A Guide to Minnesota's ientific and Natural Areas

Minnesota Department of Natural Resources
n of Wildlife, Scientific and Natural Areas Program

Dedicated to...

...all of those who have worked to protect critical lands throughout the state, either through their volunteer time and energy, quiet or active support, inspiration, gifts of land and or money, or their careful stewardship of the land. They have made it possible to find these lands intact today, to be preserved for tomorrow.
All of these people working alone or in concert with others have made it possible for present and future generations to visit and study remnants of Minnesota's natural communities, rare species, and geological features and landforms until the next glacier scrapes it away.

Acknowledgements

Minnesotas'system of outstanding nature preserves has remained undiscovered for years simply for lack of a comprehensive detailed directory. It might still be undiscovered except for the significant contribution of volunteers who among others have made this guide possible.

The production of this guide is the joint effort of many persons that have contributed many hours, days, and even years to see this guide produced. The Scientific and Natural Areas (SNA) Program is deeply indebted to Marilyn Andersen, an independent writer and instructional designer/ developer that for the past two years assisted me in the conceptualization, design, and development of the guide. Marilyn over this time also wrote over thirty site descriptions, all on a voluntary basis, by poring through the voluminous program files and digging up other research. Without Marilyn's time commitment and writing skills this guide probably would still be years off.

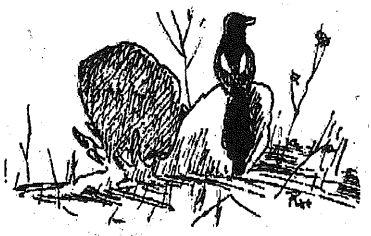
To Jean Miller who helped communicate our ideas and words visually into a balanced, consistent, and enjoyable guidebook through layout and design and for her dedication to map production and staying on schedule, her efforts are especially appreciated; and with special acknowledgement to Adele Smith who enabled Jean's time to be available. To Kelly Randall who volunteered time and his artistic abilities to produce maps and ideas on layout etc. in the evening, before work and on his lunch hours. Special thanks to Ross Heir whose freehand drawings help to capture the feeling and beauty of the natural world presented in the guide and to Tom Kline for the cover design of the Showy Ladyslipper and several illustrations. To Dr. John Green for review and comments on the geological portion and to Norm Aaseng for his review of the peatland section. To SNA staff Ellen Fuge, Lee Markel, Steve Wilson, Peter Buesseler, Tim Marion and Sarah Vest whose helpful ideas, proof reading and corrections were essential to completion. To Tom Baumann for negiotating and arranging for publication. Thanks also go out to Carmen Converse for helpful suggestions on the final draft and to Alan Carpenter and John G. Miller for volunteering their time to proof the final version and offer suggestions.

I hope you enjoy the guide. Please let us know of your opinion of the Guide. We welcome any helpful hints for making future revisions even better.

Sincerely
Bob Djupstrom

Bob Djupstrom
SNA Program Supervisor

Contents



Foreword

Aldo Leopold fashioned a philosophy some 50 years ago, whereby the most important task of intelligent tinkering is to *keep all the parts*. Never has that philosophy been more important than it is today.

Scientific and natural areas— storehouses of plants, animals, microbes, gene pools, ecological processes, unknown interrelationships, ecological problems waiting to be solved, and places where inspiration comes naturally—are Minnesota's answer to Leopold's work.

Natural areas are first and foremost places where nature is in charge, where the well-being of plants and animals and their surroundings is the first priority. Education and research are primary functions. Recreation is taking a photograph or viewing a bird through binoculars. That which is present today on natural areas will, through careful stewardship, be present 100 years from now.

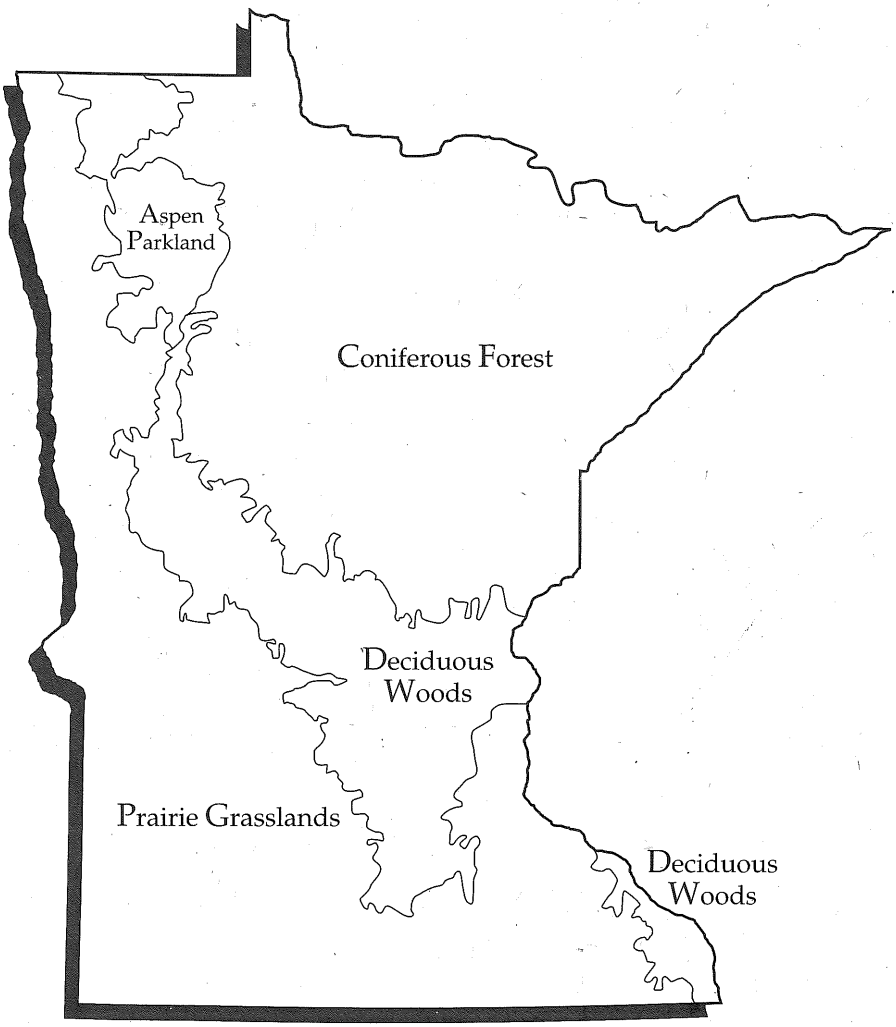
How To Use The Guide

This Guide is organized around four major sections of the Minnesota landscape: Aspen Parkland, Prairie Grasslands, Deciduous Woods, and Coniferous Forest.

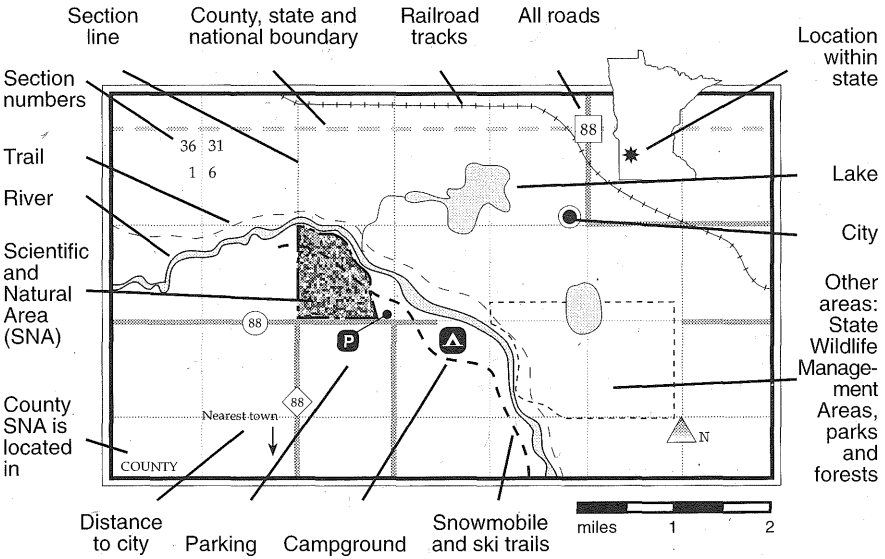
At the beginning of each section of the guidebook, a map and list are displayed of those SNAs occurring within this section, and a narrative picks up the threads of geological formation, landscape types, and selected key plant and animal types.

Key landscape types occurring within the section are explained, enabling the reader/explorer to appreciate the unique features preserved in the SNAs. Diagrams demonstrate selected concepts or features in a simplified form, directing the reader's attention to significant aspects of the concept so that in any particular SNA, he/she is better prepared to observe and truly see.

Landscape Sections



SNA Map Legend



88 Interstate Highway

88 U.S. Highway

88 State Highway

88 County Highway

88 County Road

Minnesota and Its SNAs

Values are forged from experience and understanding. This little book invites Minnesota explorers to learn about their environment through both reading and direct experience. It describes the environmental heritage of an area, then introduces specific SNAs that preserve representative examples. This book helps people see what they read about and also to understand what they see - thereby to value more highly what might otherwise have been taken for granted.

Designed for the curious nature-lover, hiker, casual weekend traveler, or out-of-state tourist, it provides a simple travel planner, and other learning and convenience tools. It encourages explorers to follow up their experiences with activities that challenge their thinking, to investigate special interest groups that offer a variety of learning experiences, and to seek out valuable resources on Minnesota's environment. As Minnesotans and other travelers learn to better read the land, can they help but value it more?

The introduction to *A Guide to Minnesota's Scientific and Natural Areas* presents the purpose and significance of these state treasures, along with background information on the natural forces that have forged them. It reviews the state's geological history, landscape regions and its plant communities in relationship to the landscape sections by which the SNA listings are organized. It helps create better informed citizens who can properly appreciate the role of SNAs in our state history, our scientific studies, and our general well being, today and tomorrow.

Minnesota's Scientific and Natural Areas

Minnesota's living museum of Scientific and Natural Areas (SNAs) has a thousand stories to tell—of Minnesota's lands and waters, its plants and animals, its past and future. SNAs preserve such tell-tale clues to our past as:

- Gneiss rock outcrops, among the very oldest exposed rocks on Planet Earth
- Glacial floodplains, riverbeds, eskers, drumlins, kettles, and kames
- Peatlands formed 12,000 years ago as glacial lakes filled with vegetation
- Prairie remnants of the vast, unbroken grasslands seen by pioneers in covered wagons, heading westward
- Bits of the Big Woods that once covered major portions of the state with unbroken deciduous forest

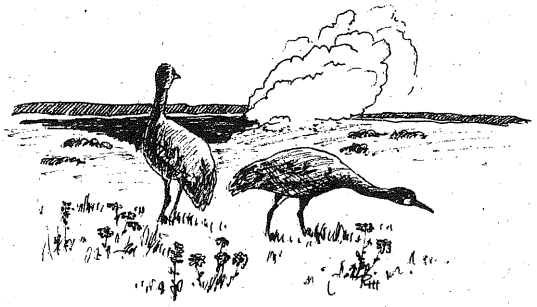
Through its SNA program, Minnesota's Department of Natural Resources (DNR) preserves natural features and rare resources of exceptional scientific and educational value, including:

- Undisturbed plant communities, such as virgin prairie, old growth forest, or peatlands
- Rare or endangered species habitat required to support such species as the ramshead orchid, the Assiniboia Skipper butterfly, the marbled godwit
- Seasonal homes for concentrations of birds, such as piping plovers and common terns, and other animals
- Natural landscape formations and features, such as lava formations along Lake Superior, ancient gneiss outcrops at Morton, or dry beach ridges that once rimmed prehistoric seas in the Red River valley

Minnesota's SNAs also provide keys to the future by maintaining exemplary sites of ecological diversity. They enable teachers and students to study natural sciences in the best of all classrooms—the natural laboratory. Researchers require such preserves in order to gain insight into natural processes, gather information on environmental contaminants, and identify benchmarks against which to measure environmental changes. These sites protect genetic material for future breakthroughs in medicine, agriculture, and industry.

SNAs also maintain the thread of ecological diversity, protecting the best or last remaining occurrences of rare plant and animal species and their communities.

Finally, these sites provide public access so we, as interested individuals and families, can see rare and endangered features in their natural communities. Learning their value makes us better able to develop and observe effective public policies regarding their protection and use.



Minnesota's Story

Minnesota SNAs help us discover how the landscape formed and then nurtured natural communities. This introduction reviews the development of Minnesota's landscape, then introduces the natural communities that have developed here.

In this quest for our past, truth proves to be stranger than fiction; Minnesota, icebox of the nation, once sweltered in tropical heat. Minnesota, breadbox to the world, was once the barren scene of titanic mountain-building and volcanic activity. This same country has been covered by countless seas—slowly advancing, then ebbing. Later came the ice sheets. To read such a history stretches the human imagination and instills a new perspective on life.

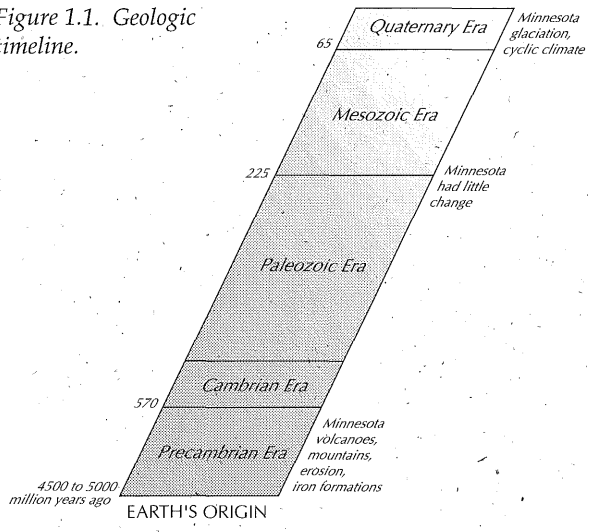


Figure 1.1. Geologic timeline.

The trail of discovery can lead to unlikely places. Rock exposures, fossils, fault lines, landforms, drainage patterns, and natural communities all provide intriguing evidence of past events. SNAs preserve many of these records. Others occur on lands under private or public ownership. Countless others await us beneath the massive glacial deposits of the landscape.

Geologists have constructed a chronological framework of these clues, summarized in the form of the timeline shown in figure 1. *Minnesota's Geology*, by Richard Ojakangas and Charles Matsch (Minneapolis: University of Minnesota Press, 1982) presents a highly readable description of Minnesota's geological record. The overview that follows is based on this source.

Early Precambrian Minnesota (4,500–2,500 million years ago)

Minnesota's oldest records—**Lower Precambrian** rocks—lie in alternating belts within the Canadian shield, which underlies the northern half of the state and much of the Minnesota River Valley. The belts approximated in Figure 1.2 are of volcanic and sedimentary rocks; granitic rock materials lie in the areas between the belts.

Figure 1.2. Canadian shield with rock belts.

Gneiss outcrops along the Minnesota River Valley date back 3,600 million years. Gneiss is a metamorphic rock formed when granite and other rocks were subjected to intense heat and pressure within the earth, causing a chemical and structural change. The Gneiss Outcrops SNA just south of Granite Falls preserves a significant example.

Volcanic and sedimentary rocks, also occurring in the Canadian shield, began their formation 2,700 million years ago, when lava escaped the depths of the earth through rifts in the sea floor. Volcanic formations lie throughout Minnesota's portion of the Canadian Shield, deep beneath glacial drift. Volcanic debris—sand, mud, and gravel—released into the nearby seas later settled, forming massive layers of sedimentary rock.

Granite and gneiss rock complexes lie exposed between the volcanic belts throughout the older part of the Canadian shield. Like volcanic rock, granite formed from magma within the earth but because it cooled so slowly under the earth's surface, it formed large crystals. Burntside Islands SNA has such granite outcrops.

Tectonic activity folded many of these rock formations forming faults, or slippage planes, during this period. Many of the volcanic rocks have metamorphosed to greenstone. Also during this active time period, a range of mountains several kilometers high formed in northern Minnesota.

Iron Ore and More Mountains Form (2,500–1,600 million years ago)

Most of the world's iron ore was formed during the **Middle Precambrian** period. This was a time of massive erosion that leveled the earlier mountain range, releasing iron and silica particles into a new sea. It is theorized that the appearance of abundant marine algae at this time began to create large quantities of atmospheric oxygen, which combined with the iron and precipitated in layers of iron formations known as the Mesabi, Gunflint, and Cuyuna iron ranges.

Several other features took shape in Minnesota during tectonic activity from 1,900 to 1,800 million years ago. The Panokean Mountains emerged, extending from east-central Minnesota through northern Wisconsin and Michigan. The tilted beds of the Thomson formation southwest of Duluth were part of the large folds formed during this time period. Finally a collision of crustal plates produced the Great Lakes Tectonic Zone, extending diagonally across the state from Morris and Alexandria toward Duluth. It is still mildly active today, producing five of the state's last seven earthquakes.

Minnesota's Volcanoes (1,110–1,090 million years ago)

Late Precambrian records in Minnesota again show volcanic and sedimentary activity. The Penokean mountains eroded, producing deposits of quartz sand grains now found in the thick Sioux Quartzite of southwestern Minnesota, dating from about 1,600 million years ago. Later quartzite formations can be seen as Nopeming Quartzite in the Duluth area, and the Puckwunge formation, near Grand Portage.

Beginning about 1,100 million years ago, intense volcanic activity took place for the following 20 million years along a great continental rift from eastern Lake Superior to Kansas. Much of the molten rock never reached the surface, but solidified underground to form dark-colored, coarse-grained gabbro. Lava that reached the earth's surface cooled in huge overlapping flows, found now along the north shore of Lake Superior mostly as dark-colored basalt. Lake Superior agates formed in the cavities left by gas escaping the cooling lava. Sugarloaf Point SNA, on the North Shore, protects a prime example of volcanic formations dating from this period.

After the rifting and outpouring of lava suddenly stopped, the rift zone continued to sink. Flowing water deposited thousands of feet of sandstone along this zone extending from Lake Superior to the Hinkley-Kettle River area, onward to the Twin Cities.

Post-Precambrian Activity (600–2 million years ago)

The **Post-Precambrian** period featured advancing and retreating seas, development of plant and animal life forms, and lots of sediment. The best evidence of this period lies in southeastern Minnesota, where fossils of early marine plant and animal life abound in sandstone, limestone, and shale formations. Major tectonic shifts gave Minnesota an equatorial climate during the **Paleozoic Era** (570 to 225 million years ago) as seen in the many fossils preserved in these rocks.

Glaciers, from A to Z (2 million years ago to present)

Despite all the geological drama and turmoil up to this time, The current landscape results largely from glacial activity during the **Quaternary Period** (2 million years ago to the present). Minnesota's present climate, with its cyclic warm and cold seasons, became established during this time. Glaciers "warehoused" huge quantities of the earth's water supplies, lowering ocean levels and expanding continental boundaries. Plant and animal communities migrated, adapted selectively, or became extinct with the changing climate. Minnesota saw the advance and retreat of several major, successive periods of continental ice sheets.

Glacial Advances

The gigantic Laurentide Ice Sheet, centered in what is now the Hudson Bay, grew and retreated with climatic changes throughout the Ice Age. During colder periods, it extended southward across the upper midwest in what are called *glaciations*, each named for a geographic area: Nebraskan, Kansan, Illinoian, and Wisconsin.

The Wisconsin glaciation, the most recent, had 'the last word' as it created the surface features we live with today. Beginning about 75,000 years ago, it, too, experienced periodic growth and decay with changing conditions. Its advances produced tongues of ice called *lobes*, each named for a specific geographic area: Wadena, Rainy, Superior, and Des Moines. Each lobe also experienced periodic growth and decay.

Figure 1.3 Minnesota's most recent glacial lobes and paths.

Wadena Lobe

Rainy and Superior Lobes

Des Moines Lobe

- The **Wadena Lobe** advanced from the north several times. Its last advance deposited the Alexandria moraine (which was later reglaciated), the Itasca moraine, and the drumlin fields spanning Otter Tail, Wadena, and Todd counties.

- The **Rainy and Superior Lobes** came out of the northeast and advanced, sometimes with and sometimes independently of the Wadena. Its last advance left a coarse-textured till of basalts, gabbro, granite, iron formation, red sandstone, slate, and greenstone strewn across the northeastern half of Minnesota and as far south as the Twin Cities.

- The **Des Moines Lobe** originated in the northwest and advanced in a southeasterly direction across Minnesota and into Iowa. Its fine-textured till consisted of limestone, shale, and granite fragments, from which developed the fine prairie (now agricultural) soils found in these areas.

Earlier lobes and glaciations also left their marks, though their effects are generally buried beneath more recent glacial drift. We occasionally glimpse the underlying till that is distinctive of their origin, or the striations on bedrock outcrops that indicate their direction of travel. They echo much earlier times.

Glacier Defined

Because glaciation is so significant to understanding today's landforms, it warrants a closer look. A *glacier* is a large body of ice moving slowly across a land surface. It forms when snow accumulates faster than it melts over a long period of time. Under the weight of the ice mass, a *sole* of ice melts at the bottom and allows the glacier to move. A glacier also moves by internal, plastic flow. The ice mass shrinks or expands yearly, reflecting the net effect of the year's weather.

Glacial Erosion

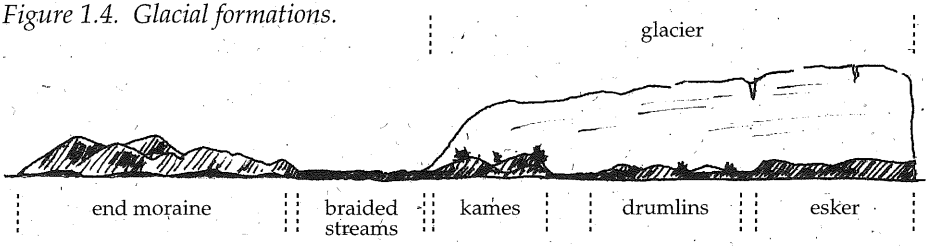
Glaciers sculpt the surface of the earth as they expand, cutting through relatively soft materials, picking up occasional pieces of rock or debris along the way, and depositing them further on. As the sole picks up various sizes of debris, it acquires texture and abrasive power that varies much like grades of sandpaper. On some bedrock outcrops today, parallel lines scar the surface, indicating that a rock frozen into the glacier's sole passed here long ago. These markings

are called *striations*, while wider, deeper markings are known as *grooves*. Finely textured particles in the sole produced highly polished rock surfaces, much like fine sandpaper. Striations and grooves are helpful in identifying the direction of the glacial flow that took place on a given site. Gneiss Outcrops and Swedes Forest SNAs are good places to see such markings.

Glacial Deposits

The glacier deposits its collection of rocks and debris in a variety of ways. Glacial deposits, generally, are called *drift*. However, other terms are more descriptive of the materials and their formation. A collection of debris, unsorted by size or substance, is known as *till*. Single rocks deposited far from their source are known as *erratics*. A thin blanket of low hills and lowlands laid down while the glacier is moving is called *ground moraine*. Ground moraine that has been

Figure 1.4. Glacial formations.



molded into streamlined hills with its long axes parallel to the direction of ice flow is called a *drumlin field*. An *end moraine* is an irregular, hilly deposit of till at the ice margin or toe of the ice sheet; Prairie Coteau SNA is a fine example.

Often a huge chunk of ice, buried by debris, becomes isolated from the glacier. It then slowly melts, and leaves a collapsed pit of debris. This is called a *kettle* or *ice-block*, which often becomes a *kettle lake* when conditions are right. In the prairie, these are called *potholes*. Boot Lake SNA contains a kettle, or ice-block, lake.

Along the margins of the glacier, wet sediment collects, then settles and slumps, forming hummocks and uneven terrain. A *chain of lakes* often forms along these glacial margins. Stagnant ice sometimes forms a meltout depression that fills with outwash deposits when the rest of the ice melts. This leaves a conical hill called a *kame*. Yellow Bank Hills SNA, in

Lac qui Parle county, preserves kames that host a prairie community.

Recurrent melting within the glacier creates streams of meltwater that tunnel through the ice mass. These streams carry debris, which may actually plug a tunnel, resulting in the formation of a new tunnel. Later, when the glacier melts away, this plug is left on the land in a long, molded ridge of sand and gravel called an *esker*. Ripley Esker SNA, just north of Little Falls, protects a fine example of such a plug. If the stream carries the debris outside the glacier, it may be deposited as *outwash*, or sorted sand and gravel sediment deposited along the stream bed; Helen Allison Savanna SNA is a good example.

The tundra-like climate of the Ice Ages produced wind that also moved glacial debris; it could pick up the finely textured silt and deposit it downwind in what is called *loess*. The soils across western and southern Minnesota contain loess, a constituent of prairie soils.

Glacial Lakes and Rivers

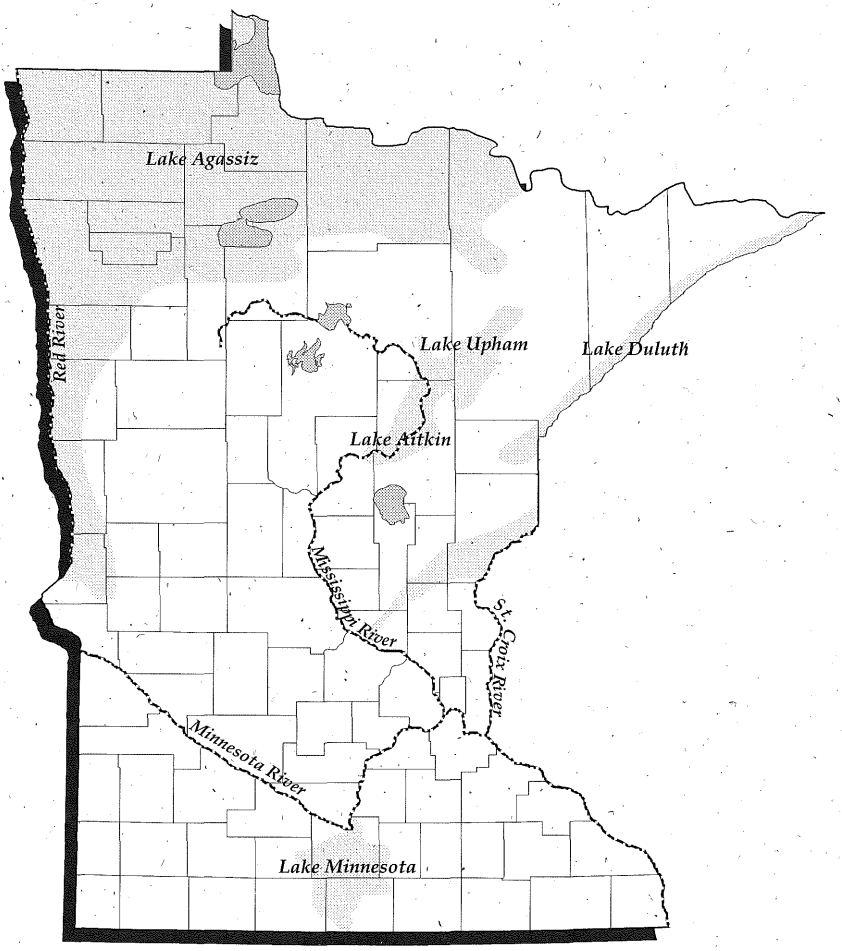
Glacial lakes are another great legacy of the glaciers. All were dammed on one side by the ice sheet and many approached the scale of a sea. Glacial Lake Agassiz was the largest. Fluctuating in size and depth, in left behind a series of beaches that now outline the broad, flat Red River Valley. Others include Glacial Lakes Upham, Aitkin, and Duluth.

From time to time these glacial lakes overflowed, and cut huge river channels. At its highest level, Glacial Lake Agassiz crested a moraine at Brown's Valley and spilled over to become the Glacial River Warren. Its bed continues to drain the surrounding uplands, though the water volume of today's Minnesota River is a fraction of the original flow. Consequently, the broad river valley and high stream terraces, remnants from long ago, dwarf today's river. This is also true for today's St. Croix and Mississippi River valleys. Visit the high terrace on Bonanza Prairie SNA near Big Stone Lake to get a sense of the magnitude of the ancient river as you look across this broad lake to the bluffs in North Dakota.

Driftless Areas

The southwestern and southeastern corners of Minnesota escaped the Wisconsin glaciation, though evidence exists that they were subject to earlier glaciations. These landscapes feature more bedrock exposures that escaped a blanket of Wisconsin glacial till, or drift—thus the reference to these areas as *driftless*. Their rivers and streams are better developed than areas with more recent glaciation, resulting in more efficient drainage systems and more advanced erosion.

Figure 1.5. Minnesota's glacial lakes and rivers.



The relative old age of these areas results in landforms and pockets of plant communities that open a window into earlier biological systems. For example, Wykoff Balsam Fir SNA in Fillmore County contains several steep talus slopes with cold air drainage, creating a specialized community usually found well north of Minnesota. Rushford Sand Barrens SNA contains bedrock exposures from an earlier glacial period, when glacial winds formed the sand savanna for which the SNA is named. The flatness of southwestern Minnesota, with its Blue Mounds quartzite outcrops, is another example of the driftless area that escaped the Wisconsin glaciation.

As described earlier, meltwater from the ice masses first pooled in lakes, then overflowed into rivers, which sought sea level. Though southeastern Minnesota escaped the glacial drift deposits, it lay directly in the drainage path to the Gulf of Mexico. Paleozoic limestone formations here were susceptible to the slightly acidic groundwater passing through. Consequently, the limestone gradually dissolved along many of the planes and fractures of these formations.

The cavernous tunnel systems in Fillmore and Olmsted counties are a legacy from this period. When the water volume eventually abated, the caves emptied, and residual seepage began to form stalagmites, stalactites, and other cave structures. Weaker cave ceilings that collapsed created *sinkholes*, or pits, at the surface. Southeastern Minnesota contains excellent examples of *karst topography*, which is surface developed by solution and subsidence into underground drainage, sinkholes, and caves.

The Ever-Changing Surface of the Earth

Conditions continue to change on the "blue planet"—composition of the atmosphere, orientation of the magnetic poles, adjustments in plate tectonics, and gradual changes in climate are just some of the factors we're only beginning to understand and monitor. The face of the earth has been registering these changes since its formation. Eventually our current landscape will completely erode, just as the ancient mountain ranges did. Minnesota's SNAs capture some of the stages in this natural process—for study, for education, and for appreciation. Go see one soon!

Today's Landscape and Plant Communities

The preceding section described the natural processes that sculpted today's landscape on a macro level. The rest of this guide focuses on localized results of these natural processes: i.e., specific landscapes, their plant communities, and the SNAs that protect such samples. We have arranged this guide to SNAs in four easy-to-use landscape sections—Prairie Grasslands, Coniferous Forest, Deciduous Woods, and Aspen Parkland.

Landscape Sections

Three of these sections are large enough to contain several distinct landscape regions. For example, the Minnesota traveler who has visited the North Shore along Lake Superior as well as the Boundary Waters and Red Lake areas can easily distinguish differences in terrain, yet they all fall within the coniferous forest section. Similarly, prairies come in many varieties—some grow on sand dunes, others in wet meadows, and others in deep, rich, black soil as tall-grass prairie.

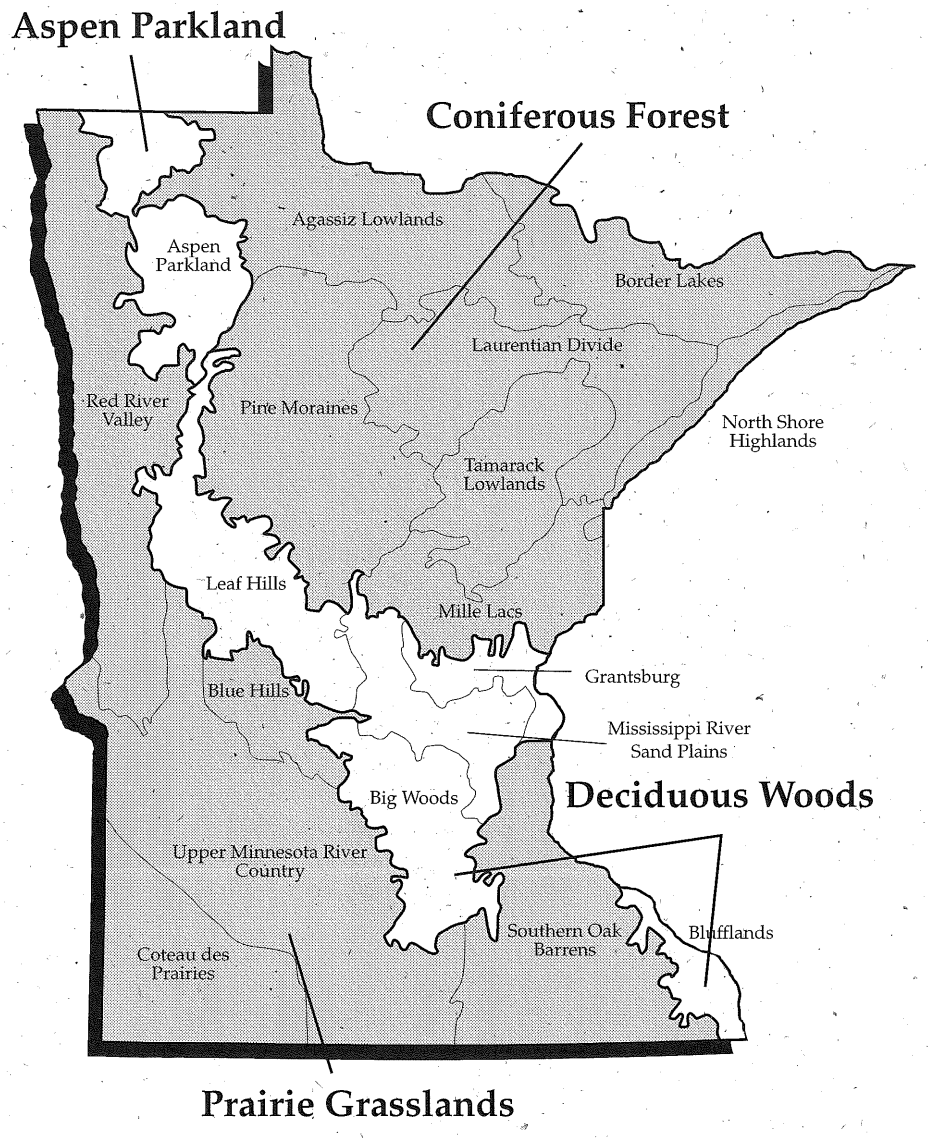
The fourth section, Aspen Parkland, is small in comparison. It represents a distinct zone of transition between grassland and forest communities.

Climate plays an important role in landscape development. Minnesota's climate is affected in the north by Arctic air, and in the south by weather systems from the Gulf of Mexico. The landscape map in Figure 1.6 shows the approximate division, with coniferous forest in the colder northern climate, and prairie and deciduous forest in the warmer, southern part of the state.

State "landscape regions" have been classified technically on the basis of their geology, climate, ecological similarity, and plant distribution. The accompanying map shows the four landscape sections and the regions that occur within them. Note that at publication time, this regional system is being reclassified, with refinements being worked through final approvals.

In this guide, each section begins with a discussion of its landscape regions and plant communities, and is followed by individual SNA site descriptions.

Figure 1.6. Minnesota's landscape groups and constituent regions.



Communities

Plant and animal species flourish or perish, depending upon their environmental conditions. Local groupings of trees, shrubs, grasses, and forbs are called *plant communities*, and are characterized by the kinds and quantities of species they contain.

Communities are subject to change. The change may be rapid, as after a disturbance, when pioneer species move into the altered environment. As the community develops, it may change the local conditions enough to favor other kinds of species, and a new community succeeds the old. Climax communities, such as the maple-basswood forest, continue to thrive under the conditions they create, and remain stable until disturbed.

Communities serve as the basis for evaluating SNA priorities. Since 1979, the Minnesota DNR's Natural Heritage Program (NHP) has identified, tracked, and prioritized communities and rare species for research and conservation. To date, over 20,000 records of rare features are housed in the NHP data base. *Minnesota's Native Vegetation: A Key to Natural Communities*, version 1.5 (currently under revision) contains a description of 57 natural community types and 196 community subtypes. This classification serves as a standard for ecologists as they identify and assess communities. It is useful to anyone wishing to recognize and understand Minnesota's landscapes and our Scientific and Natural Areas.

Distribution and Diversity

Plant distribution varies with factors such as climate, soils and subsoils, landforms, water drainage, and natural disturbances such as fire, wind, insects, and disease.

Many presettlement plant communities were particularly affected by fire. For example, forests reached maturity where fire was prevented by a river or lake, whereas other forests developed into diverse mosaics of old-growth stands, postfire stands, and assorted types ranging in between. At the same time, fire eliminated intrusive species: fire-sensitive species could not survive, while native fire-resistant species did. In this way, fire diversified yet protected the species of plants growing over a broad area.

Human interaction, by both American Indians and European settlers has also dramatically affected plant communities. This was most dramatic as settlers converted land to economic production purposes. Wetlands have been drained, prairies plowed, forests logged, and habitat and food chain systems dramatically altered. In the process, we've introduced non-native species such as ragweed, dandelions, loosestrife, buckthorn, and other exotics. Consequently, many native species have been lost or locally extirpated.

The Value of Diversity

Destruction and pollution of forests, native grasslands, wetlands, and water supplies are rapidly reducing our biological diversity. Preserving biological diversity serves many purposes:

- Diversity strengthens and stabilizes natural ecosystems.
- Diversity contributes to the quality of air, soil, and water, which affect all living species, including humans.
- Diverse communities provide untapped reservoirs of genetic materials useful in agriculture, medicine, and industry.
- Natural ecosystems serve as outdoor laboratories for research on plants, animals, and their interrelationships.
- Natural communities provide living museums of our natural world and are sources of beauty, recreation, and inspiration.

The more diverse a community, the greater its resilience. Disruption can take years to repair, and extensive destruction may eliminate the community. To eliminate a single natural community is to eliminate entire chapters of possibility for future development, at the same time eroding the natural system, or "scaffolding," that supports human life.

Minnesota has taken action to ensure preservation of representative natural community samples through the SNA program. Learn to recognize SNA goals and related issues—to value, to support, and to enjoy. They are keys to our future.

The SNA Program

To ensure preservation of Minnesota's invaluable legacy of land and all its biological diversity, a complex of public and private programs work together in various capacities. The Scientific and Natural Areas Program is one of these programs, and it is a young one. It began in the mid-1960s when Dr. Walter Breckenridge, Dr. Don Lawrence, and others approached Minnesota's Department of Natural Resources (DNR) about establishing a state system of natural areas.

Purpose of the Program

Scientific and natural areas are established to protect and perpetuate in an undisturbed natural state those lands and waters embracing natural features of exceptional scientific and educational value—natural features such as:

- Undisturbed plant communities, such as prairie or peatlands
- Rare or endangered species habitat, such as the ramshead orchid
- Seasonal habitat for bird or animal concentrations, such as piping plover and common terns
- Natural formations and features, such as volcanic or glacial formations
- Plant communities undergoing succession as a result of natural processes, such as active sand dunes or old-growth forest

The SNAs Program's goal is to ensure that no single rare feature is lost from any region of the state. This requires protection and management of each feature in sufficient quantity and distribution across the landscape. The Program's Long Range Plan is to protect at least:

- Five locations of plant communities known to occur in each landscape region
- Three locations per region of each rare species, plant or animal, and geological feature

It is estimated that 500 natural areas are needed throughout the state to adequately protect significant features. Because over 40 percent of these rare features occur in prairies, 200 SNAs would be in the prairie area of the state. Of the

remainder, approximately 135 are estimated to be needed in the deciduous and 165 in coniferous forest landscape communities in the next 100 years.

Protection of multiple sites in each landscape region is a vital means of capturing the genetic diversity and preventing the loss of important species, communities, and features. This strategy observes the wisdom of not putting all our eggs in one basket.

In addition to SNA, Itasca and Crow Wing Counties have established county natural areas. Itasca County's natural areas were established in 1966.

Site Selection

Sites are set aside as SNAs because of their natural attributes and rare resources, which warrant protection for their inherent values and as places for scientific and educational use. Protection guards against developments such as trails, campgrounds, picnic sites, logging, mineral exploration and development, cultivation, and other uses of land, public or private, that interfere with the preservation of its natural features.

Data Collection and Analysis

Systematic site selection begins with data collection and analysis to ensure appropriate priorities are assigned to deserving sites. In view of the urgent need for an accurate, systematic inventory of its natural resources, the State of Minnesota initiated the Minnesota County Biological Survey (MCBS). The survey is conducted through the Minnesota DNR's Natural Heritage and Nongame Wildlife programs. The MCBS gathers information on sensitive natural habitats and rare plant and animal species, building upon data from previous surveys as appropriate.

The survey proceeds on a county-by-county basis in a three-step method:

1. Identify all potential natural habitat by interpreting aerial photography and satellite imagery.
2. Evaluate natural areas to determine which have experienced human alteration.
3. Conduct an intensive ground survey of sites selected as high-quality natural areas, documenting the occurrence and condition of rare plants, animals, and natural communities.

The MCBS, begun in 1987, has completed its survey of 23 counties and has eleven more in process. Over 6,000 new locations of rare features have been recorded. Our understanding of plant communities has also increased, along with knowledge of the status and distribution of the state's native plants and animals.

All data are stored with the Minnesota Natural Heritage and Nongame Wildlife Research Program. This is the only statewide, comprehensive collection of data on rare natural features. The information is used to guide:

- Land purchases—such as SNAs— for which protection is the primary objective
- Land conservation programs, such as the Minnesota DNR's Reinvest in Minnesota (RIM) Native Prairie Bank
- Environmental impact reviews used in planning development projects, such as housing, highways, and utility corridors
- Research and public information on rare species

Evaluation

Once prospective sites have been identified, an extensive evaluation process follows to ensure consideration of a wide range of issues. Prospective land parcels are further evaluated by the SNA Program for feasibility of site management, jeopardy, and other factors. In turn, priority candidate sites are reviewed by the Commissioner' Advisory Committee, which provides oversight and guidance for the selection, management, and research uses of SNAs. This 15-member committee consists of scientists, educators, and lay persons who are knowledgeable and dedicated to natural area protection.

Site Protection

Protection of high priority sites is achieved through acquisitions, gifts, conservation easements, or if already owned by the state, through dedication. Landowners of qualifying sites are contacted by the SNA Program to determine their interest in gifting or selling their land.

Protection proceeds somewhat differently in each case:

- **Dedication of public lands**—The existing public land base may provide as many as 20 percent of all new SNAs. Most of these would be in the northern part of

the state, which has the majority of DNR-administered land. Interagency land exchanges also occur between public bodies.

- **Land purchases**—Purchase of a land parcel requires a willing seller and an appropriate budget—two factors that vary independently.
- **Private gifting**—Gifting by a variety of methods is a significant means of acquisition:
  - Land in some cases is gifted outright by individuals.
  - Legislation of 1986 under the DNR's Reinvest in Minnesota Program contains a Critical Habitat Matching Account provision, which provides state funds to match each dollar or dollar value of land donated. Many new SNAs have resulted from this provision—Chamberlain Woods, Osmundson Prairie, McGregor Marsh, and others.
  - Private, non-profit organizations have gifted or assisted in the acquisition of many SNA sites. The Nature Conservancy has been the largest giftor under this provision. Sites now owned wholly or in part by The Nature Conservancy are so identified in the individual site descriptions that make up the rest of this Guide. SNA status provides them with the strongest legal protection possible in this state.
- **Prairie Bank Program**—This program promotes acquisition of conservation easements to protect native prairie, such as the Joseph Tauer Prairie near Hanska. The easement also permits SNA dedication, if the landowner is willing.

Site Management

Land protection alone does not assure long-term preservation of natural areas and their endangered species. These scattered remnants are generally islands of habitat surrounded by highly altered landscapes. They often lack some of the natural processes necessary for their long-term survival. Therefore, there is often a need to replace or supplement natural processes with ongoing management activities.

An important objective for each natural area is the development of a management plan. Management plans detail the special management needs of rare species and communities, identify unnatural disturbances, recommend protection measures, and consider public uses of the area. These plans also recommend management actions necessary to restore natural conditions, such as the reintroduction of fire and the control of problem pest species. Today a helping hand is recognized as a necessary and integral part of natural area protection.

These and other management activities are conducted by the SNA Program, with the advice of the Commissioner's Advisory Committee.

Use of SNA Sites

The SNAs listed in this volume are open to public use, with noted exceptions that are reserved for research or educational use by written permit only. Some are not directly accessible by road, but may require a boat or a significant hike. Site development varies widely; signage and parking facilities may or may not exist at individual sites. Public conveniences are the exception.

Primitive conditions fit program goals of undisturbed natural areas, and the visitor who can appreciate this very quality will value these sites. Those who look for the best examples of prehistoric geologic formations or pre-settlement natural communities can most readily find them on SNAs.

Visitors are encouraged to observe and learn, while protecting the plants, animals, and geological features on the site. Please:

- Leave wildflowers, plants, animals, rocks, and other elements in place to fulfill their life cycle and role in the environment.
- Enjoy the site only on foot, snow shoes, or skis, leaving all vehicles off site.
- Leave the site in as pristine a condition as it was when you arrived.
- Camp in designated campsites rather than on Scientific and Natural Areas; in many instances, public camping facilities are available nearby.

- Hunting and fishing are permitted only on peatland SNAs or those listed in the hunting synopsis; consult the regulations carefully regarding areas that are open for hunting and fishing.

These standards carry the full force and effect of state law. Any activity that violates or damages resources—air, water, soil, plants, animals, and rocks—is punishable by fine or jail sentence.

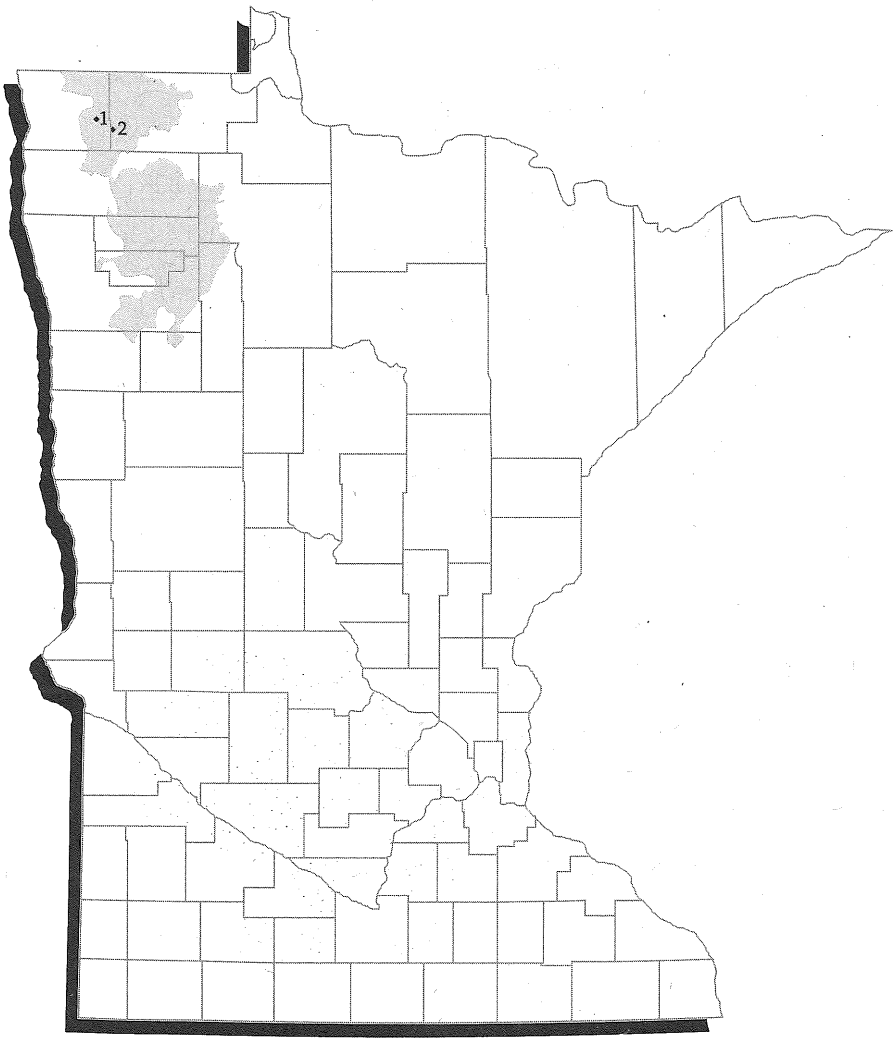
Remember that the state manages public lands for varying levels of usage; it has determined that these sensitive SNAs deserve maximum protection for scientific and educational uses. Help protect SNAs plants, animals, and geological features:

- Respect the rules
- Report problems
- Spread the word of SNA significance
- Support establishment of SNAs by...
  - — Volunteering to help protect and manage sites
  - — Supporting the program financially
  - — Supporting favorable legislation
  - — Supporting private conservation groups that actively help preserve such lands
  - — Donating land or making financial contributions (see donor page in appendix, page 6.5.)

