufted cotton-grass
	786		Ait	Bel		Hub	Ita	Mor			Cass	<i>Eriophorum tenellum</i>	Delicate cotton-grass
	787		Ait	Bel	CrW		Ita	Mor			Cass	<i>Eriophorum virginicum</i>	Virginia cotton-grass
	788			Bel	CrW	Hub	Ita			Wad	Cass	<i>Eriophorum viridi-carinatum</i>	Green-keeled cotton-grass
	585			Bel	CrW						Cass	<i>Erucastrum gallicum</i>	Dog mustard
SPC	1819											<i>Eryngium yuccifolium</i>	Rattlesnake-master
	586							Mor				<i>Erysimum asperum</i>	Western wallflower
	587		Ait		CrW	Hub	Ita	Mor	Tod		Cass	<i>Erysimum cheiranthoides</i>	Wormseed mustard
	588					Hub		Mor	Tod		Cass	<i>Erysimum inconspicuum</i>	Small-flowered wallflower
	1255		Ait					Mor			Cass	<i>Erythronium albidum</i>	White trout-lily
END	1256											<i>Erythronium americanum</i>	Yellow trout-lily
	1257											<i>Erythronium propullans</i>	Dwarf trout-lily
	294	*										<i>Euonymus atropurpureus</i>	Wahoo
	423						Ita					<i>Eupatorium altissimum</i>	Tall boneset
	424		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Eupatorium maculatum</i>	Spotted Joe-pye weed
THR	425		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Eupatorium perfoliatum</i>	Common boneset
	426			Bel			Ita					<i>Eupatorium purpureum</i>	Sweet Joe-pye weed
	427		Ait		CrW			Mor	Tod		Cass	<i>Eupatorium rugosum</i>	Common snakeroot
	428											<i>Eupatorium sessilifolium</i>	Upland boneset
	850											<i>Euphorbia corollata</i>	Flowering spurge
	851											<i>Euphorbia cyathophora</i>	Painted leaf
	852	*		Bel								<i>Euphorbia cyparissias</i>	Cypress spurge
	853											<i>Euphorbia dentata</i>	Toothed spurge
	854											<i>Euphorbia geyeri</i>	Geyer's spurge
	855				CrW		Ita	Mor	Tod		Cass	<i>Euphorbia glyptosperma</i>	Ridge-seeded spurge
	856					Hub						<i>Euphorbia maculata</i>	Prostrate hairy spurge
	857											<i>Euphorbia marginata</i>	Snow-on-the-mountain
	858											<i>Euphorbia nutans</i>	Nodding spurge
	859	*		Bel			Ita		Tod		Cass	<i>Euphorbia podperae</i>	Leafy spurge
	860		Ait	Bel	CrW							<i>Euphorbia serpyllifolia</i>	Thyme-leaved spurge
SPC	861											<i>Euphorbia spathulata</i>	Prairie spurge
	9000											<i>Euphorbia vermiculata</i>	Hairy Spurge
	1755											<i>Euphrasia hudsoniana</i> var. <i>ramosior</i>	Hudson Bay eyebright
	429		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Euthamia graminifolia</i>	Grass-leaved goldenrod
	430											<i>Euthamia gymnospermoides</i>	Great Plains goldenrod
	1426	*		Bel				Mor				<i>Fagopyrum esculentum</i>	Buckwheat
	965	*										<i>Festuca arundinacea</i>	Tall fescue
	966		Ait		CrW			Mor	Tod		Cass	<i>Festuca obtusa</i>	Nodding fescue
	967							Mor				<i>Festuca ovin-long-saxi complex</i>	Sheep fescues
	968	*				Hub						<i>Festuca pratensis</i>	Meadow fescue
SPC	969	*			CrW						Cass	<i>Festuca rubra</i>	Red fescue
	789						Ita					<i>Fimbristylis autumnalis</i>	Slender fringe-rush
	790											<i>Fimbristylis puberula</i> var. <i>interior</i>	Downy fring-rush
	1283								Tod			<i>Floerkea proserpinacoides</i>	False mermaid
	1607		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Fragaria vesca</i> ssp. <i>americana</i>	Wood strawberry
THR	1608		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Fragaria virginiana</i>	Common strawberry
	1324		Ait				Ita					<i>Fraxinus americana</i>	White ash
	1325		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Fraxinus nigra</i>	Black ash
	1326		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass	<i>Fraxinus pennsylvanica</i>	Green ash
	139											<i>Froelichia floridana</i> var. <i>campestris</i>	Prairie cottonweed
SPC	431											<i>Gaillardia aristata</i>	Blanket-flower
	1366											<i>Galearis spectabilis</i>	Showy orchis

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
	1137	*	Ait		CrW	Hub	Ita	Mor			Cass	<i>Galeopsis tetrahit</i>	Hemp-nettle	
	432	*						Mor			Cass	<i>Galinsoga parviflora</i>	Small-flowered galinsoga	
	433	*						Mor			Cass	<i>Galinsoga quadriradiata</i>	Hairy galinsoga	
	1674		Ait		CrW		Ita	Mor			Cass	<i>Galium aparine</i>	Cleavers	
	1675		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Galium asprellum</i>	Rough bedstraw	
	1676		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Galium boreale ssp. septentrionale</i>	Northern bedstraw	
	1677		Ait					Mor			Cass	<i>Galium brevipes</i>	Short-stalked bedstraw	
	1678											<i>Galium concinnum</i>	Elegant bedstraw	
	1679		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Galium labradoricum</i>	Marsh bedstraw	
	1680			Bel								<i>Galium obtusum</i>	Obtuse bedstraw	
NON	1681		Ait	Bel	CrW			Mor		Wad	Cass	<i>Galium tinctorium</i>	Small bedstraw	
	1682		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Galium trifidum</i>	Three-cleft bedstraw	
	1683		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Galium triflorum</i>	Three-flowered bedstraw	
	1684	*										<i>Galium verum</i>	Yellow bedstraw	
	836		Ait	Bel		Hub	Ita				Cass	<i>Gaultheria hispidula</i>	Creeping snowberry	
	837		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Gaultheria procumbens</i>	Wintergreen	
	1337						Ita					<i>Gaura biennis</i>	Biennial gaura	
	1338						Ita					<i>Gaura coccinea</i>	Scarlet gaura	
	838											<i>Gaylussacia baccata</i>	Black huckleberry	
	877											<i>Gentiana affinis</i>	Northern gentian	
SPC	878											<i>Gentiana alba</i>	Yellowish gentian	
	879		Ait		CrW		Ita	Mor			Cass	<i>Gentiana andrewsii</i>	Closed gentian	
	880							Mor				<i>Gentiana puberulenta</i>	Downy gentian	
	881		Ait	Bel		Hub	Ita				Cass	<i>Gentiana rubricaulis</i>	Great Lakes gentian	
SPC	882											<i>Gentianella amarella ssp. acuta</i>	Felwort	
	883											<i>Gentianella quinquefolia ssp. occidentalis</i>	Stiff gentian	
NON	884		Ait				Ita	Mor			Cass	<i>Gentianopsis crinita</i>	Wide-leaved fringed gentian	
	885											<i>Gentianopsis procera</i>	Smaller fringed gentian	
NON	1712											<i>Geocaldon lividum</i>	Northern comandra	
	887		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Geranium bicknellii</i>	Bicknell's cranesbill	
	888						Ita					<i>Geranium carolinianum</i>	Carolina cranesbill	
	889		Ait	Bel	CrW	Hub		Mor	Tod	Wad	Cass	<i>Geranium maculatum</i>	Wild geranium	
	1609		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Geum aleppicum var. strictum</i>	Yellow avens	
	1610		Ait		CrW		Ita	Mor	Tod		Cass	<i>Geum canadense</i>	White avens	
	1611							Mor				<i>Geum laciniatum var. trichocarpum</i>	Rough avens	
	1612			Bel		Hub	Ita		Tod			<i>Geum macrophyllum var. perincisum</i>	Big-leaf avens	
	1613			Bel	CrW	Hub		Mor	Tod	Wad	Cass	<i>Geum rivale</i>	Purple avens	
	1614				CrW	Hub		Mor	Tod	Wad	Cass	<i>Geum triflorum</i>	Prairie smoke	
	1505											<i>Glaux maritima</i>	Sea-milkwort	
NON	1138	*					Ita	Mor	Tod		Cass	<i>Glechoma hederacea</i>	Creeping Charlie	
	1191										Cass	<i>Gleditsia triacanthos</i>	Honey-locust	
	970		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Glyceria borealis</i>	Northern manna-grass	
	971		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Glyceria canadensis</i>	Rattlesnake grass	
	972		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Glyceria grandis</i>	Tall manna-grass	
	973		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Glyceria striata</i>	Fowl manna-grass	
	1192		Ait	Bel				Mor	Tod			<i>Glycyrrhiza lepidota</i>	Wild licorice	
	434				CrW			Mor				<i>Gnaphalium obtusifolium</i>	Sweet everlasting	
	435	*	Ait		CrW		Ita	Mor			Cass	<i>Gnaphalium uliginosum</i>	Low cudweed	
	436										Cass	<i>Gnaphalium viscosum</i>	Clammy cudweed	
	1367		Ait		CrW			Mor			Cass	<i>Goodyera pubescens</i>	Downy rattlesnake-plantain	
	1368		Ait	Bel	CrW	Hub	Ita				Cass	<i>Goodyera repens var. ophioides</i>	Lesser rattlesnake-plantain	
	1369		Ait		CrW	Hub	Ita	Mor			Cass	<i>Goodyera tessellata</i>	Tesselate rattlesnake-plantain	
	1756		Ait					Mor			Cass	<i>Gratiola neglecta</i>	Hedge-hyssop	
	437				CrW		Ita				Cass	<i>Grindelia squarrosa</i>	Gumweed	
	74		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Gymnocarpium dryopteris</i>	Common oak-fern	
	75											<i>Gymnocarpium X intermedium</i>	Intermediate oak-fern	
	76											<i>Gymnocarpium jessoense ssp. parvulum</i>	Nahanni oak-fern	
	77			Bel								<i>Gymnocarpium robertianum</i>	Northern oak fern	
	267	*		Bel		Hub				Wad	Cass	<i>Gypsophila paniculata</i>	Paniculate baby's breath	
	201			Bel	CrW		Ita			Wad	Cass	<i>Hackelia deflexa var. americana</i>	Nodding stickseed	
	202								Tod			<i>Hackelia virginiana</i>	Virginia stickseed	
	886		Ait	Bel		Hub	Ita				Cass	<i>Halenia deflexa</i>	Spurred gentian	

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
SPC	1077								Tod				<i>Hamamelis virginiana</i>	Witch-hazel
SPC	438												<i>Haplopappus spinulosus</i>	Cutleaf ironplant
	1139				CrW	Hub		Mor	Tod	Wad	Cass		<i>Hedeoma hispida</i>	Mock pennyroyal
	1685		Ait		CrW	Hub		Mor	Tod	Wad	Cass		<i>Hedyotis longifolia</i>	Bluets
	439				CrW			Mor		Wad	Cass		<i>Helenium autumnale</i>	Autumn sneezeweed
	316		Ait	Bel	CrW	Hub		Mor		Wad	Cass		<i>Helianthemum bicknellii</i>	Hoary frostweed
NON	317								Tod				<i>Helianthemum canadense</i>	Canadian frostweed
	440				CrW		Ita						<i>Helianthus annuus</i>	Common sunflower
	441		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Helianthus giganteus</i>	Giant sunflower
	442				CrW			Mor	Tod				<i>Helianthus grosseserratus</i>	Sawtooth sunflower
	443		Ait	Bel	CrW			Mor			Cass		<i>Helianthus hirsutus</i>	Woodland sunflower
	444						Ita				Cass		<i>Helianthus maximiliani</i>	Maximilian's sunflower
SPC	445												<i>Helianthus nuttallii</i> ssp. <i>rydbergii</i>	Nuttall's sunflower
	446												<i>Helianthus occidentalis</i>	Western sunflower
	447							Mor					<i>Helianthus petiolaris</i>	Prairie sunflower
	448			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Helianthus rigidus</i>	Stiff sunflower
	449				CrW	Hub		Mor	Tod	Wad	Cass		<i>Helianthus strumosus</i>	Rough-leaf sunflower
	450		Ait	Bel	CrW			Mor			Cass		<i>Helianthus tuberosus</i>	Jerusalem artichoke
SPC	974												<i>Helictotrichon hookeri</i>	Spike oat
	451		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Helioopsis helianthoides</i> ssp. <i>occidentalis</i>	Ox-eye
	1258	*	Ait										<i>Hemerocallis fulva</i>	Fulvous day-lily
	791						Ita				Cass		<i>Hemicarpha micrantha</i>	Hemicarpha
	1542							Mor					<i>Hepatica acutiloba</i>	Sharp-lobed hepatica
	1543		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Hepatica americana</i>	Round-lobed hepatica
	1820		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Heracleum lanatum</i>	Cow-parsnip
	589	*						Mor					<i>Hesperis matronalis</i>	Dame's rocket
THR	1466					Hub	Ita	Mor		Wad			<i>Heteranthera dubia</i>	Water star-grass
	1467												<i>Heteranthera limosa</i>	Mud-plantain
	452				CrW	Hub		Mor			Cass		<i>Heterotheca villosa</i>	Prairie golden aster
	1716		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Heuchera richardsonii</i>	Alum-root
	1296	*											<i>Hibiscus trionum</i>	Flower-of-an-hour
	453	*				Hub					Cass		<i>Hieracium aurantiacum</i>	Orange hawkweed
	454	*											<i>Hieracium floribundum</i>	Smooth king-devil
	455		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Hieracium kalmii</i>	Kalm's hawkweed
NON	456												<i>Hieracium longipilum</i>	Long-bearded hawkweed
	457										Cass		<i>Hieracium piloselloides</i>	King-devil hawkweed
	458		Ait	Bel	CrW		Ita	Mor	Tod		Cass		<i>Hieracium scabrusculum</i>	Rough hawkweed
	459		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Hieracium scabrum</i>	Sticky hawkweed
	975		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Hierochloa odorata</i> ssp. <i>hirta</i>	Sweet grass
	1078			Bel		Hub	Ita	Mor			Cass		<i>Hippuris vulgaris</i>	Mare's-tail
	976	*		Bel	CrW		Ita	Mor	Tod		Cass		<i>Hordeum jubatum</i>	Foxtail barley
NON	977												<i>Hordeum pusillum</i>	Little barley
SPC	318				CrW			Mor					<i>Hudsonia tomentosa</i>	False heather
	9000												<i>Humulus japonicus</i>	Japanese hop
	1305		Ait	Bel		Hub	Ita	Mor	Tod		Cass		<i>Humulus lupulus</i>	Common hop
END	1544												<i>Hydrastis canadensis</i>	Golden seal
SPC	1821												<i>Hydrocotyle americana</i>	Water-pennywort
	1083												<i>Hydrophyllum appendiculatum</i>	Appendaged waterleaf
	1084		Ait					Mor	Tod		Cass		<i>Hydrophyllum virginianum</i>	Virginia waterleaf
	1086				CrW			Mor					<i>Hypericum boreale</i>	Northern St. John's-wort
	1087										Cass		<i>Hypericum ellipticum</i>	Pale St. John's-wort
	1088		Ait		CrW	Hub	Ita	Mor			Cass		<i>Hypericum majus</i>	Large St. John's-wort
	1089	*						Mor			Cass		<i>Hypericum perforatum</i>	Common St. John's-wort
	1090										Cass		<i>Hypericum punctatum</i>	Spotted St. John's-wort
	1091		Ait					Mor			Cass		<i>Hypericum pyramidatum</i>	Great St. John's-wort
	140							Mor					<i>Hypoxis hirsuta</i>	Yellow star-grass
	152		Ait		CrW		Ita	Mor			Cass		<i>Ilex verticillata</i>	Winterberry
	178		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Impatiens capensis</i>	Spotted touch-me-not
	179		Ait					Mor			Cass		<i>Impatiens pallida</i>	Pale touch-me-not
END	590												<i>Iodanthus pinnatifidus</i>	Purple rocket
	1093		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Iris versicolor</i>	Northern blue Flag
	1094												<i>Iris virginica</i> var. <i>shrevei</i>	Southern blue flag

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Alt	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
END	1140				CrW							<i>Isanthus brachiatus</i>	False pennyroyal	
	14		Ait			Hub	Ita				Cass	<i>Isoetes echinospora</i> var. <i>braunii</i>	Braun's quillwort	
	15											<i>Isoetes macrospora</i>	Lake quillwort	
	16											<i>Isoetes melanopoda</i>	Prairie quillwort	
	1545							Mor				<i>Isopyrum bitematum</i>	False rue-anemone	
SPC	460				CrW		Ita				Cass	<i>Iva xanthifolia</i>	Marsh-elder	
	182											<i>Jeffersonia diphylla</i>	Twingleaf	
SPC	1100		Ait		CrW			Mor			Cass	<i>Juglans cinerea</i>	Butternut	
NON	1101											<i>Juglans nigra</i>	Black walnut	
	1102			Bel	CrW	Hub	Ita				Cass	<i>Juncus alpinoarticulatus</i>	Alpine rush	
	1103											<i>Juncus articulatus</i>	Jointed rush	
NON	1104		Ait	Bel	CrW		Ita	Mor			Cass	<i>Juncus balticus</i> var. <i>littoralis</i>	Stiff rush	
	1105											<i>Juncus brachycarpus</i>	Short-fruited rush	
NON	1106		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Juncus brevicaudatus</i>	Narrow-panicled rush	
	1107				CrW		Ita				Cass	<i>Juncus bufonius</i>	Toad rush	
	1108			Bel							Cass	<i>Juncus canadensis</i>	Canada rush	
	1109											<i>Juncus compressus</i>	Compressed rush	
	1110			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Juncus dudleyi</i>	Dudley's rush	
NON	1111				CrW		Ita	Mor			Cass	<i>Juncus effusus</i>	Soft rush	
	1112						Ita				Cass	<i>Juncus filiformis</i>	Thread-like rush	
	1113											<i>Juncus gerardii</i>	Black-grass rush	
	1114											<i>Juncus X gracilescens</i>	Grass-like rush	
	1115						Ita		Tod		Cass	<i>Juncus greenei</i>	Greene's rush	
SPC	1116		Ait	Bel							Cass	<i>Juncus interior</i>	Inland rush	
	1117											<i>Juncus longistylis</i>	Long-styled rush	
	1118											<i>Juncus marginatus</i>	Margined rush	
SPC	1119		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Juncus nodosus</i>	Knotty rush	
	1120				CrW	Hub	Ita				Cass	<i>Juncus pelocarpus</i>	Brown-fruited rush	
	1121			Bel								<i>Juncus stygius</i> var. <i>americana</i>	Bog rush	
SPC	1122		Ait	Bel	CrW	Hub	Ita	Mor	Tod			<i>Juncus tenuis</i>	Path rush	
	1123		Ait									<i>Juncus torreyi</i>	Torrey's rush	
	1124							Mor				<i>Juncus vaseyi</i>	Vasey's rush	
	100		Ait	Bel		Hub	Ita	Mor		Wad	Cass	<i>Juniperus communis</i> var. <i>depressa</i>	Bush juniper	
	101											<i>Juniperus horizontalis</i>	Creeping juniper	
SPC	102							Mor	Tod		Cass	<i>Juniperus virginiana</i>	Red cedar	
	839		Ait	Bel	CrW		Ita				Cass	<i>Kalmia polifolia</i>	Bog laurel	
	819	*									Cass	<i>Knautia arvensis</i>	Bluebuttons	
	310	*					Ita					<i>Kochia scoparia</i>	Summer-cypress	
	978			Bel	CrW	Hub		Mor	Tod	Wad	Cass	<i>Koeleria macrantha</i>	June-grass	
END	461			Bel		Hub		Mor		Wad	Cass	<i>Krigia biflora</i>	Two-flowered Cynthia	
	462											<i>Kuhnia eupatorioides</i> var. <i>corymbulosa</i>	False boneset	
	463		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Lactuca biennis</i>	Biennial blue lettuce	
	464		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Lactuca canadensis</i>	Canada wild lettuce	
	465										Cass	<i>Lactuca ludoviciana</i>	Louisiana lettuce	
END	466			Bel		Hub	Ita				Cass	<i>Lactuca pulchella</i>	Beautiful blue lettuce	
	467	*	Ait									<i>Lactuca serriola</i>	Prickly lettuce	
	1840		Ait	Bel			Ita	Mor	Tod		Cass	<i>Laportea canadensis</i>	Wood-nettle	
	203	*					Ita	Mor		Wad		<i>Lappula redowskii</i>	Western stickseed	
	204	*		Bel	CrW	Hub	Ita					<i>Lappula squarrosa</i>	Two-row stickseed	
END	468	*										<i>Lapsana communis</i>	Nipplewort	
	105		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Larix laricina</i>	Tamarack	
	1194		Ait		CrW						Cass	<i>Lathyrus japonicus</i> var. <i>glaber</i>	Beach pea	
	1195		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Lathyrus ochroleucus</i>	Pale vetchling	
	1196		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Lathyrus palustris</i>	Marsh vetchling	
END	1197		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Lathyrus venosus</i> var. <i>intonsus</i>	Veiny pea	
	319		Ait			Hub						<i>Lechea intermedia</i>	Intermediate pinweed	
	320		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Lechea stricta</i>	Prairie pinweed	
	321										Cass	<i>Lechea tenuifolia</i>	Narrow-leaved pinweed	
	840		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Ledum groenlandicum</i>	Labrador tea	
SPC	979											<i>Leersia lenticularis</i>	Catchfly grass	
	980		Ait		CrW		Ita	Mor				<i>Leersia oryzoides</i>	Rice cut grass	
	981							Mor				<i>Leersia virginica</i>	White grass	

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
THR END	1234		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Lemna minor</i>	Lesser duckweed
	1235		Ait	Bel	CrW		Ita	Mor	Tod		Cass		<i>Lemna trisulca</i>	Star-duckweed
	1141	*					Ita	Mor	Tod				<i>Leonurus cardiaca</i>	Lion's ear
	591	*											<i>Lepidium campestre</i>	Field pepper-grass
	592		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Lepidium densiflorum</i>	Green-flowered pepper-grass
	593						Ita						<i>Lepidium virginicum</i>	Virginia pepper-grass
	982												<i>Leptoloma cognatum</i>	Fall witch grass
	1198		Ait		CrW			Mor			Cass		<i>Lespedeza capitata</i>	Round-headed bush-clover
	1199												<i>Lespedeza capitata</i> X <i>L. leptostachya</i>	Hybrid bush-clover
	1200				CrW								<i>Lespedeza leptostachya</i>	Prairie bush-clover
	594												<i>Lesquerella ludoviciana</i>	Bladderpod
	469		Ait		CrW	Hub		Mor	Tod	Wad	Cass		<i>Liatris aspera</i>	Rough blazing star
	470				CrW								<i>Liatris cylindracea</i>	Cylindric blazing star
	471			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Liatris ligulistylis</i>	Northern plains blazing star
	SPC NON	472						Mor						<i>Liatris punctata</i>
473							Mor	Tod					<i>Liatris pycnostachya</i>	Gayfeather
1259			Ait		CrW		Ita	Mor	Tod	Wad	Cass		<i>Lilium michiganense</i>	Michigan lily
1260				Bel	CrW	Hub		Mor	Tod	Wad	Cass		<i>Lilium philadelphicum</i> var. <i>andinum</i>	Wood lily
1757													<i>Limosella aquatica</i>	Mudwort
1758							Ita						<i>Linaria canadensis</i>	Blue toadflax
1759		*											<i>Linaria genistifolia</i>	Broad-leaf toadflax
1760		*	Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Linaria vulgaris</i>	Butter-and-eggs
1761													<i>Lindernia anagallidea</i>	Anagallis false pimpernel
1762			Ait					Mor					<i>Lindernia dubia</i>	Low false pimpernel
240			Ait	Bel		Hub	Ita	Mor		Wad	Cass		<i>Linnaea borealis</i> var. <i>americana</i>	Twinflower
1284													<i>Linum lewisii</i>	Blue flax
1285													<i>Linum rigidum</i> var. <i>simulans</i>	Stiff-stem yellow flax
1286								Mor					<i>Linum sulcatum</i>	Grooved yellow flax
NON END SPC		1287	*		Bel									<i>Linum usitatissimum</i>
	1370								Tod				<i>Liparis liliifolia</i>	Lily-leaved twayblade
	1371		Ait	Bel		Hub	Ita				Cass		<i>Liparis loeselii</i>	Loesel's twayblade
	1372												<i>Listera auriculata</i>	Auricled twayblade
	1373												<i>Listera convallarioides</i>	Broad-leaved twayblade
	1374		Ait	Bel		Hub	Ita				Cass		<i>Listera cordata</i>	Heart-leaved twayblade
	205			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Lithospermum canescens</i>	Hoary puccoon
	206				CrW		Ita	Mor	Tod	Wad	Cass		<i>Lithospermum carolinense</i> ssp. <i>croceum</i>	Hairy puccoon
	207												<i>Lithospermum incisum</i>	Narrow-leaved puccoon
	208												<i>Lithospermum latifolium</i>	American gromwell
	1402												<i>Littorella americana</i>	American shore-plantain
	229												<i>Lobelia cardinalis</i>	Cardinal-flower
	230												<i>Lobelia dortmanna</i>	Water-lobelia
	231		Ait		CrW								<i>Lobelia inflata</i>	Indian tobacco
	SPC	232		Ait	Bel	CrW	Hub					Cass		<i>Lobelia kalmii</i>
233				Bel		Hub		Mor			Cass		<i>Lobelia siphilitica</i>	Great lobelia
234			Ait				Ita	Mor					<i>Lobelia spicata</i>	Rough-spiked Lobelia
983											Cass		<i>Lolium perenne</i>	English rye grass
1822													<i>Lomatium orientale</i>	Wild parsley
241			Ait	Bel	CrW		Ita	Mor			Cass		<i>Lonicera canadensis</i>	Fly honeysuckle
242			Ait	Bel	CrW	Hub	Ita		Tod		Cass		<i>Lonicera dioica</i>	Wild Honeysuckle
243			Ait		CrW	Hub	Ita	Mor		Wad	Cass		<i>Lonicera hirsuta</i>	Hairy honeysuckle.
244				Bel		Hub					Cass		<i>Lonicera oblongifolia</i>	Swamp fly-honeysuckle
245													<i>Lonicera prolifera</i>	Grape honeysuckle
246		*		Bel	CrW		Ita		Tod		Cass		<i>Lonicera tatarica</i>	Tartarian Honeysuckle
247			Ait	Bel		Hub	Ita	Mor			Cass		<i>Lonicera villosa</i>	Mountain fly-honeysuckle
125													<i>Lophotocarpus calycinus</i>	Large-calyxed arrowhead
1201		*	Ait				Ita				Cass		<i>Lotus corniculatus</i>	Bird's-foot trefoil
1202					CrW								<i>Lotus purshianus</i>	Prairie trefoil
1339												<i>Ludwigia palustris</i>	Water-purslane	
1340												<i>Ludwigia polycarpa</i>	False loosestrife	
1203				CrW			Mor			Cass		<i>Lupinus perennis</i>	Wild lupine	
1204	*					Ita						<i>Lupinus polyphyllus</i>	Large-leaf lupine	
1125		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Luzula acuminata</i>	Pointed wood-rush	

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Alt	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
SPC	1126												<i>Luzula luzuloides</i>	Lamarck's wood-rush
	1127		Ait		CrW	Hub		Mor	Tod	Wad	Cass		<i>Luzula multiflora</i>	Many-flowered wood-rush
	1128												<i>Luzula parviflora</i> var. <i>melanocarpa</i>	Small-flowered wood-rush
	19												<i>Lycopodium appalachianum</i> X <i>L. lucidulum</i>	Hybrid lycopodium
	20												<i>Lycopodium appalachianum</i> X <i>L. selago</i>	Hybrid lycopodium
	17		Ait	Bel	CrW	Hub	Ita			Wad	Cass		<i>Lycopodium annotinum</i>	Bristly clubmoss
	18												<i>Lycopodium appalachianum</i>	Appalachian clubmoss
	21												<i>Lycopodium</i> X <i>buttersii</i>	Butters' clubmoss
	22		Ait	Bel		Hub	Ita			Wad	Cass		<i>Lycopodium clavatum</i>	Running clubmoss
	23				CrW	Hub					Cass		<i>Lycopodium comp-digi complex</i>	Ground-cedar
THR	24		Ait	Bel	CrW	Hub	Ita			Wad	Cass		<i>Lycopodium dendroideum</i>	Round-branched ground-pine
	25			Bel		Hub					Cass		<i>Lycopodium</i> X <i>habereri</i>	Haberer's ground-cedar
	26		Ait				Ita						<i>Lycopodium inundatum</i>	Bog clubmoss
	27		Ait	Bel	CrW	Hub	Ita				Cass		<i>Lycopodium lucidulum</i>	Shining clubmoss
	28		Ait	Bel						Wad	Cass		<i>Lycopodium obscurum</i> var. <i>isophyllum</i>	Flat-branched ground-pine
	29												<i>Lycopodium porophilum</i>	Limestone clubmoss
	30												<i>Lycopodium selago</i>	Fir clubmoss
	31			Bel		Hub	Ita				Cass		<i>Lycopodium tristachyum</i>	Wirey ground-cedar
	1142		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Lycopus americanus</i>	Cut-leaved bugleweed
	1143								Tod				<i>Lycopus asper</i>	Rough bugleweed
NON	1144		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Lycopus uniflorus</i>	Northern bugleweed
	1145		Ait					Mor			Cass		<i>Lycopus virginicus</i>	Virginia bugleweed
	474				CrW						Cass		<i>Lygodesmia juncea</i>	Skeleton-weed
	1506		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Lysimachia ciliata</i>	Fringed loosestrife
	1507							Mor			Cass		<i>Lysimachia hybrida</i>	Hybrid loosestrife
	1508	*											<i>Lysimachia nummularia</i>	Moneywort
	1509						Ita				Cass		<i>Lysimachia quadriflora</i>	Prairie loosestrife
	1510										Cass		<i>Lysimachia quadrifolia</i>	Whorled loosestrife
	1511		Ait	Bel	CrW		Ita	Mor			Cass		<i>Lysimachia terrestris</i>	Yellow loosestrife
	1512		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Lysimachia thyrsoiflora</i>	Tufted loosestrife
SPC	1292												<i>Lythrum alatum</i>	Wing-angled loosestrife
	1293		Ait							Wad	Cass		<i>Lythrum salicaria</i> var. <i>tomentosum</i>	Purple loosestrife
	1261		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Maianthemum canadense</i>	Canada mayflower
	1375		Ait		CrW	Hub	Ita				Cass		<i>Malaxis monophylla</i> var. <i>brachypoda</i>	White adder's-mouth
	1376			Bel		Hub							<i>Malaxis paludosa</i>	Bog adder's-mouth
	1377		Ait	Bel		Hub	Ita				Cass		<i>Malaxis unifolia</i>	Green adder's-mouth
	1297	*			CrW	Hub							<i>Malva neglecta</i>	Cheeses
	1298	*			CrW			Mor	Tod				<i>Malva rotundifolia</i>	Round-leaved mallow
	1299	*											<i>Malva sylvestris</i>	High mallow
	32												<i>Marsilea mucronata</i>	Hairy pepperwort
END	475	*					Ita				Cass		<i>Matricaria maritima</i>	Wild chamomile
	78		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Matteuccia struthiopteris</i> var. <i>pennsylvanica</i>	Ostrich-fern
	1205	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Medicago lupulina</i>	Black medick
	1206	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Medicago sativa</i>	Alfalfa
	476		Ait		CrW		Ita				Cass		<i>Megalodonta beekii</i>	Water-marigold
	1763		Ait	Bel		Hub	Ita	Mor		Wad	Cass		<i>Melampyrum lineare</i>	Cow-wheat
	984												<i>Melica nitens</i>	Three-flowered melic
	1207	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Melilotus alba</i>	White sweet clover
	1208	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Melilotus officinalis</i>	Yellow sweet clover
	1302		Ait	Bel			Ita	Mor			Cass		<i>Menispermum canadense</i>	Canada moonseed
THR	1146		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Mentha arvensis</i> var. <i>glabrata</i>	Common mint
	1147	*											<i>Mentha cardiaca</i>	Heart-mint
	1303		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Menyanthes trifoliata</i> var. <i>minor</i>	Buckbean
	209						Ita				Cass		<i>Mertensia paniculata</i>	Tall lungwort
	210												<i>Mertensia virginica</i>	Virginia bluebells
	985				CrW		Ita	Mor		Wad	Cass		<i>Milium effusum</i> var. <i>cisatlanticum</i>	Woodland millet grass
	1764				CrW	Hub		Mor	Tod		Cass		<i>Mimulus glabratus</i> var. <i>fremontii</i>	Yellow monkey-flower
	1765		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Mimulus ringens</i>	Purple monkey-flower
	1314				CrW	Hub		Mor		Wad			<i>Mirabilis hirsuta</i>	Hairy four-o'clock
	1315												<i>Mirabilis linearis</i>	Narrow-leaved four-o'clock
	1316		Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Mirabilis nyctaginea</i>	Heart-leaved four-o'clock
	986	*											<i>Miscanthus sacchariflorus</i>	Amur silver-grass

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
NON	1686		Ait		CrW		Ita	Mor			Cass	<i>Mitchella repens</i>	Partridge-berry	
	1717		Ait				Ita	Mor		Wad	Cass	<i>Mitella diphylla</i>	Two-leaved miterwort	
	1718		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Mitella nuda</i>	Naked miterwort	
	121	*	Ait		CrW	Hub	Ita	Mor		Wad	Cass	<i>Mollugo verticillata</i>	Carpet-weed	
	1148		Ait	Bel		Hub	Ita	Mor	Tod	Wad	Cass	<i>Monarda fistulosa</i>	Wild bergamot	
	1149											<i>Monarda punctata</i> var. <i>villicaulis</i>	Horsemint	
	1516		Ait	Bel	CrW	Hub	Ita				Cass	<i>Moneses uniflora</i>	One-flowered pyrola	
	311											<i>Monolepis nuttalliana</i>	Poverty-weed	
	1517		Ait			Hub	Ita	Mor			Cass	<i>Monotropa hypopitys</i>	Pinesap	
	1518		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Monotropa uniflora</i>	Indian pipe	
END	1471											<i>Montia chamissoi</i>	Montia	
NON	1306	*										<i>Morus alba</i>	White mulberry	
	1307											<i>Morus rubra</i>	Red mulberry	
SPC	987											<i>Muhlenbergia asperifolia</i>	Scratchgrass	
	988							Mor				<i>Muhlenbergia cuspidata</i>	Plains muhly	
	989											<i>Muhlenbergia frondosa</i>	Swamp satin-grass	
	990		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Muhlenbergia glomerata</i>	Clustered muhly grass	
	991		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Muhlenbergia mexicana</i>	Mexican satin-grass	
	992			Bel			Ita	Mor			Cass	<i>Muhlenbergia racemosa</i>	Marsh muhly grass	
	993											<i>Muhlenbergia richardsonis</i>	Richardson's muhly grass	
	994											<i>Muhlenbergia schreberi</i>	Dropseed wire-grass	
	995						Ita					<i>Muhlenbergia sylvatica</i>	Woodland muhly grass	
	996											<i>Muhlenbergia uniflora</i>	One-flowered muhly	
NON	211	*										<i>Myosotis arvensis</i>	Field forget-me-not	
	212				CrW		Ita	Mor		Wad	Cass	<i>Myosotis laxa</i>	Smaller forget-me-not	
NON	213	*									Cass	<i>Myosotis scorpioides</i>	True forget-me-not	
	214											<i>Myosotis verna</i>	Virginia forget-me-not	
NON	268						Ita		Tod		Cass	<i>Myosoton aquaticum</i>	Giant chickweed	
	1546											<i>Myosurus minimus</i>	Mouse-tail	
NON	1309			Bel							Cass	<i>Myrica gale</i>	Sweet gale	
	1072											<i>Myriophyllum alterniflorum</i>	Alternate-flower water-milfoil	
	1073					Hub	Ita				Cass	<i>Myriophyllum farwellii</i>	Farwell's water-milfoil	
	1074		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Myriophyllum sibiricum</i>	Siberian water-milfoil	
	1075		Ait		CrW		Ita				Cass	<i>Myriophyllum tenellum</i>	Delicate water-milfoil	
	1076			Bel	CrW	Hub	Ita				Cass	<i>Myriophyllum verticillatum</i>	Whorled water-milfoil	
	1310		Ait	Bel	CrW	Hub	Ita		Tod	Wad	Cass	<i>Najas flexilis</i>	Flexuous naiad	
	1311		Ait		CrW						Cass	<i>Najas gracillima</i>	Slender naiad	
	1312										Cass	<i>Najas guadalupensis</i>	Southern Naiad	
	1313											<i>Najas marina</i>	Holly-leaf Naiad	
THR	1300											<i>Napaea dioica</i>	Glade mallow	
NON	595	*				Hub						<i>Nasturtium microphyllum</i>	Small-leaved water-cress	
	596	*				Hub		Mor			Cass	<i>Nasturtium officinale</i>	Common water-cress	
	1318											<i>Nelumbo lutea</i>	American lotus	
	153											<i>Nemopanthus mucronatus</i>	Swamp holly	
	1150	*	Ait		CrW		Ita	Mor			Cass	<i>Nepeta cataria</i>	Catnip	
	477											<i>Nothocalais cuspidata</i>	False dandelion	
	1319											<i>Nuphar luteum</i> ssp. <i>pumilum</i>	Yellow pond-lily	
	1320		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Nuphar luteum</i> ssp. <i>variegatum</i>	Yellow pond-lily	
	1321		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Nymphaea odorata</i>	Fragrant white water-lily	
	1322			Bel			Ita					<i>Nymphaea tetragona</i>	Small white water-lily	
THR	1323		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Nymphaea tuberosa</i>	Tuberous white water-lily	
	1341		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Oenothera biennis</i>	Common evening-primrose	
NON	1342		Ait									<i>Oenothera clelandii</i>	Cleland's evening-primrose	
	1343											<i>Oenothera laciniata</i>	Cut-leaved evening-primrose	
NON	1344			Bel		Hub			Tod	Wad	Cass	<i>Oenothera nuttallii</i>	Nuttall's evening-primrose	
	1345		Ait									<i>Oenothera oakesiana</i>	Oake's evening-primrose	
	1346				CrW							<i>Oenothera parviflora</i>	Northern evening-primrose	
	1347		Ait									<i>Oenothera perennis</i>	Perennial sundrops	
	1348								Tod			<i>Oenothera rhombipetala</i>	Rhombic evening-primrose	
	1349			Bel			Ita	Mor				<i>Oenothera villosa</i>	Hairy evening-primrose	
	79		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Onoclea sensibilis</i>	Sensitive fern	
	215											<i>Onosmodium molle</i> ssp. <i>hispidissimum</i>	False gromwell	

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Alt	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
SPC	216												<i>Onosmodium molle</i> ssp. <i>occidentale</i>	False gromwell
	44		Ait	Bel		Hub		Mor			Cass		<i>Ophioglossum pusillum</i>	Adder's-tongue
	220												<i>Opuntia fragilis</i>	Brittle opuntia
	221												<i>Opuntia macrorhiza</i>	Plains prickly pear
	1393												<i>Orobanche fasciculata</i>	Clustered broom-rape
SPC	1394												<i>Orobanche ludoviciana</i>	Louisiana broom-rape
SPC	1395												<i>Orobanche uniflora</i>	One-flowered cancer-root
END	1766												<i>Orthocarpus luteus</i>	Owl-clover
	997		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Oryzopsis asperifolia</i>	Moutain rice-grass
	998						Ita						<i>Oryzopsis hymenoides</i>	Indian rice-grass
	999		Ait		CrW	Hub	Ita	Mor		Wad	Cass		<i>Oryzopsis pungens</i>	Sharp-pointed rice-grass
END	1000							Mor	Tod		Cass		<i>Oryzopsis racemosa</i>	Black-fruited rice-grass
	1823												<i>Osmorhiza chilensis</i>	Chilean sweet cicely
SPC	1824		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Osmorhiza claytonii</i>	Clayton's sweet cicely
	1825		Ait			Hub	Ita		Tod		Cass		<i>Osmorhiza longistylis</i>	Anise-root
	1826												<i>Osmorhiza obtusa</i>	Black-fruited sweet cicely
	45		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Osmunda cinnamomea</i>	Cinnamon fern
NON	46		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Osmunda claytoniana</i>	Interrupted fern
	47		Ait		CrW			Mor					<i>Osmunda regalis</i> var. <i>spectabilis</i>	Royal fern
	197		Ait	Bel	CrW		Ita	Mor	Tod		Cass		<i>Ostrya virginiana</i>	Ironwood
	1396					Hub	Ita	Mor		Wad			<i>Oxalis dillenii</i>	Southern wood-sorrel
	1397												<i>Oxalis montana</i>	Common wood-sorrel
	1398		Ait		CrW	Hub	Ita	Mor	Tod		Cass		<i>Oxalis stricta</i>	Yellow wood-sorrel
	1399							Mor	Tod				<i>Oxalis violacea</i>	Violet wood-sorrel
	1827												<i>Oxypolis rigidior</i>	Cowbane
	1209				CrW								<i>Oxytropis campestris</i> var. <i>dispar</i>	Flat locoweed
	1210				CrW								<i>Oxytropis lambertii</i>	Lambert's locoweed
END	1211											<i>Oxytropis viscida</i>	Sticky locoweed	
SPC	162		Ait		CrW				Tod				<i>Panax quinquefolium</i>	American ginseng
	163												<i>Panax trifolium</i>	Dwarf ginseng
THR	1001							Mor					<i>Panicum boreale</i>	Northern panic grass
	1002			Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Panicum capillare</i>	Witch grass
	1003									Wad			<i>Panicum columbianum</i>	Columbian panic grass
	1004				CrW								<i>Panicum commonsianum</i>	White-haired panic grass
	1005			Bel		Hub	Ita			Wad			<i>Panicum depauperatum</i>	Poor panic grass
	1006								Tod				<i>Panicum dichotomiflorum</i>	Fall panic grass
	1007				CrW	Hub	Ita						<i>Panicum lanuginosum</i> var. <i>fasciculatum</i>	Hairy panic grass
	1008		Ait			Hub							<i>Panicum lanuginosum</i> var. <i>implicatum</i>	Hairy panic grass
	1009			Bel	CrW		Ita	Mor	Tod	Wad			<i>Panicum lanuginosum</i> var. <i>praecocius</i>	Hairy panic grass
	1010										Cass		<i>Panicum latifolium</i>	Broad-leaved panic grass
	1011				CrW	Hub		Mor	Tod		Cass		<i>Panicum leibergii</i>	Leiberg's panic grass
	1012			Bel	CrW	Hub			Tod	Wad	Cass		<i>Panicum linearifolium</i>	Linnear-leaved panic grass
	1013										Cass		<i>Panicum meridionale</i>	Southern panic grass
	1014	*											<i>Panicum miliaceum</i>	Proso millet
	1015			Bel	CrW			Mor	Tod				<i>Panicum oligosanthos</i>	Few-flowered panic grass
	1016				CrW	Hub		Mor			Cass		<i>Panicum perlongum</i>	Long-leaved panic grass
	1017						Ita						<i>Panicum philadelphicum</i>	Philadelphia panic grass
	1018		Ait		CrW			Mor	Tod		Cass		<i>Panicum virgatum</i>	Switchgrass
	1019				CrW			Mor					<i>Panicum wilcoxianum</i>	Wilcox's panic grass
	1020				CrW	Hub	Ita	Mor		Wad	Cass		<i>Panicum xanthophysum</i>	Yellowish panic grass
END	1841							Mor					<i>Parietaria pensylvanica</i>	Pellitory
	1719		Ait	Bel									<i>Parnassia glauca</i>	American grass-of-Parnassus
	1720		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Parnassia palustris</i> var. <i>neogaea</i>	Marsh grass-of-Parnassus
	269												<i>Paronychia canadensis</i>	Canada forked chickweed
	270												<i>Paronychia fastigiata</i>	Forked chickweed
	478												<i>Parthenium integrifolium</i> var. <i>integrifolium</i>	Wild quinine
	1875		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Parthenocissus inserta</i>	Five-leaved Virginia creeper
	1876												<i>Parthenocissus quinquefolia</i>	Inserted Virginia creeper
	1021												<i>Paspalum ciliatifolium</i> var. <i>stramineum</i>	Fringe-leaf paspalum
	1828		Ait	Bel		Hub	Ita		Tod		Cass		<i>Pastinaca sativa</i>	Wild parsnip
1767			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Pedicularis canadensis</i>	Wood-betony	
1768		Ait	Bel	CrW			Mor		Wad	Cass		<i>Pedicularis lanceolata</i>	Swamp lousewort	

MN	Map	N	COUNTY									Scientific Name	Common Name	
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
SPC	80											<i>Pellaea atropurpurea</i>	Purple cliff-brake	
	81											<i>Pellaea glabella</i>	Smooth cliff-brake	
	1769											<i>Penstemon albidus</i>	White beard-tongue	
	1770											<i>Penstemon digitalis</i>	Foxglove beard-tongue	
	1771		Bel	CrW	Hub			Mor	Tod	Wad	Cass	<i>Penstemon gracilis</i>	Slender beard-tongue	
NON	1772			CrW				Mor			Cass	<i>Penstemon grandiflorus</i>	Large-flowered beard-tongue	
	1773											<i>Penstemon pallidus</i>	Pale beard-tongue	
	549	Ait	Bel				Ita	Mor				<i>Penthorum sedoides</i>	Ditch-stonecrop	
	1212		Bel	CrW	Hub			Mor	Tod	Wad	Cass	<i>Petalostemon candidum</i>	White prairie-clover	
	1213											<i>Petalostemon occidentale</i>	Western prairie-clover	
SPC	1214			CrW	Hub			Mor	Tod	Wad	Cass	<i>Petalostemon purpureum</i>	Purple prairie-clover	
	1215			CrW				Mor				<i>Petalostemon villosum</i>	Silky prairie-clover	
	479	Ait	Bel	CrW	Hub	Ita		Mor		Wad	Cass	<i>Petasites frigidus var. palmatus</i>	Palmate sweet coltsfoot	
	480	Ait	Bel	CrW	Hub	Ita		Mor		Wad	Cass	<i>Petasites sagittatus</i>	Arrow-leaved sweet coltsfoot	
	481		Bel	CrW	Hub			Mor				<i>Petasites X vitifolius</i>	Grape-leaved sweet coltsfoot	
SPC	1085											<i>Phacelia franklinii</i>	Wild heliotrope	
	1022	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Phalaris arundinacea</i>	Reed canary-grass	
	1023	*										<i>Phalaris canariensis</i>	Birdseed grass	
	1024	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Phleum pratense</i>	Cultivated timothy	
	1413							Mor				<i>Phlox divaricata ssp. laphamii</i>	Blue phlox	
	1414											<i>Phlox maculata</i>	Wild sweet William	
	1415	*										<i>Phlox paniculata</i>	Garden phlox	
	1416				CrW	Hub			Mor	Tod	Wad	Cass	<i>Phlox pilosa ssp. fulgida</i>	Prairie phlox
	1025	Ait	Bel	CrW	Hub	Ita		Mor	Tod		Cass	<i>Phragmites australis</i>	Common reed	
	1401	Ait	Bel	CrW			Ita	Mor	Tod		Cass	<i>Phryma leptostachya</i>	Lopseed	
	1847											<i>Phyla lanceolata</i>	Fog-fruit	
	1787	Ait					Ita	Mor				<i>Physalis heterophylla</i>	Clammy ground-cherry	
	1788	Ait	Bel	CrW	Hub	Ita		Mor	Tod	Wad	Cass	<i>Physalis virginiana</i>	Ground-cherry	
	1615							Mor				<i>Physocarpus opulifolius</i>	Ninebark	
	1151	Ait	Bel	CrW			Ita	Mor			Cass	<i>Physostegia virginiana</i>	Obedient plant	
	106	Ait	Bel	CrW	Hub	Ita		Mor			Cass	<i>Picea glauca</i>	White spruce	
	107	Ait	Bel	CrW	Hub	Ita		Mor		Wad	Cass	<i>Picea mariana</i>	Black spruce	
	1842			CrW			Ita	Mor	Tod		Cass	<i>Pilea fontana</i>	Black-fruited clearweed	
	1843	Ait					Ita	Mor			Cass	<i>Pilea pumila</i>	Dwarf clearweed	
	1239											<i>Pinguicula vulgaris</i>	Butterwort	
	108	Ait	Bel	CrW	Hub	Ita		Mor	Tod	Wad	Cass	<i>Pinus banksiana</i>	Jack pine	
	109	Ait	Bel	CrW	Hub	Ita		Mor	Tod	Wad	Cass	<i>Pinus resinosa</i>	Red pine	
	110	Ait	Bel	CrW	Hub	Ita		Mor	Tod		Cass	<i>Pinus strobus</i>	White pine	
	217											<i>Plagiobothrys scopulorum</i>	Popcorn-flower	
	1403	*										<i>Plantago aristata</i>	Bracted plantain	
THR	1404											<i>Plantago elongata</i>	Slender plantain	
	1405											<i>Plantago eriopoda</i>	Alkali plantain	
	1406	*										<i>Plantago lanceolata</i>	English plantain	
	1407	*	Ait	Bel	CrW	Hub	Ita		Tod	Wad	Cass	<i>Plantago major</i>	Common plantain	
	1408							Mor	Tod	Wad	Cass	<i>Plantago patagonica</i>	Pursh's plantain	
	1409	*										<i>Plantago psyllium</i>	Leafy-stemmed plantain	
	1410	Ait		CrW				Mor			Cass	<i>Plantago rugelii</i>	Rugel's plantain	
	1411											<i>Plantago virginica</i>	Hoary plantain	
	1378	Ait					Ita					<i>Platanthera clavellata</i>	Club-spur orchid	
	1379	Ait	Bel			Hub	Ita					<i>Platanthera dilatata</i>	Tall white bog-orchid	
END	1380			CrW				Mor		Wad		<i>Platanthera flava var. herbiola</i>	Tubercled rein-orchid	
	1381	Ait		CrW	Hub	Ita					Cass	<i>Platanthera hookeri</i>	Hooker's orchid	
	1382	Ait	Bel	CrW	Hub	Ita				Wad	Cass	<i>Platanthera hyperborea</i>	Northern bog-orchid	
	1383	Ait	Bel					Mor			Cass	<i>Platanthera lacera</i>	Ragged fringed-orchid	
	1384	Ait	Bel			Hub	Ita				Cass	<i>Platanthera obtusata</i>	Small northern bog-orchid	
END	1385	Ait	Bel			Hub	Ita			Wad	Cass	<i>Platanthera orbiculata</i>	Large round-leaved orchid	
	1386											<i>Platanthera praeclara</i>	Western prairie fringed-orchid	
	1387	Ait	Bel	CrW			Ita	Mor			Cass	<i>Platanthera psycodes</i>	Small purple fringed-orchid	
	1026											<i>Poa alsodes</i>	Wood bluegrass	
	1027	*		CrW			Ita	Mor				<i>Poa annua</i>	Annual bluegrass	
NON	1028											<i>Poa arida</i>	Plains bluegrass	
	1029											<i>Poa chaixii</i>	Tall bluegrass	

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
THR	1030	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Poa compressa</i>	Canada bluegrass
	1031												<i>Poa glauca</i>	Pale bluegrass
	1032		Ait		CrW								<i>Poa interior</i>	Inland bluegrass
	1033				CrW	Hub		Mor					<i>Poa languida</i>	Weak bluegrass
	1034	*											<i>Poa nemoralis</i>	Sylvan bluegrass
	1035							Mor					<i>Poa paludigena</i>	Bog bluegrass
	1036		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Poa palustris</i>	Fowl meadow-grass
NON	1037	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Poa pratensis</i>	Kentucky bluegrass
	1038										Cass		<i>Poa saltuensis</i>	Pasture bluegrass
	1039										Cass		<i>Poa sylvestris</i>	Woodland bluegrass
SPC	1040												<i>Poa X tomentulosa</i>	Woolly bluegrass
	1041	*											<i>Poa trivialis</i>	Rough bluegrass
	1042												<i>Poa wolfii</i>	Wolf's bluegrass
END	183												<i>Podophyllum peltatum</i>	May-apple
	1388		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Pogonia ophioglossoides</i>	Rose pogonia
	237			Bel	CrW						Cass		<i>Polanisia dodecandra</i>	Clammy weed
END	238												<i>Polanisia jamesii</i>	James's polanisia
	1417												<i>Polemonium occidentale ssp. lacustre</i>	Western Jacob's-ladder
	1418												<i>Polemonium reptans</i>	Spreading Jacob's-ladder
END	1419												<i>Polygala cruciata</i> var. <i>aquilonia</i>	Cross-leaved milkwort
	1420			Bel		Hub	Ita				Cass		<i>Polygala paucifolia</i>	Gaywings
	1421		Ait	Bel						Wad	Cass		<i>Polygala polygama</i> var. <i>obtusata</i>	Racemed milkwort
	1422		Ait		CrW			Mor					<i>Polygala sanguinea</i>	Purple milkwort
	1423			Bel	CrW	Hub		Mor		Wad	Cass		<i>Polygala senega</i>	Seneca snakeroot
	1424										Cass		<i>Polygala verticillata</i> var. <i>isocycla</i>	Whorled milkwort
	1262		Ait		CrW	Hub	Ita	Mor	Tod		Cass		<i>Polygonatum commutatum</i>	Giant Solomon's-seal
	1263		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Polygonatum pubescens</i>	Hairy Solomon's-seal
	1427										Cass		<i>Polygonella articulata</i>	Coast jointweed
	1428	*			CrW		Ita	Mor	Tod	Wad	Cass		<i>Polygonum achoreum</i>	Blue knotweed
	1429		Ait		CrW	Hub	Ita	Mor			Cass		<i>Polygonum amphibium</i> var. <i>stipulaceum</i>	Water smartweed
	1430	*	Ait		CrW	Hub	Ita	Mor	Tod	Wad			<i>Polygonum arenastrum</i>	Common knotweed
NON	1431		Ait		CrW								<i>Polygonum arifolium</i> var. <i>pubescens</i>	Halberd-leaved tearthumb
	1432	*				Hub				Wad	Cass		<i>Polygonum aviculare</i>	Prostrate knotweed
	1433												<i>Polygonum bungeanum</i>	Prickly smartweed
SPC	1434												<i>Polygonum careyi</i>	Carey's smartweed
	1435		Ait	Bel		Hub	Ita				Cass		<i>Polygonum cilinode</i>	Fringed false buckwheat
	1436		Ait	Bel	CrW		Ita	Mor			Cass		<i>Polygonum coccineum</i>	Swamp smartweed
	1437	*		Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Polygonum convolvulus</i>	Black bindweed
	1438		Ait					Mor			Cass		<i>Polygonum cristatum</i>	Climbing buckwheat
	1439										Cass		<i>Polygonum douglasii</i>	Douglas' knotweed
	1440												<i>Polygonum erectum</i>	Erect knotweed
	1441	*			CrW		Ita	Mor	Tod		Cass		<i>Polygonum hydropiper</i>	Marsh water-pepper
	1442		Ait										<i>Polygonum hydropiperoides</i>	Mild water-pepper
	1443	*		Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Polygonum lapathifolium</i>	Nodding smartweed
	1444				CrW			Mor					<i>Polygonum pensylvanicum</i>	Pennsylvania smartweed
	1445	*	Ait			Hub	Ita	Mor	Tod		Cass		<i>Polygonum persicaria</i>	Lady's thumb
	1446		Ait		CrW		Ita	Mor	Tod	Wad	Cass		<i>Polygonum punctatum</i>	Dotted smartweed
	1447	*			CrW			Mor			Cass		<i>Polygonum ramosissimum</i>	Bushy knotweed
	1448		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Polygonum sagittatum</i>	Arrow-leaved tearthumb
	1449						Ita						<i>Polygonum scabrum</i>	Rough smartweed
	1450		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Polygonum scandens</i>	False buckwheat
	1451												<i>Polygonum tenue</i>	Slender knotweed
SPC	1452												<i>Polygonum virginianum</i>	Virginia knotweed
	1453												<i>Polygonum viviparum</i>	Alpine bistort
	482												<i>Polymnia canadensis</i>	Leaf-cup
THR	82		Ait	Bel		Hub	Ita	Mor			Cass		<i>Polypodium virginianum</i>	Common polypody
	83												<i>Polystichum acrostichoides</i>	Christmas fern
	84												<i>Polystichum braunii</i>	Braun's holly-fern
END	1829												<i>Polytaenia nuttallii</i>	Prairie parsley
	1468		Ait		CrW								<i>Pontederia cordata</i>	Pickereel-weed
	1689		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Populus balsamifera</i>	Balm-of-Gilead
SPC	1690		Ait	Bel	CrW	Hub			Tod	Wad	Cass		<i>Populus deltoides</i> ssp. <i>monilifera</i>	Cottonwood

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
END	1691		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Populus grandidentata</i>	Big-toothed aspen
	1692			Bel									<i>Populus X jackii</i>	Jack's cottonwood
	1693												<i>Populus X smithii</i>	Smith's aspen
	1694		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Populus tremuloides</i>	Quaking aspen
	1472	*			CrW	Hub		Mor	Tod				<i>Portulaca oleracea</i>	Purslane
	1475		Ait			Hub					Cass		<i>Potamogeton alpinus</i>	Alpine pondweed
	1476		Ait		CrW	Hub	Ita			Wad	Cass		<i>Potamogeton amplifolius</i>	Large-leaved pondweed
	1477												<i>Potamogeton bicipulatus</i>	Two-cupped pondweed
	1478	*						Mor					<i>Potamogeton crispus</i>	Curly pondweed
	1479		Ait										<i>Potamogeton diversifolius</i>	Snailseed pondweed
	1480		Ait			Hub	Ita				Cass		<i>Potamogeton ephidrus</i>	Ribbon-leaf pondweed
	1481										Cass		<i>Potamogeton filiformis</i>	Thread-leaf pondweed
	1482		Ait	Bel		Hub	Ita	Mor	Tod	Wad	Cass		<i>Potamogeton foliosus</i>	Leafy pondweed
	1483			Bel	CrW	Hub		Mor			Cass		<i>Potamogeton friesii</i>	Fries' pondweed
	1484		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Potamogeton gramineus</i>	Grass-leaf pondweed
	1485												<i>Potamogeton X haynesii</i>	Haynes' pondweed
	1486		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Potamogeton illinoensis</i>	Illinois pondweed
	1487		Ait	Bel	CrW	Hub	Ita		Tod		Cass		<i>Potamogeton natans</i>	Floating pondweed
	1488		Ait		CrW		Ita	Mor	Tod				<i>Potamogeton nodosus</i>	American pondweed
	9000		Ait			Hub							<i>Potamogeton oakesianus</i>	Oake's pondweed
SPC	1489		Ait		CrW						Cass		<i>Potamogeton obtusifolius</i>	Blunt-leaved pondweed
	1490		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Potamogeton pectinatus</i>	Sago pondweed
	1491				CrW	Hub	Ita	Mor			Cass		<i>Potamogeton praelongus</i>	White-stemmed pondweed
	1492												<i>Potamogeton pusillus</i> var. <i>pusillus</i>	Very small pondweed
	1493		Ait		CrW						Cass		<i>Potamogeton pusillus</i> var. <i>tenuissimus</i>	Very small pondweed
	1494		Ait	Bel	CrW	Hub	Ita			Wad	Cass		<i>Potamogeton richardsonii</i>	Richardson's pondweed
	1495					Hub	Ita	Mor			Cass		<i>Potamogeton robbinsii</i>	Robbins' pondweed
	1496		Ait						Tod		Cass		<i>Potamogeton spirillus</i>	Coiled pondweed
	1497			Bel	CrW		Ita	Mor			Cass		<i>Potamogeton strictifolius</i>	Straight-leaved pondweed
	1498			Bel			Ita						<i>Potamogeton vaginatus</i>	Sheathed pondweed
	1499		Ait										<i>Potamogeton vaseyi</i>	Vasey's pondweed
	1500		Ait	Bel			Ita	Mor			Cass		<i>Potamogeton zosteriformis</i>	Flat-stemmed pondweed
	1616				CrW		Ita	Mor			Cass		<i>Potentilla anserina</i>	Silverweed
	1617	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Potentilla argentea</i>	Silvery cinquefoil
	1618			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Potentilla arguta</i>	Tall cinquefoil
	1619					Hub							<i>Potentilla bipinnatifida</i>	Prairie cinquefoil
	1620												<i>Potentilla effusa</i>	Spreading cinquefoil
	1621												<i>Potentilla finitima</i>	Finite cinquefoil
NON	1622			Bel									<i>Potentilla fruticosa</i>	Shrubby cinquefoil
	1623												<i>Potentilla gracilis</i>	Slender cinquefoil
	1624												<i>Potentilla intermedia</i>	Downy cinquefoil
	1631												<i>Potentilla mill-pent-riva complex</i>	Cinquefoil
	1625												<i>Potentilla nicolletii</i>	Nicollet's cinquefoil
	1626	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Potentilla norvegica</i>	Rough cinquefoil
	1627		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Potentilla palustris</i>	Marsh cinquefoil
	1628												<i>Potentilla paradoxa</i>	Bushy cinquefoil
	1629				CrW			Mor					<i>Potentilla pensylvanica</i>	Prairie cinquefoil
	1630	*	Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Potentilla recta</i>	Rough-fruited cinquefoil
	1632		Ait		CrW			Mor			Cass		<i>Potentilla simplex</i>	Old-field cinquefoil
	1633		Ait	Bel	CrW	Hub							<i>Potentilla tridentata</i>	Three-toothed cinquefoil
	483		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Prenanthes alba</i>	White rattlesnake-root
	484												<i>Prenanthes aspera</i>	Hairy rattlesnake-root
	485												<i>Prenanthes crepidinea</i>	Crepis-like rattlesnake-root
	486							Mor					<i>Prenanthes racemosa</i>	Smooth rattlesnake-root
	1513												<i>Primula mistassinica</i>	Mistassini primrose
	1152	*	Ait		CrW		Ita	Mor		Wad	Cass		<i>Prunella vulgaris</i>	Heal-all
SPC	1634		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Prunus americana</i>	Wild plum
	1635			Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Prunus nigra</i>	Canada plum
	1636		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Prunus pensylvanica</i>	Pin cherry
	1637		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Prunus pumila</i>	Sand cherry
	1638		Ait	Bel	CrW				Tod	Wad	Cass		<i>Prunus serotina</i>	Black cherry
	1639		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Prunus virginiana</i>	Chokecherry

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
END	1216								Tod				<i>Psoralea argophylla</i>	Silvery scurf-pea
	1217												<i>Psoralea esculenta</i>	Prairie-turnip
	1218												<i>Psoralea tenuiflora</i>	Slender-leaved scurf-pea
NON	85		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Pteridium aquilinum</i> var. <i>latiusculum</i>	Bracken
	1043												<i>Puccinellia nuttalliana</i>	Nuttall's alkali grass
	1547				CrW			Mor		Wad	Cass		<i>Pulsatilla nuttalliana</i>	Pasque-flower
SPC	1153		Ait				Ita	Mor			Cass		<i>Pycnanthemum virginianum</i>	Virginia mountain-mint
	1519		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Pyrola asarifolia</i>	Pink-flowered pyrola
	1520		Ait	Bel		Hub	Ita	Mor		Wad	Cass		<i>Pyrola chlorantha</i>	Green-flowered pyrola
SPC	1521		Ait		CrW	Hub	Ita	Mor			Cass		<i>Pyrola elliptica</i>	Common pyrola
	1522												<i>Pyrola minor</i>	Lesser pyrola
	1523		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Pyrola rotundifolia</i> var. <i>americana</i>	Round-leaved pyrola
NON	1524		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Pyrola secunda</i>	One-sided pyrola
	1640												<i>Pyrus ioensis</i>	Iowa crabapple
	1641	*											<i>Pyrus malus</i>	Apple
NON	862				CrW			Mor	Tod				<i>Quercus alba</i>	White oak
	863												<i>Quercus bicolor</i>	Swamp white oak
	864		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Quercus ellipsoidalis</i>	Northern pin oak
NON	865		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Quercus macrocarpa</i>	Bur oak
	866												<i>Quercus muhlenbergii</i>	Chestnut oak
	867		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Quercus rubra</i>	Northern red oak
NON	868												<i>Quercus velutina</i>	Black oak
	1548		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Ranunculus abortivus</i>	Kidney-leaf buttercup
	1549	*	Ait				Ita	Mor	Tod		Cass		<i>Ranunculus acris</i>	Tall buttercup
NON	1550							Mor		Wad			<i>Ranunculus aquatilis</i> var. <i>capillaceus</i>	Limp white water-crowfoot
	1551												<i>Ranunculus circinatus</i> var. <i>subrigidus</i>	Coiled white water-crowfoot
	1552									Wad			<i>Ranunculus cymbalaria</i>	Sea-side crowfoot
NON	1553												<i>Ranunculus fascicularis</i>	Swamp buttercup
	1554					Hub		Mor	Tod	Wad	Cass		<i>Ranunculus flabellaris</i>	Large yellow water-crowfoot
	1555		Ait	Bel			Ita				Cass		<i>Ranunculus flammula</i>	Spearwort
NON	1556		Ait	Bel		Hub	Ita	Mor			Cass		<i>Ranunculus gmelini</i>	Small yellow water-crowfoot
	1557			Bel			Ita	Mor		Wad	Cass		<i>Ranunculus hispidus</i> var. <i>caricetorum</i>	Hispid buttercup
	1558												<i>Ranunculus hispidus</i> var. <i>nitidus</i>	Hispid buttercup
SPC	1559		Ait	Bel			Ita						<i>Ranunculus lapponicus</i>	Lapland buttercup
	1560			Bel				Mor		Wad			<i>Ranunculus longirostris</i>	Stiff white water-crowfoot
	1561			Bel							Cass		<i>Ranunculus macounii</i>	Macoun's buttercup
NON	1562		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Ranunculus pensylvanicus</i>	Bristly buttercup
	1563		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Ranunculus recurvatus</i>	Hooked crowfoot
	1564	*											<i>Ranunculus repens</i>	Creeping buttercup
NON	1565				CrW	Hub		Mor	Tod		Cass		<i>Ranunculus rhomboideus</i>	Prairie buttercup
	1566			Bel	CrW	Hub		Mor		Wad	Cass		<i>Ranunculus sceleratus</i>	Cursed crowfoot
	487					Hub							<i>Ratibida columnifera</i>	Prairie coneflower
NON	488												<i>Ratibida pinnata</i>	Gray-headed coneflower
	1572		Ait	Bel		Hub	Ita	Mor	Tod	Wad	Cass		<i>Rhamnus alnifolia</i>	Alder-leaved buckthorn
	1573	*	Ait						Tod	Wad	Cass		<i>Rhamnus cathartica</i>	Common buckthorn
NON	1574	*											<i>Rhamnus frangula</i>	Alder buckthorn
	141												<i>Rhus aromatica</i>	Fragrant sumac
	142					Hub		Mor			Cass		<i>Rhus X borealis</i>	Hybrid sumac
NON	143		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Rhus glabra</i>	Smooth sumac
	144										Cass		<i>Rhus radicans</i> var. <i>negundo</i>	Poison ivy
	145		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Rhus radicans</i> var. <i>rydbergii</i>	Poison ivy
NON	146		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Rhus typhina</i>	Staghorn sumac
	147												<i>Rhus vernix</i>	Poison sumac
	792		Ait	Bel	CrW		Ita	Mor			Cass		<i>Rhynchospora alba</i>	White beaked-sedge
THR SPC	793												<i>Rhynchospora capillacea</i>	Hair-like beaked-sedge
	794			Bel									<i>Rhynchospora fusca</i>	Brown beaked-sedge
	1721		Ait	Bel		Hub	Ita	Mor	Tod	Wad	Cass		<i>Ribes americanum</i>	Wild black currant
THR	1722		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Ribes cynosbati</i>	Prickly gooseberry
	1723		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Ribes glandulosum</i>	Skunk currant
	1724		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Ribes hirtellum</i>	Swamp gooseberry
THR	1725			Bel		Hub	Ita				Cass		<i>Ribes hudsonianum</i>	Northern black currant
	1726				CrW	Hub	Ita						<i>Ribes lacustre</i>	Swamp black currant

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
THR	1727							Mor			Cass	<i>Ribes missouriense</i>	Missouri gooseberry	
	1728	*										<i>Ribes nigrum</i>	Black currant	
	1729	*					Ita					<i>Ribes odoratum</i>	Flowering currant	
	1730				CrW		Ita				Cass	<i>Ribes oxycanthoides</i>	Northern gooseberry	
	1731											<i>Ribes rubrum</i>	Red currant	
	1732		Ait	Bel	CrW		Ita	Mor	Tod		Cass	<i>Ribes triste</i>	Swamp red currant	
	1219	*									Cass	<i>Robinia pseudoacacia</i>	Black locust	
	597		Ait	Bel	CrW		Ita	Mor			Cass	<i>Rorippa islandica</i>	Icelandic yellow-cress	
	598											<i>Rorippa sinuata</i>	Spreading yellow-cress	
	1642		Ait		CrW	Hub	Ita				Cass	<i>Rosa acicularis ssp. sayi</i>	Prickly rose	
	1643			Bel	CrW	Hub		Mor		Wad	Cass	<i>Rosa arkansana</i>	Prairie rose	
	1644		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Rosa blanda</i>	Smooth wild rose	
	1645			Bel		Hub	Ita				Cass	<i>Rosa macounii</i>	Macoun's wild rose	
	1294											<i>Rotala ramosior</i>	Tooth-cup	
	1646			Bel			Ita				Cass	<i>Rubus acaulis</i>	Arctic raspberry	
	1647			Bel	CrW	Hub				Wad	Cass	<i>Rubus acridens</i>	Sharp-toothed blackberry	
	1648		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Rubus allegheniensis</i>	High-bush blackberry	
	THR	1649			Bel	CrW					Wad	Cass	<i>Rubus canadensis</i>	Smooth blackberry
1650												<i>Rubus chamaemorus</i>	Cloudberry	
1651								Mor			Cass	<i>Rubus flagellaris</i>	Common eastern dewberry	
1652						Hub					Cass	<i>Rubus folioliflorus</i>	Leafy-bract dewberry	
1653			Ait	Bel	CrW	Hub					Cass	<i>Rubus groutianus</i>	Grout's blackberry	
1654												<i>Rubus latifoliolus</i>	Broad-leaflet blackberry	
1655						Hub					Cass	<i>Rubus minnesotanus</i>	Minnesota blackberry	
1656						Hub						<i>Rubus multiflor</i>	Fruitful dewberry	
1657			Ait		CrW	Hub	Ita					<i>Rubus occidentalis</i>	Black raspberry	
1658												<i>Rubus parviflorus</i>	Thimbleberry	
1659			Ait				Ita					<i>Rubus pensilvanicus</i>	Tall blackberry	
1660			Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Rubus pubescens</i>	Dwarf raspberry	
1661								Mor				<i>Rubus recurvans</i>	Low-arching blackberry	
1662					CrW							<i>Rubus rosendahlia</i>	Rosendahl's dewberry	
1663					CrW							<i>Rubus semisetosus</i>	Half-bristly blackberry	
1664			Ait	Bel	CrW	Hub	Ita	Mor				<i>Rubus strigosus</i>	Red raspberry	
1665			Ait	Bel	CrW	Hub					Cass	<i>Rubus vermontanus</i>	Vermont blackberry	
NON		489		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass	<i>Rudbeckia hirta var. pulcherrima</i>	Black-eyed Susan
	490				CrW			Mor	Tod		Cass	<i>Rudbeckia laciniata</i>	Goldenglow	
	491											<i>Rudbeckia triloba</i>	Brown-eyed Susan	
	113											<i>Ruellia humilis</i>	Wild petunia	
	1454	*						Mor				<i>Rumex acetosa</i>	Green sorrel	
	1455	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Rumex acetosella</i>	Red sorrel	
	1456		Ait									<i>Rumex altissimus</i>	Tall water-dock	
	1457	*	Ait		CrW		Ita	Mor	Tod	Wad	Cass	<i>Rumex crispus</i>	Curly dock	
	1458	*	Ait							Wad		<i>Rumex longifolius</i>	Domestic dock	
	1459		Ait	Bel	CrW		Ita	Mor		Wad	Cass	<i>Rumex maritimus var. fueginus</i>	Golden dock	
	1460			Bel	CrW		Ita	Mor			Cass	<i>Rumex mexicanus</i>	Willow-leaved dock	
	1461	*						Mor				<i>Rumex obtusifolius</i>	Bitter dock	
	1462		Ait	Bel	CrW		Ita	Mor		Wad	Cass	<i>Rumex orbiculatus</i>	Great water dock	
	1463	*						Mor			Cass	<i>Rumex patientia</i>	Patience dock	
	1464	*										<i>Rumex stenophyllus</i>	Narrow-leaf dock	
	1465											<i>Rumex verticillatus</i>	Whorled water-dock	
	1687											<i>Ruppia occidentalis</i>	Ditch-grass	
	NON	271											<i>Sagina nodosa ssp. borealis</i>	Knotty pearlwort
272												<i>Sagina procumbens</i>	Bird's-eye pearlwort	
126												<i>Sagittaria brevirostra</i>	Short-beaked arrowhead	
127			Ait			Hub	Ita	Mor			Cass	<i>Sagittaria cristata</i>	Crested arrowhead	
128			Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Sagittaria cuneata</i>	Arum-leaf arrowhead	
129			Ait									<i>Sagittaria graminea</i>	Grass-leaved arrowhead	
130			Ait	Bel	CrW		Ita	Mor		Wad	Cass	<i>Sagittaria latifolia</i>	Broad-leaved arrowhead	
131			Ait	Bel		Hub	Ita	Mor			Cass	<i>Sagittaria rigida</i>	Sessile-fruited arrowhead	
312												<i>Salicornia rubra</i>	Red glasswort	
1695		*									Cass	<i>Salix alba</i>	White willow	
1696				Bel				Mor			Cass	<i>Salix amygdaloides</i>	Peach-leaved willow	

MN	Map	N	COUNTY								Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	
SPC	1697		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Salix bebbiana</i> Bebb's willow
	1698		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Salix candida</i> Sage-leaved willow
	1699		Ait	Bel	CrW	Hub	Ita				Cass	<i>Salix discolor</i> Pussy willow
	1700		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Salix eriocephala</i> Heart-leaved willow
	1701		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass	<i>Salix exigua ssp. interior</i> Sand-bar willow
	9000											<i>Salix fragilis</i> Crack willow
	1702		Ait	Bel	CrW	Hub	Ita				Cass	<i>Salix gracilis</i> Slender willow
	1703		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Salix humilis</i> Prairie willow
	1704		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Salix lucida</i> Shining willow
	9000											<i>Salix maccalliana</i> Maccall's willow
SPC	1705		Ait			Hub	Ita	Mor	Tod		Cass	<i>Salix nigra</i> Black willow
	1706	*	Ait	Bel	CrW		Ita	Mor			Cass	<i>Salix pedicularis var. hypoglauca</i> Bog willow
	1707											<i>Salix pellita</i> Satiny willow
	1708			Bel							Cass	<i>Salix planifolia</i> Diamond-leaf willow
	1709		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Salix pyrifolia</i> Balsam willow
	1710		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Salix serissima</i> Autumn willow
	313	*										<i>Salsola collina</i> Salsola tumbleweed
	314	*		Bel	CrW	Hub	Ita		Tod		Cass	<i>Salsola iberica</i> Russian thistle
	1154											<i>Salvia reflexa</i> Lance-leaved sage
	248							Mor			Cass	<i>Sambucus canadensis</i> Common Elder
SPC	249		Ait	Bel			Ita	Mor			Cass	<i>Sambucus pubens</i> Red-berried Elder
	1400		Ait	Bel			Ita	Mor		Wad	Cass	<i>Sanguinaria canadensis</i> Bloodroot
	1830								Tod			<i>Sanicula canadensis</i> Canadian black snakeroot
	1831								Tod		Cass	<i>Sanicula gregaria</i> Gregarious black snakeroot
	1832		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Sanicula marilandica</i> Mariland black snakeroot
	1833											<i>Sanicula trifoliata</i> Three-leaved black snakeroot
	273	*				Hub	Ita	Mor		Wad	Cass	<i>Saponaria officinalis</i> Bouncing bet
	1713		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass	<i>Sarracenia purpurea</i> Pitcher-plant
	1155	*										<i>Satureja vulgaris var. neogaea</i> Wild basil
	1733											<i>Saxifraga aizoon var. neogaea</i> Encrusted saxifrage
THR END	1734											<i>Saxifraga cernua</i> Nodding saxifrage
	1735		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Saxifraga pensylvanica</i> Swamp saxifrage
	1736											<i>Saxifraga virginensis</i> Early saxifrage
	1044											<i>Schedonnardus paniculatus</i> Tumble grass
	1129		Ait	Bel		Hub	Ita				Cass	<i>Scheuchzeria palustris var. americana</i> Scheuchzeria
	1045		Ait	Bel	CrW	Hub		Mor	Tod	Wad	Cass	<i>Schizachne purpurascens</i> False melic grass
	1046				CrW			Mor	Tod			<i>Schizachyrium scoparium var. frequens</i> Little bluestem
	795		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Scirpus acutus</i> Hard-stemmed bulrush
	796			Bel	CrW	Hub	Ita	Mor			Cass	<i>Scirpus atrocinctus</i> Black-spiked bulrush
	797		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass	<i>Scirpus atrovirens</i> Dark green bulrush
SPC	798			Bel								<i>Scirpus cespitosus var. callosus</i> Tufted bulrush
	799											<i>Scirpus clintonii</i> Clinton's bulrush
	800		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Scirpus cyperinus</i> Wool-grass
	801						Ita				Cass	<i>Scirpus fluviatilis</i> River bulrush
	802											<i>Scirpus georgianus</i> Georgian bulrush
	803			Bel								<i>Scirpus hattorianus</i> Hattorian bulrush
	804		Ait				Ita		Tod			<i>Scirpus heterochaetus</i> Slender bulrush
	805			Bel		Hub						<i>Scirpus hudsonianus</i> Hudson Bay bulrush
	806		Ait			Hub	Ita	Mor			Cass	<i>Scirpus microcarpus</i> Small-fruited bulrush
	807			Bel								<i>Scirpus pallidus</i> Pale bulrush
NON	808											<i>Scirpus paludosus</i> Bayonet-grass
	809		Ait									<i>Scirpus pedicellatus</i> Pedicelled bulrush
	810		Ait	Bel	CrW		Ita				Cass	<i>Scirpus pungens</i> Three-square
	811				CrW	Hub	Ita				Cass	<i>Scirpus purshianus</i> Pursh's bulrush
	812				CrW	Hub	Ita				Cass	<i>Scirpus smithii</i> Smith's bulrush
	813			Bel		Hub	Ita	Mor			Cass	<i>Scirpus subterminalis</i> Swaying bulrush
	814		Ait				Ita				Cass	<i>Scirpus torreyi</i> Torrey's bulrush
	815		Ait	Bel			Ita	Mor	Tod	Wad	Cass	<i>Scirpus validus var. creber</i> Softstem bulrush
	274	*						Mor				<i>Scleranthus annuus</i> Knawel
	816											<i>Scleria triglomerata</i> Tall nut-rush
END THR	817											<i>Scleria verticillata</i> Whorled nut-rush
	1047											<i>Scolochloa festucacea</i> Whitetop

