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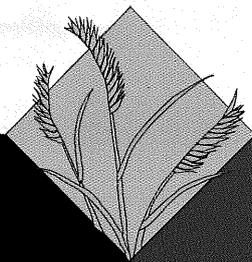
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# Interim Report 1990



## MINNESOTA COUNTY BIOLOGICAL SURVEY



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The Minnesota County Biological Survey (MCBS) is conducted by the Natural Heritage and Nongame Wildlife Programs, Section of Wildlife, Division of Fish and Wildlife, Minnesota Department of Natural Resources.

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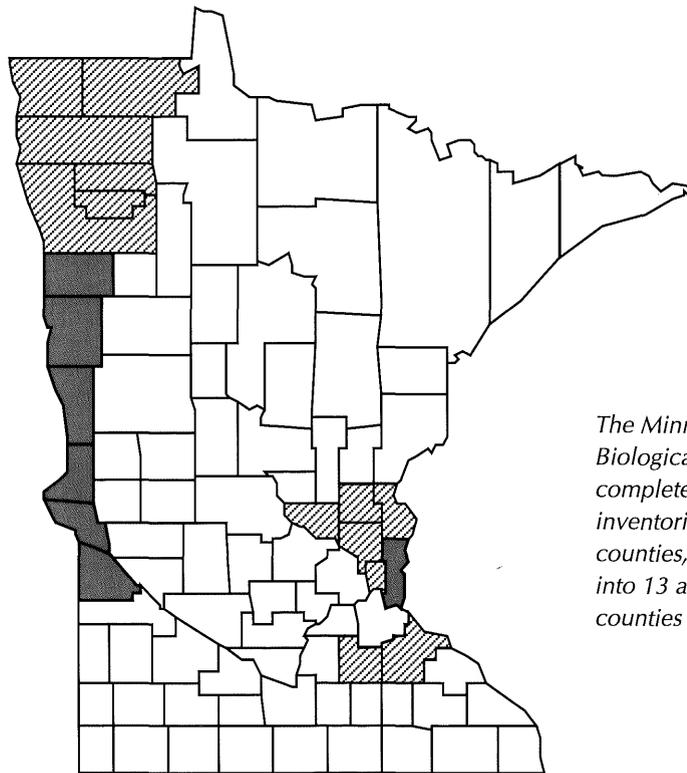
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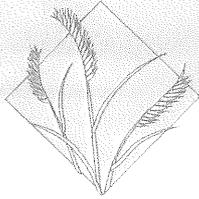
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The Minnesota County Biological Survey has completed rare features inventories in seven counties, and expanded into 13 additional counties in 1989.

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## INTRODUCTION

**P**reserving biological diversity is essential for the proper functioning of natural ecosystems. Healthy ecosystems buffer the effects of pollution, protect water quality, prevent soil erosion, improve land values, and provide opportunities for outdoor recreation. In addition, the species that make up biologically diverse areas are reservoirs of genetic materials potentially useful in agriculture, medicine and industry. On many levels, biological diversity is basic to maintaining the quality of life we enjoy. Deforestation, destruction of wetlands and degradation of native grasslands are rapidly depleting the nation's biological diversity.

Recognizing the urgency to assess the status of its unique natural resources, the State of Minnesota initiated the Minnesota County Biological Survey (MCBS) in 1987. Now in operation for three years, the fundamental objective of the MCBS is to systematically identify locations of Minnesota's rare natural ecosystems, their component natural communities and rare species. This includes the survey of selected animals and plants that are officially listed under the provisions of the Federal Endangered Species Act of 1973, Public Law 93-205 and/or Minnesota Statute 84.0895. The Department of Natural Resource's Natural Heritage and Nongame Wildlife Programs jointly conduct the county survey.

This report summarizes the accomplishments of the first two years of the survey (1987-1989). During this pilot phase, six prairie counties and one Twin Cities metropolitan county were surveyed.