SNAs are an important resource. Enjoy your visit, and plan to see them all! Additional reading suggestions are listed in the Appendix, as are organizations and associations that can help you learn more about Minnesota state treasures. The more you see, the more you'll want to learn...the more you learn, the more you'll want to see.

Aspen Parkland

1. Lake Bronson Parkland
2. Two Rivers Aspen Prairie Parkland



Aspen Parkland

This small, flat, northwestern region of Minnesota landscape, the Aspen Parkland, was once completely covered by Glacial Lake Agassiz. The slightly rolling lowlands were formed of ground moraine, its swells and swales now supporting brush prairie, wet-mesic brush prairie, and shrubby wet meadow communities that intermingle as the topography fluctuates.

Aspen Parkland soils are geomorphically distinct, their heritage being lacustrine; i.e., derived from the glacial lake bed. The Parkland lies on lake plain and lake-washed till plain (till that the lake waters reworked without depositing sediment), with coarse textured soils. The thickest clayey sediment was deposited in the western portion, thinning toward the east. Low areas have accumulated a thin layer of organic material; elsewhere a thin mantle of fine sand is occasionally found. The soil generally is calcareous (containing calcium carbonate), with some saline pockets (containing soluble salts). Boulders are common.

Drainage is poor to moderate, due to the flat topography and the clayish soil. Numerous beach ridges left by the receding Glacial Lake Agassiz further preclude drainage. Rivers and streams meander about, and few lakes have developed.

Before European settlement, parkland prairie burned regularly, controlling aspen and other woody intrusions. Wet prairie, sedge meadow, shrub thicket, and aspen grove plant communities thrived. Tall grass and wet prairie dominated, with occasional aspen thickets in the eastern portions, and elm and ash along the floodplains. Surveyors in 1877 described the area as low prairie covered with willow brush and luxuriant grass. Postsettlement fire suppression, however, has encouraged succession—from prairie to brushland to woodland.

Parkland soils and drainage are poorly suited to cultivation, leaving vast, continuous areas of natural parkland. Agriculture has developed in the west, with agriculture and forestry mixed in the eastern portion.

Parkland Plant Communities

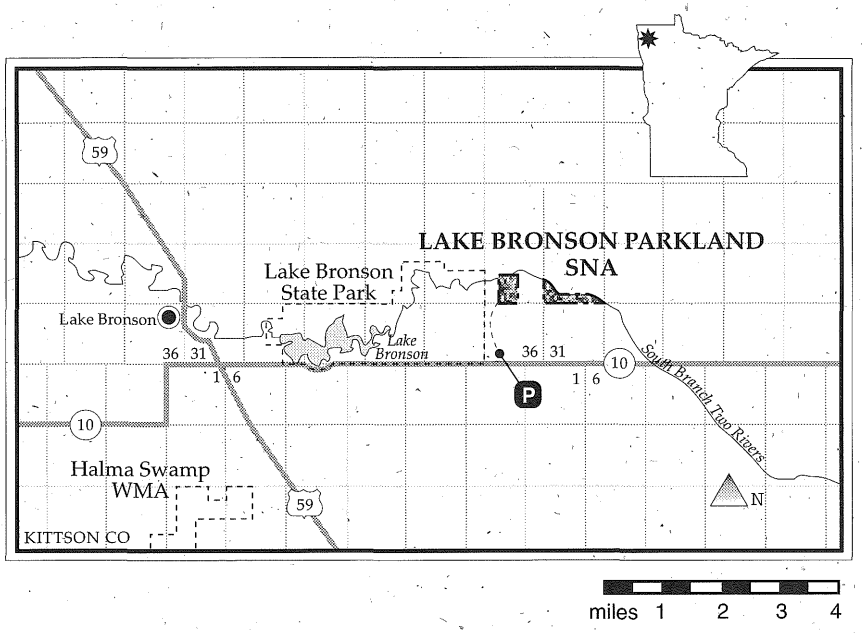
The Aspen Parkland is actually a transition between prairie country, to the west and south, and coniferous forest along the north and east. The long, undulating beach ridges of sand and gravel in the **western** portion of the area are dominated by oak and aspen. With post settlement fire suppression, dry sites between the beach ridges have become wooded as well. Oak sand savanna and sand prairie communities have developed on the sand dunes and beach ridges, with prairie grassland elements in the groundlayer revealing the prairie heritage of this community. Fire could easily return this woodland to presettlement era savanna, brush prairie, or sand prairie, as appropriate to local topography and hydrological influence.

The **eastern** portion of the Aspen Parkland tends to be lower, with more soil moisture. Wet sedge meadows, brush prairie, and wet prairie vegetation grow in these areas, particularly the eastern portion. Brush prairie, most common in the eastern portion, varies locally with topography and drainage, grading into wet-mesic brush prairie and shrubby wet meadow. Brush covers less than half the landscape. Willows dominate the wet areas, mixed with bog birch and shrubby cinquefoil. Hazel, chokecherry, and serviceberry thrive on drier ground, with bur oak and trembling aspen occurring as small to medium sized trees.

The prairie heritage of the Parklands is easy to find. Big bluestem, prairie dropseed, mat muhly, prairie cordgrass, northern reed grass, and bluejoint grass form the grasslands in wet-mesic Parkland areas. Indian grass, prairie cordgrass, northern reed grass, bluejoint grass, and sedges are common meadow grasses. Aspen Parkland also supports the rare northern gentian and prairie-fringed orchid.

Large, open, natural communities in the Parkland provide good opportunities to see moose feeding on aquatic plants during spring and autumn months. Birders commonly find sandhill cranes, sharptail grouse, and yellow rails in this landscape.

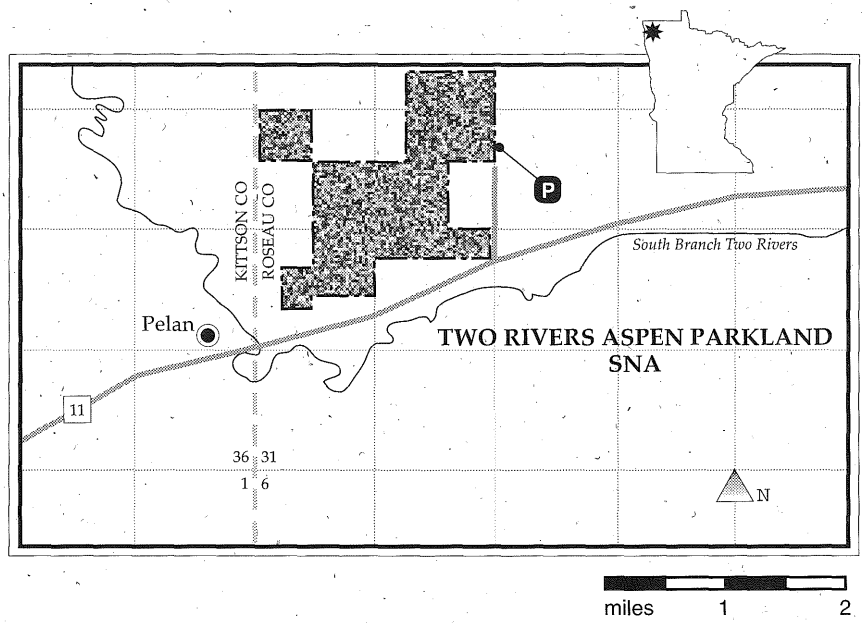
Kittson County Twp 161N Rng 46W Sec 25



From the intersection of US Hwy 59 and Co Hwy 10 just west of Lake Bronson State Park, travel four miles east to field approach. Park and walk 1 mile north and 0.25 miles east to SNA.

Located on the plain produced by Glacial Lake Agassiz, Lake Bronson Parkland protects a fine example of the aspen parkland landscape. Its level topography supports a mixture of prairie and wetland vegetation interspersed with aspen woodland. Wet brush prairie, with big bluestem, prairie cordgrass, northern reed grass, and sedges, dominate the ground layer. Abundant low growing shrubs in this community include slender willow, pussy willow, bog birch, and shrubby cinquefoil. Historically, periodic fires have burned through the area, maintaining its parkland character. Management of this site includes reintroduction of controlled burning to restore the natural dynamics of the parkland.

Roseau County Twp 160N Rng 44W Sec 17-20, 29, 30

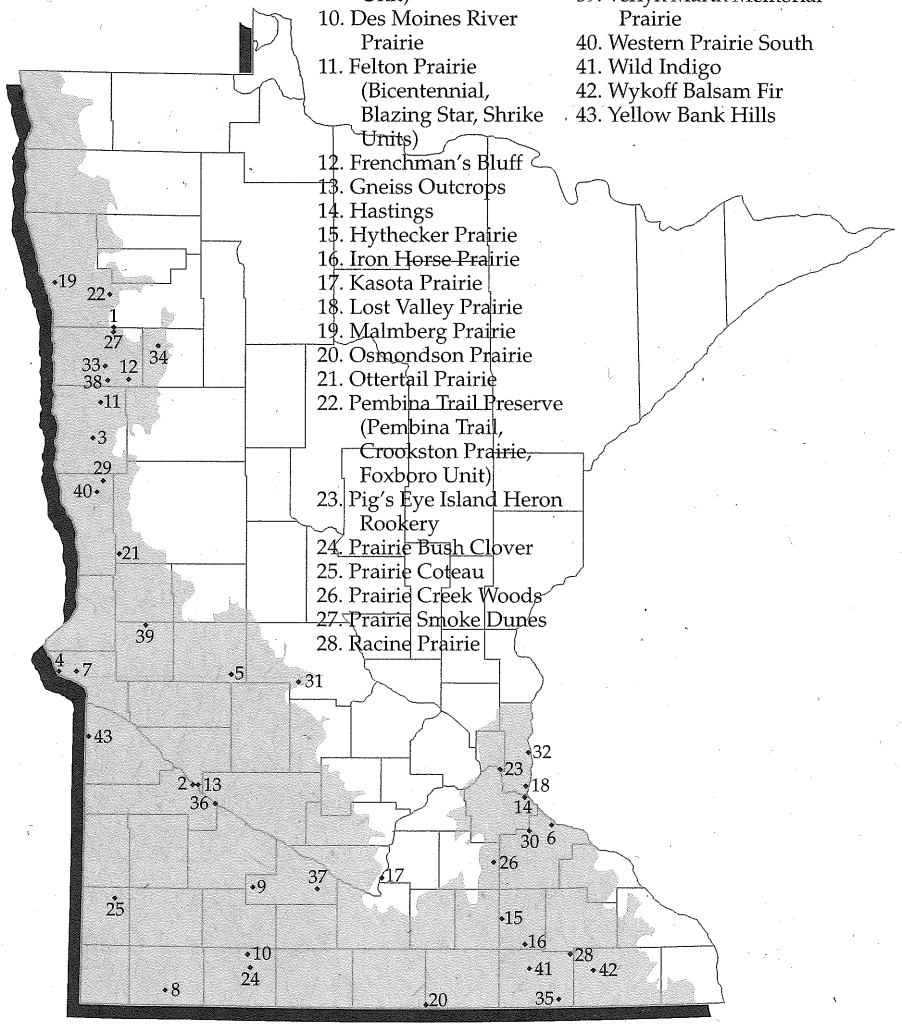


Located from Karlstad in Kittson Co; take MN Hwy 11 E about 8 miles to 0.5 miles E of Pelan; turn N for 0.25 miles.

This site contains some of the finest prairie parkland in northwestern Minnesota: its swells and swales support extensive areas of wet and wet-mesic brush prairie, shrubby wet meadow, and aspen woodland. A prominent beach ridge of the Agassiz Lacustrine Plain lies along the south margin. Big bluestem, Indian grass, prairie dropseed, mat muhly, prairie cordgrass, northern reed grass, and bluejoint grass dominate, with sedges appearing in meadow communities. Willows, bog birch, and shrubby cinquefoil dot the wet areas. In better drained sites, hazel, chokecherry, and serviceberry thrive, with scattered bur oak. Quaking aspen increases in density toward the southwest, where it forms an aspen woodland. In summer, the rare northern gentian and nesting sandhill cranes can be found on the prairie. Diverse prairie lands provide a variety of native flowers, including sunflowers, asters, star toadflax, purple prairie clover, bedstraw, harebells, wood betony, puccoon, tall meadow rue, marsh peas, wood lilies, Culver's root, brown-eyed Susan, blazing star, alum root, Canada anemone, dogbane, water hemlock, swamp lousewort, and blue lettuce.

Prairie Grasslands

1. Agassiz Dunes
2. Blue Devil Valley
3. Bluestem Prairie
4. Bonanza Prairie
5. Bruce Hitman Heron Rookery
6. Cannon River Turtle Preserve
7. Clinton Prairie
8. Compass Prairie
9. Cottonwood River Prairie (Prairie Sky Unit)
10. Des Moines River Prairie
11. Felton Prairie (Bicentennial, Blazing Star, Shrike Units)
12. Frenchman's Bluff
13. Gneiss Outcrops
14. Hastings
15. Hythecker Prairie
16. Iron Horse Prairie
17. Kasota Prairie
18. Lost Valley Prairie
19. Malmberg Prairie
20. Osmondson Prairie
21. Ottertail Prairie
22. Pembina Trail Preserve (Pembina Trail, Crookston Prairie, Foxboro Unit)
23. Pig's Eye Island Heron Rookery
24. Prairie Bush Clover
25. Prairie Coteau
26. Prairie Creek Woods
27. Prairie Smoke Dunes
28. Racine Prairie
29. Richard M. & Mathilda Rice Elliot
30. River Terrace Prairie
31. Roscoe Prairie
32. St. Croix Savanna
33. Sandpiper Prairie
34. Santee Prairie
35. Shooting Star Prairie
36. Swede's Forest (Homme-Kollin Unit)
37. Joseph A. Tauer Prairie
38. Twin Valley Prairie
39. Verlyn Marth Memorial Prairie
40. Western Prairie South
41. Wild Indigo
42. Wykoff Balsam Fir
43. Yellow Bank Hills



Prairie Grasslands

The grasslands of the Great Plains once covered one-third of Minnesota, nearly equal to the extent of coniferous forest. Prairie Grasslands is the only of the four landscape areas that extends beyond all four borders of the state. Once virtually treeless, this vast prairie was covered with little bluestem, Indian grass, needle grass, prairie cordgrass, and other classic prairie vegetation. Cattail marshes and sedge meadows grew in lowlands. Wildfires maintained the prairie character by eliminating major intrusions by trees and brush, while enhancing native prairie vegetation.

Where at one time 18 million acres of dry, mesic and wet prairie occurred, less than 150,000 acres remain today, and most of these have been disturbed. As natural prairie habitats dwindle, so too, do the species of prairie mammals, birds, and insects. At one time, prairie birds—marbled godwits, upland sandpipers, sprague's pipits, chestnut collared longspurs, bobolinks, meadowlarks, kingbirds—were numerous. Waterfowl covered the marshes; bison roamed the western areas, and elk and deer were common.

Today, Minnesota's prairies are still some of the most diverse on the continent, containing a range of prairie communities, from the mesic tall grass to the dry short grass prairies more typical of the Dakotas. Each type holds a unique gene pool and system of natural information.

Prairie Communities

Prairie communities are as varied as the landforms on which they occur—beach ridges and swales, flat glacial lake beds, moraines, steep bluffs, and rolling plains of glacial till. Moisture levels vary throughout, determining the types of plant communities that develop. A Guide to *Minnesota Prairies*, written by Keith M. Wendt and published by the Natural Heritage Program of the Minnesota Department of Natural Resources, describes these communities and identifies selected Minnesota preserves where they may be seen. Five types of prairie are most common.

Dry lime prairies, generally in the western portion of the state, are found on calcareous beach deposits, gravely glacial kames, limestone-capped bluffs, and rocky glaciated hills. Shallow, dry soils provide limited moisture and nutritional support, resulting in fewer species and low production

levels. Even in the absence of fire, these conditions inhibit tree invasion. Short prairie grass species, such as little bluestem and sideoats grama, dominate.

Dry sand prairies occur on sand and sandy loam soils that are coarsely textured and excessively drained. Sandy river terraces, inland dunes, glacial lake beachlines, and coarse sandy outwashes are typical sites. Low nutrient and dry soil conditions again inhibit tree invasion; sand reed and little bluestem dominate these grasslands.

Mesic blacksoil prairie communities form on deep, nutrient-rich loam soils with moderate soil moisture. Prairie communities on such soils can produce grasses up to eight feet tall and support as many as 300 plant species, making them the most species-rich of the plant communities. These fertile, moist, black topsoils have been highly productive, agriculturally, and they readily support trees, necessitating periodic burning for control. Plants comprising these communities vary with the extremes of Minnesota's southeastern to western areas.

Wet (low) blacksoil prairies, found along water courses and in swales between beach ridges, are inundated seasonally. Wet prairie grasses, such as cordgrass and bluejoint grass, and sedges dominate these communities. Lowland shrubs and trees invade in the absence of fire.

Saline prairies occur on the irregularly flooded mudflats and alkali seeps on the western border of Minnesota. Common to the Great Plains, saline prairies are rare in Minnesota. They occur on soils with high levels of salts, which most plant species do not tolerate. Saltgrass, glasswort, and sea blite are among the distinctive salt-tolerant species to be found on these sites.

Where prairie meets forest, whether deciduous or coniferous, a plant community of prairie with scattered trees, called a **savanna**, is commonly found. Tree associations found in Minnesota's savannas vary with the soil and climate:

- Bur and northern pin oak are characteristic of savannas across much of our forest-to-prairie transitions.
- Jackpine savanna may be found with dry sand prairie and dunes in the central portion of the state and in a few locations in the southeast.

- Aspen are scattered among the oak in savannas that border wet prairie and sedge meadows.

Regional Distribution

Prairie communities remaining within Minnesota are scattered in isolated patches, usually of marginal use for agriculture, with the largest remaining portions in the western area of the state.

The northern portion of Prairie Grasslands contains the Red River and the bed of the Glacial Lake Agassiz. The sandy, gravely beaches and sediments of this ancient lake form a surface layer over the deepest glacial deposits in the state. Dry sand prairies have developed along beach ridges, with extensive wet prairies—the largest tracts remaining in the state—in low areas. Sandpiper Prairie SNA contains samples of dry, wet, and wet mesic prairie.

Deep beneath the far southwestern prairie soils lies the reddish pink Sioux Quartzite rock formation. This formation rises dramatically out of the plains, forming the high plateau that early French observers dubbed "Couteau des Prairies," or highland of the prairie. Sioux Quartzite rises to the surface occasionally, as at the Polzin Prairie near the Jeffers Petroglyphs in Cottonwood County. The small, isolated prairies in this area, too dry and rocky to plow, are small and far apart. Prairie plant and animal species survive in these rich prairie pockets.

The north side of the coteau, along with much of southwestern Minnesota, drains into the Minnesota River, its broad floodplain guarded by great knobby outcrops along high, sandy terraces formed by the Glacial River Warren. The south side of the coteau drains into the Missouri River watershed.

Minnesota's most endangered prairie community, the deep soil mesic tallgrass prairie, once occupied what are today's fertile farmlands, stretching from New Ulm to LeRoy in Mower County. Few intact prairies remain in south central Minnesota, but those that do are the most species-rich plant communities found in Minnesota. Few are large enough to support the whole array of animal species, but most of the plant components still survive.

Southeastern Minnesota features several types of prairie communities. Bluff prairies, referred to as goat prairies because of their steep inclines, have developed along the Mississippi, Cannon, and Root Rivers. Their soils formed from glacial till and loess blown over the area during glaciation. Today these sites are threatened with invasive eastern red cedar, domestic grazing, and residential development. King's Bluff SNA offers a fine example of bluff prairie.

Tallgrass prairie remnants occupy the more even ground of southeastern Minnesota. Deep below the hardwood forests and prairie topsoil, caves formed when groundwater dissolved the limestone and dolomite layers of bedrock as long as 30,000 years ago. The resulting sinks, underground streams, and caverns are scattered widely throughout what is known as the *karst* area of the southeastern region.

Prairie Grassland Landscape Regions

Now mostly used as richly productive agricultural land, Minnesota's Prairie Grasslands contain five landscape regions. (Figure 1.6).

Red River Valley

This long region extends along the North Dakota border, from Canada down to Traverse county. Once covered by Glacial Lake Agassiz, the region now drains northward, through the Red River, ultimately to Lake Winnipeg and the Hudson Bay. Soils are often heavy, reflecting the lake sediment deposited long ago. Dry lime and dry sand prairie communities occupy the high ground, with extensive wet prairies in lower areas. Malmberg Prairie SNA, containing both dry and wet prairie communities, is an excellent example of the lacustrine soils formed from the basin of the glacial lake. Felton Prairie SNA, its dry gravel prairie lying atop a large beach ridge complex of the former Lake Agassiz, provides a marked contrast to the Malmberg Prairie.

Upper Minnesota River Country

From Ortonville to Mankato, the Minnesota River and its valley wind their way through remnants of virgin prairie, granite knob outcrops, and prime agricultural land. The broad river valley reminds us of the huge Glacial River Warren that originally cut this river channel when Glacial Lake Agassiz overflowed its banks at Brown's Valley. Blue Devil Valley SNA provides a good example of a granite outcrop community, where the endangered five-lined skink

lives. Mesic blacksoil prairie dominates this landscape area, with wet prairie and river bottom forest communities also represented. Kasota Prairie SNA, near St. Peter, is a classic prairie site.

Blue Hills

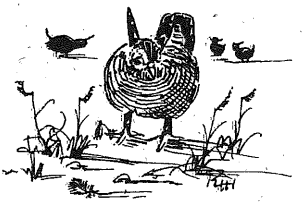
Just southeast of Alexandria, stretching southeast to Litchfield lies the Blue Hills landscape region. The rugged topography of the Alexandria moraine complex typifies the western portion of this region, while the northeast portion is covered with an outwash plain. Mesic blacksoil prairie sweeps across the area, with occasional wet prairie, oak openings, and oak barrens.

Coteau des Prairies

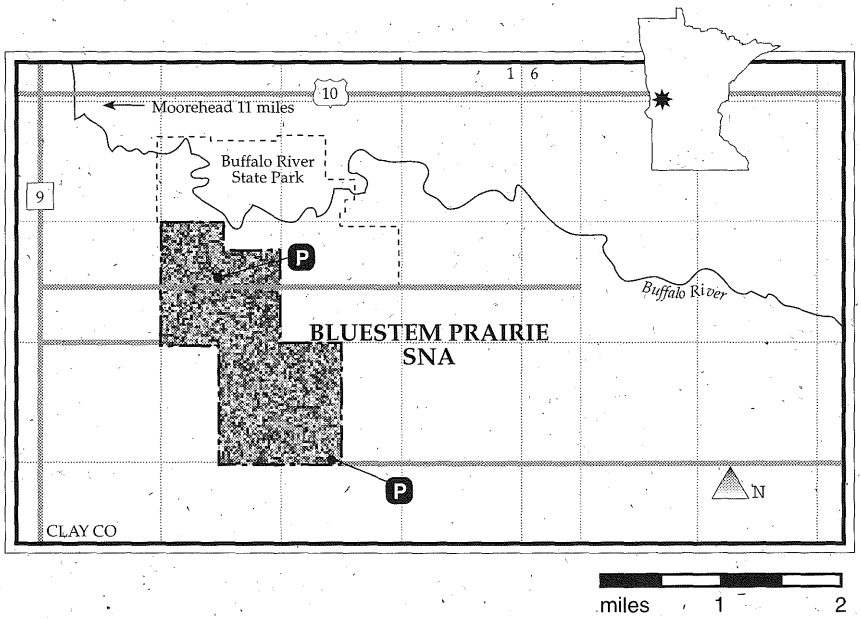
The southwestern corner of the state rises high on an escarpment of exposed red quartzite that rises about 200 meters above the Upper Minnesota River Country to the north. Covered by several hundred feet of glacial deposits, most of this prairie community has been taken for agricultural purposes. Mesic blacksoil prairie dominates the area, with some wet prairie in low areas. Prairie Coteau SNA is the site to visit here.

Southern Oak Barrens

Just west of the Blufflands, extending southward from the Twin Cities to the Iowa border, the Southern Oak Barrens serves as transition between the deciduous woods and Prairie Grasslands. The rich soils of its prairie and oak openings and barrens communities have now been largely converted to agricultural use. Osmundson Prairie SNA protects a remnant of the mesic blacksoil prairie community now generally under cultivation. Big woods, aspen-oak land, brush prairie, and wet prairie communities also occur locally.



Clay County Twp 139N Rng 46W Sec 10, 15, 22, 23

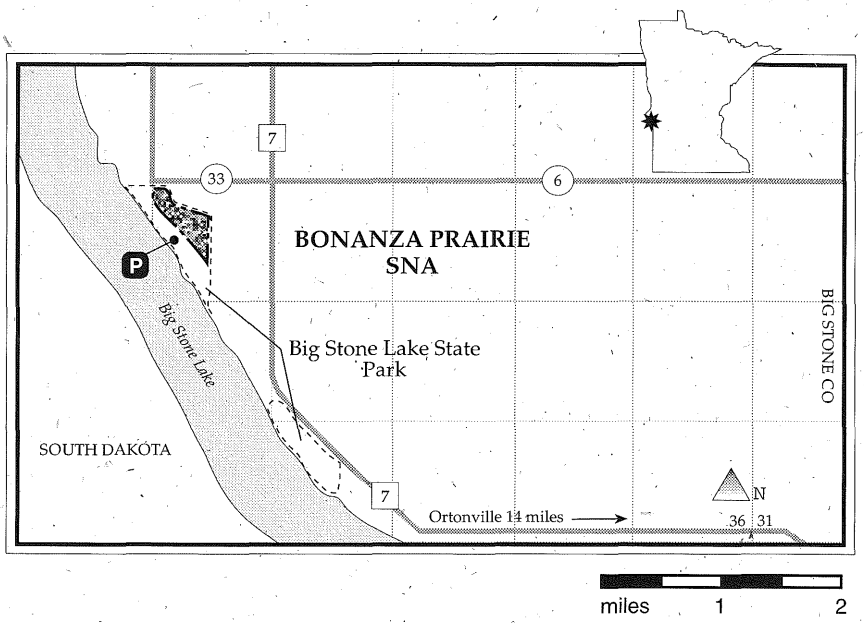


Located from Moorhead 11 miles E on US Hwy 10, then 1 mile S on MN Hwy 9, then 1 mile E on Co Rd 79.

Bluestem Prairie is an extensive remnant of "a vast sea of natural grassland" that at one time covered the entire Red River valley. It is also one of the highest quality prairie sites in the U.S. Lying within the Glacial Lake Agassiz bed, it contains two significant shorelines, the Norcross and Campbell Standlines. Uplands contain mesic tallgrass prairie, while low swales contain wet blacksoil prairie with sedge meadow and calcareous fen communities. Plant species found here include the rare sticky false asphodel, alkali cord-grass, small white lady slipper, and scirpiform sedge. Rare fauna species include regal fritillary, mesissa blue, prairie vole, plains pocket mouse, northern grasshopper mouse, Henslow's sparrow, upland sandpiper, marbled godwit, eastern meadowlark, loggerhead shrike, and greater prairie chicken. Blinds for viewing the prairie chickens' courtship behavior in March are available by reservation through The Nature Conservancy Bluestem Prairie office (218) 498-2679. Visit in early spring, when pasque flowers bloom and prairie chickens boom and dance, and again in late summer to see blazing stars and sunflowers in bloom.

TNC indicates ownership in part or in whole by The Nature Conservancy.

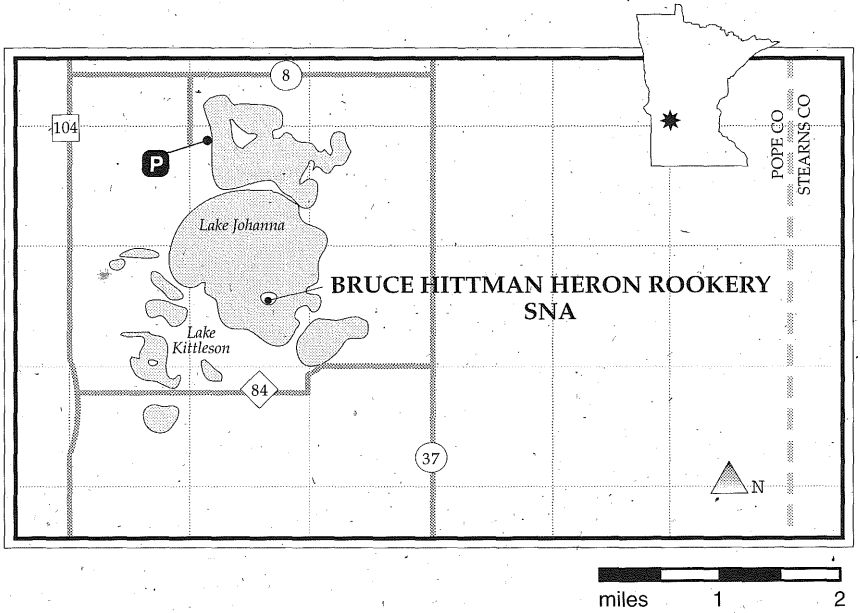
Big Stone County Twp 123N Rng 48W Sec 18-20, 29



Located 14 miles NW of Ortonville on MN Hwy 7, then 0.5 miles W, in the Bonanza Unit of Big Stone Lake State Park.

Bonanza Prairie contains an example of undisturbed, glacial till hill prairie. The gravelly, well-drained soils on the steep, west facing slopes support dry prairie, dry to mesic prairie, and bur oak savanna plant communities. Prairie plants include little bluestem, purple coneflower, prairie thistle, prairie clover, silverleaf scurfpea, big bluestem, and grama grasses. The state endangered prairie moonwort and rare Missouri milkvetch also occur here. The best time to visit is late summer to see prairie plants in bloom.

Pope County Twp 123N Rng 36W Sec 17

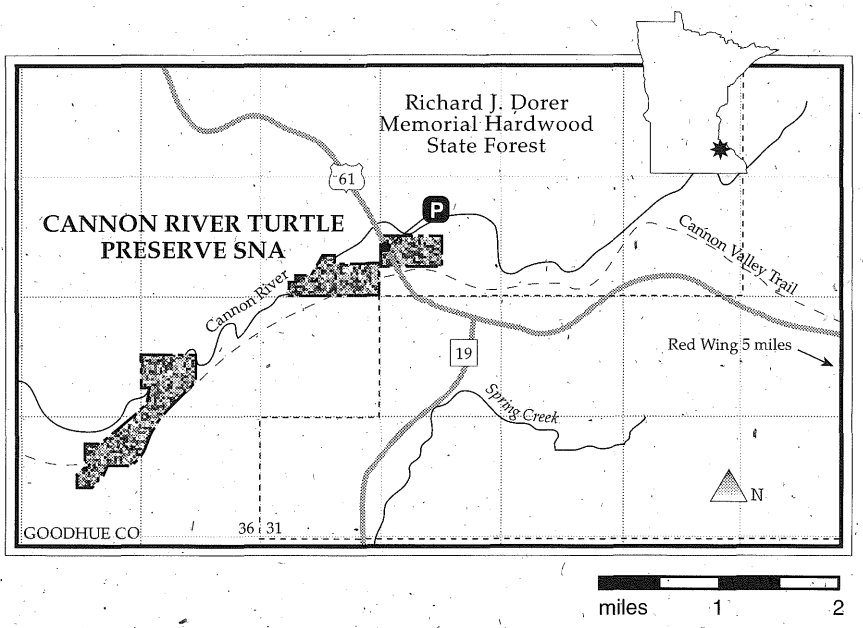


Located from Brooten 3 miles W on Co Hwy 8, then 3 miles S on Co Hwy 37 to the public access area. The lake is a 0.3 miles walk to the NW.

Note: The island SNA is closed to the public from April 1 through July 15 to protect the herons in true nesting season.

Bruce Hitman did an early study of the herons, and this small island SNA within Lake Johanna is named for him. The rookery is notable for being one of the largest and most diverse nesting sites for colonial water birds in the state. Large numbers of great blue herons, great egrets, double-crested cormorants, and black-crowned night herons nest here. The state rare bird species, little blue heron, snowy egret, yellow-crowned night heron, snowy egret, and cattle egret, have been present or nested at the site. Green-backed heron are also known to nest here.

Goodhue County Twp 113N Rng 15W Sec 19

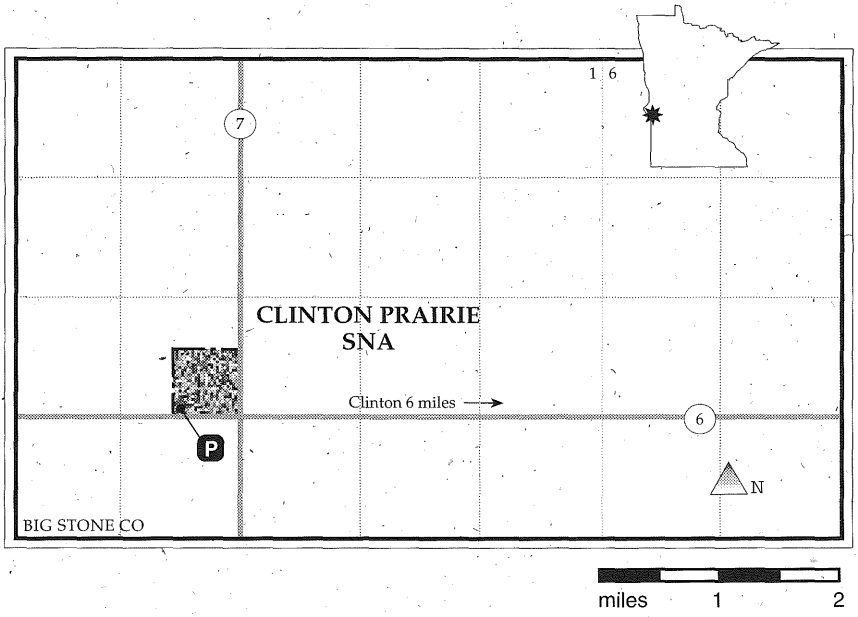


Located 5 miles W of Red Wing on US Hwy 61. Access is easiest along the Cannon Valley bike trail.

Note: Sand bars closed to visitation to protect wood turtle courtship and nesting.

Cannon River Turtle Preserve, located on the lower Cannon River, contains floodplain forest dominated by silver maple and cotton wood. American elm was formerly the most important species in this floodplain forest. The site provides habitat for the state-threatened wood turtle, which nests on the river's sand bars. While it is mostly found in the northeastern states, the wood turtle is rarely abundant anywhere. Low reproductive potential and loss of habitat combine to make the species vulnerable. Woodland turtles prefer small, fast moving streams in forests with grassy meadows on the banks and raised sandbars for nesting; the Cannon River Turtle Preserve appears to be just right. The best time to visit is in the spring, before mosquitoes become too abundant, or during fall leaf color season.

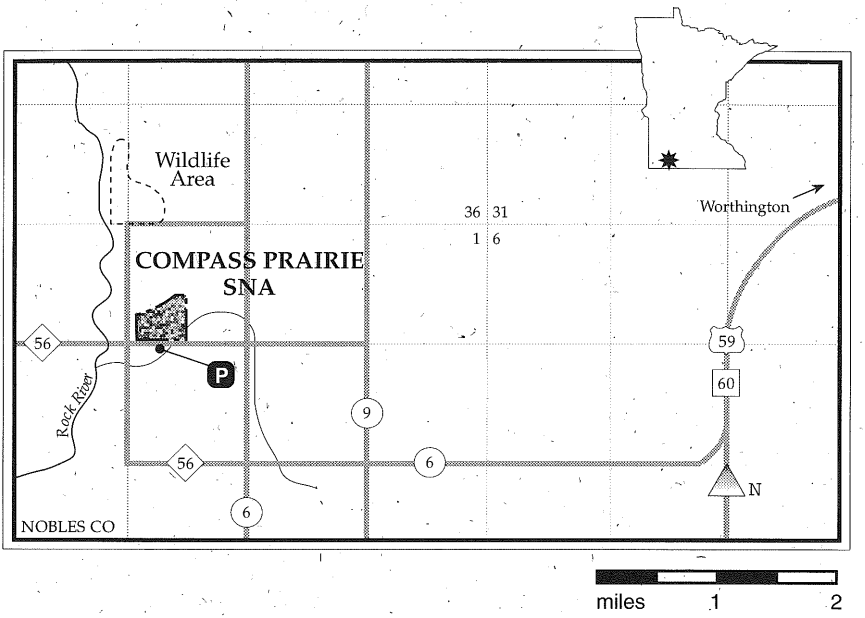
Big Stone County Twp 123N Rng 47W Sec 16



Located 6 miles W of Clinton on Co Hwy 6. Park on the field entrance by the wooden SNA sign.

Clinton Prairie lies in a gently rolling ground moraine with broad, rounded swells and small, shallow depressions. The calcareous soils on this site were formed of glacial drift of the Des Moines Lobe, and the glacial till hill prairie community here is distinctive. While past use as a hay meadow and possibly as pasture have disturbed the prairie somewhat, it is an important remnant of gently rolling upland blacksoil prairie, now scarce in the region. Most surviving prairie in the area is on different landforms and soils. The rare Poweshiek skipper is found on many Minnesota prairies, yet is extremely limited in range; details of its life history remain unknown. Upland sandpiper and chestnut-collared longspur also occur here among diverse native grasses and flora. Summer is a good time to view butterflies and grasses; from spring through fall, visitors will see a range of prairie birds and invertebrates, including abundant orb spiders in their webs anchored among the grasses.

Nobles County Twp 101N Rng 41W Sec 03

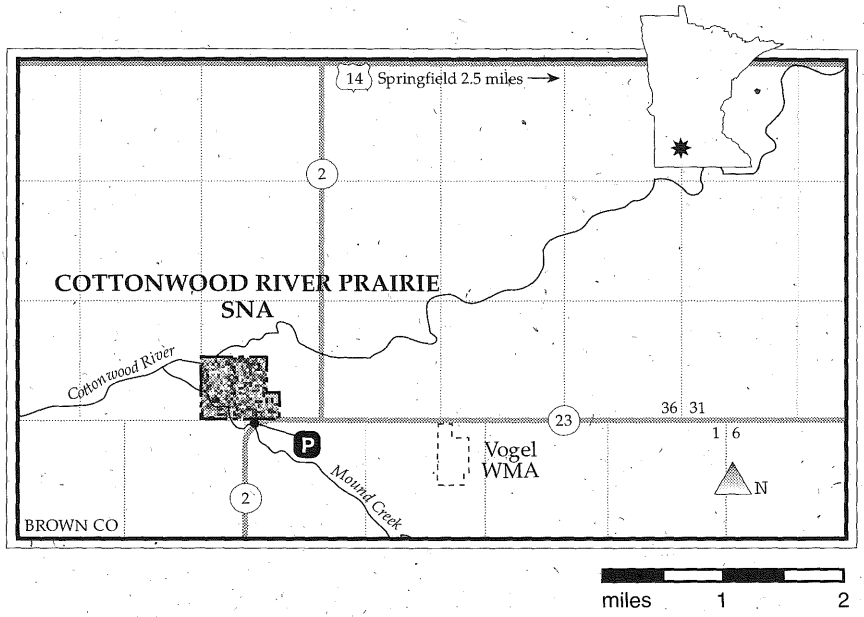


Located from Worthington, S on MN Hwy 60/US Hwy 59, then W on Co Hwy 6 for 3 miles, then N on Co Hwy 9 for 1 mile, then W on a gravel road for 1.5 miles. The SNA is on the N side of the road.

Compass Prairie, the largest known prairie remaining in Nobles County, lies on the two slopes facing the creek coursing its way to the Rock River. This small, mesic blacksoil prairie remnant echoes the once great tallgrass prairie, whose fertile soils now serve agricultural purposes. The tall, yellow-flowered compass plants, their leaves oriented north to south on the stalk, were once common across the prairies of southern Minnesota. Compass plants thrive here now, along with locoweed, a legume that produces a substance mildly toxic to livestock. Poweshiek skippers, which are rare prairie butterflies, are also found here.

Prairie Sky Unit
Brown County

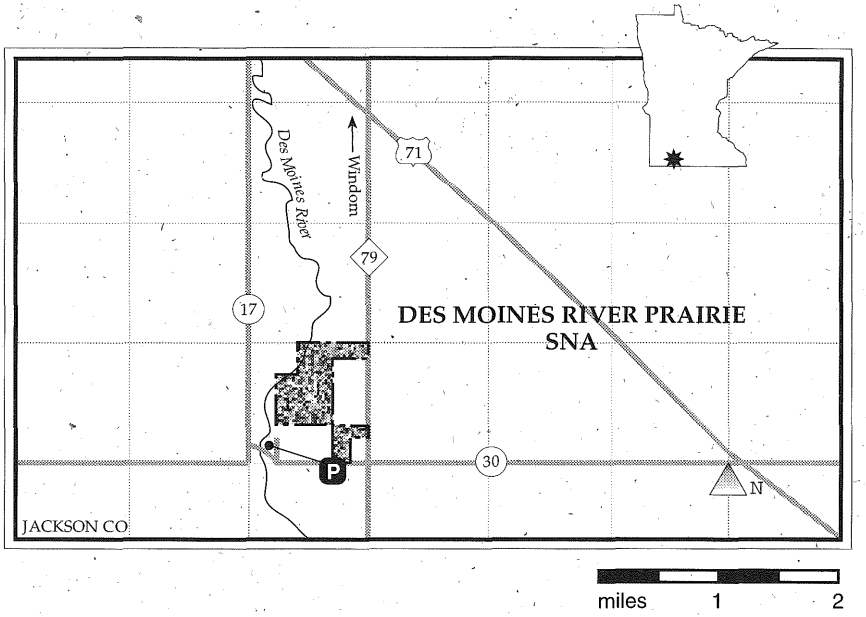
Twp 109N Rng 35W Sec 33



Located from Springfield 2.5 miles W on US Hwy 14, then 3 miles south on Co Hwy 2. Turn W, staying on County Road 2, and travel 0.5 mile. Park on the field road W of the SNA sign.

The Prairie Sky Unit of the Cottonwood River Prairie SNA occupies north- and south-facing slopes of a ridge between the present Cotton wood River and an older, abandoned channel on Mound Creek. Prairie Sky Unit is named for the scenic view from the top of the hill. The site contains a large population of the federally threatened prairie bush clover, which prefers north-facing slopes on dry, gravely hill prairies and thin-soil prairies. Abundant displays of prairie wildflowers, such as purple coneflowers, lead plant, puccoon, and blazing stars, can be seen spring through fall, along with many species of butterflies and skippers. The spectacular view from the top, combined with the plants and wildlife of this prairie community, make this a rewarding site to visit.

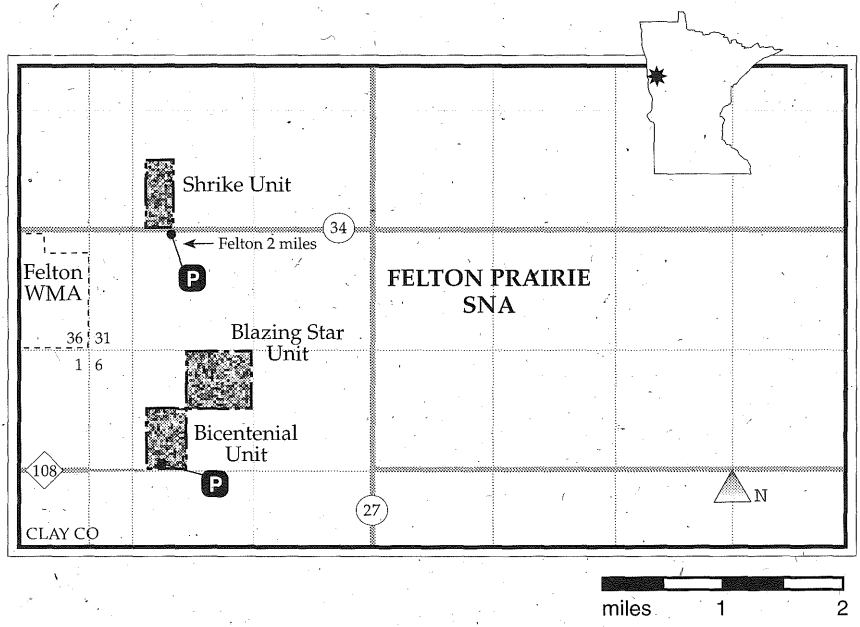
Jackson County Twp 104N Rng 35W Sec 19



Located from Windom 4 mi S on Co Rd 79, then 0.5 mi E on Co Rd 30. Public access is E of the river and road.

This high quality hill prairie is home to numerous prairie plant species, including one of the largest known populations of the federally threatened prairie bush clover. The prairie bush clover is now rare, its dry gravely hill prairie habitat largely destroyed. A member of the pea family, prairie bush clover is silvery green in color, with narrow, clover-like leaves, and pale pink to cream colored flowers that bloom briefly in mid-July. While you are looking for prairie bush clover, enjoy the bird's foot violets, puccoon, finger tickseed, blazing stars and wild bergamot.

Bicentennial Prairie Unit	160 Acres
Blazing Star Prairie Unit	160 Acres
Shrike Unit	90 Acres
Clay County	Twp 141N Rng 45W Sec 05, 30



Located from Felton 2 miles S on MN Hwy 9, then E on Co Rd 108. Continue on to the gravel road about 0.25 miles to the SNA.

The Felton Prairie complex is composed of three units which all lie within a large beach ridge complex of Glacial Lake Agassiz, forming the most important gravel prairie complex in the state. Amoco Oil Corporation gifted the Shrike Unit to the SNA program, while the Bicentennial Unit is owned by Clay County and dedicated through a conservation easement. Mesic blacksoil prairie dominates throughout the complex, with gravel prairie on the beach ridge and wet blacksoil prairie in the swales. Many glacial erratics lie scattered about. Several rare plants and animals occur here, including the endangered butterflies, Assiniboia skipper and Dakota skipper. Rare birds found here include the upland sandpiper, marbled godwit, Sprague's pipit, Baird's sparrow, and chestnut-collared longspur. Come on an early spring morning to see prairie chickens booming on the four leks within a two-mile radius, and check out the prairie smoke and pasque flowers, as well. Gentian, lilies, orchids, needlegrass, and side oats grama color the summer view. Visit again in the late summer for the butterflies, prairie dropseed, blazing stars, and sunflowers; asters bloom in the fall.