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
THR	1774		Ait	Bel			Ita	Mor	Tod	Wad	Cass		<i>Scrophularia lanceolata</i>	Lance-leaved figwort
	1775												<i>Scrophularia marilandica</i>	Maryland figwort
	1156		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Scutellaria galericulata</i>	Marsh skullcap
	1157		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Scutellaria lateriflora</i>	Mad-dog skullcap
	1158							Mor		Wad	Cass		<i>Scutellaria leonardi</i>	Leonard's skullcap
	1159												<i>Scutellaria ovata ssp. versicolor</i>	Heart-leaved skullcap
	1160												<i>Scutellaria parvula</i>	Prairie skullcap
	1048	*				Hub							<i>Secale cereale</i>	Cultivated rye
	550	*				Hub					Cass		<i>Sedum acre</i>	Mossy stonecrop
	END	551											<i>Sedum integrifolium ssp. leedyi</i>	Leedy's roseroot
END	552	*			CrW		Ita						<i>Sedum purpureum</i>	Orpine
	98			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Selaginella rupestris</i>	Rock spikemoss
END	99												<i>Selaginella selaginoides</i>	Northern spikemoss
	492		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Senecio aureus</i>	Golden ragwort
SPC	493												<i>Senecio canus</i>	Gray ragwort
	494		Ait	Bel	CrW	Hub	Ita				Cass		<i>Senecio congestus</i>	Swamp ragwort
	495												<i>Senecio indecorus</i>	Unsightly ragwort
THR	496												<i>Senecio integerrimus</i>	Entire ragwort
	497		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Senecio pauperculus</i>	Balsam ragwort
	498					Hub	Ita		Tod				<i>Senecio plattensis</i>	Prairie ragwort
	499							Mor					<i>Senecio pseud aureus var. semicordatus</i>	False Golden Ragwort
	500	*											<i>Senecio vulgaris</i>	Common groundsel
	1049	*					Ita		Tod				<i>Setaria faberi</i>	Giant foxtail
	1050	*			CrW		Ita	Mor			Cass		<i>Setaria glauca</i>	Yellow foxtail
	1051	*											<i>Setaria italica</i>	Foxtail millet
	1052	*											<i>Setaria verticillata</i>	Bristly foxtail
	1053	*	Ait	Bel	CrW		Ita	Mor	Tod	Wad			<i>Setaria viridis</i>	Green foxtail
THR	826												<i>Shepherdia argentea</i>	Buffalo-berry
	827												<i>Shepherdia canadensis</i>	Soapberry
	501												<i>Shinnersoseris rostrata</i>	Annual skeleton-weed
	605			Bel							Cass		<i>Sicyos angulatus</i>	Bur-cucumber
SPC	275		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Silene antirrhina</i>	Sleepy catchfly
	276	*			CrW			Mor					<i>Silene armeria</i>	Sweet William
	277	*	Ait			Hub	Ita	Mor	Tod	Wad	Cass		<i>Silene cserei</i>	Bladder-campion
	278	*				Hub		Mor	Tod	Wad			<i>Silene dichotoma</i>	Forking catchfly
THR	279							Mor			Cass		<i>Silene drummondii</i>	Drummond's campion
	280	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Silene latifolia ssp. alba</i>	White campion
	281												<i>Silene nivea</i>	Snowy campion
	282	*		Bel							Cass		<i>Silene noctiflora</i>	Night-flowering campion
THR	283												<i>Silene stellata</i>	Starry campion
	284	*	Ait	Bel			Ita						<i>Silene vulgaris</i>	Bladder campion
	502												<i>Silphium laciniatum</i>	Compass-plant
	503												<i>Silphium perfoliatum</i>	Cup-plant
	599	*		Bel	CrW		Ita	Mor	Tod	Wad			<i>Sisymbrium altissimum</i>	Tumble-mustard
	600	*											<i>Sisymbrium loeselii</i>	Tall hedge mustard
	601	*			CrW			Mor	Tod				<i>Sisymbrium officinale</i>	Hedge mustard
	1095						Ita	Mor	Tod	Wad	Cass		<i>Sisyrinchium campestre</i>	Field blue-eyed grass
	1096							Mor			Cass		<i>Sisyrinchium montanum</i>	Mountain blue-eyed grass
	1096		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Sisyrinchium montanum var. crebrum</i>	Mountain blue-eyed grass
THR	1097								Tod		Cass		<i>Sisyrinchium mucronatum</i>	Pointed-petal blue-eyed grass
	1834		Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Sium suave</i>	Water-parsnip
	1264		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Smilacina racemosa</i>	Racemose false Solomon's-seal
	1265		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Smilacina stellata</i>	Starry false Solomon's-seal
	1266		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Smilacina trifolia</i>	Three-leaved f. Solomon's-seal
	1267		Ait		CrW		Ita				Cass		<i>Smilax ecirrata</i>	Erect carrion-flower
	1268		Ait										<i>Smilax herbacea</i>	Tendriled carrion-flower
	1269												<i>Smilax hispida</i>	Green-briar
	1270		Ait		CrW			Mor					<i>Smilax illinoensis</i>	Illinois carrion-flower
	1271		Ait	Bel	CrW		Ita	Mor		Wad	Cass		<i>Smilax lasioneura</i>	Hairy-nerved carrion-flower
THR	1789	*						Mor					<i>Solanum carolinense</i>	Horse-nettle
	1790	*	Ait								Cass		<i>Solanum dulcamara</i>	Bittersweet nightshade
	1791		Ait	Bel	CrW		Ita	Mor			Cass		<i>Solanum ptycanthum</i>	Black nightshade

MN	Map	N	COUNTY										Scientific Name	Common Name	
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass				
SPC	1792	*											<i>Solanum rostratum</i>	Buffalo-bur	
	504												<i>Solidago X bernardii</i>	Bernard's goldenrod	
	505		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Solidago canadensis</i> var. <i>canadensis</i>	Canada goldenrod	
	506		Ait		CrW		Ita	Mor			Cass		<i>Solidago flexicaulis</i>	Zig-zag goldenrod	
	507		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Solidago gigantea</i>	Giant goldenrod	
	508		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Solidago hispida</i>	Hairy goldenrod	
	509			Bel	CrW	Hub	Ita	Mor			Cass		<i>Solidago juncea</i>	Early goldenrod	
	510			Bel	CrW	Hub		Mor		Wad	Cass		<i>Solidago missouriensis</i>	Missouri goldenrod	
	511												<i>Solidago mollis</i>	Soft goldenrod	
	512		Ait	Bel	CrW	Hub	Ita	Mor		Wad	Cass		<i>Solidago nemoralis</i>	Gray goldenrod	
	513				CrW	Hub	Ita	Mor	Tod	Wad			<i>Solidago ptarmicoides</i>	Upland white aster	
	514												<i>Solidago riddellii</i>	Riddell's goldenrod	
	SPC	515			Bel		Hub	Ita	Mor	Tod	Wad	Cass		<i>Solidago rigida</i>	Stiff goldenrod
516									Tod				<i>Solidago sciaphila</i>	Cliff goldenrod	
517				Bel	CrW	Hub		Mor		Wad	Cass		<i>Solidago speciosa</i>	Showy goldenrod	
518			Ait	Bel	CrW	Hub	Ita		Tod		Cass		<i>Solidago uliginosa</i>	Bog goldenrod	
519							Ita						<i>Solidago ulmifolia</i>	Bog goldenrod	
520		*					Ita						<i>Sonchus arvensis</i>	Field sow-thistle	
521		*			CrW		Ita				Cass		<i>Sonchus asper</i>	Spiny sow-thistle	
522		*						Mor					<i>Sonchus oleraceus</i>	Common sow-thistle	
523		*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Sonchus uliginosus</i>	Smooth sow-thistle	
1666		*					Ita						<i>Sorbaria sorbifolia</i>	False spiraea	
1667					CrW		Ita						<i>Sorbus americana</i>	American mountain-ash	
1668		*											<i>Sorbus aucuparia</i>	European mountain-ash	
1669				Bel	CrW	Hub	Ita			Wad	Cass		<i>Sorbus decora</i>	Showy mountain-ash	
SPC	1054				CrW			Mor	Tod	Wad	Cass		<i>Sorghastrum nutans</i>	Indian grass	
	1793							Mor			Cass		<i>Sparganium americanum</i>	Nuttall's bur-reed	
	1794												<i>Sparganium androcladum</i>	Branching bur-reed	
	1795						Ita						<i>Sparganium angustifolium</i>	Narrow-leaved bur-reed	
	1796		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Sparganium chlorocarpum</i>	Green-fruited bur-reed	
	1797		Ait				Ita	Mor		Wad	Cass		<i>Sparganium eurycarpum</i>	Giant bur-reed	
	1798		Ait		CrW	Hub	Ita				Cass		<i>Sparganium fluctuans</i>	Floating bur-reed	
	1799						Ita				Cass		<i>Sparganium glomeratum</i>	Clustered bur-reed	
	1800			Bel		Hub	Ita	Mor					<i>Sparganium minimum</i>	Small bur-reed	
	NON	1055												<i>Spartina gracilis</i>	Alkali cord-grass
		1056		Ait		CrW			Mor			Cass		<i>Spartina pectinata</i>	Prairie cord-grass
		1301												<i>Sphaeralcea coccinea</i>	Scarlet mallow
		1057		Ait		CrW	Hub	Ita	Mor					<i>Sphenopholis intermedia</i>	Slender wedge-grass
1058													<i>Sphenopholis obtusata</i>	Prairie wedge-grass	
1670			Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Spiraea alba</i>	Meadowsweet	
1671			Ait		CrW			Mor					<i>Spiraea tomentosa</i> var. <i>rosea</i>	Steeple-bush	
1389			Ait		CrW		Ita	Mor					<i>Spiranthes cernua</i>	Nodding ladies'-tresses	
1390			Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Spiranthes lacera</i>	N. slender ladies'-tresses	
1391													<i>Spiranthes magnicamporum</i>	Great Plains ladies'-tresses	
1392					CrW	Hub							<i>Spiranthes romanzoffiana</i>	Hooded ladies'-tresses	
1236			Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Spirodela polyrhiza</i>	Greater duckweed	
1059								Mor	Tod		Cass		<i>Sporobolus asper</i>	Rough dropseed	
1060				CrW			Mor	Tod	Wad	Cass		<i>Sporobolus cryptandrus</i>	Sand dropseed		
SPC	1061					Hub		Mor					<i>Sporobolus heterolepis</i>	Prairie dropseed	
	1062					Hub							<i>Sporobolus neglectus</i>	Annual dropseed	
	1063					Hub							<i>Sporobolus vaginiflorus</i>	Poverty dropseed	
	1161		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Stachys palustris</i>	Woundwort	
	1162						Ita	Mor			Cass		<i>Stachys tenuifolia</i>	Smooth hedge-nettle	
	1801												<i>Staphylea trifolia</i>	Bladdernut	
	285												<i>Stellaria alsine</i>	Alsine starwort	
	286						Ita						<i>Stellaria borealis</i>	Northern starwort	
	287					Hub	Ita	Mor			Cass		<i>Stellaria crassifolia</i>	Fleshy-leaved starwort	
	288	*											<i>Stellaria graminea</i>	Lesser stitchwort	
	289		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Stellaria longifolia</i>	Long-leaved chickweed	
	290												<i>Stellaria longipes</i>	Long-stalked starwort	
	291	*					Ita	Mor	Tod		Cass		<i>Stellaria media</i>	Common chickweed	
1064												<i>Stipa comata</i>	Needle-and-thread grass		

MN	Map	N	COUNTY								Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	
THR	1065			Bel	CrW	Hub		Mor	Tod	Wad	Cass	<i>Stipa spartea</i> Porcupine-grass
	1066											<i>Stipa viridula</i> Green needle-grass
	1272											<i>Streptopus amplexifolius</i> White mandarin
	1273		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Streptopus roseus</i> var. <i>longipes</i> Rosey twisted-stalk
	1220											<i>Strophostyles helvola</i> Wild bean
	1221											<i>Strophostyles leiosperma</i> Trailing pea
	315											<i>Suaeda calceoliformis</i> Sea-blite
	602											<i>Subularia aquatica</i> ssp. <i>americana</i> Awlwort
	1737											<i>Sullivantia renifolia</i> Reniform Sullivantia
	250		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Symphoricarpos albus</i> Snowberry
SPC	251			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Symphoricarpos occidentalis</i> Wolfberry
	252											<i>Symphoricarpos orbiculatus</i> Coralberry
NON	158		Ait		CrW							<i>Symplocarpus foetidus</i> Skunk-cabbage
	1835											<i>Taenidia integerrima</i> Yellow pimpernel
END	1473											<i>Talinum parviflorum</i> Small-flowered fameflower
	1474											<i>Talinum rugospermum</i> Rough-seeded fameflower
SPC	524 *		Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Tanacetum vulgare</i> Tansey
	525 *						Ita	Mor	Tod		Cass	<i>Taraxacum erythrospermum</i> Red-seeded dandelion
	526 *		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Taraxacum officinale</i> Common dandelion
	112		Ait	Bel	CrW	Hub	Ita		Tod		Cass	<i>Taxus canadensis</i> Canada yew
	1222								Tod			<i>Tephrosia virginiana</i> Goat's-rue
THR	1163											<i>Teucrium canadense</i> Germander
	1567		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Thalictrum dasycarpum</i> Tall meadow-rue
	1568		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Thalictrum dioicum</i> Early meadow-rue
	1569		Ait	Bel		Hub					Cass	<i>Thalictrum venulosum</i> Veiny meadow-rue
	1836											<i>Thaspium barbinode</i> Meadow-parsnip
	86											<i>Thelypteris hexagonoptera</i> Broad beech-fern
	87		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Thelypteris palustris</i> Northern marsh-fern
	88		Ait	Bel			Ita				Cass	<i>Thelypteris phegopteris</i> Long beech-fern
	603 *		Ait	Bel			Ita	Mor		Wad	Cass	<i>Thlaspi arvense</i> Penny-cress
	103		Ait	Bel	CrW		Ita				Cass	<i>Thuja occidentalis</i> White cedar
THR	1738 *											<i>Tiarella cordifolia</i> Foamflower
	1803		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass	<i>Tilia americana</i> Basswood
	553											<i>Tillaea aquatica</i> Pygmyweed
	1274											<i>Tofieldia glutinosa</i> Sticky false asphodel
	1275											<i>Tofieldia pusilla</i> Small false asphodel
END SPC	1067						Ita					<i>Torreyochloa pallida</i> Torrey's manna-grass
	324							Mor	Tod	Wad	Cass	<i>Tradescantia bracteata</i> Bracted spiderwort
	325				CrW			Mor			Cass	<i>Tradescantia occidentalis</i> Western spiderwort
	326								Tod			<i>Tradescantia ohimensis</i> Ohio spiderwort
	527 *		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Tragopogon dubius</i> Yellow goat's-beard
	528 *						Ita	Mor				<i>Tragopogon pratensis</i> Meadow goat's-beard
	1092		Ait	Bel	CrW	Hub	Ita	Mor			Cass	<i>Triadenum fraseri</i> Marsh St. John's-wort
	1514		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass	<i>Trientalis borealis</i> Starflower
	1223 *		Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Trifolium arvense</i> Rabbit's-foot clover
	1224 *		Ait		CrW		Ita				Cass	<i>Trifolium aureum</i> Palmate hop-clover
NON	1225 *		Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Trifolium campestre</i> Field hop-clover
	1226 *		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Trifolium hybridum</i> Alsike clover
	1227 *		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Trifolium pratense</i> Red clover
	1228 *		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Trifolium repens</i> White clover
	1130			Bel	CrW	Hub	Ita				Cass	<i>Triglochin maritima</i> Seaside arrow-grass
	1131											<i>Triglochin palustris</i> Marsh arrow-grass
	1276		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass	<i>Trillium cernuum</i> Nodding trillium
	1277											<i>Trillium flexipes</i> Drooping trillium
	1278		Ait		CrW		Ita	Mor			Cass	<i>Trillium grandiflorum</i> Large-flowered trillium
	1279						Ita					<i>Trillium nivale</i> Snow trillium
SPC	235											<i>Triodanis leptocarpa</i> Slender-fruited Venus' l-glass
	236				CrW							<i>Triodanis perfoliata</i> Clasping Venus' looking-glass
SPC	253					Hub		Mor	Tod	Wad	Cass	<i>Triosteum perfoliatum</i> Horse-gentian
	1068											<i>Triplasis purpurea</i> Sand-grass
SPC	1069											<i>Trisetum spicatum</i> Spike trisetum
	111											<i>Tsuga canadensis</i> Hemlock

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
NON	1804		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Typha angustifolia</i>	Narrow-leaved cat-tail
	1805		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Typha latifolia</i>	Broad-leaved cattail
	1807		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Ulmus americana</i>	American elm
	1808	*	Ait	Bel				Mor		Wad	Cass		<i>Ulmus pumila</i>	Siberian elm
	1809		Ait		CrW		Ita	Mor			Cass		<i>Ulmus rubra</i>	Slippery elm
	1810						Ita	Mor					<i>Ulmus thomasii</i>	Rock elm
	1844		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Urtica dioica ssp. gracilis</i>	Stinging nettle
	1240			Bel			Ita						<i>Utricularia cornuta</i>	Horned bladderwort
	1241		Ait		CrW		Ita	Mor			Cass		<i>Utricularia gibba</i>	Humped bladderwort
	1242		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Utricularia intermedia</i>	Flat-leaved bladderwort
SPC	1243		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Utricularia minor</i>	Lesser bladderwort
	9000				CrW						Cass		<i>Utricularia purpurea</i>	Purple-flowered
	1244												<i>Utricularia resupinata</i>	Reclined bladderwort
	1245		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Utricularia vulgaris</i>	Greater bladderwort
	1280		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Uvularia grandiflora</i>	Yellow bellwort
	1281		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Uvularia sessilifolia</i>	Pale bellwort
	292	*		Bel							Cass		<i>Vaccaria pyramidata</i>	Cow-herb
	841		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Vaccinium angustifolium</i>	Lowbush blueberry
	842				CrW	Hub					Cass		<i>Vaccinium cespitosum</i>	Dwarf bilberry
	843		Ait		CrW	Hub	Ita	Mor			Cass		<i>Vaccinium macrocarpon</i>	Large cranberry
THR	844		Ait	Bel	CrW	Hub	Ita		Tod	Wad	Cass		<i>Vaccinium myrtilloides</i>	Velvet-leaf blueberry
	845		Ait	Bel	CrW	Hub	Ita	Mor			Cass		<i>Vaccinium oxycoccus</i>	Small cranberry
	846												<i>Vaccinium uliginosum var. alpinum</i>	Alpine bilberry
	847			Bel		Hub	Ita						<i>Vaccinium vitis-idaea var. minus</i>	Mountain cranberry
	1845												<i>Valeriana edulis ssp. ciliata</i>	Edible valerian
	1846	*											<i>Valeriana officinalis</i>	Garden heliotrope
	1081		Ait				Ita	Mor			Cass		<i>Vallisneria americana</i>	Eel-grass
	1776	*	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Verbascum thapsus</i>	Common mullein
	1848			Bel	CrW		Ita	Mor			Cass		<i>Verbena bracteata</i>	Large-bracted vervain
	1849		Ait	Bel	CrW		Ita	Mor	Tod	Wad	Cass		<i>Verbena hastata</i>	Blue vervain
SPC	1850												<i>Verbena simplex</i>	Narrow-leaved vervain
	1851							Mor					<i>Verbena stricta</i>	Hoary vervain
	1852				CrW	Hub		Mor	Tod		Cass		<i>Verbena urticifolia</i>	White vervain
	529		Ait		CrW			Mor					<i>Vernonia fasciculata</i>	Bunched ironweed
	1777					Hub					Cass		<i>Veronica americana</i>	American brooklime
	1778	*						Mor					<i>Veronica arvensis</i>	Corn-speedwell
	1779		Ait	Bel			Ita	Mor		Wad	Cass		<i>Veronica catenata</i>	Water-speedwel
	1780	*											<i>Veronica longifolia</i>	Seaside veronica
	1781	*											<i>Veronica officinalis</i>	Common speedwell
	1782		Ait	Bel			Ita	Mor	Tod		Cass		<i>Veronica peregrina</i>	Purslane speedwell
THR	1783		Ait			Hub		Mor					<i>Veronica scutellata</i>	Marsh speedwell
	1784	*											<i>Veronica serpyllifolia</i>	Thyme-leaved speedwell
	1785		Ait		CrW			Mor	Tod	Wad	Cass		<i>Veronicastrum virginicum</i>	Culver's root
	254												<i>Viburnum edule</i>	Squashberry
	255		Ait		CrW		Ita	Mor	Tod	Wad	Cass		<i>Viburnum lentago</i>	Nannyberry
	256		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Viburnum rafinesquianum</i>	Downy arrow-wood
	257		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Viburnum trilobum</i>	High-bush cranberry
	1229		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Vicia americana</i>	American vetch
	1230	*											<i>Vicia angustifolia</i>	Narrow-leaved vetch
	1231	*									Cass		<i>Vicia cracca</i>	Tufted vetch
THR	1232	*											<i>Vicia sativa</i>	Spring vetch
	1233	*	Ait				Ita	Mor		Wad	Cass		<i>Vicia villosa</i>	Hairy vetch
	1853		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Viola adunca</i>	Sand violet
	1854												<i>Viola affinis</i>	Blue violet
	1855		Ait	Bel			Ita				Cass		<i>Viola canadensis var. rugulosa</i>	Rugulose violet
	1856		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Viola conspersa</i>	Dog violet
	1857		Ait			Hub	Ita	Mor			Cass		<i>Viola cucullata</i>	Marsh violet
	1858		Ait	Bel	CrW	Hub	Ita		Tod		Cass		<i>Viola incognita</i>	Big-leaf white violet
	1859												<i>Viola labradorica</i>	Labrador violet
	1860												<i>Viola lanceolata</i>	Lance-leaved violet
THR	1861		Ait	Bel	CrW	Hub	Ita	Mor	Tod		Cass		<i>Viola macloskeyi ssp. pallens</i>	Northern white violet
	1862												<i>Viola missouriensis</i>	Missouri violet

MN	Map	N	COUNTY										Scientific Name	Common Name
Status	No.	N	Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass			
THR	1863			Bel		Hub		Mor	Tod	Wad			<i>Viola nephrophylla</i>	Northern bog violet
	1864						Ita				Cass		<i>Viola novae-angliae</i>	New England violet
	1865												<i>Viola nuttallii</i>	Yellow prairie violet
	1866												<i>Viola pedata</i>	Bird-foot violet
	1867				CrW			Mor	Tod	Wad	Cass		<i>Viola pedatifida</i>	Prairie bird-foot violet
	1868					Hub					Cass		<i>Viola pratensis</i>	Meadow violet
	1869		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Viola pubescens</i>	Yellow violet
	1870		Ait	Bel	CrW	Hub				Wad	Cass		<i>Viola renifolia</i>	Kidney-leaf violet
	1871		Ait		CrW			Mor			Cass		<i>Viola sagittata</i>	Arrow-leaved violet
	1872		Ait	Bel			Ita				Cass		<i>Viola selkirkii</i>	Great-spurred violet
SPC	1873		Ait		CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Viola sororia</i>	Common blue violet
	1874	*			CrW		Ita						<i>Viola tricolor</i>	Pansy
	1877												<i>Vitis aestivalis</i> var. <i>argenteifolia</i>	Summer grape
	1878		Ait		CrW		Ita	Mor	Tod		Cass		<i>Vitis riparia</i>	Wild grape
SPC	1070			Bel	CrW			Mor					<i>Vulpia octoflora</i> var. <i>glauca</i>	Eight-week fescue
SPC	1672						Ita				Cass		<i>Waldsteinia fragarioides</i>	Barren strawberry
	1237		Ait		CrW			Mor	Tod				<i>Wolffia columbiana</i>	Columbian water-meal
	1238		Ait		CrW			Mor	Tod		Cass		<i>Wolffia punctata</i>	Spotted water-meal
	89												<i>Woodsia X abbeae</i>	Abbe's woodsia
	90												<i>Woodsia alpina</i>	Alpine woodsia
	91												<i>Woodsia glabella</i>	Smooth woodsia
	92												<i>Woodsia X gracilis</i>	Slender woodsia
	93						Ita	Mor					<i>Woodsia ilvensis</i>	Rusty woodsia
	94												<i>Woodsia obtusa</i>	Blunt-lobed woodsia
	95										Cass		<i>Woodsia oregana</i>	Oregon woodsia
THR	96												<i>Woodsia scopulina</i>	Cathcart's woodsia
SPC	530				CrW		Ita	Mor			Cass		<i>Xanthium strumarium</i>	Cocklebur
	1879			Bel			Ita						<i>Xyris montana</i>	Yellow-eyed grass
	1880												<i>Xyris torta</i>	Yellow-eyed grass
	1881						Ita						<i>Zannichellia palustris</i> var. <i>major</i>	Horned pondweed
	1688		Ait	Bel	CrW		Ita	Mor	Tod		Cass		<i>Zanthoxylum americanum</i>	Prickly ash
	1282												<i>Zigadenus eleg-glau complex</i>	Camass
END	1071		Ait	Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Zizania palustris</i>	Wild rice
	1837			Bel	CrW	Hub	Ita	Mor	Tod	Wad	Cass		<i>Zizia aptera</i>	Heart-leaved alexanders
	1838						Ita	Mor	Tod	Wad	Cass		<i>Zizia aurea</i>	Golden alexanders

*Techniques for Collecting and Preserving
Vascular Plant Specimens*

(Natural Heritage and Nongame Research Program)

TECHNIQUES FOR COLLECTING AND PRESERVING VASCULAR PLANT SPECIMENS*

Natural Heritage and Nongame Research Program, MNDNR

- 1. Equipment:** Plant press, straps (2), felt blotters, archival quality paper (acid-free) for labels, ventilators (corrugated boards), newspaper. Also a knife or other tool for cutting and digging and a notebook or standardized form for recording field data. The press can be made from 3/4" plywood cut 12" x 18" (2 pieces); the ventilators can be cut from discarded "cardboard" boxes, also 12" x 18" (the corrugations should run the short direction). Labels should be no larger than 3" X 5". The blotters and label paper can be obtained from biological supply houses. Desk blotter paper, which can be obtained from a stationery store, is an acceptable substitute for professional blotter paper.
- 2. Determining the portion of the plant to collect:** Once the specimen is found, it is necessary to determine what portion of the plant will be collected. A complete collection includes the entire plant with roots, but for purposes of conservation the roots of rare species should not be collected if the population consists of fewer than 100 individuals. For most species, such as orchids, a single flower is enough for purposes of identification. Other species, e.g. sedges, usually require the complete above-ground stem with mature fruit. Specimens of trees and shrubs should include a twig with mature leaves and flowers and/or fruit. Specimens that do not show diagnostic features cannot be identified and are worthless. Some herbaria may not accept a partial specimen unless it has special significance, (i.e. a new location for an endangered species). If only a portion of the plant is collected it is important to record a description of the entire plant.
- 3. Pressing and processing the specimen:** The freshly collected specimen is placed within a sheet of folded newspaper with the leaves, flowers, etc. in a natural position, but clearly showing the diagnostic features. The paper is placed between two sheets of felt blotters, which are themselves placed between two corrugated ventilators. It is then put within the press which is tightened with the straps (or ropes). Several specimens can be put in a single press by layering the blotters and ventilators. The press must then be put in a warm dry place until the plants are dry. A simple plant drier that uses heat rising from a light bulb works well, but is not essential. The blotters should be changed every day until the specimen is dry. If a specimen does not dry within 4-5 days it will likely begin to decompose. When the specimen is dry it should be taken from the press, but kept within the folded newspaper for protection.
- 4. Preparing the label:** Before the specimen can be sent to a herbarium a label must be prepared. It should be on acid-free, archival quality paper, and be no larger than 3 inches x 5 inches (see example on reverse). At a bare minimum the label must contain: the name of the species, location of collection, description of habitat, name of collector and date of collection. Providing a label is the responsibility of the collector, not the herbarium or the DNR. Put the label with the specimen inside the folded newspaper, which may be held between two corrugated ventilators for rigidity.
- 5. Submitting the specimen:** Specimens of endangered and threatened plants can be collected only by those with permits from the DNR. Send specimens of endangered, threatened, and special concern species, along with MN Natural Heritage Database Rare Plant Report Form, to Welby Smith, 500 Lafayette Rd., Box 25, St. Paul, MN, 55155-4001. After identification is verified, specimens will be sent to the herbarium. The herbarium mounts the specimens and labels on a stiff sheet of paper and accessions them into their collection.

***A more extensive description of how to collect vascular plants can be found in *Guide to collecting vascular plants for museum specimens* by Dr. Anita Cholewa, UMN herbarium, 220 BioSciences Center, 1445 Gortner Ave., St. Paul, MN 55108-1095.**

SAMPLE HERBARIUM LABEL

**MINNESOTA COUNTY BIOLOGICAL SURVEY
Plants of Fillmore County, Minnesota, USA**

Dodecatheon amethystinum Fassett

Shattuck Creek valley. Extensive, north-facing, dolomite cliff system on upper slope, canopy of *Tilia americana* and *Quercus rubra*. Abundant along 1/4 mile stretch. On ledges and in talus below cliff face. Associated with *Cystopteris bulbifera*, *Pellaea glabella*, *Dicentra cucullaria*, *Asarum canadense*.

T 102N R 8W SW¼ of NW¼ of Sec 8

Michael D Lee 404

4 May 1994

**MINNESOTA NATURAL HERITAGE PROGRAM
MINNESOTA DEPARTMENT OF NATURAL RESOURCES**

Annotated Bibliography: Plant Collection, Nomenclature, and Identification

Compiled by Janet Boe, County Biological Survey, Minnesota Department of Natural Resources, with contributions from Carol Estes Mortensen (CEM), John C. Almendinger (JCA), and Nancy Sather (NS).

Plant Collection

Engelmann, G. 1986. **Instructions for the collection and preservation of botanical specimens.** Ann. Missouri Bot. Gard. 73:504-507.

Reprint of instructions prepared by author in mid 1800s. Contains basic, useful information, e.g., the importance of fruit and flower in identification, dealing with large specimens, label information, and record keeping.

Hale, A.M. 1976. **A portable electric herbarium drier.** Rhodora 78:135-140.

Describes a break-down plywood-and-lightbulb style plant drier.

Haynes, R.R. 1984. **Techniques for collecting aquatic and marsh plants.** Ann. Miss. Bot. Gard. 71:229-231.

Recommends collecting plants with flowers and fruits ("...if a specimen cannot be determined, it might as well be left in nature"). Reviews label data important for identification of aquatics, and describes a variety of collecting techniques (floating, waxed paper, construction of a "duckweed press").

Hicks, A.J., and P.M. Hicks. 1978. **A selected bibliography of plant collection and herbarium curation.** Taxon 27(1):63-99.

Extensive bibliography (784 entries) dealing with herbarium management and plant collection and preservation. Includes index by topic.

Jenne, G. 1968. **A portable forced air plant drier.** Taxon 17:184-185.

A heater, blower unit, and zippered plastic sections for holding the presses.

Porter, C.L. 1967. **Taxonomy of flowering plants.** W.H. Freeman and Co., San Francisco.

Basic plant taxonomy text. Includes chapters on plant names, terminology used in describing plants, and field and herbarium methods.

Radford, A.E., W.C. Dickison, J.R. Massey, and C.R. Bell. 1974. **Vascular plant systematics.** Harper and Row Publishers, New York.

A compendium of information on plant taxonomy. Includes chapters on botanical names, collection and preparation of specimens, herbaria, plant identification, and many other topics.

Robertson, K.R. 1980. **Observing, photographing, and collecting plants.** Ill. Nat. Hist. Survey 55:1-62.

Broad coverage of topics associated with plant collection. Includes chapters on poisonous plants, plant names (including pronunciation), use of dichotomous keys, plant photography (including information on cameras, films, lenses, and composition), and preparation of herbarium specimens. Illustrated with line drawings and photographs.

Saville, D.B.O. 1962. **Collection and care of botanical specimens.** Research Branch, Canada Department of Agriculture. Publication 1113. Information Canada, Ottawa.

Describes basic collecting and pressing information for vascular plants. Also includes chapters on collecting and preserving mosses, fungi, and algae. Line drawings illustrate plant press construction, plant driers, field forms, and herbarium labels.

Tillett, S.S. 1977. **Technical aids for systematic botany: new models of plant-press driers.** Taxon 26(5/6):553-556.

Describes laboratory, field-camp, and vehicle-adapted plant driers.

Woodland, D.W. 1991. **Contemporary plant systematics.** Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

General plant taxonomy text that includes chapters on plant names, identification, and collection and preservation of plants.

Plant Names and Terminology

Bailey, L.H. **How plants get their names.** Dover Publications, Inc., New York, New York.

Contains several explanatory chapters, a list of generic names, and a glossary of specific names. (CEM)

Brako, L., A.Y. Rossman, and D.F. Farr. 1995. **Scientific and common names of 7,000 vascular plants in the United States.** APS Press, St. Paul, Minnesota.

Includes multiple common names for plants. Listed by scientific name and common names.

Coombes, A.J. **Dictionary of plant names.** Timber Press, Portland, Oregon.

Contains a few pages of introduction, a pronunciation guide, and glossary. The main body of text is a dictionary, with pronunciation, derivation, and meaning of botanical names, and their common-name equivalents. (CEM)

Gledhill, D. 1992. **The names of plants.** Cambridge University Press, Cambridge, England, UK.

Contains a few brief chapters on nomenclature followed by the glossary. Few illustrations, but the glossary gives short definitions of terms, translations of Latin names, etc. (CEM)

Harris, J.G., and M.W. Harris. 1994. **Plant identification terminology: an illustrated glossary.** Spring Lake Publishing, Spring Lake, UT.

Contains dictionary of terms with many illustrations, plus illustrated sections pertaining to roots, stems, surfaces, leaves, inflorescences, flowers, and fruit. (CEM)

Vascular Plant Identification

Popular Keys and Manuals

Baumgardt, J.P. 1982. **How to identify flowering plant families: a practical guide for horticulturists and plant lovers.** Timber Press, Portland, Oregon.

Contains introduction, a key to some plant families, floral diagrams, pronunciation, photographs of representative plants, and drawings and text for each family, with a listing of the more common genera. (CEM)

Cobb, B. 1963. **A field guide to the ferns.** Peterson Field Guide Series. Houghton Mifflin Co., Boston.

Covers an area from Wisconsin eastward, but many Minnesota species are included. Includes keys, line drawings, and species descriptions.

Courtenay, B. and J. H. Zimmerman. 1972. **Wild-flowers and weeds.** Van Nostrand Reinhold Co., New York.

Small color photographs of many herbaceous species. Modified keys. Quite comprehensive. Covers the Great Lakes region of the U.S. and Canada.

Eggers, S.D., and D.M. Reed. 1987. **Wetland plants and plant communities of Minnesota and Wisconsin.** U.S. Army Corps of Engineers, St. Paul.

Color photographs and descriptions of selected wetland plants.

Fink, D.F. 1994. **A guide to aquatic plants.** Ecological Services Section, Minnesota Department of Natural Resources, St. Paul, Minnesota.

An illustrated guide to common aquatic plants in Minnesota. Includes discussion of state regulations and factors that influence aquatic plant abundance.

Looman, J. 1982. **Prairie grasses.** Publication 1413. Agriculture Canada. Canada Communication Group-Publishing, Ottawa.

107 grass species identified and described by vegetative characters and illustrated (whole plant) with line drawings. Primarily rangeland species, but some forest and wetland species included.

Mohlenbrock, R.H., and J.W. Thieret. 1987. **Trees: a quick reference guide to trees of North America.** Macmillan Publishing Company, New York.

Popular key. Includes color plates, distribution maps, and brief species descriptions for about one third of the most common native species found north of Mexico.

Moyle, J.B. and E.W. Moyle. 1977. **Northland wildflowers.** University of Minnesota Press, Minneapolis.

Photographs of some of the more common Minnesota flowering plants.

Newcomb, L. 1977. **Newcomb's wildflower guide.** Little, Brown, and Co., Boston.

Includes many line drawings and a few colored drawings. Covers eastern North America from central Minnesota eastward. Used by MNDNR Forestry in plant identification training courses.

Peterson, R.T., and M. McKenny. 1968. **A field guide to wildflowers of northeastern and northcentral North America.** Houghton Mifflin Company, Boston.

Popular key to many species of flowering plants. Illustrated with colored plates. Plants grouped by flower color.

Petrides, G.A. 1972. **A field guide to trees and shrubs.** Houghton Mifflin Company, Boston.

In the Peterson Field Guide series. Includes species descriptions and some line drawings.

Severin, B. C. 1980. **A key to the woody plants of Minnesota.** St. Mary's Press, Winona, Minnesota.

Key based on vegetative structures. Line drawings of leaves. Includes cultivated as well as native plants.

Symonds, G.W.D. 1958. **The tree identification book.** William Morrow and Co., New York.

Uses photographs to identify trees. Includes photographs of leaves, twigs, bark, and fruit. Covers species from Maine to North Dakota and Texas to Florida.

Symonds, G.W.D. 1963. **The shrub identification book.** William Morrow and Co., New York.

Uses photographs to identify shrubs. Includes many but not all shrub species found in MN. Especially useful when only part of a plant (e.g., leaves, buds) is available.

Van Bruggen, T. 1976. **Wildflowers of the northern plains and Black Hills.** Bulletin No. 3. Badlands Natural History Association, Interior, South Dakota.

Color photographs and species descriptions of many prairie (mostly) plants. Grouped by flower color.

Technical Keys and Manuals

Regional

Case, F.W., Jr. 1987. **Orchids of the Western Great Lakes region.** Second edition. Bulletin 48. Cranbrook Institute of Science, Bloomfield Hills, Michigan.

Keys, photographs, distribution maps, and extensive species descriptions for Great Lakes orchid species. First edition 1964.

Fassett, N.C. 1951. **Grasses of Wisconsin.** Univ. of Wisconsin Press, Madison.

Includes 58 page section of illustrations and a glossary.

Fassett, N.C. 1957. **A manual of aquatic plants.**

University of Wisconsin Press, Madison.

Technical keys to aquatic plants found from Minnesota south to Missouri and east to the east coast.

Includes line drawings of many plants.

Fassett, N.C. 1976. **Spring flora of Wisconsin.**

University of Wisconsin Press, Madison.

Key to Wisconsin plants blooming before 15 June.

Some illustrations.

Fernald, M.L. 1950. **Gray's manual of botany.** 8th edition. American Book Company, New York.

Classic technical key and plant descriptions for ferns and flowering plants found in central and northeastern United States and adjacent Canada. Includes pronunciation guides and a few line drawings.

Flora of North America Editorial Committee. 1993.

Flora of North America north of Mexico. Vol. 2: Pteridophytes and Gymnosperms. Oxford University Press, New York.

Technical key, species descriptions, and distribution maps to ferns, conifers, and related plants. Volume 1 relates the history of the Flora of North America project. Ten volumes are planned.

Gleason, H.A., and A. Cronquist. 1991. **Manual of vascular plants of northeastern United States and adjacent Canada.** Second edition. New York Botanical Garden, New York.

Updated version of manual (technical key and plant descriptions) that contains same information (but updated) as the illustrated flora but lacks the line drawings.

Gleason, H.A. 1952. **Illustrated flora of the northeastern United States and adjacent Canada.**

Macmillan Publishing Co., New York.

Three volumes. Includes keys, descriptions, and line drawings of all species known to occur in area covered. Out of print. Available in most university libraries. An earlier edition is published in paperback by Dover.

Great Plains Flora Association. 1986. **Flora of the Great Plains**. R.L. McGregor, coord.; T.M. Barkley, ed. Univ. Press of Kansas, Lawrence.

Technical key to plants of the Great Plains, including western Minnesota. Not illustrated.

Great Plains Flora Association. 1977. **Atlas of the flora of the Great Plains**. R.L. McGregor, coord.; T.M. Barkley, ed. The Iowa State Univ. Press, Ames.

Distribution maps to accompany the keys found in Flora of the Great Plains. Includes western Minnesota.

Hitchcock, A.S. 1950. **Manual of the Grasses of the United States**. Dover Publications, Inc., New York. Two volumes. Revised by Agnes Chase.

First published in 1935. The Dover edition is a reprint of the revised edition published by the U.S. Government Printing Office in 1950. Includes keys, species descriptions, distribution maps, and line drawings.

Holmgren, N.H., et al., eds. 1998. **Illustrated companion to Gleason and Cronquist's manual**. New York Botanical Garden, New York, NY.

827 plates to accompany the text in the 1991 edition of Gleason and Cronquist's Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Based on original artwork of the 1952 edition of the New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada.

Lellinger, D.B. 1985. **A field manual of the ferns and fern allies of the United States and Canada**.

Smithsonian Institution Press, Washington, D.C.

Contains color photographs and introductory chapters on nomenclature, ecology, and structure. Comprehensive keys to fern-allies and ferns, with glossary, bibliography, checklist, and indices to common and scientific names. (CEM)

Preston, R.J. 1976. **North American trees**. Iowa State University Press, Ames.

Technical keys, line drawings, and distribution maps for tree species found north of Mexico.

Reddoch, J.M., and A.H. Reddoch. 1997. **The orchids in the Ottawa District: floristics, phytogeography, population studies, and historical review**.

Canadian Field-Naturalist 111:1-186.

Each species (of 44) superbly illustrated with line drawings. Includes graph showing blooming periods. Some populations monitored for up to 30 years. Contains a wealth of information about native orchids.

Rosendahl, C.O. 1955. **Trees and shrubs of the upper midwest**. University of Minnesota Press, Minneapolis.

Includes keys, some line drawings, and a few photographs. Also includes detailed species descriptions.

Schuyler, A.E. 1967. **A taxonomic revision of North American leafy species of *Scirpus***. Proceeding, Academy of Natural Sciences of Philadelphia 119(6): 259-323.

Technical key requiring fruits and rhizomes. Not illustrated.

Scoggan, H.J. 1957. **Flora of Manitoba**. Bulletin No. 140. Biological Series No. 47. National Museum of Canada, Ottawa.

Technical keys and habitat descriptions. Not illustrated.

Stevens, O.A. 1963. **Handbook of North Dakota plants**. North Dakota Institute for Regional Studies, Fargo.

Technical key and plant descriptions. Includes a few line drawings and black and white photographs.

University of Illinois at Urbana-Champaign. 1981. **Weeds of the north central states**. Univ. of Illinois Publications Dept., Urbana.

Contains drawings of plants and plant parts. Includes range maps. Text discusses plant parts used for identification and explains why the plant is troublesome. (CEM)

Van Bruggen, T. 1976. **The vascular plants of South Dakota**. Iowa State University Press, Ames.

Technical key and species descriptions for South Dakota plants. Not illustrated.

Voss, E.G. 1972. **Michigan flora**. Part 1. Bulletin 55. Cranbrook Institute of Science and Univ. of Michigan Herbarium. Bloomfield Hills, Michigan.

_____. 1985. **Michigan flora**. Part 2. Bulletin 59. Cranbrook Institute of Science and Univ. of Michigan

Herbarium. Ann Arbor, Michigan.

_____. 1996. **Michigan flora**. Part 3. Bulletin 61.

Cranbrook Institute of Science and Univ. of Michigan Herbarium. Ann Arbor, Michigan.

Set includes keys, line drawings, distribution (dot) maps. Part 1: gymnosperms and monocots; part 2: dicots through Cornaceae; part 3: remainder of dicots.

Voss, E.G. 1996. **Michigan plants in print: new literature relating to Michigan botany**. The Michigan Botanist 35(2):57-62.

An extensive annotated bibliography. Divided into 4 categories: 1) maps, soils, geology, climate, general; 2) books, bulletins; 3) journal articles; 4) history, biography, exploration.

Whitson, T.D., ed. 1991. **Weeds of the west**. Western Soc. Of Weed Science, Western U.S. Land Grant Universities Coop. Ext. Services, and the University of Wyoming, Laramie.

Contains good color photos showing the whole plant and the important key characters of leaves, flowers, seeds and roots. Text gives botanical name, family, description of plant, origin of plant, and habitat. Many plants found along roadsides and in other disturbed areas in the Upper Midwest are illustrated and discussed. (CEM)

Minnesota

Allison, H. 1959. **Key to the grasses of Minnesota found in the wild or commonly cultivated as crops**. Department of Botany, University of Minnesota, Minneapolis.

Key to grasses of the state. Species not illustrated, but includes illustrations of grass anatomy. Includes glossary and common names. Out of print. Available from Univ. of Minn. libraries and herbarium.

Carlson, R.A. and J.B. Moyle. 1975. **Key to the common aquatic plants of Minnesota**. Minnesota Dept. of Conservation, St. Paul.

An illustrated key to many of the common emergent and submergent aquatics found in Minnesota.

Clemants, S.E. 1985. **A key to the rushes (*Juncus* spp.) of Minnesota**. The Michigan Botanist 24:33-37.
The most current technical treatment of the genus in Minnesota. (JCA)

Lakela, O. 1965. **A flora of northeastern Minnesota**. University of Minnesota Press, Minneapolis.

Technical keys to plants found in St. Louis and Lake counties. Includes distribution maps for each species within the two counties, species descriptions, and a few line drawings.

Morley, T. 1969. **Spring flora of Minnesota**. University of Minn. Press, Minneapolis.

Key to Minnesota plants blooming before 7 June. Not illustrated.

Moyle, J.B. 1964. **Northern non-woody plants**. Burgess Publishing Company, Minneapolis, Minn.

Technical key to some of the more common ferns and flowering plants in Minnesota.

Ownbey, G. B., and T. I. Morley. 1991. **Vascular plants of Minnesota**. University of Minn. Press, Minneapolis.

Available in both hard and soft cover. Checklist of and distribution maps for all plants collected in the state. Includes common names for most plants.

Rosendahl, C.O. and A. Cronquist. 1945. **The goldenrods of Minnesota: a floristic study**. American Midland Naturalist 33(1): 244-253.

A good key to begin with in the identification of Minnesota material. Nomenclature somewhat outdated. (JCA)

Rosendahl, C.O. and A. Cronquist. 1949. **The asters of Minnesota: a floristic study**. American Midland Naturalist 44 (2): 502-512.

A good key to begin with in the identification of Minnesota material. Nomenclature somewhat outdated. (JCA)

Russell, N.H. 1958. **The violets of Minnesota**. Proceedings, Minnesota Academy of Science 25-26:126-191.

Illustrated. A good key to begin with in the identification of Minnesota material. (JCA)

Sather, N. and K. VanNorman. 1988. Results of a survey for *Sparganium glomeratum* in the Chippewa National Forest. Minnesota Department of Natural Resources, Natural Heritage Program, St. Paul, Minnesota.

Includes key to species of Sparganium in Minnesota.

Seaholm, J.E. 1964. A taxonomic study of the genus *Galium* in Minnesota. Proceedings, Minnesota Academy of Science 31(2): 99-104.

The best key for Minnesota material. Illustrated. (JCA)

Smith, W.R. 1993. **Orchids of Minnesota.** University of Minnesota Press, Minneapolis.

Key, line drawing, distribution map, and photograph for all orchid species found in Minnesota. Also includes detailed species descriptions, chart of known flowering dates, and glossary.

Smith, W.R. 1988. A new bladderwort for Minnesota. Minnesota Plant Press 7(3): 1-4.

Includes a key to species of Utricularia found in Minnesota. Utricularia purpurea had not been collected in Minnesota when this key was written but is described in the article. Illustrated.

Tryon, R. 1980. **Ferns of Minnesota.** University of Minnesota Press, Minneapolis.

Technical keys, distribution maps, line drawings, silhouettes, and a few color photographs of ferns, horsetails, and related plants.

Wheeler, G.A. and Ownbey, G.B. 1984. Annotated list of Minnesota Carices, with phytogeographical and ecological notes. Rhodora 86: 151-231.

The distribution maps and species descriptions contain information not found in keys. (JCA)

Wheeler, G.A. 1981. **Carex of Minnesota.** Ph.D. Dissertation. University of Minnesota, St. Paul.

A full treatment of the taxonomy of Carex including a key for the state. This is the authoritative treatment of the genus. The key is not illustrated, and the author uses precise botanical language. (JCA)

Moss and Liverwort Identification

Andrus, R.E. 1980. **Sphagnaceae (Peat Moss Family) of New York State.** Contributions to a Flora of New York Stat III. R.S. Mitchell, editor. Bulletin No. 442. New York State Museum, University of the State of New York, Albany, New York.

An excellent review of the genus Sphagnum including ecology and phytogeography, with illustrated keys to the species. (JCA)

Conrad, H.S.; rev. by P.L. Redfearn, Jr. 1979. **How to know mosses and liverworts.** Wm. C. Brown Company Publishers. Dubuque, Iowa.

One in the Pictured Key Nature Series. Less intimidating for beginners than some other keys. Uses couplets; major keys lead to genera, then species are keyed out under each genus. (CEM)

Crum, H. 1973. **Mosses of the great lakes forest.** Contributions from the University of Michigan Herbarium. Vol. 10. pp. 1-404.

A comprehensive, illustrated key to the genera and species of mosses of the Great Lakes region. (JCA)

Crum, H. 1988. **A focus on peatlands and peat mosses.** University of Michigan Press. Ann Arbor, Michigan.

Contains keys, illustrations, and photomicrographs of common North American species of peat mosses. Includes an overview of peatland ecology. (CEM)

Glimes, J.M. **The elfin world of mosses and liverworts of Michigan's Upper Peninsula and Isle Royale.** Isle Royale Natural History Association, Houghton, MI.

Illustrated with high-quality color photographs. Text and photos arranged by habitat.

Ireland, R.R., G.R. Brassard, W.B. Schofield, and D.H. Vitt. 1987. **Checklist of the mosses of Canada II.** Lindbergia 13(1-2): 1-67.

Commonly cited as standard nomenclature for mosses in North American research papers. (JCA)

Schuster, R.M. 1992. **The Hepaticae and Anthocerotae of North America east of the hundredth meridian.** Columbia University Press, New York, New York.

The authoritative work on liverworts and hornworts. Six volumes. (JCA)

Sims, R.A., and K.A. Baldwin. 1996. **Sphagnum species in northwestern Ontario: a field guide to their identification.** Technical report TR-30. NWST technical report TR-101. Nat. Resour. Can., Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, Ontario.

Dichotomous and multiple access keys. Descriptions and line drawings of species.

Thomas, L. P. 1985. **Walk softly upon the earth: a pictorial field guide to Missouri mosses, liverworts, and lichens.** Missouri Department of Conservation, Jefferson City, Missouri.

A non-technical picture guide to common mosses and other lower plants of Missouri. Includes color photo of each. (NS)

McQueen, C.B. 1990. **Field guide to the peat mosses of boreal North America.** University Press of New England, Hanover, New Hampshire.

Contains color photos, brief segments on morphology and terminology, a random access key, descriptive key, macroscopic key, glossary, and suggestions for further reading. (CEM)

Vitt, D.H., J.E. Marsh, and R.B. Bovey. 1988. **Mosses, lichens, and ferns of northwest North America.** University of Washington, Lone Pine, Washington.

Contains keys, color photographs, and maps. Applies to many species in the Upper Midwest. (CEM)

8. Rare Animal Survey

<i>Introduction</i>	<i>8.1.1</i>	<i>Figures, tables, and appendices</i>	<i>8.5.1</i>
<i>Mammal Surveys</i>	<i>8.2.1</i>	<i>Rare species accounts</i>	<i>8.6.1</i>
<i>Breeding Season Bird Surveys.....</i>	<i>8.3.1</i>	<i>Annotated bibliography: animals.....</i>	<i>8.7.1</i>
<i>Amphibian and Reptile Surveys</i>	<i>8.4.1</i>		

Introduction

Cass County, the fifth largest county in Minnesota, stretches over 80 miles from peatlands along its northern boundary, through lands dominated by lakes and boreal hardwood-conifer forests, to the broken country of wetlands, prairie openings, and forests in the south. This wide range of vegetation and soil types provides potential habitat for many of Minnesota's native fauna. The ranges of a number of animals reach their northernmost and southernmost limit within or near the county, further enhancing the likelihood of high faunal species richness in Cass County.

The animal survey component of Minnesota County Biological Survey (MCBS) is charged with the documentation of rare animal species. These include those that are (1) federally-listed as endangered, threatened, or under consideration for listing; (2) state-listed as endangered, threatened, or special concern; or (3) tracked as rare elements by the Natural Heritage Information System (NHIS; refer to Chapter 1 for definitions of statuses and additional information on NHIS). In the process of searching for rare species, MCBS has the opportunity to collect information on other animals that, while not rare, lack documentation in the county.

Surveys for rare small mammals, breeding birds, reptiles, and amphibians were conducted by MCBS from April through September 1994. The findings from these surveys are presented in Sections 8.2 through 8.4. Selected rare species for which MCBS has collected substantial information are discussed in greater detail in Section 8.6. Selected references on animal groups and survey techniques, including references for fish, mussels, and insects, are compiled in an annotated bibliography in Section 8.7.

Rare animals documented from Cass County or thought to potentially occur there are listed in Table 1. From this list, species were selected for targeted searches. Although Table 1 lists rare fish, mussels, and butterflies potentially present in Cass County, no surveys for these groups were done by MCBS due to funding limitations and the lack of staff expertise. The Chippewa National

Forest (CNF) was particularly interested in gaining additional information on animals they considered forest sensitive, thus MCBS animal surveys included these species among those being considered for field searches (refer to Chapter 6 for additional information on CNF Forest-Sensitive species).

Following discussions with CNF and Leech Lake Reservation biologists, MN DNR Regional Nongame Wildlife specialists, and Cass County Land Department staff, the animals identified initially for MCBS surveys were evaluated according to their need for additional information. A summary of these evaluations is presented in Appendix 1. Between the 1994 animal surveys and the preparation of this report, the state list of endangered, threatened, and special concern species, as well as the list of elements tracked by NHIS, was revised (refer to Chapter 1 for a discussion of the list revision). Statuses from both the current and past state lists are included in Table 1 and Appendix 1.

Prior to MCBS animal surveys, a considerable amount of information had been gathered on a number of rare animal species in Cass County. Numerous Bald eagle, Osprey, and colonial waterbird nest sites were documented by staff from the Chippewa National Forest and MN DNR Nongame Wildlife. The Minnesota Prairie Chicken Society provided regular updates on Greater Prairie-chicken booming ground locations. Through the efforts of Region 3 Nongame Wildlife staff, many sightings of Blanding's turtles from Cass County were obtained. All of this information is contained in NHIS databases.

Documentation of some rare animal species was notably lacking from the county prior to MCBS surveys. No rare mammal species, excluding Gray wolves, had been recorded, and several rare wetland bird species had not been documented from Cass County. The MCBS animal surveys collected 74 new or updated locations for rare animals, including one rare mammal and four rare birds not previously recorded from the county (Table 2). Additional information about these records can be obtained from NHIS (refer to Chapter 1 for a request form).

Surveys for rare herpetofauna (amphibians and reptiles) in the Itasca County portion of the Chippewa National Forest documented the presence of a salamander not known from the state, the Four-toed salamander (*Hemidactylium scutatum*). The presence of similar habi-

tat in nearby Cass County suggests strongly that this species occurs here, as well. Figure 1 shows the locations of rare animals and animal aggregations in Cass County

Mammal Surveys

Rare mammal surveys conducted by the Minnesota County Biological Survey (MCBS) focused on the smaller mammal species, utilizing techniques that would be unsuitable for documenting larger rare mammals, such as Gray wolf and Mountain lion. Data on the status and distribution of these species traditionally have been collected and managed by staff with the US Fish and Wildlife Service and the Minnesota Department of Natural Resources Wildlife Research Unit. Although no surveys were conducted for the larger rare mammals (Gray wolf, Mountain lion, Wolverine, and Lynx), locations of tracks or other signs of their presence were noted during MCBS animal surveys.

Mammal species targeted for surveys by MCBS were selected with the assistance of biologists from the Chippewa National Forest (CNF). Included for consideration were all rare mammals that could potentially occur in Cass County, species identified by CNF as forest-sensitive species, and species lacking distributional information from the county. Table 1 lists the rare mammals potentially occurring in Cass County, Appendix 1 ranks species according to priority for MCBS animal surveys.

The Northern bog lemming and Prairie vole were ranked high for survey effort. Although no records existed for these species in Cass County, a Northern bog lemming had been documented in the Itasca County portion of the Chippewa National Forest in 1993 (Don Christian, personal communication), and Dick Oehlenslager (1994) had found Prairie voles in adjacent Wadena County in the 1960s. The Heather vole was ranked as low priority for surveys because it has only been documented in the far northeastern part of the state and it was doubtful that it occurred in Cass County. However, since the Northern bog lemming and Heather vole occur in similar peatland habitats, surveys effectively searched for both species.

The importance of forests to bats, particularly the tree bats, has been a topic of long-standing concern to the National Forest Service. Thus, CNF ranked surveys for bats as a high priority for MCBS. One of two state-listed bats, the Northern myotis, was likely to occur in Cass County, as well as all three species of tree bats, the

Red bat, Hoary bat, and Silver-haired bat. Jack Davis and John Casson, from the CNF Cass Lake District, provided valuable technical assistance in mist-net surveys for Northern myotis.

The Eastern spotted skunk was listed as high priority for surveys due to its apparent rarity in the state. However, it was recognized that intense survey efforts to find this species could not be done adequately in a single field season. Searches for spotted skunks elsewhere in the state have shown that the best strategy for documenting this species is to follow up on sightings soon after they are reported. Information on past occurrences of this species was solicited, but no sightings of spotted skunks were reported during the 1994 animal surveys. No surveys were recommended for the Least weasel because it was not placed on the state list of rare mammals until the 1996 revision.

Methods

Records of small mammals and bats were obtained using small mammal trap grids, drift fences, bat detectors, mist nets, and incidental observations. Surveys were conducted from May through September 1994.

Small mammal trap grids: Habitats in Cass County most closely resembling those where the targeted mammals had been found elsewhere were selected for small mammal trap grids. Drier native prairies and old fields were selected for Prairie voles, and open bogs, poor fens, and conifer swamps for Northern bog lemmings. Trap grids were set in other habitats to collect additional information on the small mammal fauna of the county. Some of these additional grid sites were selected to supplement the Ecological Classification System (ECS) project being conducted at the same time in Cass County (refer to Chapter 2 for information on ECS).

A total of 32 trap grids were set in Cass County between 26 July and 18 August 1994 (see Fig. 2 and Appendix 2a for grid locations). The trap grids were set in a 4-by-10 or 2-by-20 station array with one trap per station. Traps included 16 Sherman live traps, 16 Museum Special snap traps, 4 cone pitfall traps, and 4 Victor rat traps. All traps, except the pitfall traps, were baited with a mixture of peanut butter and oatmeal. The grids were set for four days and checked twice a day. For grids in open areas, the Sherman livetraps were closed during

the day. During each check, live animals were processed in the field, marked with a permanent marker, and released. Other captures were taken back to the field station for additional measurements and representative examples were prepared as permanent voucher specimens. Data obtained from each specimen included species identification, sex, external reproductive condition, age, weight, and molt. In addition to these data, standard measurements and internal reproductive condition were recorded from voucher specimens. These voucher specimens were cataloged for permanent storage at the Bell Museum of Natural History, University of Minnesota, St. Paul.

Drift fences: Fourteen drift fences were set primarily as an amphibian and reptile survey technique, however, they also were effective at capturing small mammals (see Fig. 2 and Appendix 2c for drift fence locations). Eight of the drift fences were associated with two ECS Land Type Associations (LTA), Bena Dunes and Guthrie Till Plain. Within each LTA, drift fences were set in a range of soil and forest types that represented well-drained, mesic, poorly-drained, and wet-forested. This was done as an experiment to see if data collected on herpetofauna and mammals (as well as birds, using other techniques) could be meaningfully incorporated with data collected on soil, hydrology, and vegetation to describe units of the landscape in Cass County (see Almendinger, et al. 1994).

Five-gallon buckets or pitfall traps were set on either side of aluminum flashing (refer to the section on amphibian and reptile surveys for a more detailed discussion of this survey technique). The drift fences were run for varying lengths of time between 28 April and 15 September (see Table 11 for a summary of drift fence operation). Fences were checked periodically and mammals identified and released if alive, or collected for later identification. Some or all of the data described under trap grid methods was collected from drift fence captures, depending on their condition. Voucher specimens were prepared of selected species.

Bat detectors and mist-nets: The presence of foraging bats was documented by listening to their ultrasonic calls, using an ultrasonic receiver. Based on the frequency and characteristics of the call, five of the six species of bats expected to occur in Cass County could be

identified with this technique. The two *Myotis*, Little brown myotis and Northern myotis, could be distinguished from other bat species on the basis of their calls, but not from each other. Other ultrasonic detecting equipment may distinguish between these species by comparing call spectrographs, however, that equipment was not available at the time of the MCBS animals surveys. Foraging bat surveys were conducted from dusk to approximately 2400 hours on nights when there was little-to-no wind or rain. A variety of habitats were sampled, but most were associated with forest openings, lakes or streams, or lights where insects might congregate (see Fig. 2 and Appendix 2a for locations of bat survey stops and habitats). Some of the bat surveys were done in conjunction with anuran call surveys that sampled a range of wetland habitats (refer to the Section 8.4 on amphibians and reptiles for information on anuran surveys). At other times, roads were traveled slowly until foraging bats were located. At each survey stop, bats heard during a five-minute interval were identified, the number of each species estimated, and the habitat briefly described. A total of 100 bat survey stops were conducted between 11 May and 18 July 1994.

Due to the inability to distinguish the state-listed Northern myotis from the abundant Little brown myotis using the bat detector, mist-nets were set across forest openings where bats were likely to fly. In Cass County, nets were set at two locations, Norway Beach and Stony Point. Mist-nets of nylon mesh were stretched between metal poles. The nets were opened after dark to prevent accidental capture of birds. Nets were continually tended or checked on an hourly basis until approximately 2400 hours, at which time the nets were taken down. Bats caught in the nets were immediately removed. External data (species, sex, weight, molt, external reproductive condition) were collected and the bats released.

Northern myotis are strongly associated with heavily wooded habitats and have been observed foraging along high ridges and in breaks of the forest canopy (Fitch and Shump, Jr. 1979, Cowan and Guiguet 1973), although some evidence suggests that they may also forage beneath the canopy (LaVal et al. 1977). In an effort to raise mist nets to the level of the forest canopy, Cass Lake District biologists built a 40-foot mist-net pulley system, according to published guidelines (Kunz and Kurta 1988). Bats appeared to avoid the mist nets under this system and

given the difficulty in setting up the poles and nets, this technique was abandoned.

Incidental observations: During MCBS animal surveys, incidental observations of large and medium-sized mammals or their sign were recorded when encountered.

Results

A total of 47 mammal species were recorded during MCBS animal surveys (Table 3). Twenty small mammals were documented from trap grids and drift fences (Tables 4, 5) and five bat species were documented during foraging bat surveys (Table 6). The remaining mammals were recorded as incidental observations, such as road-kills, sightings, or sign (burrows, tracks, scats, or calls).

The Prairie vole was the only rare small mammal documented in Cass County (see Fig. 1). The species was taken from county-owned land in McKinley township that is being managed for prairie and as a booming-ground site for Greater prairie-chickens. No Northern bog lemmings were documented from Cass County during MCBS animal surveys, despite considerable effort focused on suitable peatland sites. While bog lemmings were found at a number of sites throughout the county, all were identified as Southern bog lemmings. Among larger rare mammals, Gray wolf tracks, scats, and howling were recorded at several locations in northern Cass County and a report of a Mountain lion attacking livestock occurred near Cass Lake while MCBS animal surveys were being conducted.

Discussion

Cass County is located within the Laurentian Mixed Forest province, however, its close proximity to the Eastern Broadleaf Forest province makes it an area of potential interest in terms of the possible occurrences of species associated with northern and southern habitats. Although Cass County is removed from the Prairie Parkland province, it does have prairie openings, or areas that were previously prairie. Thus, there is the opportunity for prairie-associated mammals to occur here, as well. In fact, it is ironic that while Cass County is placed squarely in the Laurentian Mixed Forest province, the single rare small mammal documented from

Cass County during MCBS animal surveys was the Prairie vole, a prairie-dependent species.

Prairie vole: Prairie voles also were documented from adjacent Wadena County in the mid-1960s. These were taken from agricultural fields that originally had been jack pine forest (Oehlenschläger 1994). He suggested that fire-generated clearings within these stands would have contained prairie flora suitable to supporting Prairie vole populations. The Cass County site with Prairie voles was located 9 miles north and 4 miles east of the nearest location of this species in Wadena County. Soil and vegetation at this site were similar to those described by Oehlenschläger (1994). The next closest known population of Prairie voles is located at the Camp Ripley Military Reservation in Morrison County, 35 miles south and 13 miles east of the Cass County location. Prairie voles at Camp Ripley were found in an extensive grassland and associated with areas of native prairie vegetation (Dorff and Nordquist 1993). This area also had been formerly covered by jack pine and oak woodlands (Oehlenschläger 1994).

Trapping efforts by MCBS in apparently suitable habitat elsewhere in Morrison and Cass counties failed to find additional locations for Prairie voles. Recent efforts to find new Prairie vole sites in Wadena County and to relocate Prairie voles from the original sites were unsuccessful (Oehlenschläger 1994). It is possible that, with the suppression of fire and changing land use practices in this region, Prairie voles are now present in small, isolated populations in this area. If true, these small populations are vulnerable to local extinction with little chance of recolonization from distant populations.

Northern bog lemming: The capture of a Northern bog lemming in 1993 by Don Christian (University of Minnesota-Duluth) in the Itasca County portion of the Chippewa National Forest was a notable find. Previously, this species had been recorded from only a few locations in Roseau, Lake of the Woods, and Koochiching counties (Hazard 1982, Nordquist and Birney 1980). The Northern bog lemming reaches its southern distributional limit in northern Minnesota, and the Itasca County record constitutes a significant southern extension of the known distribution for this species in the state. In the past decade, Rock voles (*Microtus chrotorrhinus*) have expanded their range considerably in northeastern Minnesota (Rich Jannett, Science Mu-

seum of Minnesota, personal communication). It is not known whether the Itasca County record represents a recent range extension or simply a previously undocumented population of Northern bog lemmings. MCBS animal surveys failed to document this species in Cass County, despite the presence of suitable habitat in the northern portion of the county. However, given the proximity of the Itasca County population, it is not unreasonable to expect to find this species in Cass County in the future.

Other small mammals: Twenty species, including two distinct subspecies, of small mammals were documented during MCBS animal surveys (Tables 4, 5). The transitional position of Cass County is reflected in the composition of small mammals that includes representatives of the northern forests (e.g. Least chipmunk, Northern flying squirrel, Southern bog lemming), as well as the prairie regions (Prairie vole, Prairie deer mouse). In the deciduous forests of the county, both the Woodland deer mouse and the White-footed mouse occurred within the same site. Further north, the Woodland deer mouse would be the predominant species in these forest types, while to the south the White-footed mouse would be the only *Peromyscus* present. Southern bog lemmings, typically associated with peatland habitats in the northern counties, were found in a variety of habitats in Cass County ranging from poor fen to sedge meadow/old field to jack pine forest (Table 5). The majority of small mammals documented in Cass County were species with broad habitat preferences and distributions, including Masked shrew, White-footed mouse, and Meadow jumping mouse.

The use of drift fences, in addition to small mammal trap grids, added important information concerning the small mammals present in particular habitats. This technique provided the only records for Water shrews, as well as contributing a number of records for Star-nosed moles. (The trapping record of a Star-nosed mole along a railroad grade with prairie vegetation was likely a dispersing individual from the adjacent black spruce swamp.) A comparison of the species taken from similar habitats demonstrates that the two collecting techniques preferentially sampled different species or collected species in different numbers (Tables 4, 5). For example, trap grids in jack pine forests documented seven species, of which the Masked shrew was the only shrew species col-

lected. Drift fences set in the same forests documented nine small mammal species that included four shrew species. Clearly, drift fences were more effective in documenting shrews and moles, while trap grids were better able to document squirrels and chipmunks. This illustrates a problem in interpreting what small mammals are typical of a particular habitat and which species are the most abundant. Using one or the other method as the sole source of information results in incomplete or misleading information. For example, using the trapping data, alone, it would appear that Pygmy shrews are found only in forested conifer swamps. However, drift fence data reveal that Pygmy shrews are widespread across a variety of habitat types and suggests that they may be most numerous in upland deciduous forests.

Northern myotis: Hazard (1982) shows a single record of the Northern myotis from northwestern Cass County, although details on this occurrence are not known. This species is known to hibernate in considerable numbers in iron ore mines in St. Louis County. While no suitable hibernacula are known to exist in Cass County, it seems highly likely that Northern myotis range into the county during the non-hibernating period (May - October).

The lack of documentation for this species in the county is due largely to the limitations in survey methodology. Mist-netting, a labor- and materials-intensive technique, is further hampered by the landscape of Cass County. The many wetlands, lakes, and rivers in a largely level terrain result in foraging bats that are widely dispersed. In situations like this, where there are few areas that concentrate the bats or focus their flight paths, mist-netting can yield poor results. Bat detectors get around the logistical problems of mist nets and are able to document the presence of bats without having to capture them. However, accurate identification of bat species requires a skilled surveyor who is familiar with the detecting equipment and aware of sources of bias and erroneous readings. At the time of MCBS animal surveys, the bat-detecting equipment used was not able to distinguish the rare Northern myotis from the common Little brown myotis. However, interest in using bat detectors as survey and monitoring tools has increased dramatically in the past years. As a result, affordable bat detectors and associated software to display and analyze calls are now available that may be able to separate these two species.

Other bat species: In addition to *Myotis* spp. (either the Little Brown myotis and/or the Northern myotis), four other bat species were recorded from Cass County (Big brown bat, Red bat, Hoary bat, and Silver-haired bat). The only bat that occurs in Minnesota but not found in Cass County was the Eastern pipistrelle. Similar to the Northern myotis, this species is difficult to distinguish using the bat detector employed at the time of MCBS animal surveys. The Eastern pipistrelle occurs primarily in the southeastern portion of Minnesota, however a few individuals have been found hibernating in mines and caves in northern Minnesota. Thus, it could be possible, although unusual, to find this species foraging in Cass County as well.

Among those species identified from foraging bat surveys, *Myotis* spp. and Silver-haired bats were most frequently encountered. The remaining three species were detected considerably less often, with the Red bat found least of all (Table 6). These species varied in the breadth of habitats in which they were found. *Myotis* spp. were widely distributed among all types of habitats and were the only species found in agricultural areas. Big brown bats, quite common elsewhere, were detected only over water or wetlands surrounded by forested habitats. The Hoary bat was found most often in towns where it could be seen hawking for moths under street lights.

Other information about habitat use by bats was obtained by examining bat houses set up by Jack Davis (Cass Lake District) in the Chippewa National Forest. His on-going work with bat house design and monitoring bat occupancy continues to add to the knowledge of bats in this area. During MCBS animal surveys, bats observed in the bat houses were all identified as Little brown myotis and included a maternity colony at Norway Beach.

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Breeding-season Bird Surveys

Based on the lack of records in Cass County for certain rare bird species associated with sedge wetland, mature deciduous forest, and conifer swamps, MCBS bird surveys focused on these habitat types. Sedge wetlands were of particular interest because they are the preferred habitat of several state-listed bird species of high survey priority, including Yellow rail, Wilsons phalarope, and Nelsons sharp-tailed sparrow (Table 1, Appendix 1; refer to Table 7 for scientific names of all bird species mentioned in the text). Extensive areas of wet meadow and fen occur in Cass County, particularly adjacent to larger lakes and rivers. Mature deciduous and mixed deciduous-coniferous forests, common community types in the county, are the primary habitat of the Red-shouldered hawk (state-listed as special concern). Another deciduous forest species, the Black-throated blue warbler, was of moderate survey priority. This species had been recorded in the county but was not known to nest regularly. A third habitat targeted by MCBS for bird surveys was lowland conifer swamp. Although no listed bird species typically occur in this community type, several uncommon birds associated with conifer swamps reach their distributional limits in or near Cass County.

Since the objective of the MCBS bird surveys was to find as many locations of rare birds as possible, given the constraints of a single field season, techniques were used that best met this objective. Locational information collected during the survey identified areas important to rare birds in Cass County and provided insight into the rarity of these species in the region. During the time that MCBS was conducting rare bird surveys, other research on birds was on-going in the county. Long-term monitoring of forest bird populations (Hanowski and Niemi 1991, 1992) and habitat requirements of Red-shouldered hawks (McLeod and Andersen 1996) provided important information on birds in Cass County that was outside the scope of MCBS surveys.

Methods

The bird surveys were conducted during the breeding season, when it was assumed that all species present were summer residents, not migrants. Surveys for Red-shouldered hawks were made during April and May, while surveys for other species were conducted from late May through early July.

Point counts: The primary survey method used by MCBS was a modified fixed-radius point count. At several points within a given habitat all birds heard or seen during a five-minute interval were identified and evidence of breeding behavior or nesting was recorded. At each point the number of individual birds within a 50-meter radius were counted. Birds detected outside the 50-meter radius, but within the habitat being surveyed, were recorded but not enumerated. Birds flying over a point were counted if they were "using" the habitat (e.g., foraging swallows). Species detected outside the habitat being surveyed were also recorded for use in generating species lists for a site or area. Points were spaced a minimum of 300 meters apart and at least 150 meters from the edge of the habitat, when possible. The exact number of points within a particular site was determined by the size of the area and ranged from 1 to 10 points per site. Point counts were conducted from approximately 15 minutes before sunrise to about 4 hours after sunrise, during suitable weather conditions (i.e., wind less than 10 mph, precipitation no greater than a very light rain). At each point basic habitat information recorded included dominant plant species, canopy height, percent cover of different vegetation layers (canopy, sub-canopy, shrub, herb), water depth in wetlands, and litter depth. Locations of points are recorded on USGS 7.5-minute quadrangle maps. Supplemental record forms, with space for detailed notes on habitat and behavior, were filled out for all state-listed species, or other species of interest when encountered.

A total of 185 point counts were conducted in Cass County between 27 May and 1 July 1994. An additional 24 points were surveyed in portions of the Chippewa National Forest (CNF) in the Itasca County and were combined with those from Cass County for analysis (refer to Fig. 5 for a map of point count locations and Appendix 2b for a list of locations and associated habitats). Point count surveys were distributed among the priority habitats as follows: wet meadow/fen - 110 points, upland deciduous forest - 40 points, and conifer swamp - 45 points. The remaining points were conducted among a variety of other habitat types.

Playbacks: Playback of taped conspecific calls was used to locate territorial Red-shouldered hawks. Survey routes were established along roads or rivers in areas of suitable habitat. Stops were spaced 1/2 mile apart in extensive

habitat tracts, however in most areas good Red-shouldered hawk habitat was not evenly distributed. The 1/2 mile spacing was used as a rough guideline, with the selection of actual playback sites based on the location of potential habitat. For example, when the location for the next 1/2 mile stop consisted of inappropriate habitat (e.g., extensive marsh, cultivated field, or aspen regeneration), the distance between stops was extended to the next tract of potential Red-shouldered hawk habitat. At each stop, 20-30 seconds of calls were played, followed by 1-2 minutes of silence, and then another set of calls. A third set of calls was played if conditions seemed to warrant it. The observer remained at the site at least five more minutes before moving to the next stop to ensure a late response was not missed. Red-shouldered hawk surveys were conducted during the latter half of April and early May, before incubation began. While surveys may be conducted from mid-April through July, the birds seem to be more responsive during the earlier period. MCBS surveys were usually conducted during morning hours, but the time of day did not seem to be critical, with birds responding well in early afternoon on cool, cloudy days.

Red-shouldered hawk playback surveys were conducted at 48 locations in Cass County, between 21 April and 12 May 1994. An additional eight playback stops were surveyed in CNF in Beltrami and Itasca counties (Fig. 3, Appendix 2b).

Night road surveys: Road surveys were conducted after sunset for species that regularly vocalized at night (e.g., Yellow rail and Nelsons sharp-tailed sparrow), as a supplement to the morning point counts. Routes were selected that passed through known areas of potential habitat. At each stop the observer listened approximately five minutes for vocalizations of the targeted species. As with the Red-shouldered hawk surveys, stops were spaced approximately mile apart in extensive tracts of suitable habitat. At most stops, small stones were clicked together to imitate the song of Yellow rails. While the success of stone-clicking was inconclusive, it did seem to induce enough responses to warrant continued use of the technique.

Road surveys were conducted at 25 stops for Yellow rails and Nelsons sharp-tailed sparrows (Fig. 3, Appendix 2b). Surveys were made along wetlands adjacent to roads, primarily in southern Cass County.

Results

MCBS bird surveys documented 162 species in Cass County and adjacent portions of CNF during the breeding season (Table 7). This included locations of 11 rare species, several of which had not previously been documented for Cass County in the Natural Heritage Information System (NHIS). Sixty-nine new records were obtained for the following state-listed species: Yellow rail (26 locations), American bittern (17), Nelsons sharp-tailed sparrow (12), Red-shouldered hawk (9), Sandhill crane (3), and Wilsons phalarope (2) (Figure 4). Refer to Section 8.6 for additional information on some of these species. American white pelican, Osprey, Bald eagle, Greater prairie-chicken, and Common tern also were documented during the survey. These observations were either updates of previous records or, for the pelican and tern, were observations of non-breeding individuals. The Black-throated blue warbler, not state-listed but tracked by NHIS as a rare species, was recorded from the county by MCBS.

Although most bird species expected to breed in Cass County were recorded by MCBS, several species that almost certainly occur in the county were not found (Table 7). This probably was due to a concentration of survey effort on selected habitat types, such as wetlands rather than upland forests. Only 21% of the points counts were conducted in upland forests. Table 8 summarizes the distribution of point counts among the habitats surveyed and the bird species recorded from the various habitat types.

Discussion

Documenting the presence of rare bird species was the primary focus of MCBS bird surveys, however, a significant amount of data was collected on more common birds, as well. The repeated co-occurrence of groups of species in certain habitat types enabled us to make some general observations on the nature of these bird assemblages or communities. These are presented below for selected habitat categories that appear to be relevant to groups of bird species. Included in the discussion under each habitat type are important areas in Cass County for rare birds and suggestions for additional surveys. Table 9 lists bird species that have been recorded from Cass County or are likely to occur there, associated with their

primary breeding habitat, Fig. 4 shows the locations of rare birds, and Fig. 5 identifies areas in Cass County that are important to rare birds.

Birds found in sedge wetlands of Cass County: Two types of sedge-dominated plant communities important to rare birds are wet meadow (dominated by wide-leaved sedges and grasses) and rich fen (dominated by narrow-leaved sedges). A third type of sedge wetland, poor fen, which has a significant sphagnum component, is usually not as important for these rare species (see Table 1), and was not surveyed in Cass County. In other regions of Minnesota where both wet meadow and rich fen sites have been surveyed by MCBS, the bird communities of these habitats have been found to differ somewhat in their bird species composition. Wet meadows usually include several bird species, such as Swamp sparrows, that are more typically associated with emergent marsh habitat (i.e., deeper water and coarser vegetation, particularly cattails), while rich fens often support species generally associated with grasslands, like the Bobolink. Rich Fen seems to be a more preferred breeding habitat for rare species, such as Yellow rail, Wilsons phalarope, and Nelsons sharp-tailed sparrow than wet meadow.

Most sedge wetland communities in Cass County were classified as wet meadow, however, these plant communities frequently had a significant narrow-leaved sedge component (more typical of rich fen), which was reflected in the associated bird communities. Thus, for purposes of the discussing the birds found using these plant communities as breeding habitat in Cass County, they will be referred to, collectively, as sedge wetlands. Compared to previous MCBS surveys in Morrison County (adjacent and south of Cass County) and several counties in the far northwest, bird species composition of sedge wetlands in Cass County was quite similar to those of the other counties.

The typical bird community of sedge wetlands can be divided into two groups of species. The first group is comprised of sedge specialists (i.e., species that occur most frequently and are most common in sedge wetlands and are found rarely and are uncommon elsewhere). This included three rare species, Yellow rail, Wilsons phalarope, and Nelsons sharp-tailed sparrow (refer to Section 8.6 for detailed information on these species). The most ubiquitous bird in this community type was the Sedge

wren, which occurred at over 90% of points surveyed (see Table 8). Also common were Le Contes sparrow and Bobolink, which occurred at 46 and 25% of points, respectively.

The second significant component of the sedge wetland bird community are wetland generalists such as Common yellowthroat, Red-winged blackbird, and Swamp sparrow (which occurred at 67, 54, and 46% of points, respectively). These species are generalists in the sense that they are usually associated with habitat components, such as shrubs, small trees, or patches of cattails, that are typically present in many wetland types (e.g., sedge fen/meadow, emergent marsh, shrub swamp, and wetland-forest edge). Other generalists occurring regularly in Cass County sedge wetlands included Alder flycatcher, Tree swallow, Yellow warbler, and Song sparrow. One uncommon generalist, the American bittern, also occurs in a variety of wetlands. Species typical of cattail marshes, such as Marsh wren, are often encountered within large sedge wetlands, usually in areas where isolated pockets of cattails border larger rivers or lakes.

Sedge wetland sites important for rare birds: MCBS identified several important sedge wetland sites for rare birds in Cass County that are discussed below (see Fig. 4 for location of rare species and Fig. 6 for a map of important sites). Foremost among these were six areas of sedge wetlands associated with Leech Lake. Eighty-five percent of MCBS records of Yellow rail, Wilsons phalarope, and Nelsons sharp-tailed sparrow were found at these six sites. Several other wetland areas bordering Leech Lake were not surveyed for rare species. Yellow rails, Nelsons sharp-tailed sparrows, and perhaps Wilsons phalarope might be expected to occur if relatively large areas (>100-200 ha) of suitable sedge habitat is present at these sites. Two promising areas are the wetlands surrounding Waboose Bay and those along Sucker Creek and Sucker Bay.

Yellow rails and Nelsons sharp-tailed sparrows may also occur in larger sedge wetlands associated with other lakes and rivers in Cass County. Both of these species were found in the sedge wetland adjoining Laura Lake, but numerous other lakes with sedge borders were not surveyed by MCBS. Big Rice Lake, in particular, appears to have good habitat for these species. Other large areas of wetlands occur along the Mississippi River, par-

ticularly the area near White Oak Lake in northeastern Cass and adjacent Itasca County.

Several areas in southern Cass County had what appeared to be suitable habitat for Yellow rails and Nelsons sharp-tailed sparrows, however, the birds were not found there during MCBS surveys. For example, both species had been recorded previously from sedge wetlands in McKinley township, however, Yellow rails were only found at one site and no sharp-tailed sparrows were located. Many of these wetlands have been altered or disturbed, through ditching and haying, reducing the suitability of these sites as habitat for rare wetland birds. Some of the better sites had poor to marginal water conditions in 1994, and ditches through these wetlands probably contributed to the low-water conditions. Nevertheless, Yellow rails and Nelsons sharp-tailed sparrows should occur at scattered locations in this part of the county during years with more favorable water-level conditions.

Boy River - Boy Bay

The most important area in Cass County for rare wetland birds is the large tract of sedge wetland bordering the Boy River and Boy Bay (Leech Lake). See A on Figure 5. Much of this wetland site consists of a rather narrow strip of wet meadow, approximately 0.7 km in width, along the Boy River. This tract widens considerably in two areas, one adjoining Boy Bay, and the other situated north-northeast of Boy and Swift Lakes. This large wetland, approximately 2900 hectares in total area, contained 14 of 26 (54%) Yellow rail locations found in Cass County; and 8 of 12 (67%) locations for Nelsons sharp-tailed sparrows. The high density of Yellow rails and Nelsons sharp-tailed sparrows in the Boy River - Boy Bay complex makes this one of the most important areas in the state for these species. Prior to MCBS surveys, neither of these species were known to occur on the CNF during the breeding season. American bitterns were also quite common at this site (6 of 17 Cass County records).

Federal Dam - Leech Lake River

This sedge wetland area adjacent to Leech Lake at the mouth of the Leech Lake River, east of Federal Dam, is another important site (see B on Figure 5). Nowhere else in Cass County or the CNF were all of the rare species typical of sedge wetlands found together (Yellow rail, Sandhill crane, Wilson's phalarope, and Nelsons sharp-tailed sparrow). While none of these species were found

in the narrow strip of wetland bordering the Leech Lake River east of Leech Lake, the American bittern, previously a state-listed species, was found here. This river corridor of sedge wetland is disjunct from that of the Mud-Goose WMA (see below).

Swamp Lake - Steamboat River

This extensive sedge wetland (see C on Figure 5) is particularly important to Yellow rails. Although this species had been reported at Swamp Lake in a year or two previous to MCBS surveys, NHIS had no record for the species at this location. MCBS found three occurrences of Yellow rail here, however, no Nelsons sharp-tailed sparrows were detected. American bitterns also were present at this site. The area east of the Steamboat River adjacent to Steamboat Bay was not surveyed, but the habitat appeared to be suitable for rare species.