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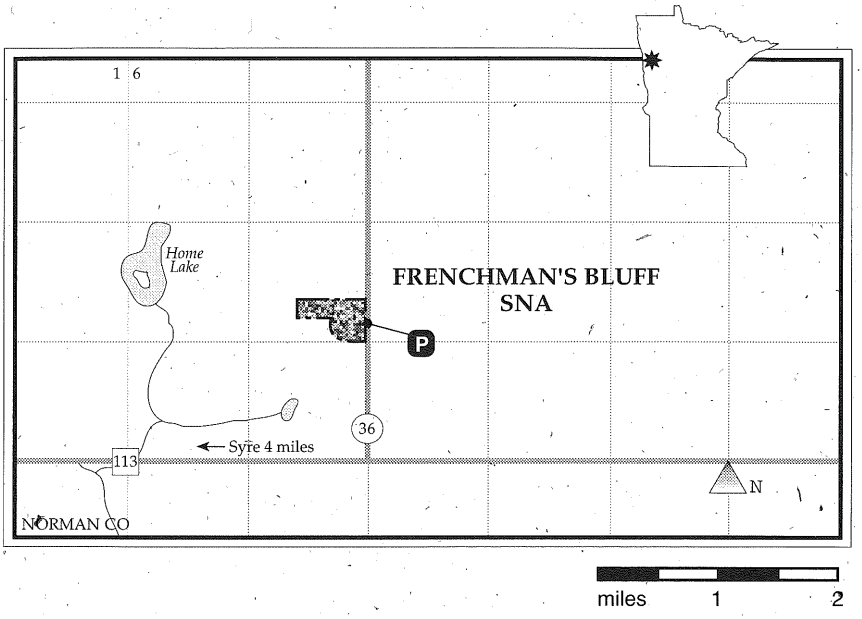
Norman County Twp 143N Rng 43W Sec 18



Located from Syre 4 miles E on MN Hwy 113, then 1.1 miles N on Co Hwy 36.

Frenchman's Bluff is actually a prominent hill that overlooks the broad expanse of the Red River Valley to the west. It's a fine vantage point from which to watch a summer rainstorm move in. This moraine, deposited by glaciation some 12,000 to 9,000 years ago, now supports an unusual mix of tallgrass prairie, including big bluestem, and shorter grasses more typical of western prairies—hairy grama, needle and thread grass, and prairie dropseed. Rare plants and animals found at the site include Dakota skipper, Poweshiek skipper, northern grasshopper mouse, plains reed grass, and Nuttall's ground rose. The inconspicuous, elusive moonwort, which prefers open, gravelly banks, rocky ledges, or talus slopes, makes its highly select appearance here; this tiny fern has been found in fewer than a dozen locations in Minnesota. In all, 26 butterfly and 48 bird species have been documented on this SNA. The best times to visit are in the spring, when pasque flowers and prairie smoke are in bloom, and during late summer and early fall, when many other prairie plants bloom.

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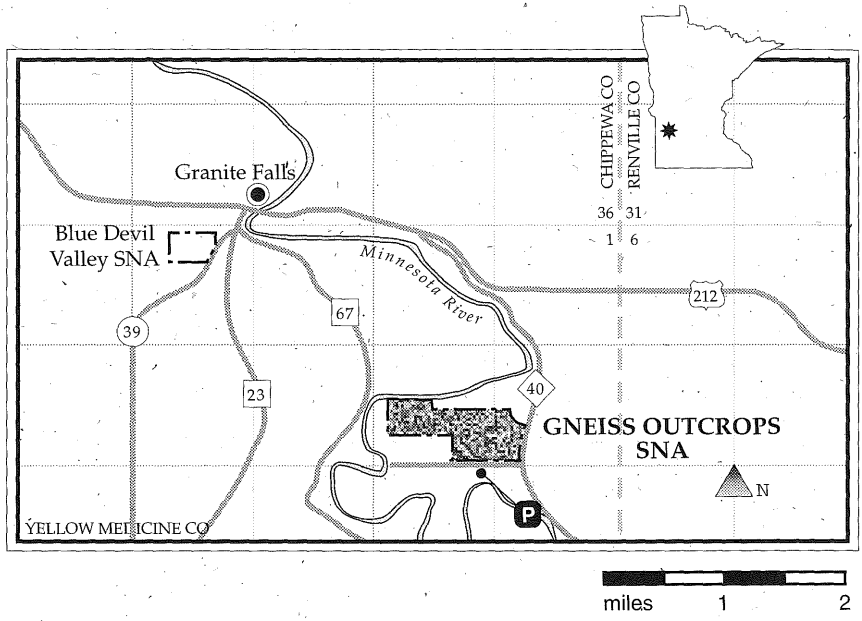
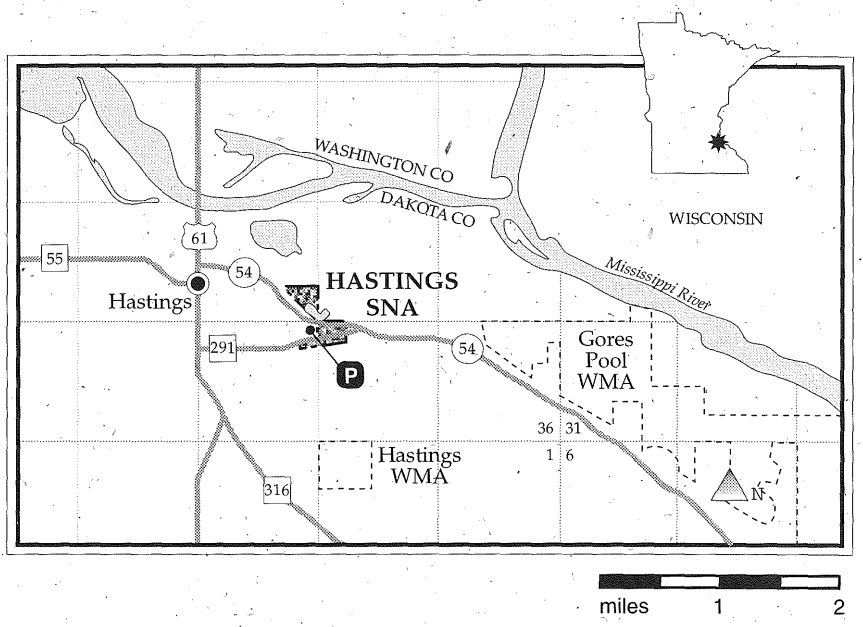
Chippewa County Twp 115N Rng 39W Sec 11, 12



Located from Granite Falls; take MN Hwy 212 1.5 mi E, then Co Rd 40 for 1 mi S.

The Gneiss outcrops, formed approximately 3.9 billion years ago, are among the oldest known rock on the earth's surface. This SNA's significance steadily increases as other outcrops along the Minnesota River are exploited for granite mining, housing, and recreational use. These pyramidal outcrops along the Glacial River Warren Valley rise to about 50 feet above the general level of the land, revealing parallel bands of gneisses. Granitic gneiss is light-colored, pink to red; the less common hornblende-pyroxene gneiss is darker, ranging from gray to black. Garnet-biotite gneiss appears in dark and light gray variations. In addition to these metamorphic rocks, the outcrops reveal igneous rock complexes, formed by heat and pressure below the earth's surface. A natural lake lies between the two major rock outcrops, providing a stunning contrast to the adjacent rock cliffs. Great Plains prickly pear and brittle cactus can be found on dry rock; Carolina foxtail, little barley, and mousetail grow in shallow depressions among the outcrops.

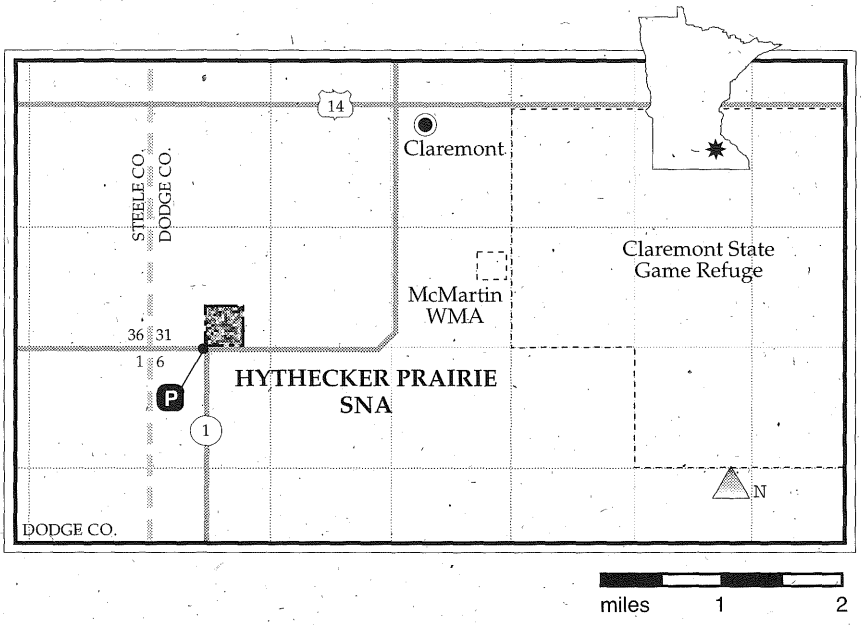
Dakota County Twp 115N Rng 17W Sec 27, 34, 35



Located in Hastings on MN Hwy 291 near the eastern city limit.

The Hastings site contains two forest communities. The upland hardwood forest is dominated by red oak, sugar maple, and basswood; the floodplain forest, by American elm, cottonwood, green ash, and silver maple. A wide diversity of plant species occur on this site, including the rare snow trillium. Talus slopes and steep escarpments of dolomitic limestone provide habitat for specialized plants, such as mosses, lichens, and liverworts. The best time to visit is early April for the snow trilliums, or later in spring when woodland wildflowers such as hepaticas, bloodroots, dutchman's breeches, and other trilliums are in bloom.

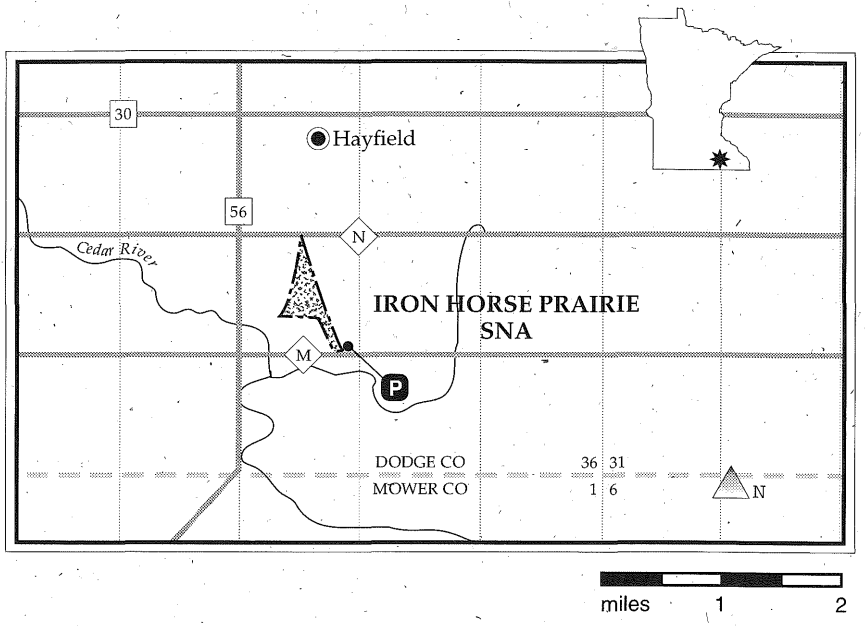
Dodge County Twp 107N Rng 18W Sec 31



Located from Claremont 1 mile S then 1.5 miles W on Co Hwy 1.

Hythecker Prairie is an excellent example of mesic tallgrass prairie. Because tallgrass prairie soils are well suited for cropland, very little original prairie remains undisturbed. This bit of prairie was protected from the plow by its namesake, who eventually sold it to The Nature Conservancy, which later transferred it to the state as an SNA. Some rare plant species, including valerian, rattlesnake master, and compass plant, are still found here, and old field portions are gradually being restored to native vegetation. Visit in spring to view valerian in bloom, and in late summer to view blooming rattlesnake master, blazing stars, and sunflowers.

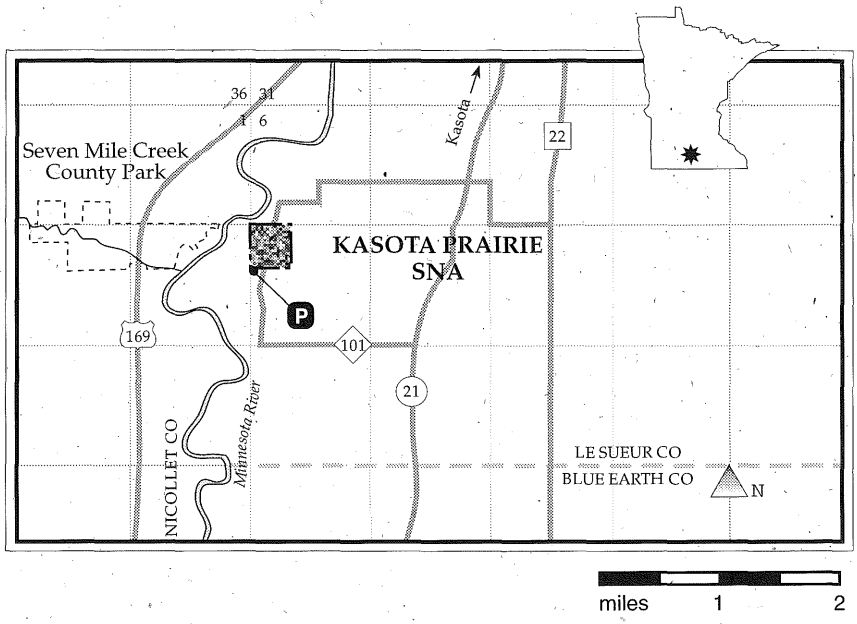
Dodge County Twp 105N Rng 17W Sec 27



Located from Hayfield 2 miles S on MN Hwy 56, then 0.5 miles E on Co Rd M to the old railroad grade.

Iron Horse Prairie is a triangular shaped site between two diverging railroad spurs. The "iron horses" of the railroad protected this 35-acre site, now the largest contiguous example of mesic tallgrass prairie remaining in southeastern Minnesota. Species diversity is very high on this site and includes the rare plant species Sullivant's milkweed, Indian plantain, wild quinine, and valerian. Visit in late spring to view blooming swamp saxifrage, valerian, and prairie smoke. Summer is a great time to see the milkweed, rattlesnake master, and other prairie flowers, while late summer offers wild quinine, blazing stars, and sunflowers, among others.

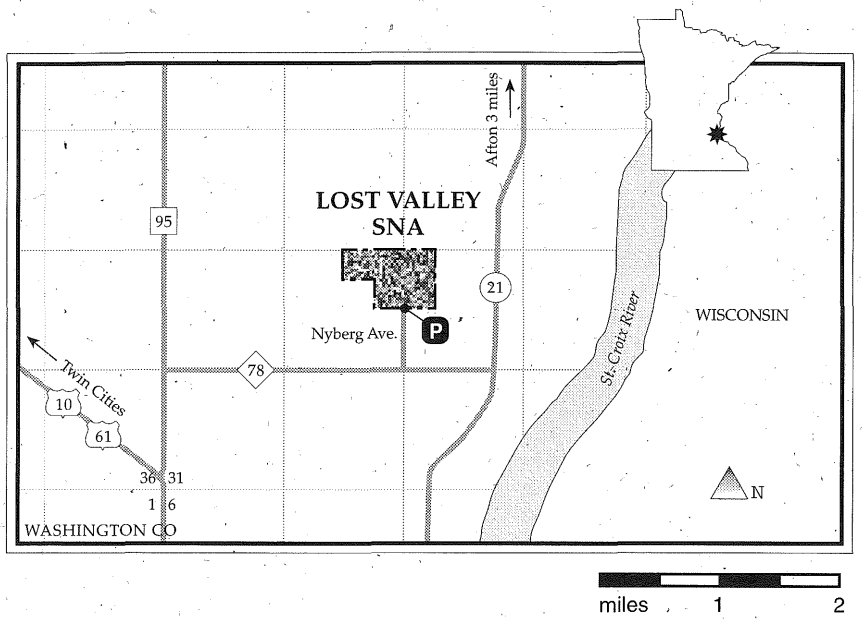
LeSueur County Twp 109N Rng 26W Sec 07



Located from Kasota, S on Co Hwy 21 to Co Rd 101. Turn W on gravel road and go 1.5 miles. Park on pull-out on the E side of the road.

Located on an extensive rock terrace 70 feet above the Minnesota River Valley, the Kasota Prairie is named for its view, Kasota meaning "cleared-off place." When the Glacial River Warren originally carved the Minnesota River valley, the flooded river covered this terrace. Today, prairie, wet meadow, oak woodland, and lowland hardwood plant communities thrive in the thin soils, only 12 inches deep here. They are managed by periodic burning. Shrubby patches of wild plum, wolfberry, and narrow-leaved meadowsweet provide nesting and perching sites for open-country birds such as horned larks, loggerhead shrikes, and upland sandpipers. The palette of wildflower color ranges from the first pasque flowers in early spring, on to yellow prairie violet, pale-spike lobelia, and sunflowers in mid-summer, and deepening with the last gentians in October. Look for yellow nutsedge on the meadow area, and Sullivant's milkweed on the prairie. Rattlesnake master, actually a member of the parsley family, marks the northern extent of its range right here at Kasota Prairie SNA.

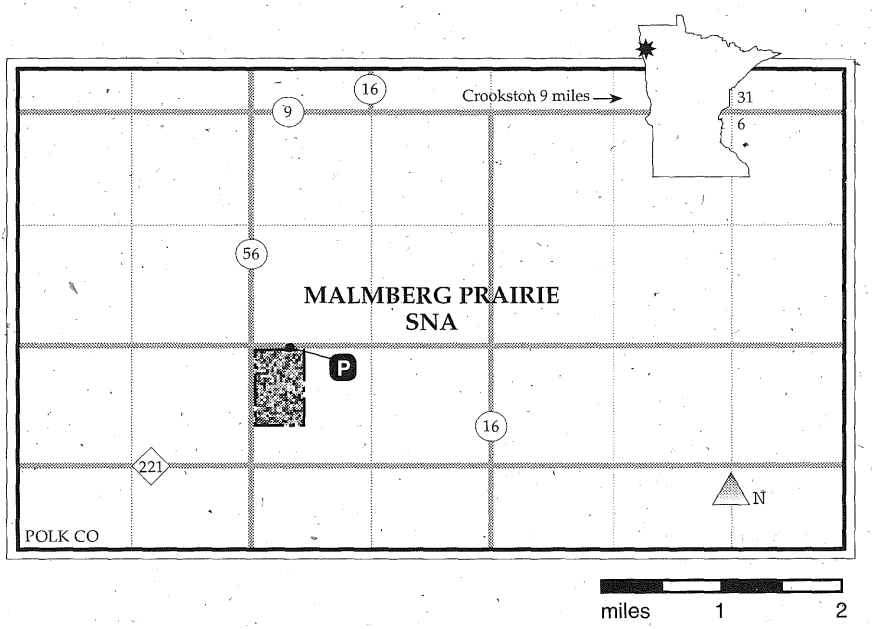
Washington County Twp 27N Rng 20W Sec 20, 21, 28, 29



Located from the Twin Cities, S on US Hwy 61 to MN Hwy 95, then N on MN 95 to Co Rd 78, then E on Co. Rd. 78 to Nyberg Avenue, then .5 mi N on Nyberg. Park at the end of the road.

Lost Valley Prairie is located in the southern oak barrens landscape region on the east side of the metro region. This bluff prairie contains a series of limestone ridges and dry swales, or lowlands, where a rich collection of native prairie grasses thrives on the ridge crests and upper slopes. The dominant native grass is little bluestem, followed by prairie drop-seed, side-oats grama, hairy grama, Indian grass, and big bluestem. Lost Valley Prairie is one of the few sites in the state where rock sandwort is found. This small plant is circumpolar in range and generally found much further north. Hill's thistle also occurs here in the dry, sandy soil; because it grows only in a few small, remote locations, its declining range is cause for concern. Summer months afford best viewing of the many prairie wildflowers, including prairie smoke, puccoon, bird's foot violets, yellow star grass, blue-eyed grass, and beard-tongue.

Polk County Twp 149N Rng 48W Sec 16



Located from Crookston 9 miles W on Co Hwy 9, then 2 miles S on Co Hwy 56.

Malmberg Prairie, situated within the southern basin of the ancient Glacial Lake Agassiz, is one of the last undisturbed tracts in this intensively farmed area. Buffalo once roamed on this very sod, among the big and little bluestem, the mat muhly, and the cordgrass. The poorly drained silt and clay soils support both mesic and wet prairie plant communities. Rare animal species on the site include prairie vole, white-tailed jack rabbit, and sharp-tailed sparrow. Short-eared owl and LeConte's sparrow can also be found. Maximilian's sunflower, Heath's aster, wild prairie rose, northern bedstraw, and closed gentians color the prairie. The best time to visit is late summer when asters, goldenrods, sunflowers, and blazing stars are in bloom.

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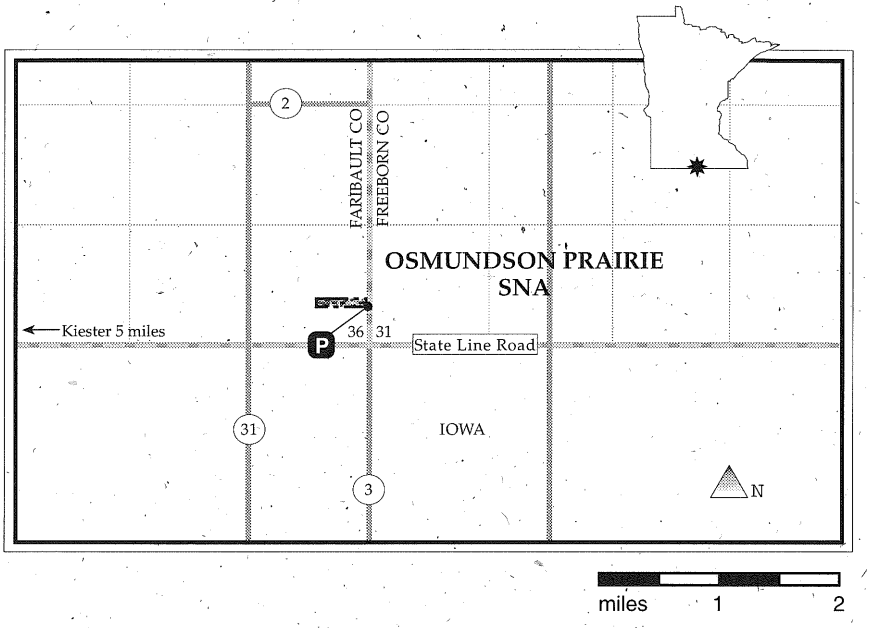
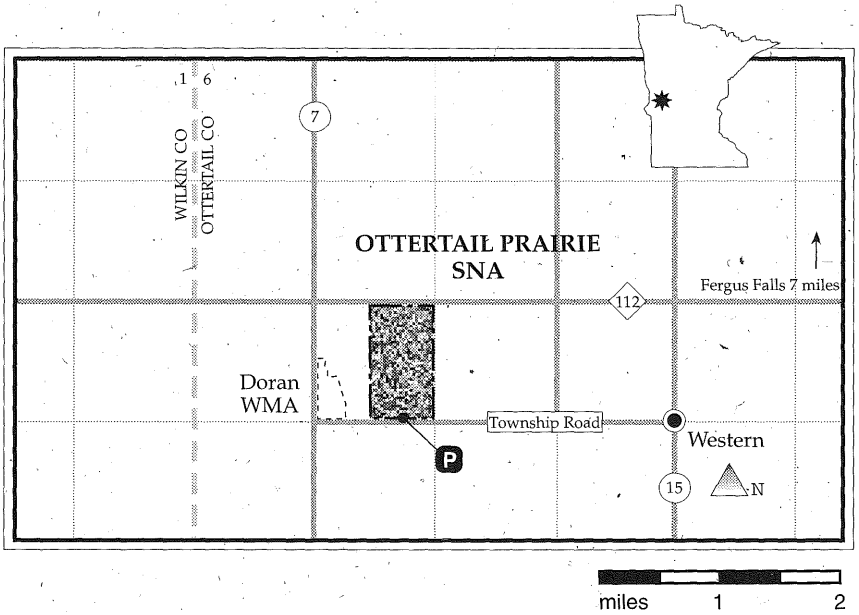
Faribault County Twp 101N Rng 24W Sec 36



Located from Kiester 2 miles S on MN Hwy 22, then 3 miles E on the State Line Road, then about 0.5 miles N on Co Rd 3.

Through the efforts of the Albert Lea Audubon Society and the subsequent donation of land to the state of Minnesota by Mildred Osmundson Wickman, Osmundson Prairie survives today, surrounded by intensive agriculture. The Osmundson family farmed in northern Iowa, and this site honors their memory. It protects a rare remnant of the mesic blacksoil prairie community, as well as two rare plant species, rattlesnake master and tuberous Indian plantain. Located on the rolling topography of the Emmons-Faribault moraine, the prairie is dominated by Indian grass, big bluestem, and grama grasses. The best times to visit are during the spring blooming of pasque flowers and prairie smoke, and in the late summer when blazing stars, rattlesnake master, and sunflowers bloom.

Otter Tail County Twp 131N Rng 44W Sec 17

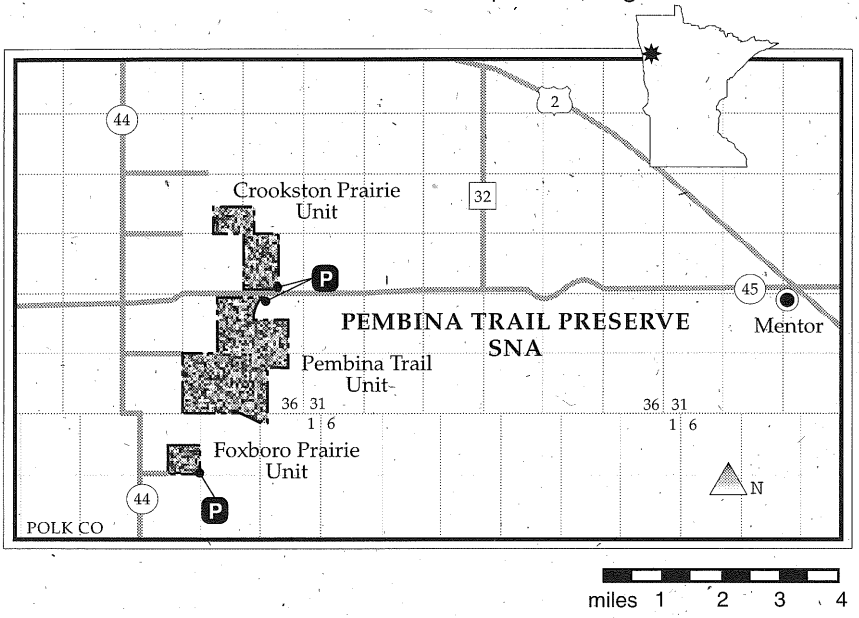


Located from Fergus Falls 7 miles S of I-94 on Co Hwy 1, then 6 miles W on Co Rd 112.

Ottertail prairie is a low, wet prairie site which may be totally flooded for short periods during some springs. The groundwater seepage is mostly calcareous, influencing the plants that grow well here. This community type is dominated by grasses, with some sedges and forbes. The rare downy gentian occurs here, and greater prairie chickens, upland sandpipers, and marbled godwits may be found. Visit in late summer when blazing stars and sunflowers are blooming.

Pembina Trail Preserve TNC — 2,320 Acres

Pembina Trail Unit	(1,600 Acres)
Crookston Prairie Unit	(560 Acres)
Foxboro Prairie Unit	(160 Acres)
Polk County	Twp 149N Rng 44W Sec 18, 19, 30, 31
	Twp 148N Rng 45W Sec 01, 02, 03
	Twp 149N Rng 45W Sec 13, 25, 36



Located 9 miles W of Mentor on Co Hwy 45; or, from U.S. 2, 1 mi S on Co Hwy 32 to Co 45, then 3 mi W.

Pembina Trail Preserve lies on a prominent beach ridge at the western edge of Glacial Lake Agassiz. The site is associated with the Pembina trail, a major ox-cart route that traders used to haul furs and supplies between Winnepeg and St. Paul. The Pembina Trail Preserve is one of the most spectacular prairies in northwestern Minnesota. It exhibits the great diversity of forb and grass species typical of mesic tallgrass prairie, with large areas of meadow, marsh, and shrub swamp, as well. The site contains patches of aspen and spring-fed wetlands at the base of the low, sandy ridges. A small calcareous fen also occurs here. Rare plant and animal species include hair-like beak rush, marsh arrow-grass, sticky false asphodel, upland sandpiper, yellow rail, marbled godwit, greater prairie chicken, Wilson's phalarope, and Dakota skipper. Sandhill cranes gather here by the thousands during fall migration. Moose are commonly seen. Visit this site in spring to observe its animal diversity, or in late summer to view asters, sunflowers, blazing stars, and goldenrods in bloom.

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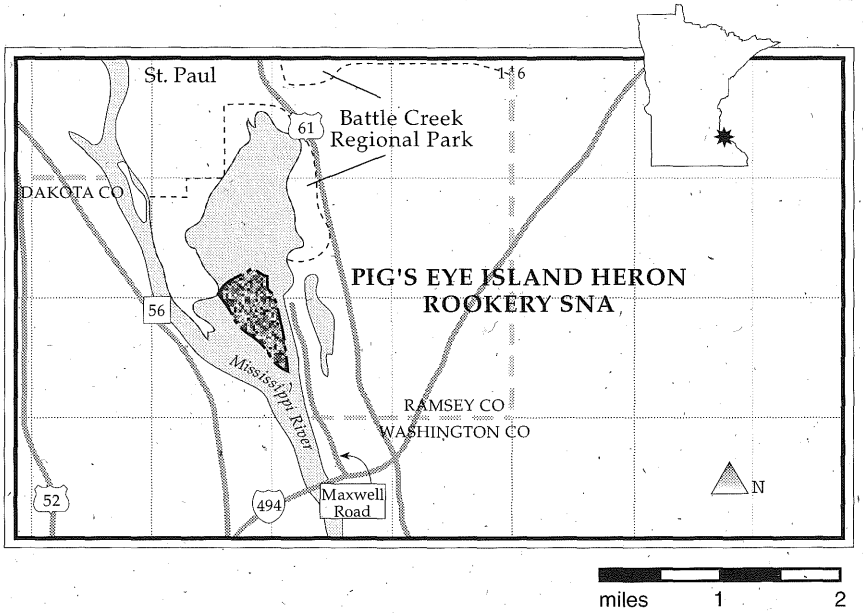
Ramsey County Twp 28N Rng 22W Sec 14, 15, 22, 23

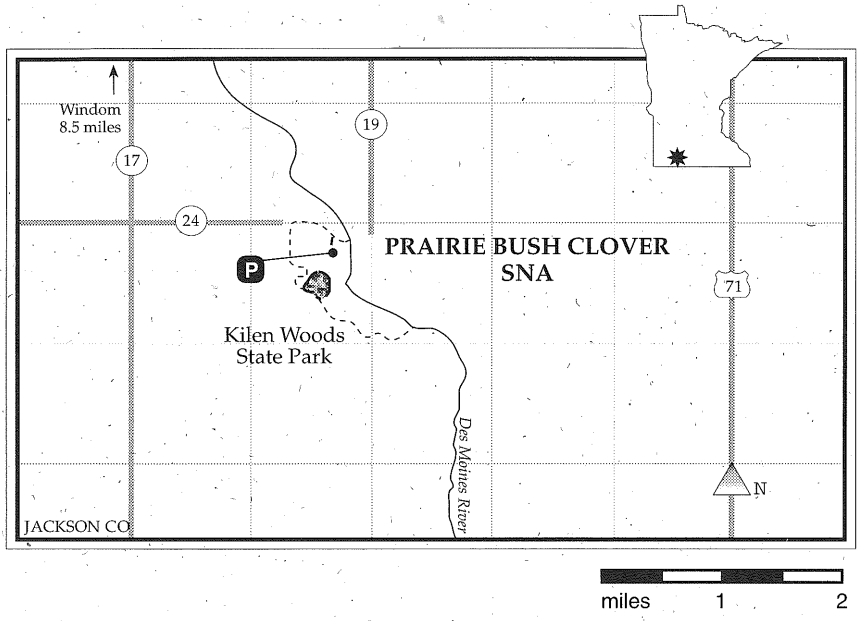


Located in SE St. Paul on the Mississippi River.

Note: Visitation by permit only from April 1 through July 15. Apply through Minnesota SNA Program at (612) 296-3344.

This metropolitan site, named after its famous settler, is notable for being one of the largest nesting sites for colonial waterbirds within the state. Species that nest in the rookery include great blue heron, great egret, black-crowned night-heron, double-crested cormorants, and yellow crowned night heron. This is one of the four places in the state where yellow-crowned night herons are known to nest.

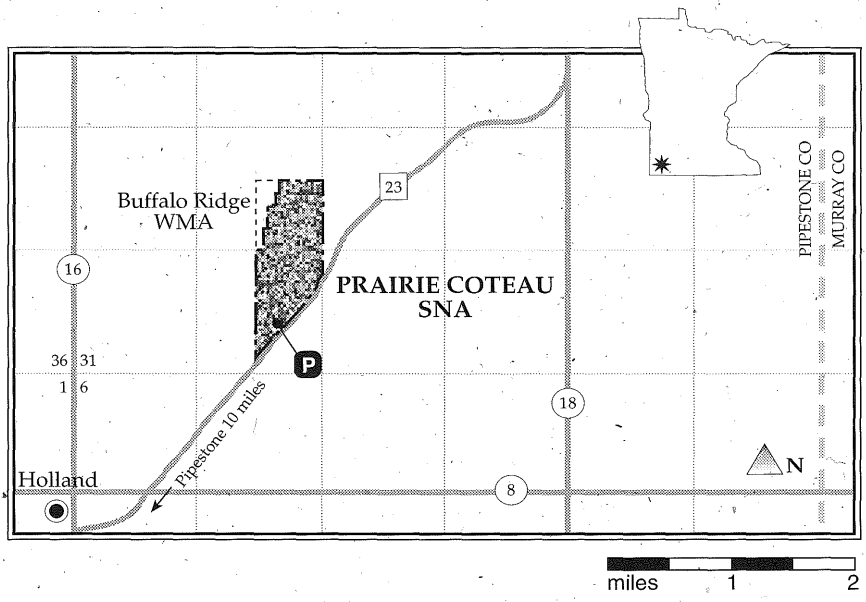
Jackson County Twp 103N Rng 35W Sec 17



Located from Windom 8.5 miles S on Co Hwy 17, then 1.5 miles E on Co Hwy 24, in Kilen Woods State Park.

Prairie Bush Clover SNA is located entirely within Kilen Woods State Park, along the deep narrow valley of the Des Moines River. The hill prairies within this SNA, although dominated by sideoats grama and little bluestem, support one of the world's largest populations of the federally threatened prairie bush clover. Also notable is a small calcareous fen located on one of the prairie hillsides. Look for the state park trail that passes through this site, providing an opportunity to view the prairie while minimizing trampling disturbance. The best times to visit are in early spring, to enjoy blooming pasque flowers, and in late summer, when purple coneflowers, blazing stars, and sunflowers bloom.

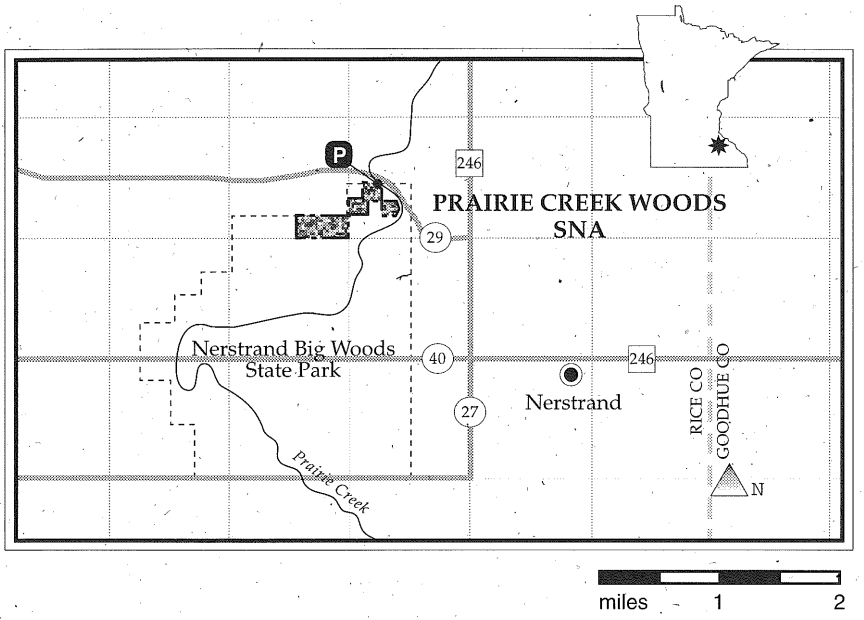
Pipestone County Twp 108N Rng 44W Sec 29, 32



Located 10 miles NE of Pipestone on MN Hwy 23.

Prairie Coteau is one of the most important and stunning prairies in southwestern Minnesota. It occupies an area of steep slopes and valleys which cut through the Bemis glacial moraine. George Catlin called this area the Couteaus des Prairies, or highland of the prairies. Deep stony till deposited from 18,000 to 12,000 years ago lies exposed on eroded slopes, while the flat ridge tops are covered by loess. Despite former grazing, two rare communities—the southwestern dry hill prairie and dry sand-gravel prairie—survive here. The rolling topography bears dry prairie vegetation on the higher elevations, while wet prairie species flourish in the lowlands. Rare animal species inhabiting this prairie include the Dakota skipper and Ottoe skipper, among at least 40 other butterfly species. More than 60 species of grasses, sedges, and rushes can be found here, with over 200 wildflower species. Disturbed areas of this SNA are being actively managed to reduce the presence of non-native species and to convert old fields to native vegetation. To observe fragile prairie flowers in bloom, visit in late spring to see puccoons and prairie smoke; in summer, look for wood lilies and prairie phlox; and in late summer, for blazing stars, asters, goldenrods and sunflowers.

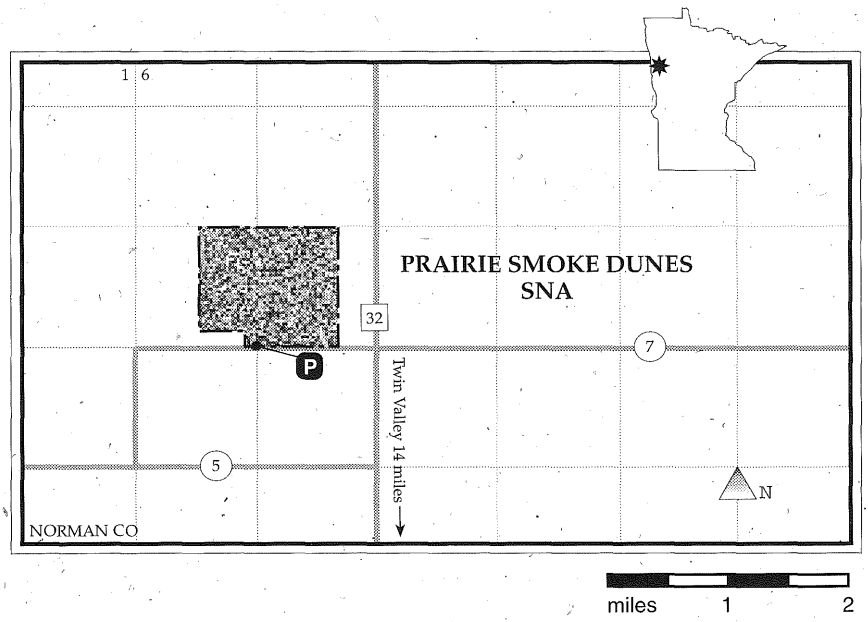
Rice County Twp 110N Rng 19W Sec 03, 04, 10



Located N and W of Nerstrand: take MN Hwy 246 W and N out of Nerstrand, then turn W on Co Hwy 29.

Prairie Creek Woods, abutting Nerstrand Woods State Park, is one of the few sites of Minnesota's dwarf trout lily—our only endemic species, and a federally endangered one. The dwarf trout lily is believed to have evolved in the Faribault area after a glacial retreat some 13,000 years ago. Mary B. Hedges, a botany instructor at St. Mary's School, first discovered the tiny lily in 1870, and submitted it to Asa Gray, the American botanist, for official description. Its inefficient reproduction and dispersal restrict its range to small portions of two drainage systems within a 200 square mile area. Most of the colonies are clones of identical genetic composition. Artificial propagation has been unsuccessful, and preservation of wild plants in their natural habitat is the best way to assure survival. The lily prefers the lower portion of a wooded, north-facing slope, above or near a stream bed. Its pinkish blooms peak in late April before trees leaf out in spring.

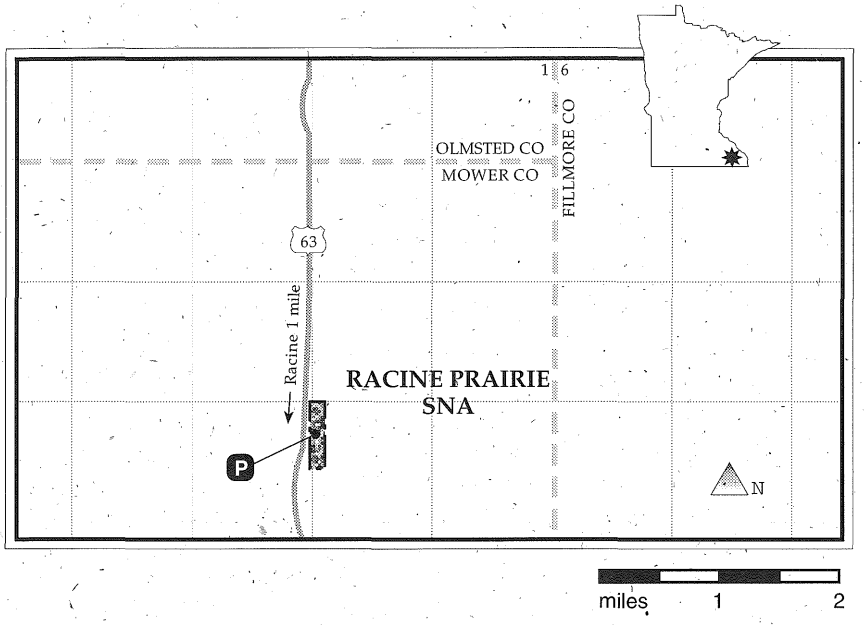
Norman County Twp 146N Rng 44W Sec 17, 18



Located from Twin Valley approximately 14 miles N on MN Hwy 32, then 0.25 miles W on Co Hwy 7.

Fine sand dominates the ancient inter-beach area along the east margin of the Agassiz lacustrine plain, site of the Prairie Smoke Dunes SNA. Dunes in the northern portion of the site range from 40 to 50 feet high, with the leading edge of the dune forming an abrupt scarp nearly 60 feet high. This dry sand savanna community includes skeleton weed, ricegrass, and purple sand-grass, patchy bur oaks, and occasional basswood and green ash, with frequent dune blowouts and sparsely vegetated slopes punctuating the landscape. Vegetation changes dramatically at the top of the dune faces, with a dense forest of bur oak, basswood, green ash, and elm found on the north side. The gentler relief of the southern savanna was grazed heavily. Across the remainder of the site, various sedge meadow, wet prairie, and wet-mesic prairie communities are found, with aspen growing among the various grasses, big bluestem, leadplants, and wood lilies. Prairie smoke, a small plant usually under six inches, grows in clumps and, after blooming, forms plumes. The extensive prairie, the plant elements, and the high quality dune area make this a uniquely interesting site.

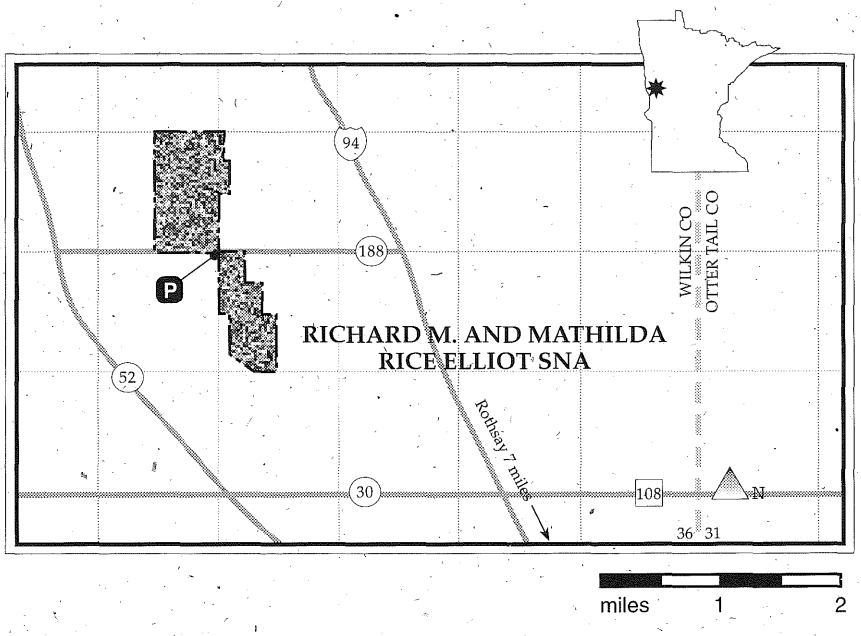
Mower County Twp 104N Rng 14W Sec 22, 23



Located 1 mile N of Racine on US Hwy 63.

This small remnant of mesic prairie survives along the abandoned Chicago-Northwestern Railroad right-of-way. Mesic prairie has become quite rare because the valuable soil on which it grows has been almost completely converted to agricultural use. This site contains four rare plant species: wild quinine, white wild indigo, rattlesnake master, and compass plant. To see wildflowers in bloom, visit in early spring for pasque flowers and prairie smoke; in summer, for wild indigo; and in late summer for blazing stars, gray-headed coneflowers, and sunflowers.

Wilkin County Twp 136N Rng 45W Sec 16, 17, 21



Located from Rothsay 7 miles NW on MN Hwy 52, then 1.5 miles E on Co Rd 188.

Located within the basin of Glacial Lake Agassiz, this nearly level SNA contains undisturbed tallgrass and wet communities, with small scattered sedge meadows and willow thickets. Occasional boulders, called erratics, rest in earthen pits where they were deposited by a passing glacier long ago. Rare animal species include the marbled godwit, upland sandpiper, greater prairie chicken, and the prairie vole. Northern gentian, glasswort, and alkali grass are rare plants found on the site. Visit in early spring to hear the prairie chickens booming, and then again in late summer to see sunflowers and asters in bloom.

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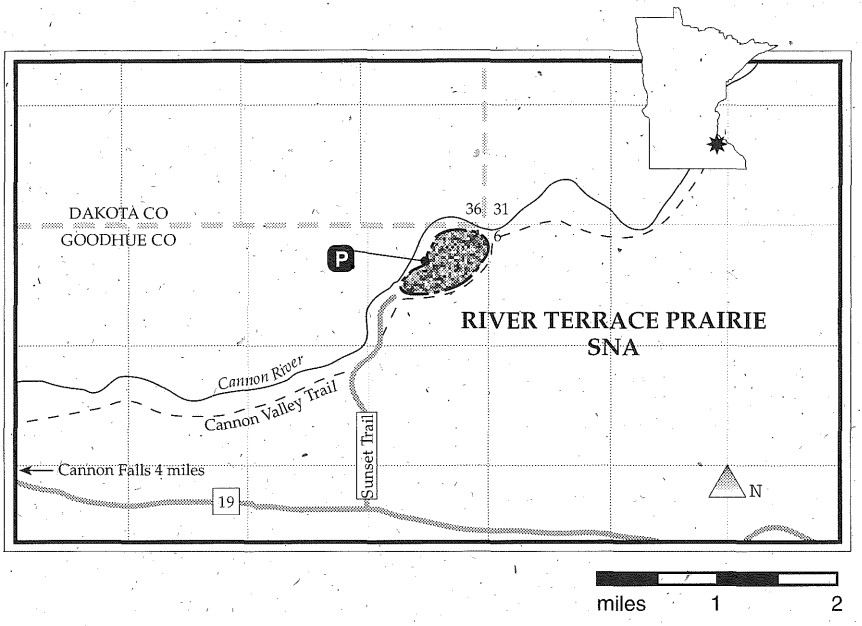
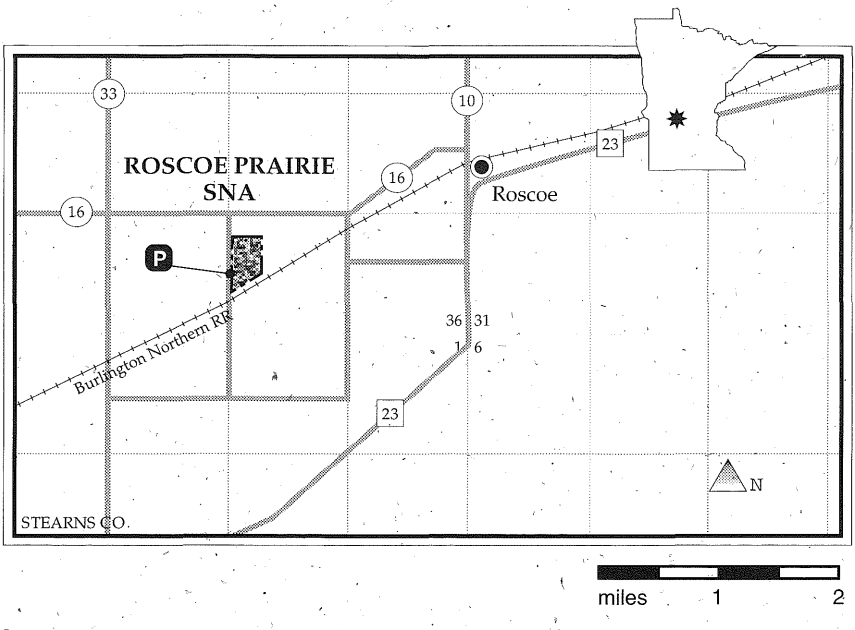
Goodhue County Twp 112N Rng 17W Sec 01



Located from Cannon Falls four miles E on MN Hwy 19, then 2 miles N on Sunset Trail.

This gravel prairie community was formed of glacial outwash atop an isolated Cannon River terrace, now 30 feet above the surrounding lower terraces. Even from a mile away, this prairie is a striking feature on the landscape. Gravel prairie communities are rare in the state, and this is the only example in Goodhue county. One of the largest known populations of the rare kittentail occurs here, along with other native prairie forbs and grasses. An active management program of cutting and controlled burning has been initiated to decrease the amount of cedar and other woody species that have invaded the prairie in the absence of fire. The long-range management plan includes restoration of old fields to native prairie vegetation.

Stearns County Twp 123N Rng 32W Sec 35



Located from Roscoe 2 miles W on Co Hwy 16, then 0.2 miles S.

A sandy outwash plain of the Crow River, the Roscoe Prairie landscape shows little variation in topography, yet it contains several prairie plant communities. The southern portion, a bit higher than the rest of the site, consists of nearly 25 acres of undisturbed blacksoil prairie, characterized by prairie dropseed, Indian grass, and big gluestem—fine breeding territory for the threatened Dakota skipper. The northern area is nearly level, with a few wet swales in which cordgrass and sedges dominate. Rich in species, this prairie SNA is home to pocket gophers, fox, short tail weasel, 13-lined groundsquirrel, and whitetail jackrabbits. Hill's thistle, prairie orchids, spiderwort, prairie smoke, Indian turnip, purple prairie clover, wood sorrel, mountain mint, and spiked lobelia add their colors to prairie grasses through the summer, and a variety of butterfly species thrive here. Bird watchers may find upland sandpipers, marbled godwits, and American woodcock, among other bird species. Visit in the spring to watch migrating birds and see pasque flowers and puccoons in bloom; in late summer come see the abundant purple coneflowers and leadplants.

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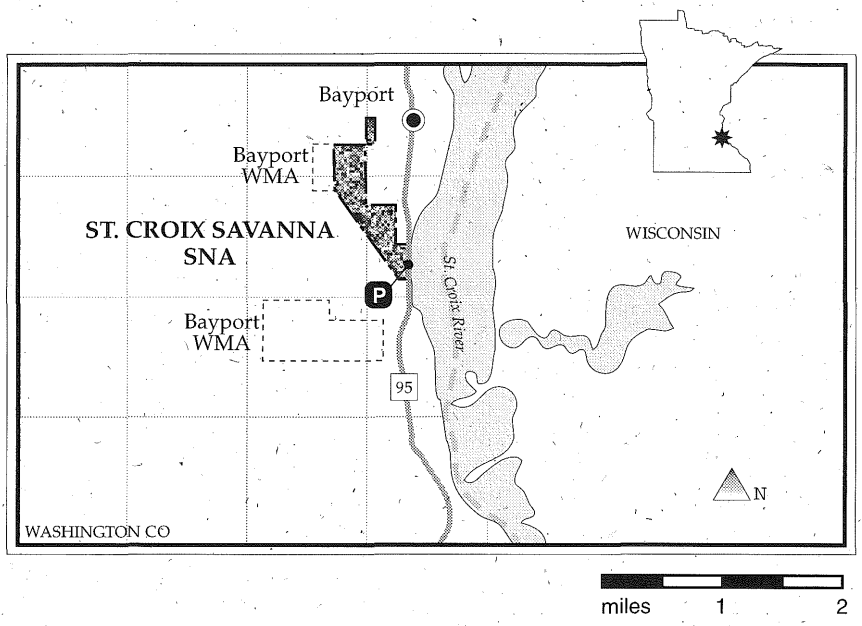
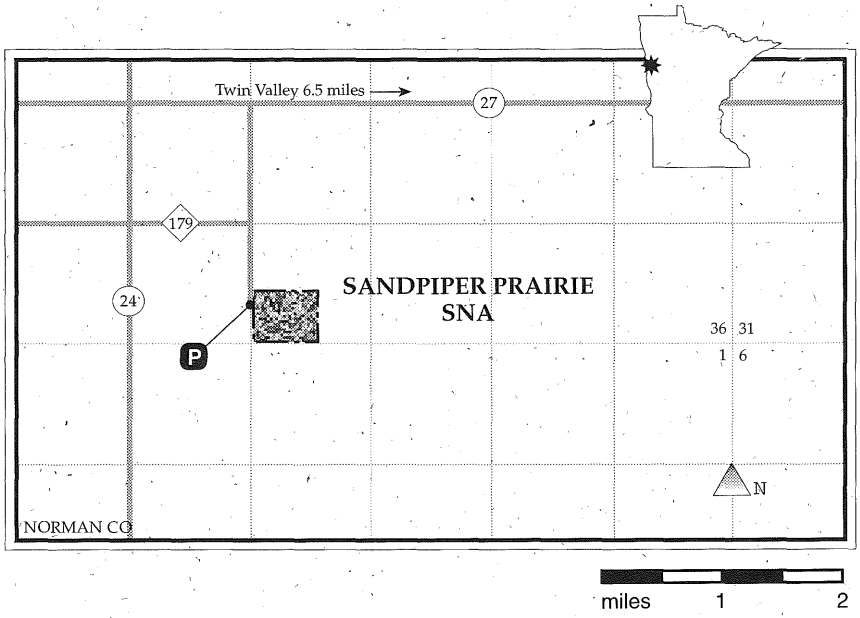
Washington County Twp 29N Rng 20W Sec 14, 15



Located approximately 0.5 miles S of Bayport on MN Hwy 95. Park along the shoulder of Hwy 95 near the SNA sign.

The St. Croix Savanna occurs along the top and side of a south-facing bluff, with views of the St. Croix River. Its slopes of loamy sand have eroded extensively, their soils now supporting an alluvial forest along the bottom. Scattered bur oak and pin oak on the open gravel prairie become increasingly dense toward the northeast and northwest, forming first an oak woodland and then an oak forest. The dry savanna exhibits a significant diversity of grasses: hairy and side oats grama, needle and thread, prairie dropseed, and many others. Several species of goldenrod, sunflower, aster, and blazing star join the pasque flower, prairie gentian, coreopsis, flowering spurge, potentilla, fleabane, coneflowers, and hoary vervain in an ever-changing palette of prairie color. Rare kitten tails grow in the partial shade of bur oaks; other rare species found here include James' polanisia, Illinois tick-trefoil, and a species of pinweed. The St. Croix Savanna is the best hill prairie and oak savanna along the Lower St. Croix National Scenic Riverway.

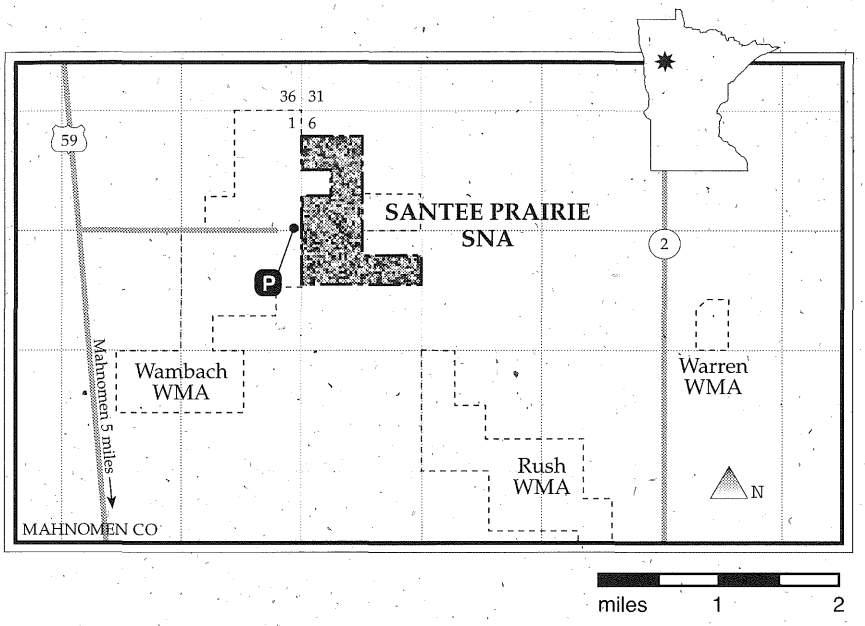
Norman County Twp 144N Rng 45W Sec 33



Located from Twin Valley, 6.5 mi W on Co Rd 27, past the airport; then take the gravel road S for 1.5 mi. Park on the side of the road.

The gravel beach ridges, loamy lake bottom, and floodplain soils of the ancient Lake Agassiz made the Red River Valley attractive for farming and gravel-mining operations. Sandpiper Prairie preserves samples of these dry, wet, and dry mesic prairie communities. Look in the dry prairie for little bluestem, side oats grama, needle and thread grass, puccoon, and painted cup. Along the sandy, gravely upper slopes of the beach ridges, note the native mesic prairie plants such as lead plant, asters, and purple prairie clover; this is prime habitat for prairie chickens and marsh hawks. In wet prairies among the lower slopes, fen-like seepages provide the salty, alkaline soils that support halophytic plant species, including the rare bunch speargrass, Culver's root, and alkali cordgrass.

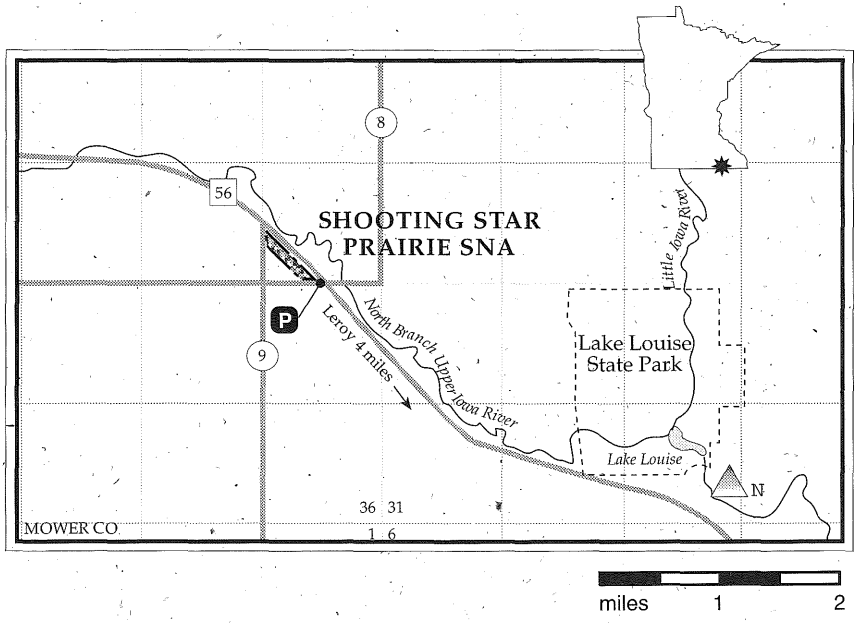
Mahnomen County Twp 145N Rng 41W Sec 06, 07



Located from Mahnomen 5 miles N on US Hwy 59, then 2.5 miles E.

Santee Prairie SNA is a diverse prairie that adjoins the Wambach Wildlife Management Area, together forming just part of an extensive prairie and wetland complex. This landscape is a ground moraine, its undulating, nearly level surface supporting native blacksoil prairie as well as small, pothole marshes, sedge meadows, and aspen thickets. Bird species such as the greater prairie chicken, marbled godwit, upland sandpiper, sandhill crane, and Wilson's phalarope are found here. Visit in late summer to see the blazing stars, purple coneflowers, and sunflowers in bloom.

Mower County Twp 101N Rng 15W Sec 13

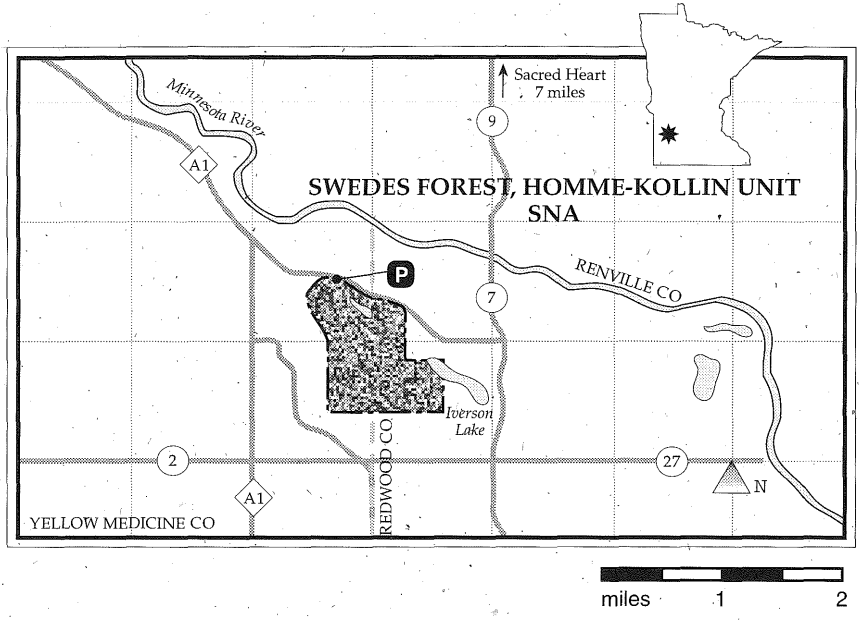


Located from Leroy 4 miles NW on MN Hwy 56.

Named in honor of the prairie wildflower that once grew here, Shooting Star Prairie SNA's sandy soil will once again support shooting stars, which are being reintroduced. This small mesic tallgrass prairie remnant survives on an abandoned Milwaukee Railroad right-of-way. Most tallgrass prairie has been taken for agricultural use, enhancing the value of this small remnant. Shooting stars bloom in the spring; rattlesnake master and wild indigo, in midsummer; sunflowers, asters, goldenrods, and blazing stars, in late summer.

Yellow Medicine County
Redwood County

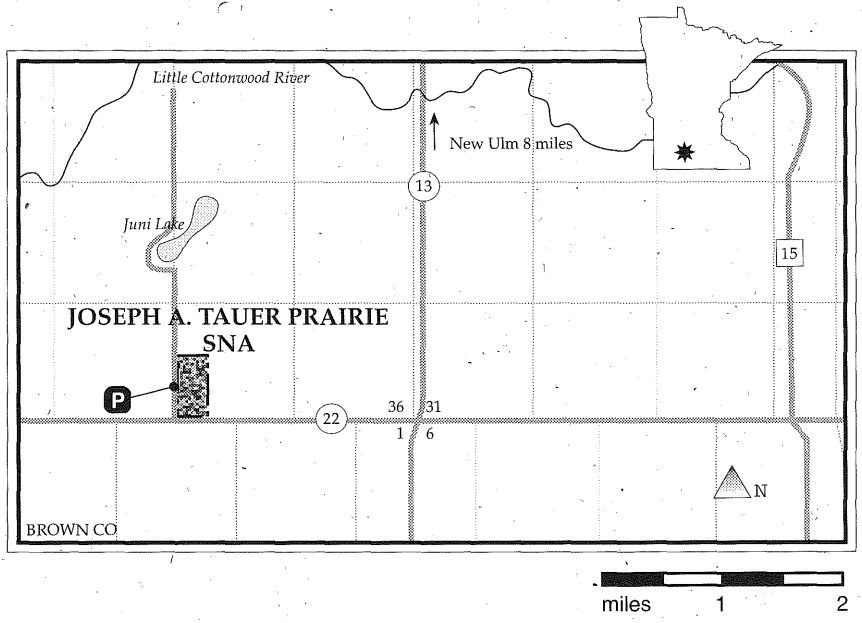
Twp 114N Rng 38W Sec 12, 13
Twp 114N Rng 37W Sec 18



Located from Hwy 212 at Sacred Heart; take Co Rd 9 S for 7 mi, then take the gravel road W for 3/4 mi.

Located within the Minnesota River Valley in Swedes Forest township, this site contains the granite outcrop community type that supports the rare five-lined skink. Several old quarries on the site provide an important hibernacular for the skink. The Minnesota populations of these small, blue tailed lizards (sometimes called "blue devils") are isolated from the main range of this species in the eastern United States. The five-lined skink requires open, sunny, bedrock exposures near oak woodland habitat. The red cedar which has encroached on the bedrock openings in the absence of periodic fire is being managed by controlled burning and cutting. Several undisturbed wetlands are also found on the site.

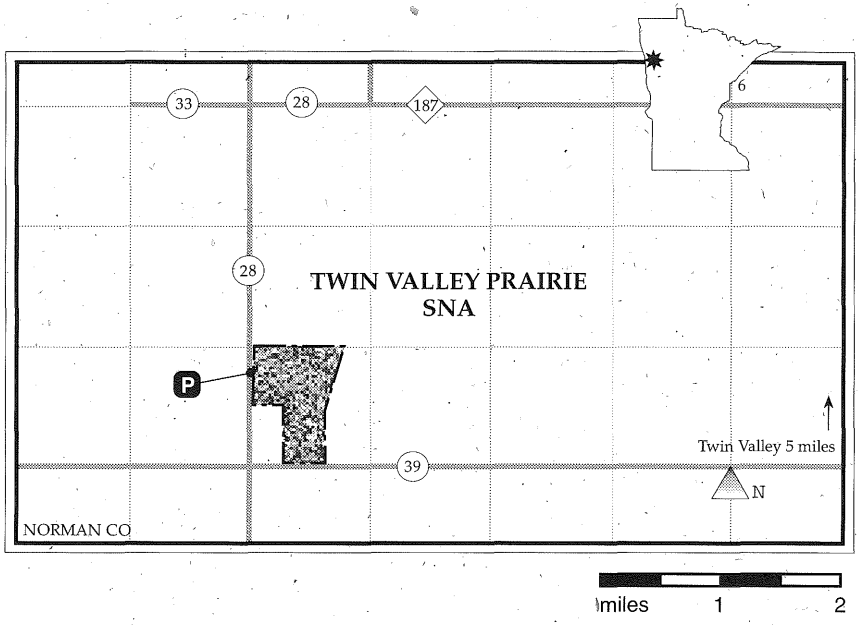
Brown County Twp 109N Rng 31W Sec 35



Located from New Ulm, 8 miles S on MN 13, then 2 miles W of the junction of Co Hwys 13 and 22, on the N side of the road. Park on the township road on the west side of the prairie.

This prairie was owned by Joseph A. Tauer, whose "eccentric" farming practices preserved the virgin prairie portions of this SNA. Tauer used only horses to farm until the 1980s, and he refused to drain the low portions of his land. He restricted his farming to the high, dry uplands of the several hundred acres of his holdings. When Tauer retired to a nursing home, he continued to protect his land through a Prairie Bank easement, thus funding his expenses. Just as Tauer protected his prairie land, the land in turn protected him. Upon his death, fee title for the remaining property was gifted to the state of Minnesota, leaving us the prairie we see today. The farmed, upland portions are now being restored. The undisturbed mesic to wet mesic prairie supports two rare species—tuberous Indian plantain and rattlesnake master—found here at the western limits of their ranges. Prairie clover, gray coneflower, star toadflax, tall blazing star, sneezeweed, wood betony, northern bedstraw, and other flowers bloom among the prairie grasses on this exceptionally rich, fertile soil.

Norman County Twp 143N Rng 45W Sec 23



Located from Twin Valley 5 miles S on MN Hwy 32, then 4.5 miles W on Co Hwy 39.

Twin Valley Prairie contains a prominent beach ridge of Glacial Lake Agassiz that supports plant communities ranging from wet to dry prairie. Sedge meadow and marsh communities occupy the poorly drained swales alongside the beach ridge. Sedges and cottongrass dominate these low areas, with cattails, American great bulrush, and Buxbaum's sedge also occurring. The remainder, nearly 150 acres of choice mesic blacksoil prairie, is dominated by big bluestem and prairie cordgrass, with forbs such as tall meadow rue, prairie sunflower, tall blazing star, and golden alexanders. Moose, white tailed deer, jackrabbits, ground squirrels, the white-footed mouse, and masked shrew make their homes here. This site is one of several in the area that are important to the long-term survival of the prairie chicken. Other plant and animal species include Dakota skipper, sandhill crane, marbled godwit, upland sandpiper, and prairie vole. A late summer visit will find blazing stars, sunflowers, asters, and goldenrods blooming.

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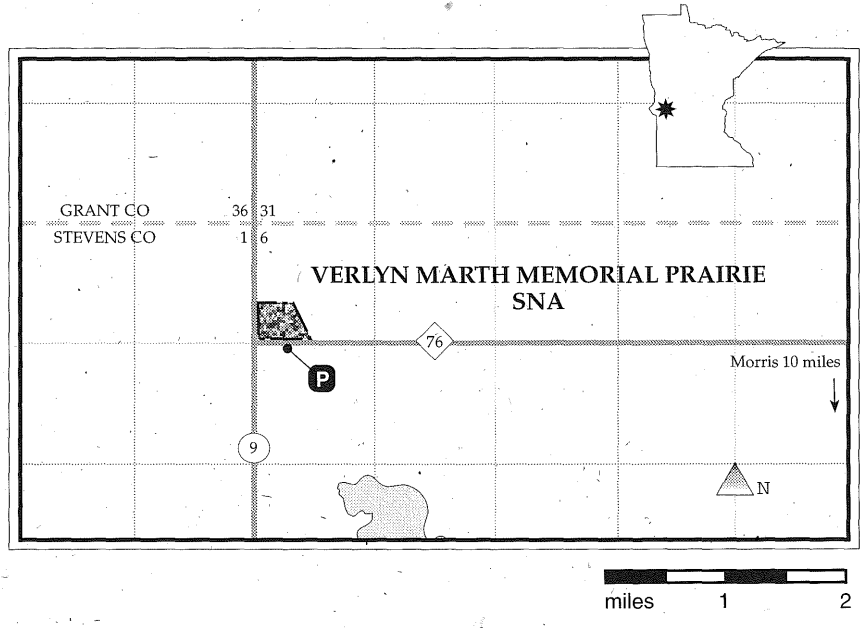
Stevens County Twp 126N Rng 42W Sec 06

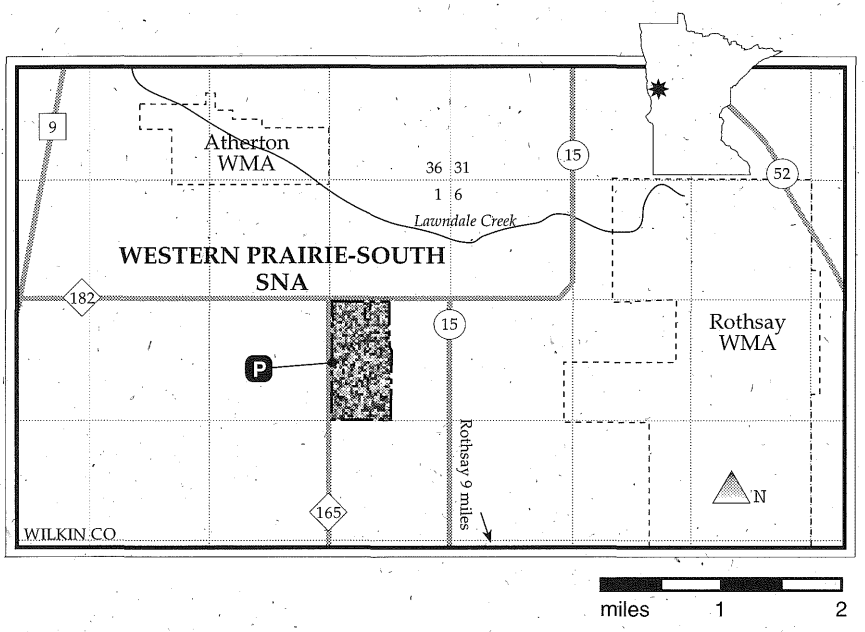


From Morris, take MN Hwy 9 to Donnelly, then travel N on Co Hwy 9 approximately 3 miles to junction with Co Rd 76. Park along Co Highway 76.

Located in the gently rolling hills of the Fergus Falls till plain, this SNA was named after Verlyn Marth, a citizen known locally for his botanical skills and his advocacy of prairie protection. He had observed this site, with its two dry-mesic prairie knolls and its cattail marsh/sedge meadow, as it was used for pasture land during the 1930s and 40s. When he saw it being plowed and planted, he purchased the land to prevent further destruction. From then on, he worked to manage it as a prairie and restore it to its original condition. Despite his careful planting, transplanting, hand-weeding, and burning, however, he concluded that preservation of existing native prairie was far more effective than prairie restoration. His journals detail his work and his evaluation of it. The side slopes bordering the ravine support the best prairie communities; look there for little bluestem, big bluestem, Indian grass, switch grass, needle and thread, side oats grama, flat head goldenrod, coreopsis, and phlox. Purple cone flower, lead plant, and prickly pear cactus also occur on the site.

Wilkin County

Twp 135N Rng 46W Sec 12
Twp 136N Rng 45W Sec 17



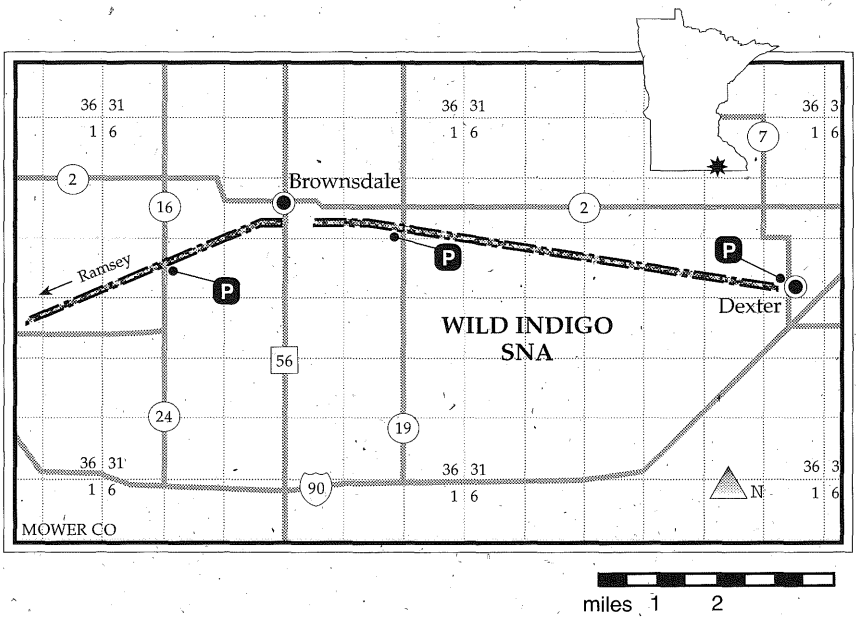
Located from Rothsay 5 miles W on Co Hwy 26, then 4 miles N on Co Hwy 15, then 0.5 miles W on Co Rd 182.

Located within the basin of Glacial Lake Agassiz between two former shorelines, the soils of this SNA are a mix of sand, loam, and clay. The site contains moist sedge meadows, tallgrass prairie, and prairie wetlands, as well as a small saline area high in mineral salts. The mesic tallgrass prairie is dominated by big and little bluestem, along with switchgrass and prairie cord grasses; Canada goldenrod, grass-leaved goldenrod, heath aster, tall meadow-rue, and gayfeather also grow on mesic prairie. Wet prairies contain such species as prairie cordgrass, reedgrass, Indian hemp, and needlegrass, along with Baltic rush, arrow grass, rush aster, Kalm's lobelia, and silverweed. A variety of small mammals, amphibians, and butterflies fluorish in this rich habitat along with rare animal species, such as greater prairie chicken, upland sandpiper, marbled godwit, Wilson's phalarope, sharp-tailed sparrow, and the regal fritillary butterfly. One rare plant, Nuttall's alkali grass, also occurs here. An early spring morning is the best time to see and hear the prairie chicken ritual dance. In late summer, listen for meadowlarks among the blooming prairie grasses and wildflowers.

TNC indicates ownership in part or in whole by The Nature Conservancy.

Mower County

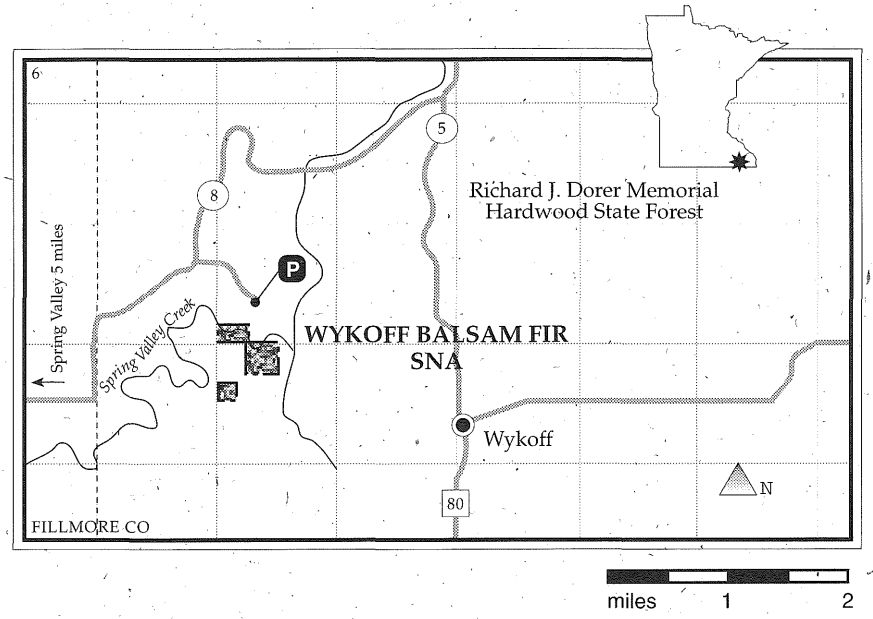
Twp 103N Rng 16W Sec 14-18
Twp 103N Rng 17W Sec 09-13, 16-18
Twp 103N Rng 18W Sec 13, 23, 24



Located in a 12 mile long strip of abandoned railroad right-of-way between Ramsey and Dexter. Park in lots located where Co Rds 16 and 19 cross the right-of-way.

Wild Indigo Prairie is one of the finest examples of mesic tallgrass prairie left in Southeastern Minnesota. This abandoned Chicago-Milwaukee right-of-way contains many fine examples of blacksoil prairie, with over 340 native plant species. The site contains such rare plants as wild quinine, compass plant, white wild indigo, and plains wild indigo. Prairie favorites such as Indian plantain, prairie milkweed, and valerian are well established here. Valerian blooms in late spring; wild indigo, compass plant, and blazing stars, in late summer. Hike the prairie from Dexter to the Cedar River for a memorable trip.

Fillmore County Twp 103N Rng 12W Sec 17, 20

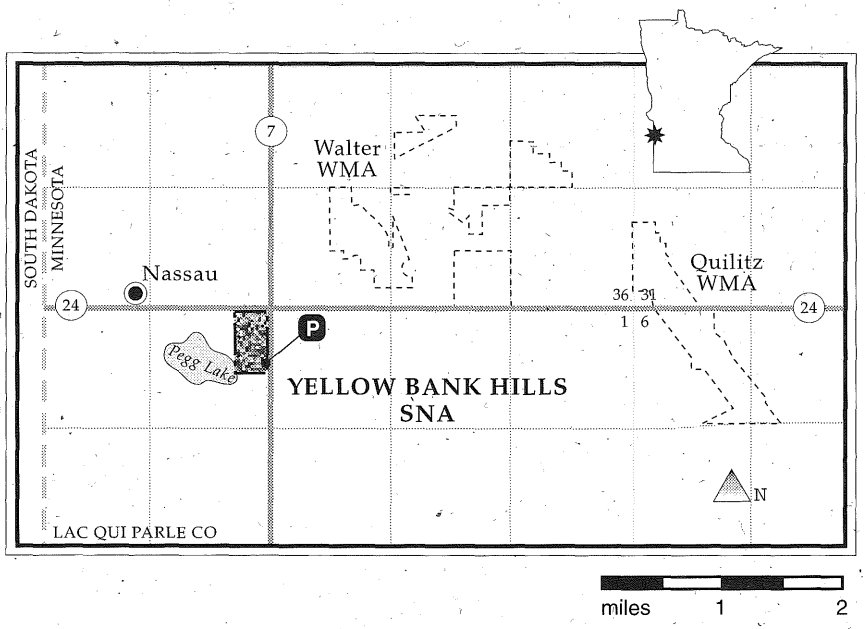


Located from Spring Valley 5 miles NE on Co Hwy 8, then about 0.8 miles SE.

Note: Visitation of the posted sanctuary portion of this site is by research permit only. Apply through Minnesota SNA Program at (612) 296-3344 or through the Regional Nongame Wildlife Program Manager (507) 285-7435.

The Wykoff Balsam Fir SNA contains several steep, moist, north-facing talus slopes with cold air drainage. Balsam fir, yellow birch, white pine, sugar maple, basswood, and American yew are among the woody plants to be found here. This unique micro climate provides habitat for several plant communities commonly found much further north. Rare plant species include golden saxifrage, panicled bluebell, moschatel, bulbet fern, and alpine enchanter's nightshade. A few species of rare land snails also occur on the slopes. The special conditions that support these species are found only in the Blufflands Landscape Region of southeastern Minnesota, on steep north-facing talus slopes with crevasses from which cold air constantly drains, and which are very sensitive to disturbance—hence, slopes are closed to visitors except by research permit. The best time to visit is in early summer when woodland wildflowers are in bloom.

Lac qui Parle County Twp 118N Rng 46W Sec 04

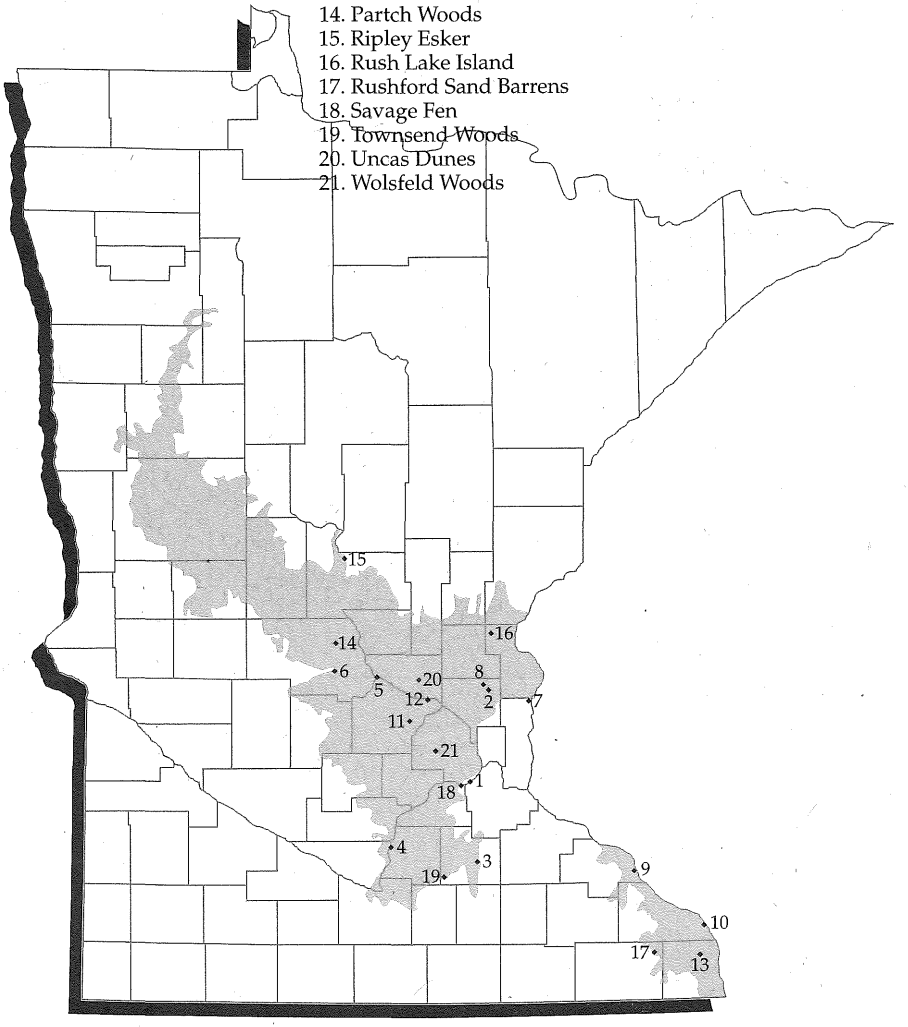


Located from Nassau 1 mile E on Co Hwy 24.

The gravelly, coarse-textured soils of Yellow Bank Hills were deposited by glaciers in mound and ridge formations known as kames. This dry, sand-gravel prairie community typical of the Great Plains includes four plant species rare in Minnesota: Missouri milkvetch, Nuttall's violet, cutleaf ironplant, and soft goldenrod. This SNA also harbors the prairie vole, a state-listed mammal that has generally been replaced by the meadow vole as agriculture has developed. Management of this site includes gradual restoration of old field areas to native vegetation. Nuttall's violet and Missouri milkvetch flower in early spring; blazing stars, purple coneflowers, cut-leaf ironplant, soft goldenrod, and sunflowers, in late summer. The adjacent Pegg Lake is a great spot for observing waterfowl during spring migration.

Deciduous Woods

1. Black Dog Preserve
2. Boot Lake
3. Cannon River Trout Lily
4. Chamberlain Woods
5. Clear Lake
6. Cold Spring Heron Colony
7. Falls Creek
8. Helen Allison Savanna
9. Kellogg-Weaver Dunes
10. King's and Queen's Bluff
11. Mary Schmidt Crawford Woods
12. Mississippi River Islands
13. Mound Prairie
14. Partch Woods
15. Ripley Esker
16. Rush Lake Island
17. Rushford Sand Barrens
18. Savage Fen
19. Townsend Woods
20. Uncas Dunes
21. Wolsfeld Woods



Deciduous Woods

The Deciduous Woods is a species-rich extension of the eastern deciduous forest, with numerous plant species occurring here at the very western edge of their range. The Deciduous Woods landscape includes the forests of southeastern Minnesota and extends through the prairie-coniferous transitional zone, up to the Aspen Parkland in northwestern Minnesota.

The Big Woods—an area of dense forest characterized by maple-basswood forests—represent the peak of deciduous forest development. Minnesota had extensive stands of this woodland community at the time of European settlement. Today only a tiny fraction remains. Common tree species in Deciduous Woods include sugar maple, basswood, various oak types, ironwood, elm, hickory, butternut, birch, and aspen.

During the last period of glaciation, the ice sheet sculpted portions of this geologically unique landscape, but missed the southeastern "driftless" portion. Most of the region's geological character is glacial, including glacial moraines, the Mississippi River Valley and its sand plain outwash, and the St. Croix River with its valley, kames, and kettle lakes. Also included is the Twin Cities metro area, cupped in a gently sloped basin formed of Paleozoic sedimentary rocks. Channels of pre-glacial rivers cut through these formations, then were filled by glacial till that later settled, forming the chains of lakes that meander through the cities.

The driftless area in southeastern Minnesota features caves, ravines, and sinkholes, with clear, spring-fed trout streams coursing through the steep and hilly countryside.

Plant Communities

Natural plant communities in this area are mostly influenced by climate, topography, soils, and fire. Gulf air masses bring warm summer temperatures and humid, sunny days that provide an ample growing season. This rich energy budget allows deciduous trees to drop their leaves each fall, then grow an entirely new crop each spring and still produce luxuriant growth each year.

The landscape includes a mosaic of prairie, forest, and wetland communities. Prairie grasslands have historically occupied the flat lands that today are agricultural fields. Today most prairies are found on steep slopes with thin

soils, or on sandy or wet areas unsuitable for agricultural production. Forests developed around lakes and wetlands along winding rivers, where the effects of fire were limited. Forests also developed on the north sides of hills, ravines, and other areas where temperatures were cooler and moisture more available. Wetlands allowed wet prairie and specialized forest communities to develop.

Deciduous forest communities themselves are distinguished by degree of soil moisture:

- Xeric forests, found on dry sites, feature drought-tolerant species, typically dominated by white, red, and black oak canopies.
- Mesic forests, found on sites with moderate soil moisture, are the stable maple-basswood forests we know as Big Woods.
- Lowland forests, found along floodplains and swamps, are adapted to the greatest extremes in moisture, ranging from spring flooding to summer drought. Cooler air settles or drains through these areas. Canopy species vary widely. Floodplain forests include silver maple, cottonwoods, black willow, American elm, green ash, and bur oak. Hardwood swamp forests include black ash, paper birch, yellow birch, red maple, American elm, slippery elm, and green ash.

Plant species associated with these communities are adapted to the stress of drought, excessive moisture, and shade in a variety of ways. Consider these examples:

- Rich, mesic forests support a variety of spring ephemerals that avoid the stress of deep shade by emerging, flowering, and fruiting before the forest canopy leafs out. Other herbaceous plants *tolerate* the shady environment, beginning their growth flush upon closure of the leaf canopy, and fruiting during the summer months.
- In the extremes of the floodplain forest, tree species *tolerate* inundation as well as abrasion by debris—ice, fallen trees, or manmade objects—in floodwater currents. Frequent treefall in these conditions create canopy openings that optimize individual tree growth, resulting in individual trees that are large in diameter and height. Trees often develop multiple stems. Floodplain understory is highly variable from year to year, depending on the duration and depth of flooding:

vines and short-lived opportunists are most successful in these communities.

Xeric Forests

Sandy, porous, nutrient poor soils on southern and western slopes or on hilltops and ridges support xeric forest communities typically of oak and aspen. Oak leaves are low in nutrients, high in acid, and can take from three to five years to decay, further affecting soil development. After a fire, oaks "stump-sprout," while aspen produce profuse suckers, both rapidly perpetuating their species as an adaptation to fire. The irregular oak-aspen canopy of southern forests creates openings for sunlight to penetrate to the forest floor, where a variety of saplings develop, opening the way for succession.

Shrub diversity is highly variable throughout this extensive landscape area, providing varied food and habitat for animal species. The ground layer under this relatively sunny canopy tends to bloom in mid-summer: orchids, rattlesnake plantain, pink shinleaf, smooth bedstraw, wild geranium, and false Solomon's seal are just some of the native flowers in this community.

Mesic Forest Communities

Mesic forest communities have developed on cool north slopes whose rich soils formed from glacial till and loess, with the fertile leaf litter of the maple-basswood forest. Adequate soil moisture and protection from fire by wetlands, rivers, and topography have promoted development of this fire-sensitive community.

The closed maple-basswood canopy intercepts most of the sunlight, impoverishing the understory's supply of light. Spring ephemerals have evolved to capitalize on the early spring sun before the tree canopy emerges. It is within the "Big Woods" mesic forest remnants that spring ephemerals are at their best. Trout lilies, Dutchman's breaches, spring beauty, toothwort, and false rue anemone are among this group of forest wildflowers. Shade tolerant wildflowers, however, retain their leaves after the canopy emergence, and ripen their fruit in mid-summer: mayapples, bloodroot, Jack in the pulpit, wild ginger, hepatica, and trilliums constitute this group. Groundcover in the mesic forest community is typically patchy in distribution.

The sparse shrub layer in the mesic forest is dominated by shade tolerant specialists, particularly saplings of the canopy species, awaiting their day in the sun when a mature tree falls, leaving its legacy of sunlight to the younger sibling. This homogeneity accounts for the long-term stability and continuity of an established maple-basswood forest. Shade-tolerant shrubs such as leatherwood, American hornbeam, ironwood, bitternut hickory, and pagoda dogwood complete the understory.

Lowland Forest Communities

Lowland forest communities occur throughout the length of this landscape wherever conditions of abundant soil moisture are found. In the southern portion, high summer temperatures, long frost-free periods, and high humidity create optimum growing conditions for lowland forests. Most extensive examples occur along floodplains where the extremes of flooding and drawdown, along with abrasion by floodwater debris, are annual events. Ice scars on trees, along with windrows of debris on the forest floor and abandoned channels of stagnant water, provide evidence of the floodplain dynamics. Hardwood swamps, though not subject to these extremes, occupy areas of poor drainage on peaty soils. In both cases, soil improvement is limited, and the communities are stable.

Floodplain communities of northwestern Minnesota include American elm, slippery elm, green ash, cottonwood, and bur oak. In southern Minnesota, silver maple, black willow, and cottonwood are more common, with scattered patches of river birch, American elm, slippery elm, green ash, and swamp white oak. Tree and shrub seedlings are limited by flooding, resulting in an open understory. Vines such as wild grape and Virginia creeper seek out light gaps and open areas, where they escape the ground layer and join the canopy. The groundlayer is low in diversity, and comprised of short-lived opportunists such as cleavers, sedges, and wood nettle.

Wet sites with muck and shallow peat substrates support hardwood swamp forests dominated by mixed hardwoods, black ash, American elm, slippery elm, green ash, quaking aspen, or balsam poplar. In the north, tamarack is common, with occasional white pine or white cedar. Canopy density varies considerably, and communities occur in isolated pockets, reflecting highly localized variations.

Deciduous Woods Landscape Regions

Communities within the deciduous landscape vary regionally as well as locally across this extended area. The northwestern woodlands differ from those in the southeast, just as climate and soils vary. As a result, the Deciduous Woods area encompasses six landscape regions. (Figure 1.6).