Pine Point RNA

The sedge wetland at the northern tip of Pine Point (see D on Figure 5) was one of only two sites in Cass County (the other was Federal Dam) where Wilsons phalarope was found by MCBS. Two Yellow rails were also found at this site. Both species were located in the portion of the wetland north and east of Lost Lake.

Stony Point

This site is a relatively small, irregularly shaped tract of sedge wetland on Stony Point (see E on Figure 5) bordered by emergent marsh and maple-basswood forest. Two Yellow rails were found here, and a Nelsons sharp-tailed sparrow was located in a portion of the tract that extended south-southwest toward Rice Lake.

Mud-Goose WMA

This is a large wetland complex of sedges and emergent marsh encompassing Mud and Goose Lakes, as well as portions of the Leech Lake River (see F on Figure 5). One Yellow rail, one Nelsons sharp-tailed sparrow, and four American bitterns were located here. In addition, a large population of Black terns was present at this site, particularly on Mud Lake. During MCBS surveys water levels were unusually high following heavy rains. Water depths were considerably deeper than the 2-20 cm depth preferred by Yellow rails and Nelson's sharp-tailed sparrows. It is quite likely that these two species are present here in higher numbers in years when water conditions are more suitable.

Birds found in deciduous forests of Cass County: The bird species present in deciduous forests in Cass County and the Chippewa National Forest have been well documented (Howe et al. 1996, Green 1995, Hanowski and Niemi 1992, 1991). Data from MCBS point counts conducted in northern hardwood forests dominated by sugar maple, basswood, and red oak agreed closely with findings of these other studies. Deciduous forest birds in Cass County are typical of those elsewhere in deciduous forests of Minnesota, with the exception of species with southern forest affinities that do not reach as far north as Cass County. In addition, most deciduous forest birds also occur in deciduous forest stands within largely coniferous forest areas.

While species compositions across deciduous forests are broadly similar, there are distinct differences in their relative abundances. Red-eyed vireos were the mostly frequently encountered species in deciduous forests in Cass County, occurring at all points surveyed (Table 8). Other abundant species included Ovenbird, Least flycatcher, and Eastern wood-pewee, occurring at 90, 80, and 50% of points, respectively. Several other species encountered at 30-40% of points were Veery, American redstart, Yellow-bellied sapsucker, and American crow. Other typical deciduous forest species, such as Great crested flycatcher, White-breasted nuthatch, Yellow-throated vireo, and Scarlet tanager, were less frequently encountered. Rounding out the list of deciduous forest species were a diverse mix, including American robin, Gray catbird, and Chestnut-sided warbler, which are more frequently associated with forest edge or disturbed habitats. Table 8 provides a complete list of deciduous forest species found by MCBS.

Rare deciduous forest species encountered in Cass County included Red-shouldered hawk (refer to Section 8.6 for additional information on this species) and Black-throated blue warbler. MCBS surveys documented nine new locations for Red-shouldered hawks in Cass County (Fig. 4). Research being conducted on this species at the same time as MCBS survey provided additional records (McLeod and Andersen 1996). Only one Black-throated blue warbler was found by MCBS, and this bird, a singing male, was not found on subsequent visits to the site.

Deciduous forest sites important for rare birds: Red-shouldered hawks were the focus of MCBS bird surveys in deciduous forests. MCBS concentrated surveys in southern Cass County, so as not to duplicate effort with an on-going study of Red-shouldered hawks being conducted on the CNF (see McLeod 1996, McLeod and Andersen 1996). Two important areas for this species were identified in the county (see Fig. 4 for locations of rare birds and Figure 5 for a map of important sites).

Many deciduous forest tracts in Cass County with the potential for supporting Red-shouldered hawks were not surveyed. Better potential habitat in southern Cass includes parts of Foothills State Forest, particularly those portions in Deerfield and Bull Moose townships. In fact, much of the St. Croix End Moraine is in need of additional surveys. In northern Cass County, much of the area east and south of Leech Lake remains largely unsurveyed for Red-shouldered hawks. Better areas include Land O'Lakes State Forest and much of the southern portion of the Walker Ranger District in the CNF.

St. Croix End Moraine

The most important area for Red-shouldered hawks in southern Cass County was a series of forested tracts along the St. Croix End Moraine (refer to Chapter 2 for a discussion on landforms). The abundance of small lakes and wetlands occurring in this kame and kettle topography provide excellent Red-shouldered hawk habitat, when mature deciduous forest is also present. The largest concentration of birds was located in Pillsbury State Forest. Of the nine Red-shouldered hawk records in southern Cass County, five were from this relatively small area in Fairview township. Other Red-shouldered hawks were found near Rat Lake (Moose Lake township), and in Foothills State Forest near Spider and Green Lakes (Bungo township).

Otter Tail Peninsula - Sucker Bay West

The largest known breeding-season concentration of Red-shouldered hawks in Cass County occurred in the extensive forests north of Leech Lake. Because an intensive Red-shouldered hawk study was underway in this area, MCBS surveys did not concentrate efforts here. Twenty-five of the 40 records for Red-shouldered hawks, listed by NHIS for Cass County, come from two townships on the Ottertail Peninsula and to the west of Sucker Bay.

Birds found in conifer swamps of Cass County: Many bird species restricted to lowland conifer swamps reach their southern distributional limits in Cass County (see Janssen 1987). MCBS point counts were conducted in two conifer swamp communities, white cedar (10 points, all in Cass County) and black spruce-tamarack (13 points, all in Itasca County) (see Table 8, Appendix 2). Bird species composition differed between these community types, but sample sizes were very small, so results are inconclusive. The Nashville warbler was the most frequently encountered species in both lowland conifer forest types, occurring at all points in the black spruce-tamarack, and 90% of the white cedar points. Yellow-bellied flycatcher, Connecticut warbler, and White-throated sparrow were also fairly common in both plant communities. Species which seemed to be much more common in black spruce-tamarack than in white cedar were Hermit thrush (92% of points in the black spruce-tamarack), Yellow-rumped warbler (38%), Chipping sparrow (38%), Palm warbler (31%), Golden-crowned kinglet (23%), and Lincoln's sparrow (23%). Occurring more frequently in white cedar swamps were Winter wren (50% of points in white cedar), Northern parula (40%), and Black-and-white warbler (30%). Table 8 lists all bird species recorded in these plant communities by MCBS.

No rare bird species were recorded from conifer swamps by MCBS, however, several species uncommon to Cass County were encountered, including Black-backed woodpecker and Gray jay. Boreal chickadees were found only in Itasca County by MCBS. This species is relatively secretive, and probably does occur in Cass County.

Birds found in emergent marshes of Cass County: Several cattail marsh specialists, such as the Marsh wren and Yellow-headed blackbird, were common, as were species more generally adapted to wetlands, including Common yellowthroat, Red-winged blackbird, and Swamp sparrow (see Table 8). Only three point counts were conducted in emergent marshes in Cass County, thus the full suite of emergent marsh species were probably not identified, particularly those associated larger marsh tracts with areas of open water (see Table 9 for a more complete list).

Birds found in prairies and disturbed grasslands in Cass County: Little native prairie occurs in Cass County. The

best and largest prairie tract is located near the Cass-Wadena county border, in an area that was formerly planted to jack pine. A population of Greater prairie-chickens, a state-listed species, persists here, disjunct from the primary prairie-chicken range in northwestern Minnesota. Elsewhere in Cass County, disturbed, non-native tracts such as pastures, old fields, and hayfields are the only extensive open grasslands available to birds. The majority of grassland birds in Minnesota occur in these human-altered grasslands and are not restricted to native prairie (most prairie-restricted birds have become extirpated). MCBS conducted only four bird point counts in grasslands in Cass County and found no rare birds other than the Greater prairie-chicken. Upland sandpiper, previously a state-listed species, probably occurs in the county, but none were found by MCBS.

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Amphibian and Reptile Surveys

Surveys in Cass County for amphibians and reptiles, conducted by the Minnesota County Biological Survey (MCBS), were intended to document (1) new locations for rare species (Table 1), (2) new county records for herpetofauna (collective term for amphibians and reptiles) not recorded from Cass County, (3) species of special interest to local resource managers (see Appendix 1), and (4) herpetofauna representative of particular plant communities in Cass County. Concurrent with MCBS animal surveys, a joint project was underway between the Minnesota Department of Natural Resources and the Chippewa National Forest (CNF) to inventory and classify the landscape according to ecological units (Almendinger, et al. 1994). As an experiment to test whether animals followed this landscape classification scheme, herpetofaunal surveys were associated with selected Land Type Associations (LTA). This is discussed in more detail under drift fence surveys.

The herpetofauna of Cass County were unevenly documented prior to MCBS animal surveys, with only three rare reptiles known from the county. Blandings turtles were well-documented in southern portions of Cass County, in large part due to the efforts of the DNR Region 3 Nongame Wildlife staff (Table 2). Snapping turtles were widely reported, however, since this state-listed species is not tracked by the Natural Heritage Information System (NHIS, see Chapter 1 for description of tracked elements), accurate numbers for this Special Concern species were not available. NHIS records of the Eastern hognose were localized to the central portion of Cass County.

Discussions with biologists of the CNF identified herpetofauna as one of the least known animal groups (Appendix 1). With the assistance of CNF staff, special effort was focused on drift fence and anuran call surveys throughout the CNF, as well as in selected areas in southern Cass County (refer to Appendix 2c for locations).

Methods

MCBS surveys for amphibians and reptiles were conducted from April through September, 1994, and utilized a variety of techniques, based on the targeted species (Table 1). Refer to Section 8.6 for references on standard survey techniques used for herpetofauna.

Anuran call surveys: Anuran call surveys were conducted at breeding sites of toads and frogs (anuran is a collective term for toads and frogs). From April through July, when particular species were expected to breed, sites were surveyed for calling males (refer to Karns 1986, Scott and Woodward 1994 for detailed methodology). At selected wetland locations, all species heard calling during a five minute interval were recorded and their corresponding call intensity (an index of the number of calling individuals) was estimated. Surveys included a variety of wetland types to characterize the species using different habitats. Each survey location was surveyed three times during the field season to span the calling periods of all anuran species potentially inhabiting the site.

Anuran surveys were conducted at 63 locations (Fig. 6, Appendix 2c). Habitats sampled included sedge meadow, emergent marsh, forested swamp, shrub swamp, lake, river, and stream. Locations were surveyed between 21 - 25 April, 24 May - 1 June, and 6 - 13 July. Forty-six additional locations were surveyed in Beltrami and Itasca counties as part of the cooperative effort between MCBS and the CNF.

Drift fences: Drift fences are effective in capturing secretive herpetofauna, such as salamanders, that may otherwise not be detected. In addition, drift fences provide valuable information on seasonal movements related to breeding activity or shifts in habitat use (Corn 1994, Karns 1986). Aluminum flashing of 50-foot lengths were embedded at least six inches into the ground. On each side of the flashing four five-gallon buckets were buried flush with the ground (eight buckets per drift fence).

Pitfall cones, normally used in mammal surveys, were substituted for buckets at flooded sites, where buckets would not stay buried. At some sites, funnel traps made of wire mesh were placed along the flashing to augment trapping success. Drift fences arrays were checked three times per week and all herpetofauna and small mammals were removed and identified.

Fourteen drift fences were installed and monitored for a total of 5,458 trap nights (Fig. 6, Appendix 2c). Five drift fences were run between 28 April and 9 June, while all drift fences were run for varying lengths between 26 July and 15 September (Table 11).

Habitats selected for placement of drift fences consisted of nine forested (both coniferous and deciduous), two grassland, two wet meadow, and one forest-lake edge. In a cooperative effort with the ECS project being conducted in the Chippewa National Forest, drift fence sites were selected from three LTAs within the CNF (two in Cass County, one in Itasca County). In Cass County, the Guthrie Till Plain and Bena Dune Area were selected. Within each LTA, four forested sites were chosen that represented soil moisture conditions of well-drained, mesic, poorly-drained, and wet. Drift fences were placed in the vicinity of an ECS plot where data on vegetation, soils, and other site characteristics were collected.

Terrestrial searches: Terrestrial searches involved actively searching a particular habitat or area and documenting all herpetofauna found. Logs and other ground debris were turned over to check for concealed herpetofauna, such as snakes, skinks, and salamanders, which frequently take refuge under objects. Snake skins, eggshell fragments, and other sign also were recorded.

Between 22 June and 15 September, searches were conducted at 11 locations (Fig. 6, Appendix 2c). Sites included various types of cover including rock piles, old foundations, woody debris, and railroad tracks. In addition, searches were made at each drift fence site to provide supplemental information on herpetofauna that might not be captured by the drift fences, such as large snakes and frogs with adhesive toe pads.

Turtle traps: Turtles were surveyed using visual searches and turtle traps (refer to Karns 1986, Lagler 1943). Surveyors used spotting scopes and binoculars to help identify basking turtles in lakes and wetlands. Hoop nets were set in shallow wetlands, baited with sardines, smelt, or chicken, and checked every other day for three to five days. Captured turtles were identified, aged, and sexed prior to release at the point of capture. Females were palpated to determine the presence of an egg mass.

Turtle traps were set at nine locations in Cass County (Fig. 6, Appendix 2c). Thirty-four traps were set in emergent marsh habitat with adjacent open grasslands and sandy soils for a total of 99 trap nights. The majority of the trapping was conducted in the southern portion of the county, where habitat suitable for Blandings turtles was more abundant. Trapping was conducted between

22 June and 15 September.

Incidental records: In addition to standard inventory techniques, herpetofauna were documented when encountered incidentally while traveling between sites. For example, during spring and summer migration, large numbers of amphibians can be found crossing roads on warm, rainy nights. Snakes will use warm road surfaces to bask and will often cross roads during spring and fall as they travel to or from hibernacula. Turtles also are found on roads during the nesting period and seasonal migration. Herpetofauna encountered under such circumstances were either photographed and released or collected as voucher specimens. Voucher photographs are maintained at the Section of Ecological Services, Minnesota Department of Natural Resources in St. Paul. Voucher specimens are collected and preserved for permanent storage at the Bell Museum of Natural History, University of Minnesota.

Results

A total of eleven amphibian and nine reptile species were documented in Cass County during MCBS animal surveys in 1994 (Table 10). This included three state-listed species, the Blanding's turtle (threatened), the Snapping turtle (special concern), and the Eastern hog-nose snake, which was recently delisted. Figure 7 shows the locations of rare herpetofauna in Cass County. New county records were established for five species in Cass County, Blue-spotted salamander, Copes gray treefrog, Snapping turtle, Painted turtle, and Spiny softshell turtle. In addition to these new county records, old or historic records were updated for nine species.

A new state record was obtained for a hybrid form of the Blue-spotted and Jeffersons salamander (*Ambystoma laterale* x *A. jeffersonianum*, LLJ). Individuals were collected near a drift fence set in a forest with poorly-drained soils and identification was verified by Dr. J. P. Bogart, University of Guelph, Ontario. Although this hybrid variation is common further east in the U.S., this record is the first documentation of this form Minnesota and constitutes the westernmost known location (Dorff 1995a). A new state record was obtained from a drift fence set in Itasca County, as part of the effort to associate MCBS animal survey sites with ESC plots in the Chippewa National Forest. The Four-toed salamander

(*Hemidactylium scutatum*), documented for the first time in Minnesota, was taken from a drift fence less than 14 miles from the Cass County border (Dorff 1995b). While not found in Cass County, appropriate habitat does exist for this species and it is likely that it occurs here, as well.

Anuran call surveys: Nine species of toads and frogs were documented from the anuran call surveys, with an average of four species heard per location. The most frequently recorded species were the Spring peeper (96 % of all locations), Gray treefrog (78%), Western chorus frog (64%), and Wood frog (62%). They also were found in a wide variety of habitats throughout the county. Some of the less common species were more closely associated with particular habitat types. Mink frogs and Green frogs were documented at permanent bodies of water, such as lakes and deep emergent marshes. Copes gray treefrogs were present only in the southern portion of Cass County, typically in sedge meadow and shrub swamp habitats. Although American toads were present throughout Cass County, they were much more common in the northern forested routes where they were recorded at 67% of the locations, compared to 30% of the locations in the southern routes.

The timing and length of breeding seasons varied among the species and was evident by the sequence of vocalizations. During the first survey period Wood frogs, Western chorus frogs, and Spring peepers were common. Although Wood frogs were silent during the second period, Spring peepers continued to call frequently. Leopard frogs were recorded occasionally during both the first and second periods. American toads and Gray treefrogs were commonly heard during the second survey. In addition, where suitable habitat was present, Copes Gray treefrogs were recorded. The only species commonly heard during the third period were Green frogs and Mink frogs.

Drift fences: Nine species of amphibians and two species of reptiles were documented from the drift fences set in Cass County. A total of 1,862 captures resulted in an overall capture of 0.34 animals/trap night (trap night calculated by multiplying the sum of buckets, cones, and funnels by the number of nights the drift fence was active, see Table 11). Since individual animals were not marked the results presented here may include recap-

tures. American toads and Wood frogs were present in all habitats and comprised 89% of the total herpetofauna captured in drift fences (Table 13). Blue-spotted salamanders were the third most frequently captured species, with 8% of the total capture. Although three species of treefrogs were captured, collectively they made up less than 2% of the total capture. However, treefrogs are often under-represented in drift fences due to their ability to adhere to and climb out of buckets.

Species richness was highly variable among the habitats surveyed, ranging from seven species in a forested site to three species in a grassland site (Table 12). A total of nine species of amphibians and one species of reptile were captured among forest drift fences (combining all soil moisture conditions). Forests with poorly-drained soils had the greatest species richness of all habitats sampled. In addition to capturing herpetofauna, large numbers of night crawlers were removed from many of the forest drift fences. Six species of amphibians were documented from the forest-lake edge drift fence. This was the only drift fence in Cass County where Mink frogs and Green frogs were recorded. Three amphibians and one reptile were captured from the wet meadow site and two amphibians and one reptile from the grassland sites.

Herpetofaunal abundance, as measured by the number of animals captured per trap night, also varied among the different habitat types. Forest drift fences had the highest cumulative abundance, with a total of 1,762 captures resulting in 0.47 animals/trap night. Within the nine forest sites, drift fences in poorly-drained soils had the highest abundance (1.09 animals/trap night), followed by mesic (0.43), wet (0.34), and well-drained sites (0.25). Across all forest habitats sampled, Wood frogs and American toads were the most abundant species, with 0.22 and 0.20 animals/trap night, respectively. Among the four soil gradients, American toads were most abundant at the poorly drained sites, with 0.63 toads/trap night. The forest-lake edge drift fence had a total of 55 captures, resulting in 0.12 animals/trap night. Drift fences in the wet meadow habitat resulted in 39 captures (0.06 animals/trap night). Grassland drift fences had the lowest abundance of all habitats sampled, with only six captures resulting in 0.01 animals/trap night.

Terrestrial searches: Six species of amphibians and two species of reptiles were documented during searches. Wood frogs, Spring peepers, and Blue-spotted salamanders were found at 75% of the forested locations. American toads and Western chorus frogs were recorded at 50% and 25% of all locations, respectively. Common garter snakes were recorded at three locations and were often associated with a forest-grassland edge. Prairie skinks were found exclusively in grasslands, while Northern leopard frogs were documented along lake shores and in grasslands.

Turtle traps: Thirty-seven turtles were captured, including 34 Painted turtles, two Snapping turtles, and one Blandings turtle. The capture success ranged from no captures up to three turtles per trap night with an overall average of 0.4 turtles per trap night.

Incidental records: Two female Blandings turtles were encountered near Dry Sand Lake Wildlife Management Area during the nesting season. Two Eastern hognose snakes were found dead on roads in southern Cass County. A Smooth green snake was found dead on a road in southern Cass County and a Spiny softshell turtle was documented basking on a structure in the Crow Wing River. Neither the green snake nor the softshell had been recorded from the county previously.

Discussion

Of the 49 species of herpetofauna in Minnesota, 12 species of amphibians and 9 species of reptiles are known to occur within Cass County. Additional species may be present, though not currently verified from the county. The landscape of Cass County is dominated by forest communities and aquatic features, consequently, most of the county's herpetofauna are closely associated with forest and wetland habitats (Table 13). In Cass County, as elsewhere in the state, the number of amphibian species and their abundances far outnumber those of reptiles. However, reptiles are relatively more numerous in southern Cass County, where drier conditions, sandy soils, and a mosaic of forest communities are intermixed with grasslands, wetlands, lakes, rivers, and streams. Cass County has relatively few rare herpetofauna when compared to counties in the southern Minnesota. However, southern Cass County, and adjacent portions of Morrison County, provide critical habitat for northern populations of Blandings turtles (see Section 8.6 for additional information). The

discovery of the Four-toed salamander in Itasca County and the Blue-spotted x Jefferson salamander hybrid in Cass County, underscores how little is known about rare herpetofauna associated with northern forest habitats. A single field season cannot begin to describe adequately the relationships between herpetofauna and habitats in Cass County. Nevertheless, results from the MCBS animal surveys can provide insight into the distributions, abundances, and habitat associations of amphibians and reptiles in the county. These findings are summarized below under broad habitat categories of forest, grasslands, and aquatic habitats (lakes and rivers).

Herpetofauna associated with forest habitats: The forest communities of Cass County are diverse in vegetation as well as moisture gradients. Results of MCBS drift fence surveys indicate that forests with poorly-drained soils had the greatest species richness and abundance (Table 12). Amphibians overwhelmingly dominated the forest herpetofauna, with the predominant species being Wood frogs and American toads. Blue-spotted salamanders also were frequently recorded in forest habitats. These results are similar to Karns (1992) who found that Wood frogs, American toads, and Blue-spotted salamanders were the most abundant species in the peatlands and forested habitats of northern Minnesota.

In general, anurans found in forested areas in Cass County are closely associated with adjacent wetlands or with moist forest conditions. However, individual species show marked differences in their preferred habitat and seasonal use. Wood frogs, American toads, and Gray treefrogs breed in shallow wetlands and overwinter in the forest floor. Green frogs and Mink frogs breed and overwinter in permanent, deeper wetlands. Northern leopard frogs and Western chorus frogs are typically associated with grassland habitat but also occupy forest edges. Although both of these species breed in shallow wetlands, the Northern leopard frog overwinters in permanent aquatic habitats and the Western chorus frog overwinters in the forest floor (see Table 13).

Salamanders are forest-dependant species that breed in shallow wetlands and obtain refuge in microhabitats such as forest depressions, areas of deep litter, and coarse woody debris. Blue-spotted salamanders were the most numerous species of this group and were found throughout Cass County. The Blue-spotted x Jefferson salamander

hybrid is a triploid member of the *Ambystoma jeffersonianum* complex which was documented for the first time in Minnesota during the MCBS animal surveys in Cass County. This hybrid closely resembles the Blue-spotted salamander but reaches a greater total body length and is typically grayer in color than the Blue-spotted salamander. The spots on the hybrid are smaller flecks compared to that of the Blue-spotted salamander. The Blue-spotted x Jefferson hybrid form is usually female and reproduces by picking up male Jefferson salamander spermatophores. This triggers embryonic development, but typically does not incorporate the chromosomes of the male, thereby producing offspring that are genetic clones of the female (Pfingsten and Downs 1989). The Jefferson salamander has never been recorded in Minnesota and the closest known populations occur in Ohio and Indiana.

The fossorial habits of Tiger salamanders made them difficult to locate and their presence in Cass County is undoubtedly greater than data from MCBS animal surveys indicated. This species typically inhabits woodland and grassland edges in close proximity to wetlands. Redback salamanders reach the western edge of their range in Cass County and, although not documented by MCBS animal surveys in 1994, previous records exist for this species in the county. Redback salamanders have small home ranges, reducing their susceptibility to capture in drift fences. They occur in moist forests with closed canopies and an abundance of leaf litter and woody debris. Recent research has found that soil pH is the single most influential factor in the activity patterns and local distribution of this species (Sugalski and Claussen 1997). Low soil pH increases sodium loss, which decreases the ability of this lungless species to osmoregulate (Frisbie and Wyman 1991).

Eastern newts are widely distributed throughout northern and eastern Minnesota but are difficult to locate due to their small size and secretive nature. Although no records currently exist for Four-toed salamanders in Cass County, this species was recorded in adjacent Itasca County. The Four-toed salamander, a species of special concern, was initially documented in Minnesota in 1994 within 14 miles of the Cass County line. This record represents the extreme western edge of this species range, with the nearest known population occurring 115 km southeast in Bayfield County, Wisconsin. There are sev-

eral small, widely scattered populations of Four-toed salamanders along the western edge of its range. Habitat occupied by this species often consists of a mosaic of mature upland forest with sphagnum bogs or conifer swamps (Table 13).

In Cass County, reptiles associated with forest habitat included the Common garter snake, Redbelly snake, and Eastern hognose snake. These species were typically found near forest edges or within smaller woodland tracts.

Herpetofauna associated with grassland habitats: In general, grasslands in Cass County tend to be small, with low plant species diversity, and surrounded by trees or shrubs. Larger tracts in the southern portion of the county are associated with sandy soils, however, these sites appear to be too small or too isolated to harbor many grassland-dependant herpetofauna.

Amphibians found in grassland habitats are dependant upon the presence of shallow wetlands nearby. Species documented during MCBS animal surveys included Western chorus frogs, Northern leopard frogs, Copes gray treefrogs, and Tiger salamanders. Grassland reptiles recorded were Northern prairie skinks, Smooth green snakes, and Common garter snakes. Cover objects (rocks, woody debris) and burrows provide important shelter for reptiles in grasslands. During the nesting season turtles utilize grasslands as nesting sites, particularly those on sandy soils, where they target sparsely vegetated sites or exposed sand (Table 13).

Herpetofauna associated with aquatic habitats: Cass County has numerous aquatic features including wetlands, lakes, streams, and rivers that provide a rich diversity of habitat for amphibians and aquatic reptiles. The shallow bays, wetlands, and wet meadows are essential for the breeding and development of larval amphibians, which emerge later to occupy more terrestrial habitats. Some species of frogs also overwinter in wetlands and streams (Table 13). While turtles are strongly associated with all the aquatic habitats of Cass County, some snakes search for amphibian prey along the edges of aquatic habitats.

Although most amphibians utilize shallow wetlands during the breeding season and larval growth stage, the Green frog and Mink frog occupy this habitat through-

out their life. They are strongly associated with permanent wetlands with abundant emergent vegetation. These two species breed later in the season than other frog species, resulting in larvae that typically overwinter in the wetlands.

Four species of turtles were documented in Cass County during MCBS animal surveys. The Painted turtle was captured most frequently in the wetlands sampled. Wetlands and shallow bays of lakes provide habitat for Snapping turtles, Painted turtles, and Blandings turtles. Streams and ditches are often used as travel corridors by these species. The greatest limiting factor for turtles appears to be lack of suitable nesting habitat. Much of the county is heavily forested, lacking the dry, open habitat with exposed sandy soils that many species prefer for nesting. Species that occupy the larger streams and rivers of the county, including the Snapping turtle and Spiny softshell, typically nest on exposed sandbars or south-facing cut banks on the rivers edge. The presence of Wood turtles (*Clemmys insculpta*) has not been verified in Cass County. While the closest known populations of this state-threatened species occur in Carlton and St. Louis counties, it is possible that this species may extend up forested rivers into Cass County. Common map turtles (*Graptemys geographica*) have been recorded from rivers in Crow Wing County, which appears to be its northern limit in Minnesota.

Recommendations for additional surveys or management actions: Data on herpetofauna of Cass County, obtained by the MCBS animal surveys in 1994, have added to the cumulative knowledge of this group for the county. Nevertheless, there is ample opportunity to expand on what is known about these species. Herpetofauna, particularly amphibians, are highly susceptible to weather cycles, and their distribution and abundance can change dramatically from year to year. Records of uncommon and secretive species may under-represent the actual numbers of these species. Long-term monitoring and accumulation of sightings and reports has in the past and will continue in the future to enhance our understanding of amphibians and reptiles in Cass County. Cass County is unique in the number of land managers that either reside in the county or whose jurisdiction includes the county. The presence of biologists from the Chippewa National Forest, Leech Lake

Reservation, County Lands Department, and the Department of Natural Resources provides an excellent opportunity to continue surveys and establish monitoring programs that focus on herpetofauna. Below are some suggestions for additional work with herpetofauna in Cass County.

Report sightings of rare amphibians and reptiles: Obtaining locations for state-listed species is the primary focus of MCBS animal surveys. However, after MCBS leaves the county, additional records or sightings of rare herpetofauna are vitally important to assessing their status in the county. Sightings of rare amphibians and reptiles should be reported to the regional DNR Nongame Wildlife Specialist or to the data manager for the Natural Heritage Information System (NHIS, refer to Chapter 1 for information on this program).

Frog and toad breeding call surveys: Amphibians occupy both aquatic and terrestrial communities and can act as indicators of environmental health. This group is a significant part of the forest faunal community in Cass County, but little is known about the role they play in forest ecosystems or how forest management practices impact their populations. Recent concern over global declines in amphibian populations and frog deformities has resulted in the establishment of a number of amphibian monitoring programs. Minnesota has initiated a long-term survey of breeding frogs and toads, as part of a national effort to identify trends in amphibian population levels. Individuals interested in participating in this monitoring program should contact the DNR Nongame Research and Heritage Program (see Chapter 1).

Surveys for the Four-toed salamander: The presence of the Four-toed salamander in Minnesota was a remarkable find, considering the closest known population of this species is in Wisconsin. Throughout its range, this species occurs in small, isolated colonies which are vulnerable to catastrophic events. More information is needed on the size and extent of the Minnesota population. Timber-harvesting activities should be evaluated to assess their potential negative effect on this species in the lowland forests and bogs where it was found. Additional study on this population could help to identify critical habitats or sites to protect for this species continued survival in the state. Old growth tracts with suitable wetland habitats (see Chippewa National Forest 1993)

are likely areas to search for additional records of this species in the state.

Mitigating for amphibians in timber-harvesting practices: Forest-dwelling amphibians require moist conditions with refuge sites. Microhabitats such as depressions, areas of deep leaf litter, and coarse woody debris provide shelter during summer droughts. Reduction of the forest canopy, through timber-harvesting, increases the temperature of the forest floor, reduces soil moisture, and may eliminate refugia by compacting the soil, changing soil pH, or removing leaf litter. Due to the limited dispersal capabilities of amphibians, isolated populations are highly susceptible to local effects if there is no connection to available habitat. Retaining small pockets of habitat within large cuts and connecting patches of small cut-over areas with older, mature stands will facilitate the repopulation of amphibians in the second growth (Waldick 1997).

Initial planning of logging activities can significantly reduce the impact to local herpetofauna. Logging roads should be constructed outside of a buffer area surrounding wetlands, riparian habitats, and temporary wetlands (deMaynadier and Hunter 1995, Raymond 1991). Coarse woody debris left on the ground and dead and live trees of various age classes that remain standing after harvesting can provide essential microhabitat for amphibians that repopulate the forest after regeneration (deMaynadier and Hunter 1995).

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Figure 1. Locations of Rare Animals and Animal Aggregations in Cass County

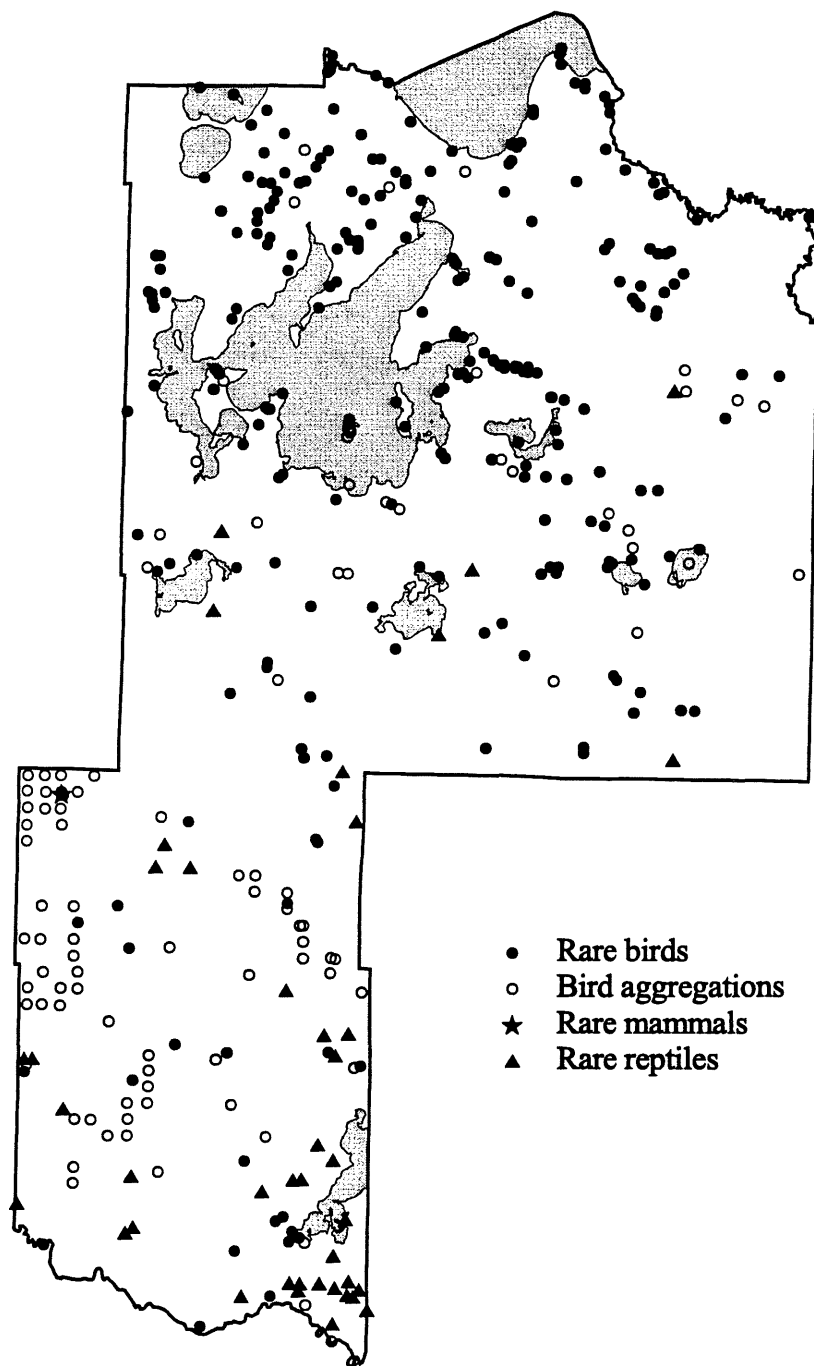


Figure 2. Locations of MCBS Mammal Surveys in Cass County

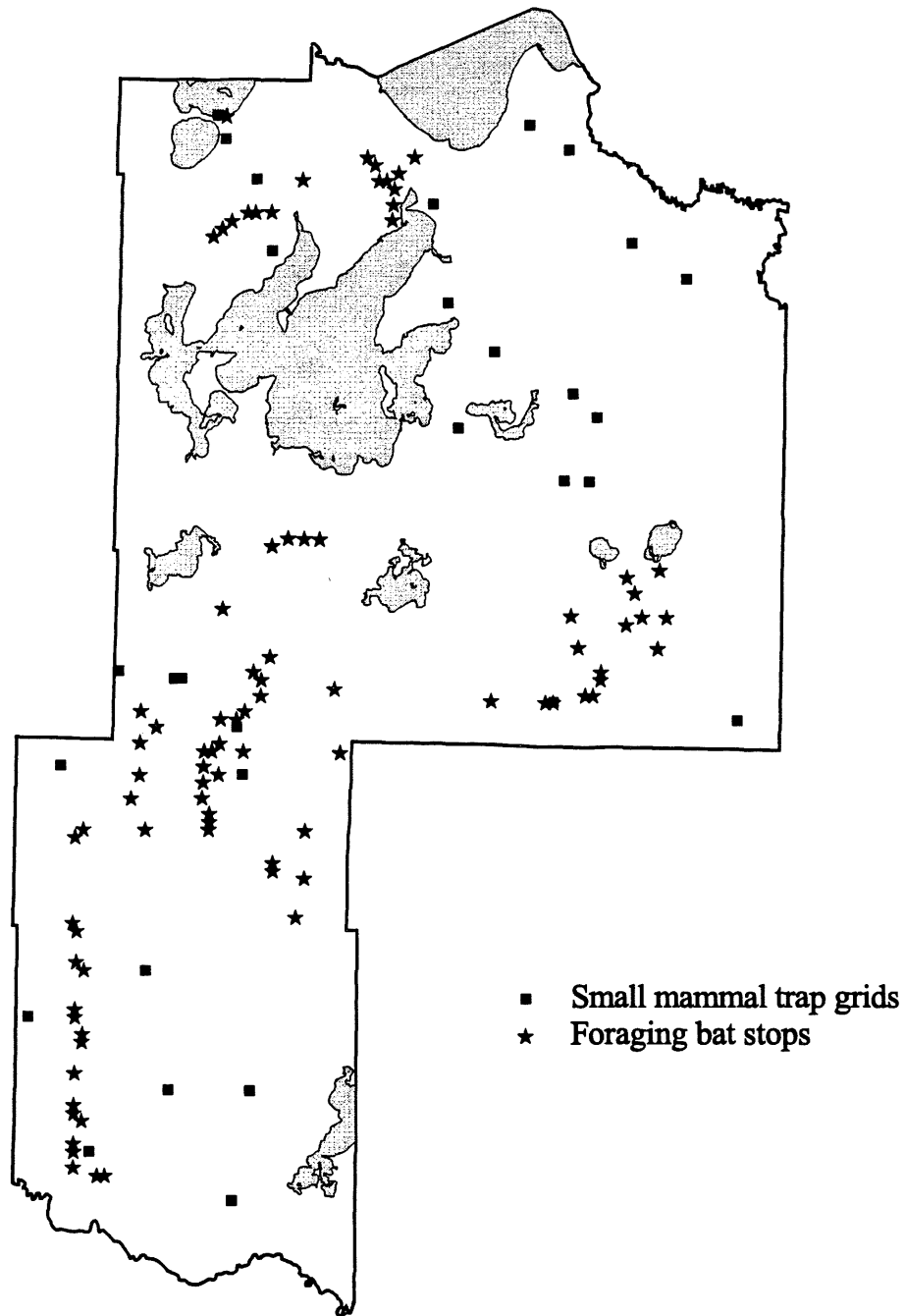


Figure 3. Locations of MCBS Bird Surveys in Cass County

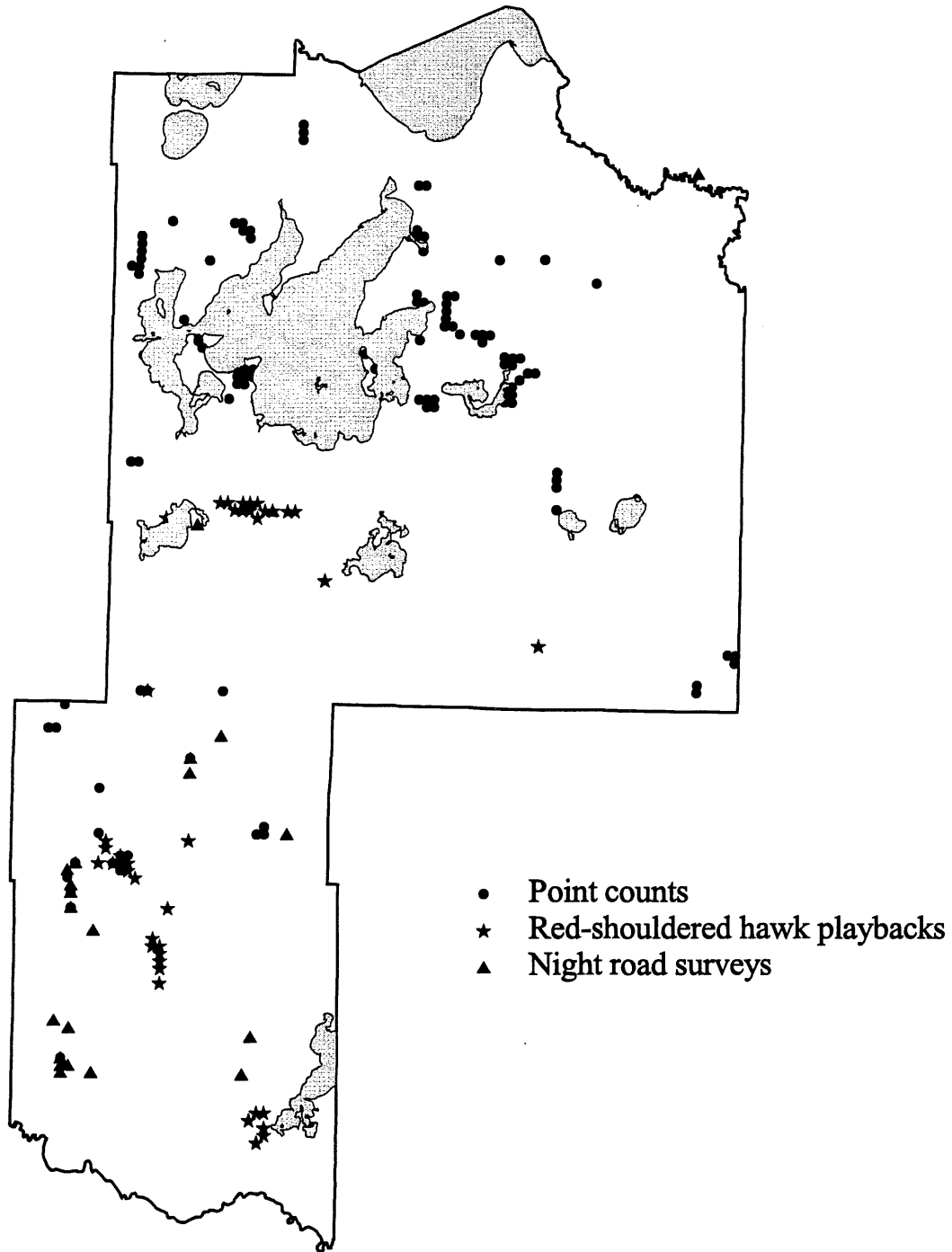


Figure 4. Locations of Rare Birds in Cass County

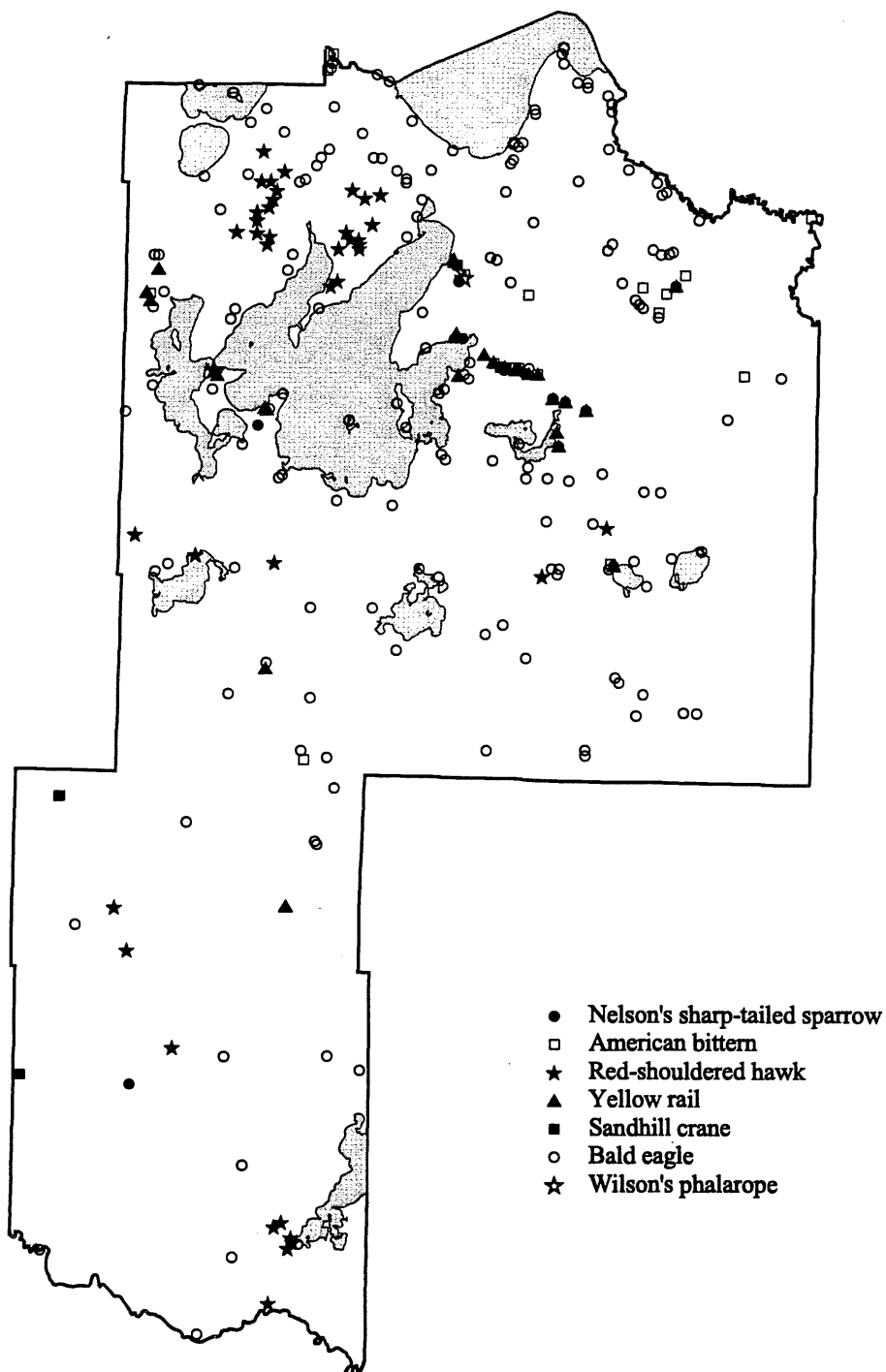


Figure 5. Locations of Sedge Wetlands Surveyed by MCBS
in Cass County that are Most Important for Rare Birds

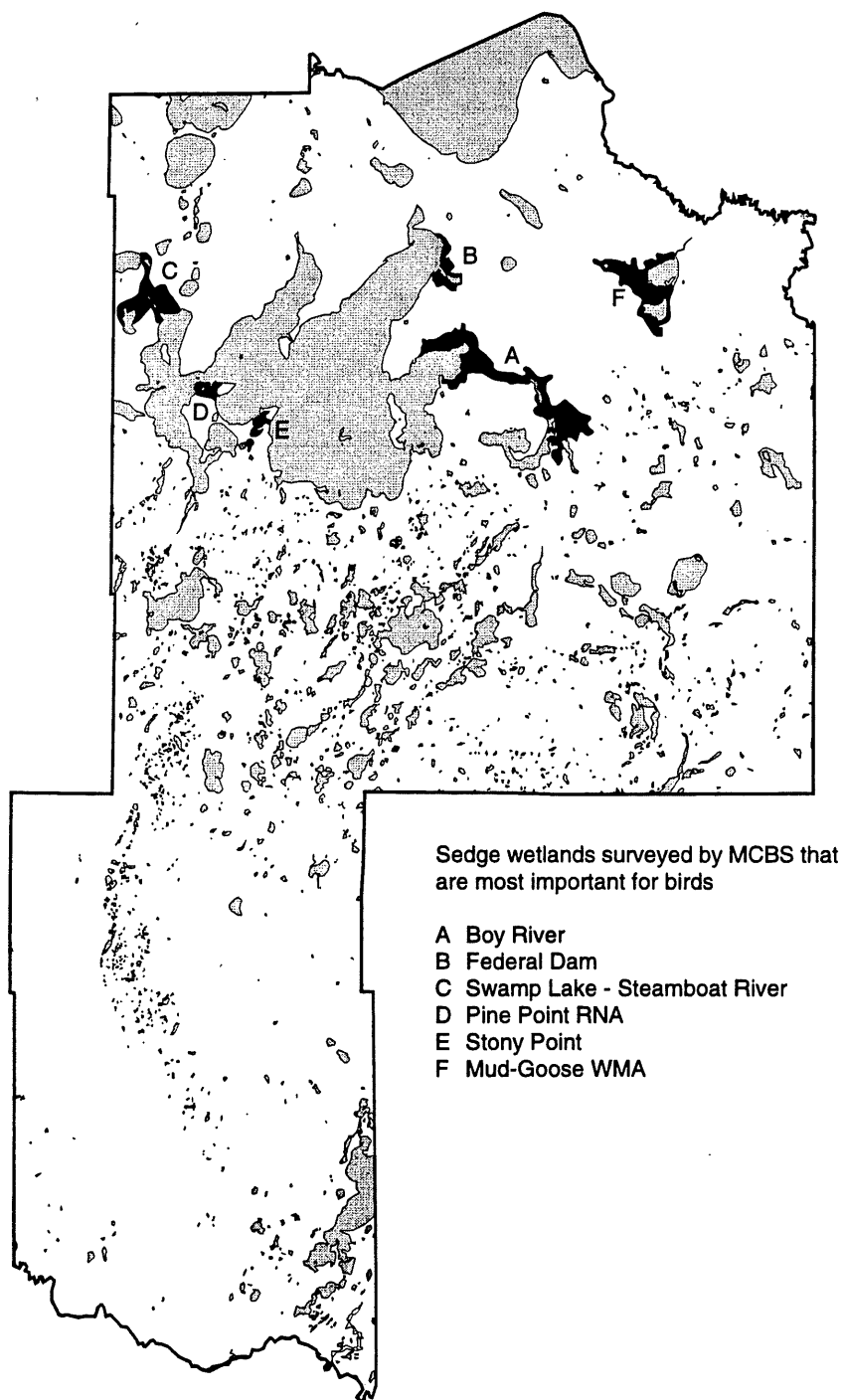


Figure 6. Locations of MCBS Amphibian and Reptile Surveys

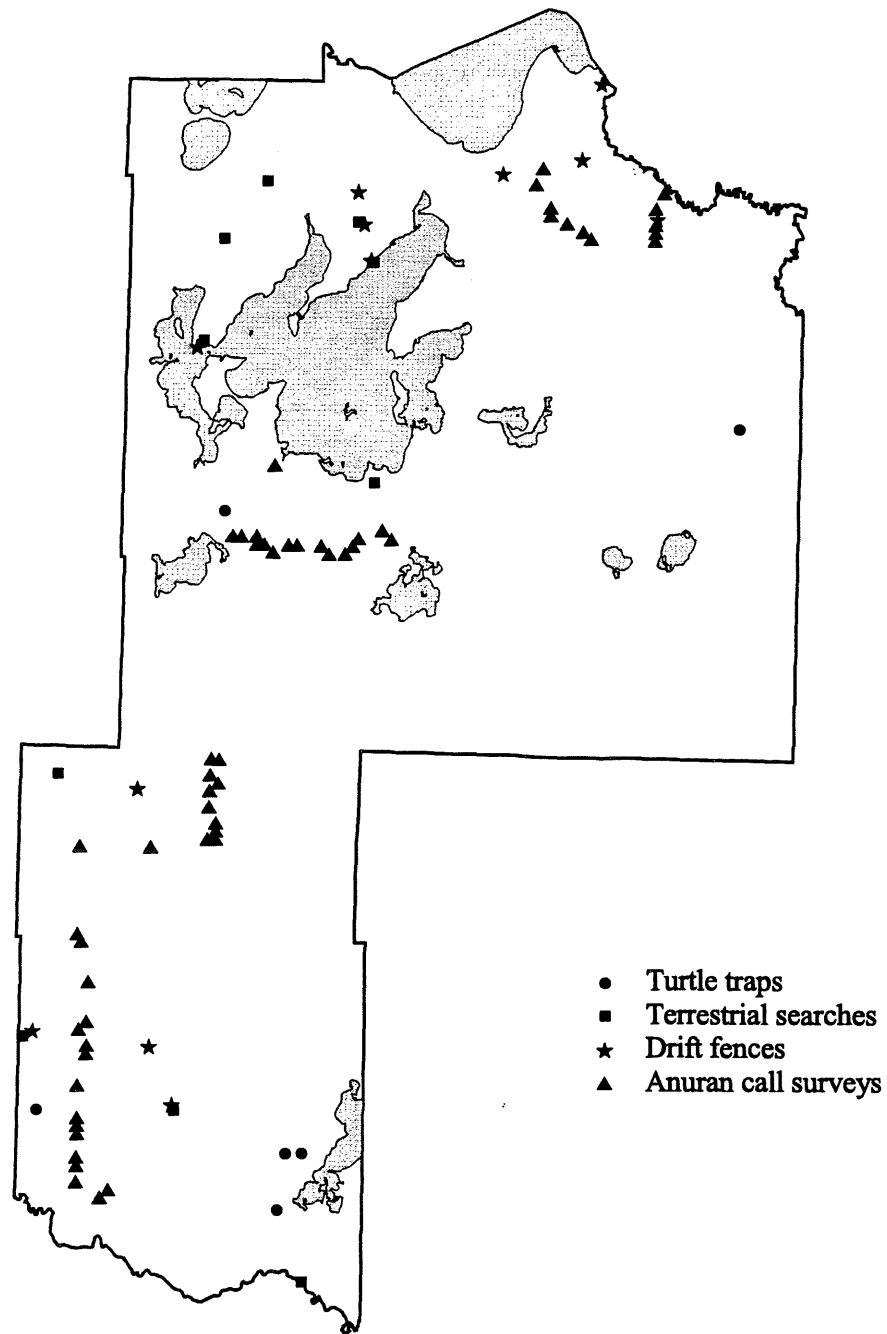


Figure 7. Locations of Rare Herpetofauna in Cass County

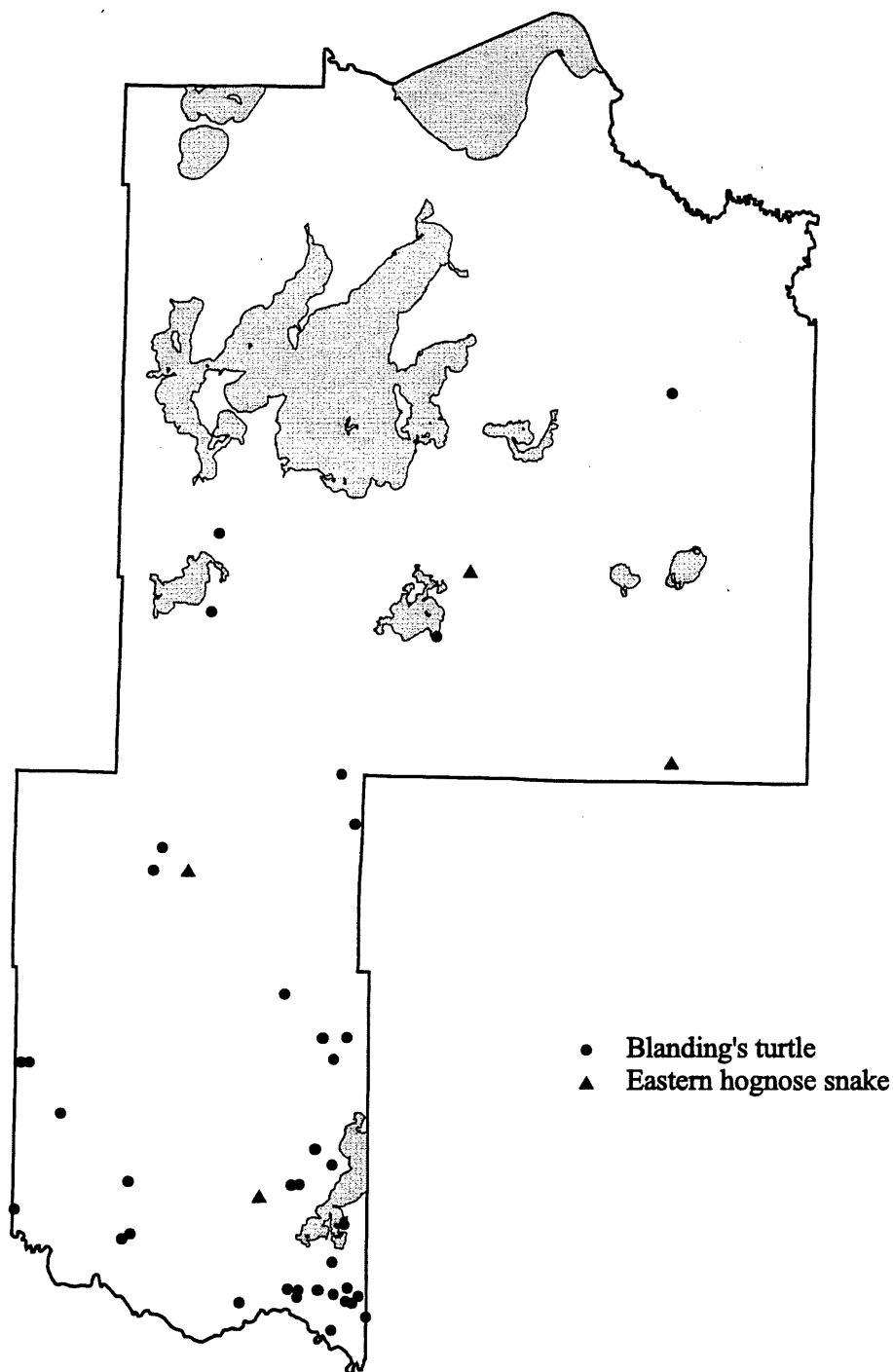


Table 1. Rare animals documented from or potentially occurring in Cass County.
(Species are associated with their primary habitats. Only breeding birds are included.
State statuses reflect changes as of July 1996. Species identified as Elements are tracked
by the NHIS Rare Features database.)

Species	Status (F:federal; S:state)
UPLAND FORESTS, FOREST OPENINGS, AND BRUSHLAND EDGES	
Mammals: Gray wolf (<i>Canus lupus</i>)	F: Threatened; S: Special Concern (1994: Thr.)
Mountain lion (<i>Felis concolor</i>)	F: Concern; S: Special Concern
Northern myotis (<i>Myotis septentrionalis</i>)	S: Special Concern
Marten (<i>Martes americana</i>)	S: Element (1994: Special Concern)
Mule deer (<i>Odocoileus hemionus</i>)	S: Element (1994: Special Concern)
Brd. Birds: Bald eagle (<i>Haliaeetus leucocephalus</i>)	F: Threatened; S: Special Concern (1994: Thr.)
Red-shouldered hawk (<i>Buteo lineatus</i>)	S: Special concern
Northern goshawk (<i>Accipiter gentilis</i>)	S: Element
Osprey (<i>Pandion haliaetus</i>)	S: Element (1994: Special Concern)
Black-throated blue warbler (<i>Dendroica caerulescens</i>)	S: Element
Herps: Eastern hognose snake (<i>Heterodon platyrhinos</i>)	S: Element (1994: Special Concern)
Insects: Nabokov's blue (<i>Lycaeides idas nabokovi</i>)	S: Special Concern
Macouns's arctic (<i>Oeneis macounii</i>)	S: Element
Tawny crescent butterfly (<i>Phyciodes batesii</i>)	S: Element
Tiger beetle (<i>Cicindela patruela patruela</i>)	S: Special Concern
LOWLAND FORESTS, CONIFER SWAMPS, AND BOGS	
Mammals: Northern bog lemming (<i>Synaptomys borealis</i>)	S: Special Concern
Lynx (<i>Lynx canadensis</i>)	F: Concern
Wolverine (<i>Gulo gulo</i>)	F: Concern; S: Element (1994: Special Concern)
Herps: Four-toed salamander (<i>Hemidactylium scutatum</i>)	S: Special Concern
Insects: Red-disked alpine (<i>Erebia discaidalis discaidalis</i>)	S: Element (1994: Special Concern)
Jutta arctic (<i>Oeneis jutta ascerta</i>)	S: Element (1994: Special Concern)
Bog fritillary (<i>Procllossiana eunomia dawsoni</i>)	S: Element (1994: Special Concern)
Freija fritillary (<i>Clossiana freija</i>)	S: Element (1994: Special Concern)
Frigga fritillary (<i>Clossiana frigga saga</i>)	S: Element (1994: Special Concern)
Dorcas copper (<i>Epidemia dorcas dorcas</i>)	S: Element (1994: Special Concern)
Bog copper (<i>Epidemia epixanthe michiganensis</i>)	S: Element (1994: Special Concern)
Purple lesser fritillary (<i>Clossiana tritania</i>)	S: Element
PRAIRIES, PASTURES, AND OLD FIELDS	
Mammals: Eastern spotted skunk (<i>Spilogale putorius</i>)	F: Concern; S: Threatened (1994: Spec. Concern)
Prairie vole (<i>Microtus ochrogaster</i>)	S: Special Concern
Least weasel (<i>Mustela nivalis</i>)	S: Special Concern
Brd Birds: Greater prairie-chicken (<i>Tympanuchus cupido</i>)	S: Special Concern
Upland sandpiper (<i>Bartramia longicauda</i>)	S: Element (1994: Special Concern)
Herps: Western hognose snake (<i>Heterodon nasicus</i>)	S: Special Concern
Gopher snake (<i>Pituophis catenifer</i>)	S: Special Concern
Insects: Regal fritillary (<i>Speyeria idalia</i>)	S: Special Concern
Arogos skipper (<i>Atrytone arogos</i>)	S: Special Concern
Tiger beetle (<i>Cicindela lepida</i>)	S: Threatened

Table 1. (continued).

Species		Status (F:federal; S:state)
FENS, WET MEADOWS, AND SHRUB SWAMPS		
Brd. Birds:	Yellow rail (<i>Coturnicops noveboracensis</i>)	S: Special Concern
	Wilson's phalarope (<i>Phalaropus tricolor</i>)	S: Threatened (1994: Special Concern)
	Short-eared owl (<i>Asio flammeus</i>)	S: Special Concern
	Nelson's sharp-tailed sparrow (<i>Ammodramus nelsoni</i>)	S: Special Concern
	Sandhill crane (<i>Grus canadensis</i>)	S: Element (1994: Special Concern)
Insects:	Jumping spider (<i>Paradamoetas fontana</i>)	S: Special Concern
	Two-spotted skipper (<i>Euphyes bimaculata</i>)	S: Element
EMERGENT MARSHES AND AQUATIC HABITATS		
Brd. Birds:	Trumpeter swan (<i>Cygnus buccinator</i>)	S: Threatened (1994: Extirpated)
	Common tern (<i>Sterna hirundo</i>)	S: Threatened (1994: Special Concern)
	Forster's tern (<i>Sterna forsteri</i>)	S: Special Concern
	American bittern (<i>Botaurus lentiginosus</i>)	S: Element (1994: Special Concern)
	Black tern (<i>Chlidonias niger</i>)	F: Concern
Herps:	Blanding's turtle (<i>Emydoidea blandingii</i>)	F: Concern; S: Threatened
	Snapping turtle (<i>Chelydra serpentina</i>)	S: Special Concern
Fish:	Lake sturgeon (<i>Acipenser fulvescens</i>)	S: Special Concern
	Least darter (<i>Etheostoma microperca</i>)	S: Special Concern
	Pugnose shiner (<i>Notropis anogenus</i>)	S: Special Concern
Mussels:	Mucket (<i>Actinonaias ligamentina</i>)	S: Threatened
	Creek heelsplitter (<i>Lasmigona compressa</i>)	S: Special Concern
	Fluted-shell (<i>Lasmigona costata</i>)	S: Special Concern
	Black sandshell (<i>Ligumia recta</i>)	S: Special Concern
Insects:	Jumping spider (<i>Marpissa grata</i>)	S: Special Concern

Table 2. Summary of records for rare animals and animal aggregations in Cass County, contained in the Rare Features database of the Natural Heritage Information System.

Federal Status	MN (legal) Status	Old MN (legal) Status (pre-96)	Last Observed	Number of Occurrences	Element Name (Common Name)
<u>RARE ANIMALS</u>					
	SC	SC	1994	13	<i>Ammodramus nelsoni</i> (Nelson's sharp-tailed sparrow)
	NS	SC	1994	19	<i>Botaurus lentiginosus</i> (American bittern)
	SC	SC	1995	40	<i>Buteo lineatus</i> (Red-shouldered hawk)
	SC	SC	1995	27	<i>Coturnicops noveboracensis</i> (Yellow rail)
	T	T	1994	36	<i>Emydoidea blandingii</i> (Blanding's turtle)
	SC	---	1936	1	<i>Etheostoma microperca</i> (Least darter)
	NS	SC	1994	3	<i>Grus canadensis</i> (Sandhill crane)
T	SC	T	1997	254	<i>Haliaeetus leucocephalus</i> (Bald eagle)
	NS	SC	1994	8	<i>Heterodon platyrhinos</i> (Eastern hognose snake)
	SC	---	1992	1	<i>Lasmigona compressa</i> (Creek heelsplitter mussel)
	SC	---	1992	6	<i>Ligumia recta</i> (Black sandshell mussel)
	SC	SC	1994	1	<i>Microtus ochrogaster</i> (Prairie vole)
	T	SC	1994	2	<i>Phalaropus tricolor</i> (Wilson's phalarope)
<u>ANIMAL AGGREGATIONS</u>					
			1996	40	Colonial waterbird nesting site (active)
			1990	37	Colonial waterbird nesting site (inactive)
			1992	2	Mussel sampling site
	SC	SC	1997	58	<i>Tympanuchus cupido</i> (Greater prairie-chicken) booming ground

Federal Status: Status of species under the Federal Endangered Species Law. Codes are E=endangered, T=threatened, C=species which have been proposed for federal listing due to sufficient information on biological vulnerability and threat(s), but which have not yet been officially designated as endangered or threatened.

MN (legal) Status: Minnesota legal status of plant and animal species under the state endangered species law. Codes for status are as follows: E=endangered, T=threatened, SC=special concern. The code, NS=no status, is applied to those species with no current legal status for which occurrence records are maintained. These species are (1) rare and may become listed if they decline further, or (2) species that had legal status prior to 1996.

Last Observed: Indicates the date of the most recent record. This field can be used as an indicator of the likelihood that the element still exists in the area searched.

Number of Occurrences: The number of element occurrence records existent in the Minnesota Natural Heritage database for each element within the area searched.

Element Name (Common Name): For plant and animal species this is the scientific name with the common name in parentheses; for all other elements it is the feature name.

Table 3. Mammals documented from or potentially occurring in Cass County.

* common names, scientific names, and taxonomic order follow Jones et al. 1992.

		Record
Documented during MCBS surveys in Cass County		MCBS
Not documented during MCBS surveys, other records exist for Cass County		Cass
No documentation from Cass County, but may occur here		Cass?

Common name*	Scientific name	Record
Opossums		
Virginia opossum	<i>Didelphis virginiana</i>	Cass
Shrews and moles		
Arctic shrew	<i>Sorex arcticus</i>	MCBS
Masked shrew	<i>Sorex cinereus</i>	MCBS
Pygmy shrew	<i>Sorex hoyi</i>	MCBS
Water shrew	<i>Sorex palustris</i>	MCBS
Northern short-tailed shrew	<i>Blarina brevicauda</i>	MCBS
Eastern mole	<i>Scalopus aquaticus</i>	Cass?
Star-nosed mole	<i>Condylura cristata</i>	MCBS
Bats		
Little brown myotis	<i>Myotis lucifugus</i>	MCBS
Northern myotis	<i>Myotis septentrionalis</i>	Cass
Eastern red bat	<i>Lasiurus borealis</i>	MCBS
Hoary bat	<i>Lasiurus cinereus</i>	MCBS
Silver-haired bat	<i>Lasionycteris noctivagans</i>	MCBS
Eastern pipistelle	<i>Pipistrellus subflavus</i>	Cass?
Big brown bat	<i>Eptesicus fuscus</i>	MCBS
Rabbits and hares		
Eastern cottontail	<i>Sylvilagus floridanus</i>	MCBS
Snowshoe hare	<i>Lepus americanus</i>	MCBS
White-tailed jackrabbit	<i>Lepus townsendii</i>	Cass?
Squirrels		
Least chipmunk	<i>Tamias minimus</i>	MCBS
Eastern chipmunk	<i>Tamias striatus</i>	MCBS
Woodchuck	<i>Marmota monax</i>	MCBS
Franklin's ground squirrel	<i>Spermophilus franklinii</i>	MCBS
Thirteen-lined ground squirrel	<i>Spermophilus tridecemlineatus</i>	MCBS
Eastern gray squirrel	<i>Sciurus carolinensis</i>	MCBS
Eastern fox squirrel	<i>Sciurus niger</i>	MCBS
Red squirrel	<i>Tamiasciurus hudsonicus</i>	MCBS
Northern flying squirrel	<i>Glaucomys sabrinus</i>	MCBS
Southern flying squirrel	<i>Glaucomys volans</i>	Cass?
Pocket gophers		
Plains pocket gopher	<i>Geomys bursarius</i>	MCBS
Beavers, porcupines		
American beaver	<i>Castor canadensis</i>	MCBS
Common porcupine	<i>Erethizon dorsatum</i>	MCBS

Table 3. continued

Common name*	Scientific name	Record
Native mice and voles		
White-footed mouse	<i>Peromyscus leucopus</i>	MCBS
Prairie deer mouse	<i>Peromyscus maniculatus bairdii</i>	MCBS
Woodland deer mouse	<i>Peromyscus maniculatus gracilis</i>	MCBS
Southern red-backed vole	<i>Clethrionomys gapperi</i>	MCBS
Prairie vole	<i>Microtus ochrogaster</i>	MCBS
Meadow vole	<i>Microtus pennsylvanicus</i>	MCBS
Common muskrat	<i>Ondatra zibethicus</i>	MCBS
Northern bog lemming	<i>Synaptomys borealis</i>	Cass?
Southern bog lemming	<i>Synaptomys cooperi</i>	MCBS
Meadow jumping mouse	<i>Zapus hudsonius</i>	MCBS
Old World rats and mice		
Norway rat	<i>Rattus norvegicus</i>	Cass?
House mouse	<i>Mus musculus</i>	Cass?
Wolves, foxes, and relatives		
Coyote	<i>Canis latrans</i>	MCBS
Gray wolf	<i>Canis lupus</i>	MCBS
Red fox	<i>Vulpes vulpes</i>	MCBS
Common gray fox	<i>Urocyon cinereoargenteus</i>	Cass?
Bears		
Black bear	<i>Ursus americanus</i>	MCBS
Raccoons		
Common raccoon	<i>Procyon lotor</i>	MCBS
Weasels, skunks, and relatives		
American marten	<i>Martes americana</i>	Cass?
Fisher	<i>Martes pennanti</i>	MCBS
Ermine	<i>Mustela erminea</i>	MCBS
Long-tailed weasel	<i>Mustela frenata</i>	MCBS
Least weasel	<i>Mustela nivalis</i>	Cass?
Mink	<i>Mustela vison</i>	MCBS
Wolverine	<i>Gulo gulo</i>	Cass?
American badger	<i>Taxidea taxus</i>	MCBS
Eastern spotted skunk	<i>Spilogale putorius</i>	Cass?
Striped skunk	<i>Mephitis mephitis</i>	MCBS
Northern river otter	<i>Lutra canadensis</i>	MCBS
Cats and relatives		
Mountain lion	<i>Felis concolor</i>	Cass
Lynx	<i>Lynx canadensis</i>	Cass
Bobcat	<i>Lynx rufus</i>	Cass
Deer and relatives		
Mule deer	<i>Odocoileus hemionus</i>	Cass
White-tailed deer	<i>Odocoileus virginianus</i>	MCBS
Moose	<i>Alces alces</i>	Cass

Table 4. Relative proportion of small mammals associated with habitats in Cass County, based on trap grids captures.

Species	Upland					Lowland		
	Open		Forested			Forested	Open	
	old field	dry prairie	jack pine	white, red pine	maple, oak aspen	blk spr, tam, cedar	poor fen, bog	sedge, shrub
Sites = 32	n = 6	n = 3	n = 2	n = 2	n = 3	n = 9	n = 5	n = 2
Prairie vole		1.00						
Prairie deer mouse	0.17	0.83						
13-lined ground squirrel	0.55	0.43	0.01					
Meadow vole	0.71	0.12	0.02			0.05	0.01	0.09
Masked shrew	0.13		0.03	0.01		0.47	0.28	0.09
Northern short-tailed shrew	0.23	0.47		0.20		0.10		
White-footed mouse	0.01	0.18		0.15	0.64	0.01		
Southern red-backed vole	0.02		0.06	0.27	0.26	0.20	0.15	0.03
Meadow jumping mouse	0.42	0.04	0.13		0.10	0.28	0.04	
Ermine	0.03		0.03			0.91	0.03	
Least chipmunk			1.00					
Eastern chipmunk				0.64	0.29	0.07		
Woodland deer mouse				0.24	0.53	0.23		
Northern flying squirrel					0.46	0.54		
Star-nosed mole		1.0*						
Red squirrel						1.00		
Arctic shrew						0.48	0.18	0.34
Pygmy shrew						0.52		0.48
Southern bog lemming						0.65	0.35	

* aberrant record, see text for explanation

Table 5. Relative proportion of small mammals associated with habitats in Cass County, based on drift fence captures.

Species	Upland					Lowland		
	Open		Forested			Forested		Open
	old field	dry prairie	jack pine	red pine	maple, oak aspen	hardwood swamp	lowland conifer	sedge meadow
Sites = 14	n = 1	n = 1	n = 2	n = 2	n = 3	n = 1	n = 2	n = 2
Northern flying squirrel				1.00				
Woodland deer mouse				0.46	0.45	0.09		
White-footed mouse			0.02	0.03	0.73	0.18	0.03	
Prairie vole		1.00						
Arctic shrew		0.03	0.04	0.32	0.31	0.20	0.07	0.02
Northern short-tailed shrew		0.03		0.19	0.54	0.17	0.07	
Masked shrew	0.01	0.02	0.03	0.32	0.28	0.09	0.18	0.05
Pygmy shrew	0.01	0.09	0.02	0.23	0.36	0.12	0.15	0.02
Meadow vole	0.18		0.13	0.03	0.03			0.62
Southern red-backed vole	0.02		0.02	0.23	0.61	0.07	0.04	0.01
Meadow jumping mouse	0.03		0.46	0.10	0.08	0.04	0.24	0.04
Southern bog lemming			0.53		0.23		0.12	0.11
Water shrew			0.11	0.14	0.11	0.25	0.11	0.27
Star-nosed mole				0.53	0.18	0.29		
Plains pocket gopher								1.0*

* dispersing subadult

Table 6. Relative abundance of foraging bats among habitats in Cass County.

Species	# stops n = 92	Forested				Open			
		water	wetland	opening	human	water	wetland	upland	human
Eastern red bat	3	1.00							
Hoary bat	6			0.33	0.50	0.17			
Big brown bat	6	0.67	0.33						
Silver-haired bat	20	0.10	0.20	0.30	0.25	0.05	0.10		
Myotis spp.	29	0.21	0.10	0.14	0.17	0.03	0.17	0.03	0.14

Table 7. Summer resident birds documented from or likely to breed in Cass County.

* Nomenclature follows the American Ornithologists' Union checklist and supplements.

		Record
Documented during MCBS surveys in Cass County		MCBS
Documented during MCBS surveys in the Chippewa National Forest outside Cass County		MCBS-CNF
Not documented during MCBS surveys, but may breed in Cass County		Cass?

Common name*	Scientific name	Record
Loons and grebes		
Common Loon	<i>Gavia immer</i>	MCBS
Pied-billed Grebe	<i>Podilymbus podiceps</i>	MCBS
Red-necked Grebe	<i>Podiceps grisegena</i>	MCBS
Pelicans and cormorants		
American White Pelican	<i>Pelecanus erythrorhynchos</i>	MCBS
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	MCBS
Bitterns and herons		
American Bittern	<i>Botaurus lentiginosus</i>	MCBS
Least Bittern	<i>Ixobrychus exilis</i>	MCBS
Great Blue Heron	<i>Ardea herodias</i>	MCBS
Green Heron	<i>Butorides virescens</i>	MCBS
Vultures		
Turkey Vulture	<i>Cathartes aura</i>	MCBS
Ducks, geese, and swans		
Trumpeter Swan	<i>Cygnus buccinator</i>	Cass?
Canada Goose	<i>Branta canadensis</i>	MCBS
Wood Duck	<i>Aix sponsa</i>	MCBS
Green-winged Teal	<i>Anas crecca</i>	MCBS
American Black Duck	<i>Anas rubripes</i>	MCBS
Mallard	<i>Anas platyrhynchos</i>	MCBS
Blue-winged Teal	<i>Anas discors</i>	MCBS
Gadwall	<i>Anas strepera</i>	Cass?
American Wigeon	<i>Anas americana</i>	MCBS
Redhead	<i>Aythya americana</i>	MCBS
Ring-necked Duck	<i>Aythya collaris</i>	MCBS
Common Goldeneye	<i>Bucephala clangula</i>	MCBS
Hooded Merganser	<i>Lophodytes cucullatus</i>	MCBS
Common Merganser	<i>Mergus merganser</i>	MCBS
Ruddy Duck	<i>Oxyura jamaicensis</i>	Cass?
Eagles, hawks, and falcons		
Osprey	<i>Pandion haliaetus</i>	MCBS
Bald Eagle	<i>Haliaeetus leucocephalus</i>	MCBS
Northern Harrier	<i>Circus cyaneus</i>	MCBS
Sharp-shinned Hawk	<i>Accipiter striatus</i>	MCBS
Cooper's Hawk	<i>Accipiter cooperii</i>	MCBS

Table 7. continued.

Common name*	Scientific name	Record
Eagles, hawks, and falcons (continued)		
Northern Goshawk	<i>Accipiter gentilis</i>	Cass
Red-shouldered Hawk	<i>Buteo lineatus</i>	MCBS
Broad-winged Hawk	<i>Buteo platypterus</i>	MCBS
Red-tailed Hawk	<i>Buteo jamaicensis</i>	MCBS
American Kestrel	<i>Falco sparverius</i>	MCBS
Merlin	<i>Falco columbarius</i>	Cass?
Gallinaceous birds		
Ruffed Grouse	<i>Bonasa umbellus</i>	MCBS
Spruce Grouse	<i>Falcapennis canadensis</i>	Cass?
Greater Prairie-chicken	<i>Tympanuchus cupido</i>	MCBS
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	Cass?
Rails and cranes		
Yellow Rail	<i>Coturnicops noveboracensis</i>	MCBS
Virginia Rail	<i>Rallus limicola</i>	MCBS
Sora	<i>Porzana carolina</i>	MCBS
American Coot	<i>Fulica americana</i>	MCBS
Sandhill Crane	<i>Grus canadensis</i>	MCBS
Plovers and sandpipers		
Killdeer	<i>Charadrius vociferus</i>	MCBS
Spotted Sandpiper	<i>Actitis macularia</i>	MCBS
Upland Sandpiper	<i>Bartramia longicauda</i>	Cass?
Common Snipe	<i>Gallinago gallinago</i>	MCBS
American Woodcock	<i>Scolopax minor</i>	MCBS
Wilson's Phalarope	<i>Phalaropus tricolor</i>	MCBS
Gulls and terns		
Ring-billed Gull	<i>Larus delawarensis</i>	MCBS
Herring Gull	<i>Larus argentatus</i>	MCBS
Caspian Tern	<i>Sterna caspia</i>	MCBS
Common Tern	<i>Sterna hirundo</i>	MCBS
Black Tern	<i>Chlidonias niger</i>	MCBS
Pigeons and doves		
Rock Dove	<i>Columba livia</i>	MCBS
Mourning Dove	<i>Zenaida macroura</i>	MCBS
Cuckoos		
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	MCBS
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Cass?
Owls		
Great Horned Owl	<i>Bubo virginianus</i>	MCBS
Barred Owl	<i>Strix varia</i>	MCBS
Great Gray Owl	<i>Strix nebulosa</i>	Cass?
Long-eared Owl	<i>Asio otus</i>	Cass?
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	MCBS

Table 7. continued.

Common name*	Scientific name	Record
Nightjars		
Common Nighthawk	<i>Chordeiles minor</i>	MCBS
Whip-poor-will	<i>Caprimulgus vociferus</i>	MCBS
Swifts and hummingbirds		
Chimney Swift	<i>Chaetura pelagica</i>	MCBS
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	MCBS
Kingfishers		
Belted Kingfisher	<i>Ceryle alcyon</i>	MCBS
Woodpeckers		
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	MCBS
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	MCBS
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	MCBS
Downy Woodpecker	<i>Picoides pubescens</i>	MCBS
Hairy Woodpecker	<i>Picoides villosus</i>	MCBS
Black-backed Woodpecker	<i>Picoides arcticus</i>	MCBS
Northern Flicker	<i>Colaptes auratus</i>	MCBS
Pileated Woodpecker	<i>Dryocopus pileatus</i>	MCBS
Flycatchers		
Olive-sided Flycatcher	<i>Contopus cooperi</i>	MCBS
Eastern Wood-Pewee	<i>Contopus virens</i>	MCBS
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>	MCBS
Alder Flycatcher	<i>Empidonax alnorum</i>	MCBS
Least Flycatcher	<i>Empidonax minimus</i>	MCBS
Eastern Phoebe	<i>Sayornis phoebe</i>	MCBS
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	MCBS
Western Kingbird	<i>Tyrannus verticalis</i>	Cass?
Eastern Kingbird	<i>Tyrannus tyrannus</i>	MCBS
Larks		
Horned Lark	<i>Eremophila alpestris</i>	MCBS
Swallows		
Purple Martin	<i>Progne subis</i>	MCBS
Tree Swallow	<i>Tachycineta bicolor</i>	MCBS
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	MCBS
Bank Swallow	<i>Riparia riparia</i>	MCBS
Barn Swallow	<i>Hirundo rustica</i>	MCBS
Cliff Swallow	<i>Petrochelidon pyrrhonata</i>	MCBS
Vireos		
Blue-headed [Solitary] Vireo	<i>Vireo solitarius</i>	MCBS
Yellow-throated Vireo	<i>Vireo flavifrons</i>	MCBS
Warbling Vireo	<i>Vireo gilvus</i>	MCBS
Red-eyed Vireo	<i>Vireo olivaceus</i>	MCBS

Table 7. continued.