Blufflands

Minnesota's beautiful southeastern region is considered part of the Wisconsin driftless area. It, too, was scoured by glaciers at one time, though not by the recent lobes that affected most of our landscapes. Its till is much older than that in the rest of the state. Rugged river valley and bluffs characterize the region, with sandstone, limestone, and dolomite outcrops rising alongside the Mississippi and Cannon River valleys. Drainage of the area is well developed, with streams ultimately emptying into the Mississippi River. Sand dunes, seen at the Kellogg-Weaver Dunes SNA, provide unique plant and animal habitat. Though forest vegetation dominates generally, the area is also renowned for its fine bluff prairies.

Mississippi River Sand Plains

The Mississippi River Sand Plains region includes the Brainerd and Anoka Sand Plains and also a substantial portion of the Mississippi valley. Dune clusters extend in a strip from the coniferous forest lying northwest of these plains, to the Twin Cities. A mosaic of jack pine, oak savanna, and prairie covers this sandy outwash left by the glacial river. The Helen Allison Savanna SNA serves as an excellent example, with its sand dunes, oak savanna, dry prairie, and even a sedge marsh.

Big Woods

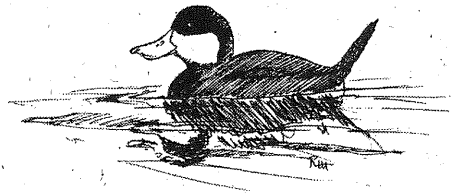
The elm-maple-basswood forest typical of this landscape has now been almost entirely lost to agricultural or urban development. The Big Woods had been sandwiched between two prairie and an oak savanna, and woodland area. Remnants remain, such as the Wolsfeld Woods SNA in the western metro area. Glacial till is brown, calcareous, and clayey, reflecting the Des Moines lobe and the Grantsburg sublobe that crossed most of this area.

Grantsburg

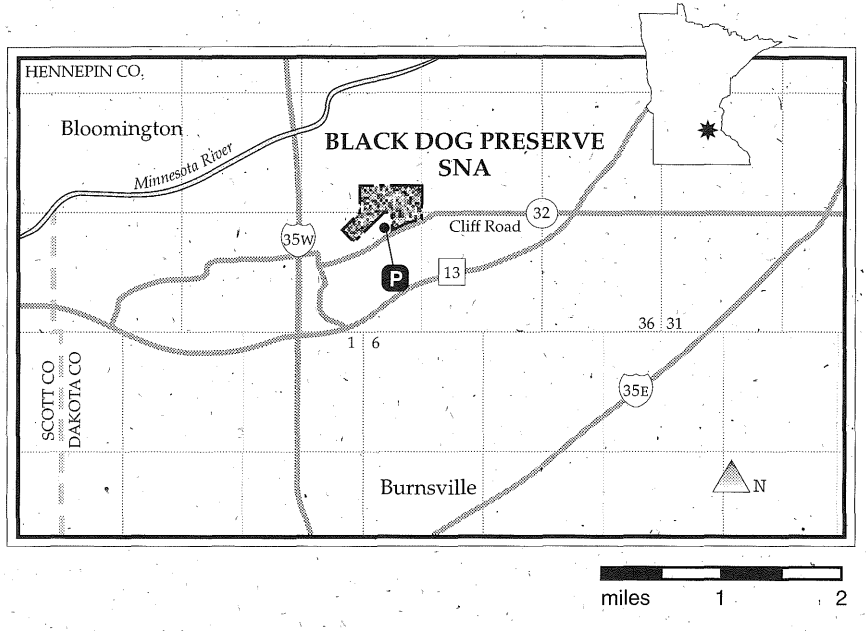
This region was partially covered by Glacial Lake Grantsburg after the Grantsburg sublobe receded. Some lake sediment remains, along with a mixture of tillite. Oak woodlands later covered the area, but have now been cleared for agricultural use. Big woods dominated, with aspen-oak, brush prairie, and wet prairie communities also represented.

Leaf Hills

This narrow strip, located between coniferous forest to the north and prairie country on the south, includes the northern part of the Alexandria moraine complex. A belt of lakes and a pitted outwash plain are tucked among the hills. The western portion of the St. Croix moraine is also included in this region.



Dakota County Twp 27N Rng 24W Sec 27, 34



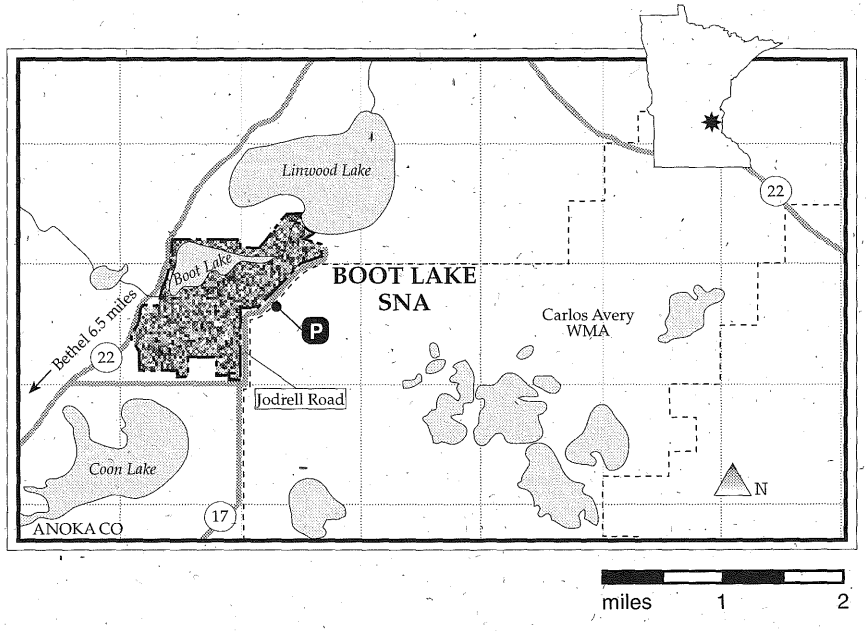
Located from I-35W in Burnsville: go 0.25 miles E on Cliff Rd to the Park and Ride lot beside the City recreation field.

Note: Visitation to the posted sanctuary portion of this SNA by research permit only. Apply through Minnesota SNA Program at (612) 296-3344.

Named after the great Dakota Sioux chief, Black Dog Preserve contains an excellent example of mesic prairie and calcareous fen plant communities, both of which are among the rarest plant communities in the state. A calcareous fen is an endangered plant community dominated by grasses, sedges, and other vegetation adapted to its unusual calcium-rich groundwater, which flows year round. The fen includes grass-based peat, and is dominated by grasses and sedges growing in alkaline groundwater; shrubby cinquefoil, fringed gentian, and grass of parnassus are found here. The mesic prairie—the finest known in the metropolitan area—grades to a wet prairie. Mesic prairie species such as big bluestem, prairie dropseed, yellow coneflower, and blazing star, can be seen here, along with such rare fen species as sticky false asphodel, hair-like beak-rush, whorled nut-rush,marsh arrow-grass, and valerian. Black Dog Preserve lies within the Minnesota Valley Wildlife Refuge, and an interpretive sign marks the end of a trail through the site. Spring displays of swamp saxifrage and valerian can be spectacular, while in July, blazing stars take the stage. The late summer bloom of goldenrods and asters is also a treat.

TNC indicates ownership in part or in whole by The Nature Conservancy.

Anoka County Twp 33N Rng 22W Sec 17, 18, 19, 20

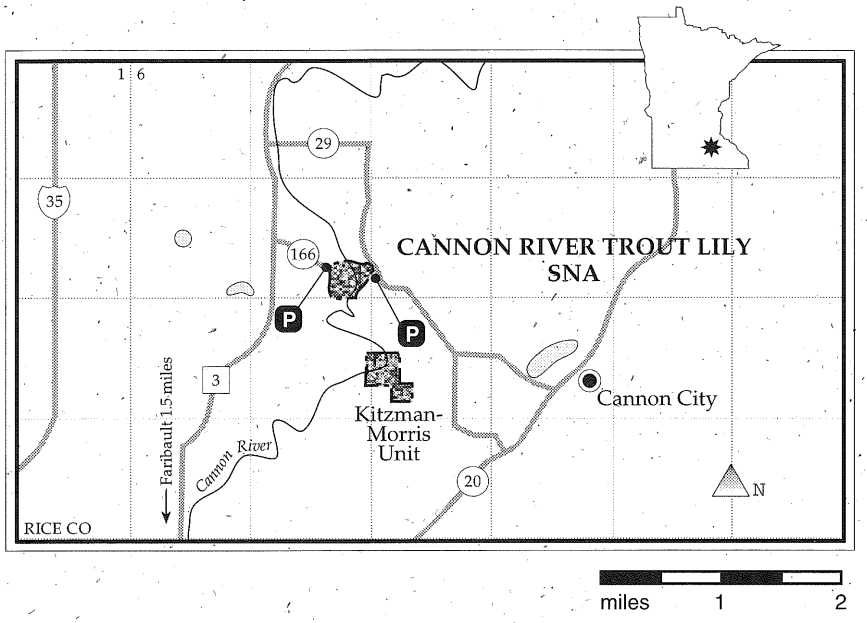


Located from MN Hwy 65 in Bethel: go 6.5 miles E on Co Hwy 22, then E for 1.5 miles on Co Rd 17 and N on Jodrell Rd.

Note: Visitation to the posted sanctuary portion of this SNA by research permit only. Apply through the Minnesota SNA Program at (612) 296-3344.

Boot Lake SNA is part of a chain of ice-block lakes within a tunnel valley system, which was formed by enormous hydraulic pressure and erosion by subglacial rivers. The site contains a continuum of plant community types including oak forest, aspen-shrub thickets, and prominant white pine stands; the wetland contains wooded bog, wet meadows, floating mats, emergent aquatic plants, duckweed, and algal communities. The rare plant species, water willow, sea-beach needle grass, and long-bearded hawkweed are present on the site, along with occasional sandhill cranes and Blanding's turtles. Woodland wildflowers make a late spring visit memorable. No watercraft are permitted on the lake.

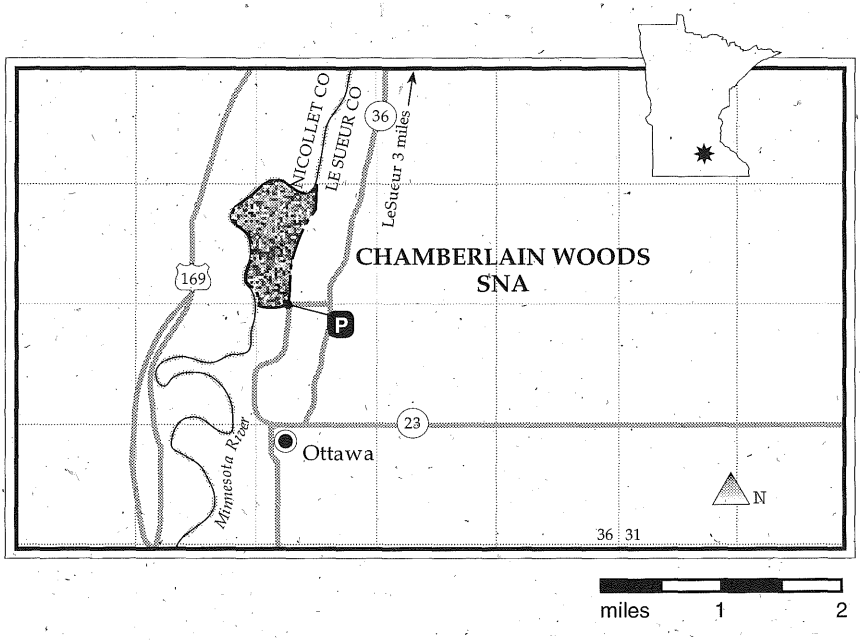
Rice County Twp 110N Rng 20W Sec 08, 16



Located NW of Faribault city limits: go N from the city limits on State Hwy 3 for 1.5 miles, then turn E on 166th Street for 0.5 miles to the SNA. Portions of this site are accessible only by canoe, with the nearest launching site at downtown Faribault.

The Cannon River Trout Lily SNA, a maple-basswood remnant of the Big Woods, features Minnesota's only federally endangered species, the dwarf trout lily. The Kitzman-Morris Unit was partially gifted by its previous owners specifically to help preserve this sensitive species. Dwarf trout lilies grow only in Minnesota, with most naturally occurring sites located in Rice and Goodhue Counties. The lilies prefer the moist woods of river bottoms and ravines along the Cannon River and its tributaries. These colonies are primarily genetic clones, making them more vulnerable to extinction by a single disease or environmental hazard. This site and the surrounding area contain about one quarter of the total number of plants in existence, as well as over 80 percent of all known genotypes of this littlest lily. The dwarf trout lily blooms early in spring before the forest canopy leafs out, along with other spring ephemerals such as hepatica, blood root, and wild ginger.

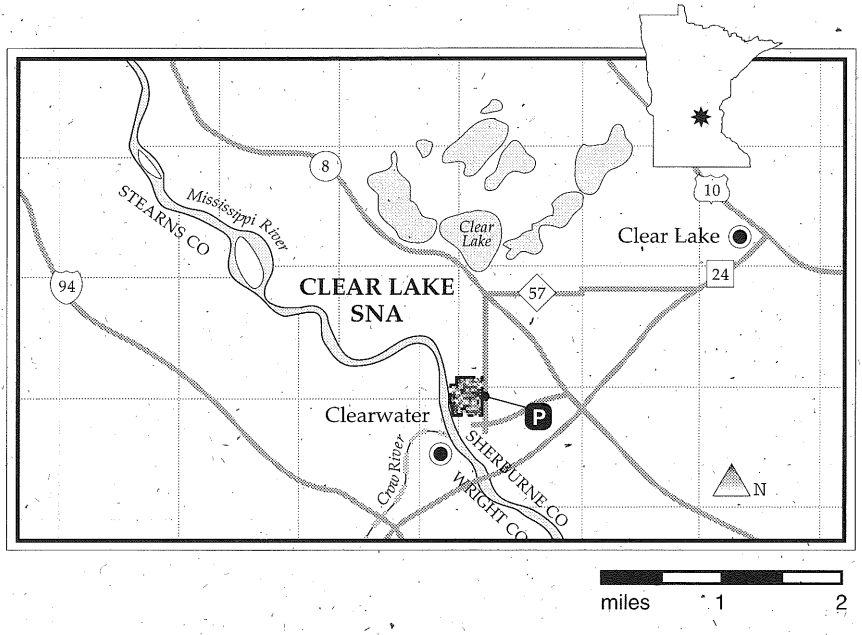
LeSueur County Twp 111N Rng 26W Sec 21, 22



Located from LeSueur 3 miles S on Co Hwy 36, then 0.25 miles W on Twp Rd.

Chamberlain woods protects a mosaic of vegetation types fronting the Minnesota River. Horace and Esther C. Chamberlain personally acquired parcels of woodland totalling 254 acres, then gifted them to the state SNA program. Giant cottonwood, basswood, and elm trees dominate the seasonally wet floodplain forest next to the river. The uplands support remnants of oak savanna, while slopes closer to the river support species typical of the deciduous forest. A series of "point bars" mark the old banks of the river, capturing a visual history as the river route has changed. The best times to visit are in the spring, to observe the dynamics of the river in this floodplain forest, and in fall, when the area is open and dry enough to walk for over a mile and a half along the river's edge.

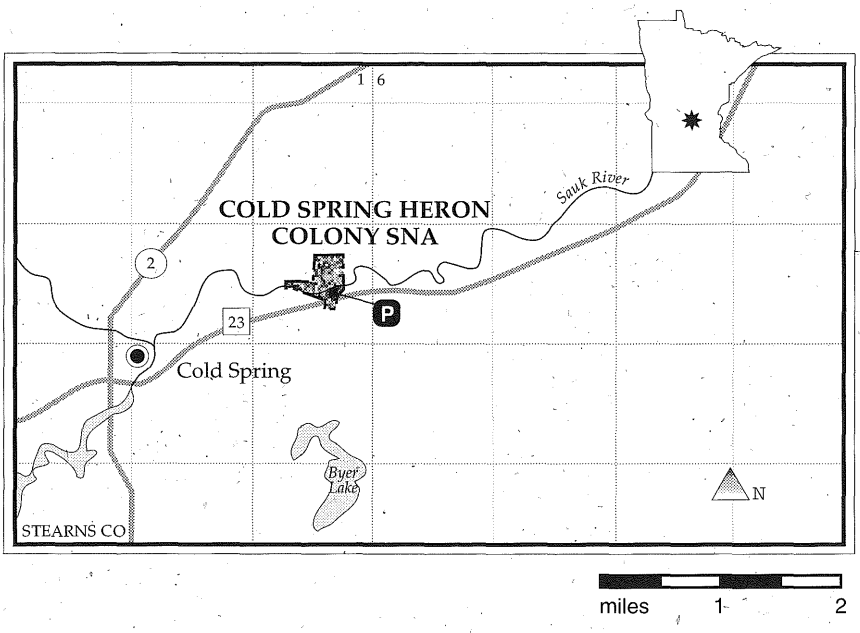
Sherburne County Twp 34N Rng 30W Sec 14, 22, 23



Located from Clear Lake: Co Rd 57 W and S for 2.5 miles. Park on road shoulder.

Clear Lake has the distinction of being the first land parcel acquired under the Wild and Scenic Rivers Program. It contains a mosaic of oak forest, floodplain forest, and old field sumac thicket, along with a small population of the rare Hill's thistle. The Hill's thistle is generally found in transition zones between major forest and prairie communities on dry, sandy or gravelly soil. It has declined as agriculture has increased. Best times to visit are early summer, when puccoons and beard-tongues are blooming, and late summer, when asters, goldenrods, and sunflowers are blooming.

Stearns County Twp 123N Rng 30W Sec 13



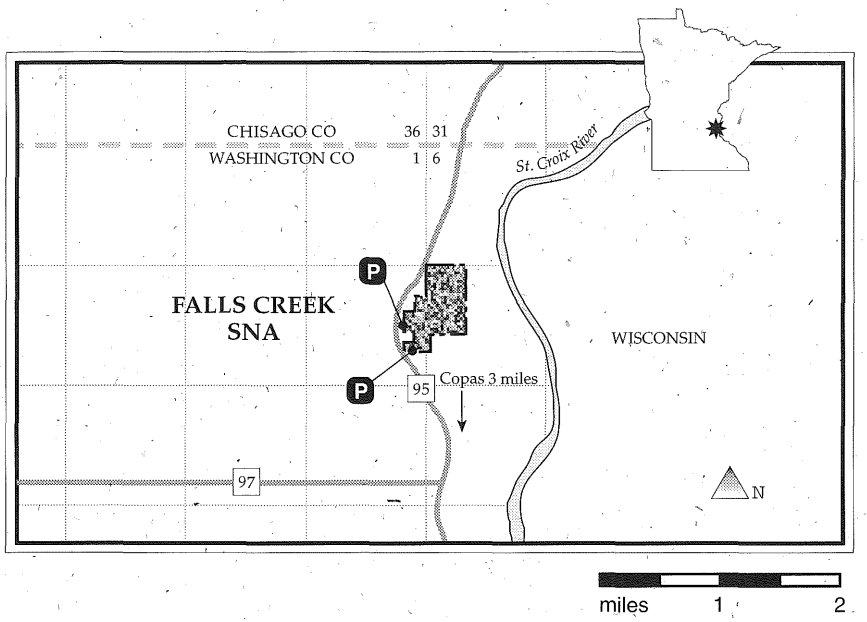
Located from Cold Spring: take MN Hwy 23 NE 2 miles; Park on north side of road across railroad tracks.

Note: Visitation to portions by permit only. Apply through Minnesota SNA Program at (612) 296-3344 or through the Nongame Wildlife Specialist at New Ulm (507) 359-6000.

Cold Spring Heron Colony is a site of open floodplain meadow, floodplain forest, and a small prairie hill. In the past, this site has been home to a large heron colony that was studied longer than any other in the state. However, the herons abandoned the site in 1989. It is not known why the herons left, but a severe drought in 1988 and the loss of many nesting trees in 1983 are likely contributing factors. One day the herons may return to nest at Cold Spring and provide additional long-term research opportunities.

Washington County

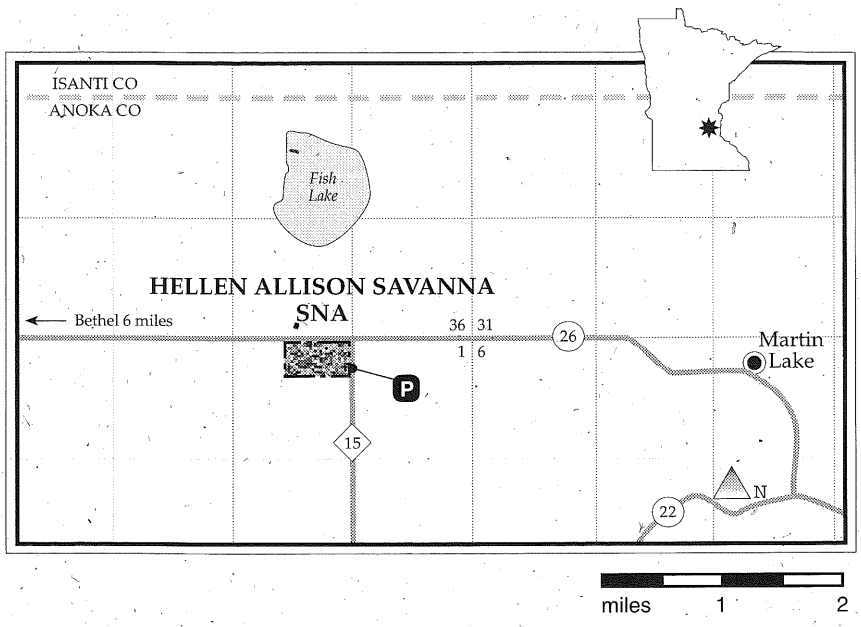
Twp 32N Rng 19W Sec 07
Twp 32N Rng 20W Sec 12



Located 3 miles N from Copas on MN Highway 95. Park next to the wooden sign on the east side of the road or on the field access 1 block north of the wooden sign.

Falls Creek is one of the most diverse natural areas remaining in Washington County. Folded and faulted rocks at this site show the largest displacement of any known Paleozoic rocks in Minnesota, revealing Decorah, Platteville, Glenwood, and St. Peter formations. Steep ravines line the intermittently active stream beds. Slopes face north or south primarily, with ground flora varied accordingly. Pine canopy openings on south slopes permit growth of many species native to bluff prairies. Oak forest occupies the drier ridge tops. The site is unique for its stand of virgin hardwood and white pine forest, which is rare along the St. Croix. Rare Louisiana water thrush and kitten-tails occur on this site. Woodland wildflowers, such as trilliums, rue anemone, and bellwort, bloom in the spring.

Anoka County Twp 33N Rng 23W Sec 02



Located from MN Hwy 65 in Bethel 1 mile E on Co Hwy 24, then 4 miles S and E on Co Hwy 26.

Helen Allison Savanna was named for Helen Allison Irvine, "Minnesota's grass lady," who wrote a text on the 180 grasses of Minnesota. This SNA lies within the Anoka sand plain, providing an excellent example of sand dune plant succession, with blowouts and dunes in various stages of stabilization by pioneer species. Community types found on the site include oak sand savanna, dry prairie with bur oak and pin oak, thickets of willow and aspen, and sedge marshes in scattered depressions. Trees and shrubs characteristic of a savannah are found here: pin oak, bur oak, American hazelnut, choke cherry, willow, and quaking aspen. Other savanna species include lead plant, smooth sumac, slender willow, steeple bush, aster, and goldenrod. Look on the dunes for pioneer sand plants such as sea-beach needle grass and hairy panic grass. Sedge meadows contain tussocks of Hayden's sedge, along with marsh fern and blue-joint grass. Other rare plant species occurring here include long-bearded hawkweed, rhombic-petaled evening-primrose, and tall nut-rush. Prime times to visit are when the pasque flowers bloom in the spring and when the prairie grasses are at their finest in late summer.

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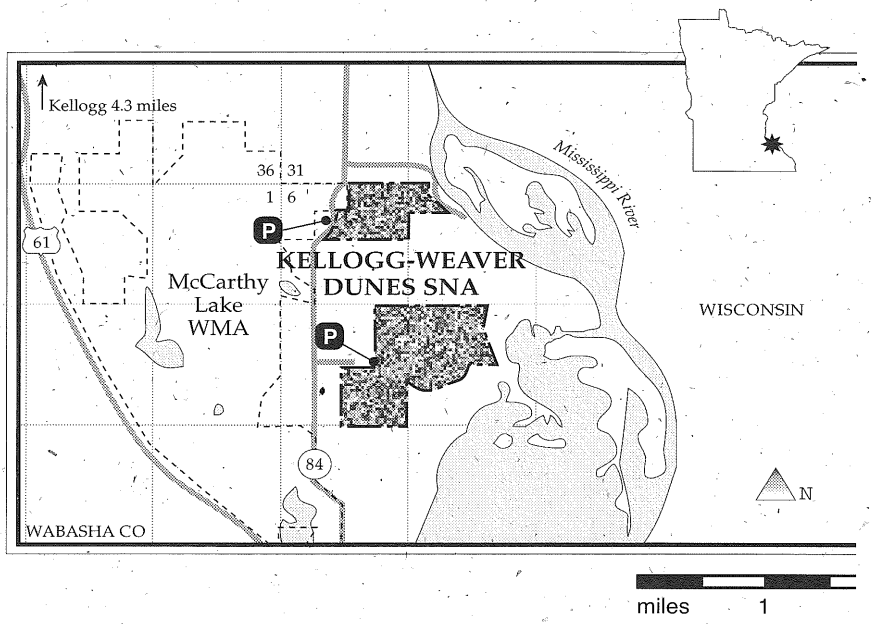
Wabasha County Twp 109N Rng 09W Sec 05-08

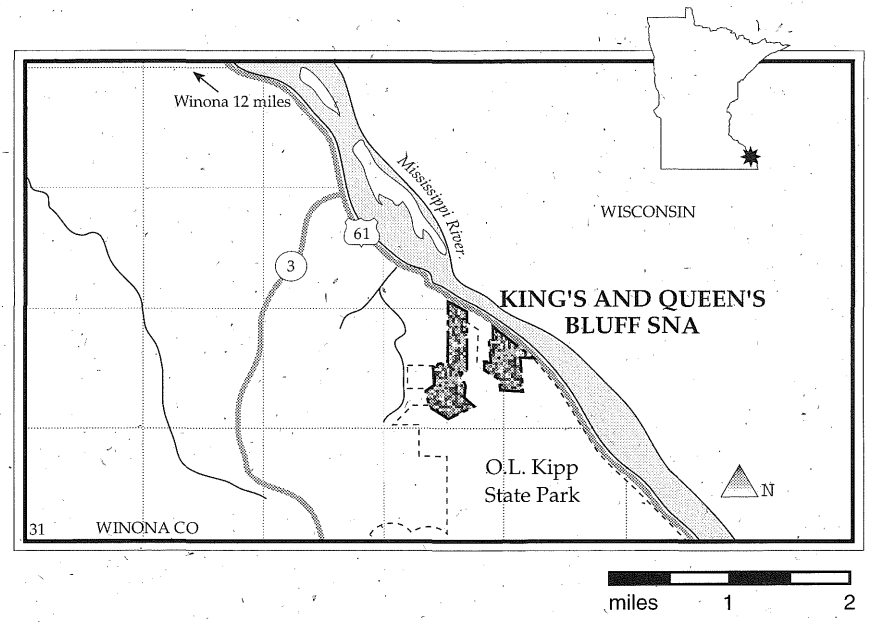


Located from Kellogg 4.3 miles SE on Co Rd 84.

Kellogg-Weaver Dunes contains a rolling sand dune topography well above the current floodplain of the Mississippi River, on a terrace where the Mississippi, Chippewa, and Zumbro Rivers once came together. Some dunes are 30 feet high. The site encompasses a diversity of successional stages ranging from blowouts with bare sand, to mature dunes with dry, mesic, or wet prairie species. An oak savanna, with pin oak, bur oak, and jack pine, occurs along the edges. One of the largest populations of the rare Blanding's turtle uses this site, which provides an ideal habitat of calm, shallow waters rich in aquatic vegetation, with sandy uplands for nesting. Unfortunately, roadways separate the water and upland Blanding's habitats, which means that both the mature females and their hatchlings risk roadkill during their journeys in June and late August. The sand dunes provide another special mid-summer event when the rough-seeded fameflower blooms daily after 4:30 p.m. for just three hours. Midsummer is a good time, too, to observe the rare yellow-fruited sedge and Ottoe skipper butterfly amidst the unusual grasses and wildflowers. Other good times to visit are in mid- to late-spring to see pasque flowers in bloom, and again in the fall for blazing stars, purple coneflowers, and sunflowers.

TNC indicates ownership in part or in whole by The Nature Conservancy.

Winona County Twp 106N Rng 05W Sec 26, 27

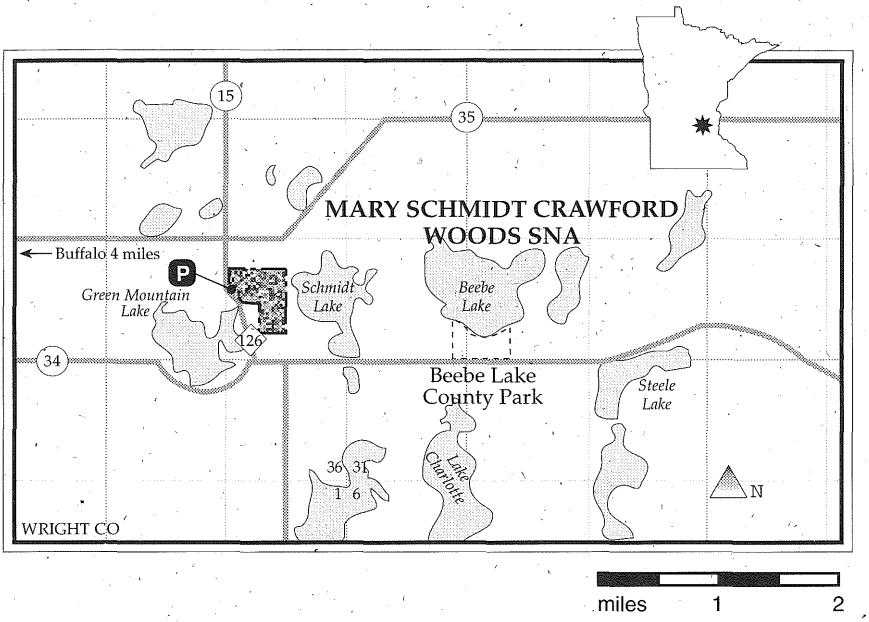


Located from Winona 12 miles SE on US Hwy 61.

Note: Visitation of Queen's Bluff by educational use permit only; closed to all activity from August 15 through September 30. Apply through one of the following: Minnesota SNA Program at (612) 296-3344, the Regional Park Resource Coordinator (507) 285-7432, or the Park Manager at O. L. Kipp State Park (507) 643-6849.

King's and Queen's Bluff support a number of diverse plant community types, including mixed oak forest, second growth forest, goat prairie, and moist shaded cliff. At least fifteen rare species of plants occur here. King's Bluff, open all year round, is northwest of Queen's Bluff; it features goat prairies on the southwest slopes and deciduous forest on the northeast slope. Queen's Bluff is designated as an educational unit and requires an entry permit. King's Bluff affords an excellent view of Queen's Bluff, which rises 500 feet above the Mississippi; a bur oak savanna grows atop the bluff, with goat prairies on the southerly slopes, grading to deciduous forest at lower levels. Late summer is a good time to see the asters, goldenrods, and coneflowers in bloom.

Wright County Twp 120N Rng 25W Sec 25

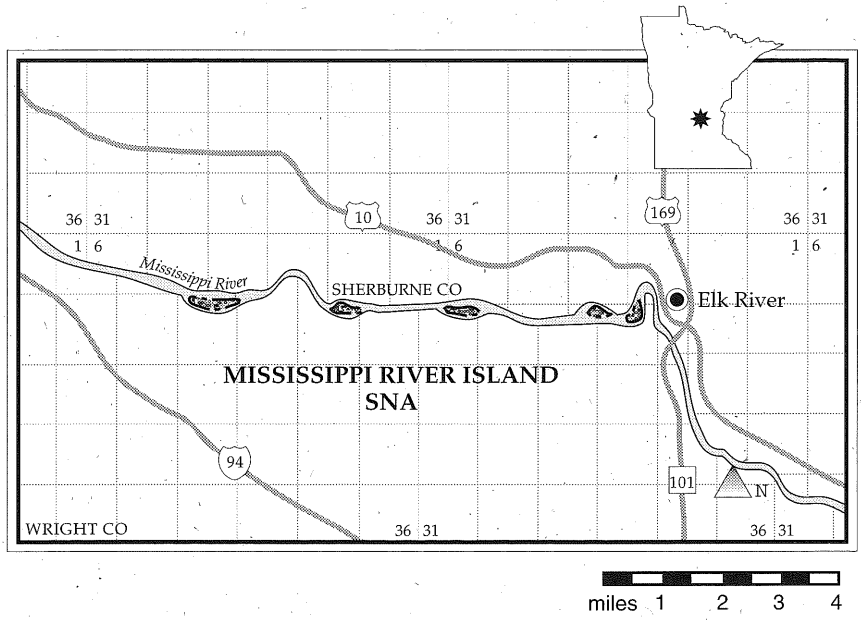


Located from Buffalo 4 miles E on Co Hwy 35, then 0.5 miles S on Twp Rd 126.

Mary Schmidt Crawford, the last private owner of this property, was a descendent of the original settlers. Purchased by The Nature Conservancy at the request of the DNR to preclude development of a housing subdivision, this site contains an excellent remnant of the maple-basswood forest called the "Big Woods," as well as several small wetlands. An old logging trail leads from the parking lot through portions of the site that were logged off in the early 1980s. The best time to visit is in late spring to view trillium, hepatica, and false rue anemone in bloom.

Sherburne County — Twp 32N Rng 26W Sec 03, 04, 06
Twp 32N Rng 27W Sec 02, 04

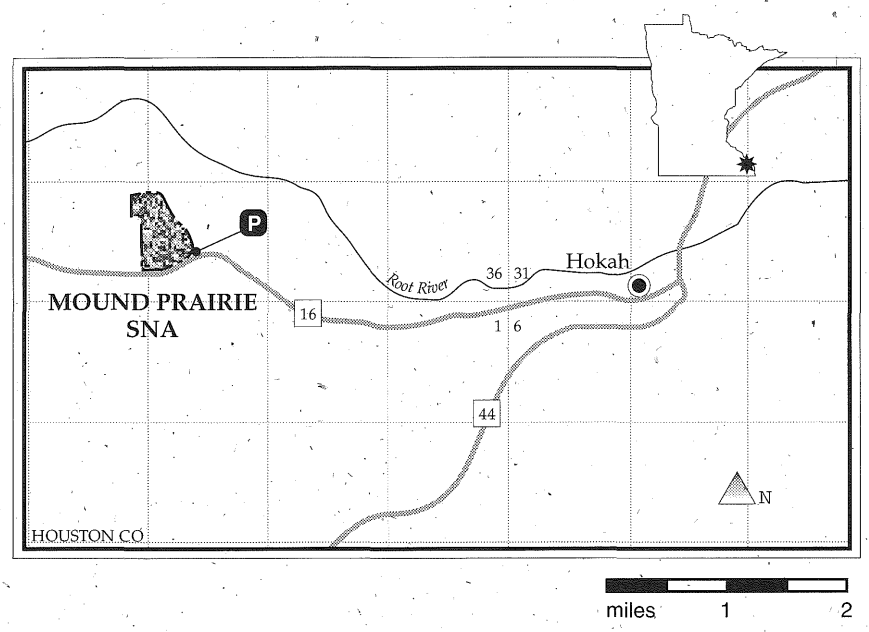
Wright County — Twp 121N Rng 23W Sec 07, 18
Twp 121N R24W Sec 09



Located in the Mississippi River upstream from Elk River.

This site includes five islands formed of outwash and alluvium deposited by the Mississippi River. The islands now rise as high as 30 feet above river level. Flooding, erosion, and sedimentation have resulted in various stages of succession, creating a mosaic of wet floodplain forest, drier floodplain forest, and sandbar plant communities. The best time to visit is when mosquitoes are not at peak density and when stinging nettles are small or dormant.

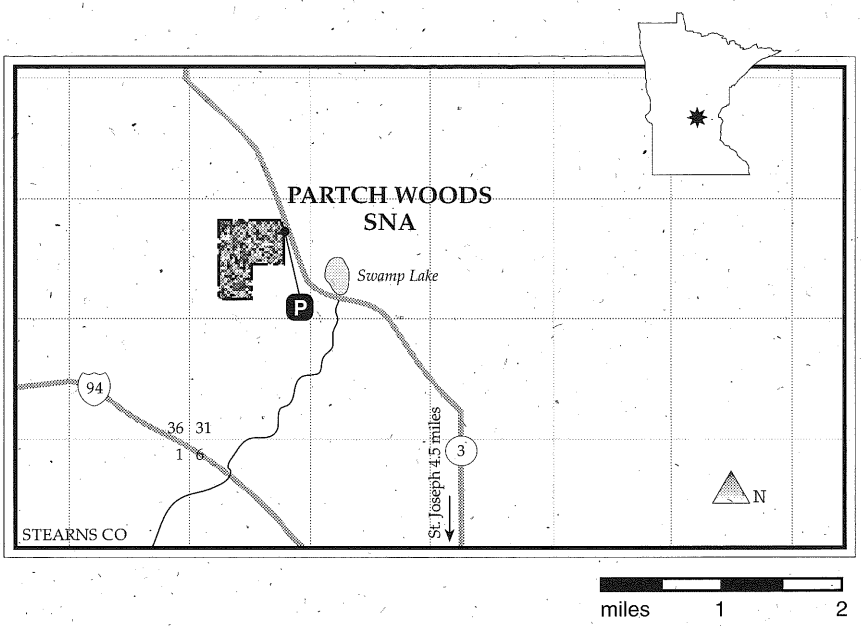
Houston County Twp 104N Rng 05W Sec 33, 34



Located from Hokah about 4 miles W on MN Hwy 16. Park on the gravel forest road on the north side of the highway.

Mound Prairie is located within the Richard J. Dorer Memorial Hardwood State Forest, just south of the Root River. The site contains three southwest-facing goat prairies separated by oak forests and the steep, rocky ravines of ancient stream beds. Stream terraces contain remnants of fine, glacial silt deposited when the valley floors were higher. The superb goat prairies support a highly diverse plant community that includes such rare species as white wild indigo, goat's rue, jewelled shooting star, Ohio spiderwort, and the narrow-leaved milkweed with its greenish flowers. Hike the goat prairies in early to late summer to find these plants in bloom. Spectacular views from this outstanding prairie SNA make the upward climb well worthwhile.

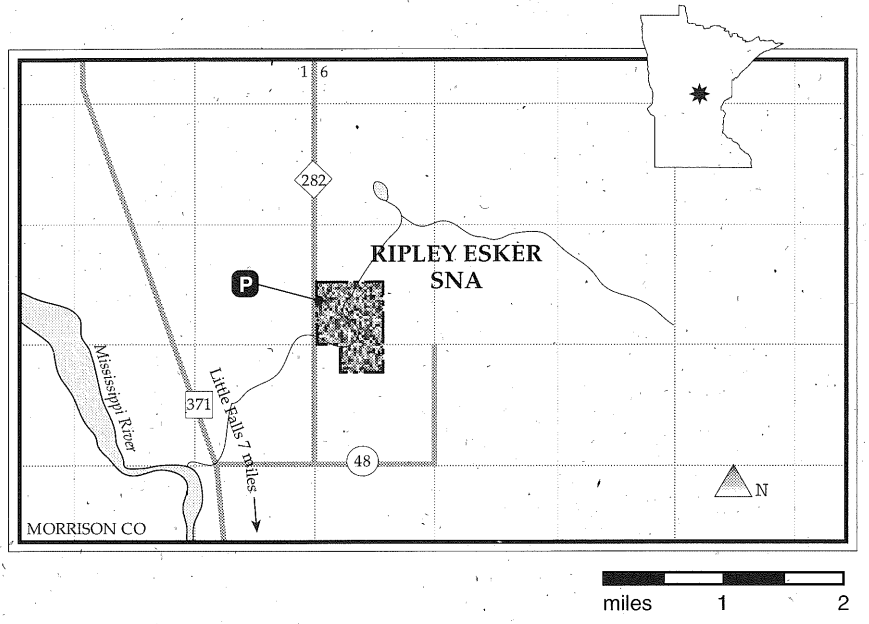
Stearns County Twp 125N Rng 29W Sec 19



Located from St. Joseph 4.5 miles N on Co Hwy 3.

Located near the western border of hardwood forest, Partch Woods contains a fine example, for this latitude, of climax maple-basswood forest. It is named after Max Partch, a professor at St. Cloud University and former student of Aldo Leopold. Partch purchased the property, used it for his study plots, and deeded it to The Nature Conservancy, who transferred it to the SNA program. The site harbors a great variety of spring ephemerals and a spring-fed stream that flows into a wet meadow. The best time to visit is from late spring to early summer when trillium, bellwort, hepatica, and bloodroot are blooming.

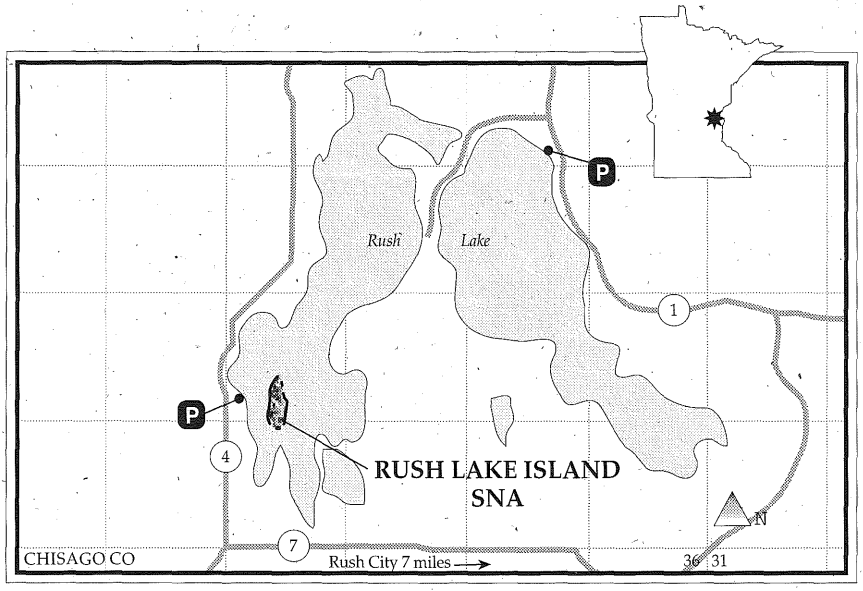
Morrison County Twp 42N Rng 31W Sec 18, 19



Located from Little Falls 7 miles N on MN Hwy 371, then 0.7 mi E on Co Hwy 48, then 1 mile N on Co Rd 282.

This site contains an excellent example of an esker—a glacial deposit that forms a meandering, steep-sided ridge of stream sand and gravel. The esker protected at this site is approximately 0.75 mile long and is part of a 4.75 mile long esker system. Eskers are mined for their valuable gravel and sand, and are becoming increasingly rare. Plant communities range from oak savanna remnant on the south side, to a diverse deciduous woodland on the north. To best view this glacial formation, visit in early spring or late fall when the trees have no leaves and the prairie grasses have cured.

Chisago County Twp 37N Rng 22W Sec 21, 28

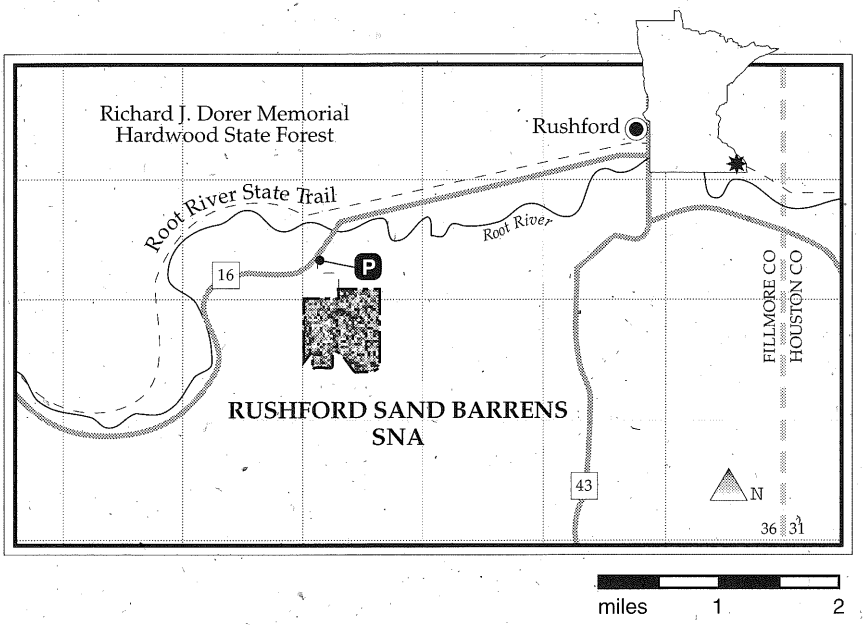


Located from Rush City 7 miles W on Co Hwy 7, then N about 1 mile on Co Hwy 4 to Rush Lake Haven Resort. Accessible by boat. Rush Lake Haven resort, the closest launching ramp, charges a small fee for boat launching.

Note: Closed to landing on the island between April 15 through July 15 to protect young herons.

Rush Lake Island SNA protects one of the state's largest heron rookeries, with as many as 500 active great blue heron nests each year. A few great egrets have begun to nest on the island in the last decade. The best time for viewing is in the spring and early summer from a boat—landing on the island is not permitted between April 15 and July 15 in order to protect the young herons.

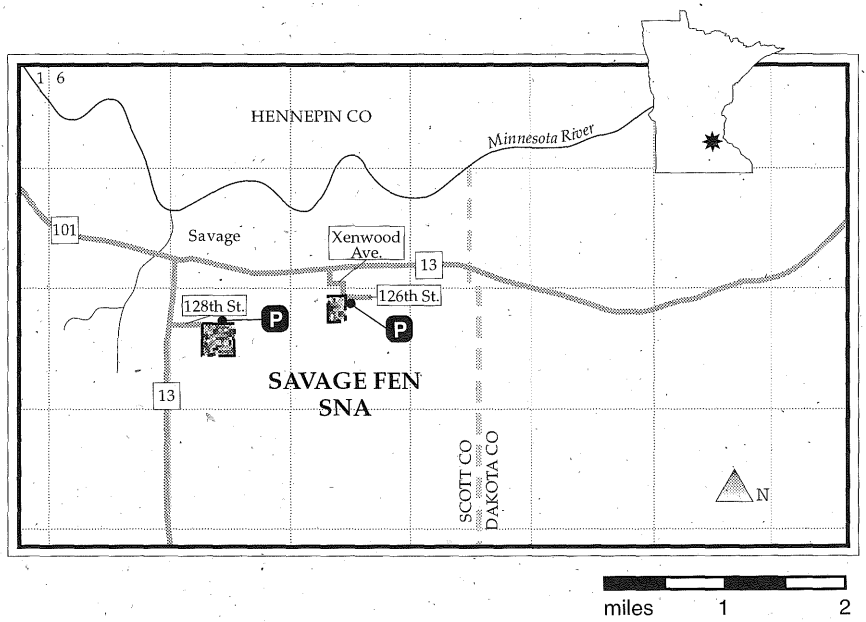
Fillmore County Twp 104N Rng 08W Sec 21, 28



Located 2.5 miles W of Rushford off MN Hwy 16. Walk the posted field lines, beginning with the row of trees heading south, then east. Then walk south through the woods and find the metal sign with the showy lady slipper.