Common name*	Scientific name	Record
Jays and crows		
Gray Jay	<i>Perisoreus canadensis</i>	MCBS
Blue Jay	<i>Cyanocitta cristata</i>	MCBS
American Crow	<i>Corvus brachyrhynchos</i>	MCBS
Common Raven	<i>Corvus corax</i>	MCBS
Chickadees, nuthatches, and creepers		
Black-capped Chickadee	<i>Poecile atricapillus</i>	MCBS
Boreal Chickadee	<i>Poecile hudsonicus</i>	MCBS-CNF
Red-breasted Nuthatch	<i>Sitta canadensis</i>	MCBS
White-breasted Nuthatch	<i>Sitta carolinensis</i>	MCBS
Brown Creeper	<i>Certhia americana</i>	MCBS
Wrens		
House Wren	<i>Troglodytes aedon</i>	MCBS
Winter Wren	<i>Troglodytes troglodytes</i>	MCBS
Sedge Wren	<i>Cistothorus platensis</i>	MCBS
Marsh Wren	<i>Cistothorus palustris</i>	MCBS
Kinglets and thrushes		
Golden-crowned Kinglet	<i>Regulus satrapa</i>	MCBS
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Cass?
Eastern Bluebird	<i>Sialia sialis</i>	MCBS
Veery	<i>Catharus fuscescens</i>	MCBS
Swainson's Thrush	<i>Catharus ustulatus</i>	Cass?
Hermit Thrush	<i>Catharus guttatus</i>	MCBS
Wood Thrush	<i>Hylocichla mustelina</i>	MCBS
American Robin	<i>Turdus migratorius</i>	MCBS
Catbirds and thrashers		
Gray Catbird	<i>Dumetella carolinensis</i>	MCBS
Brown Thrasher	<i>Toxostoma rufum</i>	MCBS
Starlings		
European Starling	<i>Sturnus vulgaris</i>	MCBS
Waxwings		
Cedar Waxwing	<i>Bombycilla cedrorum</i>	MCBS
Warblers		
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	MCBS
Tennessee Warbler	<i>Vermivora peregrina</i>	Cass?
Nashville Warbler	<i>Vermivora ruficapilla</i>	MCBS
Northern Parula	<i>Parula americana</i>	MCBS
Yellow Warbler	<i>Dendroica petechia</i>	MCBS
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	MCBS
Magnolia Warbler	<i>Dendroica magnolia</i>	MCBS
Cape May Warbler	<i>Dendroica tigrina</i>	Cass?
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	MCBS

Table 7. continued.

Common name*	Scientific name	Record
Warblers (continued)		
Yellow-rumped Warbler	<i>Dendroica coronata</i>	MCBS
Black-throated Green Warbler	<i>Dendroica virens</i>	MCBS
Blackburnian Warbler	<i>Dendroica fusca</i>	MCBS
Pine Warbler	<i>Dendroica pinus</i>	MCBS
Palm Warbler	<i>Dendroica palmarum</i>	MCBS
Black-and-white Warbler	<i>Mniotilta varia</i>	MCBS
American Redstart	<i>Setophaga ruticilla</i>	MCBS
Ovenbird	<i>Seiurus aurocapillus</i>	MCBS
Northern Waterthrush	<i>Seiurus noveboracensis</i>	MCBS
Connecticut Warbler	<i>Oporornis agilis</i>	MCBS
Mourning Warbler	<i>Oporornis philadelphicus</i>	MCBS
Common Yellowthroat	<i>Geothlypis trichas</i>	MCBS
Canada Warbler	<i>Wilsonia canadensis</i>	MCBS
Tanagers		
Scarlet Tanager	<i>Piranga olivacea</i>	MCBS
Towhees, sparrows, and juncos		
Eastern [Rufous-sided] Towhee	<i>Pipilo erythrophthalmus</i>	MCBS
Chipping Sparrow	<i>Spizella passerina</i>	MCBS
Clay-colored Sparrow	<i>Spizella pallida</i>	MCBS
Vesper Sparrow	<i>Pooecetes gramineus</i>	MCBS
Savannah Sparrow	<i>Passerculus sandwichensis</i>	MCBS
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	MCBS
Le Conte's Sparrow	<i>Ammodramus leconteii</i>	MCBS
Nelson's Sharp-tailed Sparrow	<i>Ammodramus nelsoni</i>	MCBS
Song Sparrow	<i>Melospiza melodia</i>	MCBS
Lincoln's Sparrow	<i>Melospiza lincolnii</i>	MCBS
Swamp Sparrow	<i>Melospiza georgiana</i>	MCBS
White-throated Sparrow	<i>Zonotrichia albicollis</i>	MCBS
Dark-eyed Junco	<i>Junco hyemalis</i>	MCBS
Grosbeaks and buntings		
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	MCBS
Indigo Bunting	<i>Passerina cyanea</i>	MCBS
Blackbirds and orioles		
Bobolink	<i>Dolichonyx oryzivorus</i>	MCBS
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	MCBS
Eastern Meadowlark	<i>Sturnella magna</i>	MCBS
Western Meadowlark	<i>Sturnella neglecta</i>	MCBS
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	MCBS
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	MCBS
Common Grackle	<i>Quiscalus quiscula</i>	MCBS
Brown-headed Cowbird	<i>Molothrus ater</i>	MCBS
Baltimore Oriole	<i>Icterus galbula</i>	MCBS

Table 7. continued.

Common name*	Scientific name	Record
Finches		
Purple Finch	<i>Carpodacus purpureus</i>	MCBS
House Finch	<i>Carpodacus mexicanus</i>	MCBS
Pine Siskin	<i>Carduelis pinus</i>	MCBS
American Goldfinch	<i>Carduelis tristis</i>	MCBS
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	MCBS-CNF
Old World sparrows		
House Sparrow	<i>Passer domesticus</i>	MCBS

Table 8. Birds documented from MCBS point count surveys and distribution of points among habitats in Cass County and adjacent portions of the Chippewa National Forest.

Habitat categories

Emergent	emergent marsh (dominated by cattails, bulrush, with occasional sedges)
Sedge	sedge or grass wetlands (generally not found in other marsh types)
Grass	prairie, old field, pasture, hayfields, and other grasslands
Deciduous	upland deciduous forest, hardwood swamp, floodplain forest, and overgrown woodland/savanna
DF	upland deciduous forest
LD	lowland deciduous forest
Coniferous	upland forest (pine, spruce-fir), mixed coniferous-deciduous forest, conifer swamp (tamarack, black spruce, white cedar)
CF	upland coniferous forest, pine plantation
BT	black spruce/tamarack swamp
CS	white cedar swamp

Species	Habitat categories	Emergent	Sedge	Grass	Deciduous		Coniferous		
	# of points				DF	LD	CF	BT	CS
		n=3	n=52	n=4	n=20	n=3	n=3	n=13	n=10
Loons and grebes									
Pied-billed Grebe		1							
Bitterns and herons									
American Bittern		1	2						
Least Bittern		1							
Great Blue Heron			1						
Ducks, geese, and swans									
Wood Duck		1							
Mallard			3						
Blue-winged Teal			1	1					
Ring-necked Duck			1						
Eagles, hawks, and falcons									
Red-shouldered Hawk					1				
Broad-winged Hawk					1				
Gallinaceous birds									
Ruffed Grouse					1				

Table 8. continued.

Species	Habitat categories	Emergent	Sedge	Grass	Deciduous		Coniferous		
	# of points				DF	LD	CF	BT	CS
		n=3	n=52	n=4	n=20	n=3	n=3	n=13	n=10
Rails and cranes									
Yellow Rail			4						
Sandhill Crane			3	1					
Plovers and sandpipers									
Killdeer				1					
Common Snipe			4						
Wilson's Phalarope			2						
Gulls and terns									
Black Tern		1	3						
Swifts and hummingbirds									
Chimney Swift					1	1			
Woodpeckers									
Yellow-bellied Sapsucker					7				
Downy Woodpecker					4				1
Flycatchers									
Olive-sided Flycatcher								1	1
Eastern Wood-Pewee					10				
Yellow-bellied Flycatcher								4	4
Alder Flycatcher			7						
Least Flycatcher					16		1		
Eastern Phoebe					1				
Great Crested Flycatcher					4	1			1
Eastern Kingbird			1	1		1			
Larks									
Horned Lark				1					
Swallows									
Tree Swallow			7	3					
Barn Swallow			2						

Table 8. continued.

Species	Habitat categories	Emergent	Sedge	Grass	Deciduous		Coniferous		
	# of points				DF	LD	CF	BT	CS
		n=3	n=52	n=4	n=20	n=3	n=3	n=13	n=10
Vireos									
Blue-headed Vireo								1	2
Yellow-throated Vireo					3	1			
Red-eyed Vireo					20	3	2		
Jays and crows									
Blue Jay		1			2	1	1	2	3
American Crow					6	2	1	1	
Chickadees, nuthatches, and creepers									
Black-capped Chickadee				2	1		1		
Red-breasted Nuthatch									1
White-breasted Nuthatch					2				
Brown Creeper						2		1	
Wrens									
Winter Wren								1	5
Sedge Wren			48	3		3			
Marsh Wren		3	4						
Kinglets and thrushes									
Golden-crowned Kinglet								3	
Eastern Bluebird				1					
Veery		1			8	2	2	1	
Hermit Thrush					1		1	12	1
Wood Thrush					1				
American Robin					2			1	3
Waxwings									
Cedar Waxwing						1			

Table 8. continued.

Species	Habitat categories	Emergent	Sedge	Grass	Deciduous		Coniferous		
	# of points	n=3	n=52	n=4	DF n=20	LD n=3	CF n=3	BT n=13	CS n=10
Warblers									
Nashville Warbler					1		2	13	9
Northern Parula									4
Yellow Warbler			9						
Chestnut-sided Warbler					2				
Yellow-rumped Warbler								5	
Black-throated Green Warbler					4	2			
Blackburnian Warbler						1	1	1	
Palm Warbler				2				4	
Black-and-white Warbler							1		3
American Redstart					8	1	1		
Ovenbird					18	3	2		
Northern Waterthrush						1	2		1
Connecticut Warbler								10	3
Mourning Warbler						1			
Common Yellowthroat		3	35	2		1		2	3
Canada Warbler									1
Tanagers									
Scarlet Tanager					2				
Towhees, sparrows, and juncos									
Chipping Sparrow					1			5	
Clay-colored Sparrow			1	3					
Vesper Sparrow				2					
Savannah Sparrow			4		3			1	
Le Conte's Sparrow			24						
Nelson's Sharp-tailed Sparrow			1			2			
Song Sparrow		1	8	4				1	

Table 8. continued.

Species	Habitat categories	Emergent	Sedge	Grass	Deciduous		Coniferous		
	# of points	n=3	n=52	n=4	DF n=20	LD n=3	CF n=3	BT n=13	CS n=10
Towhees, sparrows, and juncos (continued)									
Lincoln's Sparrow								3	
Swamp Sparrow		2	24						1
White-throated Sparrow							1	12	6
Grosbeaks									
Rose-breasted Grosbeak		1			4				
Blackbirds and orioles									
Bobolink			13						
Red-winged Blackbird		3	28	1					
Yellow-headed Blackbird		3							
Brewer's Blackbird			1	1					
Common Grackle		1				1			
Brown-headed Cowbird							1		
Baltimore Oriole					1				
Finches									
Purple Finch								1	
American Goldfinch				1					

Table 9. Habitat associations for summer resident birds in Cass County.

Habitat categories

Aquatic	open water (lake or river, often interspersed with emergent vegetation)
Emergent	emergent marsh (dominated by cattails, bulrush, with occasional sedges)
Sedge	sedge or grass wetlands (generally not found in other marsh types)
Grass	prairie, old field, pasture, hayfields, and other grasslands
Fragmented	forest-shrub edge, shrub swamp edge, savanna, cultivated field, urban/suburban areas, and other disturbed habitats
Deciduous	upland deciduous forest, hardwood swamp, floodplain forest, and overgrown woodland/savanna
Coniferous	upland forest (pine, spruce-fir), mixed coniferous-deciduous forest, conifer swamp (tamarack, black spruce, white cedar)

Species	Habitat						
	Aquatic	Emergent	Sedge	Grass	Fragmented	Deciduous	Coniferous
Loons and grebes							
Common Loon							
Pied-billed Grebe							
Red-necked Grebe							
Pelicans and cormorants							
American White Pelican							
Double-crested Cormorant							
Bitterns and herons							
American Bittern							
Least Bittern							
Great Blue Heron							
Green Heron							
Vultures							
Turkey Vulture							
Ducks, geese, and swans							
Trumpeter Swan							
Canada Goose							
Wood Duck							
Green-winged Teal							
American Black Duck							
Mallard							

Table 9. continued.

Species	Habitat						
	Aquatic	Emergent	Sedge	Grass	Fragmented	Deciduous	Coniferous
Blue-winged Teal							
Gadwall							
American Wigeon							
Redhead							
Ring-necked Duck							
Common Goldeneye							
Hooded Merganser							
Common Merganser							
Ruddy Duck							
Eagles, hawks, and falcons							
Osprey							
Bald Eagle							
Northern Harrier							
Sharp-shinned Hawk							
Cooper's Hawk							
Northern Goshawk							
Red-shouldered Hawk							
Broad-winged Hawk							
Red-tailed Hawk							
American Kestrel							
Merlin							
Gallinaceous birds							
Ruffed Grouse							
Spruce Grouse							
Greater Prairie-chicken							
Sharp-tailed Grouse							
Rails and cranes							
Yellow Rail							
Virginia Rail							

Table 9. continued.

Species	Habitat						
	Aquatic	Emergent	Sedge	Grass	Fragmented	Deciduous	Coniferous
Rails and cranes (continued)							
Sora							
American Coot							
Sandhill Crane							
Plovers and sandpipers							
Killdeer							
Spotted Sandpiper							
Upland Sandpiper							
Common Snipe							
American Woodcock							
Wilson's Phalarope							
Gulls and terns							
Ring-billed Gull							
Herring Gull							
Caspian Tern							
Common Tern							
Black Tern							
Pigeons and doves							
Rock Dove							
Mourning Dove							
Cuckoos							
Black-billed Cuckoo							
Yellow-billed Cuckoo							
Owls							
Great Horned Owl							
Barred Owl							
Great Gray Owl							
Long-eared Owl							
Northern Saw-whet Owl							

Table 9. continued.

Species	Habitat						
	Aquatic	Emergent	Sedge	Grass	Fragmented	Deciduous	Coniferous
Nightjars							
Common Nighthawk							
Whip-poor-will							
Swifts and hummingbirds							
Chimney Swift							
Ruby-throated Hummingbird							
Kingfishers							
Belted Kingfisher							
Woodpeckers							
Red-headed Woodpecker							
Red-bellied Woodpecker							
Yellow-bellied Sapsucker							
Downy Woodpecker							
Hairy Woodpecker							
Black-backed Woodpecker							
Northern Flicker							
Pileated Woodpecker							
Flycatchers							
Olive-sided Flycatcher							
Eastern Wood-Pewee							
Yellow-bellied Flycatcher							
Alder Flycatcher							
Least Flycatcher							
Eastern Phoebe							
Great Crested Flycatcher							
Western Kingbird							
Eastern Kingbird							

Table 9. continued.

Species	Habitat						
	Aquatic	Emergent	Sedge	Grass	Fragmented	Deciduous	Coniferous
Larks							
Horned Lark							
Swallows							
Purple Martin							
Tree Swallow							
Northern Rough-winged Swallow							
Bank Swallow							
Barn Swallow							
Cliff Swallow							
Vireos							
Blue-headed [Solitary] Vireo							
Yellow-throated Vireo							
Warbling Vireo							
Red-eyed Vireo							
Jays and crows							
Gray Jay							
Blue Jay							
American Crow							
Common Raven							
Chickadees, nuthatches, and creepers							
Black-capped Chickadee							
Boreal Chickadee							
Red-breasted Nuthatch							
White-breasted Nuthatch							
Brown Creeper							
Wrens							
House Wren							
Winter Wren							

Table 9. continued.

Species	Habitat						
	Aquatic	Emergent	Sedge	Grass	Fragmented	Deciduous	Coniferous
Wrens (continued)							
Sedge Wren							
Marsh Wren							
Kinglets and thrushes							
Golden-crowned Kinglet							
Ruby-crowned Kinglet							
Eastern Bluebird							
Veery							
Swainson's Thrush							
Hermit Thrush							
Wood Thrush							
American Robin							
Catbirds and thrashers							
Gray Catbird							
Brown Thrasher							
Starlings							
European Starling							
Waxwings							
Cedar Waxwing							
Warblers							
Golden-winged Warbler							
Tennessee Warbler							
Nashville Warbler							
Northern Parula							
Yellow Warbler							
Chestnut-sided Warbler							

Table 9. continued.

Species	Habitat						
	Aquatic	Emergent	Sedge	Grass	Fragmented	Deciduous	Coniferous
Warblers (continued)							
Magnolia Warbler							
Cape May Warbler							
Black-throated Blue Warbler							
Yellow-rumped Warbler							
Black-throated Green Warbler							
Blackburnian Warbler							
Pine Warbler							
Palm Warbler							
Black-and-white Warbler							
American Redstart							
Ovenbird							
Northern Waterthrush							
Connecticut Warbler							
Mourning Warbler							
Common Yellowthroat							
Canada Warbler							
Tanagers							
Scarlet Tanager							
Towhees, sparrows, and juncos							
Eastern [Rufous-sided] Towhee							
Chipping Sparrow							
Clay-colored Sparrow							
Vesper Sparrow							
Savannah Sparrow							
Grasshopper Sparrow							
Le Conte's Sparrow							
Nelson's Sharp-tailed Sparrow							

Table 9. continued.

Species	Habitat						
	Aquatic	Emergent	Sedge	Grass	Fragmented	Deciduous	Coniferous
Towhees, sparrows, and juncos(continued)							
Song Sparrow							
Lincoln's Sparrow							
Swamp Sparrow							
White-throated Sparrow							
Dark-eyed Junco							
Grosbeaks and buntings							
Rose-breasted Grosbeak							
Indigo Bunting							
Blackbirds and orioles							
Bobolink							
Red-winged Blackbird							
Eastern Meadowlark							
Western Meadowlark							
Yellow-headed Blackbird							
Brewer's Blackbird							
Common Grackle							
Brown-headed Cowbird							
Baltimore Oriole							
Finches							
Purple Finch							
House Finch							
Pine Siskin							
American Goldfinch							
Evening Grosbeak							
Old World sparrows							
House Sparrow							

Table 10. Amphibians and reptiles documented from or likely to occur in Cass County.

		Record
Documented during MCBS surveys in Cass County		MCBS
Documented during MCBS surveys in the Chippewa National Forest outside Cass County		MCBS-CNF
Not documented during MCBS surveys, other records exist for Cass County		Cass
Not documented during MCBS surveys, but may occur in Cass County		Cass?

Common name	Scientific name	Record
Salamanders		
Blue-spotted salamander	<i>Ambystoma laterale</i>	MCBS
Blue-spotted x Jefferson salamander	<i>Ambystoma laterale x jeffersonianum</i>	MCBS
Tiger salamander	<i>Ambystoma tigrinum</i>	MCBS
Redback salamander	<i>Plethodon cinereus</i>	Cass
Eastern newt	<i>Notophthalmus viridescens</i>	Cass
Four-toed salamander	<i>Hemidactylium scutatum</i>	MCBS-CNF
Frogs and Toads		
American toad	<i>Bufo americanus</i>	MCBS
Cope's gray treefrog	<i>Hyla chrysoscelis</i>	MCBS
Gray treefrog	<i>Hyla versicolor</i>	MCBS
Spring peeper	<i>Pseudacris crucifer</i>	MCBS
Western chorus frog	<i>Pseudacris triseriata</i>	MCBS
Green frog	<i>Rana clamitans</i>	MCBS
Northern leopard frog	<i>Rana pipiens</i>	MCBS
Mink frog	<i>Rana septentrionalis</i>	MCBS
Wood frog	<i>Rana sylvatica</i>	MCBS
Turtles		
Spiny softshell	<i>Apalone spinifera</i>	MCBS
Snapping turtle	<i>Chelydra serpentina</i>	MCBS
Painted turtle	<i>Chrysemys picta</i>	MCBS
Blanding's turtle	<i>Emydoidea blandingii</i>	MCBS
Lizards		
Prairie skink	<i>Eumeces septentrionalis</i>	MCBS
Snakes		
Eastern hognose snake	<i>Heterodon platirhinos</i>	MCBS
Smooth green snake	<i>Opheodrys vernalis</i>	MCBS
Brown snake	<i>Storeria dekayi</i>	Cass?
Redbelly snake	<i>Storeria occipitomaculata</i>	MCBS
Plains garter snake	<i>Thamnophis radix</i>	Cass
Common garter snake	<i>Thamnophis sirtalis</i>	MCBS

Table 11. Comparison of herpetofauna capture success among drift fences set in Cass County.
(drift fences are grouped by habitat and soil moisture)

Site	traps	nights	trap nights	herps captured	herps/trap night
Forested, well-drained					
Bena LTA	8	45	360	150	0.42
Guthrie LTA	8	44	352	66	0.19
Dry Sand Lake WMA	8	58	464	78	0.17
Forested, mesic					
Bena LTA	8	45	360	67	0.19
Guthrie LTA	8	43	344	237	0.69
Forested, poorly-drained					
Bena LTA	8	45	360	328	0.91
Guthrie LTA	8	44	352	447	1.27
Forested, wet					
Bena LTA	10*	45	450	35	0.08
Guthrie LTA	16*	43	688	354	0.51
Forest-lake edge					
Dry Sand Lake WMA	8	58	464	55	0.12
Grassland					
Prairie Chicken Site	8	19	152	2	0.01
Meadowbrook WMA	8	59	472	4	0.01
Wet meadow					
Dry Sand Lake WMA	8	46	368	34	0.09
Meadowbrook WMA	8	34	272	5	0.02

Table 12. Relative proportion of captures among species taken from each drift fence in Cass County (drift fences are grouped by habitat and soil moisture).

Site	herps/ trap night	Species										
		Blue-spotted salamander	American toad	Gray treefrog	Spring peeper	Chorus frog	Green frog	Wood frog	N. Leopard frog	Mink frog	N. prairie skink	Redbelly snake
Forested, well-drained												
Bena LTA	0.42	0.22	0.37		0.01	0.01		0.40				
Guthrie LTA	0.19	0.02	0.74		0.06	0.09		0.07				0.02
Dry Sand Lake WMA	0.17		0.06					0.94				
Forested, mesic												
Bena LTA	0.19	0.36	0.06		0.04	0.04		0.46	0.03			
Guthrie LTA	0.67	0.01	0.43		0.00			0.55				
Forested, poorly-drained												
Bena LTA	0.91	0.05	0.69	< 0.01	0.01	0.03		0.21	0.01			
Guthrie LTA	1.30	0.03	0.49					0.47	< 0.01			
Forested, wet												
Bena LTA	0.08	0.66		0.03	0.03			0.29				
Guthrie LTA	0.52	0.08	0.21					0.69	0.01			
Forest-lake edge												
Dry Sand Lake WMA	0.12		0.06			0.02	0.03	0.71	0.16	0.02		
Grassland												
Prairie Chicken Site	0.01										1.00	
Meadowbrook WMA	0.01		0.75					0.25				
Wet meadow												
Dry Sand Lake WMA	0.10		0.03					0.97				
Meadowbrook WMA	0.02		0.39		0.22						0.39	

Table 13. Habitat associations for amphibians and reptiles potentially occurring in Cass County.

Habitat use categories

B	breeding
N	nesting
S	summer
W	winter

Species	Upland			Lowland					Aquatic	
	grassland	savanna, woodland	forest	forest	open wetland				lake, pond	river, stream
					bog	shrub swamp	fen, wet meadow	emergent marsh		
Salamanders										
Blue-spotted salamander			S-W	S	S	B	B	B		
Blue-spotted x Jefferson salamander			S-W	S	S	B	B	B		
Tiger salamander	S-W	S-W	S-W			B	B	B	B	
Redback salamander			B-S-W	S						
Eastern newt			S-W		B	B	B	B		
Four-toed salamander			B-S-W		N		N			
Frogs and Toads										
American toad		S-W	S-W	S	S	B	B	B		
Cope's gray treefrog	S					B-S	B-S	B-S		
Gray treefrog		S-W	S-W	S	S	B-S	B-S	B-S		
Spring peeper		S	S-W	S	S	B-S	B-S	B-S		
Western chorus frog	S-W	S-W			S	B-S	B-S	B-S		
Green frog							S	B-S	B-S-W	B-S-W
Northern leopard frog	S	S			S	B-S	B-S	S	W	W
Mink frog					S			B-S	B-S-W	
Wood frog		S-W	S-W	B-S	B	B	B	B		
Turtles										
Spiny softshell									S	S-W
Snapping turtle	N				S			S-W	S	S-W
Painted turtle	N				S			S-W	S	S-W
Blanding's turtle	N					B-S	B-S	B-S	S	S-W
Lizards										
Prairie skink	N-S-W	S	S							
Snakes										
Eastern hognose snake		S-W	S-W							
Smooth green snake	S-W	S								
Brown snake		S-W	S-W							
Redbelly snake		S-W	S-W	S	S					
Plains garter snake	S-W									
Common garter snake		S-W	S-W	S	S	S	S			

Appendix 2a. Survey locations for 1994 MCBS animal surveys in Cass County -- mammal surveys.

Trap grids								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T133N	R30W	SWNW	18		T141N	R27W	NWNW	11
T134N	R30W	NENW	32		T141N	R27W	NWNE	12
T134N	R32W	SENE	14		T142N	R26W	SENE	19
T135N	R30W	NENW	28		T142N	R27W	SESE	11
T135N	R31W	SWNW	27		T142N	R28W	SWNE	27
T136N	R31W	SWSE	17		T143N	R26W	SENE	01
T136N	R32W	SESE	31		T143N	R28W	NENE	16
T138N	R30W	SENE	16		T143N	R28W	SENE	36
T138N	R32W	NWSE	09		T144N	R26W	NWNW	28
T139N	R25W	NWNW	27		T144N	R28W	SESE	08
T139N	R25W	SWNW	27		T144N	R30W	NESW	27
T139N	R27W	SWNE	22		T144N	R30W	SWNW	04
T139N	R30W	SWNE	32		T145N	R27W	SWSE	17
T139N	R31W	NENW	14		T145N	R27W	SWNW	26
T139N	R31W	SWNE	15		T145N	R30W	SWNW	18
T139N	R31W	SWSW	07		T145N	R30W	SESE	19

Bat survey stops								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T133N	R31W	SWSW	07		T139N	R27W	NESE	13
T134N	R32W	SESE	10		T139N	R27W	SWSE	13
T134N	R32W	SENE	15		T139N	R27W	NWNE	22
T134N	R32W	SENE	22		T139N	R27W	NENW	22
T134N	R32W	SESW	24		T139N	R28W	SENE	24
T134N	R32W	SESE	24		T139N	R29W	SESE	17
T134N	R32W	SWNW	02		T139N	R30W	NENW	15
T135N	R32W	SWNW	11		T139N	R30W	SWNW	22
T135N	R32W	SENE	22		T139N	R30W	SWNW	28
T135N	R32W	NENE	34		T139N	R30W	SESE	29
T135N	R32W	NESE	34		T139N	R30W	NWSE	30
T135N	R32W	SWSW	02		T139N	R30W	SWSE	03
T136N	R32W	SWSW	14		T139N	R30W	SESE	09
T136N	R32W	SENE	15		T139N	R31W	SENE	29
T136N	R32W	NENE	34		T139N	R31W	NENE	33
T136N	R32W	SESE	34		T140N	R26W	NENE	16
T136N	R32W	NENE	03		T140N	R26W	SWSW	22
T137N	R29W	NWSW	18		T140N	R26W	SWSE	23
T137N	R30W	NWSW	11		T140N	R26W	NWNW	28
T137N	R30W	SWNW	14		T140N	R26W	SWSW	35
T137N	R30W	NWNE	36		T140N	R26W	SWSW	02
T137N	R32W	NESE	34		T140N	R26W	NWNW	09
T137N	R32W	NENE	03		T140N	R27W	NWSE	23
T138N	R29W	SWSW	31		T140N	R27W	NWSW	36
T138N	R29W	SESW	31		T140N	R30W	NWSE	19

Appendix 2a. (continued).

Bat survey stops (continued)								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T138N	R29W	NWSW	04		T141N	R29W	SWNE	31
T138N	R30W	NWNE	18		T141N	R30W	NWSE	34
T138N	R30W	NWSW	30		T141N	R30W	NWNE	35
T138N	R30W	NWSW	31		T141N	R30W	SENE	36
T138N	R30W	SWNW	31		T144N	R29W	SESW	12
T138N	R30W	SWSW	31		T144N	R29W	SWSW	13
T138N	R30W	SWSW	04		T144N	R29W	NWSW	01
T138N	R30W	NENE	06		T144N	R29W	NWNW	02
T138N	R30W	NESW	06		T144N	R29W	NENE	02
T138N	R31W	SESE	12		T144N	R30W	NWNW	15
T138N	R31W	SESE	13		T144N	R30W	SENE	16
T138N	R31W	SENE	17		T144N	R30W	SENE	17
T138N	R31W	NESW	20		T144N	R30W	SESE	18
T138N	R31W	NESE	24		T144N	R30W	NENW	19
T138N	R31W	SESW	33		T144N	R30W	NWNW	01
T138N	R31W	NESE	01		T144N	R31W	NESE	24
T138N	R31W	NENE	05		T145N	R28W	NESE	30
T138N	R32W	SWSW	35		T145N	R29W	SWSE	27
T139N	R26W	SWSW	18		T145N	R29W	SWNW	35
T139N	R26W	NWSE	07		T145N	R29W	NESE	36
T139N	R26W	SWNE	07		T145N	R30W	NENE	18

Appendix 2b. Survey locations for 1994 MCBS animal surveys in Cass County -- bird surveys.

Point counts								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T135N	R32W	SWSW	34		T142N	R30W	SESW	10
T135N	R32W	SESW	34		T142N	R30W	NWNW	15
T136N	R32W	NESE	3		T142N	R30W	NWNW	16
T136N	R32W	NESE	10		T142N	R30W	NWSW	16
T137N	R30W	NWSE	14		T142N	R30W	NWSE	16
T137N	R30W	NESW	14		T142N	R30W	NENE	16
T137N	R30W	SWNE	14		T142N	R30W	SWNW	16
T137N	R31W	NENW	29		T142N	R30W	SWSW	16
T137N	R31W	SWNW	29		T142N	R30W	SENE	16
T137N	R31W	SWNE	29		T142N	R30W	NWSE	20
T137N	R31W	SWSW	29		T142N	R31W	NENE	1
T137N	R31W	SWSE	30		T142N	R31W	NWSW	4
T137N	R31W	SESE	30		T142N	R31W	SWSW	4
T137N	R31W	NENW	32		T143N	R26W	NESW	9
T137N	R32W	NESE	13		T143N	R27W	NWNE	2
T137N	R32W	SW	26		T143N	R27W	SENE	5
T137N	R32W	SE	34		T143N	R27W	NESE	31
T138N	R31W	NWSE	24		T143N	R27W	SWNW	31
T138N	R31W	NESE	24		T143N	R27W	SWNE	31
T138N	R32W	SWNW	3		T143N	R27W	SENE	31
T138N	R32W	NWSE	9		T143N	R27W	SENE	31
T138N	R32W	NESW	9		T143N	R27W	SWNW	32
T138N	R32W	SWSE	9		T143N	R28W	SWSW	14
T138N	R32W	SESW	9		T143N	R28W	SWSE	14
T138N	R32W	SWSE	36		T143N	R28W	SESW	14
T138N	R32W	SESE	36		T143N	R28W	NWSW	16
T139N	R25W	NENE	13		T143N	R28W	SESW	16
T139N	R25W	SENE	13		T143N	R28W	NWNE	21
T139N	R25W	SESE	13		T143N	R28W	NENW	21
T139N	R25W	NWNW	27		T143N	R28W	NWNW	23
T139N	R25W	NWSW	27		T143N	R28W	NWSW	23
T139N	R25W	SWNW	27		T143N	R28W	SWNW	23
T139N	R25W	SESW	27		T143N	R28W	NWSW	26
T139N	R30W	SWNE	32		T143N	R28W	NWSE	26
T139N	R31W	NWNE	33		T143N	R28W	SWNW	26
T139N	R31W	NENW	33		T143N	R28W	NESW	26
T141N	R27W	NWSE	13		T143N	R28W	SWSE	26
T141N	R27W	SENE	13		T143N	R28W	SESE	26
T141N	R27W	SENE	24		T143N	R28W	NWSE	33
T141N	R27W	NWSE	25		T143N	R28W	SWSE	33
T141N	R27W	SESE	25		T143N	R28W	NWNW	36
T141N	R27W	SESE	25		T143N	R28W	NENW	36
T141N	R31W	NENW	17		T143N	R30W	NENW	6
					T143N	R30W	SWNW	6

Appendix 2b. (continued).

Point counts (continued)								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T141N	R31W	SWNE	17		T143N	R31W	NWNE	5
T141N	R31W	SENE	17		T143N	R31W	NWSW	5
T141N	R31W	SENE	17		T143N	R31W	NESW	5
T142N	R27W	NWSW	3		T143N	R31W	SE	5
T142N	R27W	NWSW	4		T143N	R31W	NE	8
T142N	R27W	SWSW	4		T143N	R31W	NENE	26
T142N	R27W	SESE	4		T143N	R31W	SWNE	26
T142N	R27W	NWNE	9		T143N	R31W	NWSE	36
T142N	R27W	NENW	9		T143N	R31W	SWNE	36
T142N	R27W	NENE	9		T143N	R31W	SESE	36
T142N	R27W	SWNE	9		T144N	R28W	NENW	9
T142N	R27W	NESE	10		T144N	R28W	NENE	9
T142N	R27W	NWSW	11		T144N	R28W	SENE	9
T142N	R27W	NENW	15		T144N	R28W	NESW	28
T142N	R27W	SENE	15		T144N	R28W	SWNW	28
T142N	R27W	SWSE	16		T144N	R28W	SWSE	28
T142N	R27W	SESW	16		T144N	R28W	SESE	28
T142N	R27W	NWNE	21		T144N	R28W	NESE	29
T142N	R27W	NWSE	21		T144N	R28W	NWSE	33
T142N	R27W	NENW	21		T144N	R30W	SESE	20
T142N	R27W	NESW	21		T144N	R30W	SWSW	21
T142N	R27W	SWSE	21		T144N	R30W	SESW	21
T142N	R28W	NESE	21		T144N	R30W	NWSE	28
T142N	R28W	SESE	21		T144N	R30W	NENW	28
T142N	R28W	SWSW	22		T144N	R30W	SWNE	28
T142N	R28W	SWSE	22		T144N	R31W	SWSE	22
T142N	R28W	SESW	22		T144N	R31W	SESE	22
T142N	R28W	NWNW	27		T144N	R31W	SESE	29
T142N	R28W	NWNE	27		T144N	R31W	NENE	32
T142N	R28W	NENE	27		T144N	R31W	NESE	32
T142N	R29W	SWSE	2		T144N	R31W	SENE	32
T142N	R29W	NWSW	12		T144N	R31W	SESE	32
T142N	R30W	NWSE	9		T145N	R29W	NWSE	19
T142N	R30W	NESW	9		T145N	R29W	SWSE	19
T142N	R30W	NESE	9		T145N	R29W	SWNE	19
T142N	R30W	SWSE	9		T145N	R29W	NWNE	30
T142N	R30W	SESW	9					

Red-shouldered hawk play back								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T134N	R30W	NWSW	22		T137N	R31W	SENE	32
T134N	R30W	NENE	22		T137N	R31W	NWSW	33
T134N	R30W	NESW	22		T137N	R32W	NESE	25
T134N	R30W	SWNW	23		T139N	R27W	NESE	11

Appendix 2b. (continued).

Red-shouldered hawk play back (continued)								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T134N	R30W	SWSW	26		T139N	R31W	NWNE	33
T134N	R30W	SENE	26		T139N	R31W	NENE	33
T134N	R30W	NWNE	34		T139N	R31W	SWNE	33
T134N	R30W	NENE	34		T140N	R29W	SWSW	21
T135N	R31W	NWSW	3		T141N	R29W	SENE	31
T136N	R31W	SESW	10		T141N	R30W	NESW	27
T136N	R31W	NESE	21		T141N	R30W	SESE	27
T136N	R31W	NWSW	27		T141N	R30W	SESW	28
T136N	R31W	NENW	27		T141N	R30W	NESW	29
T136N	R31W	NENE	28		T141N	R30W	NESE	29
T136N	R31W	NWNW	34		T141N	R30W	SENE	33
T136N	R31W	SWSW	34		T141N	R30W	NWNW	34
T137N	R31W	NWNW	19		T141N	R30W	NWSE	34
T137N	R31W	NWSW	19		T141N	R30W	SWNW	35
T137N	R31W	NWNE	24		T141N	R30W	SENE	35
T137N	R31W	NWNW	29		T141N	R30W	SWNE	36
T137N	R31W	SWNW	29		T141N	R30W	SENE	36
T137N	R31W	SWSW	29		T141N	R31W	NWSE	34
T137N	R31W	SWSE	29					
T137N	R31W	SWSE	30					

Night road surveys								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
133	30	SWSW	9		136	32	SENE	3
134	30	SESE	4		136	32	NSE	10
134	32	SWSW	1		136	32	SWNW	24
134	32	NWNW	3		137	29	W	18
134	32	NENW	3		137	32	SSW	26
134	32	SENE	3		137	32	NENE	34
134	32	SSW	3		138	30	SWNE	17
135	30	NWNW	27		138	31	NESE	24
135	32	NNE	21		138	31	SESE	25
135	32	SESE	22		140	31	NNE	1
135	32	SWSW	34		141	30	WNE	35
135	32	SESW	34		144	25	N	4
136	32	SWSE	3					

Appendix 2c. Survey locations for 1994 MCBS animal surveys in Cass County -- herp surveys.

Anuran call surveys								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T133N	R32W	SESW	7		T141N	R29W	SESE	28
T134N	R32W	SENE	3		T141N	R29W	NESE	31
T134N	R32W	SESE	10		T141N	R29W	SWNW	31
T134N	R32W	SENE	15		T141N	R29W	SWSE	32
T134N	R32W	SENE	22		T141N	R29W	SENW	33
T134N	R32W	SESE	24		T141N	R29W	SWNW	33
T134N	R32W	NENW	25		T141N	R30W	SWNW	3
T135N	R32W	SWSW	2		T141N	R30W	NWSW	28
T135N	R32W	SWNW	11		T141N	R30W	SESW	28
T135N	R32W	SENE	22		T141N	R30W	NESW	29
T135N	R32W	NESE	34		T141N	R30W	NESE	30
T135N	R32W	NENE	34		T141N	R30W	NWSE	30
T136N	R32W	SENE	3		T141N	R30W	NENW	33
T136N	R32W	NENE	3		T141N	R30W	SENE	33
T136N	R32W	SWSW	14		T141N	R30W	NWSW	34
T136N	R32W	SESE	34		T141N	R30W	NWSW	34
T136N	R32W	NWNW	35		T141N	R30W	NWNE	35
T137N	R31W	NENW	4		T141N	R30W	SWNW	35
T137N	R32W	NENE	3		T144N	R26W	NWSW	3
T137N	R32W	NESE	34		T144N	R26W	NESE	9
T138N	R30W	NESW	6		T144N	R26W	NESE	16
T138N	R30W	NENW	18		T144N	R26W	SENE	21
T138N	R30W	NWSW	30		T144N	R26W	SWSE	21
T138N	R30W	SWNW	31		T144N	R27W	NENW	5
T138N	R30W	NWSW	31		T144N	R27W	SWSW	9
T138N	R31W	NESE	1		T144N	R27W	SESW	15
T138N	R31W	SESE	12		T144N	R27W	NENW	16
T138N	R31W	SESE	13		T144N	R27W	SENW	16
T138N	R31W	NESE	24		T144N	R27W	NWSE	23
T138N	R31W	SESE	36	T144N	R27W	SWNW	23	
T141N	R29W	SENW	26	T145N	R27W	SENE	32	
T141N	R29W	SESE	26					

Drift fences								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T135N	R31W	NESW	27		T144N	R26W	NESE	16
T135N	R31W	NWSW	27		T144N	R29W	SESW	16
T135N	R32W	SENE	6		T144N	R29W	NWNW	34
T135N	R32W	SENE	6		T144N	R30W	NENW	4
T136N	R32W	SESE	31		T145N	R27W	SWNW	26
T138N	R32W	NWSE	9		T145N	R28W	SWNE	36
T143N	R31W	SWNE	26		T146N	R27W	SWSE	36

Appendix 2c. (continued).

Terrestrial searches								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T133N	R30W	NWNW	19		T143N	R31W	SWNE	26
T133N	R30W	NW	24		T144N	R29W	SESW	16
T135N	R31W	NESW	27		T144N	R29W	NWNW	34
T135N	R32W	SESW	6		T144N	R30W	NENW	4
T138N	R32W	NWSW	9		T144N	R31W	NWSE	24
T141N	R29W	SWNE	10					

Turtle traps								
Twp	Rng	Qtr-qtr	Sec		Twp	Rng	Qtr-qtr	Sec
T134N	R29W	NESW	32		T135N	R32W	SE	6
T134N	R30W	NENW	11		T135N	R32W	SW	29
T134N	R30W	NWNW	11		T141N	R30W	NWNW	19
T134N	R30W	NW	12		T142N	R25W	NW	21
T134N	R30W	SE	27					

NELSON'S SHARP-TAILED SPARROW

Ammodramus nelsoni

Official 1996 Minnesota Legal Status: None
(formerly Special Concern)

Number of records in Minnesota: 397 EORs

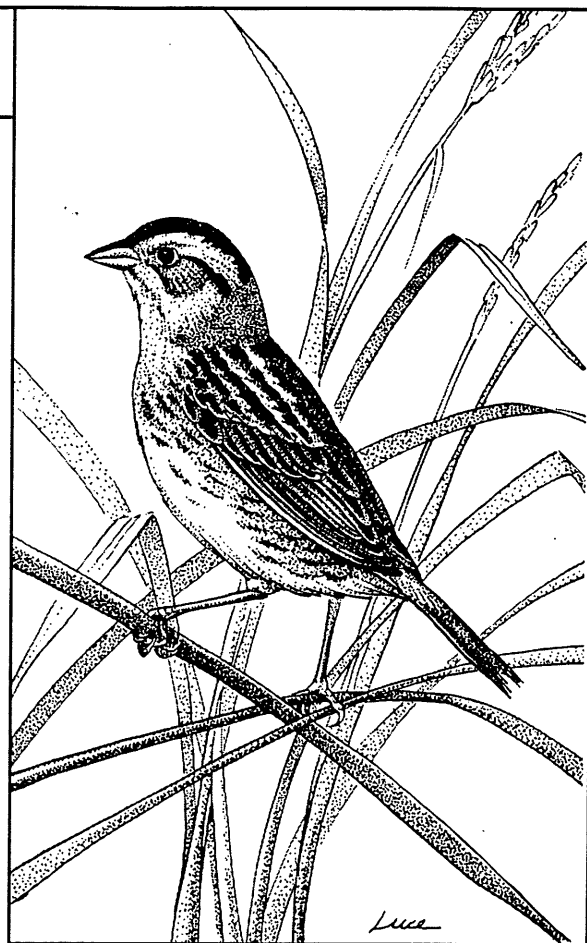
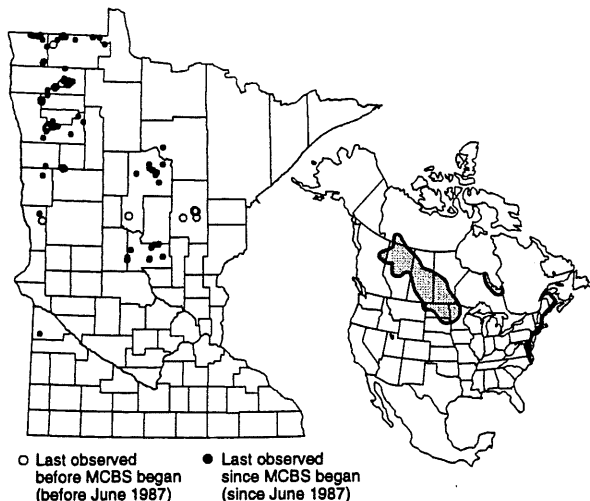
STATE DISTRIBUTION AND HABITAT

Nelson's Sharp-tailed Sparrows [now considered a separate species from the Saltmarsh Sharp-tailed Sparrow, found on the mid-Atlantic coast] are sparsely-distributed in suitable habitat within their range in the state (refer to key habitat characteristics, below). Often absent from seemingly suitable habitat, they are most numerous in wetlands, including Wet Meadows bordering large lakes and marshes. Habitat requirements of Nelson's Sharp-tailed Sparrows are generally similar to that of Yellow Rails, however, Nelson's Sharp-tailed Sparrows will utilize grassy wetlands with slightly deeper water and more rank vegetation (occasionally reed-canary grass or phragmites). At many locations where Sharp-tailed Sparrows were found, Yellow Rails were also present (60% of sites with Nelson's Sharp-tailed Sparrows also had Yellow rails).

Important habitat components include:

- (1) sedge- or grass-dominated wetlands, particularly Rich Fens with narrow-leaved sedge (*Carex lasiocarpa*) and Wet Meadows with wide-leaved sedges and grasses (eg. *Carex lacustris*, *Calamagrostis canadensis*).

Mappable records in the Minnesota Natural Heritage Database as of 06/08/98



- (2) water depths between 3 and 30 cm (1- 10 inches). Appropriate water depths are extremely important to Nelson's Sharp-tailed Sparrows during the breeding season. Sites with ideal vegetational structure but unsuitable water conditions (either too wet or too dry) will not likely contain Nelson's Sharp-tailed Sparrows.
- (3) litter layer of dead sedge or grass.
- (4) large tracts of open habitat. Nelson's Sharp-tailed Sparrows occur more frequently in suitable habitat surrounded by open country (e.g. Brush Prairie, Shrub Swamp).

IMPORTANT AREAS IN CASS COUNTY:

Nelson's sharp-tailed sparrows are locally common in expansive wet meadows bordering larger lakes and rivers, mainly in the northern half of Cass County. The most important areas by far were wetlands along Leech Lake (2 at Stony Point; one at Federal Dam) and Boy Bay-River (7 of the County's 12 records (58%)). The Boy Bay-River population represents one of the

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NELSON'S SHARP-TAILED SPARROW *continued*

IMPORTANT AREAS IN CASS COUNTY *continued*

largest known concentrations of Nelson's Sharp-tailed Sparrows in Minnesota. There have also been reports of Sharp-tailed Sparrows from southern Cass, but none were found by MCBS.

ECOLOGICAL CONSIDERATIONS

Habitats preferred by Nelson's Sharp-tailed Sparrows are highly susceptible to the effects of human disturbances or natural fluctuations on water levels. Artificial manipulation of water levels in sedge wetlands may promote vegetation that is unsuitable to both Nelson's Sharp-tailed Sparrows and Yellow Rails. Under long-term conditions of high water, for example due to impoundment or flooding, wetlands may become dominated by cattails and phragmites. Nelson's Sharp-tailed Sparrows are more tolerant of slightly deeper water and coarser vegetation than Yellow Rails, however, neither species is found in emergent marsh vegetation. When water levels are lowered, wetlands may retain their characteristic vegetation, but will be avoided by sparrows due to the lack of standing water. Although Sharp-tailed sparrows are not found in shrub-dominated wetlands (shrub coverage of approximately 50% or greater), wetlands with sparrows typically contain a few, widely-scattered shrubs. Fires appear to be one of the important factors reducing shrub densities in sedge wetlands. Therefore, prescribed burning of wetlands can be an effective management practice for maintenance of Sharp-tailed Sparrow habitat. Burned wetlands where the litter has been completely removed are not used by Sharp-tailed Sparrows until litter redevelops. However, lower intensity burns can retain sufficient litter. Leaving some areas unburned will encourage continued use of the habitat by Nelson's Sharp-tailed Sparrows.

SELECTED REFERENCES

Greenlaw, J.S., and J.D. Rising. 1994. Sharp-tailed Sparrow (*Ammodramus caudacutus*). In *The birds of North America*, No. 139 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

AMERICAN BITTERN

Botaurus lentiginosus

Official 1996 Minnesota Legal Status: None
(formerly Special Concern)

STATE DISTRIBUTION AND HABITAT

American Bitterns are relatively common in the northern two-thirds of Minnesota, but rare or absent in most of the southern one-third of the state. This species is found in a variety of wetland habitats, but prefers deepwater marshes (e.g. Cattail Marshes), over shallower, sedge-dominated wetlands. American Bitterns also frequent Shrub Swamps, Sedge Meadows, and flooded ditches, but in these habitats they are usually restricted to areas of deeper, standing water. For example, in large expanses of homogeneous sedge meadow, bitterns are usually located within small pockets of cattails associated with streams, rivers, or ditches. American Bitterns are most common in very large wetland tracts, will use smaller, more isolated wetlands.

Important habitat components include:

- (1) deepwater marshes with tall vegetation, particularly cattails.
- (2) interspersed of open water and emergent vegetation.
- (3) large tracts of habitat.



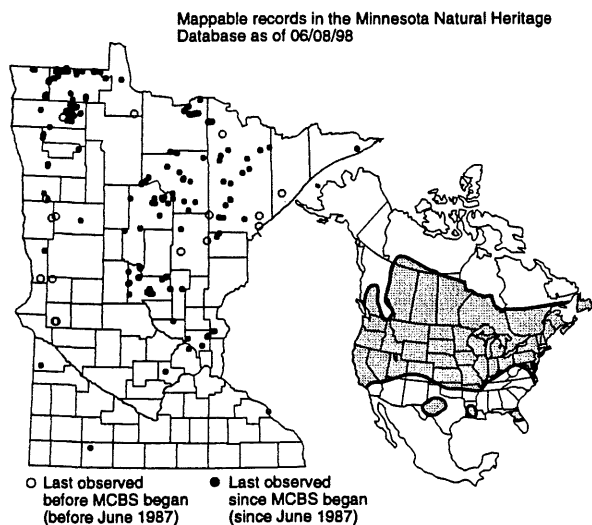
Illustration by Vera Ming Wong © 1988 State of Minnesota, Department of Natural Resources

IMPORTANT AREAS IN CASS COUNTY

American Bitterns are found primarily in Cattail Marshes and Wet Meadows. More than half of the county records obtained by MCBS of American Bitterns were located at only 2 sites: Boy Bay-River wetland complex (6 records); and Mud-Goose Wildlife Management Area (4 records). However, this species is probably widespread in Cass County.

ECOLOGICAL CONSIDERATIONS

American Bitterns are strongly associated with extensive wetland areas. For example, more than 20 percent of Minnesota's bittern records are from only 3 sites, Agassiz NWR, Roseau River WMA, and Thief Lake WMA in Marshall and Roseau counties. American Bitterns are still relatively common in Cass County, but are most abundant at only a few of the largest wetland areas. An annual monitoring program for bitterns in some of these larger wetlands (e.g. Boy Bay-River, Mud-Goose WMA) would provide valuable information on population trends.



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AMERICAN BITTERN

continued

SELECTED REFERENCES

Gibbs, J.P., S. Melvin, and F.A. Reid. 1992.
American Bittern (*Botaurus lentiginosus*).
In The birds of North America, No. 18 (A. Poole
and F. Gill, eds.). The Academy of Natural
Sciences, Philadelphia, and The American Or-
nithologists' Union, Washington, D.C.

RED-SHOULDERED HAWK

(*Buteo lineatus*)

Official 1996 Minnesota Legal Status: Special Concern

HABITAT AND POPULATION STATUS

Red-shouldered Hawks are most commonly found in mature lowland deciduous forest (e.g. Floodplain Forest, Hardwood Swamps) with scattered wetland openings, typically marshy sloughs, Wet Meadow potholes, or emergent vegetation bordering small lakes. In east-central and northern Minnesota, Red-shouldered Hawks are also found in mature upland forests. The key habitat feature of most sites where this species occurs, whether lowlands or uplands, is the presence of small, open wetlands within the forest. The exact forest composition (e.g. oak forest, Maple-basswood Forest, Black Ash swamp, etc.) is not of primary importance to Red-shouldered Hawks, however, they require relatively large tracts of mature deciduous forest. Aspen or birch-dominated forests do not seem to provide suitable habitat. Diverse topography consisting of numerous small hills, ridges and depressions seems to be a very good indicator of Red-shouldered Hawk habitat in upland forests, perhaps because this provides a high degree of interspersed forest and wetlands.

Important habitat components include:

- (1) large tracts of mature deciduous forest, with large trees (many trees 15-24+ inches diameter) with relatively open understory. Suitable forest types include Floodplain

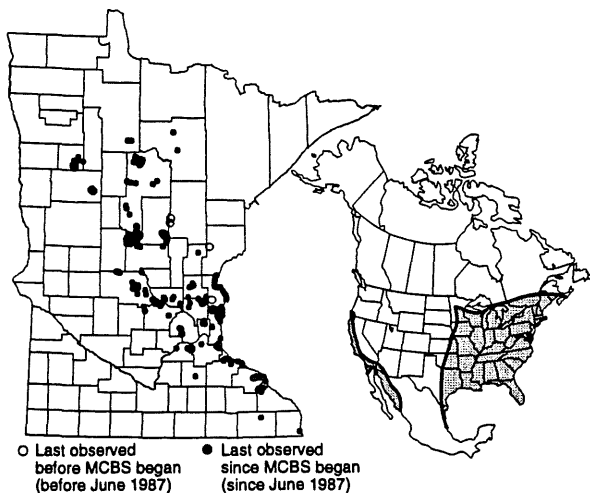


x 1/5

Forest, ash and mixed Hardwood Swamps, Mesic Oak Forest, and Maple-basswood Forest (Northern Hardwoods).

- (2) small wetland openings within or adjacent to forest. This may include small lakes with marshy borders; wet meadow potholes, or other wetland openings.

Mappable records in the Minnesota Natural Heritage Database as of 06/08/98



IMPORTANT AREAS IN CASS COUNTY:

In Cass County, Red-shouldered Hawks are found in mature upland deciduous forests as described above. This species appears to be uncommon but fairly widespread in the County, probably due to the extensive forests and abundance of lakes and other wetlands. Cass County lies near the northern edge of this species' range in Minnesota. MCBS concentrated Red-shouldered Hawk survey efforts in southern Cass County, with limited surveys on the Chippewa National Forest (CNF). Red-shouldered Hawks were found in two areas in southern Cass: Pillsbury State Forest (4 records); and Foothills State Forest (4 records). In CNF, Red-shouldered hawks were found at two sites. Other researchers conducting studies of Red-shouldered Hawkson CNF found this

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RED-SHOULDERED HAWK *continued*

IMPORTANT AREAS IN CASS COUNTY *continued*
species to be fairly common, particularly in the area of Sucker Bay-Ottertail Point (10 records, from MCBS and other researchers).

ECOLOGICAL CONSIDERATIONS/

Red-shouldered hawks are considered one of the species most likely to be adversely affected by increased timber harvest. This species requires relatively large tracts of mature deciduous forest, particularly in areas adjacent to small lakes or other wetlands. Selective cutting of forests has been found to be detrimental to this species. Red-shouldered Hawks have been found adjacent to regenerating clearcuts in areas with sufficiently large tracts of mature forest within the landscape. Aspen-dominated forests are not used by Red-shouldered Hawks, and conversion of mature hardwoods to aspen forest is detrimental for this forest raptor.

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Crocoll, S.T. 1994. Red-shouldered Hawk (*Buteo lineatus*). In *The birds of North America*, No. 107 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Hands, H.M., R.D. Drobney, and M.R. Ryan. 1989. Status of the Red-shouldered Hawk in the northcentral United States. U.S. Dept. Interior, Fish & Wildl. Serv.

McLeod, M.A. 1996. Red-shouldered Hawk habitat use and response to call-playback surveys in north-central Minnesota. M.S. thesis, Univ. Minnesota, St. Paul. 78 pp.

YELLOW RAIL

(*Coturnicops noveboracensis*)

Official 1996 Minnesota Legal Status: Special Concern

STATE DISTRIBUTION AND HABITAT

Yellow Rails are rather widespread in optimal habitat throughout their range in the state (refer to key habitat characteristics below). Never common, they are patchily-distributed in wetland habitats including Wet Meadows bordering large lakes and rivers, Rich Fens on extensive northern peatlands, Wet Prairies, and wet hayfields.

Important habitat components include:

- (1) sedge- or grass-dominated wetlands, particularly Rich Fens with narrow-leaved sedge (*Carex lasiocarpa*) and Wet Meadows with wide-leaved sedges and grasses (e.g. *Carex lacustris*, *Calamagrostis canadensis*).
- (2) water depths between 3 and 25 cm (1- 10 inches). Appropriate water depths are extremely important to Yellow Rails during the breeding season. Sites with ideal vegetational structure but unsuitable water conditions (either too wet or too dry) will not likely contain Yellow rails. However, these same sites may be utilized by rails during other years when water levels are more favorable.
- (3) litter layer of dead sedge or grass.
- (4) large tracts of open habitat. Yellow Rails

Mappable records in the Minnesota Natural Heritage Database as of 01/08/97 (23 records).

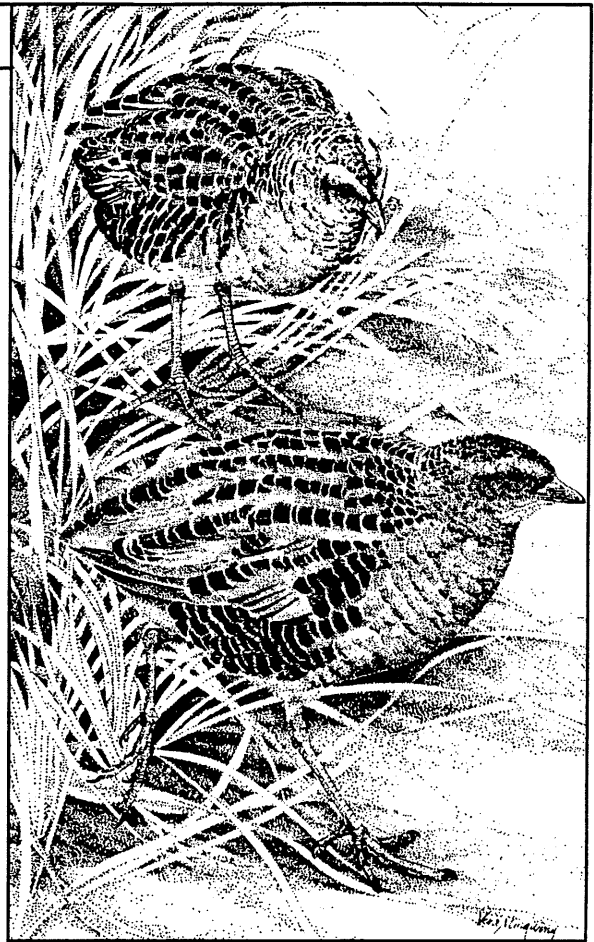
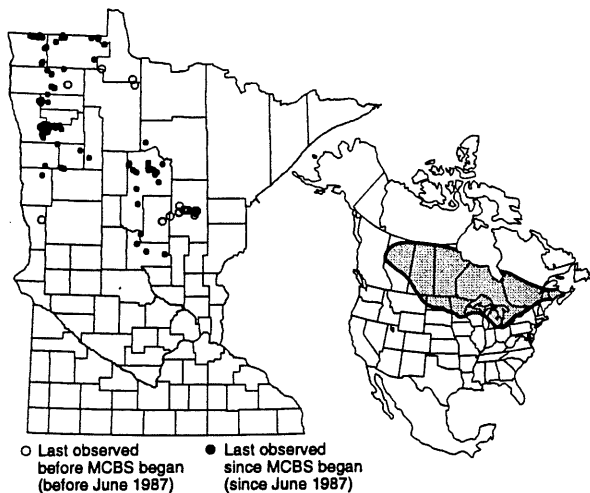


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occur more frequently in suitable habitat surrounded by open country (e.g. brush prairie, shrub swamp).

IMPORTANT AREAS IN CASS COUNTY

Yellow rails are fairly well-distributed in suitable habitat in the county. Habitats range from expansive wet meadows bordering larger lakes and rivers in northern Cass (CNF), to hayed meadows in southern Cass. The most important areas by far were wetlands bordering Leech Lake (two at Pine Point; two at Stony Point; two at Federal Dam) and Boy Bay-River (where 54% of the records for this species in the county are located). The Boy Bay-River population represents one of the largest known concentrations of Yellow rails in Minnesota. Other areas with Yellow rails the large wetland complex along Swamp Lake and the adjoining Steamboat River, and Mud-Goose Wildlife Management Area.

ECOLOGICAL CONSIDERATIONS

Yellow rails are usually sparsely-distributed, even in vast expanses of habitat, because water depths typically vary within a particular tract.

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YELLOW RAIL *continued*

ECOLOGICAL CONSIDERATIONS *continued*

Yellow Rails are only found in areas where water depths fall within the suitable range for this species. Because of this variability of water depth within a wetland, as well as seasonal fluctuations, it is important to protect large areas of habitat to ensure that optimal water conditions are present in at least a few locations within a particular wetland. Also, Yellow Rail habitat is highly susceptible to the effects of human disturbances or natural fluctuations on water levels. Artificial manipulation of water levels in sedge wetlands may promote vegetation that is unsuitable to rails. Under long-term conditions of high water, for example due to impoundment or flooding, wetlands may become dominated by cattails and phragmites. Yellow Rails are not found in emergent marsh vegetation. When water levels are lowered, wetlands may retain their characteristic vegetation, but will be avoided by rails due to the lack of standing water. Although Yellow Rails are not found in shrub-dominated wetlands (shrub coverage of approximately 50% or greater), wetlands with rails typically contain a few, widely-scattered shrubs. Fires appear to be one of the important factors reducing shrub densities in sedge wetlands. Therefore, prescribed burning of wetlands can be an effective management practice for maintenance of Yellow Rail habitat. Burned wetlands where the litter has been completely removed are not used by Yellow Rails until litter redevelops. However, lower intensity burns can retain sufficient litter. Leaving some areas unburned will encourage continued use of the habitat by Yellow Rails.

SELECTED REFERENCES

Bart, J., R.A. Stehn, J.A. Herrick, N.A. Heaslip, T.A. Bookhout, and J.R. Stenzel. 1984. Survey methods for breeding Yellow rails. *J. Wildl. Manage.* 48:1382-1386.

Bookhout, T.A. 1995. Yellow Rail (*Coturnicops noveboracensis*). In *The birds of North America*, No. 139 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Bookhout, T.A., and J.R. Stenzel. 1987. Habitat and movements of breeding Yellow rails. *Wilson Bull.* 99:441-447.

SANDHILL CRANE

(*Grus canadensis*)

Official 1996 Minnesota Legal Status: None
(formerly Special Concern)

STATE DISTRIBUTION AND HABITAT

Sandhill Cranes are locally common in Minnesota, particularly in the northwestern part of the State. This species nests in large expanses of wet, open habitat in rather remote areas. Preferred habitats include sedge-dominated wetlands (e.g. Rich Fen, Wet Meadow), Wet Prairie, and Emergent Marshes. This large, vocal species may seem to be more abundant than it really is due to its high visibility and calls which may be audible for a mile or more. Sandhill Cranes are frequently seen feeding in cultivated fields, but they do not actually nest in these areas. In central Minnesota, near the southern edge of its range, Sandhill Cranes are often restricted to the larger state wildlife management areas and national wildlife refuges. A small population of Sandhill Cranes also exists in southeastern Minnesota.

Important habitat components include:

- (1) sedge-or grass-dominated wetlands, such as Sedge Fen or Wet Prairie. Some cattails may be present, but extensive, deepwater cattail marshes are probably unsuitable.
- (2) large tracts of suitable habitat. Large habitat complexes may include upland prairie and pastures interspersed with suitable wetlands.

Mappable records in the Minnesota Natural Heritage Database as of 06/08/98

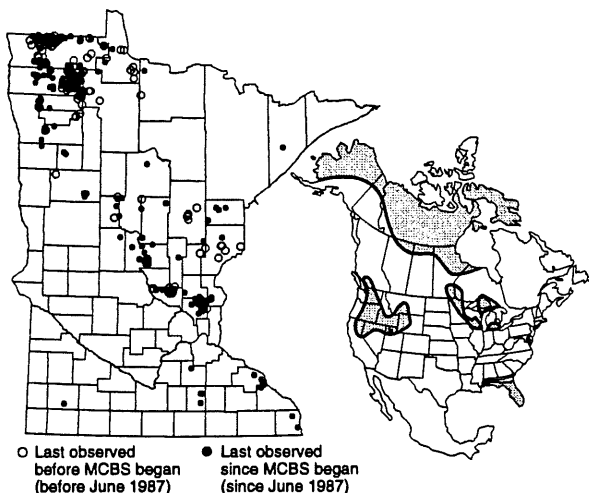


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- (3) remote areas relatively free from human disturbance during nesting season.

IMPORTANT AREAS IN CASS COUNTY

Sandhill Cranes were fairly rare in Cass County. During MCBS animal surveys, evidence of possible nesting was found at only three locations. In southern Cass County, a pair of cranes were found on county-owned land in McKinley Township and at Dry Sand Lake Wildlife Management Area. A third pair of Sandhill Cranes was found in the northern portion of the county near Federal Dam. It is unclear why this species is not more common in Cass County. Although the landscape is predominately forested, several expansive wetland areas do occur in the county.

ECOLOGICAL CONSIDERATIONS

Due to their apparent intolerance of disturbance during the breeding season, human activities should be minimized at known breeding areas during this period. Large wetland-prairie complexes should be protected from degradation or conversion to agriculture. While intensive inventories to locate additional breeding pairs are

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SANDHILL CRANE *continued***ECOLOGICAL CONSIDERATIONS** *continued*

probably not warranted, future sightings of Sandhill cranes in the county should be investigated.

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Tacha, T.C., S.A. Nesbitt, and P.A. Vohs. 1994. Sandhill Crane. Pp 77-94 in T.C. Tacha, and C.E. Braun, eds. Migratory shore and upland game bird management in North America. International Assoc. Fish & Wildl. Agencies, Washington, D.C

WILSON'S PHALAROPE

(*Phalaropus tricolor*)

Official 1996 Minnesota Legal Status: Threatened (formerly Special Concern)

STATE DISTRIBUTION AND HABITAT

This species occurs sporadically in wetlands in western and central Minnesota. Wilson's Phalaropes are most frequently found in wet, graminoid-dominated wetlands such as Wet Prairie, Sedge Fen, and Wet Meadow (refer to key habitat characteristics, below). The presence of short vegetation in or adjacent to shallow pools of open water may seem to be important microhabitat features. Human-altered habitats, particularly flooded pastures and municipal sewage ponds, may also provide important Wilson's phalarope habitat. However, there is much apparently suitable habitat in the state that is unoccupied. This species usually occurs in small numbers in Minnesota during the breeding season, with typically fewer than 2-3 pairs at any given location. Wilson's Phalaropes are often found in the same areas as Yellow rails and Nelson's Sharp-tailed Sparrows.

IMPORTANT AREAS IN CASS COUNTY

- (1) sedge-or grass-dominated wetlands, particularly wet prairies or pastures, and sedge wetlands (rich fens, with narrow-leaved sedges (eg. *Carex lasiocarpa*), or Wet Meadows dominated by wide-leaved sedges);
- (2) open pools of shallow water, approximately 3-30 cm (1-10 inches) in depth; often with



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some exposed mud/silt;

- (3) relatively large tracts of open wetland habitat.

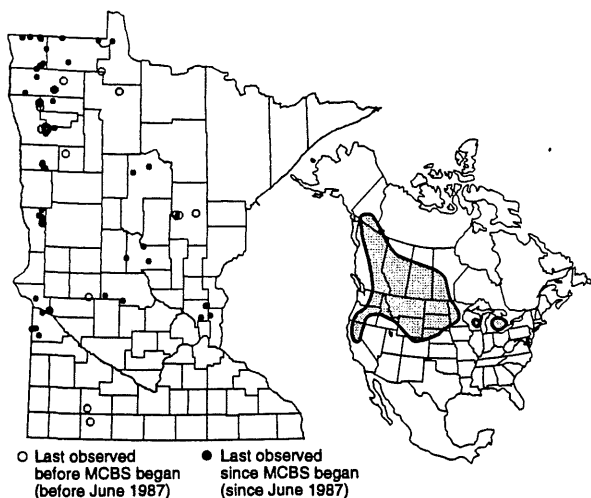
Wilson's phalaropes were rare in the Cass County, found at only two locations, both of which were in wet meadows adjacent to Leech Lake (one at Pine Point RNA; and one near Federal Dam). As many as 10-12 individuals were seen at the Walker sewage ponds (Ah-gwah-ching) during migration, but these birds did not appear to remain into the breeding season. Phalaropes might nest at these sewage ponds in years of suitable water conditions (1994 was too wet). There was much suitable sedge wetland habitat in the county that appeared to be unoccupied.

ECOLOGICAL CONSIDERATIONS

Since microhabitat conditions are very important to Wilson's Phalaropes, water conditions greatly influence habitat use. Artificial manipulation of water levels in sedge wetlands may promote vegetation that is unsuitable to Wilson's Phalaropes. When water levels are low, wetlands may retain their characteristic vegetation, but

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Mappable records in the Minnesota Natural Heritage Database as of 06/08/98



WILSON'S PHALAROPE *continued***ECOLOGICAL CONSIDERATIONS** *continued*

will be avoided by phalaropes due to the lack of standing water. Wilson's phalaropes rarely occur in extensive, cattail-dominated wetlands. Wetlands dominated by shrubs (shrub coverage of approximately 50% or greater) are also avoided. Fires appear to be one of the important factors reducing shrub densities in sedge wetlands. Therefore, prescribed burning of wetlands can be an effective management practice for maintenance of Wilson's phalarope habitat. Human-altered habitats (e.g. sewage ponds or flooded, fallow fields) may be utilized by phalaropes because they provide necessary microhabitat conditions lacking in native habitats. Any future sightings of Wilson's phalaropes in the county should be investigated.

SELECTED REFERENCES

Colwell, M.A. and J.R. Jehl, Jr. 1994. Wilson's Phalarope (*Phalaropus tricolor*). In The birds of North America, No. 139 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

BLANDING'S TURTLE

(*Emydoidea blandingii*)

Official 1996 Minnesota Legal Status: Threatened

STATE DISTRIBUTION AND HABITAT

The Blanding's Turtle is widely distributed in Minnesota, with the greatest concentration occurring in the central and eastern portions of the state. This species is often associated with wetlands and streams within sand terraces and outwash plains. Blanding's Turtles may travel long distances overland between overwintering site to nesting site. Known to live up to 77 years in the wild, they often return to the same nest site, basking log, and overwintering site each year.

Blanding's Turtles require a variety of habitats, important components include:

- (1) emergent marshes, vernal pools, shrub swamps, or fens for feeding, breeding, and overwintering.
- (2) sparsely-vegetated grasslands with sandy soils for nesting.
- (3) small streams or rivers as travel corridors connecting wetlands and nesting sites.
- (4) lack of barriers between wetlands and nesting sites, including protection from road-related mortality.

IMPORTANT AREAS IN CASS COUNTY

Ideal habitat exists in the southern portion of Cass County where numerous emergent marshes and streams lie adjacent to sandy, open grass-



Illustration by Vera Ming Wong © 1988 State of Minnesota, Department of Natural Resources

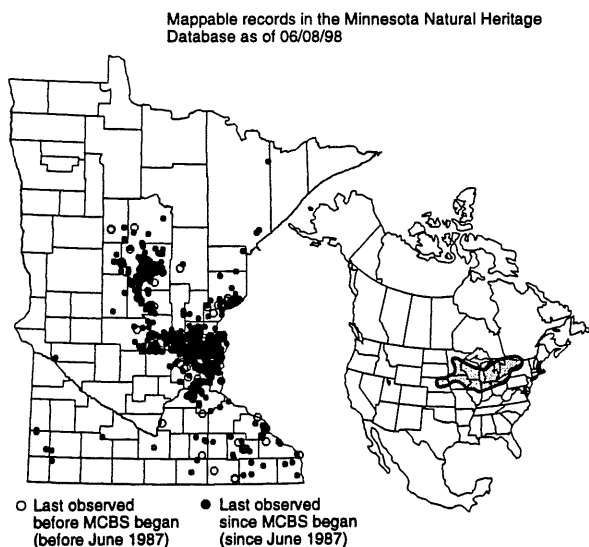
lands. However, the increased level of development in the Brainerd-Lakes area, has resulted in the fragmentation of Blanding's Turtle habitat. The heavily-forested northern half of Cass County contains suitable wetland habitat, yet lacks large open grasslands.

Wetlands in the Dry Sand Lake area including Tower, Farnham, and Martin Creeks provide ideal feeding, breeding, and overwintering habitat for Blanding's Turtles. Grasslands in this area have sandy soils, ideal as a nesting substrate, however they would be more suitable if enlarged and maintained through prescribed burning.

Wetlands in the Rice-Farber Lake area provide suitable feeding, breeding, and overwintering habitat, however, the uplands have become overgrown or were planted to pines, eliminating most of the potential nesting habitat. This area could be improved by creating openings for nesting and purchasing adjacent private lands to provide buffer.

A large number of Blanding's Turtle records

continued on next page



BLANDING'S TURTLE *continued*

are from the Gull River area near Sylvan.

IMPORTANT AREAS IN CASS COUNTY *continued*
includes numerous wetlands, streams, open grasslands, and sandy soils. The expansion of housing developments and businesses in this area, however, will continue to reduce the viability of local Blanding's Turtle populations. Without protection of remaining large, undeveloped tracts of suitable habitat the local population may become extirpated.

ECOLOGICAL CONSIDERATIONS

Loss of wetlands and associated upland nesting habitats have impacted this species throughout its range. In addition, railroad tracks and major roadways have fragmented habitat, creating dispersal barriers and increasing mortality. Public lands currently supporting Blanding's Turtle populations should be targeted for management to enhance nesting conditions and promote juvenile recruitment. Land management and acquisition should incorporate all habitat components necessary to maintain viable Blanding's Turtle populations. Sightings of Blanding's Turtles should be reported to the regional DNR Nongame Wildlife Specialist.

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Vogt, R. C. 1981. *Natural history of amphibians and reptiles of Wisconsin*. Milwaukee Public Museum, Milwaukee. 205 pp.

EASTERN HOGNOSE SNAKE

(*Heterodon platirhinos*)

Official 1996 Minnesota Legal Status: None
(formerly Special Concern)

STATE DISTRIBUTION AND HABITAT

The Eastern Hognose Snake is found in central and eastern Minnesota. It is often associated with open woodland habitat, forest edges, wetlands, and sandy soils, where it feeds primarily on toads. Listed as state Special Concern in 1984, due to the potential threat of over-collecting for the pet trade, it recently has been found in sufficient numbers to suggest that statewide populations are reasonably secure.

IMPORTANT AREAS IN CASS COUNTY

The central and southern portions of Cass County provide appropriate woodland habitat, associated with sandy soils and emergent marshes.

ECOLOGICAL CONSIDERATIONS

Although the Eastern Hognose Snake was removed from the state endangered species list, the DNR Natural Heritage Information System (NHIS) contains relatively few records for this species. It is not certain whether this paucity of records indicates that the species is sparsely distributed throughout its range or if its habits cause it to be overlooked. Resource managers should be alert to this species potential presence and report sightings to NHIS or the regional DNR Nongame Wildlife Specialist.

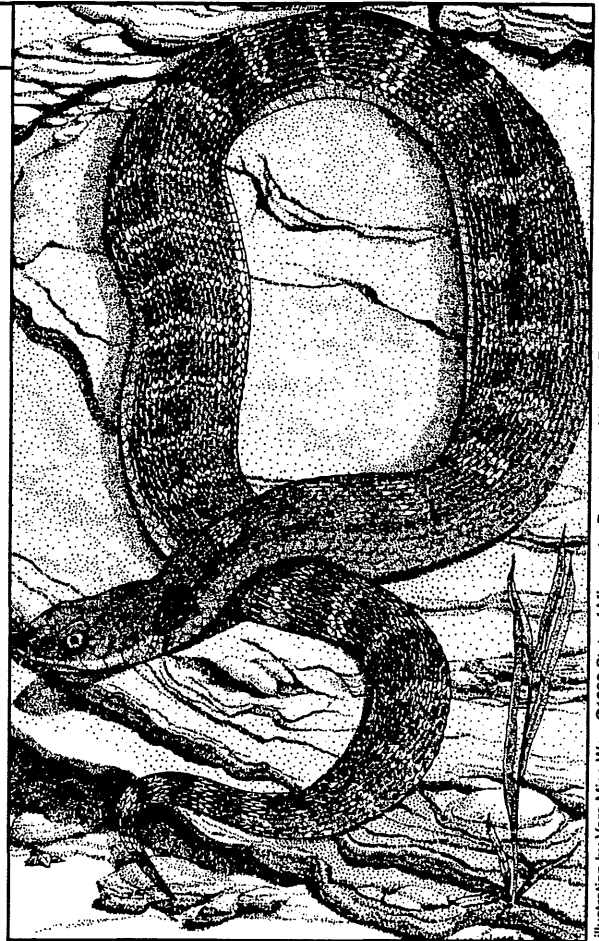


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SELECTED REFERENCES

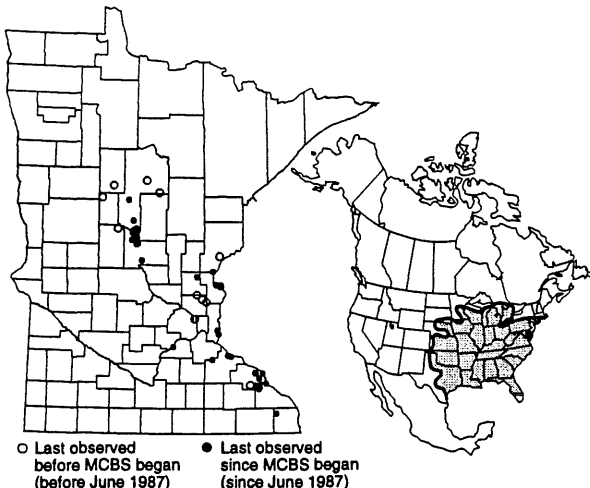
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Mappable records in the Minnesota Natural Heritage Database as of 06/08/98



Annotated Bibliography

General references

Field guides: Audubon Society, Golden, National Geographic Society, Peterson, Sierra Club, and others.

A large number of field guides are available that focus on particular animal groups, tracks and sign, or regions of North America, including Minnesota. They vary in their accuracy of taxonomic names and distribution maps and should not be used as a primary reference. The usefulness of photographs, color plates, or line drawings depends on the needs of the reader. For this reason, we have not listed any particular field guide and suggest that potential users review a number of field guides before selecting the ones that best fit their needs.

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Potential effects of timber harvest on wildlife populations in Minnesota.

Tester, J. R. 1995. Minnesotas natural heritage, an ecological perspective. University of Minnesota Press, Minneapolis. 332 pp.

This book looks at the interactions of animals and plants to their environment from a Minnesota perspective, with discussions of ecological relationships directly applicable to Cass County. Appendices associate animal species to their preferred habitats.

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applicable to similar habitats in Cass County. Animal chapters include, large mammals, small mammals, birds, and amphibians and reptiles.

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Mammalian Species. 1969 - present. Published by the American Society of Mammalogists.

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Publication numbers for Minnesota species:

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Arctic shrew 524
Pygmy shrew 33
Smokey shrew 215
Water shrew 296
Northern short-tailed shrew 261
Least shrew 43
Eastern mole 105
Star-nosed mole 129
Little brown myotis 142
Northern myotis 121
Eastern red bat 183
Hoary bat 185
Silver-haired bat 172
Eastern pipistrelle 228
Big brown bat 356
Eastern cottontail 136
White-tailed jackrabbit 288
Plains pocket mouse 525
Eastern chipmunk 168
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Northern grasshopper mouse 87
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Barbour, R. W., and W. H. Davis. 1969. *Bats of America*. University of Kentucky Press, Lexington. 286 pp.

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Hazard, E. B. 1982. *The mammals of Minnesota*. University of Minnesota Press, Minneapolis. 280 pp.

The most recent publication focusing on mammals recorded from Minnesota. Best available information on locations of verified records of mammals from the state prior to surveys by the Minnesota County Biological Survey. Good keys to identification of species by skins or by skulls.

Jackson, H. H. T. 1961. *Mammals of Wisconsin*. University of Wisconsin Press, Madison. 504 pp.

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This periodically-updated checklist of common and scientific names for North American mammals is the best reference for current opinions on taxonomy and nomenclature of mammals.

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This book covers all aspects of field and laboratory work with bats, with detail descriptions of methodologies and sources for equipment. Section on health precautions discusses rabies and histoplasmosis.

Wilson, D. E., F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster. 1996. *Measuring and monitoring biological diversity, standard methods for mammals*. Smithsonian Institution Press, Washington D. C. 409 pp.

This is a second in a series of publications (see amphibians and reptiles, below) that detail standard field methods for qualitative and quantitative sampling of biological diversity. In addition to descriptions of field techniques, this volume includes an overview of mammalian distribution, considerations for appropriate study design, specimen preparation, and human health concerns.

Bird references

American Ornithologists Union. 1983. *Check-list of North American birds*, 6th ed. American Ornitholo-

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Standard reference for North American bird nomenclature. Updated in July of odd years.

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Howe, R. W., G. Niemi, and J. R. Probst. 1996. Management of western Great Lakes forests for the

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Janssen, R. B. 1987. *Birds in Minnesota*. University of Minnesota Press, Minneapolis. 352 pp.

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Ralph, C. J., and J. M. Scott, eds. 1981. Estimating numbers of terrestrial birds. *Studies in Avian Biology*, No. 6:1-630.

Extensive reference on bird surveying and censusing techniques.

Roberts, T. S. 1932. *The birds of Minnesota*. 2 vol. University of Minnesota Press, Minneapolis.