Spared by the last period of glaciation, the Rushford Sand Barrens site features a complex of rare natural communities nestled in the Root River Valley within the Richard J. Dorer Memorial Hardwood State Forest of southeastern Minnesota. At least 13 rare plant species occur here, among one endangered and three threatened natural communities. Because many of these rare species occur at the edge of their ranges, this SNA preserves important genetic, species, and community diversity. The dry-sand oak savanna contains the rare rough-seeded fameflower, clasping milkweed, sea-beach needlegrass, long-bearded hawkweed, old-field toadflax, and others. The jack pine savanna, subject of botanical study since the early twentieth century, supports a number of rare plant species as well as Minnesota's southern-most population of jack pine. The six-lined racerunner, a small lizard, runs across the sand barrens and through the bluff prairies, among the compass plant, silky aster, downy painted cup, lead-plant, blue-eyed grass, and Leonard's skullcap. The beautiful witch hazel, a species of special concern, occurs in the mixed oak forest.

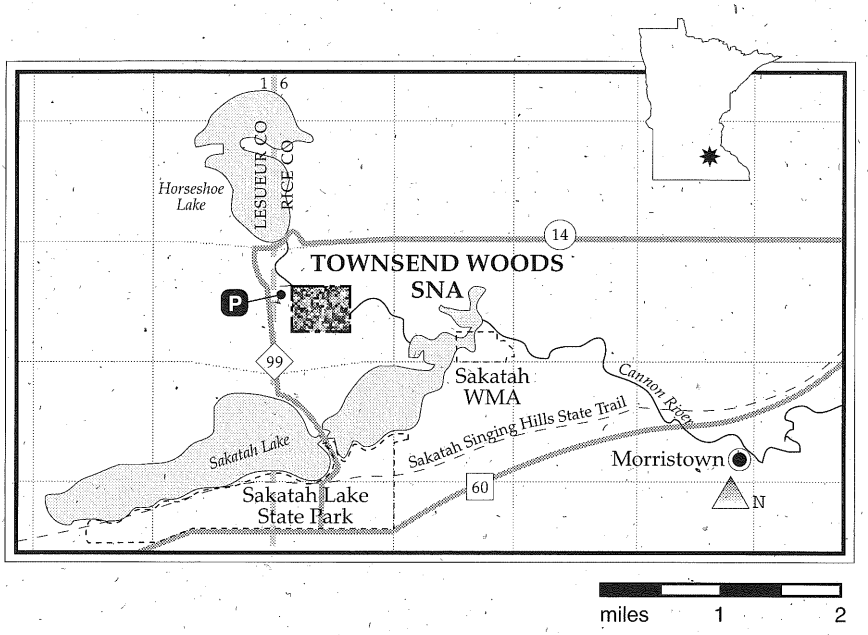
Scott County Twp 115N Rng 21W Sec 16, 17



From MN Hwy 101 in Savage, travel 0.5 miles S on MN Hwy 13, then 0.25 miles E on 128th St.

Savage Fen is notable for its rare wetland plant community. A series of alkaline seeps and springs emerge from the base of a bluff formed of calcareous glacial deposits, which were left by the Des Moines lobe at the end of the Wisconsin Glacial period. The fen community found on the moist peat substrate is very sensitive to disturbance.

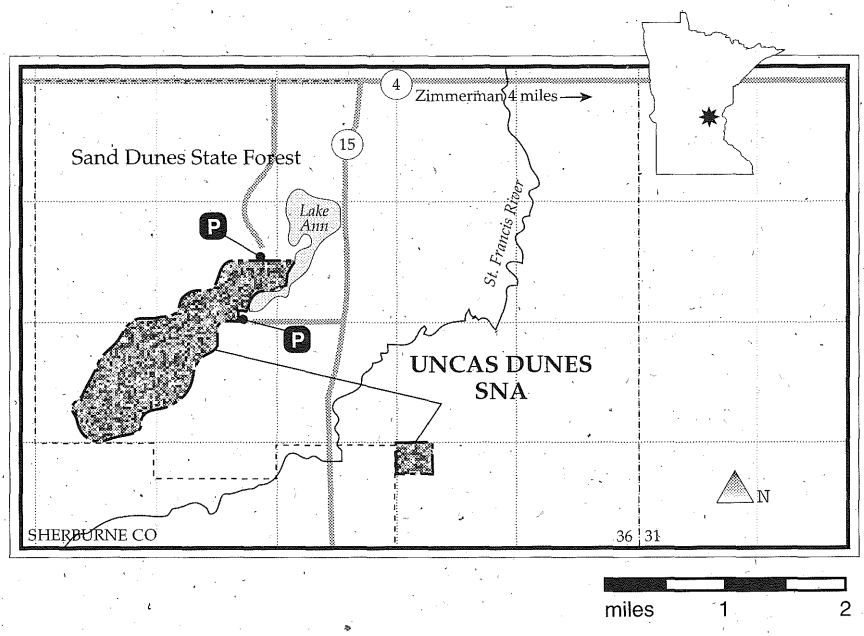
Rice County Twp 109N Rng 22W Sec 18



From Morristown, go 3 miles W on MN Hwy 60, then turn N on Co Rd 99 and go 3 miles through Sakatah Lake State Park. Park in lot.

Townsend Woods, though small, is the finest example of the "Big Woods" that used to cover parts of south central Minnesota. The Townsend family originally purchased this land from the U.S. government at the time of settlement—hence the name. The site contains a beautiful virgin forest of sugar maple, red oak, basswood, and oak, with few shrubs. The loose, fertile soil is lush with spring ephemerals. The best time to visit this site is mid- to late-spring to view woodland wildflowers such as hepaticas, bloodroots, trilliums, Dutchman's breeches, and spring beauties.

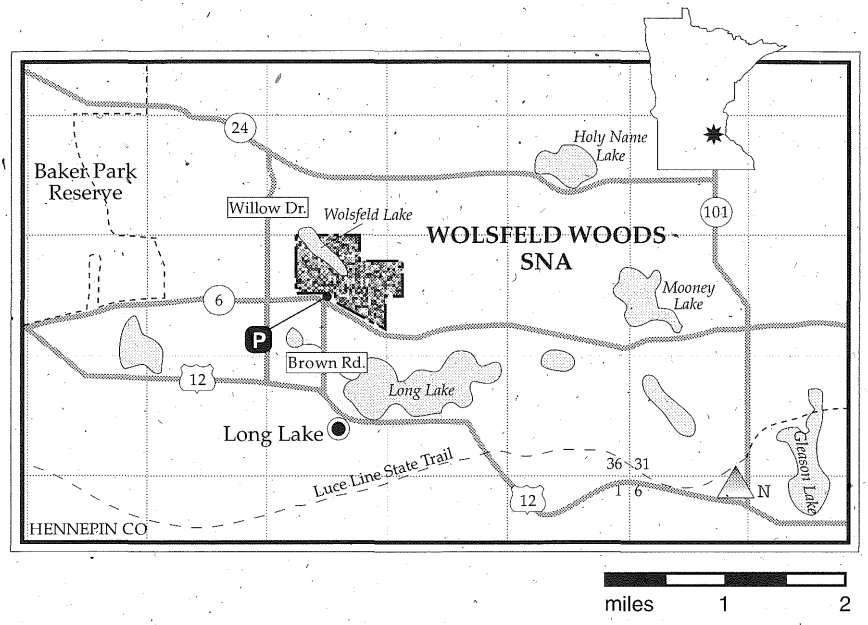
Sherburne County Twp 34N Rng 27W Sec 21, 22, 28, 29, 35



Located from Zimmermann 4 miles W on Co Hwy 4, then 1.5 miles S to the Sand Dunes State Forest Campground, then a short walk south.

Uncas Dunes, located within the Anoka Sandplain, contains a relic dunefield associated with Glacial Lake Grantsburg. Natural plant communities found here include oak savanna, oak forest, and wetland. The rare Uncas skipper gives this site its name; this is one of only two sites in the state where this species is found. Other rare species here include sea-beach needlegrass and annual skeleton-weed. Active management at this site includes removal of planted species and prescribed burning. The best time to visit is late summer when asters and goldenrods are in bloom.

Hennepin County Twp 118N Rng 23W Sec 26, 27

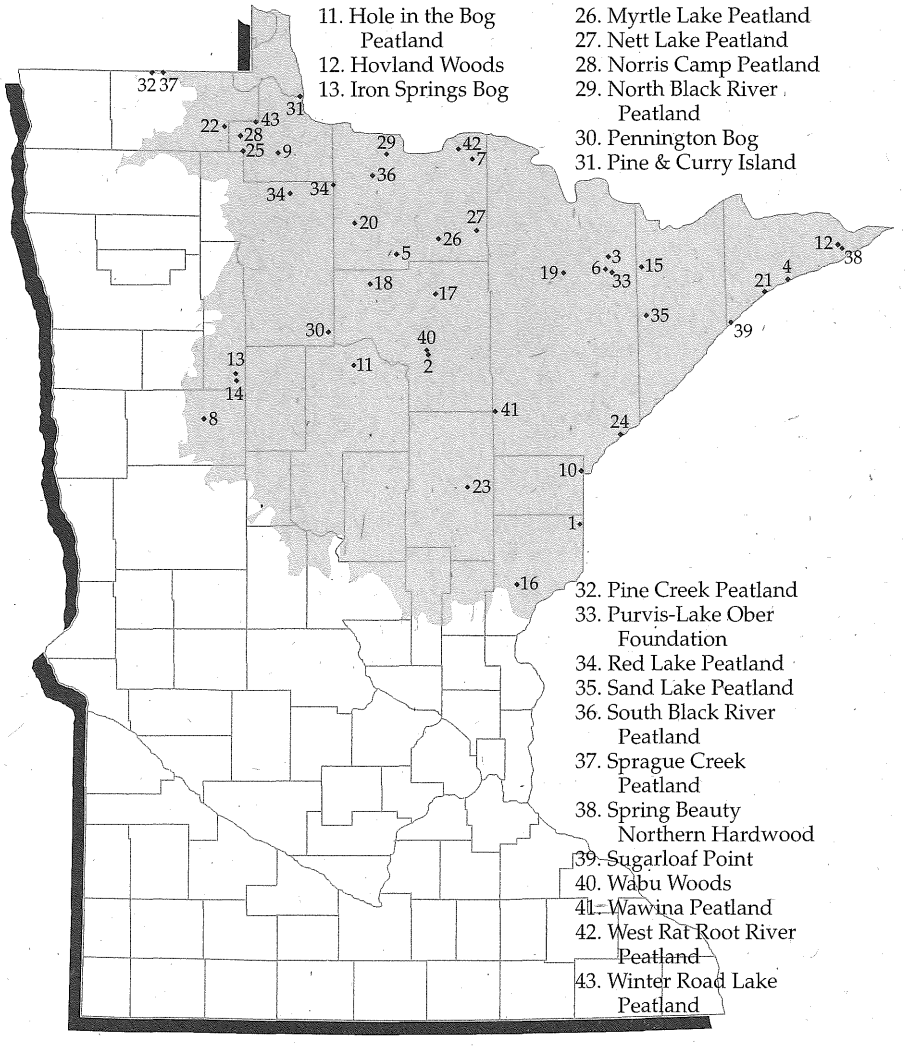


Located from Long Lake 0.5 mi N on Brown Rd to Co Hwy 6. Park in the Trinity Lutheran church parking lot.

Wolsfeld Woods, named for its German homesteaders, is a premier example of the original "Big Woods" forest that once covered the south central part of the state. Very few remnants remain due to urban expansion, agriculture, and industrial development. This large, mature stand of hardwoods covers gently rolling hills with a wide variety of tree species, including red oak, ironwood, butternut, maple, elm, and basswood. Trilliums, hepatica, bloodroot, and dutchman's breeches grow on the forest floor. Visitors are required to stay on marked trails. The best time to visit is in late spring to view blooming woodland wildflowers and in fall for the outstanding color display.

Coniferous Forest

1. Black Lake Bog
2. Botany Bog
3. Burntside Islands
4. Butterwort Cliffs
5. Caldwell Brook Cedar Swamp
6. Eagle's Nest Island No. 4
7. East Rat Root River Peatland
8. Greenwater Lake
9. Gustafson's Camp
10. Hemlock Ravine
11. Hole in the Bog Peatland
12. Hovland Woods
13. Iron Springs Bog
14. Itasca Wilderness
15. Kawishiwi Triangle
16. Kettle River
17. Ladies Tresses Swamp
18. Lost 40
19. Lost Lake Peatland
20. Lost River Peatland
21. Lutsen Natural Area
22. Luxemberg Peatland
23. McGregor Marsh
24. Moose Mountain
25. Mulligan Lake Peatland
26. Myrtle Lake Peatland
27. Nett Lake Peatland
28. Norris Camp Peatland
29. North Black River Peatland
30. Pennington Bog
31. Pine & Curry Island



32. Pine Creek Peatland
33. Purvis-Lake Ober Foundation
34. Red Lake Peatland
35. Sand Lake Peatland
36. South Black River Peatland
37. Sprague Creek Peatland
38. Spring Beauty Northern Hardwood
39. Sugarloaf Point
40. Wabu Woods
41. Wawina Peatland
42. West Rat Root River Peatland
43. Winter Road Lake Peatland

Coniferous Forest

The Coniferous Forest is the largest of the state's four landscape areas. It covers two-fifths of the state, including the north central and northeastern regions. Once mountainous, this rugged area claims both the highest and lowest points in the state.

Glaciers sculpted this landscape, leaving relatively thin deposits of till blanketing the bedrock, in the northeast portion of this region to deeper deposits in the southern and western portions Boulders, outcrops, hills, numerous lakes, bogs, and vast tracts of forest land comprise Minnesota's scenic and much beloved "up north." The state's iron ranges also occur here, along with many other Precambrian rocks and well-exposed lava flows. Dense forests occupy the uplands, with bedrock lakes in the northeast, ice block lakes in the south and west, and large, open peatlands in lower areas.

Forest Communities

Cold winters and cool summers caused by Arctic air masses result in extreme temperature variations and a low energy budget for the plant communities found here. Most of the precipitation occurs during warm months, and the air and soils are moist in comparison to the non-forested landscapes of western Minnesota. Soils that have developed from glacial till and loess now thinly overlay the Canadian shield.

Species that succeed in this environment have adaptations that economize on energy—both temperature and sunlight—and on nutrient requirements. For example, coniferous trees hold their needles from 2 to 15 years, depending on the species. This adaptation avoids the necessity for producing a full crop of new leaves every spring, and it also allows photosynthesis for extended periods of the year. Species that occur in the boreal hardwoods, such as trembling aspen, balsam poplar and paper birch have special adaptations to withstand temperatures below -30° Fahrenheit.

Forest Canopy

The canopy layer of a forest community may be seen as being the primary buffer between atmospheric conditions and the communities below; it bears the brunt of wind and temperature extremes, and is the first beneficiary of sunlight.

Coniferous Forest canopies may be dominated by coniferous, deciduous, or mixed coniferous-hardwood species.

Six forest communities that are characteristic of in Minnesota's Coniferous Forest area: white pine, red pine, jack pine, black spruce-feathermoss, spruce-fir, and upland white cedar. While all pines regenerate after fire, the fire regime differs for each species.

After a disturbance in the coniferous forest, such as logging or burning, the canopy opening favors deciduous species, with their higher rates of photosynthesis. Aspen and paper birch pioneer such areas, and they may in turn be followed by mixed hardwood and coniferous trees in a zone of intergrading communities. Northern hardwood stands of sugar maple, basswood, yellow birch, and associated species develop on mesic uplands. On drier sites in the south and west portions of the Coniferous Forest, oak communities are more common.

Shrub Layers

Beneath the canopy layer, shrubs vary locally in density. Seedlings and saplings of canopy trees bide their time in the shade; when a canopy tree falls, these young trees inherit the sunlight they need to succeed to canopy status themselves. Shrub-level species also include beaked hazel, mountain maple, honeysuckle, and dogwood, along with others associated with specific soils and canopies. Variation of shrub density within the forest significantly affects the habitat and diversity of animal species.

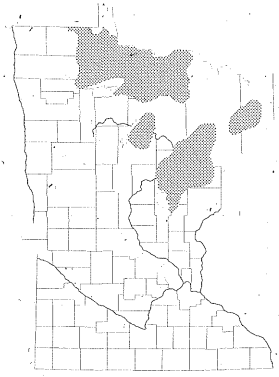
Groundlayer

The groundlayer in coniferous plant communities often includes feathermosses as well as forest herbs. The acid needle litter on the forest floor supports herbs such as clintonia and rose twisted-stalk, while feathermoss communities support such herbs as wintergreen and pyrola.

Peatlands

Though prehistoric in origin, the peatlands have only recently "arrived" in public awareness. Most are relatively remote, undeveloped, and not suited to casual exploration. As a result, our understanding of peatland ecological systems has just begun to develop. Minnesota's peatlands have achieved special recognition as a world resource, and deserve special attention.

Figure 5.1. Peatland distribution in Minnesota



Within the Coniferous Forest's rugged, coniferous terrain lie the vast lowlands of Minnesota's glacial lake plains. Unique soils, natural communities, climate, and water conditions in these areas have combined to form some of the world's largest peatlands. Smaller peatlands occur in scattered kettle-hole basins throughout the Coniferous Forest region. Figure 5.1 shows peatland and distribution within the state.

Formation

Peat formation requires steady, stagnant, low-oxygen conditions that prevent normal decomposition of plant debris. These conditions exist on all continents and at all latitudes, including tropical marshes and swamps. Variations in climate, hydrology, native species, and other factors result in the considerable range of peatland communities to be found around the world.

Minnesota's peatlands formed in areas of poor drainage and cool climates, with little evaporation during summer months. The water table lies at or near the surface in these areas, limiting the oxygen needed for decomposition of plant debris. Year after year, these organic materials accumulate, forming the partially decomposed mass of organic material, dark brown or black in color, that is known as *peat*.

Peatlands are fascinating ecosystems, about which we will undoubtedly hear more in the future. A useful source of information on this subject can be found in the book, The Patterned Peatlands of Minnesota, edited by H.E. Wright, Jr., Barbara Coffin, and Norman E. Aaseng, published by the University of Minnesota Press in 1992. Most of the information in the following discussion comes from this source.

Significance

Minnesota's peatlands are regionally and internationally significant for a variety of reasons. One reason is their extent: Minnesota has more peatland area (over 6 million acres) than any other state in the U.S. except Alaska. These peatlands serve as an important water reservoir, the significance of which has yet to be fully understood.

In addition, Minnesota peatlands present—in nearly pristine condition—unique developmental stages and landforms for research by the world's scientific community. They demonstrate the intricate hydrological patterns and landforms that develop over large areas with diverse water chemistry, flow patterns, and developmental processes. As an added aid to research, Minnesota's peatlands are among the few in the world that are free of permafrost. Permafrost makes it harder to investigate the groundwater and subtle drainage systems so essential to peatland formation and development.

Peatlands also offer excellent research opportunities regarding the complex adjustment of living organisms to their environment. Harsh environmental conditions in the peatlands present dramatic challenges to the survival and adaptation of plant and animal species. In addition, Minnesota peatlands occur at the edges of three biomes, resulting in unique species assemblages, including 24 species that are endangered, threatened, or of special concern in the state.

Minnesota's peatlands present other research advantages as well. Other world peatlands have been utilized commercially (such as northern Europe) or exist in areas even more difficult to reach (such as Siberia and the Hudson Bay Lowlands). In comparison, Minnesota peatlands are relatively accessible, yet relatively free of development.

Bogs and Fens

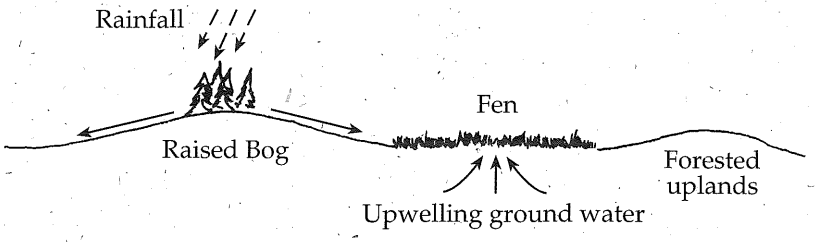
A peatland community reflects relationships among plants, topography, climate, and water, that are very different from those found on other Minnesota landscapes. These communities vary with the water chemistry and sources, and are very sensitive to disturbance.

Peatlands that receive water both from precipitation and ground water, which has percolated through mineral soil, are classified as *fens*. The water supply in a fen is only slightly acidic or nearly neutral, and it carries minerals and other nutrient content. Fens look like watery meadows, with sedges, reeds, grass-like plants, occasional shrubs, and scattered, stunted trees.

Bog communities, on the other hand, develop in isolation from ground water and run-off from nearby uplands. They receive water only through precipitation—snow or water. Bog waters have higher levels of acid and less mineral and

nutrient content than ground water does. Fewer plants and animals have adapted to these conditions. Sphagnum mosses, ericaceous shrubs, and some sedges cover the ground; trees may or may not develop. (See figure 5.2).

Figure 5.2. Fens and bogs



Peat Landforms

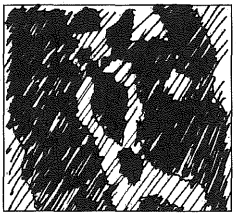
Boreal peatland communities are distinguished by their shape, vegetation, and water chemistries. Though these communities are actually comprised of land, water, and plants, they often resemble geological landforms, such as river channels, islands, and ripple marks. These landform shapes give each community and its features their names. Three peat landforms are commonly found in Minnesota: the raised bog, the water track, and the spring fen.

The *raised bog* is one of Minnesota's most prominent peat landforms. It is a dome-shaped accumulation of peat, often with a forested crest of black spruce growing at the top and radiating down along the sloping sides. At the base lies either a sphagnum lawn (muskeg) or a fen. The only source of water in a raised bog is precipitation: its raised profile isolates it from run off, and an underlying basin of clay or loam topped with peat prevents groundwater from reaching it. As a result, bog water is acidic and low in mineral nutrients, limiting the number and diversity of plant species.

Water tracks look like river channels on aerial photos. They receive runoff from across the peatland surface, putting them in the fen category of water chemistry and vegetation. Often formed on glacial outwashes and beach ridges, their sandy soils allow groundwater to percolate up from the water table below to join the surface run-off. Watertracks are bordered by swamp forests or raised bogs. A watertrack may be featureless or patterned:

Figure 5.3. *Patterned fen*

Figure 5.4. *Spring fen*



—*Featureless watertracks* lack pattern but may contain linear bands of trees, shrubs, or meadow that are *parallel* to the flow.

—*Patterned fens* may contain networks of peaty ridges (known as strings) and pools (known as flarks) that are perpendicular to the slope, or tree islands that parallel the prevailing slope. Island shapes may be ovoid, tear drop, or circular, reflecting variations in hydrology. *Spring fens* are similar to water tracks with tree islands. They are a network of nonforested channels that branch, then rejoin, as they drain through the swamp forest. Their waters are alkaline, reflecting their ground water source.

These landforms often co-exist in complexes; that is, a large peatland contains more than one landform type. Known as mire complexes, they are classified by size and arrangement of bog, fen, and mineral soil formations. Table 5.1 shows landforms contained in representative peatland SNAs.

Table 5.1. Peat Landforms in Minnesota SNAs

SNA	Water track	Ribbed fen	Tear drop islands	Circular islands	Spring fen	Raised bog	Ovoid island
East Rat Root River	x					x	
Hole In Bog						x	
Lost Lake	x	x				x	
Lost River	x	x	x		x	x	
Luxemberg	x	x					
Mulligan Lake	x	x	x				
Myrtle Lake	x	x	x	x		x	x
Nett Lake					x		
Norris Camp	x	x					
North Black River	x	x				x	x
Pine Creek	x	x			x		
Red Lake	x	x	x	x		x	x
Sand Lake	x	x				x	
South Black River	x	x				x	
Sprague Creek					x		
Wawina	x					x	x
West Rat Root River	x					x	
Winter Road Lake	x	x					

Plant Communities

Despite the varied and often harsh conditions of peatland landforms, many plants grow in all of these wetlands. The acidic waters of the bog, however, exclude some species that grow only in fens. For this reason, peatland plant communities are classified on the basis of these indicator species.

Eight of Minnesota's rare vascular plant species occur in peatlands, mainly patterned peatlands. Included among these are sundews and orchids. Other unique plants of peatlands include insectivorous pitcher plants, bladderworts, and ericaceous plants.

Historically, wildfire helped maintain brushland habitat that supported moose, waterfowl, and fur bearers. Fire suppression has permitted brushland to succeed to forest in many locations.

Table 5.2. Bog and fen plant communities

Characteristic	Bog	Fen
Forest	Black spruce, optional	None; too wet
Shrubs	Ericaceous; Labrador Tea, leatherleaf, swamp laurel, bog rosemary	Willows, bog birch
Ground layer	Sedges, cotton grasses, nearly continuous mat of Sphagnum moss species	Narrow-leaved grasses and sedges, optional mosses (usually no Sphagnum moss species) and aquatic species
Other	Poor vascular plant diversity and little biomass	Moving groundwater is either visible or apparent from vegetative patterns

Typical forest communities consist of stunted black spruce and tamarack. Nonforested peatland communities are highly specialized, usually consisting of sedge tussocks, mossy carpets, and a variety of other specialized plants, including some orchid species, as indicated in Table 5.2.

Peatland Animals

The unique character of the peatlands provides relatively sparse cover for large animals. The limited habitat serves only specialized species, and extreme conditions exclude many others. Animals that spend part or all of the year here form distinctive communities of habitat specialists: their

adaptations to these harsh conditions make them less adaptable to other areas. To add to the unique interest of peatland communities, their very newness (estimated at less than 4000 years) may mean that species migration and adaptation are still taking place.

Few **large mammal** species are specifically associated with forested peatlands.

- Woodland caribou thrived here until their migration routes to Canadian breeding grounds were cut off, and the small bands that were stranded in Minnesota peatlands died off. Moose and timber wolves also inhabit the edges of the peatlands, where forest cover and browse species are available.
- Construction of ditches during early statehood have allowed beaver and muskrat to increase, along with their predators, otter and mink.

As with large mammals species, fewer **small mammal** species inhabit peatlands. Many mammals require dry nest sites, protective shelter, upland foods, or a burrowing habitat that the peatlands do not provide. Bog lemmings actually prefer peatland habitat, however, and many species of shrews and voles can also be found. Although animals of the peatlands may be difficult to observe directly, careful observers can find evidence of their activity, such as sedge "haystacks" piled in the sun (bog lemmings), heaps of spruce cone bracts (red squirrel), or pruned alder stems (snowshoe hare).

Migratory **bird species** bring special interest to the peatlands in spring and summer breeding months. Their preferences for food and cover draw them to bog or fen habitats, as shown in Table 5.3. Great gray owls are permanent residents of northern Minnesota peatlands, where they nest in forests. Winter sightings of great grays are most common in "invasion years." No federal or state endangered or threatened bird species occur in peatlands, though 14 species of special concern utilize habitats of open fen, muskeg, or coniferous forest.

"Cold-blooded" **amphibians and reptiles** that inhabit peatlands are relatively limited. More frogs and toads have adapted to this environment than turtles, lizards, and snakes, though they also occur here. Species requirements for moisture, pH levels, temperature, and nutrition govern distribution. For example, terrestrial burrowers and aquatic

Table 5.3. Preferred peatland habitat of bird species

Vegetation	Birds that prefer fens	Birds that prefer bogs
Trees shrubby habitat	Alder flycatcher Swamp sparrow Common yellow-throated LeConte's sparrow Clay-colored sparrow Yellow warbler	Connecticut warbler Yellow-rumped warbler Nashville warbler Palm warbler Hermit thrush Yellow-bellied flycatcher Dark-eyed junco Chipping sparrow Lincoln's sparrow
Meadow habitat	Savannah sparrow Bobolink Sandhill Sedge wren	Savannah sparrow

species that require deep water that does not freeze to the bottom find this environment discouraging; species that breed early in spring are limited by the short summer season. Toxicity of bog waters affects the survival rate of creatures using it as a breeding medium.

Insects inhabit the peatlands in abundance, though there remains much to be learned about them. Visitors will find an ample supply of mosquitoes, damsel flies, dragon flies, and deer flies.

Coniferous Forest Landscape Regions

Wetland and upland plant communities merge gradually from one to another, reflecting changes in landforms, moisture, and microclimate. Across the huge area of the Coniferous Forest, variations also occur regionally, the extreme eastern and western portions showing considerable differences, for example. Seven landscape regions within the Coniferous Forest are recognized, and a brief description of each one follows. (Figure 1.6).

Border Lakes

Glacial erosion produced the patterned lakes and ridges of this strip of land extending along the Canadian border. This is the landscape region of the Boundary Waters Canoe Area. Little glacial deposition occurred here; soil is thin and only slightly developed. Bedrock outcrops are common in this rugged terrain.

North Shore Highlands

This scenic, narrow strip along the north shore of Lake Superior overlooks the lake from about 300 meters above. Many inland rivers cross it as they flow directly into the lake. Rugged volcanic formations are preserved in the Sugarloaf Point SNA, while Butterwort Cliffs SNA, just west of Grand Marais, contains a wet rock shore natural community. The lake climate influences the vegetation, which is dominated by aspen-birch conifer, along with white and red pine and northern hardwoods. Soil is better developed than in the Border Lakes.

Laurentian Divide

This central part of the Arrowhead contains the three-way drainage divide; water flows northward to Hudson Bay, eastward to Lake Superior and the St. Lawrence River, and southward to the Mississippi and the Gulf of Mexico. Just west of this region lies the Herman beach line of the Agassiz lowlands. Aspen-birch conifer vegetation covers over 75 percent of this area, with many conifer bogs and swamps. Other vegetation includes white and red pine and the mixed hardwood and pine types.

Tamarack Lowlands

Once entirely covered by the glacial lakes Aitkin and Upham, this region has few uplands. The Automba Drumlin area lies in its southern portion; the Swatera Plain and Aitkin Lacustrine Plain make up its western area. Extensive peatlands are intermittently interrupted by sandy mineral soils. Conifer bogs and swamps characterize this landscape. Aspen-birch conifer communities are also found here, with scattered white and red pine and mixed hardwood and pine.

Agassiz Lowland

This low, flat landscape region accounts for 9 percent of the state. Entirely covered at one time by Glacial Lake Agassiz, this region's legacy lies in its extensive peatlands. Conifer bogs and swamps account for over 75 percent of this landscape, with occasional aspen-birch conifer and other communities. The Herman beach line marks its southeastern border.

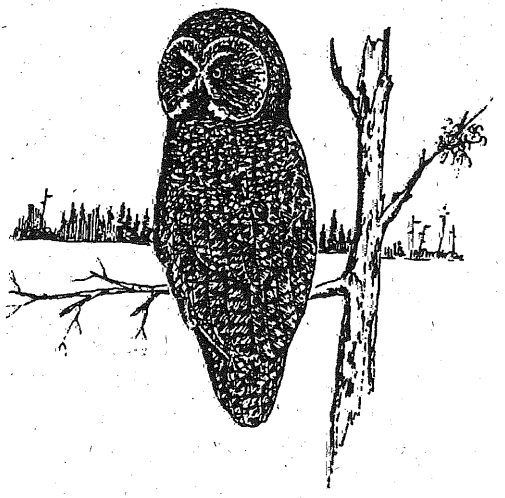
Pine Moraine

This north central region of Minnesota originally was covered with aspen, white, red, and jack pine forest, with some conifer swamps. These plant communities dominate

today, where development has not taken over. Nearly every vegetation type that occurs in Minnesota can be found here, though the sample may be small.

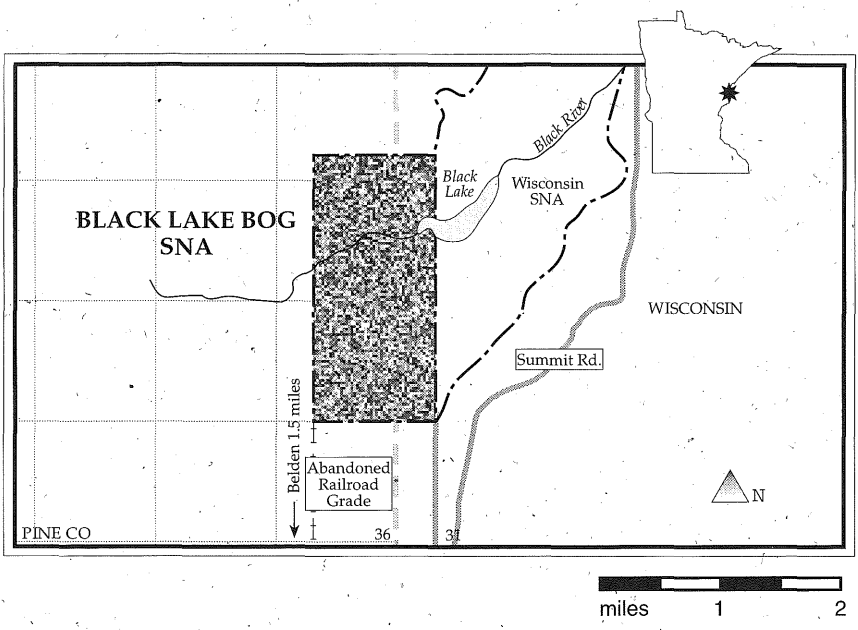
Mille Lacs

Including Lake Mille Lacs, the Brainerd-Pierz Drumlin area, and excellent samples of gneiss and granite, this area is rich in glacial history. The white pine forest here fed the flourishing lumbering industry at the turn of the century. Today, vegetation is equally divided among the aspen-birch conifer, conifer bogs and swamps, white and red pine, white pine, and mixed hardwood and pine types.



Pine County

Twp 45N Rng 15W Sec 18, 19, 30, 31
Twp 45N Rng 16W Sec 13, 24, 25, 36

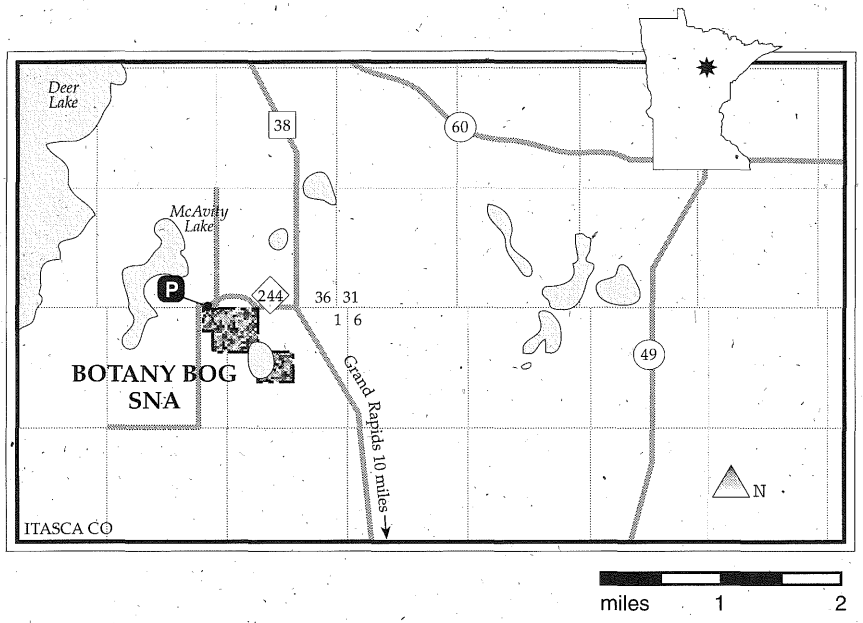


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located from Sandstone 25 miles E on Co Hwy 30 and Co Rd 141, then 13 miles N on Co Hwy 31 to the abandoned town of Beldon, then 1.5 miles N on the abandoned Soo Line. Access by canoe from Wisconsin, via Black River.

Black Lake Bog is an interstate natural area located in Pine County, Minnesota and Douglas County, Wisconsin. The Minnesota portion of the site contains black ash swamp, fen, forested bog, and open bog plant communities. Insectivorous pitcher plants and round-leaved sundews can be found in open bog communities. The best times to visit are in early summer to view coniferous woodland wildflowers in bloom, in early fall for the tremendous diversity of color, and again in mid-winter to see timber wolf tracks in the snow.

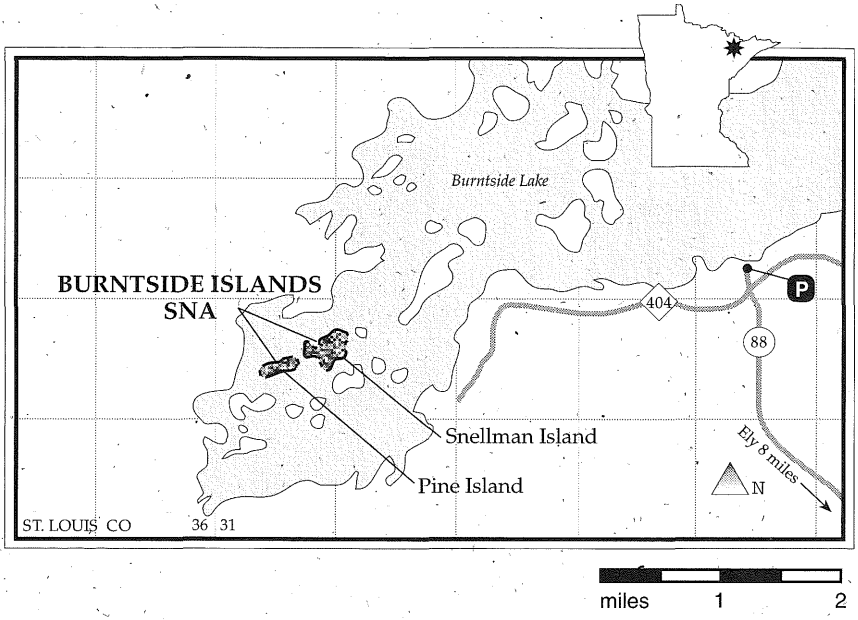
Itasca County Twp 56N Rng 26W Sec 01, 02



Located from Grand Rapids 10 miles N on MN Hwy 38, then about 1 mile W on Twp Rd 244.

Small ponds, bog, and upland woods can all be found at Botany Bog SNA. The ponds and bog have four rare plant species occurring at the extreme limits of their ranges: the four angled water-lily, humped bladderwort, olivacious spike-rush, and yellow-eyed grass. The bog contains a great diversity of plant species. The best time to visit is early summer during the blooming period of bog laurel and rosemary, and again in late summer when joe pye-weed and swamp milkweed are blooming.

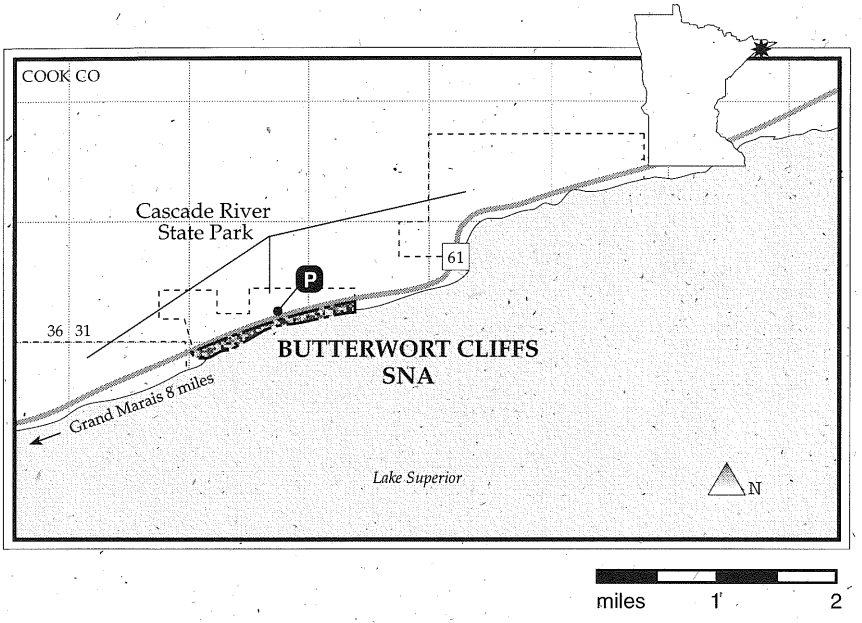
St. Louis County Twp 63N Rng 13W Sec 29, 30



Located in Burntside Lake, approximately 8 miles W of Ely. Take MN Hwy 1/169 W of Ely for about 7 miles, turn N on Co Hwy 404 (Wolf Lake Road) and go about 2 miles to boat launching site on the right. Access is by boat only; rentals available in Ely.

The Burntside Islands SNA features two adjacent islands in the south west part of Burntside Lake, located in the Border Lakes region of Minnesota. While the lake is used for recreation, with many of its 150 islands developed for summer homes, these two forested bedrock islands remain virtually undisturbed. Their virgin, old-growth Great Lakes pine forests are extremely rare outside of the BWCAW and Itasca State Park. Pine Island's 15-acre old-growth forest includes 300-year old red pines; look for the hollow centers in these older trees. Other pines date from the fires of 1862 and 1910. Dense understory, which retards production of new pines, marks areas that have not burned recently. The 49 acres of Snellman Island also support Great Lakes pine forest, spruce-fir forest, and aspen-birch forest, all undisturbed since logging at the turn of the century.

Cook County Twp 61N Rng 01W Sec 32, 33

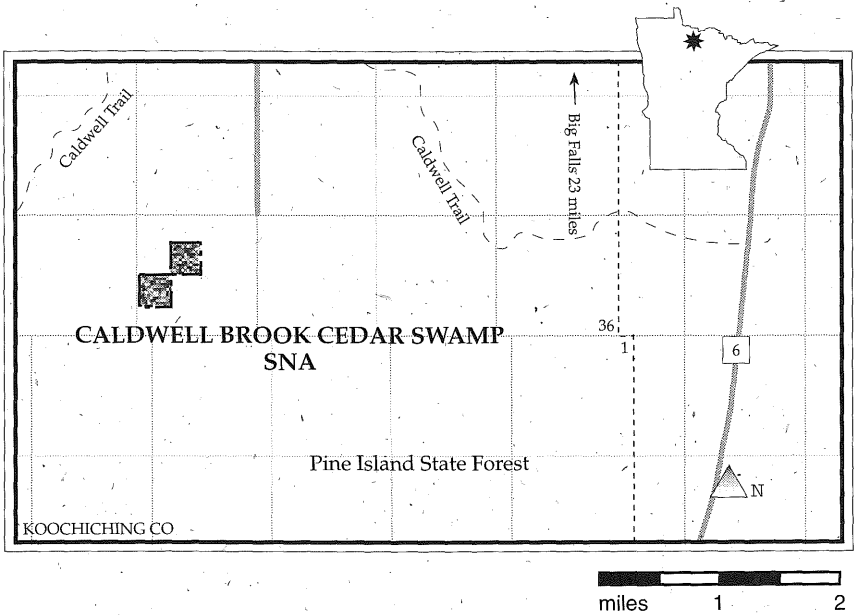


Located from Grand Marais 8 miles W on State Hwy 61 in Cascade River State Park.

Note: Closed May 1 through August 15 to protect a herring gull nesting colony.

Butterwort Cliffs SNA consists of a narrow strip of wet rock shore natural community on Lake Superior and the aspen-birch forest that extends from the rock shore to the northern border of the SNA. Cold, wet rocks near the lake provide habitat for a unique assemblage of rare arctic-alpine plants, including butterwort and northern eyebright. Butterwort, for which this SNA is named, grows in fragile mats, its sticky, yellow-green leaves trapping insects as a nutritional supplement.

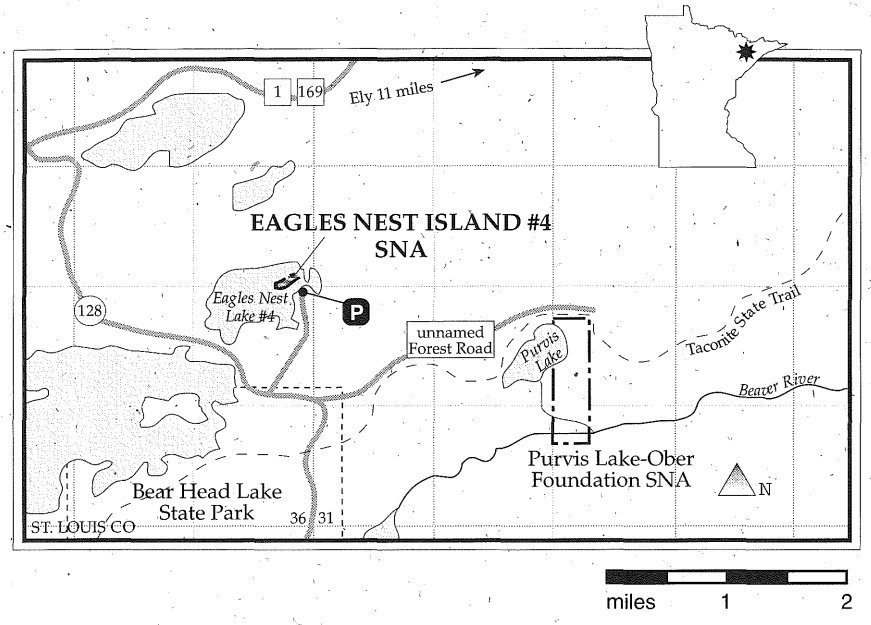
Koochiching County Twp 152N Rng 25W Sec 33



Located from Big Falls 23.3 miles SW on US Hwy 71, then 8 miles SE on Gemmell Rd, then 5 miles NE on Caldwell Trail, 2 miles S on a winter trail, then 0.5 miles SE.

Caldwell Brook Cedar Swamp is an excellent example of undisturbed northern white cedar forest. Because white cedars do not regenerate after being logged off, this site will serve as an important bench mark for research purposes in the future. The site protects vulnerable habitat for boreal plants. The best time to visit this site is during the winter, when skiing or snowshoeing is possible.

St. Louis County Twp 62N Rng 14W Sec 24

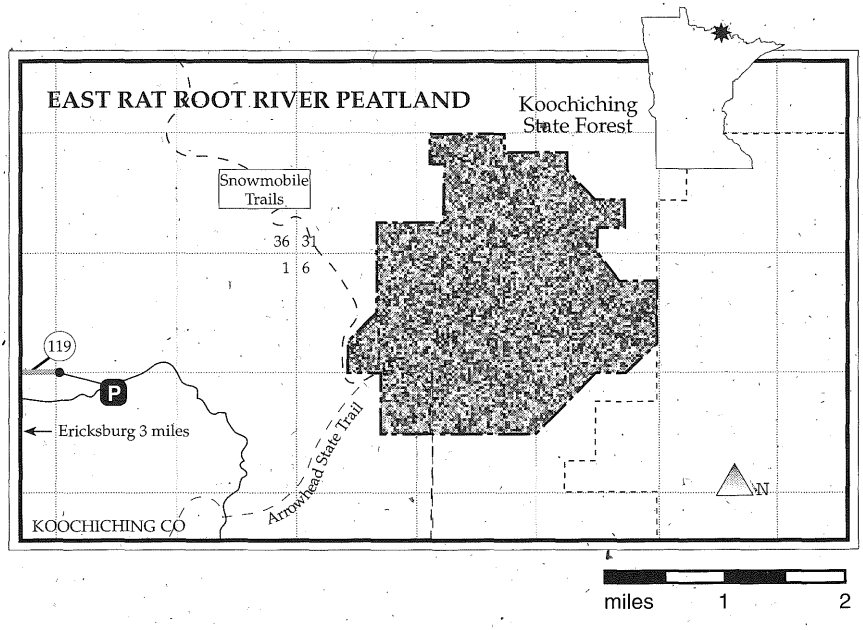


Located from Ely 11 miles SW on MN Hwy 1/169 just N of Bear Head Lake State Park on an island in Eagle's Nest Lake No. 4.