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Detailed descriptions including identification, distribution, habitat, and life history information for snakes east of the Mississippi River. Includes a key to

adult snakes, an extensive bibliography, black and white photos, and color plates.

Ernst, C. H., J. E. Lovich, and R. W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Institution, Washington D. C. 578 pp.

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Harding, J. H. 1997. Amphibians and reptiles of the Great Lakes Region. University of Michigan Press, Ann Arbor. 378 pp.

General reference for species of the Great Lakes Region.

Heyer, W. R., M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. Foster, eds. 1994. Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution Press, Washington. 364 pp.

Compilation of existing information regarding design, standard techniques, and analysis of data. Includes sample data sheets, information on handling and marking amphibians, and preparation of specimens.

Karns, D. R. 1986. Field herpetology: methods for the study of amphibians and reptiles in Minnesota. Bell Museum of Natural History, University of Minnesota, Occasional Paper 18:1-88.

An introduction to herpetology, including information on finding, observing, and surveying amphibians and reptiles and preparation of specimens.

Lagler, K. F. 1943. Methods of collecting freshwater turtles. Copeia 1:21-25.

Describes use of hoop and fyke nets for capturing turtles.

Oldfield, B. and J. J. Moriarty. 1994. Amphibians and reptiles native to Minnesota. University of Minnesota Press, Minneapolis. 237 pp.

General reference for species of Minnesota. Includes distribution maps, identification keys, glossary, and color photos.

Vogt, R. C. 1981. Natural history of amphibians and reptiles of Wisconsin. Milwaukee Public Museum, Milwaukee. 205 pp.

General reference for species of Wisconsin. Includes distribution maps, identification key, glossary, and color photos.

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Phillips, G. L., W. D. Schmid, J. C. Underhill. 1982. Fishes of the Minnesota Region. University of Minnesota Press, Minneapolis. 248 pp.

Most current review of the natural history and distribution fishes found in Minnesota. Includes identification keys and excellent color photographs of many species. [Note: a more extensive publication on Minnesota fishes is currently in preparation.]

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Bulletin 184:1-966.

Species accounts, including distribution, biology, and descriptions, for many species found in Minnesota. Includes identification keys, color plates and black-and-white drawings of many species, and extensive reference lists. North American distribution includes Minnesota, however, locations of actual records stop at the Canadian border.

Mussel references

Cummings, K. S., and C. A. Meyer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey, Manual 5:1-194.

This guide to mussel identification covers mussels found from Minnesota south to Missouri and east to Ohio. Each species account is accompanied by a photograph, regional distribution map, detailed descriptions of shells, and information on habitat and regional status.

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the U. S. Corp of Engineers. It includes photographs and brief descriptions of mussels found in the Upper Mississippi River.

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habitat photographs are useful for comparison with those in Cass County.

Scott, J. A. 1986. The butterflies of North America. Stanford University Press, Stanford. 583 pp.

This discussion of butterflies of North America includes small North American distribution maps, identification clues, habitat and associated plant species, and timing of flight periods. Scientific names may differ from other sources. Color plates of butterfly specimens valueable identification guides, useful sections on butterfly biology and ecology.

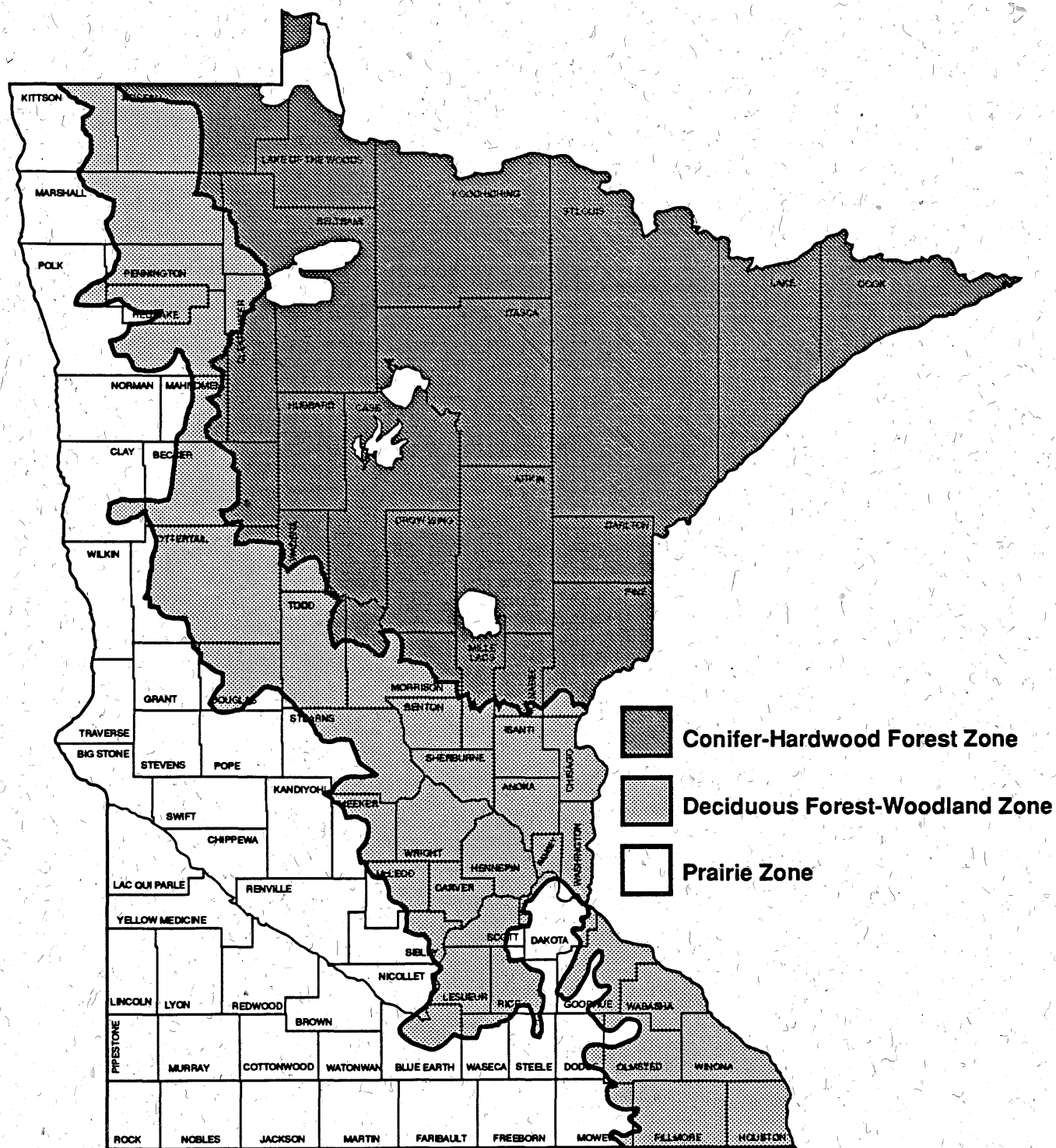
Minnesota's Native Vegetation:



A Key to Natural Communities

Version 1.5

Figure 1. The Conifer-Hardwood Forest, Deciduous Forest-Woodland and Prairie Zones of Minnesota.



MINNESOTA'S NATIVE VEGETATION

A Key to Natural Communities

Version 1.5

Minnesota Department of Natural Resources

Natural Heritage Program

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PREFATORY NOTE

The current understanding of the vegetation of Minnesota as described in *Minnesota's Native Vegetation: A Key to Natural Communities* is strongly influenced by geographical limitations of available vegetation data. As a result, this document best describes natural communities in parts of the state that have experienced systematic surveys of native vegetation. The primary source of vegetation data is the Minnesota County Biological Survey (MCBS). MCBS data from southeastern Minnesota, the northern and eastern Twin Cities metropolitan region, and the prairie regions of extreme western and northwest Minnesota were used in developing this key. Studies from the north central portion of the state and from the North Shore of Lake Superior provided additional information as did published studies of the vegetation of the Boundary Waters Canoe Areas Wilderness in the northeast and the Big Woods in east central Minnesota. For other parts of the state, information was more limited.

The ongoing work of the MCBS and other research efforts, such as vegetative sampling of old-growth forests, continue to provide new information. As MCBS data from additional counties in northwestern, north central, east central and southeastern Minnesota are analyzed, we will continue to revise this key. In preparation for the next revision of this key, we encourage users to send comments to the address below. Comments on vegetative assemblages that are not covered in this key will be especially appreciated.

Version 1.6 of the key is tentatively scheduled for release in 1996. We expect that Version 1.6 will include a variety of relatively minor revisions. The revised version will include changes in the section boundaries of several natural community types. For example, the sections of several prairie types will be modified to better reflect floristic patterns. We also expect to alter the boundaries of some sections of maple-basswood forest. An additional community type, Seepage Shrub Swamp, will be added to the Class *Shrub Swamp*. Other changes will likely include new subtypes such as a new Bur Oak-Basswood-Black Ash Subtype of Lowland Hardwood Forest.

Please address comments to:

Natural Community Key
Natural Heritage and Nongame Research Program
DNR Section of Wildlife
500 Lafayette Road, Box 7
St. Paul, MN 55155

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INTRODUCTION

This key is a revision and expansion of "A Preliminary Classification and Description of Natural Communities in Minnesota", compiled in 1984 by Keith Wendt, plant ecologist with the Natural Heritage Program. Wendt developed his classification mainly from existing literature on plant communities in Minnesota and adjacent states (especially Wisconsin). The classification was designed primarily as a tool for recognizing and preserving important natural ecosystems in Minnesota.

Since the development of Wendt's classification, a significant amount of new field data has been collected on Minnesota's vegetation and on abiotic habitat features. Most of this information has come from two new inventory projects, the Minnesota County Biological Survey (MCBS) and the Minnesota Vegetation Database (Releve System). These two inventory projects necessitated that Minnesota's natural communities be: 1) defined in a clear manner (even if somewhat arbitrarily in certain cases), 2) recognizable from aerial photographs, 3) mapped at a county scale, and 4) relatively consistent with multivariate classifications of standardized vegetation plot samples. The earlier preservation-based classification did not necessarily treat natural communities according to these guidelines, making it less useful as an aid to conducting these new inventories. For this reason, revision was begun on the Natural Heritage Program's natural community classification and key.

This new natural community key classifies and describes recurrent natural units of Minnesota's landscape by considering vegetation, topography, hydrology, landforms, substrates, soils, and natural disturbance regimes. Of these features, vascular vegetation is weighted most heavily. Abiotic features of the landscape are included in community descriptions where they correlate with the distributions of vascular plants in the community and where their effect on the ecology of the community is well understood.

The key is hierarchical, describing Systems, Classes, and Types of Natural Communities, respectively (see nomenclature below). Four Systems, nineteen Classes, and fifty-six Types appear in the key. The field data used to construct the new key comprise over 1,100 computerized records of natural communities from more than 1,000 vegetation plots. These data now exist in the Natural Heritage Program information system.

In general, the key provides a comprehensive and unambiguous means of identifying communities to the **Type** level. Community differentiation below the type level is treated less rigorously. Where there is known to be consistent geographic variation in a natural community type, the type may be subdivided into geographic **Sections**; however, better data are needed on the constituent species and statewide distributions of communities before reliable and exhaustive lists of geographic sections can be made for each natural community type. Where information is known on variation within a community type that is related to abiotic features of the environment (such as soil moisture or groundwater seepage), the community type may be further divided into **Subtypes**. As was the case for sections, because of a lack of comprehensive information the list of subtypes identified for a given community type is not necessarily

exhaustive (unless indicated--see Appendix 1).

The community types, sections, and subtypes listed in this key will be added to and revised as a result of the ongoing work of the Minnesota County Biological Survey. The final version will appear at the completion of the Survey (approximately AD 2010), at which time the distinctiveness of the communities--on aerial photographs, on satellite imagery, and in the field--will have been tested statewide. We invite anyone interested in the natural vegetation and native plants of Minnesota to participate in the refinement of this key. Plot data, computer facilities, and software are available for projects that will contribute significant information to the key.

NATURAL COMMUNITY NOMENCLATURE AND GENERAL CRITERIA

System -- Systems are based primarily on water regimes (that is, the interaction of landforms with the water table). Wetland systems are classified according to Cowardin¹ (palustrine, lacustrine, and riverine.) All non-wetland systems are classified as terrestrial systems. The names of the systems are not used in constructing the names of the natural communities in the key.

Class -- Natural community classes are designed to meet the natural community inventory and mapping needs of the Minnesota County Biological Survey and the Natural Heritage Program. Classes are identifiable from aerial photographs and sometimes from satellite imagery. The features used to define natural community classes are:

1. the water regime, including the source and chemistry of water and its seasonal availability to plants
2. the physiognomy of the vegetation, particularly the distribution, height, and cover of woody plants
3. the life form of the dominant cover species
4. landforms and associated soils

Class names are not used in forming the names of the natural communities (but they are used by MCBS ecologists as map-unit designators when identification to type is not possible.)

Type -- Natural community types are designed to meet needs for conservation planning, quantitative vegetation analysis, and expressing patterns of vegetation at a local (county) scale. Many natural community types can be identified from aerial photographs or a combination of aerial photographs, topographic maps, and soils maps. Other natural community types can be identified reliably only in the field. Some of the criteria used in defining natural community

¹Cowardin, L.M., V. Carter, F.G. Gollet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Washington, D.C.

classes are also used in defining natural community types, however types are defined primarily by their dominant cover-forming plant species.

Type names form the root of natural community names.

e.g., *Wet Prairie*

Subtype -- Subtypes describe variability within a natural community type that is evident from multivariate analyses of plot samples or that is obviously related to successional stage or to abiotic habitat features such as substrate composition or water chemistry.

Subtypes are appended to the natural community type names.

e.g., *Wet Prairie Seepage Subtype*

Section -- Sections identify consistent geographical variability within a natural community type. Sections may be based on the range limits of important species in the community, major landform or glacial drift types, climatic zones, or other features that vary regionally (over several counties).

Section names are parenthetical and are appended directly after the natural community type name and before the subtype name.

e.g., *Wet Prairie (Northwest Section) Seepage Subtype*

SCHEMATIC OF HIERARCHY AND CRITERIA

System

water regime

.
.

.....Class

water regime

vegetation physiognomy

life form of dominant plants

landforms and associated soils

.
.

.....Type.....Section

dominant cover species

indicator species

.
.

regional plant geography

climatic regions

regional geology

.....Subtype

substrate

water chemistry

successional stage

KEY TO THE NATURAL COMMUNITY SYSTEMS AND CLASSES _____

A. Habitat not flooded or saturated by groundwater for more than a few days during a normal year; vegetation always dominated by non-hydrophytic plants (Appendices 2 and 3); evidence of flooding, such as windrows of debris, raised root systems, ice scars, or peaty soil, is absent; soils predominantly mineral and without hydric characteristics (i.e., gleying or mottling)

..... **TERRESTRIAL SYSTEM 1.**

1. mature trees (Appendix 2) present (> 10% total cover) 2.

2. trees form closed stands (> 70% total cover) **FOREST 3.**

3. tree cover < 20% coniferous trees (i.e., > 80% broad-leaved deciduous trees) ..
..... page 12, **Deciduous Forest**

3. tree cover > 20% coniferous trees 4.

4. tree cover > 80% coniferous trees page 21, **Coniferous Forest**

4. tree cover < 80% coniferous trees
..... page 27, **Mixed Coniferous-Deciduous Forest**

2. tree canopy broken to scattered (10-70% total cover), surrounding matrix either brush, prairie, or a primary community **SAVANNA OR WOODLAND 5.**

5. trees mostly deciduous; community of the deciduous forest-woodland zone (Fig. 1) 6.

6. matrix surrounding trees < 30% open grassland or primary communities; tall brush cover generally dense page 30, **Deciduous Woodland**

6. matrix surrounding trees > 30% open grassland or primary communities; tall brush cover generally sparse page 33, **Deciduous Savanna**

5. trees mostly coniferous; community of the conifer-hardwood forest zone (Fig. 1) 7.

7. matrix surrounding trees < 30% open grassland or primary communities; tall brush cover generally dense page 39, **Coniferous Woodland**

7. matrix surrounding trees > 30% open grassland or primary communities; tall brush cover generally sparse page 41, **Coniferous Savanna**

1. mature trees absent (< 10% total cover) .. **PRAIRIE/PRIMARY COMMUNITY 8.**

8. ground with >30% cover of persistent vascular plants; most plants with prairie affinity (Appendix 3) 9.

9. vascular plant cover >30% brush page 43, **Upland Brush-Prairie**

9. vascular plant cover <30% brush page 46, **Upland Prairie**

8. ground with <30% cover of persistent vascular plants; plants with or without prairie affinity; mosses and lichens often abundant; rock or sand substrate
.....page 76, **Primary Community**

A. Habitat usually flooded or saturated by groundwater such that the vegetation contains at least some hydrophytic plants (Appendix 4) and, occasionally, aquatic plants (Appendix 5); evidence of flooding (such as debris windrows, raised root systems, ice scars, or peaty soil) is present in some communities; soils typically have some hydric characteristics (i.e., gleying or mottling)
.....**WETLAND B.**

B. a wetland with persistent emergent vascular plants, trees, shrubs, or emergent mosses covering more than 30% of its area **PALUSTRINE SYSTEM 10.**

10. raised peatland formed by the accumulation of sphagnum moss; has characteristic landforms (dome, crest, or ovoid island) often evident on aerial photos as radiating lines of trees and open drains in large peatlands; water input primarily from precipitation ...
..... page 53, **Bog**

10. level or sloping wetland, not raised; domes, crests, or ovoid islands present or absent; substrate peat or mineral soil; water input from both groundwater and precipitation 11.

11. tree cover >30% **FORESTED WETLAND 12.**

12. site subject to seasonal or otherwise periodic inundation or saturation; soils composed of mineral matter, typically have signs of alternating wet and dry cycles, such as mottling 13.

13. situated between an upland and a peatland, along the margin of a closed basin, or on an inactive floodplain
.....page 19, **Lowland Hardwood Forest**

13. situated on an active floodplain of a river or stream; evidence of flooding, such as debris dams, ice scars, silt deposits, etc., typically present
..... page 56, **Floodplain Forest**

12. area typically at or below the local water table, rarely drying; soils composed

- primarily of accumulated organic matter (peat); soils lack signs of alternating wet and dry cycles 14.
14. tree cover mostly deciduous page 59, **Hardwood Swamp Forest**
14. tree cover mostly coniferous page 62, **Conifer Swamp Forest**
11. tree cover < 30% **OPEN WETLAND** 15.
15. tall (> 2m) shrub cover (excludes ericaceous shrubs) interrupted to continuous (> 70% cover) page 65, **Shrub Swamp**
15. tall (> 2m) shrub cover (excludes ericaceous shrubs), open to patchy (< 70% cover) 16.
16. stands of tall (> 1m) graminoids; shrubs generally absent or if present have < 30% cover; graminoids emergent from standing water during some or all of the growing season; canopy often broken, pools or channels typically evident; obligate aquatic plants (Appendix 5) usually present page 67, **Emergent Marsh**
16. stands of short to mid-sized (generally < 1m) graminoids; shrubs present or absent (includes types ranging from entirely herbaceous, to mixed shrubs and herbs with up to 70% shrub cover); graminoids usually growing from the surface of saturated peat or moist mineral soil; canopy usually closed; obligate aquatic species (Appendix 5) mostly absent, however, facultative aquatic species often present in subcanopy page 69, **Wet Meadow/Fen**
- B.** a wetland where persistent emergents, trees, shrubs, or emergent mosses cover less than 30% of the area; however, nonpersistent emergents and submergents can be seasonally abundant **SHALLOW AQUATIC OR SHORELINE COMMUNITY** **C.**
- C.** area situated in a channel; flowing water is usually present **RIVERINE SYSTEM** 17.
17. area between normal water line and flood line page 76, **Primary Community**
17. area normally submerged page 83, **Aquatic River Community**
- C.** area situated in a basin, a catchment, or on level or sloping ground; standing water usually present **LACUSTRINE SYSTEM** 18.
18. area between normal water line and flood line page 76, **Primary Community**
18. area normally submerged page 84, **Aquatic Lake Community**

DECIDUOUS FOREST

Deciduous Forests occur primarily in the deciduous forest-woodland zone (Fig. 1); they are less common in the prairie zone and the conifer-hardwood forest zone. On dry sites, the most common canopy dominants of Deciduous Forests are oak, aspen, and birch trees. Sugar maple, basswood, elm, and ash trees are common dominants on moist sites. Pines, especially white pine, sometimes form a minor part of the forest canopy. Where the forest canopy is broken or interrupted (typically in oak-dominated forests) there is usually a dense layer of tall shrubs, including hazelnuts, dogwoods, prickly ashes, and cherries. Beneath the denser canopies formed by mesic tree species such as sugar maple, the shrub layer is sparse or absent.

The canopy tree species of Deciduous Forests occur in combinations determined primarily by environmental features (including soil texture, parent material, presence of hardpans and firebreaks, depth to the water table, topography, aspect, and local climate) that affect soil moisture and the local fire regime. These features produce a gradient of Deciduous Forest types from dry, fire-prone forests composed of fire-adapted species, to mesic forests composed of fire-sensitive species.

Many of the dry Deciduous Forests in the deciduous forest-woodland and prairie zones appear to have succeeded from deciduous brushland and savanna in the past 100 to 125 years following widespread forest fragmentation and fire suppression. Mesic Deciduous Forests in these zones occur in areas protected from fire, especially areas of rough topography and along bodies of water. In the conifer-hardwood forest zone, mesic Deciduous Forests occur on sites with impeded drainage (having impermeable banding or textural pans in the soils) and in areas of locally high precipitation or humidity, such as along the shore of Lake Superior. The dry deciduous forests of the conifer-hardwood zone, especially Aspen, Aspen-Birch, and Paper Birch forests, occur on fire-prone sites and are considered early successional communities.

There are seven Deciduous Forest community types in Minnesota. These were determined principally by literature surveys and interpretations of land survey records.

a. tree cover mostly quaking aspen, big-toothed aspen, paper birch, red maple, or oak; habitat dry to dry-mesic; early to mid-successional communities; dominant canopy trees often the same age, having germinated following disturbances such as fire, windthrow, disease epidemic, or logging b.

b. tree cover >70% aspen or paper birch, generally <30% oak; understory highly variable c.

c. tree cover dominated by aspen; paper birch absent in stands on prairie soils or a minor associate (<5% cover) in stands on forest soils; oaks and green ash are common associates (<30% cover); a community of the prairie zone or deciduous forest-woodland zone (Fig. 1) *Aspen Forest*

- c. tree cover dominated by aspen or paper birch or a combination of these species, with each having > 10% cover; a community of the conifer-hardwood forest zone or an outlier in the deciduous forest-woodland zone (Fig. 1)..... *Aspen-Birch Forest*
- c. tree cover dominated by paper birch; aspen absent or contributing less than 10% of the canopy cover; a community of the conifer-hardwood forest zone or an outlier in the deciduous forest-woodland zone (Fig. 1) *Paper-Birch Forest*
- b. tree cover < 70% aspen and paper birch, and generally > 30% oak, typically mixed with other trees; understory in older stands often includes some saplings of mesic trees
..... *Oak Forest*
- a. tree cover mostly sugar maple, basswood, yellow birch, green ash, American elm, or slippery elm; northern red oak sometimes important in the canopy; habitat mesic to wet-mesic; mid- to late-successional communities; dominant canopy trees typically not the same age, having germinated following fine-scale disturbances such as treefall gaps; evidence of widespread disturbances such as fire or windthrow is rare d.
- d. tree cover mostly sugar maple or basswood, or a mixture of the two; minor canopy species are northern red oak in drier habitats and ash, elm, or yellow birch in wetter habitats
..... e.
- e. tree cover up to 20% coniferous species, or if previously logged, conifers present in understory; groundlayer often includes herbs associated with acid conifer litter (mor humus) *Northern Hardwood Forest*
- e. tree canopy without conifers or with scattered white pine; generally no pine reproduction in understory; groundlayer dominated by herbs associated with mull humus
..... *Maple-Basswood Forest*
- d. tree cover mostly black ash, green ash, yellow birch, red maple, or elm; habitat wet-mesic; soils often mottled within tree rooting zone but not at the ground surface; groundlayer dominated by upland herbs; hydrophytic species (Appendices 4 and 5) mostly absent
..... *Lowland Hardwood Forest*

Aspen Forest

Aspen Forest occurs throughout the deciduous forest-woodland zone, with isolated patches in the prairie zone (Fig. 1). The community develops primarily on sites with wet, poorly drained soils and high water tables, although the water table is usually not high enough to affect the groundlayer composition of the community or to cause peat accumulation.

The tree canopy most often is dominated by quaking aspens. Paper birches, balsam poplars,

bur oaks, pin oaks, green ashes, or basswoods are minor canopy trees, although they may be abundant in the understory as seedlings and saplings. On low, poorly drained sites balsam poplars are sometimes more abundant than quaking aspens in the tree canopy.

The understory of Aspen Forests tends to be brushy. American hazelnut is almost always abundant in the understory. Other shrubs vary in presence and abundance with soil moisture, which ranges from wet-mesic to dry. The groundlayer is composed mostly of forest herbs and grasses capable of surviving in the shade under the dense shrub layer. These species include wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), the sedge *Carex pensylvanica*, false melic grass (*Schizachne purpurascens*), and mountain rice-grass (*Oryzopsis asperifolia*).

Aspen Forest is an early-successional community. With prolonged absence of fire or other disturbances, Aspen Forests succeed to mid-successional forests composed of the minor canopy tree species listed above. An analysis of land survey records indicates that relatively pure stands of quaking aspen historically occurred on level terrain rather than on rough topography, suggesting that these stands were maintained by fire and windthrow. The aspen trees were present most commonly on somewhat poorly drained mineral soils, especially drumlin fields and other landforms with heavy soils, while paper birch, pin oak, and bur oak trees associated with the aspens were probably present on local areas of better drained soils.

Plots of aspen trees from early public land survey records show that aspen also occurred on areas of relict prairie soils within the deciduous forest-woodland zone. These sites are now mainly forested, but the land survey records indicate that the aspen trees previously were scattered widely enough on them to constitute woodland rather than forest. This is consistent with the surveyors' written descriptions of these sites, which state that they had relatively dense shrub layers dominated by American hazelnut, and groundlayers dominated by prairie forbs and graminoids. Aspen forests that occur on prairie soils and have prairie understories eventually may be recognized as a subtype of Aspen Forest or as a phase of Aspen Woodland, following further research and analysis of survey records. No sections of Aspen Forest are anticipated.

Aspen-Birch Forest

Aspen-Birch Forest occurs almost exclusively on upland sites in the conifer-hardwood forest zone (Figure 1). The community is dominated by trees of quaking aspen, bigtooth aspen (typically in clones), and paper birch, with at least 10% of the canopy cover made up of either aspen or birch. The tall-shrub layer tends to be dense and is most often composed of beaked hazel, mountain maple, and saplings of late-successional tree species. The groundlayer is usually very diverse.

Aspen-Birch Forest is an early successional community that originates following catastrophic disturbances, especially fire and clear-cutting. In the absence of catastrophic disturbances, Aspen-Birch Forest may succeed to Spruce-Fir Forest, Boreal Hardwood-Conifer Forest, Northern Hardwood Forest, Northern Hardwood-Conifer Forest, Maple-Basswood Forest, or

even Upland White Cedar Forest. Where white pine is present in the understory, Aspen-Birch Forest may succeed to White Pine Forest.

Aspen-Birch Forest now covers a large portion of northern Minnesota because of logging and repeated post-logging fires, which eliminated most of the local pine seed sources. There are two recognized subtypes: the Spruce-Fir Subtype in which saplings of balsam fir or white spruce are conspicuous in the understory, and the Northern Hardwoods Subtype in which saplings of sugar maple and other northern hardwoods are conspicuous in the understory.

Paper Birch Forest

Paper Birch Forest occurs primarily in the conifer-hardwood zone, especially in northeastern Minnesota, with small stands present also on shaded north-facing slopes in the deciduous forest-woodland zone (Fig. 1). The canopy of Paper Birch Forests is strongly dominated by paper birch trees. The tall-shrub layer typically contains beaked hazel and mountain maple. Seedlings and saplings of mid- and late-successional tree species are often present in the understory; balsam fir is an especially common understory species in northeastern Minnesota. Little data are available on the groundlayer composition of the community, especially in regard to how it may differ from that of the closely related Aspen-Birch Forest community. However, blue-bead lily (*Clintonia borealis*), stiff clubmoss (*Lycopodium annotinum*), and mosses appear to be more common in Paper Birch Forests, while large-leaved aster (*Aster macrophyllus*) is more common in Aspen-Birch Forests.

Paper Birch Forest usually originate following fire. In the absence of disturbance the community tends to succeed to many of the community types to which Aspen-Birch Forest succeeds (see above). Like Aspen-Birch Forest, Paper Birch Forest has a Spruce-Fir Subtype and a Northern Hardwoods Subtype.

Oak Forest

Oak Forest is widespread in Minnesota. It is most common on dry to dry-mesic sites in the deciduous forest-woodland zone (Fig. 1) but also occurs occasionally in the southern and western parts of the conifer-hardwood zone, and in stream valleys in the prairie zone.

At least 30% of the tree canopy in an Oak Forest is made up of oak trees. Most often aspen, paper birch, or black cherry trees make up the remainder of the canopy. The actual composition of the community, however, varies considerably in response to variation in soil moisture, soil type, fire history, and climate. The driest stands of Oak Forest are dominated by northern pin oaks and white oaks, with black oaks, shagbark hickories, and sometimes bur oaks important in southeastern Minnesota. These stands occur on nutrient-poor, well-drained sandy soils on outwash plains, river terraces, and beach ridges. They have relatively open canopies, with between 70% and 80% cover. The canopy height is usually between 13 and 17 meters.

Because of the open canopy, the shrub layer is often very dense. American hazel dominates the shrub layer, which also often contains gray-bark dogwood, blueberries, and blackberries. Some of the more common groundlayer species are the sedge (*Carex pensylvanica*), wild geranium (*Geranium maculatum*), Virginia creeper (*Parthenocissus inserta*), wild sarsaparilla (*Aralia nudicaulis*), and hog-peanut (*Amphicarpa bracteata*).

Commonly, at least some of the oak trees in the dry stands have multiple stems and thick, spreading lower branches, indicating that these trees grew up in a disturbed and more open setting. Minnesota public land survey records indicate, in fact, that many of these dry stands were oak savanna or oak woodland before European settlement and with fire suppression have succeeded to forest. Oak regeneration is rare in these stands now, as the oak species reproduce poorly under forest canopies. In the absence of fire, relatively mesic or fire-sensitive species such as bitternut hickory, basswood, and red maple, are increasing in abundance in the community.

Northern red oaks, white oaks, or bur oaks dominate the more mesic stands of Oak Forest are dominated by . These stands occur on sites that had fewer severe fires before European settlement than the sites on which dry Mixed Oak Forest occurs. These mesic stands most likely were always forest, rather than woodland or savanna. They have tall (> 20 meters), straight, single-stemmed trees that lack spreading lower branches. Commonly, mesic fire sensitive tree species are present with the oaks in these stands, especially in the understory. These species include basswood, green ash, bitternut hickory, big-toothed aspen, and butternut.

The shrub layer in mesic stands is sparser than in dry stands and, correspondingly, the forb layer is denser and more diverse and there are more graminoid species. Like the drier stands, however, there is little oak regeneration, and most mesic Oak Forests appear to be succeeding to Maple-Basswood forest. Heavy selective logging of the oaks in mesic stands may accelerate this trend, producing young stands of Maple-Basswood Forest. The mesic stands often grade into drier stands of Maple-Basswood Forest, but differ from them by having a somewhat denser shrub layer and the herbs woodrush (*Luzula acuminata*) and pointed-leaved tick-trefoil (*Desmodium glutinosum*) in their understory.

Another variant of Oak Forest occurs in northeastern Minnesota, principally on ridgetops and upper slopes, where the forest intermingles with bedrock outcrops. These forests contain northern red oak, bur oak, pin oak, and red maple. They originated mainly following the logging and burning of stands of Red Pine Forest in the 1800s and early 1900s.

In general, most existing stands of Oak Forest have been disturbed by grazing or selective cutting, or have been fragmented by development. Natural stands of mesic Mixed Oak Forest are rare. Drier stands are more common, in part because relative to the mesic forests they occur on sites with soils less suitable for cultivation. Additionally, dry Oak Forests may have increased in extent somewhat following fire suppression, succeeding from oak savanna and woodland. Disturbed stands of oak forest commonly have dense subcanopies of prickly ash, or of the exotic species common buckthorn and Tartarian honeysuckle, which have also now invaded many undisturbed stands. Disturbance through grazing may also be partly responsible

for the lack of regeneration in Oak Forests, especially in stands with heavy soils that compact readily with trampling.

Oak Forest is divided geographically into Southeast, Big Woods, Central, Northwest, and Northeast Sections (Fig. 2). There are also three recognized subtypes (Dry, Mesic, and Red Maple), corresponding to the floristic and structural variation in the community described above.

Northern Hardwood Forest

Northern Hardwood Forest is a mesic forest community present mainly in the conifer-hardwood forest zone (Fig. 1), with small stands on the Paleozoic Plateau in southeastern Minnesota (Fig. 3). The canopy is dominated by dry-mesic to mesic hardwoods, especially sugar maple, basswood, and yellow birch. Northern red oak may be codominant in the canopy on drier sites; black ash and American elm may be codominant on wetter sites. Northern Hardwood Forest shares many of its tree species with Maple-Basswood Forest but differs from Maple-Basswood Forest by having a significant conifer component, including white pine (now present most often as stumps), balsam fir, white spruce, and white cedar.

The understory is multilayered and patchy. It is composed of shrubs and seedlings and saplings of the canopy trees. Some of the shrub species commonly present are fly honeysuckle, beaked hazel, leatherwood, mountain maple, chokecherry, and red-berried elder. The height and abundance of these shrubs varies with the degree of shading from canopy trees. In general, the shrubs are tallest beneath tree-fall canopy gaps.

The groundlayer is composed of a combination of northern and southern mesic herb species (i.e., those with distributions either mainly north or mainly south of the forest tension zone). The relatively few spring ephemerals present and the occurrence of club mosses in the groundlayer help differentiate Northern Hardwood Forest from Maple-Basswood Forest.

Northern Hardwood Forest occurs on loamy or sandy loam soils on fire-protected sites, especially on the rugged Sugar Hills Moraine and in the Lake Superior Highlands. In north-central Minnesota, Northern Hardwood Forest often occurs on sites with fine-textured subsurface layers that prevent or slow the downward movement of water and nutrients. Northern Hardwood Forest is a late-successional community with old-growth potential. Regeneration occurs primarily by gap-phase replacement so stands usually are uneven aged.

The Northern Hardwood Forest type includes most stands classified as Northern Hardwood-Conifer Forest in the 1983 community classification. Other stands previously classified as Northern Hardwood-Conifer Forest remain as Northern Hardwood-Conifer Forest in this classification or are included in the Red Maple Subtype of Oak Forest. There are two sections of Northern Hardwood Forest in Minnesota (Fig. 4), a Northern Section, occurring mainly north of the tension zone, and a Southeast Section, which occurs in southeastern Minnesota on steep north-facing slopes and bluffs. Northern Hardwood Forests in the Southeast Section contain such characteristically northern species as balsam fir, yellow birch, and American yew and often

Figure 2. The Southeast, Big Woods, Central, Northeast, and Northwest Sections of Oak Forest.

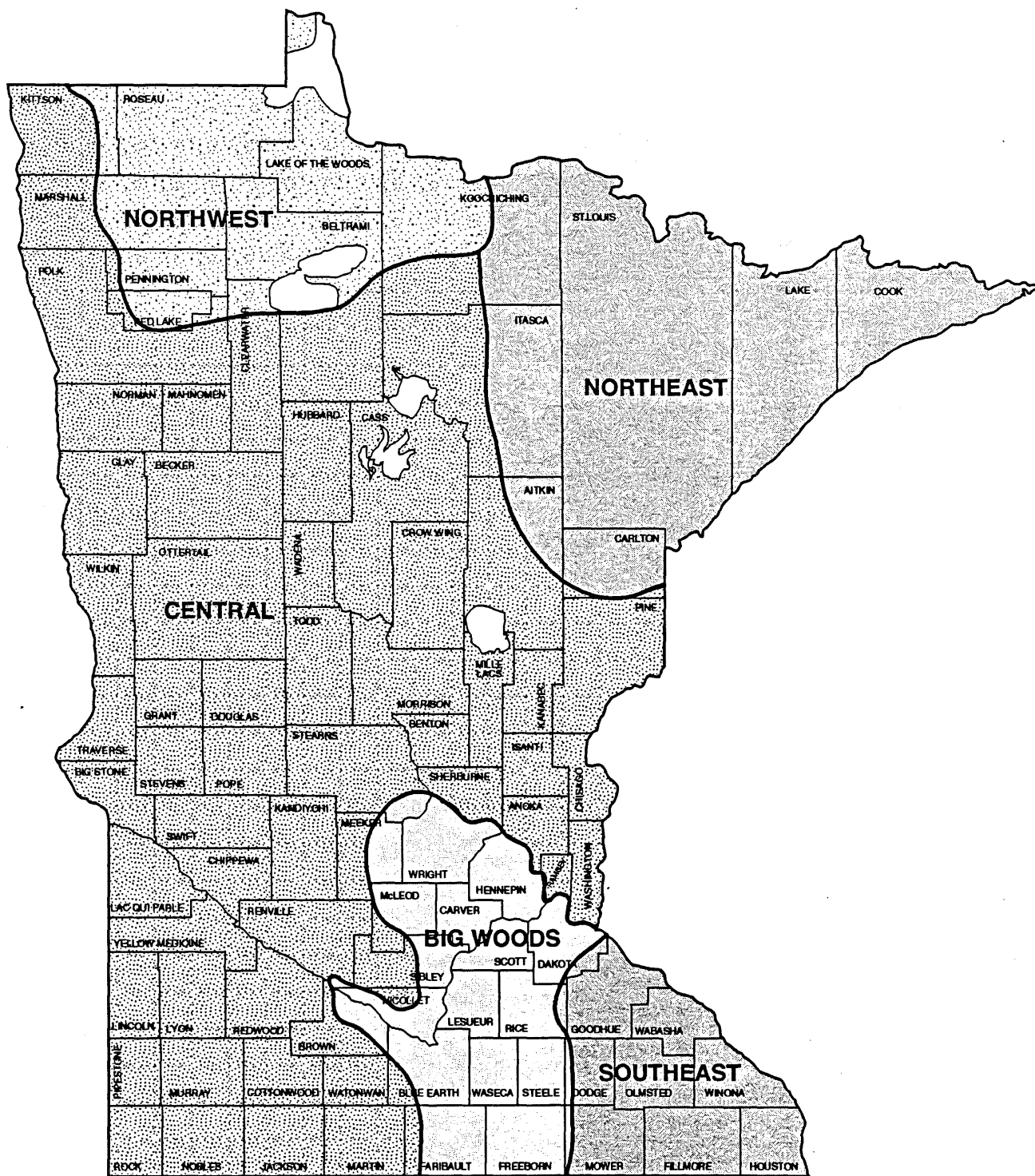


Figure 3. The Paleozoic Plateau in Southeastern Minnesota.

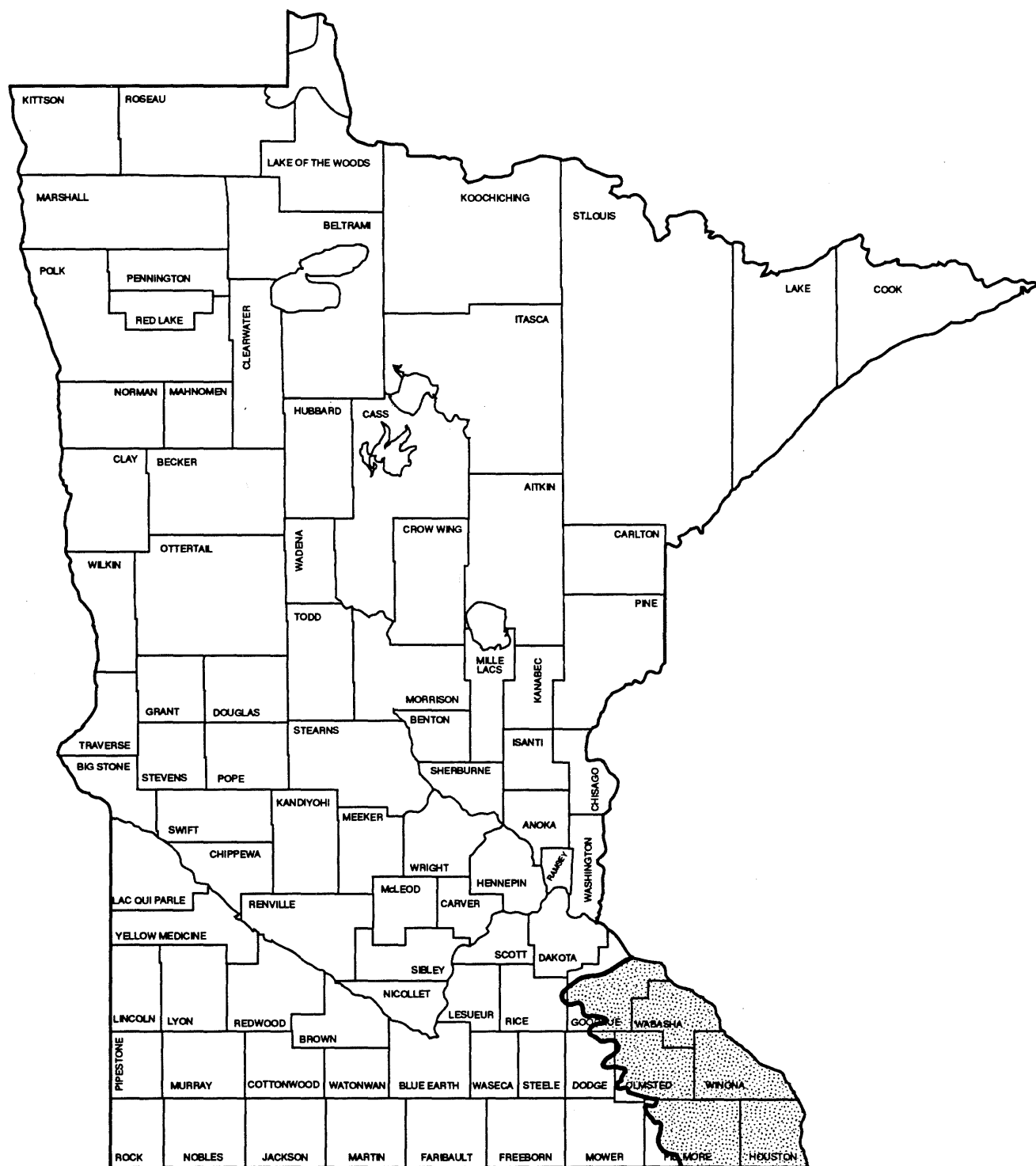
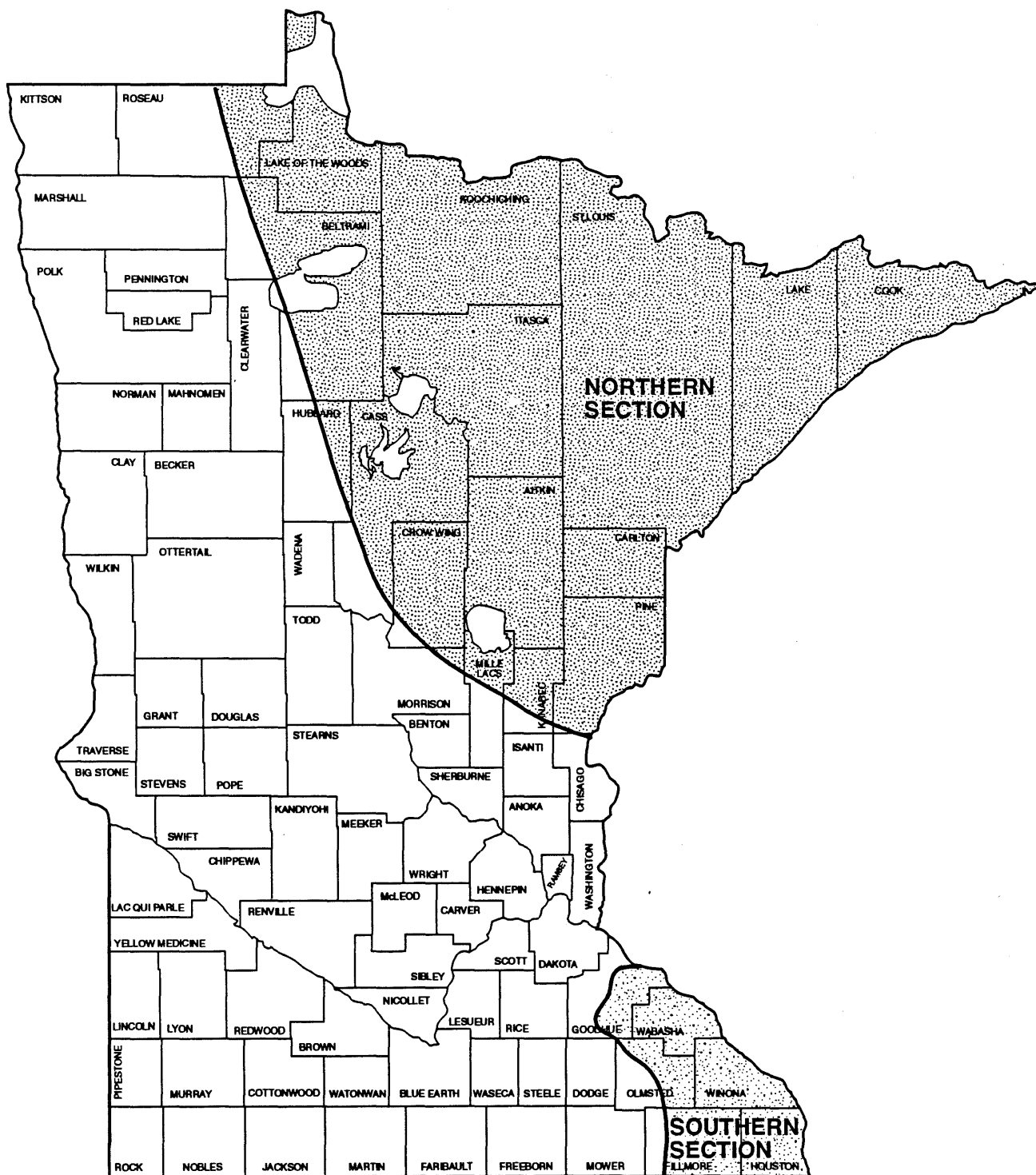


Figure 4. The Southeast and Northern Sections of Northern Hardwood Forest.



are associated with Moist Cliff communities.

Maple-Basswood Forest

Maple-Basswood Forest is a mesic community of the deciduous forest-woodland zone (Fig. 1), especially the portion from southeastern to west-central Minnesota. It also occurs occasionally in the conifer-hardwood forest zone and as isolated stands in the prairie zone on sites well protected from fire.

The tree canopy of Maple-Basswood Forests is dominated mostly by basswoods, sugar maples, and (formerly) American elms. Other mesic trees, such as slippery elms, northern red oaks, bur oaks, white ashes, and green ashes, are sometimes dominant locally. The canopy is very dense, with tall, straight, relatively narrow-crowned trees. The understory is multi-layered and patchy. It is composed of saplings and seedlings of the canopy species (especially sugar maple), along with American hornbeam, ironwood, bitternut hickory, pagoda dogwood, and leatherwood.

Because the tree canopy permits so little light to reach the forest floor during the summer, Maple-Basswood Forests have a suite of forb species that bloom, produce seeds, and die back in May and early June before tree leaves are fully developed. These species--the spring ephemerals and the winter annuals--include spring beauties (*Claytonia* spp.), Dutchman's breeches (*Dicentra cucullaria*), trout-lilies (*Erythronium* spp.), and cleavers (*Galium aparine*). Other herbs, such as the sedge *Carex pedunculata*, bottlebrush grass (*Hystrix patula*), and bearded short-husk (*Brachyelytrum erectum*), are commonly present in the groundlayer but usually not abundant.

Maple-Basswood Forest occurs only on protected sites, where catastrophic forest crown fires were rare historically. Across most of its range, the community develops most commonly on well-drained loamy soils that lack mottling or other evidence of water-table levels within the tree-rooting zone. In north-central Minnesota, Maple-Basswood Forests develop on soils with fine-textured subsurface layers that slow the downward movement of water and nutrients.

Maple-Basswood Forest is a late-successional community, tending to succeed Mixed Oak Forest (and other forest types) on mesic sites. It is self-perpetuating in the absence of catastrophic disturbance and climate change because the dominant tree species readily reproduce by gap-phase replacement. The very shade-tolerant sugar maple seedlings and saplings, especially, may exist in a suppressed state in the understory for many years until the death of a mature tree when one or a few grow rapidly into the canopy gap. Maple-Basswood Forests often develop into old-growth forests, because catastrophic disturbances are rare in the community and because the dominant tree species are long-lived (> 250 years). The trend in most stands of Maple-Basswood Forest is toward greater dominance by sugar maple.

Maple-Basswood Forest grades into Oak Forest where the frequency of fire increases in the landscape. It grades into Lowland Hardwood Forest in low areas where elms and ashes become

more abundant and where the water table is at least seasonally within the tree rooting zone. Conifers are absent or uncommon in most of the range of Maple-Basswood Forest, but grow with sugar maple, basswood, and other mesic species in northeastern and southeastern Minnesota. The mixed stands in northeastern Minnesota are classified as Northern Hardwood Forest. In southeastern Minnesota they are classified as White-Pine Hardwood forest.

Undisturbed stands of Maple-Basswood Forest are rare. The soils on which the forest grows are suitable for cultivation so much of the community has been cleared for cropland. Remaining stands have often been grazed or selectively cut for lumber or fuelwood. Heavy grazing causes compaction of the soils and the almost complete destruction of the understory, resulting in even-aged woodlots with large mature trees in the canopy, little reproduction, and few native shrubs and herbs. Selective logging of the less shade-tolerant species (northern red oak, white oak, bitternut hickory, and walnut) has been common since European settlement, and has hastened dominance by sugar maple and basswood in many stands. The composition of the community has also been altered throughout its range by Dutch elm disease, which has killed most of the mature elm trees, and in many stands by the loss of interior groundlayer species following forest fragmentation. Common buckthorn and Tartarian honeysuckle sometimes invade stands of Maple-Basswood Forest, but rarely attain the high densities they may have in Oak Forest. Maple-sugaring is one human activity associated with Maple-Basswood forests that appears to have little impact on the structure and composition of the community, as some of the best remaining tracts of Maple-Basswood Forest have long histories of maple sugar production.

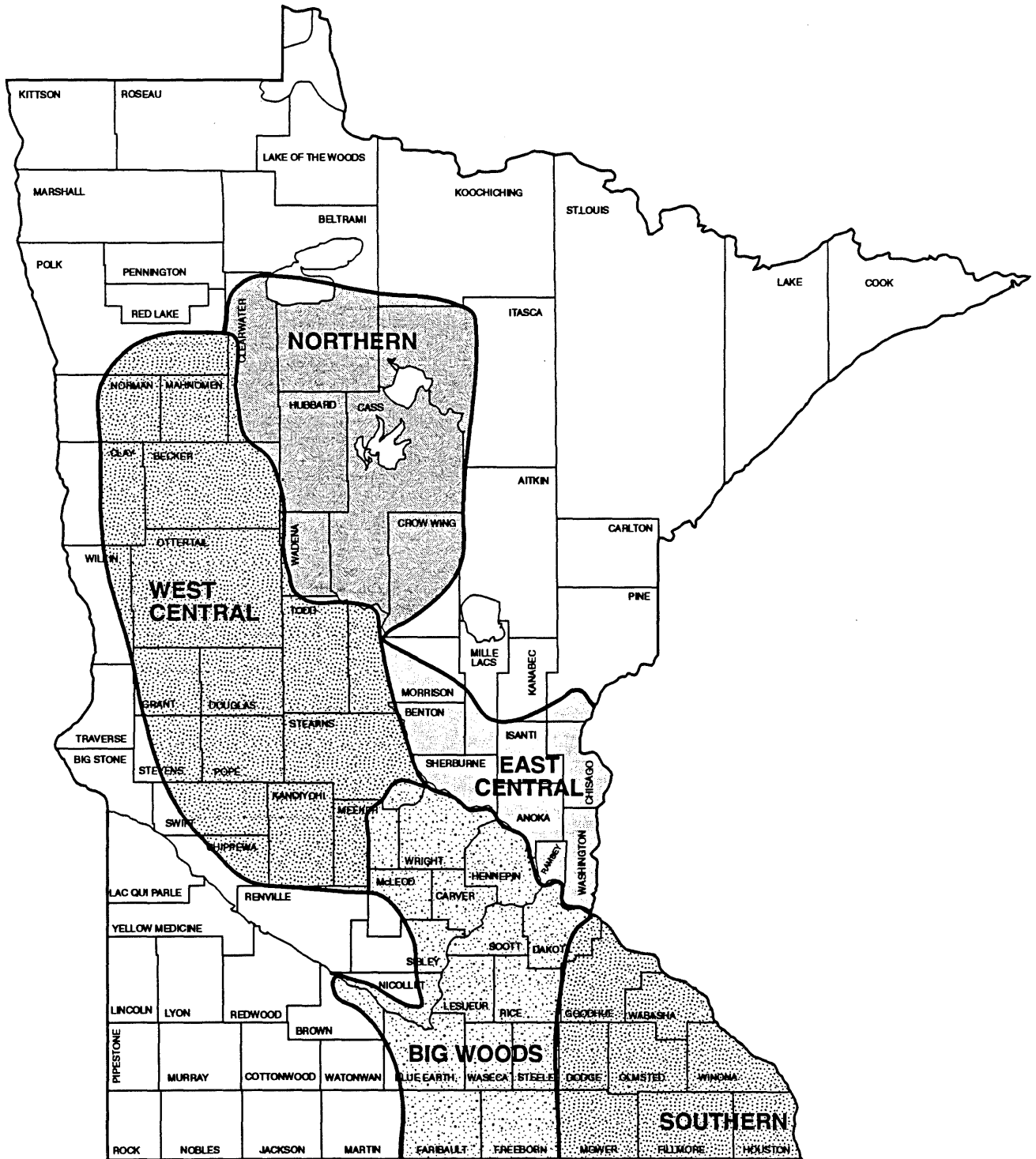
There are five recognized sections of Maple-Basswood Forest (Southeast, Big Woods, East Central, West Central, and Northern, Fig. 5). Subtypes likely will be recognized along a moisture gradient, following analysis of plot data.

Lowland Hardwood Forest

Lowland Hardwood Forest is a wet-mesic forest that is present throughout Minnesota. It is transitional between the terrestrial and palustrine systems, occurring on sites with seasonally high water tables (within the tree-rooting zone) but that do not flood regularly and that have mineral rather than peat soils. In accord with the poorly drained sites on which the Lowland Hardwood Forests occur, species tolerant of periodic soil saturation dominate the tree canopy. American elms and black ashes are common canopy dominants, but most stands are mixed, with slippery elms, rock elms, basswoods, bur oaks, hackberries, yellow birches, green ashes, black ashes, quaking aspens, balsam poplars, and paper birches as important species. The tall-shrub layer is usually discontinuous and is composed of a mixture of upland and lowland shrubs. The groundlayer is composed mostly of upland herbs that do not root to the water-table.

Lowland Hardwood Forest usually occurs in fire-protected areas, although even in unprotected areas the community burns infrequently because the woody vegetation is usually hydrated, especially in the spring. Lowland Hardwood Forest soils differ from Hardwood Swamp Forest soils by being mineral rather than peaty and from the mineral soils of other mesic upland forest types by being seasonally saturated (at depths greater than 0.5 meters).

Figure 5. The Southeast, Big Woods, East Central, West Central, and Northern Sections of Maple-Basswood Forest.



Lowland Hardwood Forest is often composed of late-successional species, but few stands in Minnesota have old canopy trees, presumably because of windthrow and infrequent episodes of killing floods. Lowland Hardwood Forest is topographically transitional between upland forests and forested peatlands and is best developed on flat terrain where such transition zones are broad (e.g., on river terraces above normal flood levels, on loamy ground moraine, and on drumlin fields).

Currently, there are no recognized subtypes or sections of Lowland Hardwood Forest. Following further field review, stands of Lowland Hardwood Forest may be reclassified as wet subtypes of Aspen-Birch or Aspen Forest, or dry subtypes of Hardwood Swamp Forest.

CONIFEROUS FOREST

Coniferous Forests are upland forest communities that occur mainly in the conifer-hardwood forest zone (Fig. 1) but also as small stands on the Paleozoic Plateau in southeastern Minnesota (Fig. 3) and in other parts of the deciduous forest-woodland zone. In general, Red Pine Forest and Jack Pine Forest occur on dry fire-prone sites, while forests composed of northern conifers (such as white spruce, balsam fir, white cedar, and black spruce) occur on mesic fire-protected sites. White Pine Forest occurs on sites ranging from wet to dry. In areas prone to fire or other disturbances, aspen and paper birch trees are common deciduous associates. In fire-protected areas, mesic northern hardwoods, such as sugar maple, basswood, and yellow birch, are common associates. The tall-shrub layer ranges from continuous to sparse, and varies locally in composition. The groundlayer is composed primarily of forest (rather than prairie) herbs, and often feathermosses. Herbs capable of growing in acid needle litter--such as clintonia (*Clintonia borealis*), partridge-berry (*Mitchella repens*), and rose twisted-stalk (*Streptopus roseus*)--and herbs that commonly grow among feathermosses--such as wintergreen (*Gaultheria procumbens*), pyrola (*Pyrola* spp.), and cow-wheat (*Melampyrum linneare*)--are characteristic of Coniferous Forests.

The canopy trees of Coniferous Forests sometimes occur in mixtures, but often form relatively pure stands. The pines all require fire for stand regeneration, however the fire regime differs among the species (see below). White spruce and white cedar are sensitive to fire and occur in areas that rarely burn. Black spruce is adapted to fire as it has semi-serotinous cones. In extreme northern Minnesota trees growing in Black Spruce Bogs readily seed into adjacent burned uplands.

There are six Coniferous Forest community types in Minnesota, recognized primarily by dominant conifer species and associated fire-regimes:

- a. canopy mostly pine b.
 - b. canopy mostly white pine, often mixed with red pine; mesic hardwoods (Appendix 2) often present as minor components of the canopy; mesic hardwoods and balsam fir are common in the understory; habitat dry-mesic to mesic **White Pine Forest**
 - b. canopy mostly red pine or jack pine; oak and boreal hardwoods (Appendix 2) are occasional canopy associates; habitat dry to dry-mesic c.
 - c. canopy < 70% jack pine **Red Pine Forest**
 - c. canopy > 70% jack pine **Jack Pine Forest**
- a. canopy mostly white spruce, black spruce, white cedar, or balsam fir d.
 - d. canopy mostly white spruce, black spruce, or balsam fir e.

- e. canopy mostly black spruce *Black Spruce - Feathermoss Forest*
- e. canopy mostly white spruce or balsam fir *Spruce - Fir Forest*
- d. canopy mostly white cedar *Upland White Cedar Forest*

White Pine Forest

White Pine Forest is a dry to dry-mesic coniferous forest present mainly in the conifer-hardwood forest zone and occasionally in the deciduous forest-woodland zone (Fig. 1). White pine trees dominate the canopy. They may be mixed with red pines and hardwoods, especially paper birches. Stands that originate following fire are often composed almost entirely of even-aged white pines. In the absence of periodic ground fires, hardwoods and other conifers increase in and dominate the understory. Balsam fir, white spruce, and white cedar are important in the understory in northeastern Minnesota, while southward sugar maple, northern red oak, red maple, and ironwood are important understory species. Stands of White Pine Forest usually have a moderately developed tall-shrub layer composed of bush honeysuckle, beaked hazel, mountain maple, round-leaved dogwood, and downy arrowwood. Prevalent groundlayer herbs include large-leaved aster (*Aster macrophyllus*), Canada mayflower (*Maianthemum canadense*), wild sarsaparilla (*Aralia nudicaulis*), bunchberry (*Cornus canadensis*), and common strawberry (*Fragaria virginiana*).

White Pine Forest occurs on moister sites--that typically burned less intensely in the past--than Red Pine Forest. White pine grows best on moderately well-drained deep loams and sandy loams. In northern Minnesota the best-developed White Pine Forests occur on mesic sites along lake margins and lower slopes. In north-central Minnesota, White Pine Forest occurs mostly on glacial till, while mixtures of white pine and red pine occur frequently on rugged moraines.

White Pine Forest is an early successional community, but is long lasting because white pine may live for several hundred years and can replace itself by gap-phase reproduction. White Pine Forest is a major old-growth forest type in Minnesota, although recruitment of white pine into the tree canopy is greatly reduced in parts of Minnesota (especially the northeast) where conditions are conducive to infestation by white pine blister rust. In northern Minnesota, White Pine Forest grades into Red Pine Forest on drier sites or where there is high fire frequency.

There are three recognized sections of White Pine Forest in Minnesota (Southeast, Central, and Northeast, Fig. 6).

Red Pine Forest

Red Pine Forest occurs in the conifer-hardwood forest zone (Fig. 1) on landforms where fires are common. These include areas of thin soil over bedrock, and coarse-textured ice-contact

The map displays the 37 counties of Minnesota, categorized into three regions:

- CENTRAL** (Stippled shading): Beltrami, Cass, Crow Wing, Hubbard, Itasca, Kandiyohi, Marshall, McLeod, Mower, Nicollet, Renville, Sibley, Stearns, Todd, and Wabasha.
- NORTHEAST** (Cross-hatch shading): Carlton, Pine, St. Louis, and Washington.
- SOUTHEASTERN** (Diagonal line shading): Goodhue, Wabasha, and Winona.

Unshaded counties include: Kittson, Roseau, Marshall, Polk, Pennington, Red Lake, Norman, Mahoning, Clay, Becker, Wilkin, Ottertail, Grant, Douglas, Traverse, Big Stone, Stevens, Pope, Swift, Chippewa, Lac Qui Parle, Lincoln, Lyon, Redwood, Pipestone, Murray, Cottonwood, Watonwan, Blue Earth, Waseca, Steele, Dodge, Olmsted, Houston, Rock, Nobles, Jackson, Martin, Faribault, Freeborn, Mower, Fillmore, and Houston.

features such as ice-contact moraines, tunnel valleys, and kames. Red pine trees dominate the canopy, which also contains lesser amounts of jack pines on dry sites and white pines, white spruces, or balsam firs on mesic sites. Hardwoods, including paper birches, northern red oaks, red maples, and quaking aspens, sometimes form a subcanopy beneath the pine canopy. The tall-shrub layer is usually patchy, and is composed mostly of beaked hazel and junberry. The groundlayer is composed of forest herbs and feathermosses. A continuous (>75%) cover of mosses (with *Pleurozium schreberi* being dominant) is common in shrub canopy openings.

Red Pine Forest is a fire-maintained community. Reconstructions of the fire regime using fire scars on red pine trees suggest that a combination of ground fires every 20 or so years and severe crown fires every 100 to 150 years were characteristic in the community before logging, settlement, and fire suppression. The ground fires kept the understory relatively open and exposed mineral soils for seed germination and continued regeneration of red pine. In the absence of fire, many of Minnesota's native red pine stands have become much brushier or are beginning to succeed to forests of mesic hardwoods and white pine. Except for some areas in the BWCAW, the Chippewa National Forest, and Itasca State Park, most of the native red pine groves have been converted by logging to other forest community types (especially Mixed Pine-Hardwood Forest) composed of the minor canopy species usually present in Red Pine Forests.

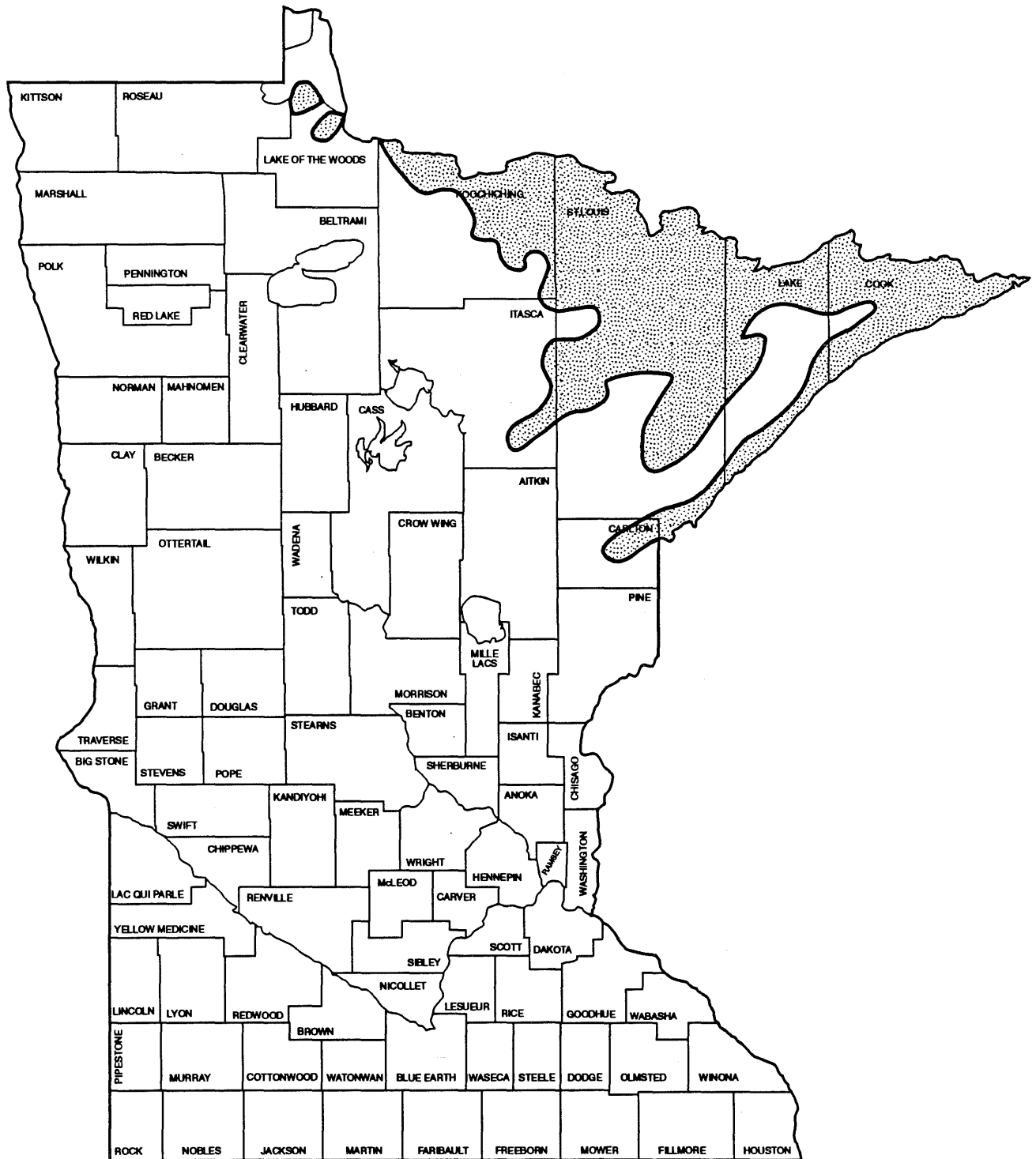
Floristic differences between stands of Red Pine Forest on the Canadian Shield and those on ice-contact features to the southwest may result in identification of Red Pine Forest subtypes. On dry-mesic sites, Red Pine Forest grades into Jack Pine Forest or Mixed Pine-Hardwood Forest. On mesic sites and sites with less frequent fire, Red Pine Forest grades into or succeeds to White Pine Forest, Boreal Hardwood-Coniferous Forest, or Northern Hardwood-Coniferous Forest.

Jack Pine Forest

Jack Pine Forest occurs on dry to dry-mesic, fire-prone sites in the conifer-hardwood forest zone (Fig. 1). On the dry sites, jack pine trees usually form almost pure stands. On the dry-mesic sites, oaks, balsam firs, black spruces, and red pines may be present with the jack pines as minor canopy codominants. The composition of the understory in the community is highly variable, with regional floristic differences between stands on the Canadian Shield of northeastern Minnesota (Fig. 7) and those on outwash plains in central Minnesota, and local differences (correlating with differences in soil organic matter) among stands on the outwash plains. Descriptions of the understory vegetation appear below, in descriptions of the subtypes of the community.

Jack Pine Forest is dependent on fire for regeneration. On the Canadian Shield, jack pines are of the closed-cone (serotinous) ecotype. Therefore the regeneration of the community usually occurs following intense forest fires that open the cones and burn away the forest litter, exposing mineral seedbeds. These stands are even aged, usually originating from a single hot fire. On outwash plains southwest of the Canadian Shield, jack pines are of the open-cone ecotype, with (at least some) cones opening up eventually with age or during hot weather. In

Figure 7. The Canadian Shield in Northeastern Minnesota.



these stands, most pine regeneration still occurs immediately following fires. If pine regeneration is poor following a fire, aspens and birches may seed into a site for several years along with jack pines, but eventually are supplanted by the jack pines. Stands of jack pines in the outwash plains often have cohorts of seedling- and sapling-sized jack pines that presumably are the offspring of parent trees that have survived minor disturbances (such as ground fires).

There are three recognized sections of Jack Pine Forest, the Central Section, the Northeast Section, and the Northwest Section (Fig. 8). The Northeast Section (which occurs primarily on the Canadian Shield) has three subtypes: Jack Pine-Oak, Jack Pine-Fir, and Jack Pine-Black Spruce. The Jack Pine-Oak Subtype occurs on rocky ridges. It is strongly dominated by jack pine, with an understory of northern red oak and red maple saplings and a groundlayer of drought-resistant forbs and grasses. This subtype often grades into Northern Coniferous Woodland. The Jack Pine-Fir Subtype occurs on relatively deep soils, often on north-facing slopes. It has saplings of balsam fir, paper birch, or black spruce in the understory, a well-developed shrub layer composed of beaked hazel, mountain maple, fly honeysuckle, and round-leaved dogwood, and a groundlayer of dry-mesic forest herbs (especially large-leaved aster (*Aster macrophyllus*)) and grasses. The Jack Pine-Black Spruce Subtype is dominated by jack pine, with black spruce trees, saplings, and seedlings present. It has a low-shrub layer of bush honeysuckle and blueberry, few forbs, and a cover of feathermosses. It often grades into Black Spruce-Feathermoss Forest.

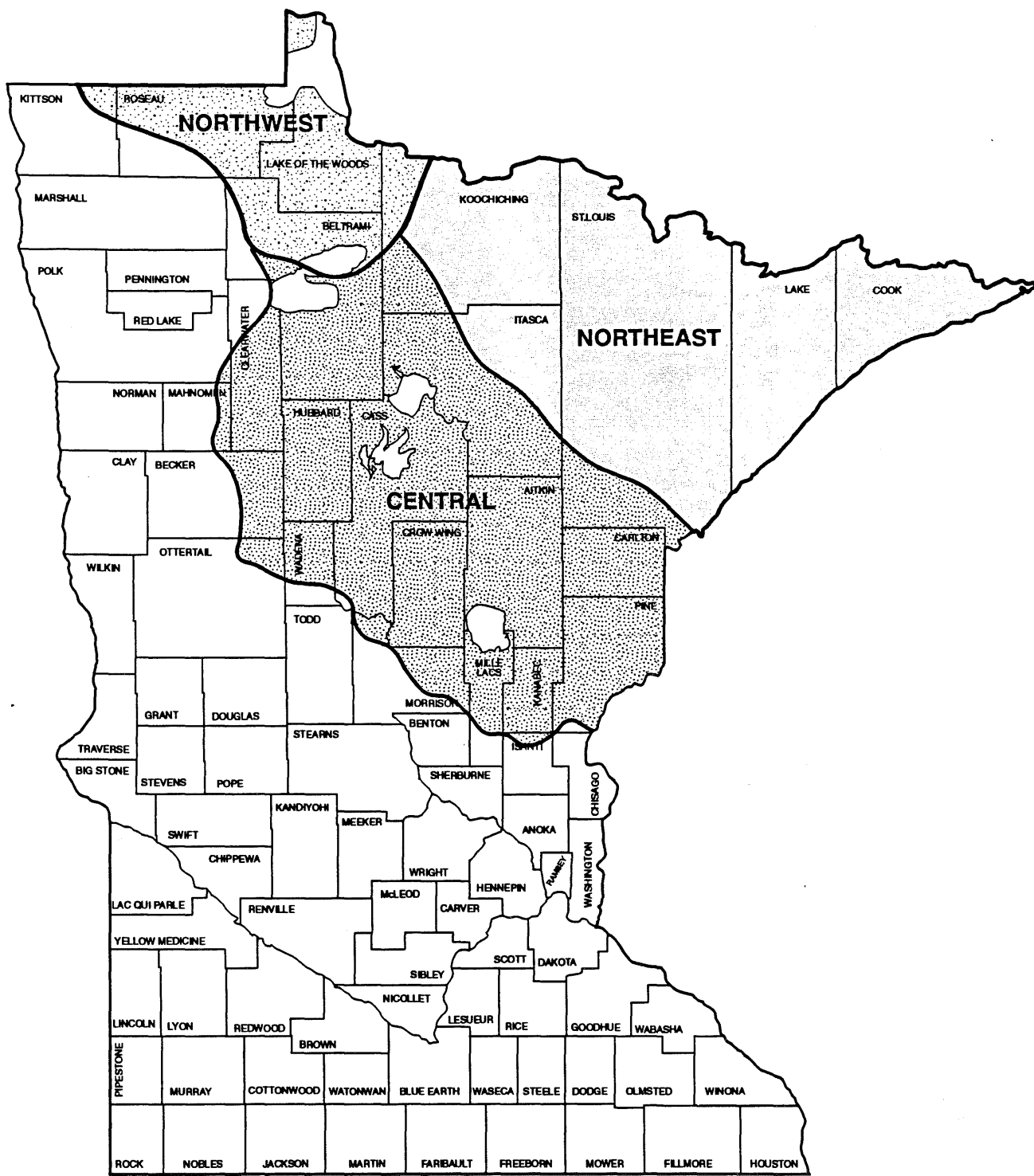
The Central Outwash Plain Section has two recognized subtypes. The most common is the Hazel Subtype, which has red pines and paper birches as common canopy or understory associates, and abundant tall shrubs including beaked hazel, junberry, and downy arrowwood. The groundlayer is composed of forest species. Soils usually have greater than 2.5% organic matter. These stands grade into Red Pine forest. The less common subtype, the Blueberry Subtype, consists of nearly pure stands of jack pines with very few, if any, tall shrubs. The groundlayer is composed of feathermosses, ericaceous half-shrubs (especially blueberries), and prairie forbs and grasses. These open stands usually occur on soils with less than 2.5% organic matter. Structurally, they resemble Black Spruce-Feathermoss Forests and the Jack Pine-Black Spruce Subtype of the Northeast Section.

The Northwest Section is centered on the Beltrami Island Highland south of Lake of the Woods. Most stands occur on poor sandy soils on beach ridge-dune complexes, although there are some outlying stands on areas of wave-washed till in the Agassiz Lake Plain. On sandy sites the understory usually is open and depauperate and composed mainly of upland forest herbs, although stands on sites with fine sand soils or high water tables sometimes have brushy understories. Stands on areas of till have more diverse understories, with denser shrub layers and more species of mesic herbs than the stands on sandy soils. Occurrences of Jack Pine Forest in the Northwest Section may grade into Black Spruce Forests in adjacent low areas.

Black Spruce - Feather Moss Forest

Black Spruce-Feather Moss Forest occurs in the conifer-hardwood forest zone (Fig. 1) in

Figure 8. The Central, Northeast and Northwest Sections of Jack Pine Forest.



northeastern Minnesota, primarily in the BWCA and surrounding areas. It is the only upland forest community in which black spruces dominate the tree canopy. Jack pines are also sometimes present in the canopy, along with lesser amounts of balsam fir, quaking aspen, white spruce, paper birch, and other tree species. Although the understory in the community typically is open, clumps of black spruce and other tree saplings sometimes form a tall-shrub layer. The low-shrub layer and herb layer are depauperate and usually dominated by ericaceous species, although bunchberry (*Cornus canadensis*) is abundant on some sites. The moss layer is conspicuous, continuous, and dominated by feathermosses (e.g., *Pleurozium schreberi*). Black Spruce - Feathermoss Forest sometimes intergrades with Jack Pine Forest (Jack Pine - Black Spruce Subtype).

Spruce-Fir Forest

Spruce-Fir Forest is a mesic coniferous forest of the northern portion of the conifer-hardwood forest zone (Fig.1). The canopy is dominated by white spruce or balsam fir, or a combination of these species with black spruce. White spruce and balsam fir are shade-tolerant, late-successional species, but they often occur on landscapes where fire frequencies are high. White spruce and, especially, balsam fir are susceptible to periodic outbreaks of spruce budworm. Structurally, the understory of Spruce-Fir Forest is quite variable.

Spruce-Fir Forest grades into Boreal Hardwood-Conifer Forest where hardwoods increase in abundance, and into Upland White Cedar Forest on sites with richer, moister soils. Old-growth Spruce-Fir Forest may develop on sites protected from catastrophic disturbance. Where deer populations are low, some stands of Spruce-Fir Forest eventually succeed to Upland White Cedar Forest.

There are two recognized subtypes of Spruce-Fir Forest, a Fir-Birch subtype, and a White Spruce-Balsam Fir subtype. These subtypes were delimited primarily from plant associations described in the scientific literature. The Fir-Birch Subtype is dominated by balsam fir and paper birch, and often contains black spruce and white cedar, and small amounts of white spruce, quaking aspen, white pine and mountain ash. The White Spruce-Balsam Fir Subtype has a canopy dominated by white spruce, with lesser amounts of balsam fir. The tall-shrub layer in this subtype is moderately dense, and is composed of balsam fir saplings, mountain maples, and beaked hazels. Some stands may have a poorly developed shrub layer, and a groundlayer of feather mosses.

Upland White Cedar Forest

Upland White Cedar Forest is a mesic to wet-mesic coniferous forest of upland sites. It occurs almost exclusively in the conifer-hardwood forest zone (Fig. 1) (there are two known outlying stands in the Mississippi River Valley in extreme southeastern Minnesota). Within the conifer-hardwood forest zone, the community is most common in northeastern Minnesota, especially near the north shore of Lake Superior.

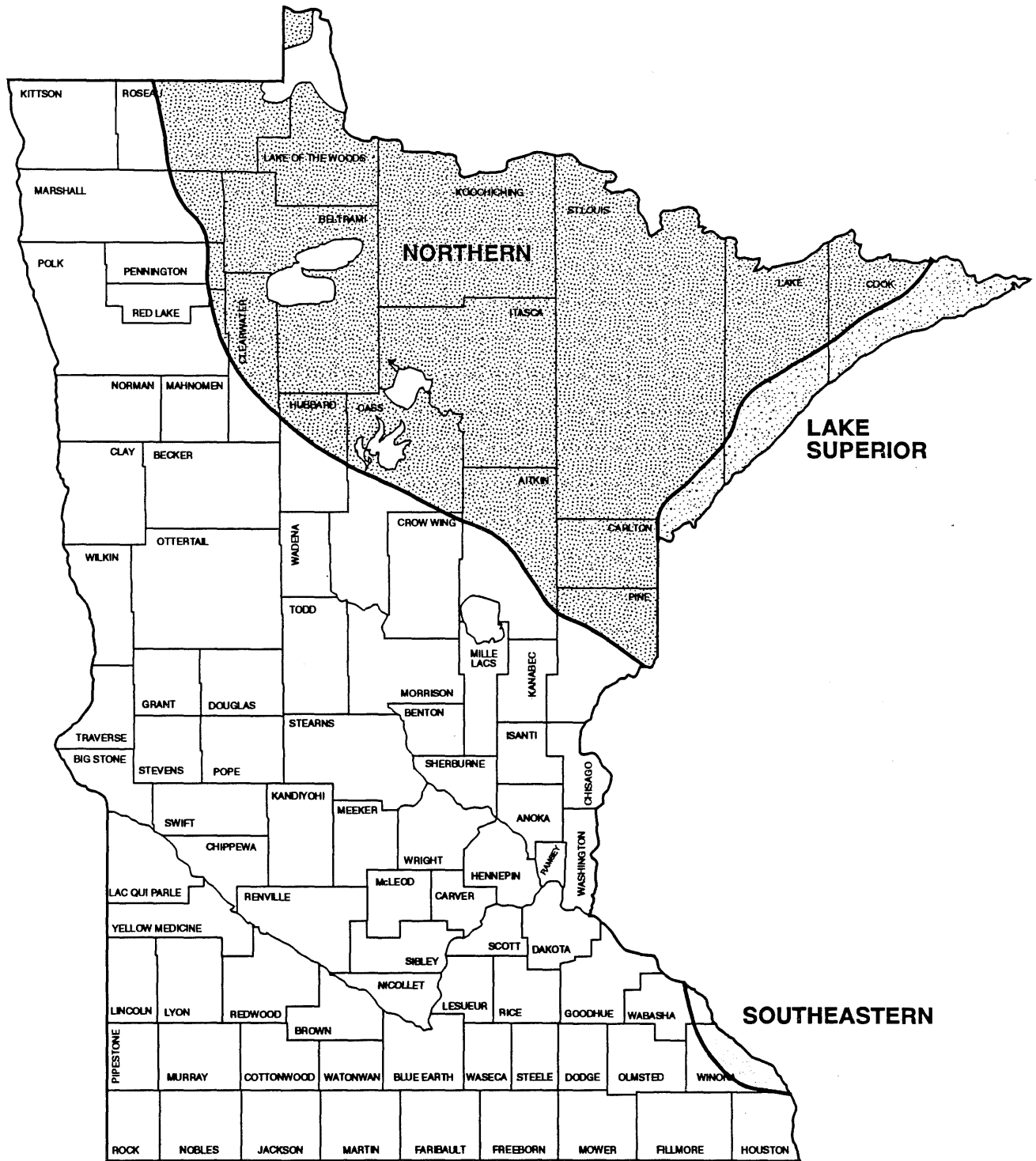
The canopy of Upland White Cedar Forest is dominated by white cedar, which may occur in extensive, nearly pure stands, in mixtures with other canopy species, or as small groves in a matrix of brushy forest. The most common subdominant canopy species are balsam fir, yellow birch, paper birch, white spruce, and black spruce. Older stands have many fallen logs and leaning trees.