This tiny island, noted for its old growth red pine forest and scenic beauty, was transferred to the state from the Federal Bureau of Land Management. A kettle block lake and lichen-encrusted granitic outcrops characterize this site, which resembles the Boundary Waters. It provides habitat for waterfowl and loons, and it is highly sensitive to damage by visitors. Just one of many islands in the lake, Island No. 4 is located near Bearhead Lake State Park. Visit it in winter to view the trees and topography, and again in spring and summer to watch waterfowl.

Koochiching County

Twp 69N Rng 22W Sec 03-09
Twp 70N Rng 22W Sec 31-33

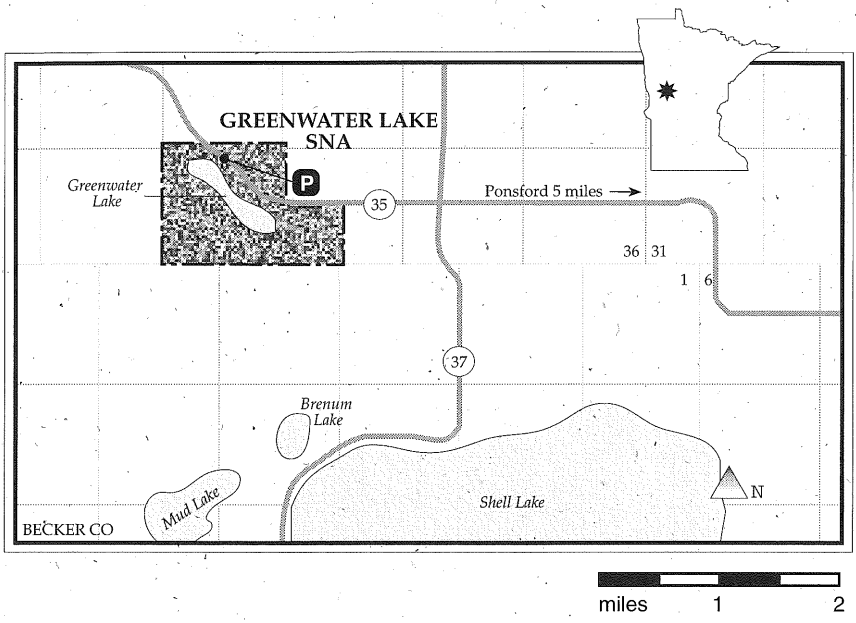


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located southeast of International Falls. Take U.S. 53 to 1.5 miles SE of Ericksburg, turn east on Co Rd 119, then walk 3 miles due E to the site.

The East Rat Root River Peatland extends eastward into Voyageurs National Park. Its raised bogs are bordered by a featureless water track formed by channeled runoff from adjacent uplands. The unusual shapes of these raised bogs make them ideal for comparative studies of the origin and pattern of surface runoff. Plant species common to patterned peatlands—ericaceous shrubs, sedges, mosses, sundew, pitcher plants, and orchids—can be found here.

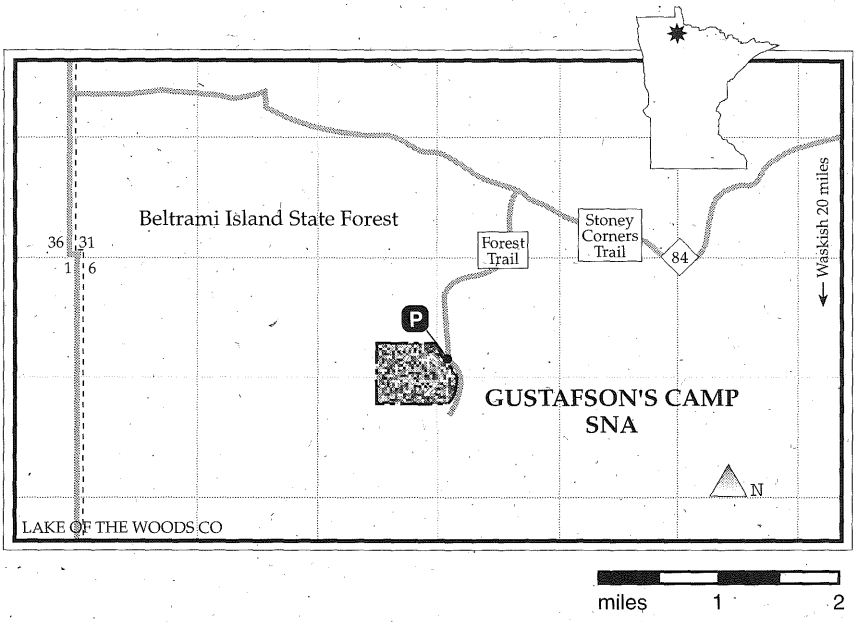
Becker County Twp 141N Rng 38W Sec 28, 33, 34



From Ponsford take Co Hwy 26 W for 1.5 miles; turn on to 129, going N and W for 3 miles; turn W on Co Hwy 35 and continue for 1.5 miles.

Greenwater Lake is a pristine, spring-fed lake dominated by a single species of diatom (a type of algae) that occurs only rarely in other lakes. The dominance of this diatom species may indicate that the lake is chemically stratified—that is, its waters do not circulate throughout the entire lake basin. These features and the lake's low nutrient levels make Greenwater Lake of special interest in research about nutrient levels of lakes. The site also features an undeveloped shoreline, the surrounding hills covered with a mixed forest of aspen and birch. Uncommon butterfly species—Appalachian brown, mustard white, and pine elfin—have been found here. The best time to visit is when spring wildflowers are in bloom.

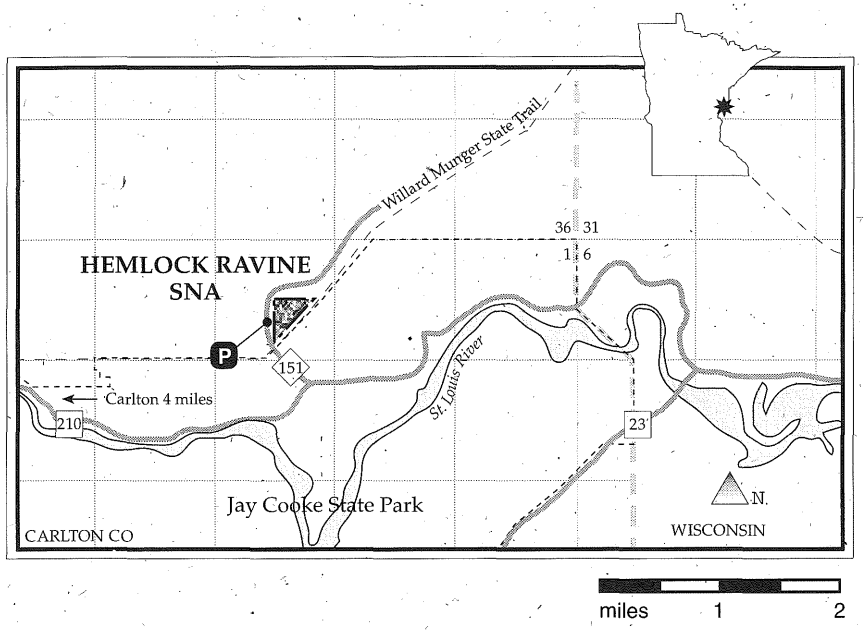
Lake of the Woods County Twp 158N Rng 33W Sec 03, 04, 09, 10



From Waskish, travel 20 miles N on MN Hwy 72, then turn W onto Co Hwy 16 to Co Hwy 1, then travel 1 mile N to Co Rd 87/ Stony Corners Trail. Turn west onto Co Rd 87 and proceed about 12 miles, then turn S on the jeep trail and travel for about 1.5 miles to a large grassy upland clearing with large white pines on the west and south ends.

Gustafson's Camp, located in the Agassiz Lowlands, contains several of the last old-growth pine stands in the Baudette Forestry Area. Its name is taken from an old logging camp that once thrived in the area. While old-growth red and white pine are the most distinguishing elements of this site, the surrounding aspen forest and the white cedar stand bordering the upland are also of key ecological interest. Together, these elements comprise an ecological continuum that permits the study and protection of ecological processes. The understory is similarly diverse; visitors may find a fairy slipper orchid in the white cedar stand. Mountain maple and hazel grow in the canopy gaps of the boreal hardwood-conifer forest, and rosy twisted stalk, wild sarsaparilla, trillium, asters, and wild lilies-of-the-valley bloom there in spring. In the pine stands, pine-needle ground cover and a sparse understory make it easy to see occasional pipsissewa, other herbs, and pine seedlings.

Carlton County Twp 48N Rng 16W Sec 03

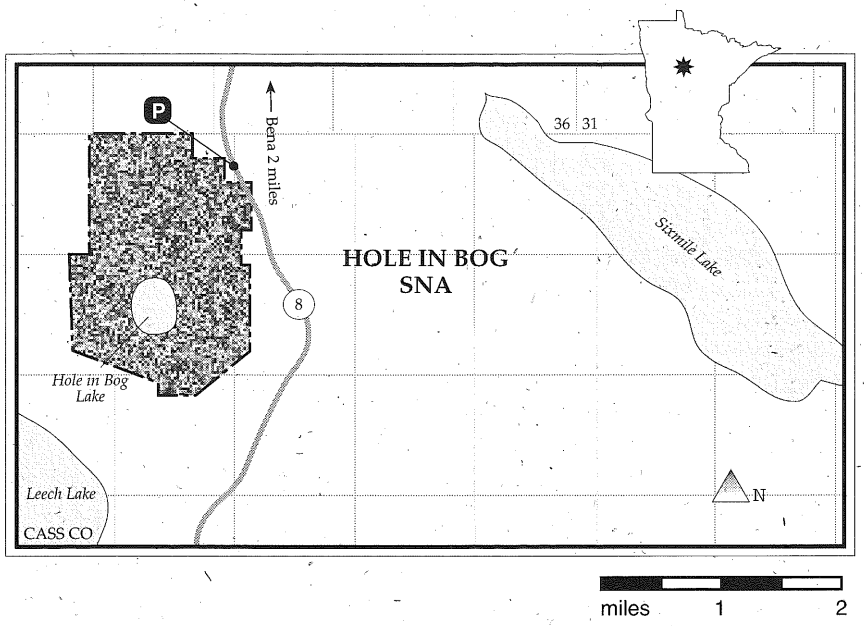


Located from Carlton 4 miles E on MN Hwy 210, then 0.5 miles N on Co Rd 151.

Note: Sanctuary on steep slopes is closed to all activity except approved research. Apply for written permission through the Minnesota DNR SNA Program (612) 296-3344.

Hemlock Ravine is wooded with northern hardwoods, white pine, and eastern hemlock. This is the extreme western range of the hemlock, which is considered rare in Minnesota. More than 25 percent of the state's hemlock trees occur on this site, which is centered on a steep ravine along a small spring-fed stream. These highly erodable slopes are subject to wash-outs and disturbance by visitors, thus endangering the hemlocks. For this reason, the ravine is designated a sanctuary. The best time to visit the site, by permit only, is in the spring to view blooming trillium, hepatica, bloodroot, and dutchman's breeches, as well as the hemlocks.

Cass County Twp 144N Rng 28W Sec 03-05, 08-10, 16

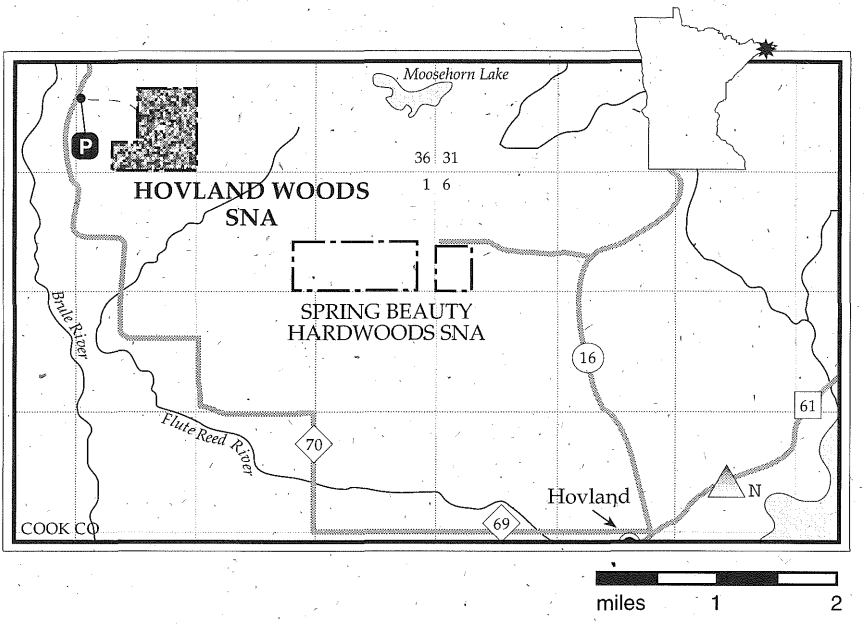


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

From Bena travel 2 miles S on Co Hwy 8. Bog is on the west side of the road.

Hole in Bog Peatland is located in north central Minnesota, south of the Agassiz Lowlands and between Leech Lake and Lake Winnibigosh. This peatland is the state's best example of a basin-filled raised bog, and it is the only peatland of this type protected as an SNA. It provides a valuable setting for peatland research, being the most south-westerly peatland SNA and also one of the few outside a major glacial lake plain. This relatively small peatland complex is characterized by a single well-defined crested raised bog and a peatland lake. Plants and animals characteristic of patterned peatlands can be found here. Disturbance has been minimal.

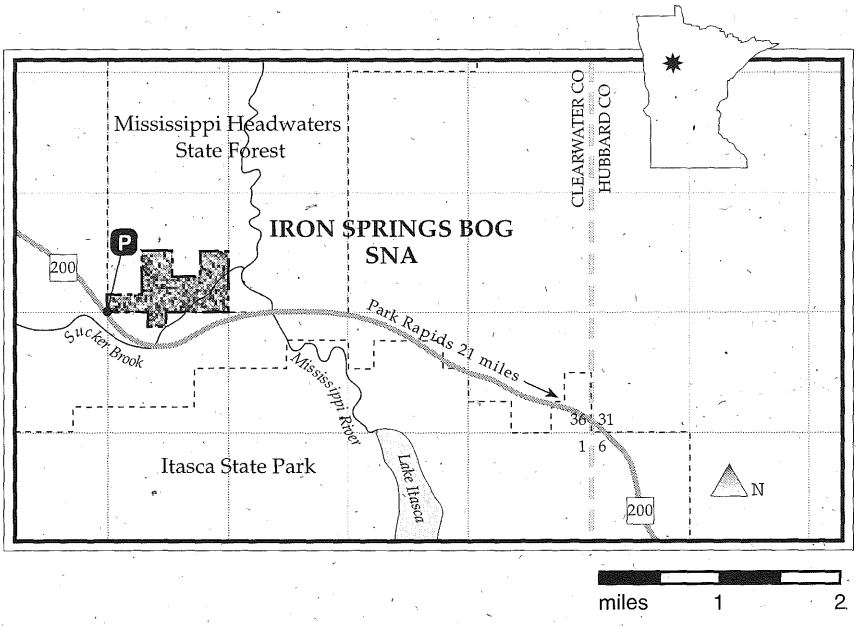
Cook County Twp 63N Rng 03E Sec 34



Located from Hovland 2 miles W on County Road 69, then 4 miles N and W on County Road 70, then 1.25 miles right on a logging trail. Park along the dirt road, then hike 0.5 miles along the forest trail on your right to Hovland Woods.

Hovland Woods features mature and old-growth virgin forest, with about 30 percent swamp, bog, and flooded beaver flowage. While access to this site is difficult, four natural forest communities await the intrepid visitor. The northern hardwood-conifer forest, predominantly maple with scattered balsam fir, shows no evidence of logging. Upland white cedar forest consists of white cedar, white spruce, paper birch, and a sparse supercanopy of white pines. The spruce-fir forest, primarily balsam fir, features white spruce up to 200 years old. The Great Lakes pine forest consists of white pines. Eastern gray wolf and marten inhabit this wilderness area. Carolina spring beauty blooms in the spring, and the threatened large-leaved sandwort blooms in summer.

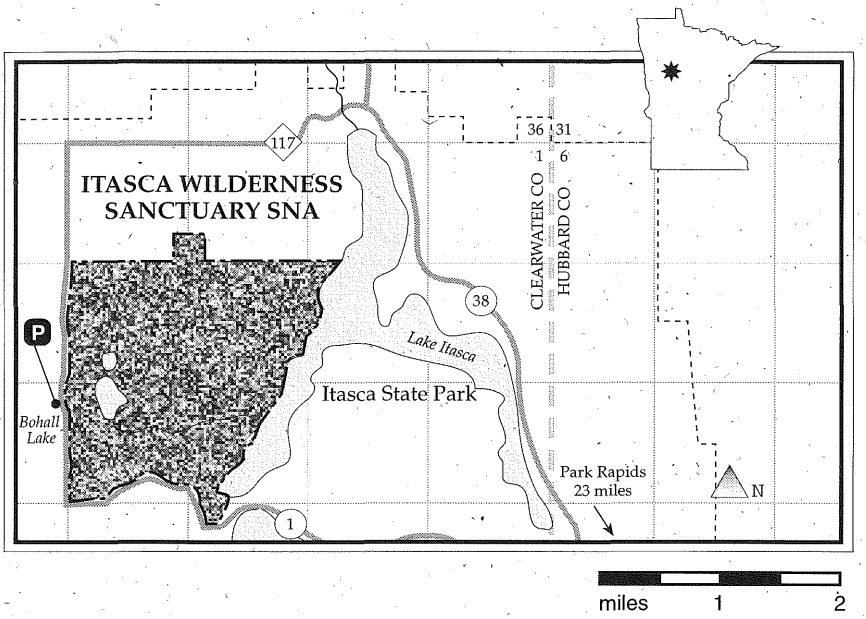
Clearwater County Twp 144N Rng 36W Sec 28, 33



Located from Park Rapids 20 miles N on US Hwy 71, then NW on MN Hwy 200 to 1 mile W of the N entrance of Itasca State Park.

Iron Springs Bog is named for springs, rich in iron-oxide, that issue from a gravelly moraine. The site, heavily used by the University of Minnesota Biological Station since the early 30s, contains a mosaic of raised-bed conifer swamp forest, boreal forest, and pine forest. Within the conifer swamp grow some of Minnesota's rarest plant species, as well as the coral root and Ladies Tresses orchids. The best time to visit is in early spring to mid-summer to view woodland wildflowers of the coniferous forest.

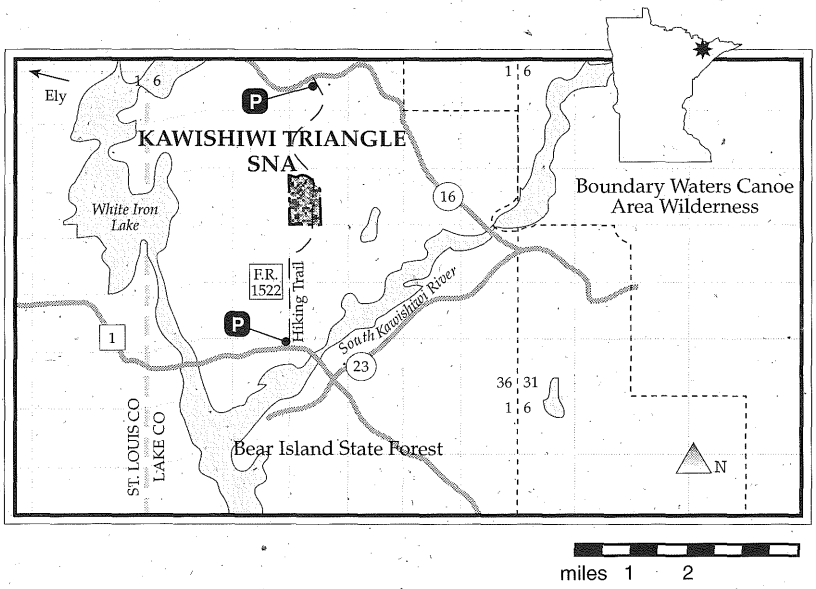
Clearwater County Twp 143N Rng 36W Sec 03, 04, 08-11, 15-17



From Park Rapids go 17 miles N on US Hwy 71, then 6 miles W on Co Hwy 1 into Itasca State Park, to Wilderness Drive.

Through a 1938 agreement between the Minnesota Academy of Science and the Conservation Commission, the Itasca Wilderness Sanctuary became the first site in Minnesota set aside for research and interpretation of its natural attributes. The Sanctuary contains a large virgin stand of white and red pine, mostly 100 to 300 years old. It provides habitat for two of the state's rarer plant species, bog adder's mouth and matricary grape-fern, and two rare bird species, the bald eagle and northern goshawk. The Bohall Wilderness Trail leads to an overlook on Bohall Lake. The best time to visit is early summer when woodland wildflowers are blooming, though a walk through the majestic pines is rewarding any time of the year.

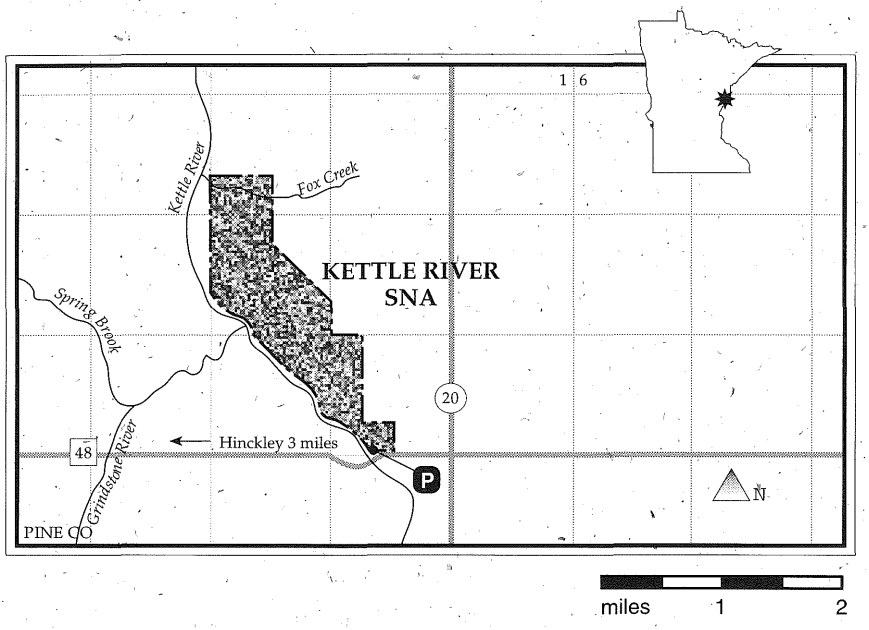
Lake County Twp 62N Rng 11W Sec 16



Located approximately 8 miles SE of Ely, accessible by two ways. From Ely, go E on Hwy 1 or park at the junction of Hwy 1 and F.R.1522 just W of the S. Kawishiwi River bridge. Hike N past the gate on F.R.1522 for 1.5 miles, then veer NW through the woods for 1.5 miles. *Or* take the gravel road going S from Lake Co 16, opposite Farm Lake Boat Access. Turn left at 0.5 mile and follow to the gate across the road. Walk past the gate, down the road for 2 to 3 miles, continuing on the old abandoned snowmobile trail that goes straight when the road turns left. The abandoned trail goes through the SNA.

This site contains a 29-acre stand of early-stage, old-growth white pine that was protected from timber harvesting through an agreement between Hedstrom Lumber Company and the Minnesota DNR. Logging in adjacent areas left this stand of old white pine, now known as the Kawishiwi Triangle. Core samples date these white pines to the regeneration period following the 1854 fires. Fallen logs and tip-ups dating from windstorms in the 1920s and 30s now serve as nurse logs, supporting new seedlings. Natural regeneration of white pine is being promoted to the north. The southern boundary is contiguous with a stand of old pine on U.S. Forest Service lands. Visitors may find large old paper birch, balsam, maple, and quaking aspen among the white pine. Pileated woodpeckers, hairy woodpeckers, and golden-crowned kinglets have been noted here, along with several species of club moss, large-leaved aster, bunchberry, twin-flower, and rice grass. The rare lichen, *Sticta fuliginosa*, was found recently in the old-growth pine forest. Best viewing is by sled dog team in the winter!

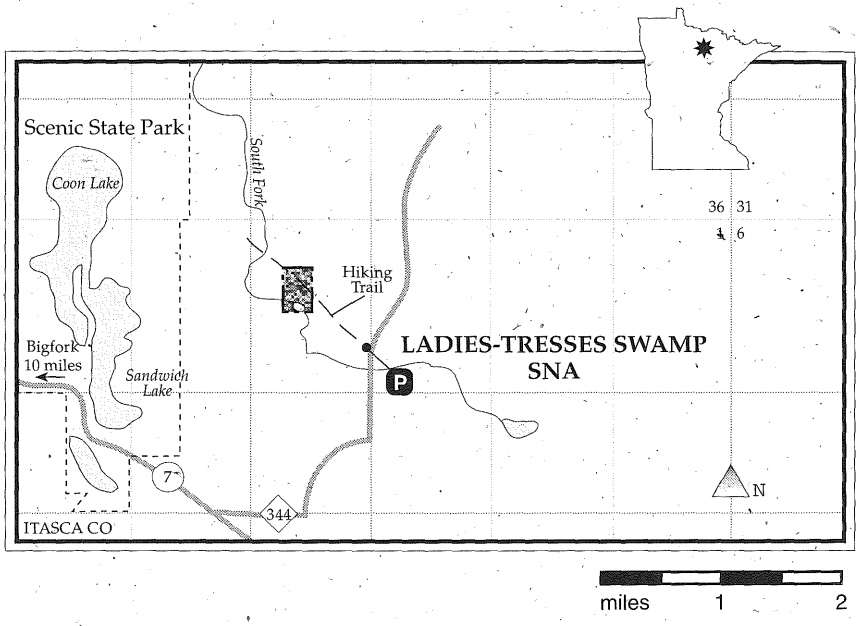
Pine County Twp 41N Rng 20W Sec 10, 15, 22, 23



Located from Hinckley 3 miles E on MN Hwy 48 to the public water access.

An impressive array of landforms and plant communities can be found at Kettle River SNA. Of geological interest is the several hundred million year-old Douglas fault, which runs northeast through the site. A small creek conceals the fault, but the two rock formations are exposed on opposite banks of the creek. With vertical movement as much as 2.5 miles, the fault has placed the 1.1 billion-year-old chengwatana basalt on a level with the 700 million-year-old Hinckley sandstone. This site also contains such biologically communities as fen, forested bog, floodplain forest, upland hardwood forest, and pine forest. A 1980 survey of this site documented 313 vascular plants, 8 butterflies, 5 amphibians, 82 birds and 18 mammal species. Rare species of interest include one of the largest known populations of bog bluegrass in the state, and a nesting population of Louisiana waterthrush. The best time to visit is in late spring to see spring beauties, Dutchman's breeches, and trilliums in bloom.

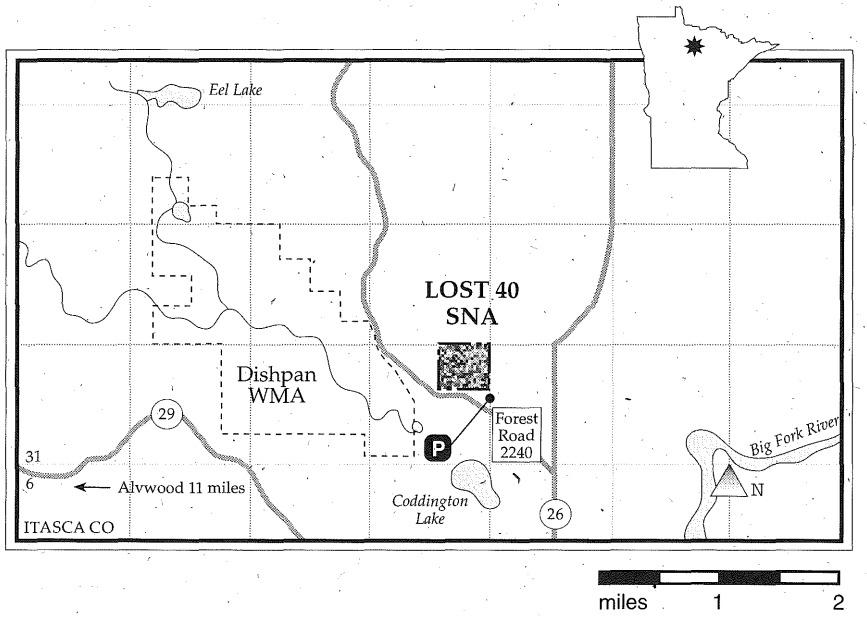
Itasca County Twp 60N Rng 25W Sec 04



Located from Bigfork 8 miles SE on Co Hwy 7, then 2.3 miles NE on Co Rd 344, then 0.5 mi NW on a trail.

Ladies Tresses Swamp contains an excellent example of lowland conifer forest dominated by mature white cedar, black ash, and black spruce. Orchids associated with coniferous forests, including ladies tresses, also grow here. This isolated site, located near Scenic State Park, was gifted to the SNA program by the U.S. Department of Interior through the Bureau of Land Management. The best time to visit is early summer when wildflowers of the coniferous forest are blooming.

Itasca County Twp 150N Rng 27W Sec 34

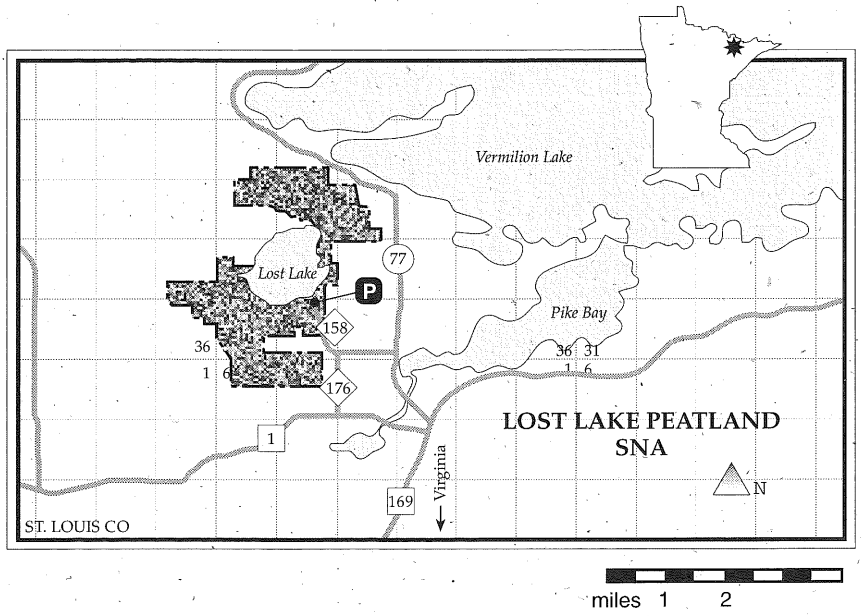


Located from Alvwood, 11 miles E on Co Hwy 29, then 2 miles N on Co Hwy 26 to Forest Road 2240. Go W less than 1 mile to marking lot on the left.

Lost 40, so-called due to a surveying slip back in 1882, is located in the Big Fork State Forest in the Agassiz Lowlands. This site includes a narrow peninsula extending from a large upland esker. The peninsula is flanked by a black spruce and tamarack bog on one side, and a willow and alder marsh on the other. The area contains 28 acres of red pine forest and 18 acres of spruce-fir forest. The virgin old-growth red pine forest is the largest and oldest stand in the Blackduck Forestry Area. White pine over 300 years old can be found on the site. The U.S. Forest Service administers adjacent lands with old growth red and white pine, as well. Fringed polygala, bluebead lily, twin flower, and Canada mayflower occur in this area. Early to mid-summer is a good time to see wildflowers in bloom.

St. Louis County

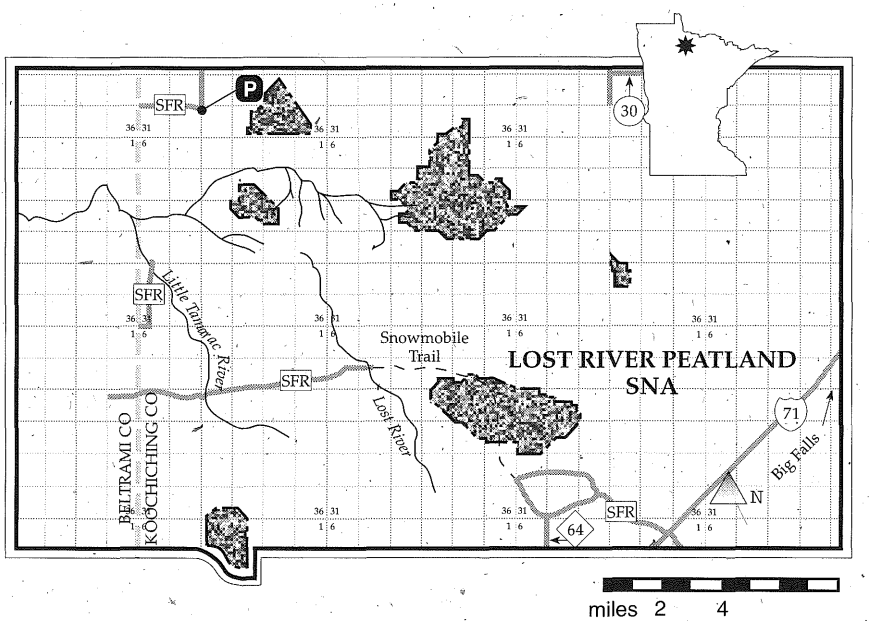
Twp 62N Rng 16W Sec 17-21, 30-32
Twp 61N Rng 16W Sec 05, 06
Twp 62N Rng 17W Sec 25, 36



If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located NE of Virginia. From Virginia, go N on MN Hwy 169 to MN Hwy 1, then 1.25 miles W on MN Hwy 1 to Co Rd 176, then N to Co Rd 158, and N to the peatland on the south side of the lake.

Lost Lake Peatland forms a link between the western peatlands of the Agassiz Lowlands and the northeastern Minnesota peatlands of Sand Lake. It demonstrates the transition between these two different peatland systems. Its landforms are only minimally disturbed by winter trails, leaving a featureless water track, a ribbed fen, a raised bog, and a crested raised bog, all in their natural state. Here visitors can see an emerging ribbed fen and ovoid island, with more mature forms nearby for comparison. This relatively small peatland also contains Lost Lake and several mineral islands. Coast sedge and American bog rush are among the notable plant species found here. Nearby, on St. Louis County land northwest of the lake, an old-growth yellow birch-white cedar community contains birch likely to be over 250 years old.

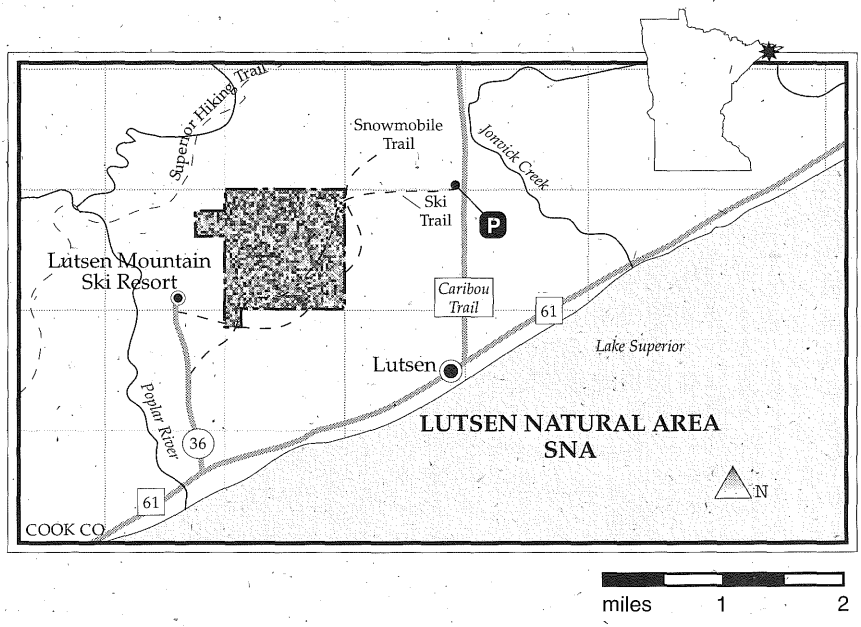


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 15 miles W of Big Falls. From Big Falls take US Hwy 71 S for 16 miles to Gemmel Forest Road (1.5 miles before Seretha Lake Road). Go about 3 miles NW, then right 3 miles to the end of Lost River Forest Road. Walk in 0.5 miles N.

The Lost River Peatland includes six units that cover a broad, nearly level lake plain interrupted only by low beach ridges and tributary streams. Minnesota's third largest peatland SNA, Lost River features semi-circular raised bogs abutted against a beach ridge on the south central portion of the Agassiz Lowland. This peatland contains patterned water tracks with tear-drop islands and several spring fens. Add to these attractions a species of moss recently thought to be extinct in North America *and* the largest number of rare plant species of any peatland in the state, and Lost River takes on high importance among Minnesota's peatlands. Linear-leaved and English sundews, several rare rushes, marsh arrow-grass, and sticky false asphodel grow in this wetland system.

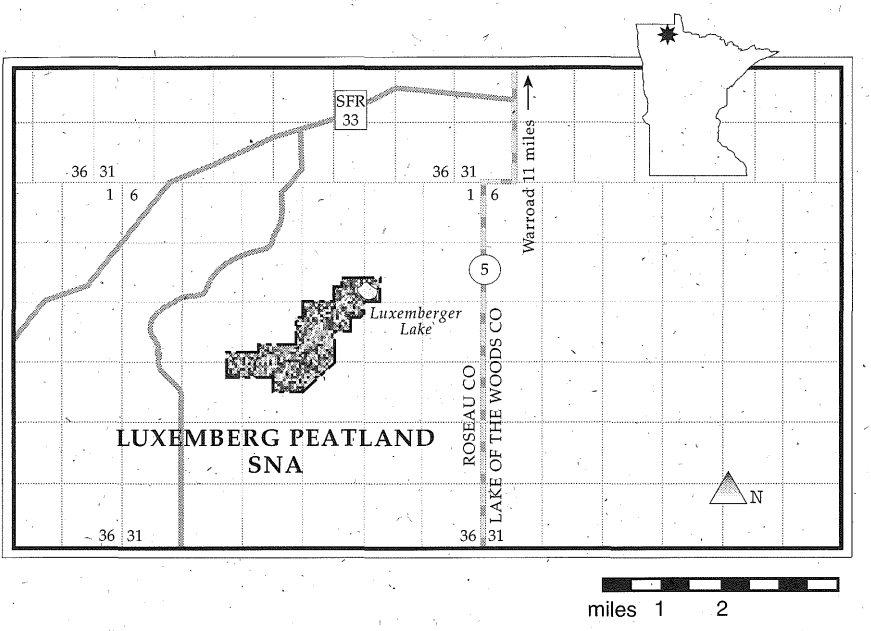
Cook County Twp 60N Rng 03W Sec 21, 22, 27



Located N and E of Lutsen Mountain Ski Resort. From County Rd 36, 0.5 to 1.0 mile S of the lodge, follow ski or snowmobile trails NE into the SNA. *Or* with permission of the Resort, walk E behind the lodge to the SNA.

The scenic Lutsen Natural Area is the largest known acreage of essentially undisturbed upland old-growth hardwood forest in the North Shore Highlands. Sweeping panoramic views of ridges, slopes, cliffs, and valleys dip to 600 feet below. Eagle Mountain and Raven Ridge, major ridges of the Sawtooth Mountains, rise over a thousand feet above Lake Superior, which lies about two miles to the southeast. The northern hardwood forest, dominated by sugar maples, blends into northern hardwood-conifer forest. Many individual trees are from 145 to 300 years old. Large diameter trees show old-growth forms, and large logs and snags that have fallen provide food and habitat for many small animals, fungi, lichens, insects, and new forest growth. Smaller areas of aspen-birch forest also occur here. Wildflowers blooming here in the spring include Dutchman's breeches, white baneberry, Carolina spring beauty, and moschatel, the only member of its family occurring in North America and uncommon over most of its range.

Roseau County Twp 160N Rng 37W Sec 10, 11, 15-17, 20-22

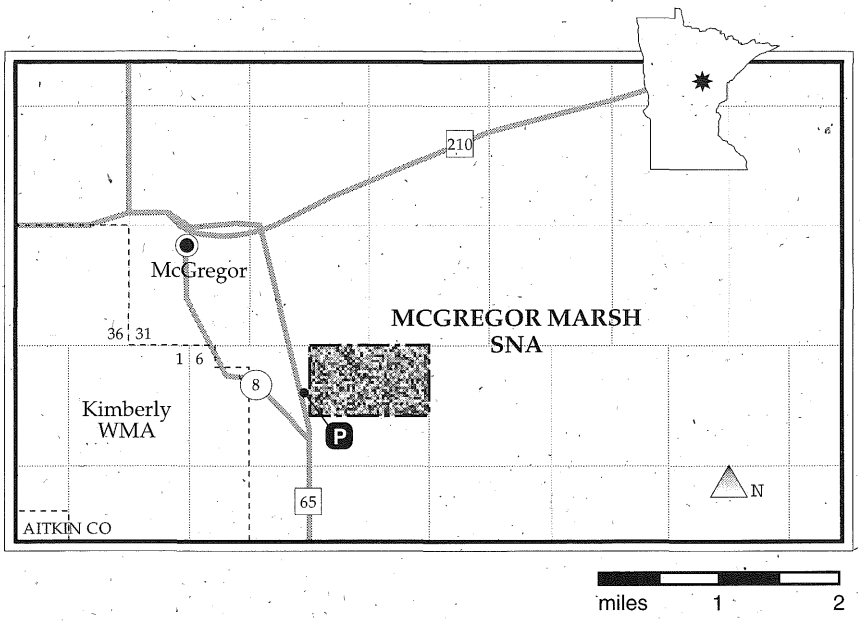


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 11 miles S of Warroad on Co Hwy 5, then 3.5 miles W on S.F.R. 33, then S on unnamed S.F.R for 2 miles. Walk 1 mile SE to the SNA.

The Luxemberg Peatland, which lies at the western edge of the Agassiz lowlands, is a small, patterned peatland near the western edge of the range. Dominated by a water track containing ribbed fen patterns, this peatland lacks bog patterns. The four-angled water lily grows in Luxemberg Lake, in the northeast corner of the area. Ditches have disturbed the area, but nesting sandhill cranes, yellow rails, short-eared owls, and English sundew may be found.

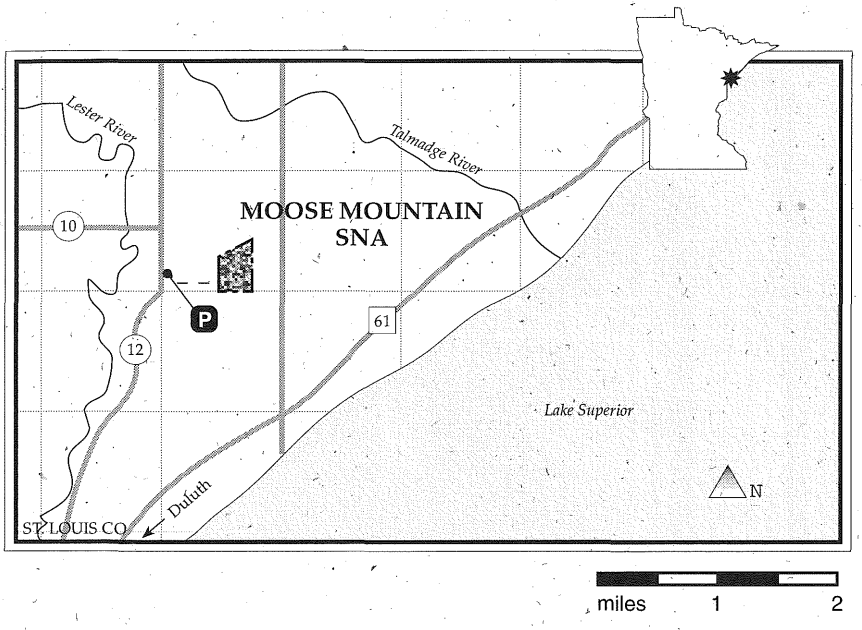
Aitkin County Twp 47N Rng 23W Sec 05



Located from McGregor 2 miles S on MN Hwy 65 on E side of highway.

McGregor Marsh, an extensive marsh land in the former bed of Glacial Lake Aitkin, contains the very specific habitat requirements of the rare yellow rail and sharp-tailed sparrow. Bird watchers have visited this area to look for these rare birds and other more common species for many years. The best times to visit this site are in early summer, when the songs of territorial birds reveal their locations, and during the winter to look for northern hawk-owls or other visiting winter birds.

St. Louis County Twp 51N Rng 13W Sec 22

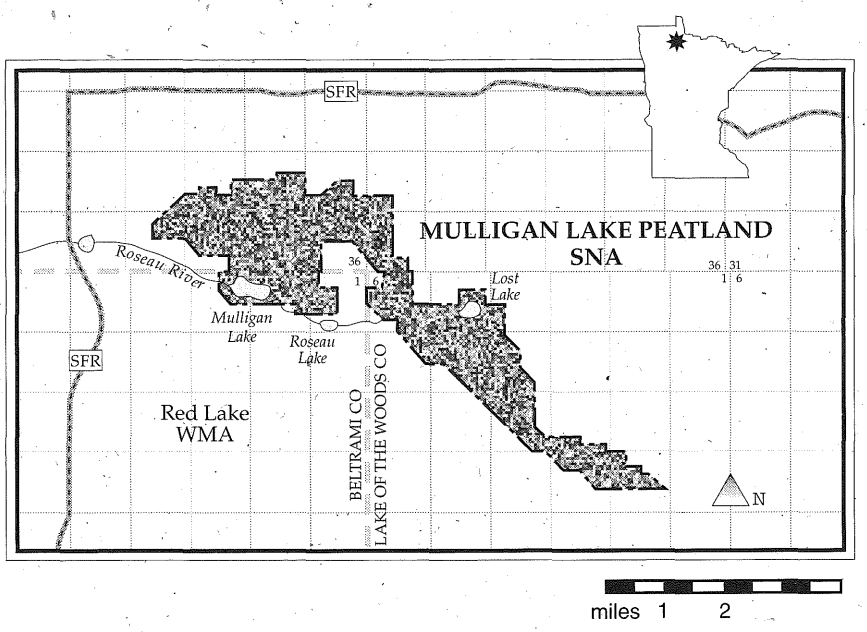


Located just N of Duluth, from US Hwy 61, 3 miles N on Lester River Road (Co Rd 12). Park along Co Rd 12 and walk 0.5 mi S and E on signed easement.

Moose Mountain is an excellent example of old growth northern hardwood forest. Sugar maple, basswood, and yellow birch dominate. Two rare plants, white baneberry and moschatel, are found here. Moschatel, the only species in its family in North America, is uncommon over most of its range, particularly with the loss of hardwood forest habitat. It prefers slopes with cold, moist air drains. The best times to visit this site are during the spring wildflower blooming season and in late fall for the dramatic fall colors.