Deciduous shrubs (especially mountain maple, with smaller amounts of speckled alder and beaked hazel) and conifer seedlings and saplings (spruce and especially balsam fir) dominate the understory of the community. The groundlayer contains a variety of species characteristic of mesic to wet-mesic sites; starflower (*Trientalis borealis*), wild sarsaparilla (*Aralia nudicaulis*), clintonia (*Clintonia borealis*), oak fern (*Gymnocarpium dryopteris*), large-leaved aster (*Aster macrophyllus*), bunchberry (*Cornus canadensis*), and dwarf blackberry (*Rubus pubescens*) are common. Three-flowered bedstraw (*Galium triflorum*) and naked bishop's-cap (*Mitella nuda*) are modal species in the community. In general, the understory and groundlayer of Upland White Cedar Forest are rich in species in stands on level, wet-mesic sites and less diverse on drier slopes.

Many of the existing Upland White Cedar Forests are over 100 years old and forests on some sites are well over 200 years old. These old-growth forests occur in fire-protected areas, typically on mineral soils. Upland White Cedar Forest occurs on diverse topographies, from very steep, well-drained slopes to gentle, wet-mesic slopes that grade into depressions containing White Cedar Swamp or other lowland types. Along the north shore of Lake Superior, Upland White Cedar Forest occurs downslope from Northern Hardwood Forest and upslope from several lowland conifer forest types. Soils in Upland White Cedar Forests tend to have relatively high levels of calcium. It appears that many of the existing stands of the community originated following catastrophic fires on sites where fire is usually rare. Browsing by deer can have a significant impact on white cedar reproduction; in areas with moderate to high deer populations, few white cedars reach the sapling size class or grow into the canopy. Where white cedar reproduction is poor, some occurrences of the community appear to be succeeding to Northern Hardwood Forest dominated by yellow birch, while others may succeed to Spruce-Fir Forest.

There are three recognized geographic sections of Upland White Cedar Forest, the Northern Section, the Lake Superior Section, and the Southeast Section (Fig. 9). Mesic and Wet-Mesic subtypes occur in the Northern and Lake Superior sections.

Figure 9. The Southeast, Northern, and Lake Superior Sections of Upland White Cedar Forest.



MIXED CONIFEROUS-DECIDUOUS FOREST

Mixed Coniferous-Deciduous Forests are upland forest communities made up of significant amounts of both coniferous trees and broad-leaved deciduous trees. They are most common in the conifer-hardwood forest zone but also occur in the deciduous forest-woodland zone (Fig. 1). The communities in this class occur on dry to wet-mesic sites, may be early successional or late successional, and originate following either natural catastrophic disturbance or clear-cutting. The logging and burning of Coniferous forests that came with European settlement caused widespread loss of pine seed sources and the subsequent conversion of large acreages of Coniferous Forests to Mixed Coniferous-Deciduous Forests and Deciduous Forests.

There are four Mixed Coniferous-Deciduous Forest community types, which are delimited by dominant canopy species. The abundance and distributions of these dominant canopy species are determined mainly by landform, soils, and the frequency and nature of disturbance at a site.

a. canopy a mixture of jack pine, red pine, or white pine with oak, aspen, or paper birch; habitat dry to dry-mesic; early to mid-successional community; dominant canopy trees usually even-aged; evidence of fire or other disturbances common b.

b. conifers predominantly jack pine, red pine, or a mixture of the two; a community primarily of the conifer-hardwood forest zone (Fig. 1) *Mixed Pine-Hardwood Forest*

b. conifers predominantly white pine; a community primarily of the deciduous forest-woodland zone/conifer-hardwood forest zone transition, or of the Paleozoic Plateau of southeastern Minnesota (Fig. 3) *White Pine-Hardwood Forest*

a. canopy a mixture of white pine, balsam fir, white spruce, or white cedar with hardwoods; habitat mesic to wet-mesic; early to late-successional community; dominant canopy trees usually uneven-aged, although boreal hardwood species in canopy may be even-aged; evidence of fire or disturbances other than windthrow absent or restricted to the oldest individual trees c.

c. hardwood component composed of boreal species such as aspen and paper birch; red maple is often a significant component, especially in the subcanopy; community present only to the conifer-hardwood forest zone (Fig. 1) ... *Boreal Hardwood-Conifer Forest*

c. hardwood component dominated by northern, long-lived, shade-tolerant species, especially sugar maple and yellow birch; basswood, northern red oak, green ash, black ash, American elm, and slippery elm also sometimes present in the canopy; community of the conifer-hardwood forest zone (Fig. 1) and the Paleozoic Plateau (Fig. 3) *Northern Hardwood-Conifer Forest*

Mixed Pine-Hardwood Forest

Mixed Pine-Hardwood Forest is a dry to dry-mesic forest of the conifer-hardwood forest and deciduous forest-woodland zones (Fig. 1). Red pines or jack pines, or both, are important in the canopy, along with aspens, paper birches, and oaks. Mixed Pine-Hardwood Forest generally occurs on sites with coarse-textured soils where pre-European settlement fires were frequent and intense. Mixed Pine-Hardwood Forest is most common on sandy outwash plains, but also occurs on morainal topography.

White Pine-Hardwood Forest

White Pine-Hardwood Forest occurs on dry to dry-mesic sites in the deciduous forest-woodland zone (Fig. 1). White pines are the only conifers in the canopy and often form a supercanopy above the hardwood canopy. Northern red oak is an important canopy species along with sugar maple, white oak, and, in southeastern Minnesota, black oak and white ash. Eastern red cedars are often abundant in disturbed (especially by grazing) southeastern forests. On the Anoka Sandplain and in the St. Croix River Valley, the most common deciduous species in the canopy are northern pin oak and big-toothed aspen. The understory of the community commonly contains species that are common also in dry-mesic Maple-Basswood Forests and mesic Oak Forests.

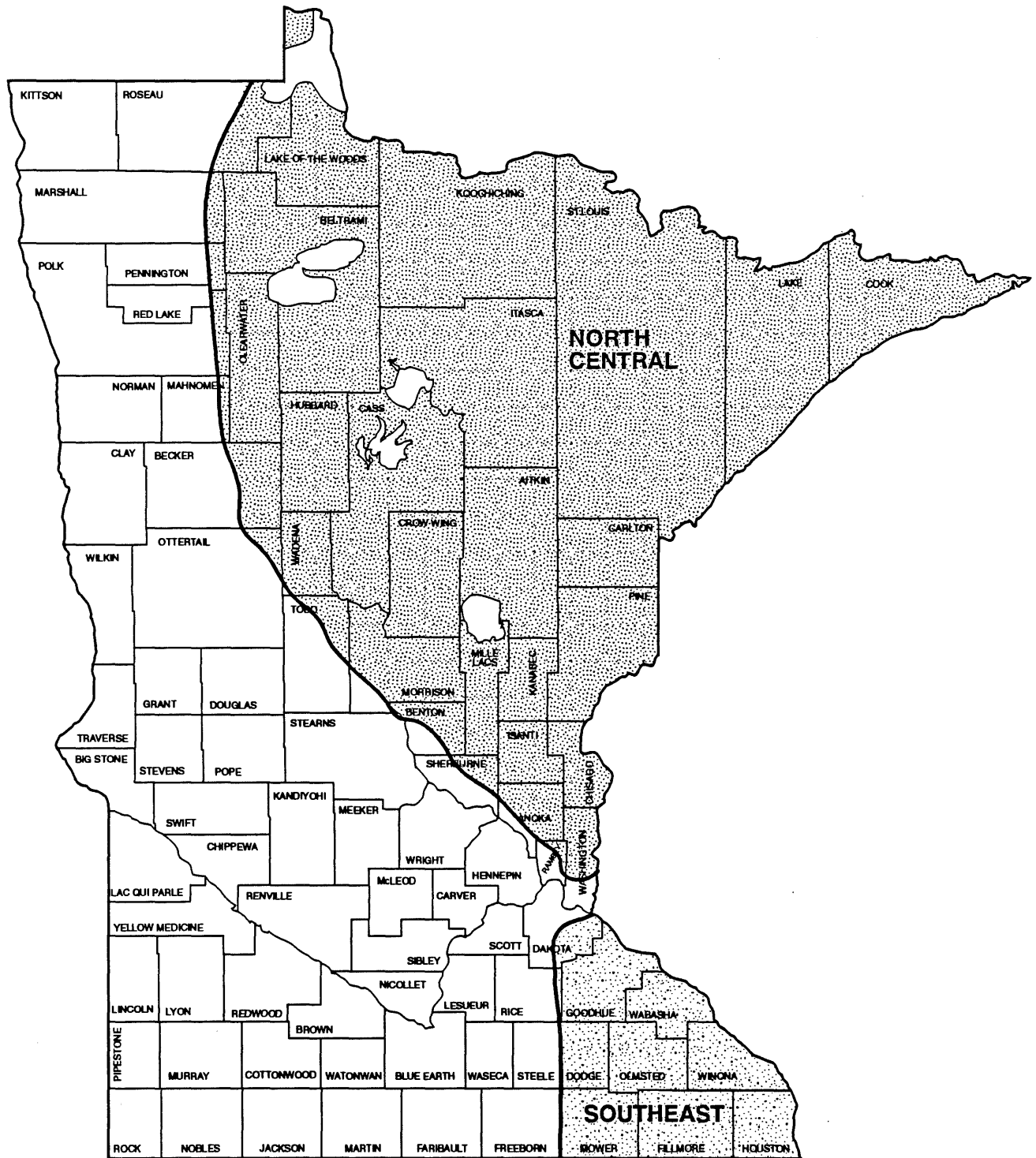
White Pine-Hardwood Forest occurs on sites with well-drained to excessively well-drained sandy loams or coarser soils, and on slopes. It is generally a mid-successional community, with some potential for developing into old-growth forest because of the longevity of white pines, the oaks, and sugar maples. In the southern and western part of its range, White Pine-Hardwood forest often grades into Maple-Basswood Forest on dry-mesic sites, and into Mixed Oak Forest on dry sites. In the northern part of its range the community commonly grades into White Pine Forest.

There are two recognized sections of White Pine-Hardwood Forest, the Southeast Section and the North-Central Section (Fig. 10). The Southeast Section has two subtypes, the Dry Subtype and the Mesic Subtype.

Boreal Hardwood-Conifer Forest

Boreal Hardwood-Conifer Forest occurs in the conifer-hardwood forest zone of northern Minnesota (Fig. 1). The tree canopy is dominated by a mixture of early successional hardwoods (primarily quaking aspen, paper birch, and red maple) and conifers (balsam fir, white spruce, white pine, jack pine, white cedar and black spruce). The proportions of these canopy trees vary significantly, in accordance with variation in soil depth and texture. Balsam fir, however, is important in the understory of Boreal Hardwood-Conifer Forests throughout the range of the community.

Figure 10. The Southeast and North Central Sections of White Pine-Hardwood Forest.



Mountain maple and beaked hazel are important species in the tall-shrub layer, which tends to be moderately dense. The low-shrub layer is not usually well-developed. Balsam fir dominates the seedling layer, but seedlings of other conifers and red maple are also sometimes important. The herb layer reflects the community's close affinity to Aspen-Birch Forest and Spruce-Fir Forest. Large-leaved aster (*Aster macrophyllus*) is the most important herbaceous species in the community, except in northwestern Minnesota, where it is replaced by Lindley's aster (*Aster ciliolatus*). Canada mayflower (*Maianthemum canadense*), clintonia (*Clintonia borealis*), bunchberry (*Cornus canadensis*), and wild sarsaparilla (*Aralia nudicaulis*) are common in the community throughout its range. Relatively high frequencies of twin-flower (*Linnaea borealis*) and starflower (*Trientalis borealis*) distinguish Boreal Hardwood-Conifer Forests from Aspen-Birch Forests.

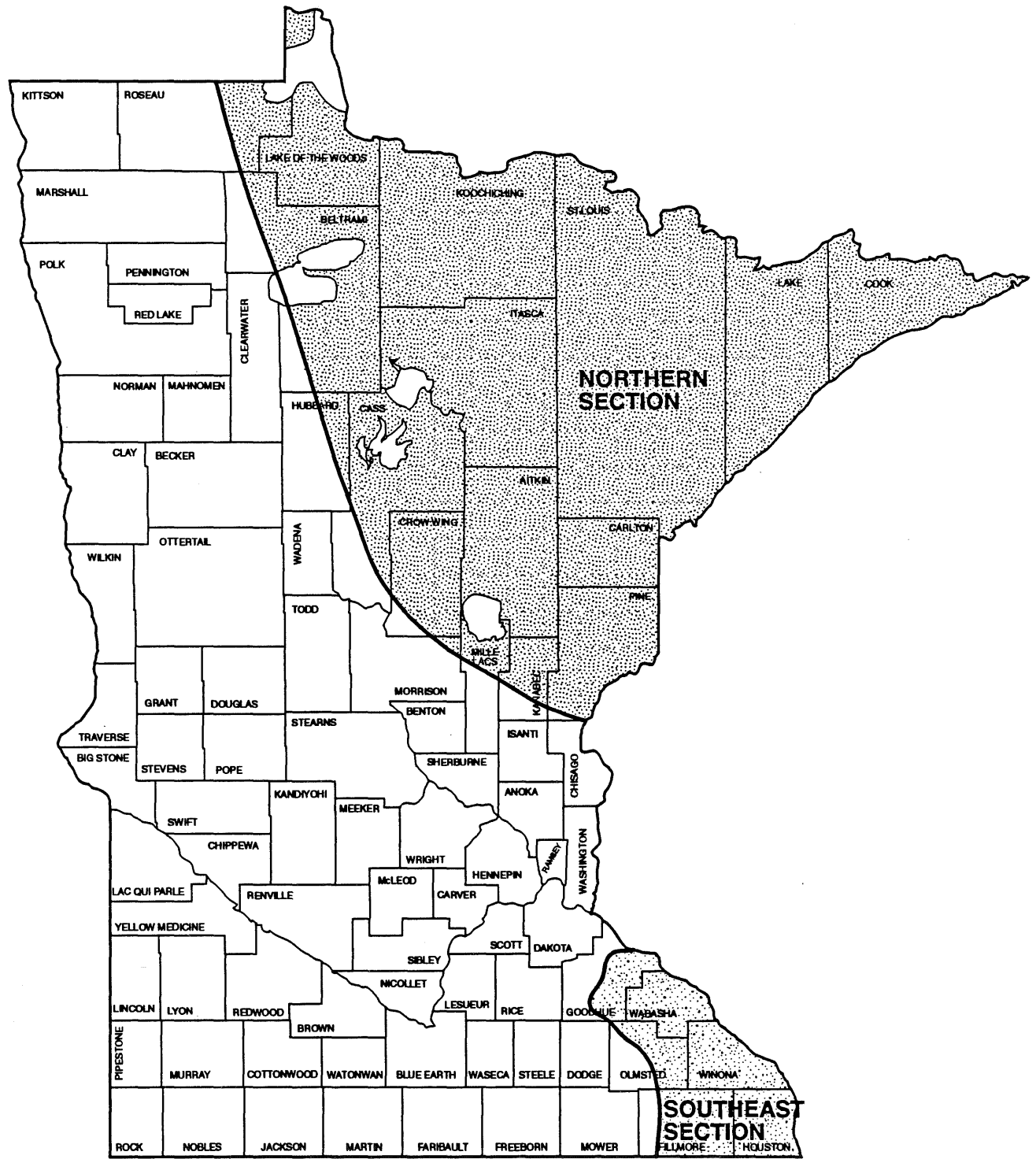
Boreal Hardwood-Conifer Forest is an early to mid-successional community that develops following forest fires or logging. If undisturbed, it tends to succeed to Spruce-Fir Forest or Upland White Cedar Forest. Boreal Hardwood-Conifer forest grades into Mixed Pine-Hardwood Forest on more xeric sites, into Aspen-Birch Forest where quaking aspens and paper birches become abundant, into Upland White Cedar where white cedars become more abundant, and into Northern Hardwood-Conifer Forest where sugar maples, basswoods and yellow birches become more abundant.

Northern Hardwood - Conifer Forest

Northern Hardwood-Conifer Forest is a mesic forest of the conifer-hardwood forest zone (Fig. 1). The canopy is dominated by sugar maples or yellow birches, or both, along with whites pine, white spruces, white cedars, and balsam firs. Northern Hardwood-Conifer Forest occurs on moist sites but also occasionally on dry-mesic sites. The community is similar to Northern Hardwood Forest, but has a greater proportion of coniferous trees in its canopy. Northern Hardwood-Conifer Forest is a late- to mid-successional community, and is an important old-growth type. It commonly grades into Northern Hardwood Forest and Upland White Cedar Forest along the north shore of Lake Superior in northeastern Minnesota.

There are two sections of Northern Hardwood-Conifer Forest, a Southeast Section and a Northern Section (Fig. 11). In southeastern Minnesota, Northern Hardwood - Conifer Forest occurs on the Paleozoic Plateau (Fig. 3), typically as small stands on steep north-facing slopes. One subtype is present in the Northern Section of Northern Hardwood - Conifer Forest, the Yellow Birch-White Cedar Subtype, which develops on mesic to wet-mesic sites and has a canopy dominated by yellow birches and white cedars.

Figure 11. The Southeast and Northern Sections of Northern Hardwood-Conifer Forest.



DECIDUOUS WOODLAND

Deciduous Woodlands are communities of the deciduous forest-woodland zone (Fig. 1), composed primarily of oak or aspen trees (or both) and brush, especially hazelnut and gray-bark dogwood. Deciduous Woodlands have patchy, interrupted tree canopies, much like Deciduous Savannas. However, woodlands differ from savannas in that the trees are set in a matrix of brush with, at most, widely scattered prairie openings. (In savannas, the understory vegetation is composed of prairie grasses and forbs.)

In the past, woodlands probably were maintained by a combination of periodic fires, grazing by native herbivores, and intensive use of openings by Native Americans. Fine-scale landscape features that favored tree growth in prairie regions (e.g., rough topography, heavy soils) or that promoted openings in forested regions (e.g., steep slopes, south to west aspects, sandy soils) contributed to the origination and maintenance of Deciduous Woodland. These patterns of openings and wooded areas are apparent only over large areas of the landscape; therefore, woodlands now occur mainly in the more remote areas of Minnesota, where the landscape is relatively unfragmented and large areas of native vegetation remain.

Presently, communities that resemble native woodland are fairly common in Minnesota. However, most of these are disturbance communities that formed recently from the grazing or selective logging of deciduous forests. Many other apparently natural woodlands are savannas in which the prairie understory was replaced by brush following the onset of fire suppression in Minnesota.

There are two recognized types of Deciduous Woodland. These include some of the areas of vegetation described as oak barrens and openings by the early land surveyors, and areas described as scatterings of aspen timber.

a. tree cover > 70% aspen; habitat dry to wet-mesic; terrain typically level to gently rolling
..... *Aspen Woodland*

a. tree cover < 70% aspen; canopy composed of any mixture of oak, green ash, and basswood, with or without aspen; habitat dry to mesic; terrain variable *Oak Woodland -Brushland*

Aspen Woodland

Aspen Woodland occurs primarily in the deciduous forest-woodland zone, with scattered groves in the prairie zone (Fig. 1). Quaking aspen is the dominant canopy species in the community across most of its range. In north-central Minnesota, however, big-toothed aspens occasionally dominate the canopy, and in the northwest, balsam poplars sometimes dominate low, moist areas. Bur oaks and green ashes are common associates throughout the community's range. Stands of Aspen Woodland have either dense canopies of even-aged immature trees,

irregular canopies of young and old trees, or tall, even canopies of mature trees.

The woody understory in the community is well-developed, with 40-90% cover. The understory may contain plants, including tree species, of several different height classes or it may have a well-defined shrub layer. On drier sites, hazelnut, gray-bark dogwood, chokecherry, downy arrowwood, *Rosa* spp., and *Rubus* spp. are common understory shrubs. On wetter sites, the common understory shrubs are red-osier dogwood, gray-bark dogwood, pussy willow, Bebb's willow, bog birch, and meadow sweet. These species are particularly characteristic in Aspen Woodlands in northwestern Minnesota that originated following the invasion of areas of wet-mesic Upland Prairie or Wet Meadow by aspen.

Aspen Woodland is a short-lived, early successional community intermediate between Upland Prairie (including Brush-Prairie) and Aspen or Oak Forests. Before European settlement, the distribution of Aspen Woodland in the prairie zone was determined by fire, with the community occurring in areas where fires were less frequent and intense than in open prairie areas. In the deciduous forest-woodland zone, Aspen Woodland probably was maintained by fire and occurred in association with Oak Forest, Aspen Forest, and some pine forests. Aspen Woodland has become more abundant in northwestern Minnesota because of fire suppression and perhaps wetland draining. Communities that originate following logging in the deciduous forest-woodland and conifer-hardwood forest zones often resemble Aspen Woodland but are not considered true Aspen Woodlands in this classification. When Aspen Woodland occurs with other related community types, such as Brush-Prairie and Aspen Openings, it tends to occur as narrow ecotonal bands between the other types or as small inclusions, and may be ignored in mapping.

There are insufficient data to delimit sections or subtypes of Aspen Woodland at this time. However, upland and lowland subtypes may be warranted, and a geographic section centered on the aspen parkland of northwestern Minnesota has been proposed. Further evaluation is necessary.

Oak Woodland - Brushland

Oak Woodland-Brushland occurs on dry to mesic sites throughout the deciduous forest-woodland zone and locally in the prairie zone near the ecotone between the prairie zone and the deciduous forest-woodland zone (Fig. 1). Oak Woodland is floristically and structurally intermediate between Oak Savanna and Oak Forest, with a patchy tree canopy and an understory dominated by shrubs and tree saplings.

The principal species in the tree canopy are bur oak, northern pin oak, white oak, and northern red oak. Aspens may form up to 70% of the tree canopy cover. The brush layer ranges in density from sparse (with 10-30% cover), to an impenetrable thicket. It is often especially dense in openings between clumps or groves of trees. Most of the floristic diversity in the community exists in the brush layer, which most commonly is composed of blackberries, raspberries, gooseberries, dogwoods, cherries, hazelnuts, prickly ashes, and sprouts of oak and

quaking aspen. Prairie vegetation, if present, occurs only in small openings in the tree or shrub canopy. Except in these scattered prairie openings, the herbaceous layer is sparse and floristically poor. It is usually composed of woodland species capable of surviving in the dense shade beneath the brush layer.

Oak Woodland-Brushland is a fire-maintained community. It is most common on rich sites where trees and shrubs grow well but where recurrent fires prevent the formation of true forest. Historically, Oak Woodland-Brushland was probably one of the most extensive community types in Minnesota, comprising much of the vegetation described as oak barrens, brushland, and thickets by the early surveyors. The fires that maintained Oak Woodland-Brushland usually started on nearby prairies. Following the conversion of these prairies to agricultural land, Oak Woodland-Brushland burned less frequently and rapidly succeeded to Oak Forest. Oak Woodland-Brushland is defined broadly enough here to include also communities in which the predominant cover is oak brush or oak-aspen brush (that originated following fire or limited human disturbance) instead of a well-developed tree canopy. There are four geographic sections of Oak Woodland-Brushland in Minnesota (Fig. 12). These sections may be modified in the future as more information becomes available.

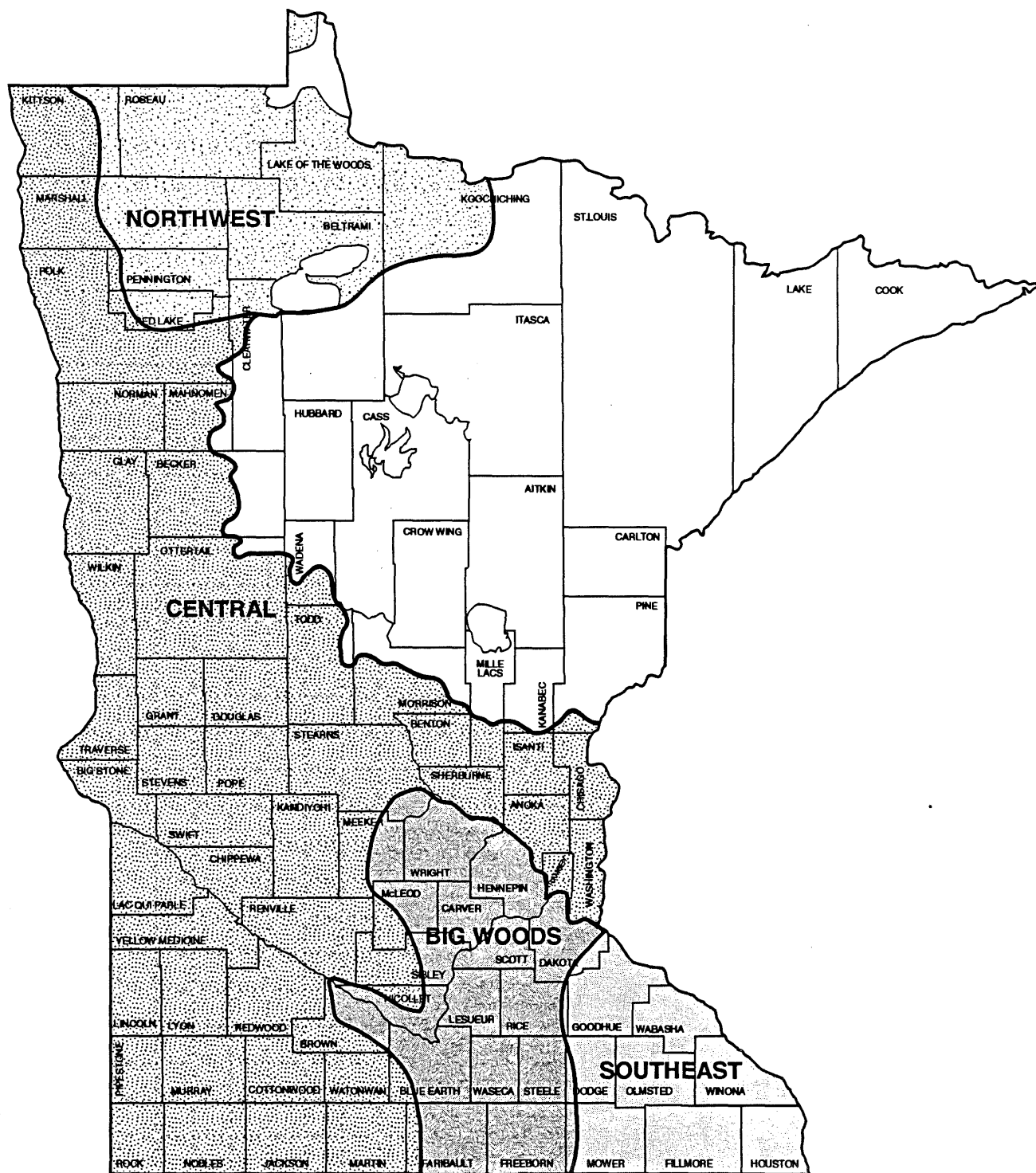
In the Southeast Section, Oak Woodland-Brushland is present on southwest-facing slopes on the bluffs and on outwash terraces of the Mississippi River and its tributaries. It generally occurs on more gentle slopes than Bluff Prairie or on lower slopes below Bluff Prairies. Bur oaks are common canopy dominants and northern red oaks are common associates. Northern pin oaks, basswoods, and black cherries may also occur in the canopy. White oaks are rare and aspens are absent. Chokecherries are common in the shrub layer, with shrub cover averaging 30-50%. On droughty sites with thin soils or steep slopes these woodlands may persist even in the absence of fire.

In the Big Woods Section, woodland dominated by white oak is present in areas with coarse-textured soils, such as on kames or eskers, or in areas prone to occasional fires. Natural woodlands are now extremely rare in this section because of logging, grazing, and fire suppression.

In the Central Section, Oak Woodland-Brushland historically occurred where there were firebreaks (such as on rough dune topography or on steep terrace slopes of the Mississippi River) in fire-prone regions. The dominant canopy species are either bur oak or northern pin oak; aspen are often present. Hazelnuts, chokecherries, gray-bark dogwoods, and *Rubus* spp. are common to abundant in the understory. Woodlands present in dune areas with nutrient-poor, droughty soils appear to persist for long periods even in the absence of fire.

In the Northwest Section, Oak Woodland-Brushland occurs on dry to dry-mesic sites on hilly moraines and glacial lake beach ridges. In the extreme northwest, the only oak species present is bur oak and the trees are often gnarled and relatively short. Aspens (either quaking aspens or balsam poplars or both) are always present. Southward, in Polk County, green ashes are occasionally present in the canopy. Hazelnuts, chokecherries, gray-bark dogwoods, *Viburnum* spp., *Rosa* spp., and *Rubus* spp. are common shrubs.

Figure 12. The Southeast, Big Woods, Central, and Northwest Sections of Oak Woodland-Brushland.



DECIDUOUS SAVANNA

Deciduous Savannas are communities of the prairie zone/deciduous forest-woodland zone transition. They are composed primarily of oak trees or aspen trees, or both, with a groundlayer of prairie species. The oak and aspen trees are distributed either evenly or in scattered groves smaller than 1 to 2 hectares (whether the trees are described as evenly distributed or clumped is of course dependent on the scale at which the vegetation is considered). The oaks have two growth forms: large-diameter open-grown trees, often with fire scars on their trunks, and clusters of spindly sprouts growing from a common root collar. The aspens usually occur in clumps, most often with all of the tree stems in a clump originating from the same root system. Brush is either absent from Deciduous Savanna communities or locally abundant, while prairie openings are always present.

Deciduous Savanna communities are early successional communities. Historically, they appear to have been maintained by fire and by grazing bison and elk. With fire suppression and the destruction of bison and elk herds, many tracts of savanna have succeeded to woodland or forest. Recently grazed woodlots may superficially resemble native savanna (especially in aerial photographs) but degraded forest or woodland lack the native prairie understory always present in ungrazed savannas.

There are three recognized types of Deciduous Savanna. These include community types historically described as oak savanna, oak openings, and oak barrens, or as aspen groves in open prairie.

a. trees most commonly bur oak, occasionally pin oak or (in southeastern Minnesota) black oak; often with some aspen or hazelnut brush; habitat dry to dry-mesic; herbaceous vegetation in open areas composed mostly of prairie species (Appendix 3) OAK SAVANNA b.

b. level to rolling topography, slopes generally $< 10\%$; habitat mesic; soils with mollic epipedon; texture clay loam to loamy fine sand; somewhat poorly to somewhat excessively drained; herbaceous vegetation in opening areas similar to that of Mesic Prairie *Mesic Oak Savanna*

b. undulating to rough topography, slopes of various degrees; habitat dry to dry-mesic; soils with or without mollic epipedon; texture loamy sand to sand on gentle slopes, or any texture on steep slopes; well drained to excessively drained *Dry Oak Savanna*

a. trees most commonly quaking aspen with various amounts of balsam poplar on wetter sites and bur oak on drier sites; habitat dry to wet-mesic, often with locally wet areas; herbaceous vegetation in open areas similar to that of Upland Brush-Prairie or Wet Brush-Prairie *Aspen Openings*

Mesic Oak Savanna

Mesic Oak Savanna is very rare in Minnesota. Historically, it occurred in the prairie and deciduous forest-woodland zones (Fig. 1). The characteristic trees were bur oaks and to a lesser extent northern pin oaks. Northward, quaking aspens were probably common in moister parts of Mesic Oak Savannas. The stature and spacing of the oaks in the community probably varied considerably, primarily with differences in fire history, which were themselves related to differences in soils, landforms, and climate. Grubs and small, gnarly, open-grown trees were probably most common. The distribution of trees ranged from evenly spaced to strongly clumped. Shrub cover, likewise, was probably quite variable. The shrub layer included chokecherries (*Prunus virginiana*), low juneberries (*Amelanchier humilis*), gray-bark dogwoods (*Cornus foemina*), wolfberries (*Symphoricarpos occidentalis*), and on lighter soils, prairie willows (*Salix humilis*), New Jersey tea (*Ceanothus americanus*), and American hazelnuts (*Corylus americana*). Leadplant (*Amorpha canescens*) was always present. The herbaceous vegetation was dominated by species typical of Mesic Prairie, but herbs typical of Oak Woodland and Oak Forest were probably present as well, especially beneath tree or shrub canopies.

Mesic Oak Savanna occurred on dry-mesic to mesic, gently undulating to moderately sloping sites. These sites were on glacial till or outwash, with soil texture ranging from clay loam to sandy loam. Mesic Oak Savanna generally occurred on sites where fire was frequent enough to prevent trees and shrubs from forming closed canopies, thereby permitting heliophilous prairie herbs to dominate the groundlayer. However, fire frequencies were lower than in prairies on similar topography and soils. Native grazing and browsing animals may also have helped maintain the open character of Mesic Oak Savanna. Out in the prairie zone, Mesic Oak Savanna occurred where either topographic features or wetlands, lakes, or streams created local fire "shadows" (areas of reduced fire frequency). Occurrences here were usually small. Closer to the deciduous forest-woodland zone and within it, where landscape character reduced fire frequency on a larger scale, Mesic Oak Savanna often covered larger areas. With settlement and the suppression of prairie fires, savannas in the deciduous forest-woodland zone that escaped clearing and cultivation quickly succeeded to woodland unless heavily and continuously grazed. No good quality examples are known.

Four geographic sections of Mesic Oak Savanna can be delineated, corresponding to the geographic sections delineated for Mesic Prairie (Fig. 13). Presettlement savannas on level outwash sands flanking the Mississippi River north of the Twin Cities and on mesic sites in the Anoka Sand Plain may have constituted a Sand Subtype, corresponding to the hypothetical Sand Subtype of Mesic Prairie.

Dry Oak Savanna

This dry to dry-mesic community is most common in the deciduous forest-woodland zone, but also occurs sporadically throughout the prairie zone (Fig. 1). The principal trees are bur oaks and northern pin oaks, but black oaks are also common in the southeast. Northwards,

quaking aspens become more frequent in the community. The stature and spacing of trees is somewhat variable, reflecting differences in soils, topography, and climate, factors that strongly affect local droughtiness and fire frequency. Small, gnarly, open-grown trees are most common, although in moister spots, or in heavier soils, larger trees are sometimes more common. Tree spacing ranges from sparsely and evenly distributed to strongly clumped in moderately dense patches. Shrub cover is variable as well. The species composition of the shrub layer depends somewhat upon soil characteristics. Oak grubs and chokecherries are common on all soil types. On sandier soils, prairie willows (*Salix humilis*), New Jersey tea (*Ceanothus americanus*), American hazelnuts (*Corylus americana*), sand cherries (*Prunus pumila*), and juneberries (*Amelanchier* spp.) are usually present. Wolfberries (*Symphoricarpos occidentalis*) are commoner on heavier soils.

Dry Oak Savanna occurs on the same kinds of landforms as Dry Prairie, except for bedrock bluffs. Correspondingly, substrates range from excessively-drained to well-drained, sand to loam soils. The presence of savanna rather than prairie indicates a lower fire frequency or intensity (or both) than in prairie. Dry Oak Savanna requires less frequent fire than Mesic Savanna for maintenance. However, in the complete absence of fire woodland will eventually replace Dry Oak Savanna. Grazing and browsing animals may also have had a role in the maintenance of Dry Oak Savanna. Because Dry Oak Savanna occurs on sites that are not as suitable for cultivation as Mesic Savanna sites, and because succession in the absence of fire is not as rapid, more examples remain of Dry Oak Savanna than of Mesic Oak Savanna.

There are four geographic sections of Dry Oak Savanna (Southwest, Southeast, Central, and Northwest (Fig. 13)), and three subtypes (Barrens, Sand-Gravel, and Hill). The subtypes are closely associated with the equivalent Dry Prairie subtypes. Not all subtypes occur in every section. Additional details of the subtypes follow.

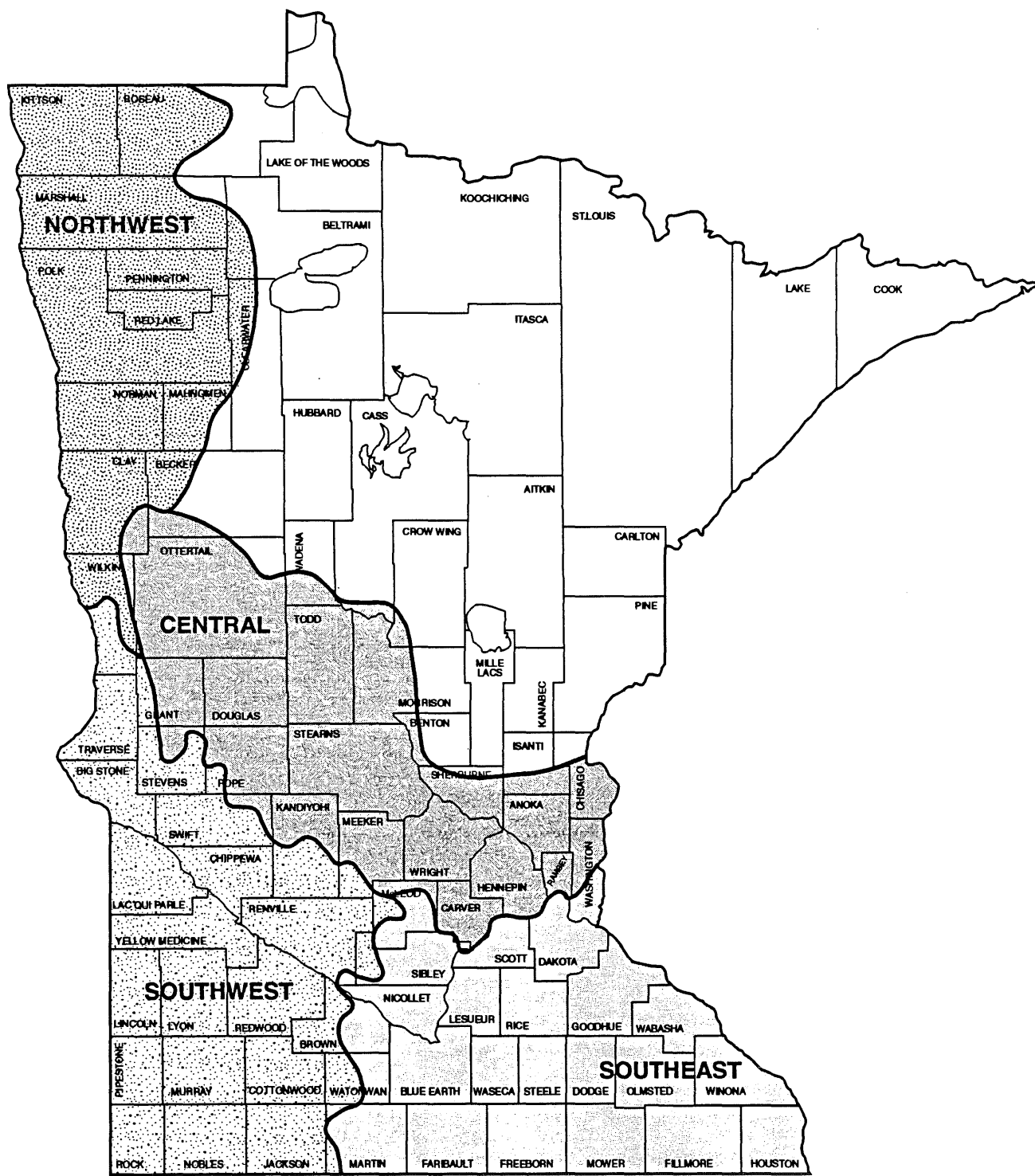
c. substrate sand (gravel fraction <10%) with little soil formation; present on dunes or on steep, erodible alluvial sand deposits such as some alluvial fans or stream cuts; herbaceous vegetation in open areas similar to that of Dry Prairie Barrens Subtype *Barrens Subtype*

c. substrate with various textures or, if sandy, gravel fraction >10%; usually some soil formationd.

d. savanna on alluvium, mostly of glacial origin (glacial lake beachlines, kames, eskers, collapsed outwash, abandoned river terraces, etc.); soils coarse textured, gravel fraction >10%; present on gentle to steep slopes; herbaceous vegetation in open areas similar to Dry Prairie Sand-Gravel Subtype *Sand-Gravel Subtype*

d. savanna on glacial till, on depositional or erosional slopes; soils fine- to medium-textured loams, gravel fraction various; slopes >10%; herbaceous vegetation in open areas similar to that of Dry Prairie Hill Subtype *Hill Subtype*

Figure 13. The Southeast, Southwest, Central, and Northwest Sections of Mesic Oak Savanna and Dry Oak Savanna.



Barrens Subtype

This subtype occurs on the same kinds of sand deposits as the Barrens Subtype of Dry Prairie. On dune blankets it tends to be favored over prairie in areas of sharper relief. Bur oaks are generally the prevalent trees; northern pin oaks are also common in the Central Section, and black oaks are common in the Southeast Section. In the Northwest and Central Sections quaking aspens are common in moister spots (this may represent post-settlement invasion). Trees range in spacing from sparse and evenly spaced to strongly clumped. The shrub layer is usually sparse; the most common species are oaks (in the form of grubs), chokecherry, American hazel, smooth sumac, and prairie willow. Creeping juniper (*Juniperus horizontalis*) is common in the northwest, and bush juniper (*Juniperus communis*) and New Jersey tea (*Ceanothus americanus*) are usually present in the Central and Southeast Sections. The herbaceous vegetation present in open areas is similar to that of the Barrens Subtype of Dry Prairie.

This subtype grades into the Sand-Gravel Subtype of Dry Oak Savanna. The Barrens Subtype occurs in the Southeast, Central, and Northwest Sections of the community.

Sand-Gravel Subtype

This subtype of Dry Oak Savanna occurs on the same kinds of sites as the Sand-Gravel Subtype of Dry Prairie. Such sites are more likely to be savanna than prairie in the far northwest and within the deciduous forest-woodland zone. Occurrences tend to be small. The oak species composition has the same geographic pattern as in the Barrens Subtype of Dry Oak Savanna, and again quaking aspen becomes important northwards. The shrub species are essentially the same as in the Barrens Subtype, but the shrub layer is generally denser. American hazels, chokecherries, and juneberries (*Amelanchier* spp.) predominate. Wolfberries are frequent. The herbaceous vegetation is similar to that of the Sand-Gravel Subtype of Dry Prairie. The Sand-Gravel Subtype of Dry Oak Savanna succeeds to woodland more rapidly than the Barrens Subtype.

As noted above, examples of this subtype on outwash material may be difficult to distinguish floristically from the Barrens Subtype. The Sand-Gravel Subtype occurs in the Southeast, Central, and Northwest Sections of Dry Oak Savanna.

Hill Subtype

This subtype occurs on the same kinds of sites as the Hill Subtype of Dry Prairie. Occurrences are concentrated along the ecotone between the prairie and deciduous forest-woodland zones (Fig. 1), and tend to be small. Bur oak and northern pin oak are the major oak species; aspen becomes important northwards. The most common shrubs are chokecherries,

wolfberries, and smooth sumacs. Leadplant is always present. The density of the shrub layer is highly variable. The herbaceous vegetation of open areas between trees is essentially the same as that of the Hill Subtype of Dry Prairie. This subtype succeeds to woodland almost as rapidly as Mesic Oak Savanna except on the steepest, driest slopes. Therefore, few examples remain. Most surviving examples have a history of fairly heavy grazing.

The Hill Subtype occurs in the Southwest, Southeast, and Central Sections of Dry Oak Savanna.

Aspen Openings

Aspen Openings are fine-grained mosaics of aspen groves and prairie or brush-prairie. They occur in the northern part of the deciduous forest-woodland zone (Fig. 1). The dominant trees are quaking aspens, which frequently are mixed with balsam poplars; bur oaks are sometimes present on drier sites. The aspen and balsam poplar groves consist predominantly of young trees that originated from scattered mature trees by root suckering following fire. The bur oaks are usually small, spindly, and overtopped by the aspens and poplars, but larger well-formed trees are not uncommon.

Aspen openings exist on sites ranging from wet to mesic. The understory composition in the tree groves and prairie openings varies with this range in moisture. Understory vegetation within the tree groves is often similar to that of Aspen Woodland. However, in young occurrences that have recently invaded prairie, prairie herbs and shrubs dominate the understory vegetation.

Aspen Openings develop on nearly level to gently undulating topography. On low sites, aspen groves occur in the better-drained areas and wet prairie occurs in the open areas between groves. On more mesic sites, especially southward, aspen groves often have developed in wet-mesic to wet depressions, with mesic prairie present in better-drained areas between the groves. Historically, Aspen Openings existed where fire was frequent or intense enough to prevent complete succession to woodland. In the prolonged absence of fire, Aspen Openings succeed to Aspen Woodland, with only the wettest areas (i.e., Wet Meadow and Marsh areas) remaining open. Drought stress is also important in maintaining Aspen Openings, and often interacts with fire. Most modern examples of Aspen Openings probably represent succession from Brush Prairie (where quaking aspen and balsam poplar were present but rarely reached tree size) following fire suppression, or from the invasion of other prairie types by aspen following fire suppression. It is not known whether Aspen Openings can be maintained as a stable type or whether occurrences are always transitory.

There is one recognized subtype of Aspen Openings, the Sand-Gravel Subtype. The Sand-Gravel Subtype is a dry-mesic to mesic savanna present in areas of undulating outwash with coarse-textured gravelly soils (gravel fraction >10%). The herbaceous vegetation in openings between aspen groves is similar to that of the Sand-Gravel Subtype of Upland Prairie.

Aspen Openings is a scale-dependent community, as it is a composite of prairie communities and Aspen Woodland. Because of this, the placement of boundaries between Aspen Openings and Aspen Woodland or between Aspen Openings and Brush-Prairie communities is usually subjective.

CONIFEROUS WOODLAND

Coniferous Woodlands occur in the conifer-hardwood forest and deciduous forest-woodland zones (Fig. 1). They have interrupted tree canopies dominated by jack pines (or occasionally by black spruces and red pines), and have relatively continuous subcanopies of stunted oaks, young aspens, hazelnuts, cherries, or dogwoods. Areas under small openings in the tree canopy have either low-growing ericaceous shrubs, mosses, lichens, forest graminoids, and species characteristic of primary communities or dry prairie species.

Coniferous Woodlands are early successional communities but tend to persist for long periods, either because they occur on sites with soils poorly suited for tree growth, or because they occur on sites prone to repeated fire. For example, Coniferous Woodlands often originate following the burning of Coniferous Forests on sites with nutrient-poor droughty soils; although these woodlands then succeed toward coniferous forest, tree growth and canopy development are so slow that a distinct woodland persists on the site for long periods. Early land surveyors described stands of pine-dominated woodland on relatively rich prairie soils on outwash plains in the deciduous forest-woodland zone. These woodlands existed in areas (along rivers, old village sites) that appear to have been burned frequently by Native Americans, which promoted the regeneration of jack pine. Most of these areas are now cultivated and the remaining pine woodlots are succeeding to Mixed Oak Forest in the absence of fire. Modern communities that fit the general description of Coniferous Woodland include small relics of pine woodlands, overgrown coniferous savanna, and areas degraded by post-logging slash fires and erosion.

There are two Coniferous Woodland community types. Both types--Jack Pine Woodland and Northern Conifer Woodland--are floristically similar to their savanna counterparts, as they usually contain some of the species characteristic of savanna openings. In general, Northern Conifer Woodland originates following the burning of Coniferous Forests on sites with very poor soils, while Jack Pine Woodland originates on sites with fertile soils and frequent fires.

a. trees mostly jack pine; habitat typically dry sandy prairie soils; openings brushy and with both shade-tolerant forest and prairie forbs and graminoids *Jack Pine Woodland*

a. trees mostly jack pine, black spruce, or both; habitat dry, mostly shallow soils over bedrock; openings brushy and with groundlayer of species associated with forests and Primary Communities *Northern Conifer Woodland*

Jack Pine Woodland

Jack Pine Woodland occurs on outwash plains along the border between the conifer-hardwood forest and deciduous forest-woodland zones (Fig. 1). The canopy is dominated by jack pines (the open-cone ecotype), with large red pines occasionally forming a sparse supercanopy above the jack pine canopy. Pin oak and bur oak grubs and juvenile aspens occur

in the understory. The shrub layer is tall, dense, and continuous, with American hazel, downy arrowwood, junberry, and prairie willow as dominant species. The groundlayer usually is sparse and is composed of dry woodland species and prairie species capable of persisting beneath the densely growing shrubs.

Jack Pine Woodland is best known from historical descriptions of pine woodlands that were present near prairie inclusions in forested regions. The prairie areas were gathering sites for Native Americans, and it is believed that the woodlands were largely maintained by fires set in the adjacent prairie openings. All of these pine woodlands occurred on prairie soils, which attests to their recent origin (within the past 600 years), when jack pines invaded areas of Brush-Prairie. Because the prairie soils are good agricultural soils, most Jack Pine Woodlands have been cleared for cropland and very few remain. Most of the remnants occur as scattered woodlots within agricultural areas and are succeeding to Mixed Oak Forest in the absence of fire.

There are no subtypes or sections of Jack Pine Woodland.

Northern Conifer Woodland

Northern Conifer Woodland occurs in the conifer-hardwood forest zone (Fig. 1), primarily on the thin rocky soils of the Canadian shield (Fig. 7) and less often on poor sandy soils in outwash areas. The canopy is sparse to patchy, with 10 to 70% cover, and is dominated by jack pines, sometimes mixed with upland black spruces or red pines. Northern red oaks, pin oaks, and, occasionally, bur oaks are present in the subcanopy.

The shrub layer is comparatively short (less than 1.5m tall) and ranges in cover from patchy to continuous. Prairie willows, Bebb's willows, junberries, beaked hazels, bush honeysuckles, and blueberries are the common shrubs. Beneath the tree canopy the groundlayer is composed of species characteristic of xeric forests, while in rocky or sandy openings the predominant groundlayer species are species characteristic of Primary Communities, especially Rock Outcrop communities.

Northern Conifer Woodland is an early successional community maintained by fire. The community is physiognomically and floristically intermediate between Northern Conifer Scrubland and Coniferous Forest communities, particularly Jack Pine Forest. Some modern stands that are classified as Northern Conifer Woodland are actually Coniferous Forest or Mixed Coniferous-Hardwood Forest community types that have been degraded by intensive logging.

There are no recognized subtypes or sections of Northern Conifer Woodland. An analysis of land survey records and evaluation of the effects of logging on some forest types may result in the recognition of subtypes or sections.

CONIFEROUS SAVANNA

Coniferous Savannas occur mostly within the conifer-hardwood forest zone (Fig. 1) although they are not widespread and probably were not common even before extensive settlement in Minnesota. The tree canopy of Coniferous Savannas is patchy or discontinuous and is dominated by either jack pines or black spruces. Stunted oaks and young aspens usually occur in the understory. Openings in the tree canopy are dominated either by low-growing ericaceous shrubs, mosses, lichens, and forest graminoids, or by dry prairie species.

There are two Coniferous Savanna community types, which were identified by examining public land survey records and by examining some of the few remaining stands.

a. trees predominantly jack pine; habitat typically dry sandy soils; openings have groundlayer composed of species characteristic of prairies *Jack Pine Barrens*

a. trees predominantly stunted jack pine, balsam fir, and white spruce, occasionally black spruce; habitat typically dry shallow soils over bedrock; openings have groundlayer composed of ericaceous shrubs and species characteristic of rock outcrop communities
.....*Northern Conifer Scrubland*

Jack Pine Barrens

Jack Pine Barrens occur on extremely droughty, nutrient-poor dune fields along the border between the conifer-hardwood and deciduous forest-woodland zones (Fig. 1) in central Minnesota. The tree canopy is patchy and most often is composed purely of jack pines, although occasionally scattered red pines may be present. The deciduous tree species that occur in the community--primarily pin oak and bur oak--are usually present as fire-stunted subcanopy grubs and only rarely grow into the canopy. Jack Pine Barrens have a sparse tall-shrub layer, composed mostly of American hazelnuts, junberries, and downy arrowwoods. The groundlayer is sparse, mainly because of the droughty, infertile soils on which the community occurs, and consists of a mixture of sand prairie species and common herbs of dry woodlands.

Jack Pine Barrens is a fire-maintained community. An analysis of fire scars on jack pines in a stand near Brainerd suggests that fires historically occurred in the community every ten years or less. Many of these jack pines have multiple fire scars on their trunks, indicating that most fires are low-intensity ground fires. This type of fire regime is very likely the result of the sparsely vegetated groundlayer in the community, which rarely contains enough biomass to fuel hot crown fires. Thus, it appears that Jack Pine Barrens are maintained by frequent, low-intensity ground fires. Occasionally, however, fires may kill some of the trees in the community, contributing to the formation of the patchy canopy characteristic of savannas. The fires also repeatedly burn back the oak shoots, maintaining the oaks in the community as grubs. The ground fires also may contribute to the open nature of the understory, by preventing the

development of a dense shrub layer. At the same time, the droughty, infertile sites on which the community occurs probably slow or prevent the development of a dense shrub layer even in the absence of fire. In the past, grazing by native herbivores may also have been important in maintaining the open structure of the community.

Structurally, Jack Pine Barrens are somewhat similar to Jack Pine Woodland. However, Jack Pine Woodland occurs on comparatively rich prairie soils on outwash, lacks a sand prairie understory, and has a dense shrub understory. There are no recognized subtypes or sections of Jack Pine Barrens.

Northern Conifer Scrubland

Northern Conifer Scrubland occurs on bald rock ridges on the Canadian Shield (Fig. 7) in the conifer-hardwood forest zone. The canopy is usually dominated by closed-cone jack pines, however white spruces and balsam firs sometimes dominate the community along the north shore of Lake Superior. Black spruces are present in occurrences of the community in Lake and Cook counties.

The conifer trees in the canopy grow scattered among shorter northern red oaks and clumps of Bebb's willow. Areas without trees contain either a drought resistant, low-shrub layer of bush honeysuckles, junberries, beaked hazels, and blueberries, or primary rock outcrop communities composed of mosses, lichens, and vascular species such as wintergreen (*Gaultheria procumbens*), pale corydalis (*Corydalis sempervirens*), bristly sarsaparilla (*Aralia hispida*), and three-toothed cinquefoil (*Potentilla tridentata*).

Northern Conifer Scrubland is an early successional community that originates following severe fires in coniferous forests on rocky sites. These fires remove all the duff and moss or lichen cover from the ground surface, exposing bare rock and patches of bare soil (where soil has accumulated in depressions and crevices in the rock). The bare soil patches are recolonized by conifer species (particularly the fire-adapted jack pine), setting the pattern for the patchy tree canopy characteristic of the community.

There are no recognized subtypes or sections of Northern Conifer Scrubland. Northern Conifer Scrubland grades into the Jack Pine-Oak Subtype of Jack Pine Forest. Similar communities (called lichen woodlands) with scattered spruces and jack pines have been described at the northern edge of the Boreal Forest in Canada.

UPLAND BRUSH-PRAIRIE

Upland Brush-Prairies are open communities composed of various amounts of low brush in a herbaceous matrix of prairie species (Appendix 3). The distributions of prairie grass and forb species in Upland Brush-Prairies correlate with changes in soil moisture along a gradient from wet-mesic to dry-mesic that parallels the moisture gradient-species distribution pattern present in mesic Upland Prairies. Upland Brush-Prairies differ from mesic Upland Prairies mainly by having many shrub species that do not occur in mesic Upland Prairies. Additionally, Upland Brush-Prairies frequently have significant numbers of small aspens, often with balsam poplars and, on drier sites, bur oak grubs and stunted trees.

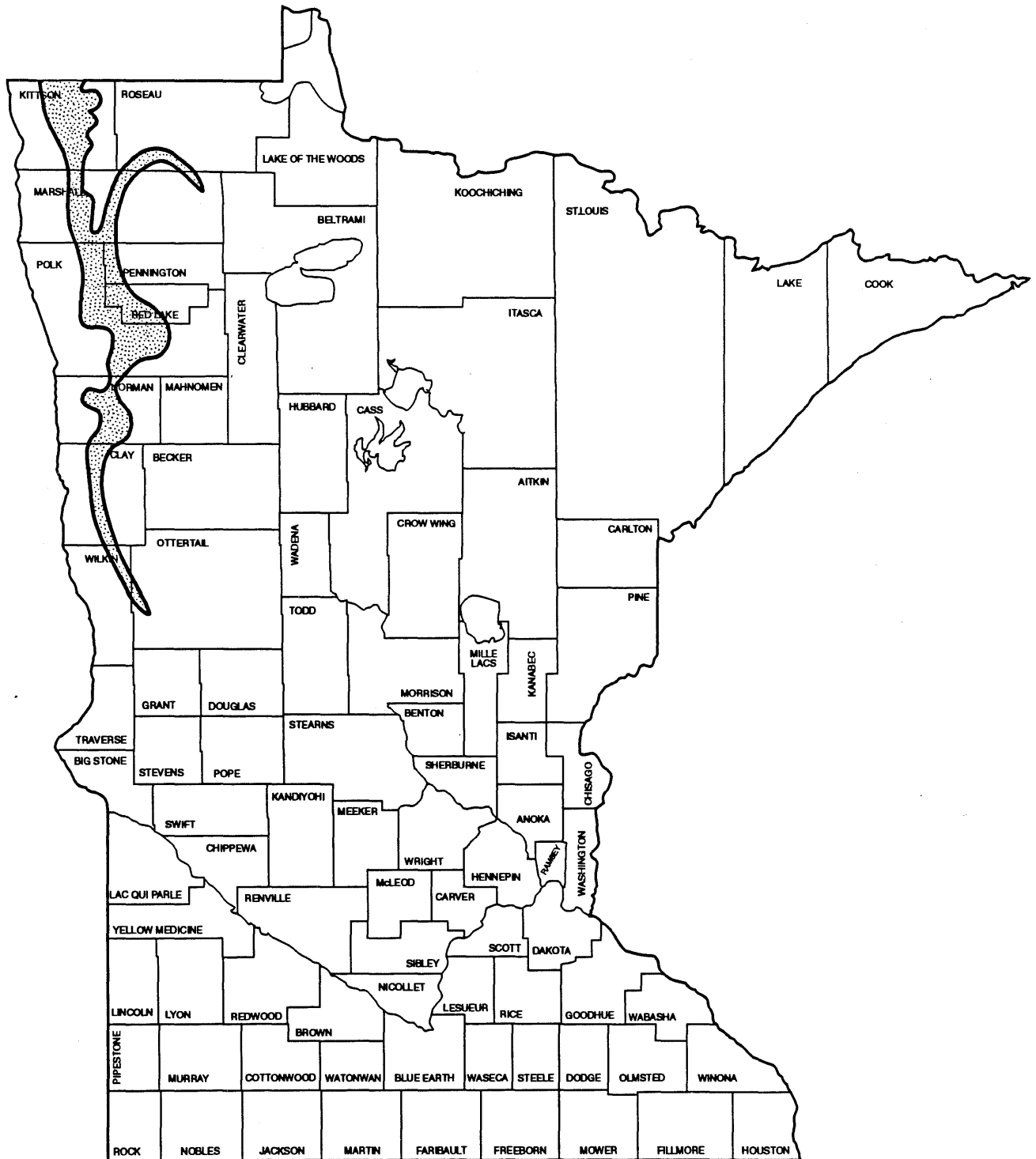
Frequent fire is important in maintaining Upland Brush-Prairies, although there appears to be a threshold of fire frequency and intensity (see below), beyond which Upland Brush-Prairies are replaced on the landscape by brush-free prairie types. In the past, bison and elk activity may also have helped to maintain Brush-Prairie communities. Where they have not been otherwise tilled for cropland, most small remnants of Upland Brush-Prairie have succeeded to woodland because of suppression of wild fires.

Although brushy areas are a common feature of prairie throughout the deciduous forest-woodland zone, these areas usually are localized patches or thickets in depressions or in association with topographic and aquatic features that provide protection from fire. However, in the far northwestern part of the deciduous forest-woodland zone, brush is more uniformly distributed in the prairie (and species are present that are rarely or never present southward) and true Upland Brush-Prairie occurs.

On the pre-settlement landscape in northwestern Minnesota, Upland Brush-Prairie and the closely associated Wet Brush-Prairie were the predominant prairie types on the Glacial Lake Agassiz Interbeach Area (Fig. 14), while just to the west on the Lake Agassiz Plain the prairies were mostly brush free. Southward within the Interbeach Area, brush prairies also gave way to standard prairie types, although Wet Brush-Prairie persisted farther southward than Upland Brush-Prairie. This suggests that a climatic gradient may have been important in causing the replacement of brush prairie, to the west and south, by brush-free prairie. That is, the cooler climate in the northwest reduced the frequency and severity of moisture stress and the intensity of fire so that, in general, brush would have a greater tendency to persist in prairie areas in the northwest. Superimposed on this climatic gradient, the Interbeach Area may have had a slight reduction in fire frequency, relative to the glacial lake plain to the west, because of its subtly greater relief and its edaphic heterogeneity. These differences may have been enough to tip the balance and prevent elimination of woody species from the prairies in the northern part of the Interbeach Area.

There is only one recognized Upland Brush-Prairie community type. However, additional data from other regions of the state may lead to the inclusion of other Upland Brush Prairie types or to reducing the existing type to a sectional variant of a more broadly defined community type.

Figure 14. The Glacial Lake Agassiz Interbeach Area of Northwestern Minnesota.



- a. represented by a single type; vegetation dominated by a mixture of prairie grasses (Appendix 3) and brush composed of young aspen, scrub oak, and hazelnut **Mesic Brush-Prairie**

Mesic Brush-Prairie

(See Upland Brush-Prairie class description above for general description.) The major grasses of Mesic Brush-Prairie are big bluestem (*Andropogon gerardii*), and prairie dropseed (*Sporobolus heterolepis*) on all sites, little bluestem (*Schizachyrium scoparium*), junegrass (*Koeleria macrantha*), and porcupine grass (*Stipa spartea*) on drier sites, and bog reed-grass (*Calamagrostis inexpansa*), prairie cordgrass (*Spartina pectinata*), and mat muhly (*Muhlenbergia richardsonis*) on moister sites. Wheatgrass (*Agropyron trachycaulum*) is also generally common in the community; Indiangrass (*Sorghastrum nutans*) is present only occasionally. Mesic Brush-Prairie contains the usual forbs of Mesic Prairie and a few species more typical of woodland, including black snakeroot (*Sanicula marilandica*), carrion-flower (*Smilax lasioneura*), spreading dogbane (*Apocynum androsaemifolium*), and the sedge *Carex pensylvanica*.

The brush layer within the community is generally less than 1.5 meters tall, with total cover ranging from 30 to 50 percent. The major shrub species present are slender willow, pussy willow, bog birch, and shrubby cinquefoil on wet-mesic sites; Bebb's willow on mesic to wet-mesic sites; hazel, saskatoon, and chokecherry on dry-mesic and mesic sites; and prairie willow and leadplant on better-drained sandy sites. Sand cherry is present on most sites, but is generally not abundant or important except on sandy sites. Quaking aspen suckers or small saplings often form dense thickets in the community; grubs and stunted trees of bur oak are common on dry sites. Scattered groves of larger aspen are also common, while larger oaks are present only occasionally.

Mesic Brush-Prairie generally occurs on somewhat poorly drained to well-drained, sandy clay loam to loamy fine sand soils. These soils form in lake-washed glacial till or in sandy lacustrine deposits (of variable thickness) over till. Mollisols predominate, but entisols are also common; most soils are strongly calcareous.

On the landscape, Mesic Brush-Prairie occurs on nearly level terrain, often in a mosaic with Wet Brush-Prairie and brushy Wet Meadow. Distinguishing between Mesic Brush-Prairie and Wet Brush-Prairie may be difficult in these cases, as the two communities share many species. In some sandy areas, Mesic Brush-Prairie grades into typical Mesic Prairie. Brush and trees may actually be common in the Mesic Prairies in these areas but are more localized (in clumps and thickets) than in Mesic Brush-Prairie. On beach ridges and other dry, gravelly sites Mesic Brush-Prairie grades into an oak scrub or savanna community. Where aspen cover increases, Mesic Brush-Prairie grades into Aspen Openings.

Mesic Brush-Prairie is a fire-dependent community. In the absence of fire, trees become more abundant in the community and it eventually succeeds to woodland. Examination of public land survey records from the late 1800s in fact indicates that tree cover is now greater in most

Mesic Brush-Prairies in Minnesota than it was in the past. If fires occur in the community only occasionally, they may actually advance succession to woodland by stimulating aspen root suckering and the production of more aspen shoots.

Mesic Brush-Prairie has a very restricted distribution; there are no geographic sections of the community. There is one recognized subtype, a Sand-Gravel Subtype, which occurs locally on coarse-textured outwash deposits. Occurrences of the Sand-Gravel subtype are dry-mesic to mesic prairies in which porcupine grass (*Stipa spartea*) is the major grass species. Leadplant and (especially) prairie willow are important shrubs.

UPLAND PRAIRIE

Upland Prairies occur primarily in the prairie zone, with scattered occurrences in the deciduous forest-woodland zone (Fig. 1). They are dominated by grasses. The tall grasses, big bluestem (*Andropogon gerardii*) and Indiangrass (*Sorghastrum nutans*), are the major dominants on moist sites, while midheight grasses, such as little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), porcupine grass (*Stipa spartea*), and june grass (*Koeleria macrantha*), are important to dominant on drier sites. Prairie dropseed (*Sporobolus heterolepis*) is common on both dry and moist sites. Short grass species, including blue grama (*Bouteloua gracilis*) and needle grass (*Stipa comata*), are common on the most xeric sites. Forbs typically are abundant (but subdominant to the grasses) and may have high local diversity. Forb species composition varies with site moisture, although some forb species occur on almost all sites, moist or dry. Several low shrub or sub-shrub species are common on Upland Prairie; the most characteristic is leadplant (*Amorpha canescens*). Taller brush and trees are absent or scattered, however brush or woodland areas may be interspersed with prairie, usually in association with topographic and aquatic features that provide protection from fire.

The most important cause of variation in species composition in prairie communities is variation in soil moisture. The local soil moisture regime is determined by slope, aspect, proximity to the water table, and soil texture. On a regional scale, variation in species composition is primarily caused by climatic variation (i.e., the westward decline in precipitation and northward decline in temperature in Minnesota).

Upland Prairies occur on a range of landforms in the prairie zone, from nearly flat glacial lakeplains to steep morainic slopes. In the deciduous forest-woodland zone, prairies occur on droughty, level outwash areas and steep south- and west-facing slopes. The pre-European settlement distribution of prairie was related to the interaction of local fire frequency with growth rates of woody species: where conditions were favorable for rapid growth, more frequent fires were necessary to maintain prairie over savanna, woodland, or forest. Fragmentation of Upland Prairie since European settlement has reduced fire frequency throughout the prairie and deciduous forest-woodland zones, and most prairie remnants have more brush and trees than were present in the past.

There are two recognized Upland Prairie community types; each type has several subtypes. Quantitative analyses of plot data may eventually result in elevation of some of the subtypes to types.

a. level to rolling topography, slopes generally <10%; habitat mesic; soils with mollic epipedon, clay-loam to loamy fine-sand texture, somewhat poorly to somewhat excessively drained **Mesic Prairie**

a. undulating to rough topography, slopes of various degrees; habitat dry to dry-mesic; soils with or without mollic epipedon; soil texture loamy sand to sand on gentle slopes or any texture on steep slopes; well drained to excessively drained **Dry Prairie**

Mesic Prairie

Mesic Prairie is a dry-mesic to wet-mesic grassland that occurs mainly in the prairie zone in southern and western Minnesota and sporadically in the deciduous forest-woodland zone (Fig. 1). Mesic Prairie is dominated by grasses. Big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and prairie dropseed (*Sporobolus heterolepis*) are the major native species on most sites, with little bluestem (*Schizachyrium scoparium*) and porcupine grass (*Stipa spartea*) important on drier sites, and switchgrass (*Panicum virgatum*) and prairie cordgrass (*Spartina pectinata*) common on wetter sites. The introduced grass Kentucky bluegrass (*Poa pratensis*) is present at most sites; its is a function of the site's disturbance history.

Forbs are abundant (but usually subdominant to grasses) and have high local diversity. Forb species-composition also varies locally with soil moisture. There is greater regional variation among forbs than among grasses. Common forb species include purple prairie-clover (*Petalostemon purpureum*), white prairie-clover (*P. candidum*), ground-plum (*Astragalus crassicaupus*), prairie-turnip (*Psoralea esculenta*), rough blazing-star (*Liatris aspera*), Canada goldenrod (*Solidago canadensis*), stiff goldenrod (*S. rigida*), Missouri goldenrod (*S. missouriensis*), prairie thistle (*Cirsium flodmani*), smooth aster (*Aster laevis*), stiff sunflower (*Helianthus rigidus*), Maximilian sunflower (*H. maximiliani*), smooth rattlesnake-root (*Prenanthes racemosa*), white sage (*Artemisia ludoviciana*), wood lily (*Lilium philadelphicum*), white camas (*Zigadenus elegans*), heart-leaved alexanders (*Zizia aptera*), prairie larkspur (*Delphinium virescens*), downy phlox (*Phlox pilosa*), hoary puccoon (*Lithospermum canescens*), tall cinquefoil (*Potentilla arguta*), alum-root (*Heuchera richardsonii*), wood-betony (*Pedicularis canadensis*), northern bedstraw (*Galium boreale*), prairie bird-foot violet (*Viola pedatifida*), oval-leaved milkweed (*Asclepias ovalifolia*), and showy milkweed (*A. speciosa*). Purple coneflower (*Echinacea angustifolia*) is common on drier sites in the western part of the community's range. Leadplant, prairie rose, sand cherry, wolfberry, and prairie willow are common low-shrub or sub-shrub species. Fragrant false indigo is common on moister sites. Trees and taller brush often occur along the margins of wetlands adjacent to Mesic Prairies.

Mesic Prairie is a fire-dependent community. In the absence of fire, occurrences of Mesic Prairie are invaded by brush and trees. In the prairie zone, Mesic Prairie occurs on nearly level glaciolacustrine and glaciofluvial deposits, and on flat or gently rolling morainic landforms. In southeastern and, to a lesser extent, southwestern Minnesota, the glacial deposits are overlain by loess. Bedrock subtypes of Mesic Prairie exist in a few areas where bedrock is within about one-and-one-quarter meters of the ground surface and there are numerous small patches of exposed rock. Within the deciduous forest-woodland zone, Mesic Prairie usually occurs on level outwash areas or on broad, sandy river terraces.

The soils in Mesic Prairie are predominantly mollisols with thick, dark mineral surface layers that have high base saturation and dominantly bivalent cations. They range in texture and drainage from silty and somewhat poorly drained to sandy and somewhat excessively drained, with moderately well-drained to well-drained, loamy soils being most common. Mesic Prairie grades into Wet Prairie on moister sites and into the Hill and Sand-Gravel subtypes of Dry Prairie on drier sites. Separation of Mesic Prairie from other prairie types is based primarily

on landform or substrate characteristics rather than on species composition, as floristic boundaries between Mesic Prairie and other prairie types are not well defined.

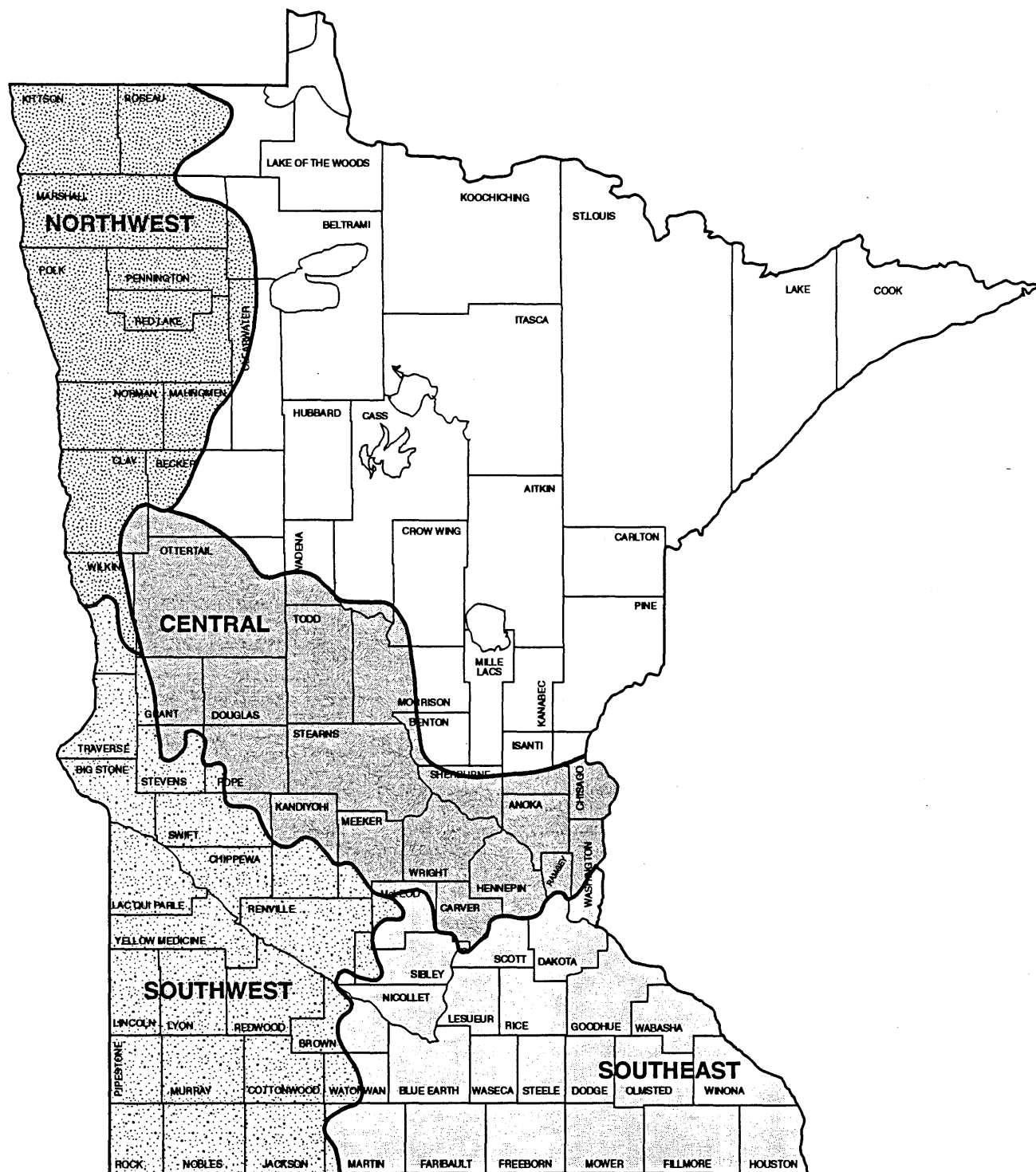
There are four geographic sections of Mesic Prairie (Southeast, Southwest, Central, and Northwest, Fig. 15) and two subtypes (Crystalline Bedrock and Carbonate Bedrock). The bedrock subtypes are rolling to level prairies on thin soils over bedrock. The Crystalline Subtype occurs on either quartzite or granite bedrock while the Carbonate Subtype occurs on dolomite or limestone bedrock. In both subtypes, the depth to bedrock is generally less than 1.25 meters, with bedrock often exposed at the ground surface. Revision of the geographic sections and additional subtyping according to soil properties is likely, following collection and analysis of additional plot data. Another distinctive subtype (a sand subtype) probably existed before European settlement on broad terraces along the Mississippi River from the Twin Cities to Brainerd. The soils of these terraces are mollisols (i.e., prairie soils), but are formed in deep outwash sands. No surviving examples of these prairies are known, although patches of prairie species growing in railroad-highway rights-of-way and other scattered spots give some indication of its former character.

Dry Prairie

Dry Prairie is a dry to dry-mesic herbaceous community dominated by grasses and sedges. It occurs throughout the prairie zone and sporadically in the deciduous forest-woodland zone (Fig. 1). Dry Prairie has considerable variation in species composition, reflecting interactions among geography (namely climate), soils, and topography. In general, Dry Prairies have a greater component of Great Plains species than Mesic Prairies, especially in prairies in the western part of Minnesota. Big bluestem (*Andropogon gerardii*) is always present in the community and usually important, but it does not achieve the dominance it typically has in Mesic Prairie. Indiangrass (*Sorghastrum nutans*) is more limited in occurrence, generally appearing only where conditions approach mesic. Mid-height and short grasses and sedges are usually dominant in Dry Prairie. Among the more common are porcupine grass (*Stipa spartea*), little bluestem (*Schizachyrium scoparium*), side-oats grama (*Bouteloua curtipendula*), prairie junegrass (*Koeleria macrantha*), and sun-loving sedge (*Carex heliophila*).

Forb variation within the community is more pronounced. Some widespread, characteristic species are dotted blazing star (*Liatris punctata*), pasque flower (*Pulsatilla nuttalliana*), prairie golden-aster (*Heterotheca villosa*), stiff sunflower (*Helianthus rigidus*), silky aster (*Aster sericeus*), green milkweed (*Asclepias viridiflora*), stiff goldenrod (*Solidago rigida*), gray goldenrod (*Solidago nemoralis*), Missouri goldenrod (*Solidago missouriensis*), and narrow-leaved puccoon (*Lithospermum incisum*). Dry Prairies share many forb species with Mesic Prairies, including rough blazing star (*Liatris aspera*), buffalo-bean (*Astragalus crassicaarpus*), tooth-leaved evening primrose (*Calylophus serrulatus*), silverleaf scurfpea (*Psoralea argophylla*), thimbleweed (*Anemone cylindrica*), Louisiana sagewort (*Artemisia ludoviciana*), prairie larkspur (*Delphinium virescens*), heartleaved alexanders (*Zizia aptera*), purple prairie-clover (*Petalostemon purpureum*), hoary puccoon (*Lithospermum canescens*), prairie smoke (*Geum triflorum*), and wood lily (*Lilium philadelphicum*).

Figure 15. The Southeast, Southwest, Central, and Northwest Sections of Mesic Prairie and Dry Prairie.



Three sub-shrubs--leadplant (*Amorpha canescens*), prairie rose (*Rosa arkansana*), and wolfberry (*Symphoricarpos occidentalis*)--typical in Mesic Prairies are also generally present in Dry Prairie. Soil-encrusting lichens and the fern-ally rock-spike moss (*Selaginella rupestris*) are often common in Dry Prairie. Brush, and sometimes trees, may be present in hollows and draws. Bur oak (*Quercus macrocarpa*), chokecherry (*Prunus virginiana*), wild plum (*Prunus americana*), and smooth sumac (*Rhus glabra*) are the most widespread woody species. Other woody species more limited in distribution in the community are northern pin oak (*Quercus ellipsoidalis*), black oak (*Quercus velutina*), and hazel (*Corylus americana*).

Dry Prairies are maintained by fire but require less frequent fires than mesic and wet prairies because the droughty conditions within Dry Prairies slow or prevent the growth of woody species. Dry Prairie occurs on a variety of landforms, including sand dune blankets of mid-Holocene origin, glacial lake beach ridges, outwash deposits, ice-contact features (kames, eskers), morainic hills, erosional slopes in glacial drift, and bedrock-cored bluffs. Soils range from nearly pure sand with little profile development, to mollisols, although the latter have a much thinner organic-rich surface horizon than the soils of Mesic Prairie. All overlie deep glacial drift except for those of the bedrock-cored bluffs, which are formed in a thin layer of loess or residuum. Soils are well drained to excessively drained. Depending upon the degree of slope, the slope aspect, and the soil composition, Dry Prairie intergrades with Mesic Prairie.

There are four Dry Prairie subtypes. The Barrens Subtype, which occurs primarily on old dune blankets, is perhaps most distinctive, and additional plot data may support recognizing it as a separate community type. The Bedrock Bluff Subtype may also deserve type status. There are four geographic sections of Dry Prairie (Southeast, Southwest, Central, and Northwest), each having the same boundaries as the equivalent sections of Mesic Prairie (Fig. 15). Not all subtypes occur in every geographic section. Additional details of the subtypes follow:

d. substrate sand (gravel fraction < 10%) with little soil formation; present on dunes or on steep, erodible alluvial sand deposits such as some alluvial fans or stream cuts *Barrens Subtype*

d. substrate variable in texture or, if sandy, gravel fraction > 10%; usually some soil formation e.

e. site on alluvium, mostly of glacial origin (glacial lake beachlines, kames, eskers, collapsed outwash, abandoned river terraces, etc.); soils coarse textured, gravel fraction > 10%; present on gentle to steep slopes *Sand-Gravel Subtype*

e. site not on alluvium, mostly on dissected till or bedrock; soils fine to medium textured, gravel fraction variable; slopes > 10% f.

f. soils on unconsolidated drift; slopes moderate to steep ... *Hill Subtype*

- f. thin soils over bedrock; typically on steep bluffs
 *Bedrock Bluff Subtype*

Barrens Subtype

The Barrens Subtype occurs on dry to dry-mesic sands on outwash plains, old dune blankets, and alluvial deposits along rivers and streams. It is present in the northwest, central, and southeastern parts of the prairie zone, and also in the deciduous forest-woodland zone. The low nutrient levels, low levels of organic matter, and poor water-retaining capacity of the deep sands presumably are the major determinants of the species composition and structure of the subtype. The vegetation is generally sparser than in other Dry Prairie subtypes (often with less than 50% cover), but is fairly rich floristically. The major graminoid species in the subtype include all of the common graminoids listed above for Dry Prairies in general, excluding side-oats grama. Other graminoids characteristic of the Barrens Subtype are sand dropseed (*Sporobolus cryptandrus*), sand reedgrass (*Calamovilfa longifolia*), hairy grama (*Bouteloua hirsuta*), blue grama (*Bouteloua gracilis*), and several sedges, notably *Carex foenea* and *Cyperus schweinitzii*.

Among the more distinctive forbs that occur in this subtype are prairie sagewort (*Artemisia frigida*), plantain-leaved pussytoes (*Antennaria plantaginifolia*), large-flowered beard-tongue (*Penstemon grandiflorus*), hairy puccoon (*Lithospermum caroliniense*) (in the southeast and central parts of the state), and silky prairie-clover (*Petalostemum villosum*). Prairie willow (*Salix humilis*) is generally a common low shrub in this subtype. Several plant species characteristic of the Barrens Subtype (for example, false heather (*Hudsonia tomentosa*)) are restricted to local disturbances such as active blowouts or slipfaces.

The Barrens Subtype often occurs as inclusions in areas of Dry Oak Savanna or Oak Woodland. Whether to classify an area as Dry Prairie Barrens Subtype or as part of a savanna community depends upon the size of the prairie opening, or often upon the degree to which fragmentation has isolated small remnants. The Barrens Subtype grades into Mesic Prairie or even into Wet Prairie in low areas or where sand grades into richer soils.

The Barrens Subtype is present in the Northwest, the Central, and the Southeast Sections of Dry Prairie (Fig. 15). In the Northwest Section, the subtype occurs on dune blankets such as the Agassiz Dunes and Skull Lake Dunes. In the Central Section, occurrences are on outwash along the Mississippi River and on the Anoka Sand Plain. In the Southeast Section, the subtype is present on dunes on terraces along the Mississippi River (Weaver Dunes) and on sandy alluvial fans at Whitewater Wildlife Management Area and Rushford Sand Barrens SNA.

Sand-Gravel Subtype

The Sand-Gravel Subtype occurs on gently to steeply sloping sites throughout the prairie zone, with scattered occurrences in the deciduous forest-woodland zone (Fig. 1). In addition

to the widespread graminoids listed above in the general description of Dry Prairies, important species in the Sand-Gravel Subtype include needle grass (*Stipa comata*), plains muhly (*Muhlenbergia cuspidata*), prairie dropseed (*Sporobolus heterolepis*), Wilcox's panic grass (*Panicum wilcoxianum*), blue grama (*Bouteloua gracilis*), hairy grama (*Bouteloua hirsuta*), and sand reedgrass (*Calamovilfa longifolia*). Some distinctive forb species, in addition to those present in all Dry Prairie subtypes, are prairie sagewort (*Artemisia frigida*), plantain-leaved pussytoes (*Antennaria plantaginifolia*), purple coneflower (*Echinacea angustifolia*) (except in the southeast), skeleton-weed (*Lygodesmia juncea*), small white beard-tongue (*Penstemon albidus*), plains paintbrush (*Castilleja sessiliflora*), prairie cinquefoil (*Potentilla pensylvanica*), and the milk-vetch *Astragalus adsurgens*.

The Sand-Gravel Subtype of Dry Prairie occurs on the former shorelines of Glacial Lake Agassiz, on outwash deposits, and on ice-contact features such as kames and eskers. Occurrences are typically small, corresponding to the local extent of these landforms. Soils are mollisols ("prairie" soils), but the organic-rich surface horizon is thinner than in Mesic Prairie, and fine to coarse gravel constitutes a significant fraction of the solum. Soil texture is most commonly sandy-skeletal, often with abundant larger stones as well as gravel. These soils are excessively drained or somewhat excessively drained.

This subtype grades into the Barrens Subtype on outwash deposits, or even into the dry-mesic phase of Mesic Prairie. Distinguishing between the Sand-Gravel Subtype when it is present on steeply sloping collapsed outwash or ice-contact deposits and the Hill Subtype may be especially difficult. The Sand-Gravel Subtype occurs in the Southeast, Southwest, Central, and Northwest Sections of Dry Prairie (Fig. 15).

Hill Subtype

The Hill Subtype occurs on steep terrain throughout the prairie zone as far north as Polk County, and sporadically in the deciduous forest-woodland zone (Fig. 1). Depending upon slope position, angle, and aspect, as well as soil type, conditions vary from dry to mesic, although drier conditions predominate. Of the Dry Prairie Subtypes, the Hill Subtype has the greatest overlap in species composition with Mesic Prairie and is richest in species. The major graminoids include those listed above for all Dry Prairies, plus prairie dropseed (*Sporobolus heterolepis*); Indian grass (*Sorghastrum nutans*) and big bluestem (*Andropogon gerardii*) are more important in the Hill Subtype than in other Dry Prairie subtypes. Less abundant but characteristic graminoids include Wilcox's panic grass (*Panicum wilcoxianum*) and plains muhly (*Muhlenbergia cuspidata*). Typical forbs other than those common to all Dry Prairie subtypes include purple coneflower (*Echinacea angustifolia*), aromatic aster (*Aster oblongifolius*), plains paintbrush (*Castilleja sessiliflora*), small white beard-tongue (*Penstemon albidus*), locoweed (*Oxytropis lambertii*), and the milk-vetch *Astragalus adsurgens*.

The Hill Subtype occurs on erosional features in glacial till (e.g., valley side slopes), but also on steep slopes in disintegration moraine. Soils are mollisols but with shallower organic-rich surface horizons than in Mesic Prairie. Soil texture ranges from clay loam to sandy loam;

cobbles and boulders are often common and gravelly inclusions may also be present. Soils are excessively drained to well drained. Floristically, the boundary between the Hill Subtype of Dry Prairie and the dry-mesic phase of Mesic Prairie is particularly indistinct. They are best separated by topography. This subtype also grades into the hillier forms of the Sand-Gravel Subtype of Dry Prairie, as noted above. Heavily grazed occurrences of the Hill Subtype are often difficult to distinguish floristically from the Sand-Gravel Subtype. The Hill Subtype is present in the Southeast, Southwest, Central, and Northwest Sections of Dry Prairie (Fig. 15).

Bedrock Bluff Subtype

The Bedrock Bluff Subtype occurs on bluffs along the Mississippi River and many of its tributaries in southeastern Minnesota, and to a very limited extent along the St. Croix River. The community is best developed on very steep south- and west-facing slopes; goat prairie, the popular name of the community, indicates the steepness of these slopes. The major graminoid species in the Bedrock Bluff Subtype are those generally common graminoids to all dry prairies (see above). Other common graminoid species are prairie dropseed (*Sporobolus heterolepis*), plains muhly (*Muhlenbergia cuspidata*), hairy grama (*Bouteloua hirsuta*), Leiberg's panic grass (*Panicum leibergii*), and long-leaved panic grass (*Panicum perlongum*). Some of the more common distinctive forbs are plains paintbrush (*Castilleja sessiliflora*), aromatic aster (*Aster oblongifolius*), sky-blue aster (*Aster oolentangiensis*), cylindric blazing-star (*Liatris cylindracea*), false boneset (*Kuhnia eupatoroides*), birdfoot coreopsis (*Coreopsis palmata*), and flowering spurge (*Euphorbia corollata*).

Soils of the Bedrock-Bluff Subtype are thin and formed in loess or residuum on steep erosional bedrock slopes. The underlying bedrock is dolomite and sandstone. Cobble to boulder sized rock rubble is abundant, and bedrock outcrops are common. Soils are excessively drained to well drained. Occurrences of this community are usually small openings surrounded by woodland or forest, although there are some large bluffs that are completely covered by prairie.

The frequency and intensity of moisture stress on the steepest south- or west-facing slopes (summer soil temperatures often exceed 40 degrees C) greatly impede invasion of Bedrock Bluff Prairies by woody vegetation, but complete suppression of fire does result in eventual succession from prairie to savanna or dry woodland.

There are no geographic sections of Bedrock-Bluff Subtype.

BOG

Bogs occur primarily on the Agassiz, Aitkin and Upham glacial lake plains in the conifer-hardwood forest zone (Fig. 1). They also occur in scattered kettle-hole basins in the conifer-hardwood forest and deciduous forest-woodland zones. Bogs have a nearly continuous mat of moss dominated by *Sphagnum* species (especially *Sphagnum fuscum* and *Sphagnum angustifolium*), and an impoverished vascular flora. A forest canopy of black spruce may or may not be present. Tall shrubs are absent. The groundlayer is dominated by low ericaceous shrubs (Labrador tea, leatherleaf, swamp laurel, or bog-rosemary), sedges (*Carex* spp.), or cotton grasses (*Eriophorum* spp.). Although there are no indicator species of Bogs, Bogs can be identified by their paucity of minerotrophic species (they usually have at most 2 minerotrophic species present, with very low coverage). Appendix 6 lists plant species tolerant of bog (i.e., non-minerotrophic) environments.

Bogs are late-successional communities that develop in peatlands where the surface substrate has become isolated from groundwater flow because of peat accumulation. A minimum of one meter of peat, with a surface composed of poorly decomposed minerotrophic sphagnum mosses, must develop before acidophilus sphagnum mosses dominate a Bog. The Bog surface is usually raised or domed, but can sometimes appear flat. Most Bogs on glacial lake plains succeed from sphagnum-dominated Black Spruce Swamps. As these swamps mature, surface water is channeled into areas (drains) that become too wet for black spruce. This results in the formation of nonforested bog fingers that radiate downslope from black spruce crests. These are identifiable on aerial photographs. In the deciduous forest-woodland zone and in small basins in the conifer-hardwood forest zone, open bog communities can succeed Poor Fen. These nonforested bogs are often identifiable by the diversion of surface waters around their perimeters, which causes the formation of characteristic moats.

Because Bogs receive most (if not all) of their water and nutrients from rainfall, the surface water in Bogs is oligotrophic or ombrotrophic. Surface waters are extremely acidic (pH <4.4) with low concentrations of dissolved nutrients (e.g., $[Ca^{2+}] < 2.2$ mg/l). The water table in Bogs is near the surface during the spring but generally falls through the summer. True ombrotrophic bogs, which include raised bogs, can be distinguished from intermediate bogs by their more extreme water chemistry (pH ≤ 4.1 , $[Ca^{2+}] \leq 2.2$ mg/l) and their lack of minerotrophic species.

There are two Bog community types, a forested bog and an open (non-forested) bog:

- a. tree cover >30%, strongly dominated by black spruce; groundlayer with few or no minerotrophic species (Appendix 4); water chemistry: pH <4.6, $[Ca^{2+}] < 6$ mg/l **Black Spruce Bog**
- a. tree cover <30%; groundlayer with few or no minerotrophic species (Appendix 4); water chemistry: pH <4.6, $[Ca^{2+}] < 6$ mg/l; often a transitional area between forested bog and fen in patterned peatlands; includes extremely poor fen **Open Sphagnum Bog**

Black Spruce Bog

Black Spruce Bog occurs mainly in the conifer-hardwood forest zone, and occasionally in the deciduous forest-woodland zone (Fig. 1). Stunted black spruce trees (<10m tall) dominate the canopy, which may also contain scattered tamaracks. Tree canopy cover is variable but usually greater than 30%. The groundlayer is dominated by ericaceous shrubs (Labrador tea, leatherleaf, swamp laurel, bog-rosemary), the sedge *Carex trisperma*, or the cotton-grass *Eriophorum spissum*. There is a continuous carpet of sphagnum mosses (usually *Sphagnum fuscum* and *S. angustifolium* (recurvum aggregate)), which form hummocks and hollows. Feather mosses (*Pleurozium schreberi*), *Dicranum undulatum*, and *Polytrichum strictum* are abundant at the bases of trees. Plant species that cause this type to differ from Open Sphagnum Bog include lingonberry (*Vaccinium vitis-idaea*), creeping snowberry (*Gaultheria hispidula*), three-leaved-false Solomon's-seal (*Smilacina trifolia*) and the sedge *Carex trisperma*.

Black Spruce Bog is best developed on drier sites--such as the crests and upper slopes of raised bogs--within bog complexes. In these complexes, vigorously growing acidophilus sphagnum mosses prevent most tree reproduction except that of black spruce and tamarack, which can reproduce by layering. Soils in Black Spruce Bogs are composed of deep, highly fibric peat.

Black Spruce Bog commonly grades into Black Spruce Swamp, from which it succeeds, but is distinguishable because it lacks the minerotrophic species present in Black Spruce Swamp (see Appendix 4). Open Sphagnum Bog can develop from Black Spruce Bog when water is channeled onto treed bog slopes and stunts or kills the trees. Although the amount of canopy tree cover may overlap between Black Spruce Bog and Open Sphagnum Bog, the two types can be separated by the abundance of shade-tolerant versus shade-intolerant species present. Distinguishing between these two types is difficult where the tree canopy in a Black Spruce Bog has recently been destroyed by fire or mistletoe.

There are two recognized subtypes of Black Spruce Bog in Minnesota, the Raised Subtype and the Intermediate Subtype. The Raised Subtype occurs only on sites that are genuinely ombrotrophic (rain nourished) with pH <4.2 and [Ca²⁺] ≤2.2 mg/l, and it lacks minerotrophic species.

Open Sphagnum Bog

Open Sphagnum Bog occurs mainly in the conifer-hardwood forest zone, with occasional inclusions in the deciduous forest-woodland zone (Fig. 1). Scattered and stunted (less than 10 m tall) black spruce and tamarack may be present, but tree cover is never greater than 30%. The groundlayer is dominated by ericaceous shrubs (leatherleaf, swamp laurel, bog-rosemary), sedges (*Carex* spp.), or cotton grasses (*Eriophorum* spp.). Other characteristic species are round-leaved sundew (*Drosera rotundifolia*) and pitcher plant (*Sarracenia purpurea*). The groundlayer also has a continuous mat of sphagnum mosses, usually dominated by *Sphagnum*

magellanicum or *S. angustifolium*. Species useful in distinguishing Open Sphagnum Bog from Black Spruce Bog are *Carex oligosperma* and *Carex pauciflora*.

Open Sphagnum Bog develops in areas of Black Spruce Bog that become too wet to support black spruce. Although canopy tree cover may overlap between the two bog types, they are separable by differences in the abundance of shade-tolerant versus shade-intolerant species present. Distinguishing between the two types may be difficult where the canopy of a Black Spruce Bog has recently been destroyed by fire or mistletoe. Open Sphagnum Bog also grades into Poor Fen at the bases of raised bogs and in small isolated basins. Species typical of Poor Fens but absent from Open Sphagnum Bogs include *Carex aquatilis*, *C. lasiocarpa*, *C. chordorrhiza*, *scheuchzeria* (*Scheuchzeria palustris*), and beaked-sedge (*Rhynchospora alba*).

There are three recognized subtypes of Open Sphagnum Bog in Minnesota, the Raised, Intermediate, and Schlenke Subtypes. These subtypes differ from one-another in water chemistry and water level.

The Raised Subtype occurs only in areas that are genuinely ombrotrophic (receiving nutrients from rainfall only, with $\text{pH} \leq 4.1$ and $[\text{Ca}^{2+}] \leq 2.2 \text{ mg/l}$) and lacks the minerotrophic species that occur in intermediate bogs. The Intermediate Subtype is not genuinely ombrotrophic, but except for a few minerotrophic indicator species is nearly indistinguishable from "true" raised bogs. The Schlenke Subtype is rare. It occurs only in three raised bogs in Minnesota in which pool formations have developed near the bog crests. The Schlenke Subtype is characterized by maritime bog species such as *scheuchzeria* (*Scheuchzeria palustris*), beaked-sedge (*Rhynchospora alba*), and horned bladderwort (*Utricularia cornuta*), and hollows containing *Sphagnum cuspidatum*.

FLOODPLAIN FOREST

Floodplain Forests are wet forests that occur on seasonally-inundated soils along the floodplains of the major rivers in Minnesota, as well as along some perennial streams. Floodplain Forests are especially well developed on floodplains in the Mississippi River, Minnesota River, and Red River valleys. The canopy dominants in Floodplain Forests vary according to the successional status of the stand and the length and duration of annual flooding. The most common canopy dominants are silver maples, cottonwoods, black willows, American elms, green ashes, and bur oaks, which occur either singly or in mixed stands. Black willow and cottonwood are pioneer species, often occurring on sand bars, mud flats, and other areas with recently disturbed soils. Black ash, box elder, hackberry, and basswood are common subdominant canopy species in Floodplain Forests.

The germination and survival of tree and shrub seedlings within Floodplain Forests is severely restricted by flooding. As a result, the understory of most Floodplain Forests is fairly open, with few tree seedlings and saplings or shrubs. Shrubs become important in Floodplain Forests only after persistent disturbance, such as grazing. Woody climbers, including wild grape (*Vitis riparia*), poison ivy (*Rhus radicans*), and Virginia creeper (*Parthenocissus quinquefolia*), are often present in light gaps and along open channels, where they may overgrow trees and contribute significantly to canopy cover. The herb layer has low diversity, and contains only short-lived species or species otherwise tolerant of frequent disturbance. Wild-rye (*Elymus virginicus*), cleavers (*Galium aparine*), sedges (*Carex* spp.), wood nettle (*Laportea canadensis*), and other members of the nettle family (Urticaceae) are common herbaceous species.

The structure and composition of Floodplain Forests is closely related to annual cycles of river flooding and drawdown. Evidence of such cycles includes windrows of debris on the forest floor, ice scars on trees, and abandoned channels that contain water at or above the level of the main river channel. In general, Floodplain Forests in Minnesota have been heavily disturbed by drainage and conversion to agricultural land, logging, channel dredging, and dam construction. In areas where tree canopies are still intact, the ground flora often is altered by human-induced changes in the flood cycle. Box elder is an increasingly common component of Floodplain Forests because of human disturbance, while mature American elms have become much rarer in Floodplain Forests since the introduction of Dutch elm disease to Minnesota.

There is only one recognized Floodplain Forest type in Minnesota:

a. represented by a single type; canopy either 1) dominated by a mixture of black willow, cottonwood, river birch, American elm, slippery elm, green ash, bur oak, or box elder, 2) strongly dominated by silver maple (>70% cover) with lesser amounts of green ash, black ash, American elm, slippery elm, or hackberry, or 3) dominated by swamp white oak, with lesser amounts of silver maple, green ash, American elm, and bur oak; soils range in texture from silty to sandy loam to sandy *Floodplain Forest*

Floodplain Forest

Floodplain Forest is a seasonally wet forest community that occurs throughout Minnesota on the active floodplains of major rivers and their tributary streams. The canopy of the community is dominated by deciduous tree species tolerant of inundation, abrasion, and other disturbances associated with flooding. The canopy is variable in composition, either composed of a mixture of tree species or strongly dominated by a single tree species.

The species composition of Floodplain Forests varies both geographically and in relation to such features as substrate type or flood cycles. Along the Red River in northwestern Minnesota, the canopy is generally a mixture of American elms, slippery elms, green ashes, cottonwoods, and bur oaks. Basswoods, box elders, and willows occur less frequently. On smaller northwestern rivers, a mixture of bur oaks, elms, green ashes, and aspens is common, with some areas having only bur oaks. In southern Minnesota, silver maples, black willows, and cottonwoods are common canopy dominants. They occur either in nearly pure stands or in mixed stands. Scattered individuals or patches of river birch, American elm, slippery elm, green ash, and swamp white oak are also common in stands in southern Minnesota. (The geographic variation that occurs among these mixed forests in different parts of Minnesota may be related to differences in substrate and flood regimes among different rivers, however more research is needed.)

The tree canopy cover is highly variable within Floodplain Forests. The canopy is continuous in some stands while other stands have open areas caused by repeated erosion, ice-scouring, and soil and debris deposition, all of which prevent the growth of trees and shrubs. In recent decades, Dutch elm disease has also caused significant canopy openings in Floodplain Forests in which mature American elm trees were abundant in the canopy. Areas beneath tree-canopy openings in the forests are either dominated by short-lived herbaceous plants or, where erosion and disturbance from flooding tend to be repeated and severe, remain unvegetated. The common herbaceous plants in these open patches include those mentioned above in the Floodplain Forest class description.

At present, there are two recognized subtypes of Floodplain Forest, the Silver Maple Subtype and the Swamp White Oak Subtype. (Additional subtypes likely will be recognized as more data on the community become available.) The Silver Maple subtype occurs mainly in the deciduous forest-woodland zone (Fig. 1) along the Minnesota, lower Mississippi, and St. Croix rivers and their tributaries, although there are some stands to the north in the conifer-hardwood forest zone, such as along the Prairie River in Carlton and southern St. Louis counties. The Silver Maple Subtype seems to be best developed in broad, deep glacial meltwater-cut river valleys that have been filling with coarse alluvium ever since the glacial meltwaters subsided. (The Mississippi and St. Croix river valleys are exemplary of these.)

As the name implies, silver maples dominate the tree canopy in this subtype, and are present in the subcanopy and shrub layer as well. Green ashes, cottonwoods, and American elms are often present in the canopy, but are most common as seedlings and saplings. Trees such as hackberry, bur oak, and box elder are sometimes present in the community, but most

often occur only on natural levees along active river channels.

The understory of the Silver Maple Subtype is open, with less than 25% cover by tree seedlings and saplings. Herbs in the nettle family, including wood nettle (*Laportea canadensis*) and clearweed (*Pilea pumila*), dominate the groundlayer. Woody and herbaceous climbers are common, especially wild grape (*Vitis riparia*), wild cucumber (*Echinocystis lobata*), bur-cucumber (*Sicyos angulatus*), groundnut (*Apios americana*), and hog-peanut (*Amphicarpa bracteata*).

The Swamp White Oak Subtype is uncommon in Minnesota, occurring only in the extreme southeastern part of the state on the Mississippi River floodplain and possibly along some smaller rivers. The tree canopy is dominated by swamp white oaks, and generally also contains silver maples, green ashes, American elms, and bur oaks. Upland tree species such as basswood and sugar maple are also present in some stands. Further inventories of stands of the Swamp White Oak Subtype are needed in order to determine whether its understory species are distinct from those of other floodplain forests.

The Swamp White Oak Subtype is thought to develop primarily on floodplain sites where soil has accumulated or mounded and that are therefore drier than the sites on which most other variants of Floodplain Forest develop. This may be because seedlings of swamp white oak survive most readily in better drained areas. Additionally, mature swamp white oak trees are more fire tolerant than most other floodplain tree species, and these drier floodplain sites may have been more likely to experience fire in the past. The presence of scattered open-grown oak trees in some occurrences of the subtype provide evidence for a previous savanna-like structure, possibly maintained or initiated by fire.

Additional Floodplain Forest subtypes likely will be identified following collection of more data. Divisions probably will be based at least partially on successional status, as Floodplain Forests dominated by black willows and cottonwoods are short-lived, early successional communities that develop on recently disturbed sites, while those dominated by elms, oaks, ashes, and silver maples are longer-lived, later-successional communities with potential for old growth. Geographic sections may also be delineated by watersheds.

HARDWOOD SWAMP FOREST

Hardwood Swamp Forests are minerotrophic wetland communities that occur on muck and shallow peat substrates on wet sites in the deciduous forest-woodland and conifer-hardwood forest zones (Fig. 1). They have tree canopies dominated by broad-leaved deciduous species, including black ash, paper birch, yellow birch, red maple, American elm, slippery elm, green ash, quaking aspen, or, rarely, balsam poplar. Tamarack is sometimes the most abundant tree species present in a stand, but never forms more than 50% of the total tree cover (if so, the swamp is classified as a Tamarack Swamp). White pines or white cedars also occur in the community on occasion. The tree canopy cover ranges from dense (especially in even-aged or drained stands) to sparse, but there is always at least 30% cover by trees over 5 meters tall.

Hardwood Swamp Forests form fairly distinct, often narrow zones at the margins of wetland basins or along streams. They form more extensive stands in shallow, poorly drained depressions or lake basins and in groundwater seepage areas on level terrain at the bases of hills or terrace slopes. Hardwood Swamp Forests often are long-lived communities on nutrient-rich low-disturbance sites. Flooding (especially that caused by beaver dams) and windthrow occasionally kill canopy trees in Hardwood Swamp Forests, causing regression to Shrub Swamps or Wet Meadows. It is usually difficult to identify boundaries between Hardwood Swamp Forests and Shrub Swamps where the two community classes intergrade or form complex patches. Hardwood Swamp Forests also grade into Tamarack Swamp. (Tamaracks tend to dominate Swamp Forests where the organic substrate is poorer in nutrients, thicker, less decomposed, more acidic, or more continuously saturated.)

Hardwood Swamp Forests differ from Floodplain Forests and from Lowland Hardwood Forests by having an organic substrate and continuously or nearly continuously saturated soils during normal years. They also differ from Lowland Hardwood Forests by lacking upland herbs in the groundlayer. Hardwood Swamp Forests and Floodplain Forests may be difficult to separate where low-gradient streams flow across flat lowlands as, for example, along the Rum River on the Anoka Sand Plain in Isanti County.

- a. canopy with >50% cover by black ash *Black Ash Swamp*
- a. canopy a mixture of broad-leaved deciduous trees, with <50% cover by black ash
..... *Mixed Hardwood Swamp*

Black Ash Swamp

Black Ash Swamp is dominated by black ash trees, which occur either in almost pure stands or in mixed stands with other hardwoods. Common tree canopy associates include green ashes, paper birches, yellow birches, red maples, and (rarely) bur oaks. In northern Minnesota, white cedars and balsam firs are sometimes present in the canopy. The understory composition

varies considerably and, at present, there are insufficient data to delineate subtypes of Black Ash Swamp or to give a statewide summary of the community. The descriptions below are for areas in Minnesota for which information is available.

On the Anoka Sand Plain, Black Ash Swamp tends to occur as narrow zones or as small inclusions in wetland complexes. (When black ash occurs in larger swamp areas here, most often it is mixed with other deciduous tree species in Mixed Hardwood Swamps rather than forming Black Ash Swamps). Where the canopy is dense, there are usually few shrubs and the ground cover is dominated by shade-tolerant herbs such as naked bishop's-cap (*Mitella nuda*), lady fern (*Athyrium angustum*), or clearweed (*Pilea pumila*), and bryophytes. Cinnamon fern (*Osmunda cinnamomea*) is sometimes abundant on moderately shady sites. In open, minerotrophic areas the groundlayer is composed of Wet Meadow species, and there is a shrub layer of alder, winterberry, and other species.

In Washington and Chisago counties, very local, small stands of Black Ash Swamp occur in seepage zones at the bases of river terrace slopes; these stands are classified as Seepage Subtypes of Black Ash Swamp. Skunk cabbage (*Symplocarpus foetidus*) and dense tussocks of the fine-bladed sedge, *Carex bromoides* are characteristic in seepage Black Ash Swamps, and the subtype also provides habitat for two rare species, bog bluegrass (*Poa paludigena*) and water-pennywort (*Hydrocotyle americana*). Black Ash Swamp and Mixed Hardwood Swamp are often closely associated and difficult to separate from one-another in these seepage zones.

In eastern St. Louis County, Black Ash Swamp occurs in draws on the Vermillion moraine and the Toimi drumlin field. It also occurs as inclusions in disturbed white cedar stands. On the Aitkin lacustrine plain and elsewhere in St. Louis and Itasca Counties, Black Ash Swamp is floristically similar to White Cedar Swamp, to Shrub Swamps, and to Wet Meadow, communities with which it intergrades. The tree canopy cover ranges from nearly closed (in post-fire, even-aged stands) to open (usually in stands in wetland complexes). Where the tree canopy is open, the understory vegetation is patchy, ranging from open, mixed alder and willow swamps to minerotrophic sedge meadows. Associated tree species include white cedar, red maple, paper birch, balsam fir, and mountain ash, with speckled alder dominant in the shrub layer. Sensitive fern (*Onoclea sensibilis*), northern bugleweed (*Lycopus uniflorus*), common mint (*Mentha arvensis*), and marsh skullcap (*Scutellaria galericulata*) are characteristic herbs. In eastern Marshall County, Black Ash Swamp occurs at the bases of beach-ridge slopes; most likely these sites are areas of groundwater seepage.

At present, there are no recognized sections of Black Ash Swamp. There is one recognized subtype (the Seepage Subtype), which occurs along the St. Croix River and its tributaries in Washington, Chisago, and Pine counties.

Mixed Hardwood Swamp

Mixed Hardwood Swamp is present in the deciduous forest-woodland and conifer-hardwood forest zones (Fig. 1). The community has a mixed canopy of hardwoods, including

paper birches, yellow birches, American elms, black ashes, red maples, quaking aspens, and green ashes. Black ashes, although commonly present, never form more than 50% of the canopy cover in the community. Tamarack or white pine are also occasionally co-dominant canopy tree species. The tree canopy cover ranges from sparse to dense, with the density of the shrub cover varying inversely with the density of the tree canopy.

Mixed Hardwood Swamp occurs most commonly on muck and shallow peat on lake plains and floodplains. It is a long-lived community and has old-growth potential. Like Black Ash Swamp, Mixed Hardwood Swamp varies considerably in its composition across Minnesota. The descriptions below are for specific areas for which information exists.

On the Anoka Sand Plain, Mixed Hardwood Swamp is common in shallow wetlands, especially near upland margins. On sites that are not too wet, Mixed Hardwood Swamp may succeed minerotrophic Alder Swamp. Common canopy dominants on the Sandplain are tamaracks, paper birches, red maples, yellow birches, and black ashes. Occasionally, white pines form a patchy supercanopy above the hardwood canopy. Speckled alders and poison sumacs are the most common shrubs. Other associated species are interrupted fern (*Osmunda claytoniana*), mad-dog skullcap (*Scutellaria lateriflora*), marsh marigold (*Caltha palustris*), the sedge *Carex stipata*, and mosses, including some sphagnum hummocks. Mixed Hardwood Swamps on the Anoka Sandplain harbor two rare plant species, halberd leaved tearthumb (*Polygonum arifolium*) and yellow bartonia (*Bartonia virginica*). Mixed Hardwood Swamp is perhaps the most species-rich community in east-central Minnesota.

A seepage subtype of Mixed Hardwood Swamp occurs in groundwater seepage areas at the bases of terrace slopes near the St. Croix River in Washington, Chisago, and Pine counties. The groundlayer commonly contains skunk cabbage (*Symplocarpus foetidus*) and dense tussocks of the fine-bladed sedge, *Carex bromoides*. Basswood often is present in the tree canopy. The Seepage Subtype is habitat for two rare species, bog bluegrass (*Poa paludigena*) and water-pennywort (*Hydrocotyle americana*).

At present, there are no defined geographic sections of the community.

CONIFER SWAMP FOREST

Conifer Swamp Forests occur mainly in the conifer-hardwood forest zone, but also occasionally in the deciduous forest-woodland zone (Fig. 1). The tree canopy is dominated by black spruces, tamaracks, or white cedars. The density of the shrub, herb, and moss layers varies greatly, depending on the density of the tree canopy, on soil nutrients, and on the level of the water table.

Conifer Swamp Forests tend to develop on sites with wet mineral or poorly drained organic soils. There is often standing or barely moving water within the community. However, the water table usually drops below the tree rooting zone in mid to late summer so the upper soil layers are aerated for at least part of the growing season. Often, Conifer Swamp Forests are associated with springs or seepage areas. The surface waters within Conifer Swamp Forests range from circumneutral to moderately acidic.

White cedars usually grow on nutrient-rich mineral or shallow peat soils in areas protected from fire. Sites with these characteristics are common at the edges of peatlands or along gentle slopes with subsurface groundwater flow. Tamaracks and black spruces occur on nutrient poor-peat soils, with tamaracks tending to occur on the more minerotrophic sites and sites with higher water tables. Black spruces are tolerant of extremely acidic conditions, so Black Spruce Swamp often grades into Black Spruce Bog.

There are three recognized Conifer Swamp Forest community types:

a. canopy mostly white cedar, often with some balsam fir and sometimes with black spruce or tamarack; *Sphagnum* spp. mostly absent **White Cedar Swamp**

a. canopy not dominated by white cedar; *Sphagnum* spp. present or absent b.

b. canopy mostly tamarack, often mixed with paper birch or black ash; groundlayer typically of minerotrophic species (Appendix 4); *Sphagnum* spp. present or absent **Tamarack Swamp**

b. canopy strongly dominated by black spruce, with minor amounts of tamarack, white cedar, and hardwoods; *Sphagnum* spp. or feathermosses present **Black Spruce Swamp**

White Cedar Swamp

White Cedar Swamp occurs primarily in the conifer-hardwood forest zone, with scattered stands in the deciduous forest-woodland zone (Fig. 1). White cedars dominate the tree canopy, either forming pure, dense, even-aged stands or mixed, uneven-aged stands with various amounts

of black spruces, balsam firs, white spruces, balsam poplars, or black ashes. The shrub layer is composed of speckled alder and associated species. Shrub cover ranges from sparse to dense, depending on the density of the tree canopy. There is usually a layer of mosses in the understory, although mosses tend to be sparse in densely shaded stands.

White Cedar Swamp occurs on wet mineral soils or well-decomposed peat soils on level to gently sloping ($<3\%$) terrain along the margins of peatlands, along drainage courses, and in shallow depressions. White cedar is a fire-sensitive species and consequently tends to grow in moist habitats where the vegetation and litter is rarely dry enough to burn, or in areas protected from fire by topographic breaks. Ecologically, white cedar acts both as a pioneer species, colonizing recently disturbed sites, and as a late-successional species, regenerating in older, closed stands by layering. White cedar is a long-lived tree and therefore White Cedar Swamp forms mature and old-growth stands in the absence of catastrophic disturbance.

There is one subtype of White Cedar Swamp, a Seepage Subtype, which occurs in groundwater seepage areas. Following the completion of studies of old-growth cedar stands, additional subtypes may be defined by nutrient levels, as some stands are very poor in nutrients and have small, very slow-growing cedar trees in comparison with other stands.

Tamarack Swamp

Tamarack Swamp is present throughout the deciduous forest-woodland and conifer-hardwood forest zones (Fig. 1). It occurs on minerotrophic muck and shallow peat along rivers and in shallow lake basins, and on nutrient-poor, mildly-acidic to acidic peat in ice-block basins or large peatland systems. Tamarack is either the only canopy species or is mixed with black spruce, paper birch, yellow birch, white pine, black ash, American elm, or red maple. In minerotrophic wetlands in the deciduous forest-woodland zone, the understory of the community commonly contains speckled alder, winterberry, blue-joint (*Calamagrostis canadensis*), broad-leaved cattail (*Typha latifolia*), and jewel-weed (*Impatiens capensis*). On less minerotrophic sites in the deciduous forest-woodland and conifer-hardwood forest zones, Tamarack Swamp typically has a continuous hummocky mat of sphagnum mosses below such fen associates as bog birch, leatherleaf and other ericaceous species, cinnamon fern (*Osmunda cinnamomea*), wiregrass sedge (*Carex lasiocarpa*), and prairie sedge (*Carex prairea*). In northern Minnesota, tamarack may grow in association with alder, red-osier dogwood, willow species, and mountain fly honeysuckle. The sedge *Carex stricta* is common under relatively open stands of tamarack; cyperus-like sedge (*Carex pseudo-cyperus*) and black chokeberry (*Aronia melanocarpa*) are often present on tear-drop islands in large peatland complexes.

In the absence of catastrophic disturbances, Tamarack Swamps may succeed Shrub Swamps, Rich Fens, Poor Fens, and possibly Hardwood Swamp Forests. Fire, flooding, and insect infestations (e.g., larch sawfly) often reverse this succession. Windthrow, disease, and selective cutting of tamaracks in dense stands help maintain tamarack cover by creating gaps in the canopy in which the very shade-intolerant tamarack seedlings and saplings are able to grow.

CONIFER SWAMP FOREST

Conifer Swamp Forests occur mainly in the conifer-hardwood forest zone, but also occasionally in the deciduous forest-woodland zone (Fig. 1). The tree canopy is dominated by black spruces, tamaracks, or white cedars. The density of the shrub, herb, and moss layers varies greatly, depending on the density of the tree canopy, on soil nutrients, and on the level of the water table.

Conifer Swamp Forests tend to develop on sites with wet mineral or poorly drained organic soils. There is often standing or barely moving water within the community. However, the water table usually drops below the tree rooting zone in mid to late summer so the upper soil layers are aerated for at least part of the growing season. Often, Conifer Swamp Forests are associated with springs or seepage areas. The surface waters within Conifer Swamp Forests range from circumneutral to moderately acidic.

White cedars usually grow on nutrient-rich mineral or shallow peat soils in areas protected from fire. Sites with these characteristics are common at the edges of peatlands or along gentle slopes with subsurface groundwater flow. Tamaracks and black spruces occur on nutrient poor-peat soils, with tamaracks tending to occur on the more minerotrophic sites and sites with higher water tables. Black spruces are tolerant of extremely acidic conditions, so Black Spruce Swamp often grades into Black Spruce Bog.

There are three recognized Conifer Swamp Forest community types:

- a. canopy mostly white cedar, often with some balsam fir and sometimes with black spruce or tamarack; *Sphagnum* spp. mostly absent **White Cedar Swamp**
- a. canopy not dominated by white cedar; *Sphagnum* spp. present or absent b.
 - b. canopy mostly tamarack, often mixed with paper birch or black ash; groundlayer typically of minerotrophic species (Appendix 4); *Sphagnum* spp. present or absent **Tamarack Swamp**
 - b. canopy strongly dominated by black spruce, with minor amounts of tamarack, white cedar, and hardwoods; *Sphagnum* spp. or feathermosses present **Black Spruce Swamp**

White Cedar Swamp

White Cedar Swamp occurs primarily in the conifer-hardwood forest zone, with scattered stands in the deciduous forest-woodland zone (Fig. 1). White cedars dominate the tree canopy, either forming pure, dense, even-aged stands or mixed, uneven-aged stands with various amounts

of black spruces, balsam firs, white spruces, balsam poplars, or black ashes. The shrub layer is composed of speckled alder and associated species. Shrub cover ranges from sparse to dense, depending on the density of the tree canopy. There is usually a layer of mosses in the understory, although mosses tend to be sparse in densely shaded stands.

White Cedar Swamp occurs on wet mineral soils or well-decomposed peat soils on level to gently sloping ($<3\%$) terrain along the margins of peatlands, along drainage courses, and in shallow depressions. White cedar is a fire-sensitive species and consequently tends to grow in moist habitats where the vegetation and litter is rarely dry enough to burn, or in areas protected from fire by topographic breaks. Ecologically, white cedar acts both as a pioneer species, colonizing recently disturbed sites, and as a late-successional species, regenerating in older, closed stands by layering. White cedar is a long-lived tree and therefore White Cedar Swamp forms mature and old-growth stands in the absence of catastrophic disturbance.

There is one subtype of White Cedar Swamp, a Seepage Subtype, which occurs in groundwater seepage areas. Following the completion of studies of old-growth cedar stands, additional subtypes may be defined by nutrient levels, as some stands are very poor in nutrients and have small, very slow-growing cedar trees in comparison with other stands.

Tamarack Swamp

Tamarack Swamp is present throughout the deciduous forest-woodland and conifer-hardwood forest zones (Fig. 1). It occurs on minerotrophic muck and shallow peat along rivers and in shallow lake basins, and on nutrient-poor, mildly-acidic to acidic peat in ice-block basins or large peatland systems. Tamarack is either the only canopy species or is mixed with black spruce, paper birch, yellow birch, white pine, black ash, American elm, or red maple. In minerotrophic wetlands in the deciduous forest-woodland zone, the understory of the community commonly contains speckled alder, winterberry, blue-joint (*Calamagrostis canadensis*), broad-leaved cattail (*Typha latifolia*), and jewel-weed (*Impatiens capensis*). On less minerotrophic sites in the deciduous forest-woodland and conifer-hardwood forest zones, Tamarack Swamp typically has a continuous hummocky mat of sphagnum mosses below such fen associates as bog birch, leatherleaf and other ericaceous species, cinnamon fern (*Osmunda cinnamomea*), wiregrass sedge (*Carex lasiocarpa*), and prairie sedge (*Carex prairea*). In northern Minnesota, tamarack may grow in association with alder, red-osier dogwood, willow species, and mountain fly honeysuckle. The sedge *Carex stricta* is common under relatively open stands of tamarack; cyperus-like sedge (*Carex pseudo-cyperus*) and black chokeberry (*Aronia melanocarpa*) are often present on tear-drop islands in large peatland complexes.

In the absence of catastrophic disturbances, Tamarack Swamps may succeed Shrub Swamps, Rich Fens, Poor Fens, and possibly Hardwood Swamp Forests. Fire, flooding, and insect infestations (e.g., larch sawfly) often reverse this succession. Windthrow, disease, and selective cutting of tamaracks in dense stands help maintain tamarack cover by creating gaps in the canopy in which the very shade-intolerant tamarack seedlings and saplings are able to grow.

Tamarack Swamp differs from Mixed Hardwood Swamp in part by having at least 50% of its canopy cover formed by tamarack. This may not be easy to determine (either from aerial photographs or in the field) because tamaracks are often slender and conical so may be numerous yet still contribute little to the total tree canopy cover. The same problem exists in Shrub Swamps where tamaracks occur as "spires" above the shrub layer. Tamarack Swamp differs from Bog communities in the pH of its surface waters and by having minerotrophic species that do not occur in true bogs (see Appendix 4).

There are three subtypes of Tamarack Swamp, a Minerotrophic Subtype, a Sphagnum Subtype, and a Seepage Subtype. The Seepage Subtype is local and rare. At present, it is documented only along the St. Croix River and along the Sauk River in Stearns County, where it occurs in groundwater seepage areas at the bases of river terrace slopes. The canopy of the seepage subtype is mixed, containing yellow birches, basswoods, and black ashes in addition to tamaracks. There are no geographic sections of Tamarack Swamp although the community may ultimately be divided into northern and southern sections.

Black Spruce Swamp

Black Spruce Swamp occurs primarily in the conifer-hardwood forest zone, with scattered outlying stands in the deciduous forest-woodland zone (Fig 1). The canopy is dominated by black spruces, often growing in pure stands or in association with tamaracks or white cedars. The shrub layer, if present, contains speckled alders. The groundlayer is dominated by sedges (*Carex trisperma*, *C. leptalea*), cotton-grasses (*Eriophorum* spp.), or ericaceous shrubs (labrador tea, bog-rosemary, swamp laurel, creeping snowberry). The moss layer is usually continuous, with feathermosses predominant, although they may be mixed with minerotrophic *Sphagnum* species.

Black Spruce Swamp occurs on shallow to deep, moderately acidic peat. Nutrient levels in the community vary with the depth and degree of decomposition of the peat. Under certain conditions, Black Spruce Swamps will succeed to Black Spruce Bogs, as the surface waters in the community become acidified and there is an increase in the abundance of peat-forming sphagnum mosses. Black Spruce Swamp differs from Black Spruce Bog by containing species that grow in minerotrophic environments (see Appendix 4). Black spruce is long-lived in swamps or bogs, and may form mature and old-growth stands.

There are no subtypes of Black Spruce Swamp in this classification. The following subtypes appear in the literature on boreal forests: black spruce-sphagnum, black spruce-alder, black spruce-herb, black spruce-sedge, black spruce-half shrub, and black spruce-seepage.

SHRUB SWAMP

Shrub Swamps are minerotrophic, tall-shrub communities, most often present on mucks and shallow peat in the deciduous forest-woodland and conifer-hardwood forest zones (Fig. 1). The major shrub species in these communities are speckled alder, willows (especially pussy willow, slender willow, and Bebb's willow), and red-osier dogwood. The shrub canopy ranges from interrupted, with many light gaps, to closed, with the ground well shaded below. Graminoid-dominated openings, if present, are not distinctly separated from shrub clumps. Poison sumac or alder buckthorn often dominate the canopy in disturbed swamps in east-central Minnesota.

Shrub Swamps are considered mid-successional communities, between Wet Meadow/Fen communities and Conifer or Hardwood Swamp Forests. However, Shrub Swamp communities are relatively stable in areas where water table fluctuations are small, as the loss or gain of woody vegetation in many wetland areas is linked to particularly dry or wet cycles that affect seedling establishment, flooding, windthrow, and fire frequency. Before European settlement, extensive areas of Shrub Swamp existed in shallow wetlands on outwash plains and in glacial lake basins. Where fires occurred relatively frequently in wetland areas, the wetland communities probably were open, mainly lacking shrubs or trees. Occasional fires or prolonged flooding (such as from beaver ponds) in Conifer Swamp or Hardwood Swamp may have been important in maintaining patches of Shrub Swamp in areas that are predominantly swamp forest. Artificially drained meadows or fens rapidly succeed to shrubby Wet Meadow or Fen, to Shrub Swamp, or to forested swamps.

Two Shrub Swamp community types exist in Minnesota, Alder Swamp and Willow Swamp. These two types are similar to alder thicket and shrub-carr communities described in other classifications.

a. speckled alder is the most abundant shrub species in the canopy although the combined cover of willows, dogwood, poison sumac or other canopy shrubs may exceed the cover of alder
..... *Alder Swamp*

a. willows or red-osier dogwood are the most abundant shrub species in the canopy; speckled alder may be present but is not the single most abundant shrub species *Willow Swamp*

Alder Swamp

Alder Swamp is a minerotrophic wetland with a canopy of tall shrubs dominated by speckled alder, often mixed with other shrub species such as willows, bog birch, poison sumac, or alder buckthorn. Common understory species in the community are tussock sedge (*Carex stricta*), prairie sedge (*Carex prairea*), lake-bank sedge (*Carex lacustris*), broad-leaved cattail (*Typha latifolia*), blue-joint (*Calamagrostis canadensis*), northern marsh fern (*Thelypteris*

palustris), jewel-weed (*Impatiens capensis*), and *Sphagnum squarrosum*. The shrub canopy is usually continuous and dense, but may be interrupted, especially as a result of flooding. The understory graminoid cover tends to be sparse wherever the shrub canopy is especially dense. Graminoid-dominated openings are not distinctly separated from shrub clumps as in Wet Meadow or Fen communities. Trees, including northern white cedars, tamaracks, black ashes, and paper birches, are occasionally present in Alder Swamps, but have less than 30% cover.

There are no recognized subtypes or sections of Alder Swamp.

Willow Swamp

Willow Swamp is a minerotrophic wetland with a canopy of medium to tall (> 1m) shrubs dominated by willows (especially pussy willow, slender willow, and Bebb's willow) and red-osier dogwood. Other shrubs, such as speckled alder, bog birch, poison sumac, and alder buckthorn, may be common in the tall shrub layer, although speckled alder is never the most abundant species present. Herbaceous species (especially graminoids) characteristic of Wet Meadow/Fen communities are common in the more open occurrences of the community. However, in Willow Swamps, unlike Wet Meadow/Fen communities, these graminoid-dominated patches are poorly separated from clumps of shrubs. The most common herbs are tussock sedge (*Carex stricta*), prairie sedge (*Carex prairea*), lake-bank sedge (*Carex lacustris*), broad-leaved cattail (*Typha latifolia*), blue-joint (*Calamagrostis canadensis*), northern marsh fern (*Thelypteris palustris*), and jewel-weed (*Impatiens capensis*).

Willow Swamps dominated by bog birch are closely related to the Shrub Subtype of Rich Fen but have more minerotrophic indicator species (see Appendix 4) than are present in Rich Fens. Following fire in Conifer Swamps or in the Shrub Subtype of Rich Fens there may be initially a dense cover of willows (usually balsam willow and bog willow), but these stands are best classified as successional stages of Conifer Swamp or Rich Fen rather than as Willow Swamp. The dense groves of sand-bar willow or juvenile black willow that occur on sand bars along rivers are not considered Shrub Swamp communities but instead River Beach communities, as they occur on mineral rather than peat or muck substrates.

At present, there are no recognized or proposed sections or subtypes of Willow Swamp.

EMERGENT MARSH

Emergent Marshes are shallow-basin wetlands that have standing water present during most of the year. They occur throughout Minnesota, typically in association with lakes, ponds, and streams. Marsh bottoms have mineral soils or relatively inorganic sediments, although marshes dominated by cattails often contain floating, peaty mats. Marsh vegetation is composed of tall, erect, rooted herbaceous hydrophytes (Appendix 4) that are present for most of the growing season during years of normal rainfall. Emergent marshes often have zones of vegetation related to soil or sediment type, to the depth and permanence of standing water, and to groundwater influence. The dominant emergent species in marshes are usually graminoids such as cattails (*Typha latifolia* and *T. angustifolia*), common reed grass (*Phragmites australis*), bulrushes (*Scirpus* spp.), rushes (*Juncus* spp.), spike-rushes (*Eleocharis* spp.), and some umbrella sedges (*Cyperus* spp.). Common herbs associated with the emergent graminoids are broad-leaved arrowhead (*Sagittaria latifolia*), swamp milkweed (*Asclepias incarnata*), willow-herbs (*Epilobium* spp.), bulb-bearing water-hemlock (*Cicuta bulbifera*), and several species of *Polygonum*. Obligate aquatic plants (including *Potamogeton*, *Elodea*, *Ceratophyllum*, and *Myriophyllum*) often are present at the bases of the emergent species. The Emergent Marsh community class includes wetland types 3 and 4 as described in Fish & Wildlife Service Circular 39.

Emergent Marsh communities are stable, and do not necessarily need frequent disturbance in order to persist at a site. Invasion by woody species may cause succession of Emergent Marshes to Shrub Swamp, but this process is slow and fires during severe drought years are believed to further retard the spread of woody vegetation. Additionally, marshes are generally too wet for most woody plants to survive, as these plants lack the adaptations common to emergent aquatic plants for distributing oxygen to roots during long periods of inundation and anoxia.

Nonpersistent emergent wetlands (those in which plants are below the surface of the water or below the soil for part of the year) are not included in this class but are treated as aquatic communities. Nonpersistent wetlands include those dominated by pond-lilies (*Nuphar* spp.), water-lilies (*Nymphaea* spp.), pickerel-weed (*Pontederia cordata*), wild rice (*Zizania aquatica*), and other nonpersistent aquatic species.

There are two recognized Emergent Marsh community types:

- a. cover mostly cattails *Cattail Marsh*
- a. cover mostly a mixture of bulrushes, common reed grass, and graminoids other than cattails *Mixed Emergent Marsh*

Cattail Marsh

Cattail Marsh is an emergent marsh dominated by cattails (including *Typha angustifolia*, *T. latifolia*, and their hybrids). It occurs most commonly along lake margins and in shallow basins, although it is sometimes also present in river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots do not contact the bottom but instead the plants grow suspended in a buoyant peaty mat. Associated species vary widely, but some of the most common ones are sedges of the genus *Carex* (*C. aquatilis*, *C. rostrata*, and *C. lanuginosa*), bulrushes (*Scirpus americanus*, *S. acutus*, and *S. heterochaetus*), and broad-leaved herbs such as northern marsh fern (*Thelypteris palustris*), swamp milkweed (*Asclepias incarnata*), jewel-weed (*Impatiens capensis*), broad-leaved arrowhead (*Sagittaria latifolia*), mad-dog skullcap (*Scutellaria lateriflora*), marsh skullcap (*Scutellaria galericulata*), and blue vervain (*Verbena hastata*).

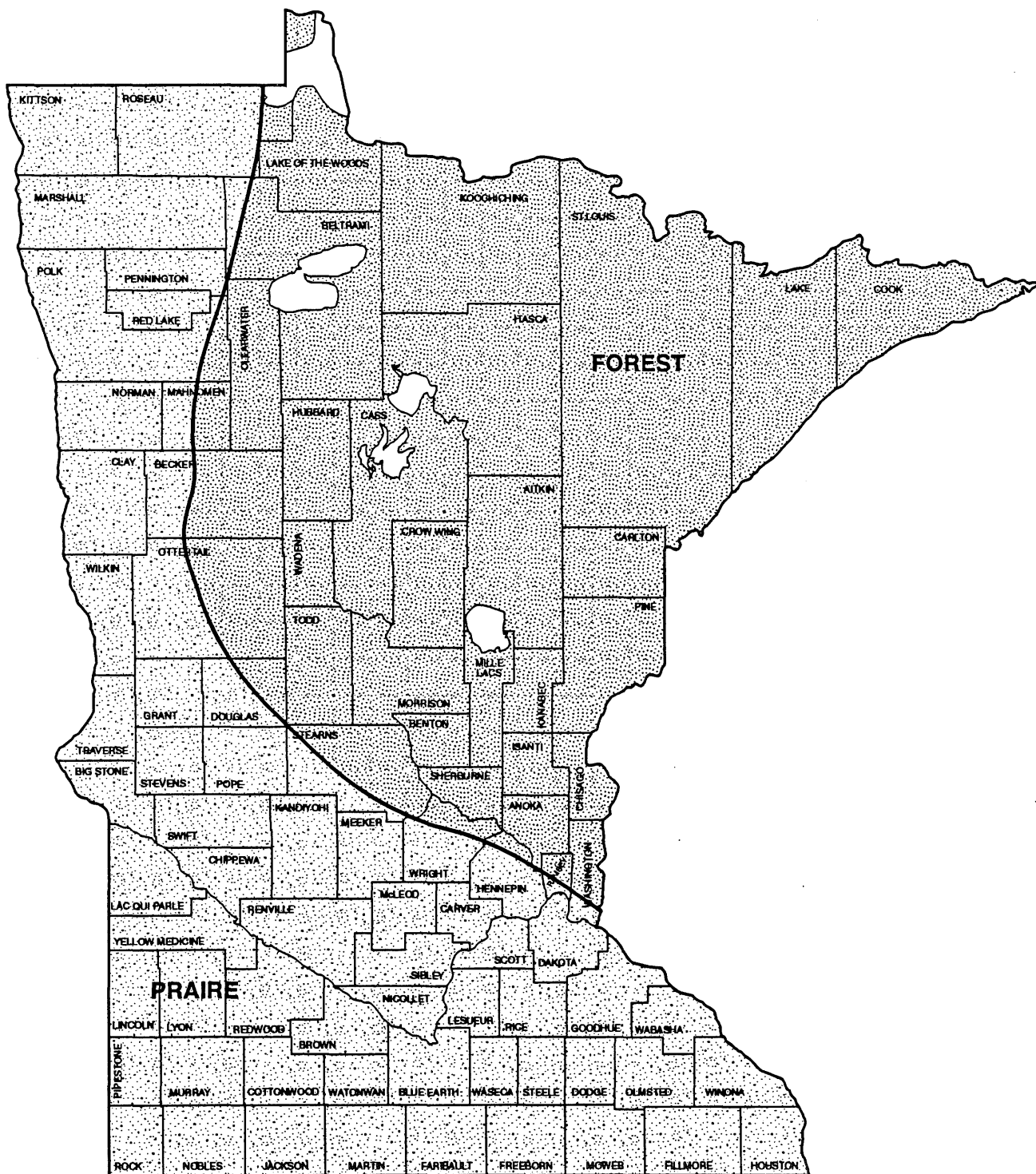
There are no recognized sections or subtypes of Cattail Marsh.

Mixed Emergent Marsh

Mixed emergent marsh is dominated by wetland species other than cattails. Bulrushes are the most common dominants, especially hard-stemmed bulrush (*Scirpus acutus*), river bulrush (*Scirpus fluviatilis*), softstem bulrush (*Scirpus validis*), *Scirpus americanus*, and *Scirpus heterochaetus*. Common reed grass (*Phragmites australis*), spike rushes (*Eleocharis* spp.), and (in some river backwaters) prairie cordgrass (*Spartina pectinata*) are less common dominants. In general, Mixed Emergent Marsh tends to occur on harder pond, lake, or river bottoms than Cattail Marsh and is less likely to contain the forbs that grow on the floating peat mats present in many cattail marshes. Broad-leaved arrowhead (*Sagittaria latifolia*) and aquatic macrophytes are the most common non-graminoid associates. Many Mixed Emergent Marsh species are sensitive to fertilizer run-off and other artificial disturbances, and disturbed Mixed Emergent Marshes (especially in the Prairie Zone) tend to convert to Cattail Marshes or become strongly dominated by reed canary grass (*Phalaris arundinacea*) or common reed grass (*Phragmites australis*), species that increase in abundance with disturbance.

Mixed Emergent Marsh is a broad community type, encompassing all marshes dominated by species other than cattails. Therefore, subtyping or recognition of new marsh types is likely following more thorough inventories of these marshes. New divisions most likely will be made according to dominant species or basin types (e.g., lacustrine versus riverine), or both. There are two geographic sections, a Forest Section and a Prairie Section (Fig. 16). The dominant species in the Prairie Section tend to have a Great Plains distribution while those in the Forest Section tend to have a Great Lakes distribution.

Figure 16. The Forest and Prairie Sections of Mixed Emergent Marsh.



WET MEADOW/FEN

Wet Meadow/Fen is a broad class of community types whose main shared characteristic is a closed canopy of mid-height graminoids. Dominant species include grasses (e.g., bluejoint (*Calamagrostis canadensis*), prairie cordgrass (*Spartina pectinata*)), sedges (eg., wiregrass sedge (*Carex lasiocarpa*), lake-bank sedge (*Carex lacustris*), tussock sedge (*Carex stricta*)), and rushes (e.g., *Scirpus cespitosus*). Although there may be significant shrub cover, especially from willow species and bog birch, a continuous matrix of graminoid species in the understory differentiates the communities of this class from Shrub Swamp communities. Obligate aquatic species (Appendix 5) are mostly absent, however facultative aquatic species are often present in the subcanopy. Mosses are present in some of the Wet Meadow/Fen community types, but sphagnum mosses are absent or have low cover compared with other (Amblystegiaceae) mosses.

Wet Meadow/Fen community types occur on wet mineral or peat soils with seasonally standing or flowing water at the ground surface. Generally, they occur on sites too wet for significant invasion by woody species or on sites that burn frequently.

Seven Wet Meadow/Fen community types are recognized in Minnesota:

- a. groundlayer dominated by prairie grasses and forbs b.
 - b. shrub cover > 30% **Wet Brush-Prairie**
 - b. shrub cover < 30% **Wet Prairie**
- a. groundlayer dominated by wetland graminoids or half-shrubs rather than prairie grasses and forbs c.
 - c. groundlayer dominated by narrow-leaved graminoids (leaves narrower than 3mm), especially wiregrass sedge (*Carex lasiocarpa*); forb cover and diversity low; peat depth generally > 0.5m; lateral movement of groundwater often visible or inferable from vegetation patterns (e.g. teardrop islands or strings) or from species associated with groundwater movement (e.g., grass of Parnassus (*Parnassia* spp.), *Scirpus cespitosus*) **FENS d.**
 - d. sphagnum cover interrupted to continuous; groundlayer of weakly minerotrophic species (Appendix 4), pH < 5.9, [Ca²⁺] < 13 mg/l **Poor Fen**
 - d. sphagnum cover patchy to absent; groundlayer of minerotrophic to highly minerotrophic species (Appendix 4), pH > 5.9, [Ca²⁺] > 10 mg/l e.
 - e. source of water from springs or zones of discharge; springs or spring features evident; water with circumneutral to high pH; groundlayer often composed of species associated with soils high in dissolved (especially

Ca²⁺-conataining) salts (Appendix 4) *Calcareous Seepage Fen*

e. source of water not obviously springs; spring features and surface-flow features absent; groundlayer composed of minerotrophic to highly minerotrophic species (Appendix 4) *Rich Fen*

c. groundlayer dominated by wide-leaved graminoids (leaves wider than 3mm), especially lake-bank sedge (*Carex lacustris*), tussock sedge (*Carex stricta*), and bluejoint (*Calamagrostis canadensis*); forb cover diverse; peat depth generally <0.5m f.

f. groundwater generally stagnant or, if flowing, flow is weak and not concentrated in obvious rivulets or streams; water generally at or near air temperature *Wet Meadow*

f. groundwater moving, rivulets and spring heads or obvious zones of groundwater discharge present; water cold; forb cover high where skunk cabbage (*Symplocarpus foetidus*) and angelica (*Angelica atropurpurea*) are present
..... *Seepage Meadow*

Wet Brush-Prairie

Wet Brush-Prairie is an open wetland community of the northern part of the deciduous forest-woodland zone (Fig. 1). It is composed of clumps or thickets of low brush in a herbaceous matrix dominated by grasses characteristic of Wet Prairie. Some of the most important grasses in the community are prairie cordgrass (*Spartina pectinata*), bog reed-grass (*Calamagrostis inexpansa*), blue-joint (*Calamagrostis canadensis*), big bluestem (*Andropogon gerardii*), and mat muhly (*Muhlenbergia richardsonis*). Wheatgrass (*Agropyron trachycaulum*), prairie dropseed (*Sporobolus heterolepis*), fowl meadowgrass (*Poa palustris*), hair grass (*Deschamsia cespitosa*), and switchgrass (*Panicum virgatum*) are also common. *Carex lanuginosa*, *C. sartwellii*, *C. buxbaumii*, and *C. tetanica* are common sedge species in the community.

Forbs are moderately abundant in most Wet Brush-Prairies. The forbs present in the community are generally those also present in Wet Prairie. Brush height is usually less than 1.5 meters, and brush cover is generally 30 to 50 percent. Willows (mainly pussy and slender willows) are the principal brush species. Bog birch and meadowsweet are also important on some sites. Shrubby cinquefoil is less common. Wet Brush-Prairies also commonly contain thickets of quaking aspen and balsam poplar saplings, or even scattered groves of aspen and poplar trees. Wet Brush-Prairie appears to extend farther southward in the Glacial Lake Agassiz Interbeach Area (Fig. 14) than Mesic Brush Prairie.

Wet Brush-Prairie is a fire-dependent community. Tracts of Wet Brush-Prairie that do not burn frequently enough succeed to Aspen Woodland. Infrequent fire can actually promote

increased aspen cover in Brush-Prairie as heat from fire stimulates aspen suckering. The tree cover in most areas of Wet Brush-Prairie appears to be greater now than that indicated by early public land surveyors (ca. 1850-1900), probably because of the effective suppression of wildfires in Minnesota since that period.

Soils in Wet Brush-Prairie range in texture from loamy fine sand to sandy clay loam and are poorly drained to very poorly drained. Most soils are mollisols but entisols are also present in the community. Most often, the soils are calcareous. On level terrain in extreme northwestern Minnesota, Wet Brush-Prairie occurs in a mosaic with Mesic Brush-Prairie and brushy Wet Meadow. These communities are not well separated floristically. Southward, the shrub species become more clumped and better separated from the prairie species, and Wet Brush-Prairie grades into Wet Prairie. Wet Brush-Prairie grades into Aspen Openings where aspen cover increases in the community relative to prairie cover.

There is one subtype of Wet Brush-Prairie, a Seepage Subtype. There are no geographic sections.

Wet Prairie

Wet prairie occurs mainly in the southern and western parts of the prairie zone, with scattered occurrences in the deciduous forest-woodland zone (Fig. 1). Typically, Wet Prairie is dominated by grasses, but sedges are also important in the community. The major cover-forming grasses in wet prairies in eastern Minnesota are prairie cordgrass (*Spartina pectinata*) and blue-joint (*Calamagrostis canadensis*). Prairie cordgrass and blue-joint are also present in Wet Prairies in western Minnesota, but the major cover-forming grasses in the west are bog reed-grass (*Calamagrostis inexpansa*), big bluestem (*Andropogon gerardii*), and the low grass, mat muhly (*Muhlenbergia richardsonis*). Other common grasses in the community are switchgrass (*Panicum virgatum*), wheatgrass (*Agropyron trachycaulum*), fowl meadow grass (*Poa palustris*), and sweet grass (*Hierocloe odorata*). The introduced grass redtop (*Agrostis stolonifera*) is often present on disturbed sites. Common Wet Prairie sedges are *Carex lanuginosa*, *C. sartwellii*, *C. tetanica*, and, in the west, *C. praegracilis*. Stiff rush (*Juncus balticus*) is frequently present.

Forbs are abundant in Wet Prairies, but on the whole fewer forb species occur in Wet Prairie than in Mesic Prairie. Common widespread Wet Prairie forb species are panicled aster (*Aster lanceolatus*), New England aster (*A. novae-angliae*), meadow ragwort (*Senecio pseud aureus*), giant goldenrod (*Solidago gigantea*), Riddell's goldenrod (*S. riddellii*), giant sunflower (*Helianthus giganteus*), sawtooth sunflower (*H. grosseserratus*), sneezeweed (*Helenium autumnale*), gay-feather (*Liatris pycnostachya*), blazing-star (*L. ligulistylis*), grass-leaved goldenrod (*Euthamia graminifolia*), Indian hemp (*Apocynum sibiricum*), golden alexanders (*Zizia aurea*), closed gentian (*Gentiana andrewsii*), yellow star-grass (*Hypoxis hirsuta*), marsh vetchling (*Lathyrus palustris*), tall meadow rue (*Thalictrum dasycarpum*), prairie loosestrife (*Lysimachia quadriflora*), Virginia mountain-mint (*Pycnanthemum virginianum*), swamp lousewort (*Pedicularis lanceolata*), and northern bog violet (*Viola neprophylla*). Small willows (pussy willow and other willow species) and meadowsweet are common in the community;

willow and aspen trees are also sometimes present, growing either singly or scattered in small clumps along wetland margins.

Wet Prairie is a fire-dependent community, with shrub and tree cover increasing in the community in the absence of fire (although regular haying will also prevent increased shrub and tree cover in the community.) Wet Prairie occurs in low areas (such as depressions and drainageways) where the water table remains within the plant rooting zone for several weeks during the growing season, but where inundation occurs only infrequently and briefly. In some Wet Prairies groundwater seepage causes soils to be very moist or wet. Wet Prairie is especially common on broad, poorly drained flats in the Glacial Lake Agassiz Interbeach Area (Fig. 14), where there are many areas of artesian seepage. In the deciduous forest-woodland zone, Wet Prairie exists on broad, nearly level river terraces or in shallow depressions on outwash.

The soils within the community are mainly mollisols (aquolls). They range in texture from silty clays to fine sands and are somewhat poorly drained to very poorly drained. Impermeable subsurface layers impede soil drainage on some sites, and a thin layer of muck may be present at the ground surface on Wet Prairies in seepage areas. Most soils are calcareous. Salt concentrations (sulfates of calcium and magnesium) high enough to influence the species composition of the community are present in the soils of Wet Prairies along the western edge of Minnesota, primarily in the Agassiz Lacustrine Plain.

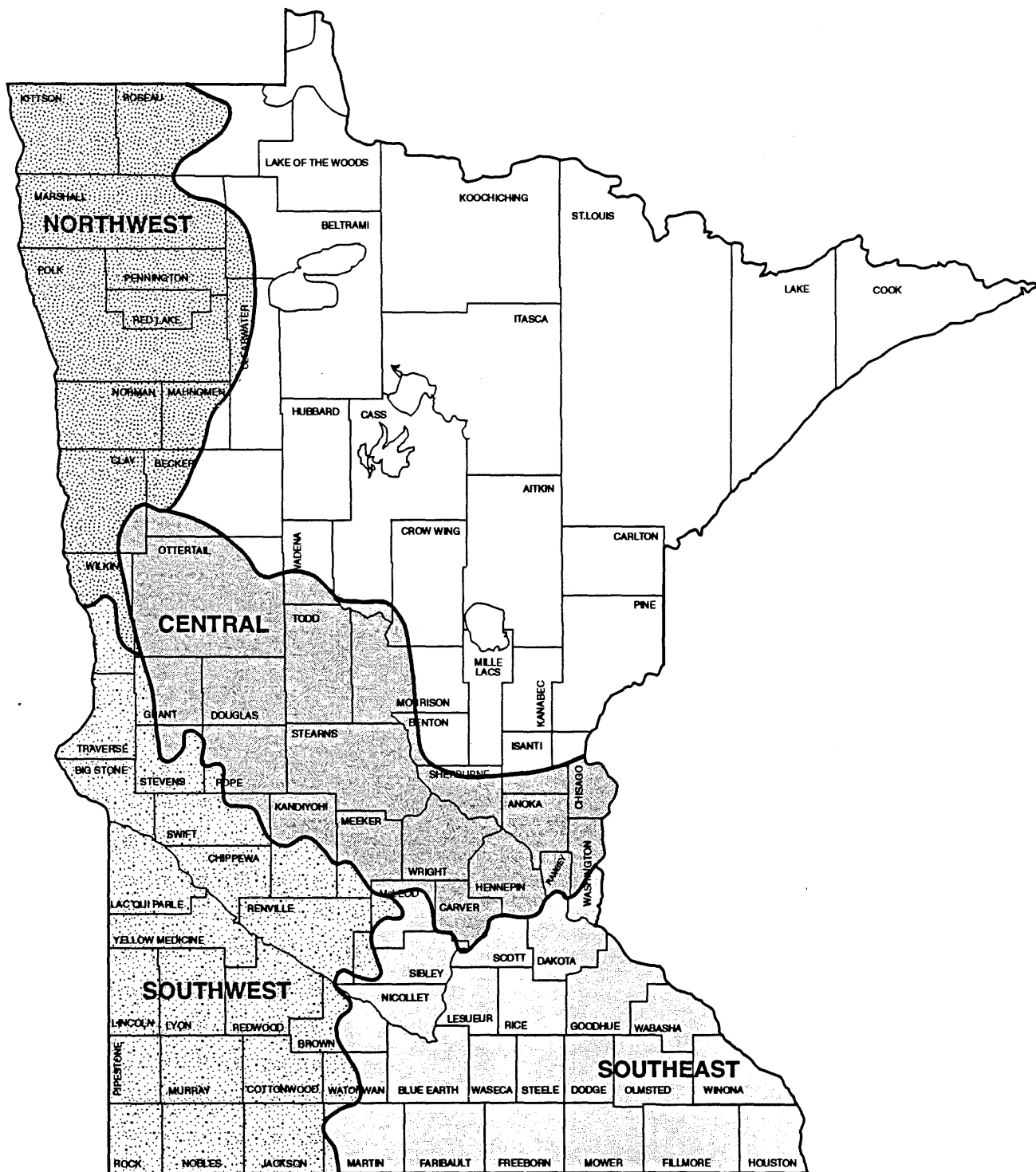
On drier sites Wet Prairie often grades into wet-mesic stands of Mesic Prairie; on wet sites it often grades into Wet Meadow. Mesic Prairie, Wet Prairie, and Wet Meadow do not have well-defined floristic boundaries, and sometimes are difficult to separate from one-another in the field when they occur together. Shrub cover increases in Wet Prairie northward, and in the northern part of the community's range Wet Prairie often grades into Wet Brush-Prairie. Wet Prairie in southeastern Minnesota is distinctive from that elsewhere in the state, containing several species with restricted distribution. Floristic diversity is low in Wet Prairies in western Minnesota, but distinctive species assemblages occur there in association with saline sites.

The regional variation described above is the basis for delineation of four geographic sections of Wet Prairie (Southeast, Southwest, Central, and Northwest, Fig. 17). There are also two recognized subtypes, a Saline Subtype and a Seepage Subtype. Occurrences of the Seepage Subtype almost always have significant shrub cover (especially by bog birch). Further data collection and analysis may reveal that these seepage occurrences are actually Wet Brush Prairie rather than Wet Prairie. Revision of the existing sections and recognition of additional subtypes on the basis of soil properties is possible, following collection and analysis of plot data.

Poor Fen

Poor Fen is most common in the conifer-hardwood forest zone, with scattered occurrences in the deciduous forest-woodland zone (Fig. 1). The ground cover of the community is dominated by wiregrass sedge (*Carex lasiocarpa*) or few-seeded sedge (*C. oligosperma*). Mud sedge (*C. limosa*), creeping sedge (*C. chordorrhiza*), beaked-sedge

Figure 17. The Southeast, Southwest, Central, and Northwest Sections of Wet Prairie.



(*Rhynchospora alba*), tufted club-rush (*Scirpus cespitosus*), scheuchzeria (*Scheuchzeria palustris*), and ericaceous shrubs are present in most Poor Fens as associates of the dominant sedges. Poor Fens have at least 50% cover by sphagnum mosses, and up to 70% cover by shrubs and small trees, most commonly bog birches and stunted tamaracks.

Poor Fen occurs on deep peat (> 1.0m) that receives minimal nutrient-rich run-off from surrounding uplands. In Minnesota's large patterned peatlands, Poor Fen often is present on sites with water infiltration from adjacent raised bogs. Less frequently, Poor Fen occurs in the interiors of small basins that are relatively isolated from run-off. The surface water of Poor Fen is slightly acidic (pH 4.1 - 5.9) and nutrient poor ($[Ca^{2+}] < 13$ mg/l). Poor Fen is transitional between Rich Fen and Open Bog and commonly grades into these communities on the landscape.

There are three subtypes of Poor Fen, a Sedge Subtype, a Shrub Subtype, and a Scrub Tamarack Subtype.

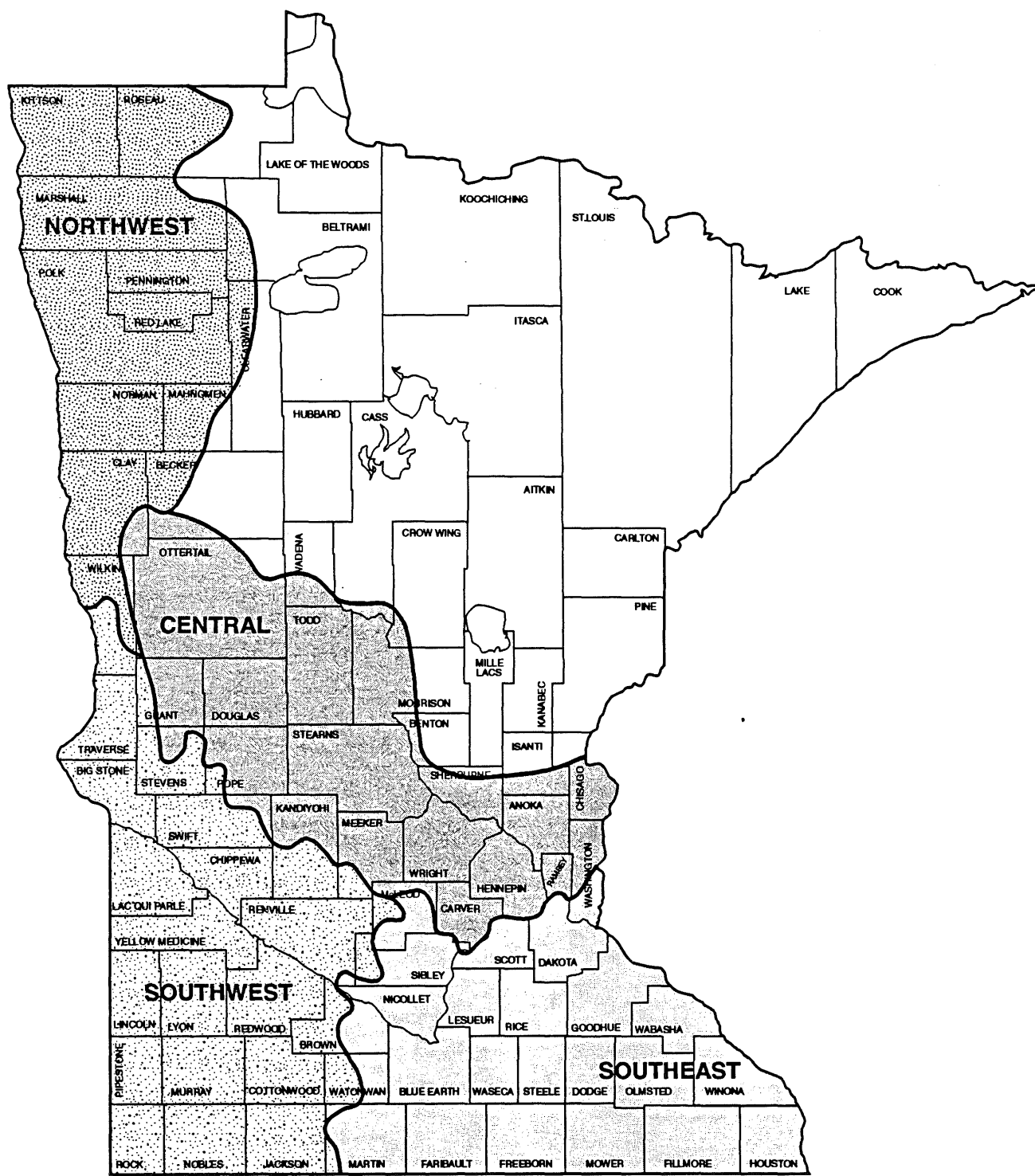
Calcareous Seepage Fen

Calcareous Seepage Fen is an open sedge and rush community that occurs throughout Minnesota. The groundlayer is usually dominated by wiregrass sedge (*Carex lasiocarpa*), *Carex sterilis*, beaked-sedge (*Rhynchospora capillacea*), spike-rush (*Eleocharis rostellata*), and *Scirpus cespitosus*. Marsh muhly (*Muhlenbergia glomerata*), grass of Parnassus (*Parnassia glauca*) and Kalm's lobelia (*Lobelia kalmii*) are often present in Calcareous Seepage Fens (as well as in Rich Fens). Shrubs, including bog birch, sage-leaved willow, and shrubby cinquefoil, are common in the community. Mosses range in cover from abundant to scarce.

Calcareous Seepage Fens occur on shallow or deep peaty soils in areas of calcareous groundwater discharge. The surface water is usually circumneutral (pH 6.8 - 8.0) with high concentrations of dissolved salts ($[Ca^{2+}] = 10-100$ mg/l) that often form a visible marl precipitate. The discharge water is low in oxygen (anoxic), which is believed to be important in inhibiting dense vegetation growth, thereby promoting the occurrence of several rare heliophytic vascular and bryophyte plant species in the community.

There are two subtypes of Calcareous Seepage Fen, a Prairie Subtype and a Boreal Subtype. The Prairie Subtype (which occurs in both the prairie and deciduous forest-woodland zones (Fig. 1)) contains many characteristically prairie species, including big bluestem (*Andropogon gerardi*), yellow stargrass (*Hypoxis hirsuta*), Virginia mountain-mint (*Pycnanthemum virginianum*), starry false Solomon's-seal (*Smilacina stellata*), and golden alexanders (*Zizia aurea*). The Prairie Subtype also commonly contains patches of emergent aquatic species such as broad-leaved cattail (*Typha latifolia*), hard-stemmed bulrush (*Scirpus acutus*), *Scirpus americanus*, and common reed grass (*Phragmites australis*). The Prairie Subtype is divided into three geographic sections, a Southeast Section, a Southwest Section, and a Northwest Section (Fig. 18). The Boreal Subtype occurs in the Conifer-Hardwood Forest Zone and contains species characteristic of high-boreal peatlands, including bog-rosemary (*Andromeda glaucophylla*), small cranberry (*Vaccinium oxycoccos*), and pitcher plant (*Sarracenia*

Figure 18. The Southeast, Southwest, and Northwest Sections of Calcareous Seepage Fen, Prairie Subtype.



purpurea). The Boreal Subtype has no recognized geographic sections.

Rich Fen

Rich Fen occurs in the conifer-hardwood forest and deciduous forest-woodland zones (Fig. 1). The groundlayer is dominated by wiregrass sedge (*Carex lasiocarpa*), brown sedge (*Carex buxbaumii*), livid sedge (*Carex livida*), *Calamagrostis neglecta*, or bog reed-grass (*Calamagrostis inexpansa*). Although generally open communities, Rich Fens may have up to 70% cover of woody shrubs, especially bog birches, sage-leaved willows, and shrubby cinquefoils. Mosses range from scarce to abundant in the community. Where mosses are abundant, the dominant species are species other than *Sphagnum* spp.

Surface waters within the community are slightly acidic to circumneutral (pH 5.8 - 7.8) with moderate nutrient levels ($[Ca^{2+}] = 10-32$ mg/l). Rich Fen grades into Poor Fen but is distinguishable from Poor Fen by its higher species diversity and by the more frequent occurrence and greater abundance of minerotrophic indicator species, including livid sedge (*Carex livida*), brown sedge (*C. buxbaumii*), swamp lousewort (*Pedicularis lanceolata*), spike-rush (*Eleocharis compressa*), marsh muhly (*Muhlenbergia glomerata*), and Kalm's lobelia (*Lobelia kalmii*).

There are two geographic sections of Rich Fen, a Transition Section and a Boreal Section (Fig 19). In the Boreal Section, Rich Fen usually occurs on deep peat and contains characteristically northern species such as bog-rosemary (*Andromeda glaucophylla*) and other ericaceous shrubs, the bulrush *Scirpus hudsonianus*, and pitcher-plant (*Sarracenia purpurea*). In the Transition Section Rich Fen may be present on relatively shallow peat, or on very shallow, highly decomposed, low-buoyancy peat, or even on wet mineral soil. Floristically, Rich Fen in the Transition Section differs from Rich Fen in the Boreal Section mainly by containing prairie species, such as grass-leaved goldenrod (*Euthamia graminifolia*), Sartwell's sedge (*Carex sartwellii*), and wooly sedge (*C. lanuginosa*).

The Boreal and Transition Sections of Rich Fen each contain three subtypes, a Sedge Subtype, in which sedges are the dominant plant species, a Floating-Mat Subtype, in which the community occurs on floating peat mats along the margins of shallow lakes, and a Shrub Subtype, in which shrubs are among the dominant plant species (with up to 70% cover.)

Wet Meadow

Wet Meadow is present throughout Minnesota. The groundlayer of the community is composed of dense, closed stands of predominately wide-leaved sedges (eg., *Carex lacustris*, *C. stricta*, *C. aquatilis*, *C. rostrata*, *C. haydenii*) or grasses (eg., *Calamagrostis canadensis*, *C. inexpansa*). Forb cover and diversity usually are high. Forbs such as spotted joe-pye weed (*Eupatorium maculatum*), common mint (*Mentha arvensis*), turtlehead (*Chelone glabra*), and swamp milkweed (*Asclepias incarnata*) are conspicuous. Shrub cover in Wet Meadows ranges



from 0 to 70% and is composed of Bebb's willows and pussy willows. Mosses are rare or absent.

Wet Meadow occurs on wet mineral soil, muck, or shallow peat (<0.5 m). Standing water (generally stagnant) is present in the spring and after heavy rains, but the water table is generally below the soil surface for most of the growing season. The drawdown of the water table as the growing season progresses enables the oxidation of dead organic matter that has accumulated on the ground surface from previous years. This process makes available nutrients for some of the nutrient-demanding species present in the community. Occurrences of Wet Meadow along stream courses or adjacent to lakes often have fairly constant water levels relative to Wet Meadows in depressions or basins. On these sites siltation may be important in maintaining high nutrient levels.