Beltrami County
Lake of the Woods County

Twp 158, 159N Rng 35, 36W

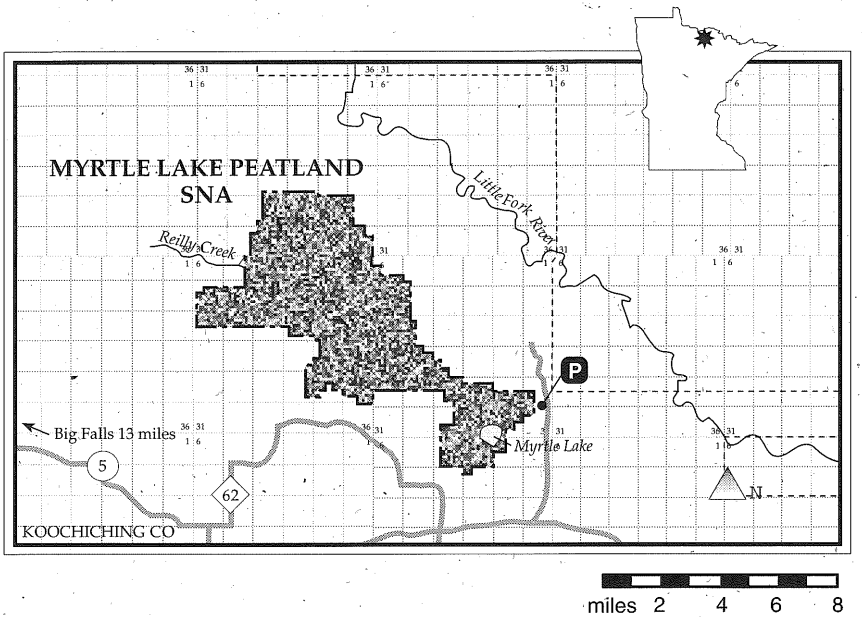


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 25 miles SW of Baudette in the Red Lake Wildlife Management Area. Contact the Red Lake Office (218) 783-6861 for the easiest walk.

Mulligan Lake, a patterned peatland near the western edge of its range, has no bog development at all. Its several water tracks exhibit all patterned fen features, however, including ribbed fens, tear-drop islands, and the net-like reticulate flark pattern. This is a land of tamarack, bog birch, conifer swamps, and carpets of feather moss. Sandhill cranes, Wilson's phalaropes, and yellow rails are common bird species. Rare mosses, sundews, and dragon's mouth grow in the sedge fen, and four-angled water lilies bloom in Lost Lake, Mulligan Lake, and the Roseau River.

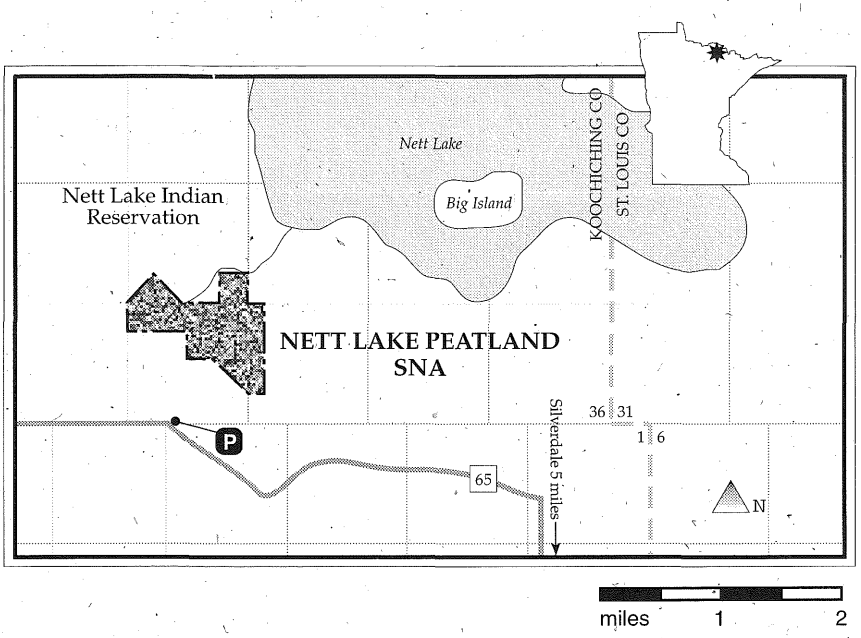
Koochiching County Twp 163-165N Rng 23-25W



If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 13 miles SE of Big Falls. From Effie, go N on Co Rd 5 for 6.5 miles, then go E and N 2 miles on Co. Rd. 62. Take the Holmstrom Spur Forest Road E for 8 miles to junction with Lofgren Forest Road, and follow it N for 0.5 mile. When road veers W, hike NE 0.5 mile to the SNA.

Myrtle Lake Peatland, a National Natural Landmark, is significant for its massive, raised bog, its very large water track, and its ribbed fen with a patterned water track, all of which are virtually undisturbed. A water falls three feet high provides a clue to the unique character of this peatland. Numerous rare plant species make this a valuable research site; it is, in fact, one of the most heavily studied peatlands in the United States. Occasional moose, Eastern timber wolf, and bog copper butterflies meander among rare sundews, rushes, sedge, and mountain yellow-eyed grass. Visitors should plan on getting wet feet in the summer, when they can best see butterflies and unusual plants.



If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

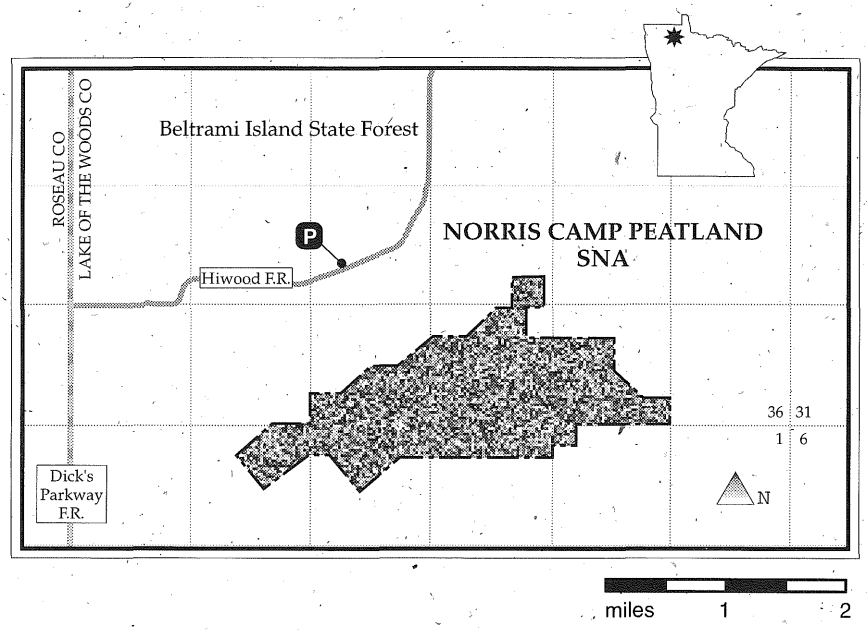
Located from Silverdale; take MN Hwy 65 N for 5 mi, then W for 3 mi. Park and hike N for 0.5 miles.

Note: Visitation by permit only from the Nett Lake Indian Reservation. Contact the Tribal Manager at (218) 757-3261 to enter tribal lands. **Note: While the state recognizes this as an ecologically significant peatland, it owns no land here.**

Nett Lake Peatland, at the southwestern corner of Nett Lake, is part of a larger peatland that completely surrounds the lake. It lies at the interface of the Agassiz Lowland and the Border Lakes. A spring fen originates near the western headwaters and feeds into a peat-cutting stream. While little data is available on wildlife species, the twig rush, beaked spike-rush, and the small, sedge-like marsh arrow-grass, all of which depend on calcareous groundwater, are found here. Hunting is permitted *only* with the permission of the Nett Lake Indian Reservation.

Lake of the Woods County
Beltrami County

Twp 159, 160N Rng 35, 36W

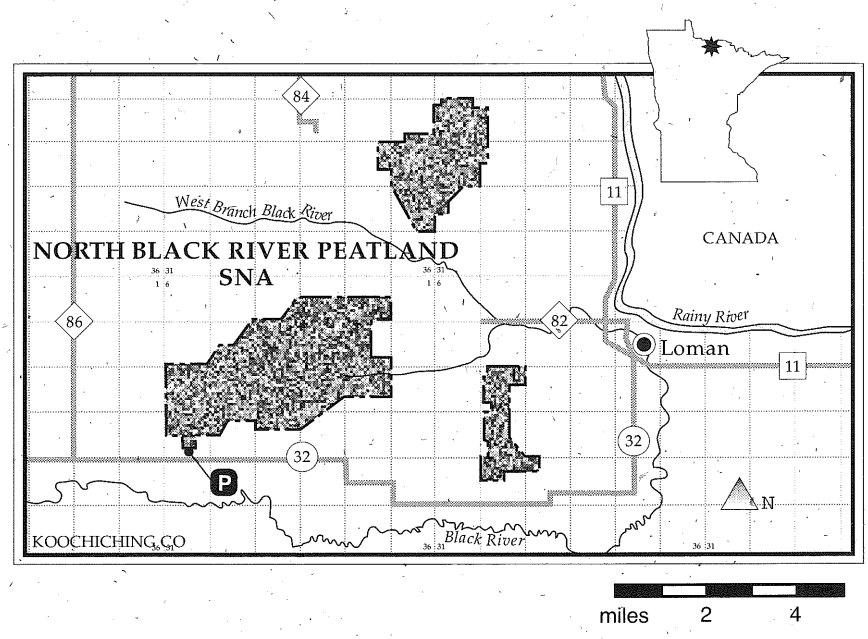


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 19 miles S of Warroad. From Warroad go 12 miles S on Co Rd 5, then 7 miles S on Dick's Parkway F.R., then 2 miles E on the Hiwood F.R. Walk 1 mile S/SE to the SNA.

The Norris Camp Peatland, at the western edge of the Agassiz Low lands, is one of the most disturbed of the patterned peatland SNAs. It offers an excellent opportunity for research on the effects of ditching and also on the rich calcium concentrations found here. Norris Camp is patterned, with ribbed fen patterns in the water track. Bogs have not developed here. While no rare species have been found, the four-angled water lily grows near here, and the greater sandhill crane nests throughout the area.

Koochiching County Twp 158, 159N Rng 25, 26W

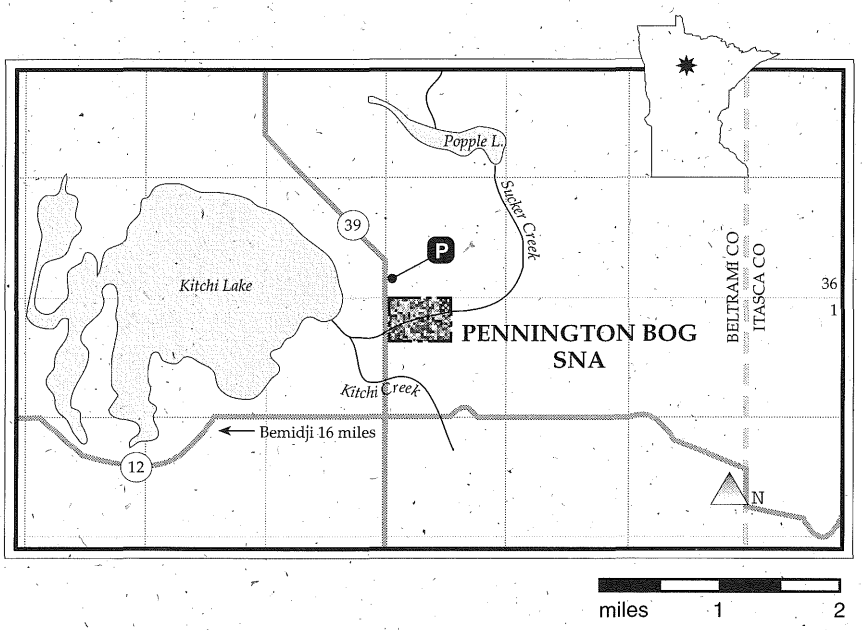


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 8 miles W of Loman. From Loman go 14 miles S and W on Co Hwy 32, then walk 0.5 miles N.

The North Black River Peatland, just south of the Rainy River and the Canadian border, lies within the large peatland area of the Agassiz Lowlands. The SNA contains a highly developed ovoid island with an internal water track, which is bordered on the north by a large water track with ribbed fen patterns downslope. This broad range of landforms offers an excellent opportunity for comparative studies of the development of peatland patterns, internal water tracks, and surface patterns. Rare plants include the linear-leaved sundew, English sundew, and American bog rush.

Beltrami County Twp 146N Rng 30W Sec 03



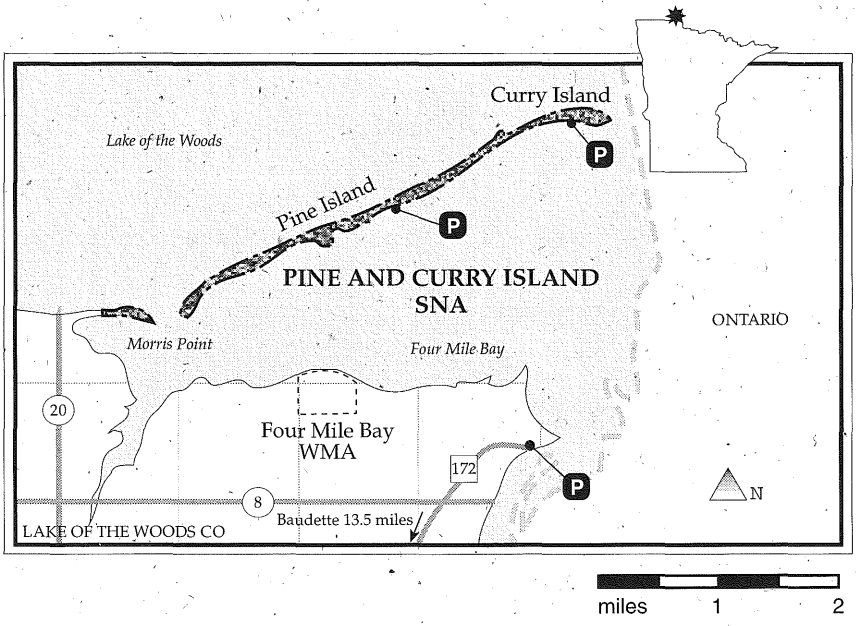
Located from Bemidji 16 miles E on Co Hwy 12, then 1 mile N on Co Hwy 39.

Note: Visitation by permit only. Permits available from the Department of Natural Resources, through the Minnesota DNR SNA Program (612) 296-3344, or the Nongame Wildlife Program at Bemidji (218) 755-2976.

Pennington Bog is a virtually undisturbed tract of coniferous forest, providing critical habitat for a diverse array of plant species. A wide assortment of beautiful and unusual plant species grows beneath a dense canopy of white cedar, balsam fir, and black spruce. The forest floor can be easily damaged from visitor use, given the wet nature of the forest community. The best time to visit the site is early- to mid-summer.

Lake of the Woods County

Twp 162N Rng 31W Sec 06
Twp 162N Rng 32W Sec 01, 10-12, 15, 16



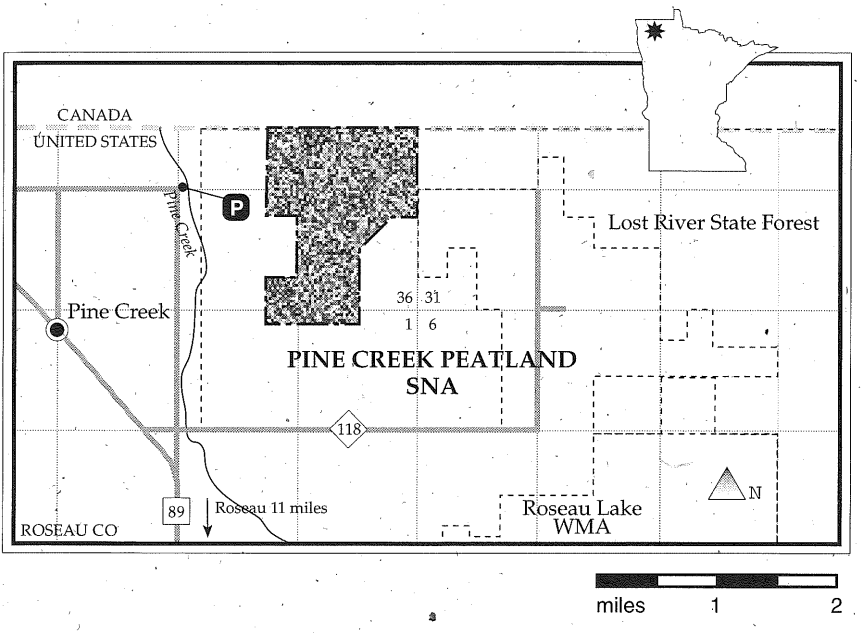
Located from Baudette 11 miles W on MN Hwy 11, then 8.2 miles N on Co Hwy 4 to Lake of the Woods, then by boat a few miles east to the island.

Note: Nesting sanctuaries as posted are closed to all activity from April 15 through September 1.

Pine and Curry Island, along with Morris Point to the southwest, form a conspicuous sandspit approximately 4 miles long. This sandspit provides habitat for the only remaining nesting population of piping plover in Minnesota. This small, sandy colored shorebird is declining alarmingly throughout its range, due in part to loss of undisturbed sandy beaches for nesting. Pine and Curry Island also supports a nesting population of the common tern, a species that is rare in the state. Because both species are very sensitive to disturbance, sanctuary areas are closed to the public from April 15 to September 1. The SNA provides great opportunities for observing and photographing many species of shorebirds. Picnicking and swimming are allowed in designated shorelunch areas only.

Roseau County

Twp 163N Rng 41W Sec 01-02
Twp 164N Rng 41W Sec 25-26, 35-36

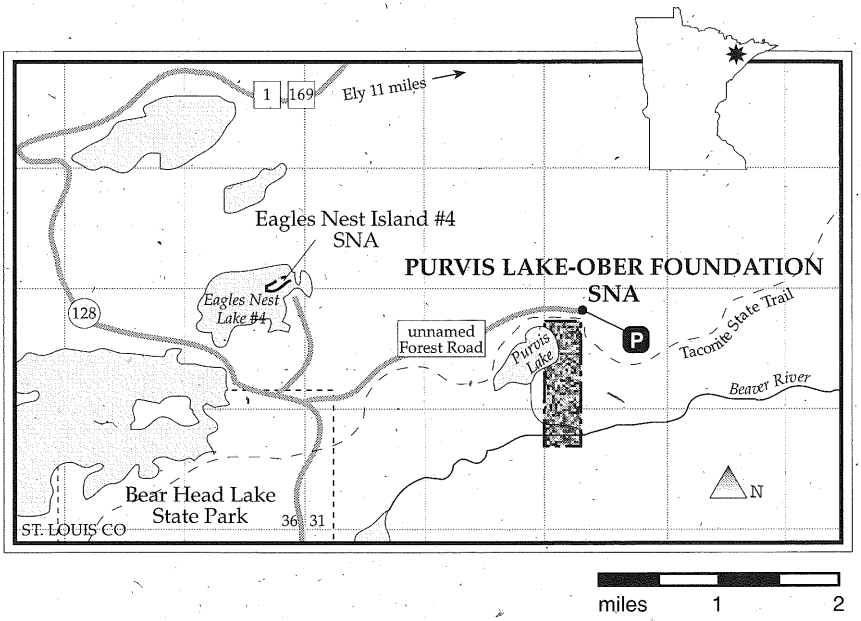


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 11 miles NW of Roseau on the Canadian border. Travel 6 miles W of Roseau on MN Hwy 11, then 9 miles N on MN Hwy 89, then N 1 mile on Forest Road and walk 0.5 miles E.

Pine Creek Peatland is the U.S. portion of a much larger peatland that extends north into Canada. It exhibits Minnesota's best developed spring fen as well as several rare plants. The spring fen features a network of non-forested channels that drain through a swamp forest. Teardrop tree islands occur in the water tracks. English sundew, linear-leaved sundew, twig rush, hair-like beak-rush, and a little-known moss grow here. Several species of bog butterflies and great grey owls have been documented, and greater sandhill cranes nest near the site.

St. Louis County Twp 62N Rng 13W Sec 28, 33

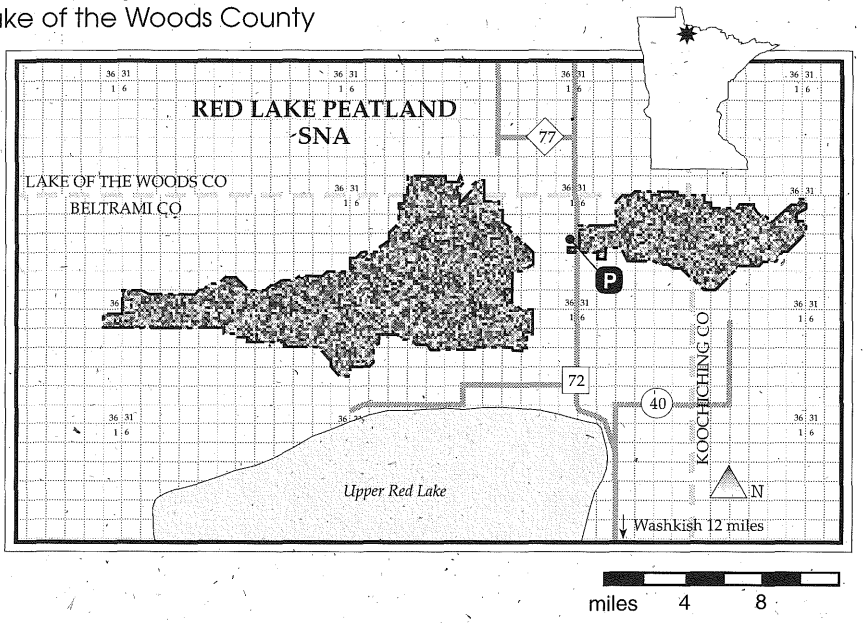


Located from Ely 12 miles W on MN Hwy 1, then 4 miles S on Co Hwy 128, then 2 miles E on a forest road.

Purvis Lake-Ober Foundation SNA bears the name of its early owner, who defended its forest and wolf population with a shot gun for many years. He eventually gifted the property to The Nature Conservancy as a wolf sanctuary at a time when wolves had few defenders. The Conservancy later transferred the property, with its diverse plant communities, to the state as an SNA. The topography reflects the effects of numerous glacial advances, with alternating lakes, bogs, and rocky ridges. A beautiful forest of white and red pine has escaped both burning and extensive logging. The best time to visit is during winter and early spring for skiing or snowshoeing into the site.

Beltrami County
Koochiching County
Lake of the Woods County

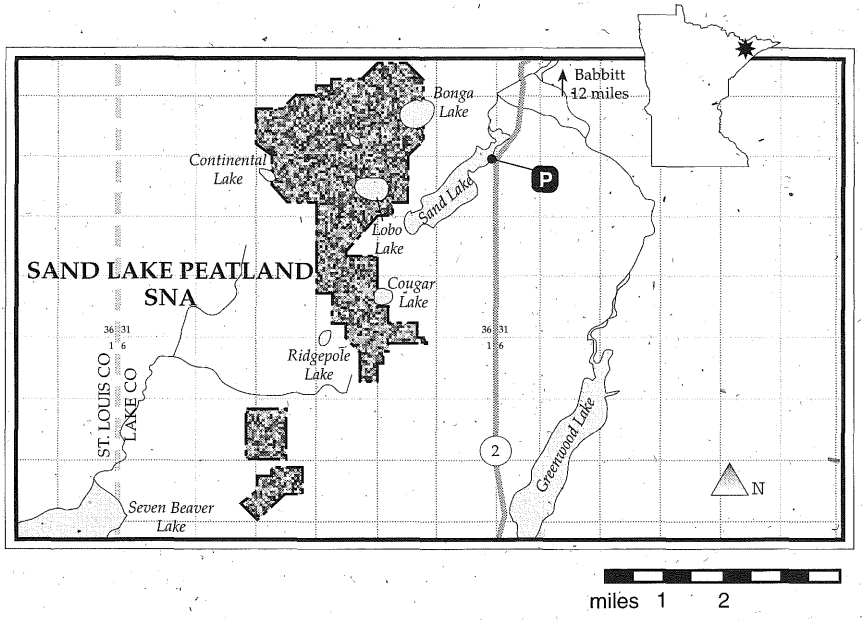
Twp 155N-157N Rng 28W-35W



If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 12 miles N of Washkish on MN Hwy 72. Park along the highway shoulder near road crossings of the ditches on each side of Hwy 72.

The Red Lake Peatland contains the largest, most diversely patterned peatland in the United States. It lies in the middle of the Agassiz Lowland landscape region in the north central part of the state. Over 50 miles long and 12 miles wide, the *big bog*, as it is called, features the largest, best developed water track in the United States. The area contains ovoid islands, circular islands, raised bogs, and every pattern of fen feature—tear drop islands, circular islands, and ribbed fens. Transitions in these surface patterns are of international significance in the effort to understand peatland features and succession. Trails used by caribou in their migration to Canada's calving grounds can still be seen, though the last migration took place in the 1930s. A portion of the area has been designated a National Natural Landmark. This national treasure provides habitat for the Eastern timber wolf, short-eared owl, yellow rail, Wilson's phalarope, and the greater sandhill crane. Rare rushes, sundews, and mountain yellow-eyed grass await the observant viewer. Part of this vast peatland is the Maurice O'Link unit, gifted in memory of Maurice O'Link.

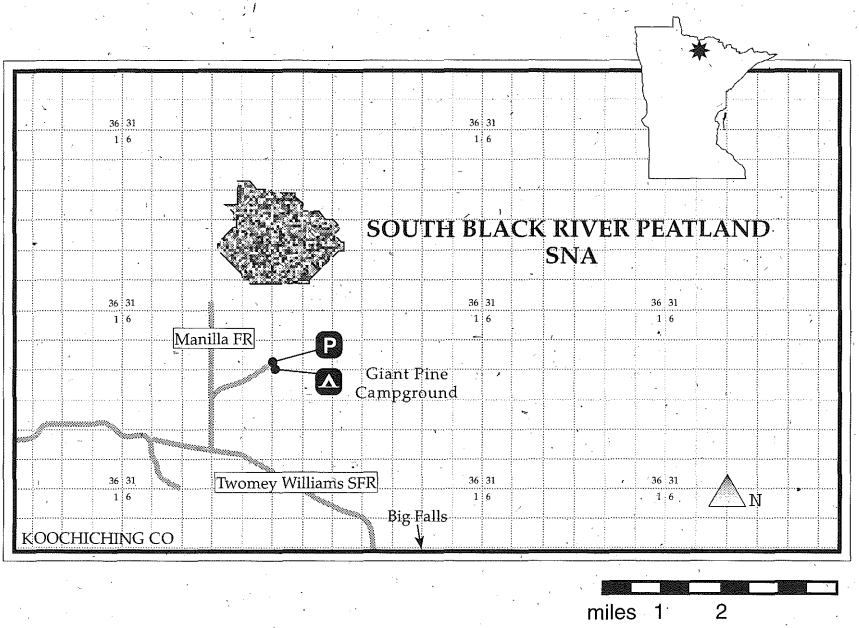


If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 12 miles SE of Babbitt. From Two Harbors take Co Hwy 2 to the Sand Lake public access. Canoe to the N shoreline at the W end of the lake. Walk W over the upland to the bog.

The only large peatland complex in northeastern Minnesota, the Sand Lake Peatland is unique in several respects. Located on an outwash plain instead of a lake plain, it lies just north of the Toimi Drumlin field, and is interrupted by lakes, eskers, and mineral island outcrops. Only the Sand Lake Peatland demonstrates how internal water tracks can originate by spread of a bog around mineral outcrops and lakes. Its lobate margins suggest a continuously advancing outward spread, as opposed to other state peatlands that appear to have stabilized. Why are these bogs still young and active? How does their development compare to the lakes and mineral islands in the area? While considering these questions, the visitor to Sand Lake may encounter the Eastern timber wolf, coast sedge, dragon's mouth, and the American bog rush. Visit by ski or snowshoe in March or April to hear the beautiful trill of the boreal owl.

Koochiching County Twp 157N Rng 26, 27W



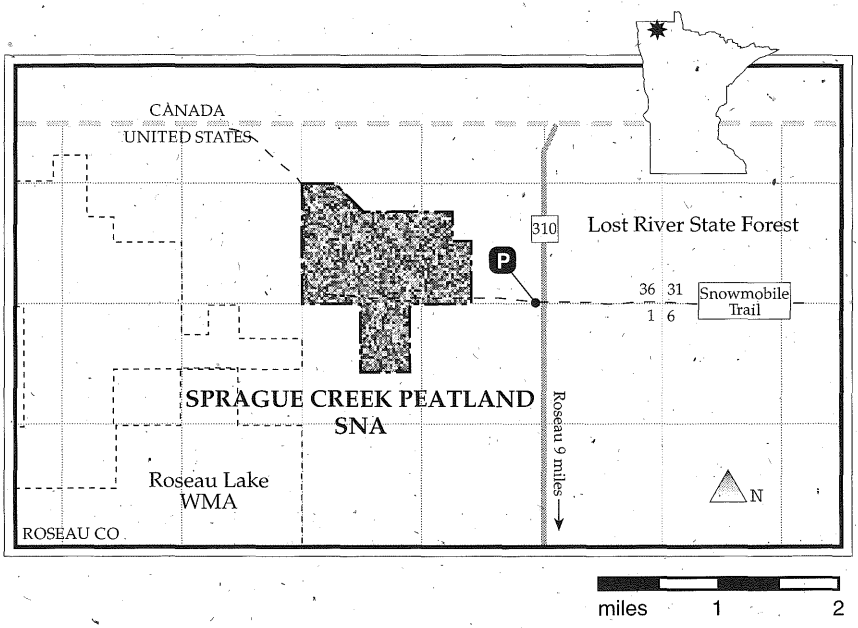
If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 16 miles NW of Big Falls. Go W on Co Hwy 30 for 9.5 miles, then 9 miles NW on the Twomey Williams State Forest Road, then 5 miles N and E on the Mannila F.R. The SNA lies 1.5 miles N.

The South Black River Peatland is a classic example of an undisturbed peatland, with water flowing around a large, extensively developed semicircular raised bog with internal water tracks. The only other example of this type is Lost River Peatland. Found in the heart of the Agassiz Lowlands, this peatland stretches for miles in either direction. Its rare features, however, occupy a relatively small, undisturbed area; rare linear-leaved and English sundews occur in sunny, shallow pools of water tracks, dominated by low-growing sedges and mosses.

Roseau County

Twp 163N Rng 40W Sec 03
Twp 164N Rng 40W Sec 34, 35



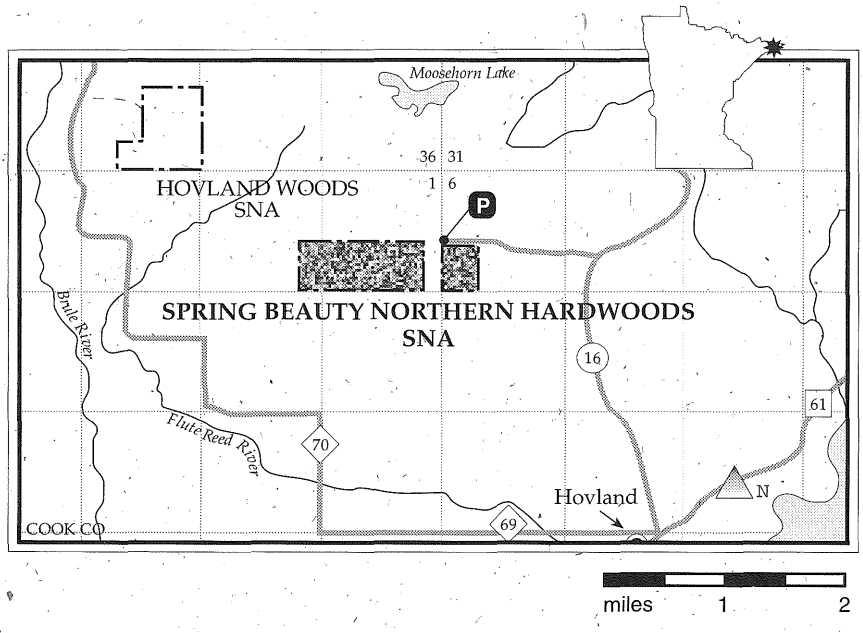
If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 9 miles N of Roseau on MN Hwy 310. Walk in 0.5 miles W.

Sprague Creek Peatland, northwest of the Agassiz Lowlands, lies near the Canadian border in a large swamp forest. Its network of non-forested channels draining through the forest is typical of spring fens, of which there are only five in the state. Forest remnants occur in the water tracks. Careful viewers can find English sundew, linear-leaved sundew, twig rush, hair-like beak-rush, dragon's mouth, and northern commandra, along with the greater sandhill crane and the great gray owl.

Cook County

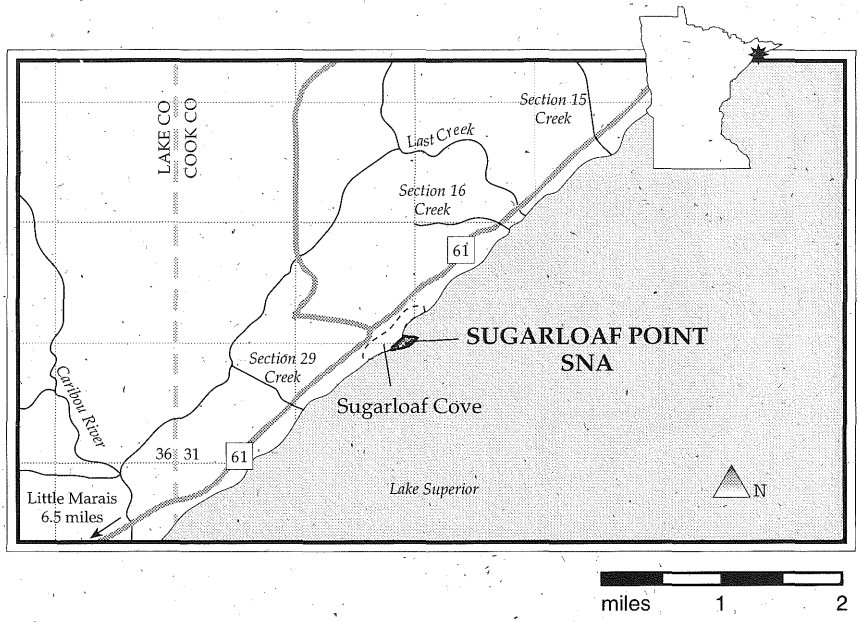
Twp 62N Rng 03E Sec 01, 02
Twp 62N Rng 04E Sec 06



Located approximately 3 miles N of Hovland on the Arrowhead Trail (Co Rd 16), then 1.5 miles W on the State Forest Road. Park by the Hovland Fire Tower.

The Spring Beauty Hardwoods SNA contains a rare, old-growth, northern hardwoods forest and several protected plant species associated only with these communities. The large size and location of this forest along the northern edge of its normal range make it particularly significant. A continuous canopy of old-growth sugar maple arches over lower-growing maple species. White cedar, white spruce, white pine, and yellow birch occur occasionally, their numbers diminished after portions were logged and/or used as a sugar bush. Look for the rare Chilean sweet cicely, blunt-fruited sweet cicely, and Carolina spring beauty, which occur only in this type of community.

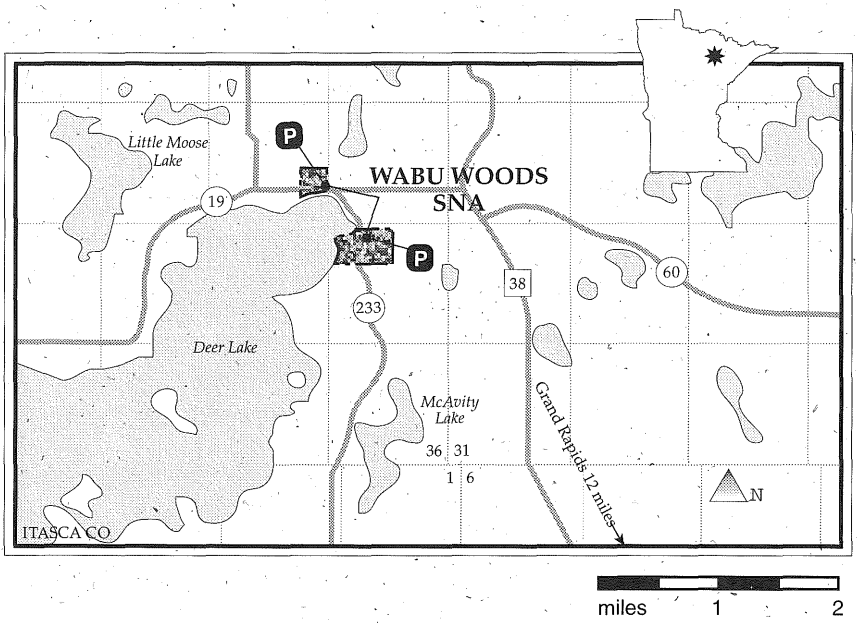
Cook County Twp 58N Rng 05W Sec 29



Located approximately 6.5 miles NE of Little Marais on State Hwy 61.

Sugarloaf Point contains pre-historic and modern beaches, along with a world-class example of thin, fluid basalt lava flows from the Precambrian age. The North Shore Volcanic Group erupted here during the mid-continent rift of North America about 1.1 billion years ago, and their lavas were never deformed or metamorphosed. The beach today is unique, composed of well-rounded boulders, cobbles, and pebbles of a wide variety of rock types, some of which originated in Canada and were brought down by the Pleistocene ice sheet. On the point at the east end of the site, wave action on the tilted lavas has produced excellent exposures of the surface and internal features of each lava flow. Their pipe amygdules (mineral fillings formed in the cavities of lava flows), and ropy, thin-bedded pahoehoe (glassy, smooth, undulating surface) can be clearly seen. Flows range from less than a meter to a few tens of meters thick. The range of eruptive styles and clear exposure of flow mechanisms make Sugarloaf Point geologically unique.

Itasca County Twp 57N Rng 26W Sec 22, 26

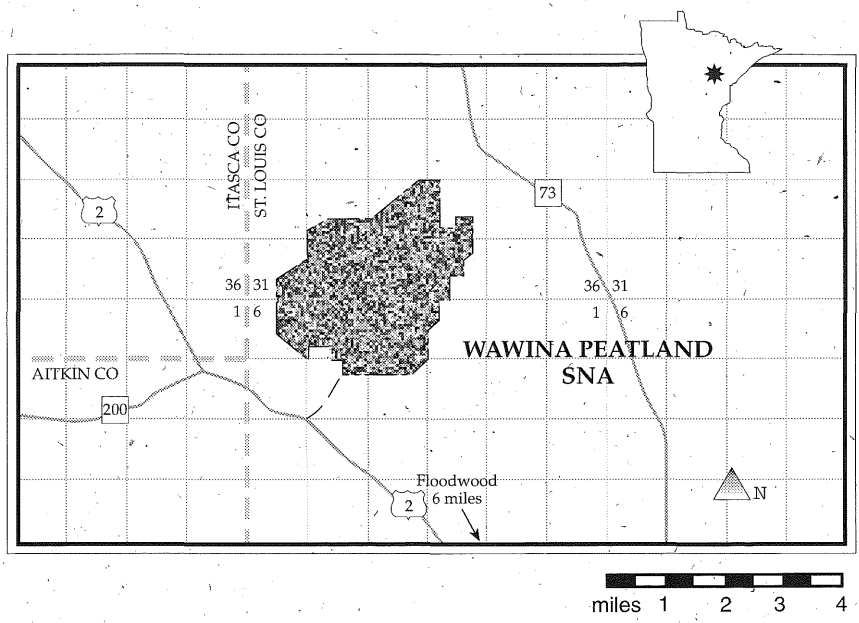


Located near Deer Lake. Travel approximately 12 miles N of Grand Rapids on MN Hwy 38, then 1 mile W on Co Hwy 19. Park along the shoulder of Co Hwys 19 or 233.

Two separate land parcels comprise the Wabu Woods SNA, located in the Laurentian Divide landscape region. The north parcel contains a 22-acre mature northern hardwood-conifer forest with scattered large white pines, a young stand of white cedar, small pockets of hardwood swamp, and several species of orchids. The southern parcel features an aspen-birch and northern hardwood-conifer forest, with scattered red pine, mature aspen, young northern hardwoods, and balsam fir. A small conifer swamp with several orchid species and an open bog dominated by leatherleaf are also found on the site.

St. Louis County

Twp 52N Rng 21W Sec 04-06, 08, 09
Twp 53N Rng 21W Sec 27-29, 31-34



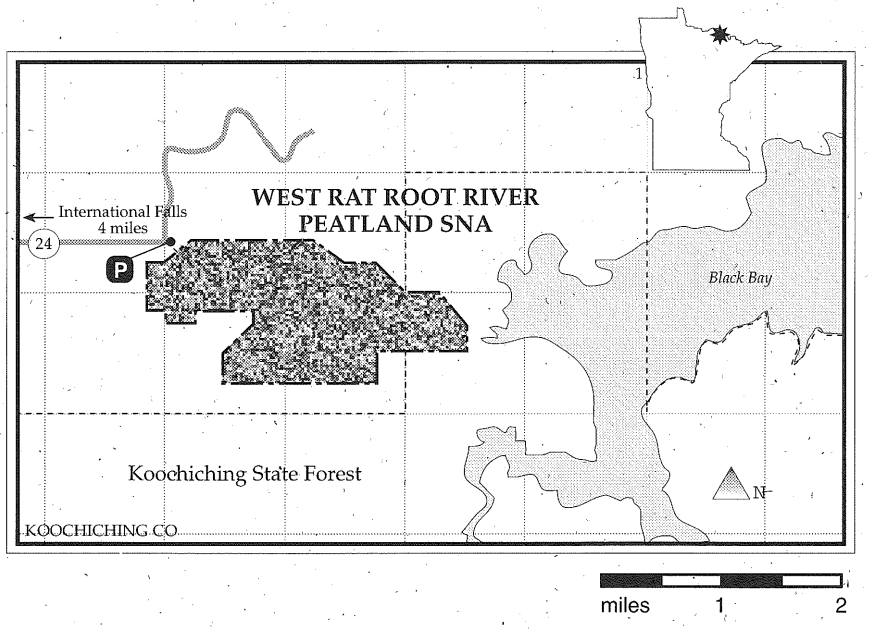
If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately midway between Grand Rapids and Duluth, 7 miles NW of Floodwood on US Hwy 2. Follow the ditch bank 1 mile N to the peatland.

Note: The state recognizes this as an ecologically significant peatland, but owns no land here; the majority of this peatland is owned by St. Louis County, and the remainder is privately owned.

Wawina Peatland is Minnesota's southernmost example of a large patterned peatland complex, and it is the only major peatland in the Glacial Lakes Aitkin and Upham areas. It contains the best ovoid island patterns in the northeastern part of the state, along with a featureless water track. A raised bog and a crested raised bog can also be seen here. Early spring viewers may witness the dancing and booming of sharp-tail grouse.

Koochiching County Twp 70N Rng 23W Sec 8-10, 14-16



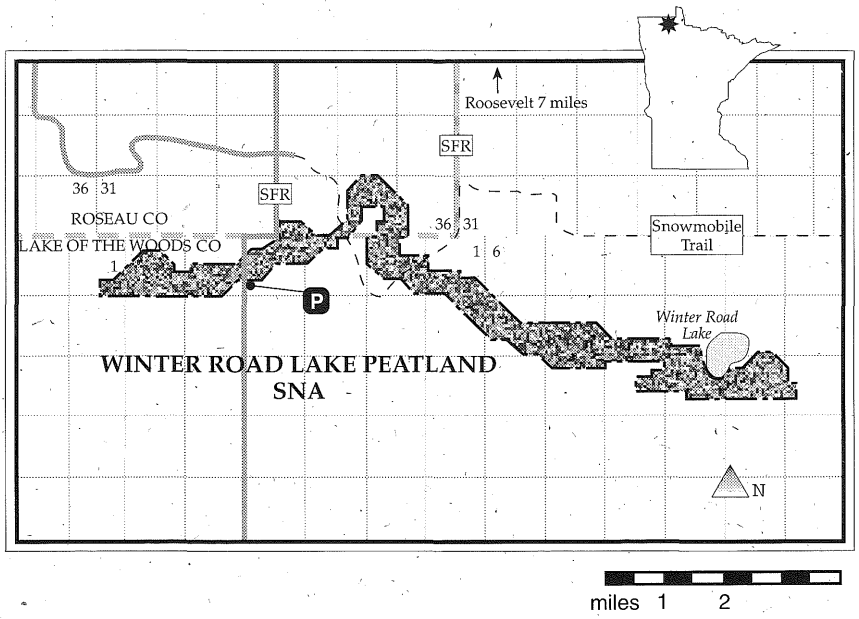
If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located southeast of International Falls. Take US Hwy 53 to Co Hwy 24, then go 4 miles E on Co Hwy 24. Walk SE for 0.5 mi on logging trail to the site.

The West Rat Root River Peatland lies across the river from the East Rat Root River Peatland, both of which are near the Canadian border at the interface of the Agassiz Lowlands and Border Lakes. Mineral-rich upland runoff feeds the featureless water tracks that dissect the bog complexes of this peatland. These waters flow around outcrops of rock and soil that slow them down, creating stagnant zones of sphagnum growth on the downstream side. Some of the raised bogs contain internal water tracks. Viewers will find some evidence of the ditches and railroad that have disturbed the area. Plant species common to patterned peatlands may be found here.

Lake of the Woods County
Roseau County

Twp 160, 161N Rng 34, 35, 36W



If you intend to visit this site it is advisable to carry a topographical map produced by the U.S. Geological Survey. These maps display many old logging trails which may or may not be identifiable on the ground anymore.

Located approximately 7 miles S of Roosevelt. From the Red Lake Wildlife Management Area sign in Roosevelt, follow the gravel road about 2 miles W, then go 7.5 miles S on the Norris-Roosevelt F.R. The State Forest Road crosses the peatland.

The Winter Road Lake Peatland, at the western edge of the Agassiz Lowlands, has only one small raised bog, an uncommon feature this far northwest in the state. The peatland is dominated by water tracks with well developed ribbed fen patterns, made striking by tree and shrub growth on the drier strings. Some rib patterns are arc-shaped. This is one of only two areas that contain net-like flark patterns in the water track. The peatland provides sharp-tailed grouse habitat; other plant and wildlife species common to patterned peatlands also occur here.

Appendix

Resources

The following resources are recommended for those who wish to learn more about Minnesota and its scientific and natural features.

Bibliography

Use these publications to learn more about the natural history of Minnesota. Many of them were used in preparing this Guide.

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Natural History Organizations

Amateurs and professionals alike maintain memberships in these organizations. Their meetings, guided field trips, publications, and general camaraderie are great ways to learn about Minnesota's natural history.

Geological Society of MN - 2642 University Ave, St. Paul, MN 55114-1057. (612) 627-4780
MN Mycological Society - 220 Biological Science Center, 1445 Gortner Ave, St. Paul, MN 55108-1095. (612) 625-1234
MN Native Plant Society - 220 Biological Science Center, 1445 Gortner Ave, St. Paul, MN 55108-1095. Thor Kommedahl, editor of MN Plant Press. (612) 625-3164
MN Ornithologists Union - 10 Church St., SE, U of M, Minneapolis, MN 55455. Robert Janssen, editor, 10521 S. Cedar Lake Rd., #212, Minnetonka, MN 55305. (612) 546-4220
Minnesota Land Trust - 70 North 22nd Avenue, Minneapolis, MN. 55411-2237. (612) 522-3743

The National Audubon Society, Minnesota - 30 E. 10th St., St. Paul, MN 55101. 612) 291-2596

The Nature Conservancy, Minnesota - 1313 5th St SE, Minneapolis, MN 55414-1588. (612) 331-0750

The Trust for Public Lands, Minnesota - 420 North Fifth Street, Suite 865, Minneapolis, MN 55401. (612)-338-8494

The Wildlife Society, Minnesota - Hennepin Park District, 3800 County Road 24 Minneapolis, MN 55359.

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To paraphrase Chief Seathl:

If all the beasts were gone, we would die from loneliness of spirit, for whatever happens to the beast, soon happens to us.... The earth does not belong to us; we belong to the earth. All things are connected like the blood which unites a family. Whatever befalls the earth, befalls the children of the earth....

Chief Seathl (Seattle)

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