Wet Meadow tends to succeed to Shrub Swamp communities in the absence of fire. Water-table lowering caused by drought or by ditching promotes succession of Wet Meadow to Shrub Swamps. Wet Meadows on organic soils, like other communities that occur on organic soils, recover very slowly, if at all, once altered by artificial flooding or draining.

There are no recognized sections of Wet Meadow. There is one subtype, a Shrub Subtype.

Seepage Meadow

Seepage Meadow probably occurs throughout Minnesota, but is best documented in the St. Croix valley. Skunk cabbage (*Symplocarpus foetidus*) and angelica (*Angelica atropurpurea*) are the dominant plants and are indicative of the community. Graminoid cover is generally low; broad-leaved sedges (*Carex lacustris*, *C. stricta*, *C. stipata*, and *C. comosa*) are the most common graminoid species. Northern marsh fern (*Thelypteris palustris*) and jewel-weed (*Impatiens capensis*) are common cover-forming species. Three rare species--bog bluegrass (*Poa paludigena*), water-pennywort (*Hydrocotyle americana*), and false mermaid (*Floerkea proserpinacoides*)--appear to be endemic to Seepage Meadow communities or to small inclusions of Seepage Meadow in swamp forests.

Seepage Meadows develop around spring heads and in broader areas of groundwater discharge, most commonly in deep glacial meltwater-cut river valleys, at the bases of slopes separating stream terraces. The upwelling groundwater is cold and flows year-round. Peat is present in some seepage areas, sometimes in layers greater than one meter thick. Other seepage areas have little organic material, with the groundwater welling up through carbonate encrusted gravel.

There are no recognized subtypes or sections of Seepage Meadow. Most occurrences of Seepage Meadow are small and are classified as inclusions within seepage subtypes of Tamarack Swamp or Hardwood Swamp communities.

PRIMARY COMMUNITY

Primary Communities comprise all habitats where persistent vegetation is sparse or absent. The forces responsible for the absence of vegetation on a site include wind erosion, wave action, flooding, mass action, and nutrient-poor soils or substrates. These forces may act singly or they may interact. In this classification sites, such as old fields and mine spoils, where the forces preventing the development of vegetation are neither natural nor recurrent, are not considered natural primary communities.

There are seven recognized Primary Community types:

- a. community on bedrock, not restricted to shorelines..... b.
 - b. vertical or nearly vertical rock wall, >3m tall c.
 - c. rock face moist with water from condensation or seepage; >30% cover of mosses or foliose lichens *Moist Cliff*
 - c. rock face dry, water mostly from precipitation; <30% cover of mosses or foliose lichens *Dry Cliff*
 - b. level to steeply inclined area of rock, <3m tall if vertical or nearly vertical d.
 - d. rock consolidated *Rock Outcrop*
 - d. rock unconsolidated, colluvium at base of cliff or steep bedrock slope *Talus Slope*
- a. community on rock, sand, or mud along lake and river shorelines e.
 - e. substrate fine textured, composed of allogenic silt and clay mixed with at least some (but often mostly composed of) autogenic sediments, such as gyttja or marl; area normally submerged in spring but exposed by late summer *Mud Flat*
 - e. substrate rock or sand, mostly lacking autogenic sediment f.
 - f. shoreline of a river *River Beach*
 - f. shoreline of a lake *Lake Beach*

Moist Cliff

Moist Cliff communities occur on north- to northeast-facing, vertical or nearly vertical exposures of bedrock or unconsolidated material. They also occur on well-shaded overhangs and sometimes on the lower portions of south- to west-facing cliffs, where these are shaded by a forest canopy. Most of the rock surface in the community is kept moist by seepage or condensation. The cool, moist microhabitat in the community supports several rare plant species. Moist Cliff communities often occur upslope from Talus Slope communities and grade into Talus Slope communities.

There are two sections of Moist Cliff, the Southeast Section and the Northeast Section (Fig. 20). These sections occur on different rock types and harbor different plant species. The Southeast Section includes one subtype, the Maderate Subtype.

Most occurrences in the the Southeast Section are on the Paleozoic Plateau of southeastern Minnesota (Fig. 3), with others along the St. Croix Valley in east-central Minnesota. The rock cliffs are formed primarily of limestone or sandstone, and the community usually occurs on these cliffs below forested slopes along major streams and rivers. Characteristic species include bulblet fern (*Cystopteris bulbifera*), fragile fern (*Cystopteris fragilis*), numerous mosses, and mesic forest herbs such as miterwort (*Mitella diphylla*) and wild ginger (*Asarum canadensis*). Moist Cliffs with continuous groundwater seepage over the rock surface often contain additional species such as reniform sullivantia (*Sullivantia renifolia*) and slender cliff-brake (*Cryptogramma stelleri*). Two of the rare species present in these southeastern Moist Cliff communities are *Poa wolfii* and shooting star (*Dodecatheon amethystinum*).

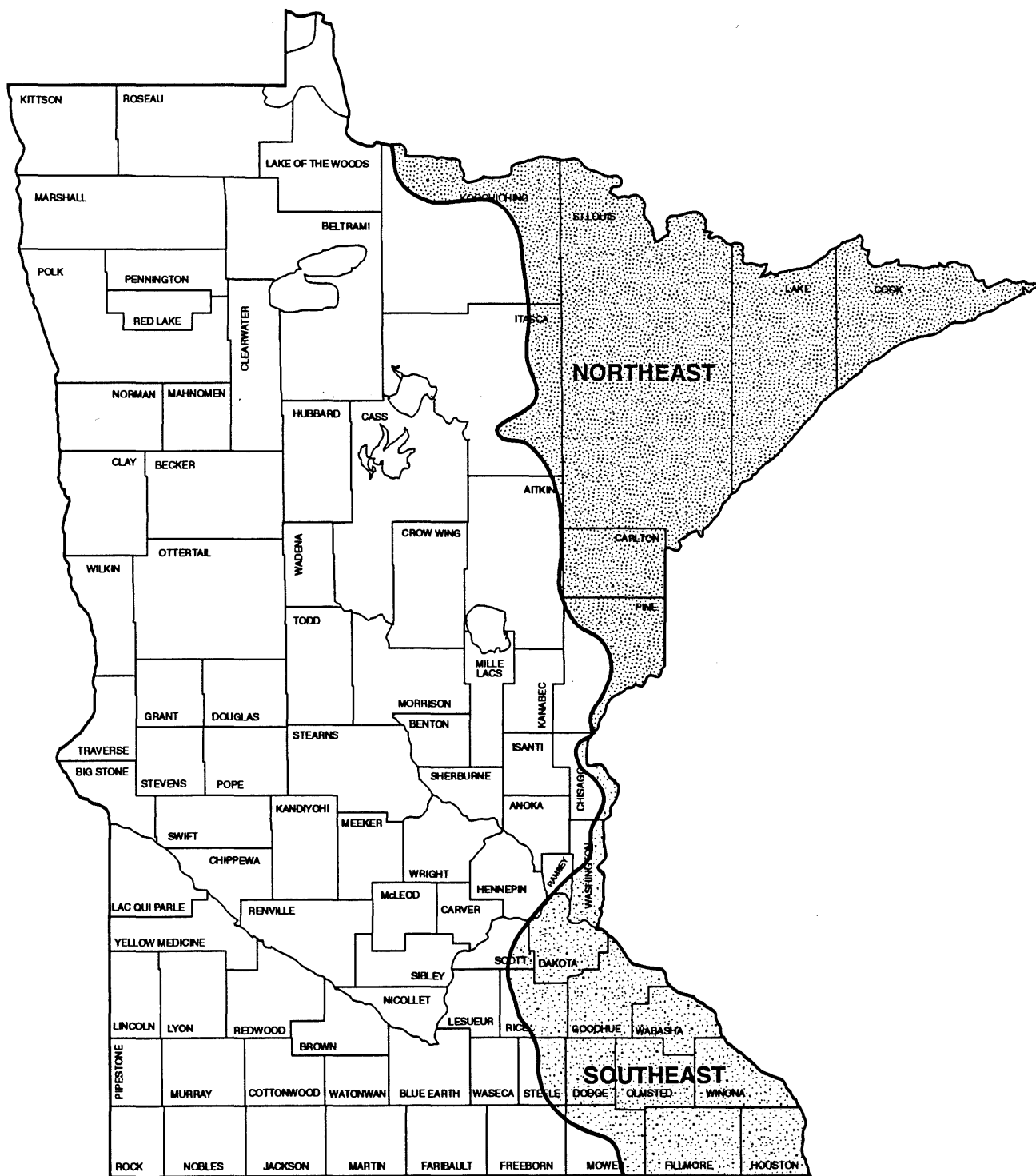
The Maderate Subtype of the Southeast Section of Moist Cliff occurs on rock faces with actively dripping cold water systems that create a cool microhabitat. The Maderate Subtype harbors several rare species of land snails, and two rare but characteristic plant species, Leedy's roseroot (*Sedum integrifolium* var. *leedyi*) and whitlow-grass (*Draba arabisans*). The Maderate subtype is often associated with the Algific Subtype of Talus Slope.

The Northeast Section occurs only in the conifer-hardwood forest zone in extreme northeastern Minnesota, at the bases of shady north-facing diabase cliffs along Lake Superior and the border lakes. The neutral and mildly basic bedrock and constant moisture provide habitat for numerous rare plants, many of which are calcicoles. Characteristic species of the Northeast Section include weak Arctic sedge (*Carex supina*), nodding saxifrage (*Saxifraga cernua*), *Poa scopulorum*, locoweed (*Oxytropis viscida*), whitlow-grass (*Draba arabisans*), and Cathcart's woodsia (*Woodsia oregana* var. *cathcartiana*).

Dry Cliff

Dry cliff communities occur on vertical or nearly vertical, south- to west-facing exposures of bedrock or unconsolidated material. In contrast to Moist Cliffs, Dry Cliffs receive moisture mainly from precipitation. Dry Cliff communities are often present just upslope from

Figure 20. The Southeast and Northeast Sections of Moist and Dry Cliff.



Talus Slope communities, with which they intergrade. There are two recognized sections of Dry Cliff, the Northeast Section and the Southeast Section (Fig. 20). These sections occur on different types of rock and contain different plant species.

Dry Cliff communities in the Southeast Section occur on exposed south- to southwest-facing limestone and sandstone cliffs and ledges, primarily on the Paleozoic Plateau (Fig. 3). The substrate is nutrient poor and sparsely vegetated, but supports a distinctive flora, including the ferns smooth cliff-brake (*Pellaea glabella*), purple cliff-brake (*Pellaea atropurpurea*), and *Woodsia* spp.

In the Northeast Section, the community is present only on dry cliff tops and at the bases of dry, south-facing diabase cliffs. Both arctic-alpine disjunct plant species (e.g., large-leaved sandwort (*Arenaria macrophylla*) and Norwegian draba (*Draba norvegica*)) and temperate plant species occur in the Northeast Section.

Rock Outcrop

Rock Outcrop communities occur on relatively level or rounded areas of exposed bedrock primarily in northeastern Minnesota, in the Minnesota River Valley, and in extreme southwestern Minnesota. Rock Outcrop communities typically are sparsely vegetated and have little soil development, with the chemical composition of the bedrock strongly influencing the species composition of the vegetation. The species that persist in the community must survive extreme drought and great fluctuations in the temperature of the ground surface. There are two recognized sections of Rock Outcrop, the Southwest Section and the Northeast Section (Fig. 21).

In the Southwest Section, the major occurrences of the community are on rugged bedrock knobs between New Ulm and Ortonville in the Minnesota River Valley, and on local bedrock outcrops in Cottonwood, Pipestone, and Rock counties. The bedrock outcrops in the Minnesota River Valley are composed primarily of granite and gneiss. Most of the plant species present on these outcrops grow in shallow dry soil that collects in small depressions on sloping rock faces. These patches characteristically contain species common to the Great Plains, including brittle opuntia (*Opuntia fragilis*), plains prickly pear (*O. macrorhiza*), ball cactus (*Coryphantha vivipara*), and wild parsley (*Lomatium orientale*), as well as other species such as rock spikemoss (*Selaginella rupestris*), fameflower (*Talinum parviflorum*), rusty woodsia (*Woodsia ilvensis*), and many spring and early summer blooming annuals.

The rock outcrops in the Minnesota River Valley also usually have two other distinctly vegetated microhabitats: small depressions that collect and hold water and have moist soils for several weeks following rain, and small rock pools (up to one meter or more deep) that contain standing water throughout the growing season. The species present in the moist depressions include Virginia forget-me-not (*Myosotis verna*), Carolina foxtail (*Alopecurus carolinianus*), and mouse-tail (*Myosurus minimus*). The deeper pools contain aquatic plant species, such as water-hyssop (*Bacopa rotundifolia*) and mudwort (*Limosella aquatica*).



The rock outcrops in Cottonwood, Pipestone, and Rock counties differ from those in the Minnesota River Valley in that they occur on outcrops of Sioux quartzite rather than granite or gneiss. However these rock outcrops generally have microhabitats similar to those on the bedrock knobs in the Minnesota River Valley and support many of the same species mentioned above for the Minnesota Valley outcrops.

Rock Outcrop communities in the Northeast Section occur primarily within the conifer-hardwood forest zone, especially on the Canadian Shield (Fig. 7), on granite (and other rock) outcrops on ridgetops, benches, and upper slopes. Occurrences in the Northeast Section are usually a mosaic of exposed rock with patches of low vegetation dominated by fruticose lichens and mosses. Shrubs, many of which have bird-dispersed fruits, frequently grow where thin soils have accumulated in rock crevices. Juneberry species, pin cherries, and bush honeysuckle are common shrubs in the community. The herb flora is depauperate; the most characteristic species are pale corydalis (*Corydalis sempervirens*), bristly sarsaparilla (*Aralia hispida*), and three-leaved cinquefoil (*Potentilla tridentata*).

Fire appears to be important in maintaining Rock Outcrop communities. In the Northeast Section, in the absence of fire Rock Outcrops are invaded by trees from surrounding forests, especially jack pines and red oaks. In the Southwest Section occurrences of the community in the Minnesota River Valley and along the St. Croix River have also been invaded by trees and shrubs. One of the most significant invading species is eastern red cedar. According to public land survey records and written accounts from early European travelers to the region, red cedars were largely absent from areas of bedrock outcrop in the Minnesota River Valley, and although present on bedrock exposures along the St. Croix Valley, occurred only in areas protected from fire, such as cliffs and steep rocky bluffs. With the onset of extensive settlement and fire suppression, red cedars have spread into many of the outcrop areas, where they displace the herbs, lichens, and mosses that characterize Rock Outcrop communities.

The Rock Outcrop community type does not generally include natural communities present on the numerous steep cliffs and bedrock bluffs along the St. Croix and Mississippi river valleys in east-central and southeastern Minnesota. These natural community occurrences are classified either as Bedrock Bluff Prairies or as cliff communities, depending on the composition and structure of the vegetation comprising them.

Talus Slope

Talus Slope communities occur in northeastern and southeastern Minnesota in the deciduous forest-woodland and conifer-hardwood forest zones (Fig. 1). They are accumulations of coarse rock and soil at the bases of cliffs and steep slopes. They range in habitat type from shady and moist to exposed and dry. There is one subtype, the Algific Subtype.

The Algific Subtype occurs only on the Paleozoic Plateau in southeastern Minnesota (Fig. 3), at the bases of steep, north-facing dolomite talus slopes. Continuous cold air drainage from fissures and ice caves in the talus creates a cool, moist microclimate in which summer

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temperatures rarely exceed 16°C. These talus slopes may be small (one square meter), or narrow linear complexes up to 1.5 km long. Disjunct populations of several northern species are present in Algific Talus Slope communities, including miterwort (*Mitella nuda*), Canada mayflower (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), smaller enchanter's nightshade (*Circaea alpina*), tall lungwort (*Mertensia paniculata*), moschatel (*Adoxa moschatellina*), alder-leaved buckthorn, balsam fir, and American yew. The rare boreal disjunct golden saxifrage (*Chrysosplenium iowense*), and several snail species occur in Minnesota only in this community. The more stable upper talus slopes are forested, usually containing northern species such as balsam fir, American yew, and yellow birch. Algific talus slopes are often associated with Moist Cliff (Southeastern Section) Moderate Subtype.

Mud Flat

Mud Flats are communities of shallow basins that flood in the spring and draw down later in the season, exposing wet sediments on which plants subsequently grow. Planktonic, benthic, and macrophyte aquatic communities are present on these sites during flood stages, producing organic detritus and precipitating inorganic salts.

The composition and structure of the vascular vegetation is influenced by the flooding regime and the composition of the sediment. In general, the vegetation is composed of terrestrial forms of aquatic plants and seedlings originating from seeds dormant in the sediment or dispersed from other communities. Most of the vegetation, especially by late summer, is composed of seedlings; species of *Cyperus*, *Scirpus*, *Juncus*, and *Polygonum* present in the seed bank often form luxuriant stands by late summer or autumn. Floating-leaved aquatic species, such as *Nuphar* spp. and *Nymphaea* spp. are common, usually present as rosettes of leaves sprouting from massive rhizomes on the mud surface. Other rooted macrophytes, such as *Potamogeton* spp., *Heteranthera* spp., and water smartweed (*Polygonum amphibium*), are common as well, and quite different in appearance in comparison with their more typical submerged forms.

There is one recognized subtype of Mud Flat, a Saline Subtype. It has several plant species tolerant of high concentrations of dissolved salts. Red glasswort (*Salicornia rubra*), Nuttall's alkali grass (*Puccinellia nuttalliana*), and *Scirpus paludosis* are particularly characteristic. The Saline Subtype occurs only in extreme western Minnesota. Other subtypes (for example, a Calcareous Subtype) and sections of Mud Flat may be recognized eventually following further data collection and analysis.

River Beach

River Beach is a sparsely vegetated community occurring on sand, gravel, cobble, boulder, or bedrock substrates along river shorelines throughout Minnesota. The vegetation of River Beaches is zonal, usually with a distinct upper beach zone and one to several lower beach zones. This zonation is caused by periodic differences in erosion and by differences in exposure

during the growing season as river levels drop. The upper beach zone is often severely eroded by currents, wave action, and ice flows during the spring high-water period. Consequently, perennial species cover is sparse in the upper zone, consisting only of a few species tolerant of inundation and physical fragmentation. Annual species, however, are common in the upper beach zone. The lower beach zones are exposed later in the growing season and contain vegetation consisting of the terrestrial forms of perennial aquatic species and other species--especially annuals--that can survive long periods of inundation.

There are no recognized sections of River Beach, but additional floristic work on river beach communities may reveal considerable floristic difference in beaches in different regions of the state. There are three subtypes of River Beach, the Sand, Gravel-Cobble, and Bedrock subtypes.

Lake Beach

Lake Beach is a sparsely vegetated community occurring on sand, gravel, cobble, boulder, or bedrock substrates along lake shorelines throughout Minnesota. The vegetation of Lake Beach communities is zonal, with a distinct upper beach zone always present and one or more lower beach zones sometimes present. The upper beach zone lies just above the "normal" water level, where the erosive power of wave action and "ice-push" prevent the formation of a stable plant community. The lower beach zone or zones lie below the normal water level. These lower zones are exposed during seasonal periods of low water. They are also exposed during less regular long-term declines in the water level. Lake Beach adjoins a wide variety of terrestrial vegetation types and often grades into Lake Bed or Emergent Marsh communities.

There are two recognized sections of Lake Beach, the Lake Superior Section and the Inland Section.

The Lake Superior Section occurs along the shoreline of Lake Superior. It varies in composition and structure according to substrate. There are three recognized subtypes, the Sand Subtype, the Gravel-Cobble Subtype, and the Bedrock Subtype.

The Sand Subtype occurs only along the northeast side of Minnesota Point in Lake Superior and only about 3 km of the community remains undeveloped. Beach grass (*Ammophila breviligulata*), beach pea (*Lathyrus japonicus*), coast jointweed (*Polygonella articulata*), bug-seed (*Corispermum hyssopifolium*), and false heather (*Hudsonia tomentosa*) are characteristic species of the upper beach zone.

The Gravel-Cobble Subtype is present along the north shore of Lake Superior on wave-washed gravel and cobble beaches and is sparsely vegetated because of disturbance, especially from storm waves. Beach pea (*Lathyrus japonicus*) is a characteristic plant species of the Gravel-Cobble Subtype.

The Bedrock Subtype also occurs along the north shore of Lake Superior, on bare rocks

of the smaller points that extend out into the lake and on wave-swept rocky ledges. The rocks, usually calcic slates and diabase, tend to be cold and wet and provide habitat for a unique assemblage of plants including rare, disjunct arctic-alpine species, such as common butterwort (*Pinguicula vulgaris*) and *Tofieldia vulgaris*. Characteristic species of the subtype include Mistassini primrose (*Primula mistassinica*), Hudson Bay eyebright (*Euphrasia hudsoniana*), northern selaginella (*Selaginella selaginoides*), hair grass (*Deschampsia cespitosa*), and harebell (*Campanula rotundifolia*). Rock crevices are sometimes colonized by mosses and shrubs (especially shrubby cinquefoil, ninebark, and bog laurel).

The Inland Section of Lake Beach occurs on lakes throughout Minnesota. It contains four subtypes, the Sand, Gravel-Cobble, Bedrock, and Mud subtypes.

The Sand Subtype is common along the shores of lakes on sandy outwash plains. It is uncommon on other landforms. The upper beach zone of this subtype has perennial graminoids tolerant of inundation and erosion, and annual species. The lower beach zone has many submergent and floating-leaved aquatic species tolerant of stranding.

There is little information available on the Gravel-Cobble Subtype, but it probably occurs principally along the shores of lakes on the Canadian Shield in northeastern Minnesota and along some of the larger lakes in central and northern Minnesota.

The Bedrock Subtype is present only along shorelines of lakes on the Canadian Shield in northeastern Minnesota. Little information is available on this subtype. There is also little information available on the Mud Subtype.

AQUATIC RIVER COMMUNITY

Aquatic River Communities are present in rivers and streams throughout Minnesota. They have less than 30% cover by persistent vegetation and sparse to continuous cover by nonpersistent vegetation. The vegetation fluctuates greatly in percent cover and species composition because of the erosion and deposition of sediment caused by changes in water levels and currents.

There is one recognized Aquatic River Community type:

- a. characterized by few persistent emergent plants, cover mostly submergent and rooted floating-leaved aquatics (Appendix 5) *River Bed*

AQUATIC LAKE COMMUNITY

Aquatic Lake Communities are present in lakes throughout Minnesota. They have less than 30% cover by persistent vegetation and sparse to continuous cover by nonpersistent vegetation.

There is one recognized Aquatic Lake Community type:

- a. characterized by few persistent emergent plants, cover mostly submergent and rooted floating-leaved aquatics (Appendix 5) *Lake Bed*

Glossary

Aeolian landform - a landform composed of fine sand or silt deposited by wind (e.g., dune).

Alluvial landform - a landform composed of sorted material (generally sand or gravel) deposited by running water or wave action (e.g., beach ridge, river terrace, fan, outwash plain).

Associates - plant species that tend to co-occur. The probability of finding two associated species growing together is greater than by chance.

Boreal hardwood - a broad-leaved deciduous tree with physiological adaptations enabling survival in regions (especially the boreal forest region of North America) where the temperature may fall below -41°C (e.g., quaking aspen and paper birch).

Brush - a generic term for a moderately dense layer of low shrubs, tall shrubs, and tree saplings, usually used in reference to woodland or brush prairies. In general, brush is composed of woody vegetation less than 3 meters tall, but sometimes up to 5 meters tall.

Canopy - generally the tallest layer of plants in a community. Canopy plants receive direct sunlight and occur in patches of individuals with approximately equal heights.

Colluvium - a deposit of rock and soil at the base of a cliff or steep slope, formed by gravitational action.

Community - an assemblage, that tends to recur over space and time, of plants and animals that interact with each other and their abiotic habitats. Communities are classified and described by considering vegetation, topography, hydrology, landforms, substrates, soils, and disturbance regimes (such as fires, wind storms, flood cycles, and infestation by insects and microorganisms). See also **Natural community**.

Conifer (tree) - a needle-leaved tree with cones (i.e., a gymnosperm).

Cover - the proportion of the ground covered by projecting the plant canopy vertically downward onto the ground. (This would be the proportion of the ground surface shaded by plants if the sun were directly overhead.)

Crested bog - a bog composed of a peat ridge (and its flanks) raised above the local water table because of the accumulation of sphagnum mosses. Crested bogs are generally forested by black spruce and are components of the large peatland complexes in northern Minnesota.

Domed bog - a bog composed of a relatively circular mound of peat raised above the local water table because of the accumulation of sphagnum mosses. Domed bogs are generally forested by black spruce. They are often parts of the large peatland complexes in northern Minnesota but also occur in isolated kettle-holes.

Glossary

Dominant - a plant species that shapes the character of a community by virtue of its great size, dense shade, allelochemic properties, or effects on soils. Dominant species generally influence the presence, growth, and distribution of other plant species in the community.

Emergent - a plant capable of surviving indefinitely with its root system and lower stem submerged and its aerial shoots above water (e.g., cattails).

Floodplain (active) - a flat terrace along a stream or river, created by erosion and deposition of sediment during flood cycles. Signs of active flooding include debris caught in trees growing on the floodplain or ice scars at the bases of the trees.

Gleyed soil - a poorly drained soil with gray coloring or mottling caused by the reduction of iron and other elements that occurs under poor drainage conditions.

Graminoid - a plant with linear "grass-like" leaves that typically branch vertically from the stem. Graminoids are members of the Gramineae, Cyperaceae, Juncaceae, Iridaceae, Typhaceae, Sparginiaceae, and other families.

Groundlayer - a vegetation layer, less than 1 meter tall, of grasses, herbs, and half-shrubs. (The groundlayer does not include tree seedlings or true shrubs).

Heliophilous - sun-loving

Herbaceous - a plant without a persistent above-ground woody stem.

Hydric soil - a soil wet long enough to be periodically anaerobic.

Hydrophyte - a plant able to grow in water or on wet soils that are periodically saturated and deficient in oxygen.

Mature tree - a tree greater than 5 meters tall.

Mesic habitat - a habitat with average soil moisture, where soil moisture is not limiting to plant growth during the growing season, and soils are not saturated except following rain or spring snowmelt.

Mesic hardwood - a broad-leaved deciduous tree generally not capable of growing in the boreal region of North America. Mesic hardwoods have physiological adaptations that protect them from freezing temperatures above, but not below, -41°C (e.g., maples, ashes, elms).

Mineral soil - a soil composed mostly of inorganic matter, including clay, silt, sand, and gravel. Mineral soils usually have less than 20% organic matter but may have organic surface layers up

Glossary

to 30cm thick.

Minerotrophic - a wetland receiving nutrients from groundwater as well as from rainwater, or a wetland with peat and surface water nutrient content considerably higher than that of rainwater.

Modal - a species of a community that has its highest frequency of occurrence in that community.

Mollic epipedon - a soft, dark, prairie-soil surface horizon, rich in nutrients (>50% base saturation), high in organic matter, with a C:N ratio of less than 17:1 (uncultivated), and less than 250 mg/l P_2O_5 soluble in citric acid.

Mostly - more than half. Generally used in describing the cover of a dominant plant in a community.

Mottled soil - a soil with spots or blotches of a color different from the base color of the soil. Mottling results from cycles of anaerobic and aerobic conditions caused by cycles of soil saturation and drying.

Native - a species that existed in Minnesota prior to European settlement.

Natural community - an assemblage, that tends to recur over space and time, of native plants and animals that interact with each other and their abiotic habitats in ways little modified by humans or non-native species. Natural communities are classified and described by considering vegetation, successional status, topography, hydrology, landforms, substrates, soils, and natural disturbance regimes (such as wild fires, wind storms, normal flood cycles, and normal infestation by native insects and microorganisms).

Oligotrophic - a minerotrophic wetland poor in nutrients.

Ombrotrophic - a wetland receiving nutrients solely from rainwater, or a wetland with peat and surface water nutrient content not exceeding that of rainwater. Ombrotrophic conditions develop in areas where the center of a bog is higher than its margins and is cut off from groundwater flow. Ombrotrophic bogs have low pH (usually less than 4).

Ovoid island - a streamlined, oval-shaped peatland landform supporting bog vegetation. Ovoid islands are believed to be remnants of crested or domed bogs. Their characteristic shapes presumably are caused by the flow of mineral-rich water (water tracks) around their margins.

Patterned peatland - a large peatland composed of mosaics of interrelated landforms (crested and domed bogs, water tracks, ovoid islands, teardrop islands, lawns).

Glossary

Peat soil - unconsolidated soil consisting largely of undecomposed (fibric peat), slightly decomposed (hemic peat), or mostly decomposed (sapric peat or muck) organic matter accumulated under conditions of excessive moisture.

Persistent vegetation - emergent hydrophytes with stems that normally remain standing until the beginning of the following growing season (e.g., cattails and bulrushes).

Physiognomy - the gross external appearance or structure of vegetation. Used loosely, physiognomy also refers to biomass structure (i.e., the spacing, height, and life-form groups of plants in a community).

Short-shrub layer - a vegetation layer of shrubs and tree seedlings and saplings between 0 and 2 meters tall.

Subcanopy - a vegetation layer, composed of patches of individuals of approximately equal height, that is lower than the canopy layer. Subcanopy often refers to a layer of smaller trees under a tree canopy.

Submergent vegetation - plants growing mostly under water.

Tall-shrub layer - a vegetation layer composed of obligate shrub species and tree saplings between 2 and 5 meters tall.

Terrestrial plant - terrestrial plants include all species adapted for growth on somewhat poorly drained to excessively drained mineral soils (i.e., mineral soils that are not hydric). Such soils lack hydric characteristics such as accumulated peat or gleyed or mottled horizons. Some plants are physiologically adapted to both terrestrial and wetland conditions, and are considered terrestrial plants when growing under terrestrial conditions and wetland plants when growing under wetland conditions.

Tree cover - the proportion of the ground covered by the vertical projection downward of the mature tree canopy.

Understory - the vegetation occurring below the canopy in a plant community.

Appendix 1. Natural community types, sections, and subtypes

(* = together, the subtypes listed for this community type or section are exhaustive; the category (i.e. community type or section) without a subtype is maintained to provide a place in the Heritage Database for occurrences that have not been identified to subtype)

The state ranks

The numerical ranks assigned to natural community types and subtypes in this appendix are intended to reflect the extent and condition of the natural communities in Minnesota. Communities are ranked on a scale from 1 to 5; those ranked "1" are considered critically endangered in Minnesota, while communities ranked "5" are considered secure under present conditions.

The community ranks were determined by Natural Heritage Program and Minnesota County Biological Survey ecologists using current information from the Natural Heritage Information System, field observations, and other sources. The ranks are based **principally** on the abundance of high-quality examples of each community. For example, the rank for northern hardwood forest was determined mainly by considering the abundance of northern hardwood forests that have mature trees and a diverse groundlayer composed of native plants, and that have had little if any logging in the past.

Ranks for some of the communities may be revised as the Minnesota County Biological Survey progresses and more information is obtained on natural communities statewide. A question mark following a rank is used in cases where only limited information is available on the community. Communities for which information is especially scarce are given a "U", for rank undetermined.

The community ranks assigned here are used by the Minnesota Natural Heritage Program to set priorities for research and for conservation planning. These ranks do not imply any statutory or regulatory protection for natural communities as such; there is no "Endangered Natural Community Act." However, several of the natural communities in this list are afforded some protection incidentally under various State and Federal wetland laws or regulations. Occurrences of one natural community, *Calcareous Seepage Fen Prairie Subtype*, are explicitly protected, as "calcareous fens," under the Wetland Conservation Act (Minn. Stat. § 103G.223, Minn. Rules ch. 8420.1010-1060), and the Water Pollution Control Act (Minn. Stat. §§ 115.03, 115.44, Minn. Rules ch. 7050.0180).

	State Rank
DECIDUOUS FOREST	
<i>Aspen Forest</i>	5
<i>Aspen - Birch Forest</i>	4?
<i>Aspen - Birch Forest Spruce-Fir Subtype*</i>	4?
<i>Aspen - Birch Forest Northern Hardwoods Subtype*</i>	4?
<i>Paper Birch Forest</i>	4?
<i>Paper Birch Forest Spruce-Fir Subtype*</i>	4?
<i>Paper Birch Forest Northern Hardwoods Subtype*</i>	4?

<i>Oak Forest (Southeast Section)</i>	2
<i>Oak Forest (Southeast Section) Dry Subtype*</i>	2
<i>Oak Forest (Southeast Section) Mesic Subtype*</i>	2
<i>Oak Forest (Big Woods Section)</i>	3
<i>Oak Forest (Big Woods Section) Dry Subtype*</i>	3
<i>Oak Forest (Big Woods Section) Mesic Subtype*</i>	2
<i>Oak Forest (Central Section)</i>	3
<i>Oak Forest (Central Section) Dry Subtype*</i>	3
<i>Oak Forest (Central Section) Mesic Subtype*</i>	2
<i>Oak Forest (Northwest Section)</i>	U
<i>Oak Forest (Northwest Section) Dry Subtype*</i>	U
<i>Oak Forest (Northwest Section) Mesic Subtype*</i>	U
<i>Oak Forest (Northeast Section)</i>	3
<i>Oak Forest (Northeast Section) Red Maple Subtype</i>	4
<i>Northern Hardwood Forest (Southeast Section)</i>	2
<i>Northern Hardwood Forest (Northern Section)</i>	2
<i>Maple - Basswood Forest (Southeast Section)</i>	2
<i>Maple - Basswood Forest (Big Woods Section)</i>	2
<i>Maple - Basswood Forest (East Central Section)</i>	3
<i>Maple - Basswood Forest (West Central Section)</i>	3
<i>Maple - Basswood Forest (Northern Section)</i>	3
<i>Lowland Hardwood Forest</i>	4

CONIFEROUS FOREST

<i>White Pine Forest (Southeast Section)</i>	2
<i>White Pine Forest (Central Section)</i>	2
<i>White Pine Forest (Northeast Section)</i>	3

<i>Red Pine Forest</i>	3
<i>Jack Pine Forest (Central Outwash Plain Section)</i>	4
<i>Jack Pine Forest (Central Outwash Plain Section) Hazel Subtype*</i>	4
<i>Jack Pine Forest (Central Outwash Plain Section) Blueberry Subtype*</i>	3
<i>Jack Pine Forest (Northeast Section)</i>	4
<i>Jack Pine Forest (Northeast Section) Jack Pine - Oak Subtype</i>	4?
<i>Jack Pine Forest (Northeast Section) Jack Pine - Fir Subtype</i>	4
<i>Jack Pine Forest (Northeast Section) Jack Pine - Black Spruce Subtype</i>	4
<i>Jack Pine Forest (Northwest Section)</i>	3
<i>Black Spruce - Feathermoss Forest</i>	4
<i>Spruce - Fir Forest</i>	4
<i>Spruce - Fir Forest Fir - Birch Subtype</i>	4
<i>Spruce - Fir Forest White Spruce - Balsam Fir Subtype</i>	3
<i>Upland White Cedar Forest</i>	3
<i>Upland White Cedar Forest (Northern Section)</i>	3
<i>Upland White Cedar Forest (Northern Section) Mesic Subtype</i>	3
<i>Upland White Cedar Forest (Northern Section) Wet - Mesic subtype</i>	2?
<i>Upland White Cedar Forest (Lake Superior Section)</i>	3
<i>Upland White Cedar Forest (Lake Superior Section) Mesic Subtype</i>	3
<i>Upland White Cedar Forest (Lake Superior Section) Wet - Mesic Subtype</i>	3
<i>Upland White Cedar Forest (Southeast Section)</i>	2

MIXED CONIFEROUS-DECIDUOUS FOREST

<i>Mixed Pine - Hardwood Forest</i>	4
<i>White Pine - Hardwood Forest (Southeast Section)</i>	
<i>White Pine - Hardwood Forest (Southeast Section) Dry Subtype*</i>	2
<i>White Pine - Hardwood Forest (Southeast Section) Mesic Subtype*</i>	2

<i>White Pine - Hardwood Forest (North-Central Section)</i>	3
<i>Boreal Hardwood - Conifer Forest</i>	3?
<i>Northern Hardwood - Conifer Forest (Southeast Section)</i>	2
<i>Northern Hardwood - Conifer Forest (Northern Section)</i>	3
<i>Northern Hardwood - Conifer Forest (Northern Section) Yellow Birch - White Cedar Subtype</i>	2

DECIDUOUS WOODLAND

<i>Aspen Woodland</i>	5
<i>Oak Woodland - Brushland (Southeast Section)</i>	4
<i>Oak Woodland - Brushland (Big Woods Section)</i>	4
<i>Oak Woodland - Brushland (Central Section)</i>	4
<i>Oak Woodland - Brushland (Northwest Section)</i>	4

DECIDUOUS SAVANNA

<i>Mesic Oak Savanna (Southeast Section)</i>	1
<i>Mesic Oak Savanna (Southwest Section)</i>	1
<i>Mesic Oak Savanna (Central Section)</i>	1
<i>Mesic Oak Savanna (Northwest Section)</i>	1
<i>Dry Oak Savanna (Southeast Section)</i>	U
<i>Dry Oak Savanna (Southeast Section) Barrens Subtype*</i>	1
<i>Dry Oak Savanna (Southeast Section) Hill Subtype*</i>	1?
<i>Dry Oak Savanna (Southeast Section) Sand - Gravel Subtype*</i>	2
<i>Dry Oak Savanna (Southwest Section)</i>	U
<i>Dry Oak Savanna (Southwest Section) Hill Subtype*</i>	1

<i>Dry Oak Savanna (Central Section)</i>	U
<i>Dry Oak Savanna (Central Section) Barrens Subtype*</i>	2
<i>Dry Oak Savanna (Central Section) Hill Subtype*</i>	1
<i>Dry Oak Savanna (Central Section) Sand - Gravel Subtype*</i>	2
 <i>Dry Oak Savanna (Northwest Section)</i>	 U
<i>Dry Oak Savanna (Northwest Section) Barrens Subtype*</i>	1
<i>Dry Oak Savanna (Northwest Section) Hill Subtype*</i>	1
<i>Dry Oak Savanna (Northwest Section) Sand - Gravel Subtype*</i>	1
 <i>Aspen Openings</i>	 2
<i>Aspen Openings Sand - Gravel Subtype</i>	1

CONIFEROUS WOODLAND

<i>Jack Pine Woodland</i>	1
 <i>Northern Conifer Woodland</i>	 4?

CONIFEROUS SAVANNA

<i>Jack Pine Barrens</i>	2
 <i>Northern Conifer Scrubland</i>	 3?

UPLAND BRUSH-PRAIRIE

<i>Mesic Brush-Prairie</i>	3
<i>Mesic Brush-Prairie Sand - Gravel Subtype</i>	2

UPLAND PRAIRIE

<i>Mesic Prairie (Southeast Section)</i>	1
<i>Mesic Prairie (Southeast Section) Carbonate Bedrock Subtype</i>	1
 <i>Mesic Prairie (Southwest Section)</i>	 2
<i>Mesic Prairie (Southwest Section) Crystalline Bedrock Subtype</i>	1

<i>Mesic Prairie (Central Section)</i>	2
<i>Mesic Prairie (Northwest Section)</i>	3
<i>Dry Prairie (Southeast Section)</i>	3
<i>Dry Prairie (Southeast Section) Barrens Subtype</i>	1
<i>Dry Prairie (Southeast Section) Bedrock Bluff Subtype</i>	3
<i>Dry Prairie (Southeast Section) Hill Subtype</i>	2
<i>Dry Prairie (Southeast Section) Sand - Gravel Subtype</i>	2
<i>Dry Prairie (Southwest Section)</i>	3
<i>Dry Prairie (Southwest Section) Hill Subtype</i>	3
<i>Dry Prairie (Southwest Section) Sand - Gravel Subtype</i>	2
<i>Dry Prairie (Central Section)</i>	2
<i>Dry Prairie (Central Section) Barrens Subtype</i>	2
<i>Dry Prairie (Central Section) Hill Subtype</i>	2
<i>Dry Prairie (Central Section) Sand - Gravel Subtype</i>	2
<i>Dry Prairie (Northwest Section)</i>	3
<i>Dry Prairie (Northwest Section) Barrens Subtype</i>	1
<i>Dry Prairie (Northwest Section) Hill Subtype</i>	3
<i>Dry Prairie (Northwest Section) Sand - Gravel Subtype</i>	2

BOG

<i>Black Spruce Bog</i>	4
<i>Black Spruce Bog Raised Subtype*</i>	3
<i>Black Spruce Bog Intermediate Subtype*</i>	4
<i>Open Sphagnum Bog</i>	4
<i>Open Sphagnum Bog Raised Subtype*</i>	3
<i>Open Sphagnum Bog Intermediate Subtype*</i>	4
<i>Open Sphagnum Bog Schlenke Subtype*</i>	2

FLOODPLAIN FOREST

<i>Floodplain Forest</i>	2
<i>Floodplain Forest Silver Maple Subtype</i>	3
<i>Floodplain Forest Swamp White Oak Subtype</i>	2?

HARDWOOD SWAMP FOREST

<i>Black Ash Swamp</i>	4
<i>Black Ash Swamp Seepage Subtype</i>	3
<i>Mixed Hardwood Swamp</i>	4
<i>Mixed Hardwood Swamp Seepage Subtype</i>	3

CONIFER SWAMP FOREST

<i>White Cedar Swamp</i>	4
<i>White Cedar Swamp Seepage Subtype</i>	2?
<i>Tamarack Swamp</i>	4
<i>Tamarack Swamp Sphagnum Subtype*</i>	4
<i>Tamarack Swamp Minerotrophic Subtype*</i>	4
<i>Tamarack Swamp Seepage Subtype*</i>	2
<i>Black Spruce Swamp</i>	4

SHRUB SWAMP

<i>Alder Swamp</i>	5
<i>Willow Swamp</i>	4

EMERGENT MARSH

<i>Cattail Marsh</i>	5
<i>Mixed Emergent Marsh (Forest Section)</i>	4
<i>Mixed Emergent Marsh (Prairie Section)</i>	2

WET MEADOW/FEN

<i>Wet Brush-Prairie</i>	3
<i>Wet Brush-Prairie Seepage Subtype</i>	2

<i>Wet Prairie (Southeast Section)</i>	1
<i>Wet Prairie (Southwest Section)</i>	2
<i>Wet Prairie (Southwest Section) Saline Subtype</i>	1
<i>Wet Prairie (Central Section)</i>	2
<i>Wet Prairie (Central Section) Seepage Subtype</i>	1?
<i>Wet Prairie (Northwest Section)</i>	3
<i>Wet Prairie (Northwest Section) Saline Subtype</i>	2
<i>Wet Prairie (Northwest Section) Seepage Subtype</i>	2
<i>Poor Fen</i>	4
<i>Poor Fen Sedge Subtype*</i>	3
<i>Poor Fen Shrub Subtype*</i>	4
<i>Poor Fen Scrub Tamarack Subtype*</i>	4
<i>Calcareous Seepage Fen (Southeast Section) Prairie Subtype*</i>	1
<i>Calcareous Seepage Fen (Southwest Section) Prairie Subtype*</i>	1
<i>Calcareous Seepage Fen (Northwest Section) Prairie Subtype*</i>	1
<i>Calcareous Seepage Fen Boreal Subtype*</i>	2
<i>Rich Fen (Boreal Section)</i>	4
<i>Rich Fen (Boreal Section) Sedge Subtype*</i>	4
<i>Rich Fen (Boreal Section) Floating-Mat Subtype*</i>	U
<i>Rich Fen (Boreal Section) Shrub Subtype*</i>	4
<i>Rich Fen (Transition Section)</i>	3
<i>Rich Fen (Transition Section) Sedge Subtype*</i>	3
<i>Rich Fen (Transition Section) Floating-Mat Subtype*</i>	3?
<i>Rich Fen (Transition Section) Shrub Subtype*</i>	3
<i>Wet Meadow</i>	3
<i>Wet Meadow Shrub Subtype</i>	3
<i>Seepage Meadow</i>	3

PRIMARY COMMUNITY

<i>Moist Cliff (Southeast Section)</i>	3
<i>Moist Cliff (Southeast Section) Maderate Subtype</i>	3
<i>Moist Cliff (Northeast Section)</i>	4
<i>Dry Cliff (Southeast Section)</i>	3
<i>Dry Cliff (Northeast Section)</i>	4
<i>Rock Outcrop (Southwest Section)</i>	3
<i>Rock Outcrop (Northeast Section)</i>	4
<i>Talus Slope</i>	U
<i>Talus Slope Algific Subtype</i>	2
<i>Mud flat</i>	U
<i>Mud flat Saline Subtype</i>	1
<i>River Beach</i>	U
<i>River Beach Sand Subtype</i>	U
<i>River Beach Gravel - Cobble Subtype</i>	U
<i>River Beach Bedrock Subtype</i>	U
<i>Lake Beach (Lake Superior Section)</i>	4
<i>Lake Beach (Lake Superior Section) Sand Subtype*</i>	1
<i>Lake Beach (Lake Superior Section) Gravel - Cobble Subtype*</i>	4
<i>Lake Beach (Lake Superior Section) Bedrock Subtype*</i>	4
<i>Lake Beach (Inland Section)</i>	4
<i>Lake Beach (Inland Section) Mud Subtype*</i>	4
<i>Lake Beach (Inland Section) Sand Subtype*</i>	3
<i>Lake Beach (Inland Section) Gravel - Cobble Subtype*</i>	4
<i>Lake Beach (Inland Section) Bedrock Subtype*</i>	4

AQUATIC RIVER COMMUNITY _____

River Bed

U

AQUATIC LAKE COMMUNITY _____

Lake Bed

U

Appendix 2. Common names and taxonomic equivalents of tree, shrub, and ericaceous shrub species appearing in *Minnesota's Native Vegetation*. (b = boreal hardwood species, m = mesic hardwood species)

Common Name	Taxonomic Equivalent
<u>Trees</u>	
American elm (m)	<i>Ulmus americana</i>
American hornbeam (m)	<i>Carpinus caroliniana</i>
ash	<i>Fraxinus</i> sp.
aspen	<i>Populus</i> sp.
balsam fir	<i>Abies balsamea</i>
balsam poplar (b)	<i>Populus balsamifera</i>
basswood (m)	<i>Tilia americana</i>
big-toothed aspen	<i>Populus grandidentata</i>
bitternut hickory (m)	<i>Carya cordiformis</i>
black ash (b)	<i>Fraxinus nigra</i>
black cherry	<i>Prunus serotina</i>
black oak	<i>Quercus velutina</i>
black spruce	<i>Picea mariana</i>
black willow	<i>Salix nigra</i>
box elder	<i>Acer negundo</i>
bur oak	<i>Quercus macrocarpa</i>
butternut (m)	<i>Juglans cinerea</i>
chokecherry (b)	<i>Prunus virginiana</i>
cottonwood	<i>Populus deltoides</i>
eastern red cedar	<i>Juniperus virginiana</i>
elm	<i>Ulmus</i> sp.
green ash (m)	<i>Fraxinus pennsylvanica</i>
hackberry (m)	<i>Celtis occidentalis</i>
ironwood (m)	<i>Ostrya virginiana</i>
jack pine	<i>Pinus banksiana</i>
mountain ash (b)	<i>Sorbus americana</i>
northern pin oak	<i>Quercus ellipsoidalis</i>
northern red oak (m)	<i>Quercus rubra</i>
oak	<i>Quercus</i> sp.
paper birch (b)	<i>Betula papyrifera</i>
pincherry (b)	<i>Prunus pensylvanica</i>
pine	<i>Pinus</i> sp.
pussy willow (b)	<i>Salix discolor</i>
quaking aspen (b)	<i>Populus tremuloides</i>
red maple (m)	<i>Acer rubrum</i>
red pine	<i>Pinus resinosa</i>

river birch
 rock elm (m)
 silver maple
 slippery elm (m)
 sugar maple (m)
 tamarack
 white ash (m)
 white cedar
 white oak (m?)
 white pine
 white spruce
 willow
 yellow birch (m)

Betula nigra
Ulmus thomasii
Acer saccharinum
Ulmus rubra
Acer saccharum
Larix laricina
Fraxinus americana
Thuja occidentalis
Quercus alba
Pinus strobus
Picea glauca
Salix sp.
Betula alleghaniensis

Shrubs

alder
 alder buckthorn
 alder-leaved buckthorn
 American hazelnut
 American yew
 balsam willow
 beaked hazel
 Bebb's willow
 blackberry
 bog birch
 bog willow
 bush honeysuckle
 bush juniper
 common buckthorn
 downy arrowwood
 fly honeysuckle
 fragrant false indigo
 gooseberry
 gray-bark dogwood
 hazelnut
 juneberry
 leadplant
 leatherwood
 meadow sweet
 mountain fly-honeysuckle
 mountain maple
 ninebark
 pagoda dogwood
 poison sumac

Alnus sp.
Rhamnus frangula
Rhamnus alnifolia
Corylus americana
Taxus canadensis
Salix pyrifolia
Corylus cornuta
Salix bebbiana
Rubus allegheniensis
Betula pumila var. *glandulifera*
Salix pedicellaris
Diervilla lonicera
Juniperus communis
Rhamnus cathartica
Viburnum rafinesquianum
Lonicera canadensis
Amorpha nana
Ribes sp.
Cornus foemina ssp. *racemosa*
Corylus sp.
Amelanchier sp.
Amorpha canescens
Dirca palustris
Spiraea alba
Lonicera villosa
Acer spicatum
Physocarpus opulifolius
Cornus alternifolia
Rhus vernix

prairie rose
prairie willow
prickly ash
pussy willow
raspberry
red-berried elder
red-osier dogwood
round-leaved dogwood
sage-leaved willow
sand-bar willow
sand cherry
Saskatoon
shrubby cinquefoil
slender willow
speckled alder
Tartarian honeysuckle
willow
winterberry
wolfberry

Rosa arkansana
Salix humilis
Zanthoxylum americanum
Salix discolor
Rubus strigosus
Sambucus pubens
Cornus stolonifera
Cornus rugosa
Salix candida
Salix exigua (formerly *S. interior*)
Prunus pumila
Amelanchier alnifolia
Potentilla fruticosa
Salix gracilis
Alnus incana ssp. *rugosa*
Lonicera tatarica
Salix sp.
Ilex verticillata
Symphoricarpos occidentalis

Ericaceous shrubs

blueberry
bog rosemary
creeping snowberry
Labrador tea
leatherleaf
swamp laurel

Vaccinium angustifolium
Andromeda glaucophylla
Gaultheria hispidula
Ledum groenlandicum
Chamaedaphne calyculata
Kalmia polifolia

Appendix 3. Common plants of prairie communities in Minnesota, by community in which they occur.
 (Emphasis is on species that occur throughout the range of the community in Minnesota; exceptions are noted (e.g., -SE = absent from southeastern Minnesota, NW = typical in Northwestern Minnesota). Species that may be common in a prairie community but that are also typical of non-prairie communities (such as Sedge Meadow) are omitted.)

T = typically present

O = occasional but not typical, or typically present only in some subtypes

Barrens = Dry Prairie Barrens Subtype and Dry Oak Savanna Barrens Subtype

Gravel = Dry Prairie Sand-Gravel Subtype

Bluff = Dry Prairie Bedrock Bluff Subtype

Hill = Dry Prairie Hill Subtype and Dry Oak Savanna Hill Subtype

Mesic = Mesic Prairie and Mesic Brush Prairie

Wet = Wet Prairie and Wet Brush Prairie

Saline = Wet Prairie Saline Subtype

Dry Habitats							
Dry-Mesic Habitats							
Mesic Habitats							
Wet-Mesic Habitats							
Wet Habitats							

Species	Barrens	Gravel	Bluff	Hill	Mesic	Wet	Saline
Graminoids							
<i>Calamovilfa longifolia</i>	T	O		O			
<i>Bouteloua gracilis</i>	T(NW)	T(NW)		O(NW)			
<i>Bouteloua hirsuta</i>	T	T	T	O			
<i>Muhlenbergia cuspidata</i>		T	T	T			
<i>Carex heliophila</i>	T	T	T	T	T		
<i>Stipa spartea</i>	T	T	T	T	T		
<i>Koeleria macrantha</i>	T	T	T	T	T		O
<i>Bouteloua curtipendula</i>	O	T	T	T	T		
<i>Schizachyrium scoparium</i>	T	T	T	T	T	O	T
<i>Panicum leibergii</i>		O	T	T	T		
<i>Sorghastrum nutans</i>	O	O	T	T	T	O	O
<i>Sporobolus heterolepis</i>		T	T	T	T	O	O
<i>Andropogon gerardii</i>	T	T	T	T	T	T	T
<i>Panicum virgatum</i>				O	T	T	T
<i>Muhlenbergia richardsonis</i> (-SE?)					O	T	T
<i>Spartina pectinata</i>					O	T	T
<i>Hierochloa odorata</i>					O	T	O
<i>Distichlis stricta</i>							T
<i>Muhlenbergia asperifolia</i>							T
<i>Spartina gracilis</i>							T
<i>Puccinellia nuttalliana</i>							O
Broad-leaved Herbs							
<i>Petalostemon villosus</i>	T						
<i>Tradescantia occidentalis</i>	T						
<i>Artemisia frigida</i>	T	T	O	O			
<i>Pulsatilla nuttalliana</i>	T	T	T	T	O		
<i>Castilleja sessiliflora</i>		T	T	O			
<i>Aster oblongifolius</i>		T	T	T	O		
<i>Lithospermum incisum</i>	O	T	T	O			
<i>Liatris cylindracea</i>			T	O(C)			
<i>Liatris punctata</i>	O	T	O	T	O		
<i>Aster sericeus</i>	T	T	T	T	O		
<i>Liatris aspera</i>	T	T	T	T	T		
<i>Heterotheca villosa</i>	T	T		T	O		
<i>Geum triflorum</i>	O	T	T	T	T		
<i>Delphinium virescens</i>	T	T	O	T	T		
<i>Anemone cylindrica</i>	T	T	T	T	T		
<i>Helianthus rigidus</i>	T	T	T	T	T		
<i>Astragalus crassicaupus</i>		T	O	T	T		
<i>Echinacea angustifolia</i> (-E)		T		T	O		
<i>Calylophus serrulatus</i>	O	T	O	T	O		
<i>Psoralea argophylla</i>		O		T	T		

Appendix 3. (cont.)

Dry Habitats							
Dry-Mesic Habitats							
Mesic Habitats							
Wet-Mesic Habitats							
Wet Habitats							

Species	Barrens	Gravel	Bluff	Hill	Mesic	Wet	Saline
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Broad-leaved Herbs (cont.)

<i>Psoralea esculenta</i>		T	O	T	T		
<i>Senecio plattensis</i>		T	O	T	O		
<i>Potentilla arguta</i>	O	T	T	T	T		
<i>Petalostemon candidum</i>	O	O	O	O	T		
<i>Heuchera richardsonii</i>	O	T	O	T	T		
<i>Comandra umbellata</i>	T	T	T	T	T	O	
<i>Solidago rigida</i>	T	T	T	T	T	O	
<i>Solidago nemoralis</i>	T	T	T	T	T	O	O/T
<i>Sisyrinchium campestre</i>	T	T	T	T	O		
<i>Solidago missouriensis</i>	T	T	O	T	T		
<i>Solidago ptarmicoides</i>		T	T	T	T	O	
<i>Allium stellatum</i>		T		T	T	O	O
<i>Lithospermum canescens</i>		T	T	T	T	O	
<i>Artemisia ludoviciana</i>	T	T	O	T	T		
<i>Petalostemon purpureum</i>	O	T	T	T	T	O	O
<i>Phlox pilosa</i> (-NW)	O	O	O	T	T		
<i>Aster laevis</i>		T	O	T	T		
<i>Coreopsis palmata</i> (-NW)	T	T	T	T	T		
<i>Viola pedatifida</i>	T	T	T	T	T	O	
<i>Cirsium flodmanii</i>		T		T	T	O	
<i>Lilium philadelphicum</i>		O	O	T	T	O	
<i>Zizia aptera</i>		O	O	T	T	O	T
<i>Zigadenus elegans</i>		O	O	T	T	O	O
<i>Oxalis violacea</i>		O	O	T	T		
<i>Asclepias speciosa</i>		O			T	O	
<i>Pedicularis canadensis</i>			T	O	T	O	
<i>Thalictrum dasycarpum</i>				T	T	T	
<i>Glycyrrhiza lepidota</i>				O	T	O	
<i>Helianthus maximilianii</i>				O	T	O	O
<i>Prenanthes racemosa</i>				O	T	O	
<i>Helioopsis helianthoides</i>					T	O	
<i>Liatris ligulistylis</i>					T	T	T
<i>Pycnanthemum virginianum</i>					O	T	
<i>Liatris pycnostachya</i>					O	T	O
<i>Aster novae-angliae</i>					O	T	
<i>Hypoxis hirsuta</i>					O	T	
<i>Zizia aurea</i>					O	T	
<i>Gentiana andrewsii</i>					O	T	
<i>Lysimachia quadriflora</i>					O	T	
<i>Solidago riddellii</i>					O	T	
<i>Euthamia graminifolia</i>					O	T	O
<i>Plantago eriopoda</i>							T

Shrubs

<i>Amorpha canescens</i>	T	T	T	T	T		
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Supplement to Appendix 3. Species of more restricted geographic distribution, species not so clearly indicative of prairie vegetation or species whose status is unknown.

	<div> <div>Dry Habitats</div> <div>Dry-Mesic Habitats</div> <div>Mesic Habitats</div> <div>Wet-Mesic Habitats</div> <div>Wet Habitats</div> </div>						
Species	Barrens	Gravel	Bluff	Hill	Mesic	Wet	Saline
Graminoids							
<i>Agropyron trachycaulum</i> var. <i>unilat.</i>		O		T	T		
<i>Agropyron trachycaulum</i> var. <i>glauc.</i>					O	T	T
<i>Aristida basiramea</i> (E)	T						
<i>Calamagrostis canadensis</i>						T	
<i>Calamagrostis inexpansa</i> (-SE)					O	T	T
<i>Carex bebbii</i>					O?	T?	
<i>Carex bicknellii</i>	O?			O?	T?	?	
<i>Carex crawei</i> (NW)					O	T	
<i>Carex eleocharis</i> (W)	?	T		O			
<i>Carex filifolia</i> (W)		T		O			
<i>Carex foenea</i>	T	O					
<i>Carex hallii</i>							T
<i>Carex lanuginosa</i>					O	T	
<i>Carex meadii</i>			O	T	T		
<i>Carex muhlenbergii</i> (E)	T	O					
<i>Carex praegracilis</i> (-SE)						O	T
<i>Carex sartwellii</i>						O	
<i>Carex tetanica</i>					O	T	
<i>Cyperus schweinitzii</i>	T						
<i>Elymus canadensis</i>					O?		
<i>Eragrostis spectabilis</i>	O	O?			O?		
<i>Glyceria striata</i>						T	
<i>Helictotrichon hookeri</i> (NW)		T					
<i>Leptoloma cognatum</i> (SE)	T						
<i>Muhlenbergia glomerata</i>						O	
<i>Panicum lanuginosum</i>						T	
<i>Panicum oligosanthos</i>		T	T	O	T		
<i>Panicum perlongum</i>	T	O	T	O			
<i>Panicum wilcoxianum</i>		T		T	O		
<i>Sporobolus asper</i>		O		T?	?	O	T
<i>Sporobolus cryptandrus</i>	T	O					
<i>Stipa comata</i> (W?)	T?	T		O			
Broad-leaved Herbs							
<i>Agalinus aspera</i>		?		T	O?		
<i>Agalinus tenuifolia</i>						O?	
<i>Agoseris glauca</i> (W)		T		T	T	O	
<i>Allium canadense</i>					?	T	
<i>Allium textile</i> (W)		T					
<i>Ambrosia coronopifolia</i>	T	?		?	T		T
<i>Anemone canadensis</i>					O	T	
<i>Antennaria plantaginifolia</i>	T	T	O				
<i>Apocynum sibiricum</i>				O	T	T	
<i>Asclepias incarnata</i>						T	
<i>Asclepias lanuginosa</i>		?		T?			
<i>Asclepias ovalifolia</i>				O	T		
<i>Asclepias tuberosa</i> (SC, SE)	T	O	O	T	T		
<i>Asclepias viridiflora</i>	T	T	O	T			
<i>Aster ericoides</i>		T	T	T	T	O	T
<i>Aster lanceolatus</i>					O	T	O
<i>Aster umbellatus</i> (-SW)						O	
<i>Astragalus adsurgens</i> (W)		T		T			
<i>Astragalus agrestis</i> (W)				O	T	O	
<i>Cacalia tuberosa</i> (SE)					T?	T?	
<i>Cerastium arvense</i>	?	T		O?			
<i>Cicuta maculata</i>					O	T	
<i>Cirsium muticum</i> (-SW)						O	

Supplement to Appendix 3. (cont.)

Dry Habitats
Dry-Mesic Habitats
Mesic Habitats
Wet-Mesic Habitats
Wet Habitats

Species	Barrens	Gravel	Bluff	Hill	Mesic	Wet	Saline
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Broad-leaved Herbs (cont.)

<i>Cypripedium candidum</i>					O	T	
<i>Desmodium canadense</i>					T	T	
<i>Equisetum hymale</i>	T?	?	O	T?			
<i>Equisetum laevigatum</i>		O			T?		
<i>Erysimum inconspicuum</i>		T?		T	O		
<i>Eupatorium maculatum</i>						T	
<i>Euphorbia corollata</i> (-W)	T	T	T	T	O?		
<i>Euthamia gymnospermoides</i>	O	O		T?	T?		
<i>Gaillardia aristata</i>		T		O?			
<i>Galium boreale</i>	O	T	O	T	T	O	
<i>Gaura coccinea</i> (W)		T		T	O		
<i>Gentiana puberulenta</i>		?	?	T	T		
<i>Gentianopsis crinita</i>						O	
<i>Gentianopsis procera</i> (-S)						O	
<i>Helenium autumnale</i>					O	T	
<i>Helianthemum bicknellii</i> (-SW)	T						T
<i>Helianthus giganteus</i>					O	T	
<i>Helianthus grosseserratus</i>					O	T	
<i>Helianthus occidentalis</i> (-W)	T		O	?	T?		
<i>Hudsonia tomentosa</i>	T						
<i>Kuhnia eupatorioides</i>		T	T	T			
<i>Lactuca ludoviciana</i>		?		T	O		
<i>Lactuca pulchella</i>	?	T		T	O		
<i>Lathyrus palustris</i>					O	T	
<i>Lathyrus venosus</i>					T		
<i>Lechea stricta</i> (-W)	T	T	O	?			
<i>Lespedeza capitata</i>	T	O	O		O		
<i>Lilium michiganense</i> (-W)						T	
<i>Linum rigidum</i> (-E?)		T		O			
<i>Linum sulcatum</i>		T	T	T	T		
<i>Lithospermum carolinense</i> (E)	T	O	O?				
<i>Lobelia kalmii</i> (N)						O	
<i>Lobelia siphilitica</i> (-N)						T	
<i>Lobelia spicata</i>			T	O	T	O	
<i>Lomatium orientale</i> (W)		T		O			
<i>Lythrum alatum</i>						T	
<i>Nothocalais cuspidata</i> (-NW)		T		O			
<i>Oenothera nuttallii</i> (NW?)	T	T		?			
<i>Onosmodium molle</i>		O	O	O	T		
<i>Oxytropis lambertii</i> (W)		T		T			
<i>Pedicularis lanceolata</i>						T	
<i>Penstemon albidus</i> (W)		T		O			
<i>Penstemon gracilis</i>	?	T	O	O?	O?		
<i>Physalis heterophylla</i>				O	T		
<i>Physalis virginiana</i>	O	T	T	T	O		
<i>Polygala senega</i>					T	?	
<i>Polygala verticillata</i>		O		T?	O		
<i>Potentilla pensylvanica</i> (-SE)		T		T			
<i>Ranunculus rhomboideus</i>	O	O	O?	T	O		
<i>Ratibida columnifera</i> (W?)		T		T	O		
<i>Ratibida pinnata</i> (S)			T	O	T		
<i>Senecio aureus</i>						T?	
<i>Senecio integerrimus</i>					T?	?	
<i>Senecio pseudoreus</i>						T	
<i>Silphium laciniatum</i> (S)		T?	T	T	O		
<i>Sisyrinchium montanum</i>					T		
<i>Sisyrinchium mUcronatum</i>						T	
<i>Solidago gigantea</i>						T	
<i>Solidago speciosa</i>	T?	O?	O?	O?	T		

Supplement to Appendix 3. (cont.)

Dry Habitats							
Dry-Mesic Habitats							
Mesic Habitats							
Wet-Mesic Habitats							
Wet Habitats							

Species	Barrens	Gravel	Bluff	Hill	Mesic	Wet	Saline
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Broad-leaved Herbs (cont.)

<i>Tradescantia bracteata</i>					T?		
<i>Verbena stricta</i>	T?	T	T	T	O		
<i>Vernonia fasciculata</i>						T	

Shrubs

<i>Amorpha nana</i> (-SE)					T	O	
<i>Ceanothus americanus</i> (-W)	O	O	O	T?	T		
<i>Ceanothus herbaceus</i> (-W)							
<i>Rosa arkansana</i>	?	T	T	T	T?		
<i>Rosa blanda</i>					T?	?	?
<i>Salix humilis</i> (-SW)	T	T	O	?	T		
<i>Spiraea alba</i>						T	
<i>Symphoricarpos occidentalis</i>		T		T	T		

Appendix 4. Common plants of wetland communities in Minnesota, by community in which they occur.

T= typical throughout community range
T(n) = typical in northern Minnesota
T(s) = typical in southern Minnesota
O = occasional, but useful indicator of the type

Forested

Ombrotrophic (pH<4.5)
Weakly Minerotrophic
Minerotrophic
Highly Minerotrophic

COMMUNITY CLASS	Hardwood Swamp Forest	Conifer Swamp Forest	Bog		Wet Meadow/Fen					Shrub Swamp	Emergent Marsh
			Black Spruce Bog	Open Sphagnum Bog	Poor Fen	Rich Fen	Calcareous Seepage Fen	Wet Meadow	Seepage Meadow		
Subtype							Boreal Subtype	Prairie Subtype			
<i>Fraxinus nigra</i>	T										
<i>Acer spicatum</i>	T(n)										
<i>Botrychium virginianum</i>	T(n)										
<i>Circaea alpina</i>	T(n)										
<i>Dryopteris disjuncta</i>	T(n)										
<i>Equisetum sylvaticum</i>	T(n)										
<i>Fragaria virginiana</i>	T(n)										
<i>Mentha arvensis</i>	T(n)										
<i>Aralia nudicaulis</i>	T(s)										
<i>Arisaema triphyllum</i>	T(s)										
<i>Betula alleghensis</i>	T(s)										
<i>Elymus patula</i>	T(s)										
<i>Dryopteris spirulosa</i>	T(s)										
<i>Linnaea borealis</i>	T(s)										
<i>Maianthemum canadensis</i>	T(s)										
<i>Mitella nuda</i>	T(s)										
<i>Carex leptalea</i>		T								T(s)	
<i>Carex paupercula</i>		T									
<i>Carex tenuiflora</i>		T									
<i>Lysimachia thysiflora</i>		T									
<i>Potentilla palustris</i>		T									
<i>Salix pedicellaris</i>		T									
<i>Thuja occidentalis</i>		T					T				
<i>Larix laricina</i>	T(s)	T		T	T		T				
<i>Carex trisperma</i>		T	T								
<i>Gaultheria hispida</i>		O	O								
<i>Smilacina trifolia</i>		T	T		T						
<i>Vaccinium vitis-idaea</i>		T	T								
<i>Ledum groenlandicum</i>		T	T	T							
<i>Picea mariana</i>		T	T	T							
<i>Chamaedaphne calyculata</i>		T	T	T	T	T					
<i>Drosera rotundifolia</i>		T		T	T		T				
<i>Andromeda glaucophylla</i>		T	T	T	T		T				
<i>Vaccinium oxycoccus</i>		T		T	T		T	T			
<i>Eriophorum spissum</i>			T	T							
<i>Kalmia polifolia</i>			T	T		T					
<i>Carex oligosperma</i>				T							
<i>Carex pauciflora</i>				T							
<i>Sarracenia purpurea</i>		T		T	T	T	T				
<i>Carex chordorrhiza</i>					T	T					
<i>Scheuchzeria palustris</i>					T	T					
<i>Carex limosa</i>					T	T	T				
<i>Menyanthes trifoliata</i>					T	T	T				
<i>Rhynchospora alba</i>					T	T	T				
<i>Betula pumila</i>		T			T	T	T	T		T(s)	
<i>Carex lasiocarpa</i>					T	T	T				
<i>Carex livida</i>						T	T				
<i>Eleocharis compressa</i>						T	T				
<i>Utricularia intermedia</i>							T				
<i>Carex exilis</i>							T				
<i>Cladium mariscoides</i>							T				
<i>Drosera anglica</i>							T				
<i>Parnassia palustris</i>							T				
<i>Scirpus hudsonianus</i>							T				
<i>Utricularia cornuta</i>							T				
<i>Muhlenbergia glomerata</i>							T				
<i>Scirpus cespitosus</i>							O	O			

Appendix 4. (cont.)

Forested	
Ombrotrophic (pH<4.5)	
Weakly Minerotrophic	
Minerotrophic	
Highly Minerotrophic	

COMMUNITY CLASS	Hardwood Swamp Forest	Conifer Swamp Forest	Bog		Wet Meadow/Fen					Shrub Swamp	Emergent Marsh
COMMUNITY TYPE			Black Spruce Bog	Open Sphagnum Bog	Poor Fen	Rich Fen	Calcareous Seepage Fen	Wet Meadow	Seepage Meadow		
Subtype							Boreal Subtype	Prairie Subtype			
Andropogon gerardi								T			
Carex interior								T			
Carex prairea								T			
Carex sterilis								O			
Carex tetanica								T			
Cirsium muticum								T			
Eriophorum angustifolium								T			
Hypoxis hirsuta								T			
Lobelia kalmii								T			
Parnassia glauca								T			
Pedicularis lanceolata								T			
Rhynchospora capillacea								O			
Salix candida								O			
Scleria verticellata								O			
Solidago ridellii								O			
Triglochin maritima								O			
Triglochin palustris								O			
Zizia aurea								T			
Caltha palustris								T			
Carex bromides									T	T(n)	
Hydrocotyle americana									T		
Poa paludigena									T		
Symplocarpus foetidus									T		
Osmunda cinnamomea	T(s)								T		T(s)
Alnus rugosa	T										T
Rhus vernix	T(s)										T(s)
Rubus pubescens	T(n)										T(s)
Cornus stolonifera	T(s)										T
Bromus ciliatus								T			T(s)
Ilex verticillata											T
Lycopus uniflorus											T
Myrica gale											T(n)
Physocarpus opulifolius											T(n)
Polygonum hydropiper											T(s)
Rhamnus frangula											T(s)
Salix bebbiana											T(s)
Spiraea alba											T(n)
Stellaria longifolia											T(s)
Impatiens capensis	T(s)								T(s)		T(s)
Rumex orbiculatus									T(s)		T(s)
Asclepias incarnata								T	T(s)		T(s)
Hypericum virginianum									T		T(n)
Lycopus americanus								T	T		
Eupatorium maculatum								T	T(s)		
Calamagrostis inexpansa								T	T		
Calamagrostis canadensis									T(s)		
Carex stricta									T(s)		
Chelone glabra									T(s)		
Cyperus strigosus									T		
Deschampsia caespitosa									T		
Eleocharis acicularis									T		
Eupatorium perfoliatum									T(s)		
Hypericum majus									T		
Juncus balticus									T		
Juncus dudleyi									T		
Ludwigia palustris									T		
Phalaris arundinacea									T(s)		
Polygonum sagittatum									T(s)		
Ranunculus repens									T		
Rorippa islandica									T(s)		
Thelypteris palustris									T(s)		
Urtica dioica									T(s)		

Appendix 4. (cont.)

Forested	
Ombrotrophic (pH<4.5)	
Weakly Minerotrophic	
Minerotrophic	
Highly Minerotrophic	

COMMUNITY CLASS	Hardwood Swamp Forest	Conifer Swamp Forest	Bog		Wet Meadow/Fen					Shrub Swamp	Emergent Marsh
COMMUNITY TYPE			Black Spruce Bog	Open Sphagnum Bog	Poor Fen	Rich Fen	Calcareous Seepage Fen	Wet Meadow	Seepage Meadow		
Subtype							Boreal Subtype	Prairie Subtype			
<i>Cicuta bulbifera</i>	T(s)								T(s)		T
<i>Carex lacustris</i>									T(s)		T
<i>Scirpus cyperinus</i>									T		T
<i>Sium suave</i>									T		T
<i>Sagittaria latifolia</i>									T(s)		T
<i>Typha latifolia</i>							T				T
<i>Carex aquatilis</i>								T			T
<i>Scirpis acutus</i>								T			T
<i>Calla palustris</i>											T
<i>Acorus calamus</i>											T
<i>Alisma subcordatum</i>											T
<i>Alisma trivale</i>											T
<i>Carex trichocarpa</i>											T
<i>Carex atherodes</i>											T
<i>Carex comosa</i>											T
<i>Carex vulpinoidea</i>											T
<i>Eleocharis elliptica</i>											T
<i>Eleocharis palustris</i>											T
<i>Glyceria grandis</i>											T
<i>Leersia orzyoides</i>											T
<i>Lemna minor</i>											T
<i>Lemna trisculata</i>											T
<i>Phragmites australis</i>											T
<i>Polygonum amphibium</i>											T
<i>Pontederia cordata</i>											T
<i>Potamogeton gramineus</i>											T
<i>Potamogeton sp</i>											T
<i>Salix exigua</i>											T
<i>Scirpus fluviatilis</i>											T
<i>Scirpus paludosus</i>											T
<i>Scirpus validus</i>											T
<i>Scolochloa festucacea</i>											T
<i>Sparganium americanum</i>											T
<i>Sparganium eurycarpum</i>											T
<i>Spirodela polyrhiza</i>											T
<i>Typha angustifolia</i>											T
<i>Utricularia vulgaris</i>											T
<i>Veronica catinata</i>											T
<i>Zizania aquatica</i>											T

Appendix 5. Common species and life-forms of aquatic plants useful in distinguishing natural communities². (These species often occur in marsh pools, but not in wet meadows or fens. All are nonpersistent (sensu Cowardin³) and common in Lake Bed and River Bed community types.)

Common Name	Taxonomic Equivalent	Life Form
American lotus	<i>Nelumbo lutea</i>	XR
coontail	<i>Ceratophyllum demersum</i>	SF
elodea	<i>Elodea canadensis</i>	SR
floating-leaved pondweed	<i>Potamogeton natans</i>	DR
fragrant white water-lily	<i>Nymphaea odorata</i>	FR
greater bladderwort	<i>Utricularia vulgaris</i>	SF
greater duckweed	<i>Spirodella polyrhiza</i>	FF
Illinois pondweed	<i>Potamogeton illinoensis</i>	SR
ivy-leaved duckweed	<i>Lemna trisulca</i>	SF
large-leaved pondweed	<i>Potamogeton amplifolius</i>	SR
lesser duckweed	<i>Lemna minor</i>	FF
liverwort	<i>Riccia fluitans</i>	FF
pipewort	<i>Eriocaulon septangulare</i>	TR
quillwort	<i>Isoetes macrospora</i>	TR
sago pondweed	<i>Potamogeton pectinatus</i>	SR
water milfoil	<i>Myriophyllum sibiricum</i>	SR
water shield	<i>Brasenia schreberi</i>	FR
tape-grass	<i>Vallisneria americana</i>	SR
yellow pond-lily	<i>Nuphar luteum</i>	FR
yellow water-crowfoot	<i>Ranunculus flabellaris</i>	SR

Life Form codes

- DR = dimorphic with submergent and floating leaves, rooted
- FF = free floating on surface, not rooted, or rooted only after stranding
- FR = floating-leaved, rooted
- SF = entirely submergent, typically free-floating
- SR = entirely submergent (except for flowering shoot), rooted
- TR = stiff-leaved submergent, rooted
- XR = dimorphic with emergent and floating leaves, rooted

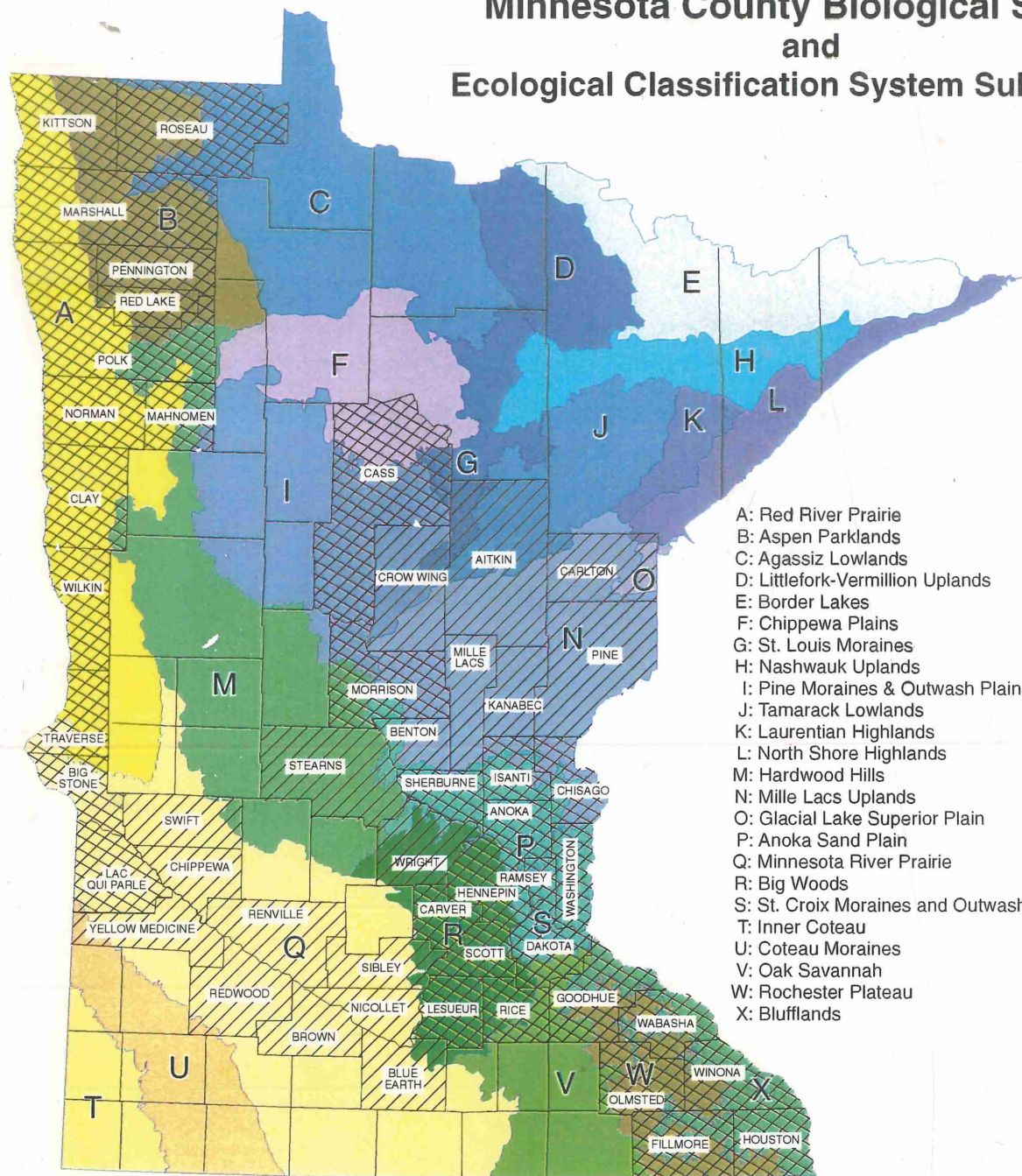
2. Primarily from Eggers, S.D. and D.M. Reed. 1987. Wetland plants and plant communities of Minnesota and Wisconsin. U.S. Army Corps of Engineers, St. Paul, Minnesota.

3. Cowardin, L.M., V. Carter, F.G. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Washington, D.C.

Appendix 6. Species tolerant of bog (ombrotrophic) environments _____

Species of forested bogs	Species of open bogs	Other species
<u>Areucethobium pusillum</u>	<u>Carex oligosperma</u>	<u>Andromeda glaucophylla</u>
<u>Carex paupercula</u>		<u>Carex pauciflora</u>
<u>Carex trisperma</u>		<u>Chamaedaphne calyculata</u>
<u>Cypripedium acaule</u>		<u>Drosera rotundifolia</u>
<u>Gaultheria hispidula</u>		<u>Eriophorum spissum</u>
<u>Listera cordata</u>		<u>Eriophorum virginianum</u>
<u>Monotropa uniflorus</u>		<u>Kalmia polifolia</u>
<u>Smilacina trifolia</u>		<u>Larix laricina</u>
<u>Vaccinium myrtilloides</u>		<u>Ledum groenlandicum</u>
<u>Vaccinium vitis-idaea</u>		<u>Picea mariana</u>
		<u>Sarracenia purpurea</u>
		<u>Vaccinium oxycoccus</u>

Minnesota County Biological Survey and Ecological Classification System Subsections



- A: Red River Prairie
- B: Aspen Parklands
- C: Agassiz Lowlands
- D: Littlefork-Vermillion Uplands
- E: Border Lakes
- F: Chippewa Plains
- G: St. Louis Moraines
- H: Nashwauk Uplands
- I: Pine Moraines & Outwash Plains
- J: Tamarack Lowlands
- K: Laurentian Highlands
- L: North Shore Highlands
- M: Hardwood Hills
- N: Mille Lacs Uplands
- O: Glacial Lake Superior Plain
- P: Anoka Sand Plain
- Q: Minnesota River Prairie
- R: Big Woods
- S: St. Croix Moraines and Outwash Plains
- T: Inner Coteau
- U: Coteau Moraines
- V: Oak Savannah
- W: Rochester Plateau
- X: Blufflands

 **SURVEY COMPLETED**
IN 33 COUNTIES (1987-1997)

 **SURVEY IN PROGRESS**
IN 18 COUNTIES (1998)



Biological Report No. 59

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