In 1989, the survey expanded into thirteen additional counties that are found in three areas of the state: the northwest, the southeastern blufflands, and the northern Twin Cities metropolitan area. This report also features the current activities of MCBS in these new counties through the 1990 field season.

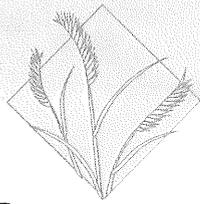
All ecological data generated from the MCBS were entered into the Minnesota Natural Heritage Information System, maintained by DNR's Natural Heritage and Nongame Wildlife programs. This system includes the only statewide repository of information on Minnesota's rare species and significant natural communities. The system is a continuously updated storehouse of ecological information made up of manual files, computerized data files and map files.

The Information System is used to:

- Guide public and private land purchases where endangered species and natural habitat protection is the primary objective.
- Conduct environmental reviews that assist in the planning of development projects (buildings, roads, utility corridors, recreational facilities).
- Expand research opportunities, and promote conservation education on Minnesota's endangered natural resources.



*Maidenhair fern and wild ginger grow beneath a canopy of basswood and sugar maple in a St. Croix River ravine. The Minnesota County Biological Survey inventories increasingly rare habitats and their component rare species.*



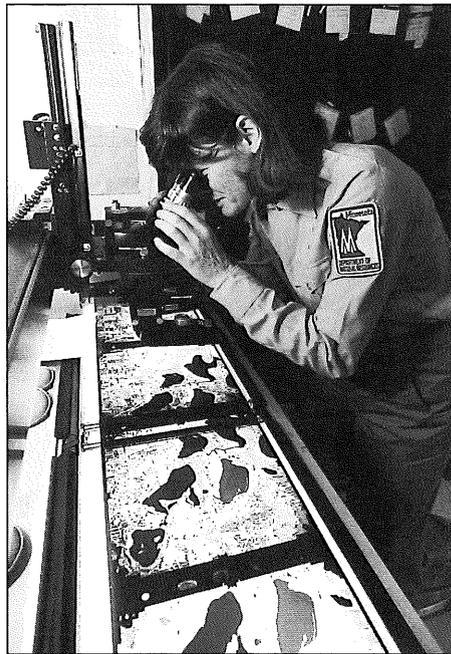
## PROCEDURES

*Flying provides a rapid means of determining which sites merit ground survey and provides access to remote areas.*



K. Wendt

*Using a stereoscope, MCBS staff can interpret aerial photographs and make preliminary selections of sites to be surveyed.*



D. Ruda

**T**he MCBS has developed an efficient and cost-effective inventory procedure. Typically, during the first field season in a new county, MCBS concentrates on the identification of natural areas—remnants of land that have escaped significant human alteration. Natural areas represent what the Minnesota landscape

looked like prior to European settlement in the 1850's. Such areas are made up of natural communities—distinctive groups of native plants and animals living together under similar environmental conditions. The following field seasons include more intensive surveys for rare plants and animals, often based on the habitats identified by ecologists during the first season.

The inventory procedure works on several levels, beginning with the identification of natural areas through the interpretation of aerial photographs and satellite imagery, followed by a combination of aircraft and ground surveys. Ecologists conduct detailed ground surveys of the highest quality natural areas by using a standardized method that verifies the identity, and assesses the condition, quality and distribution of natural community types.

Botanists and zoologists focus on priority natural areas in their surveys for rare plant and animal species. Additional sites are also selected if a targeted rare species is known from other habitats. For example, a high-priority floodplain forest may provide excellent habitat for Red-shouldered hawks,

whereas an isolated rock outcrop in an old field might be prime habitat for basking snakes and skinks.

The procedures used to survey species vary with the targeted animal or plant group. For example, an early morning count of breeding birds in June is made by listening to their songs and observing individuals at intervals within the site. Cruising roads during the heat of the day or turning over rocks and debris are techniques used to locate amphibians and reptiles.

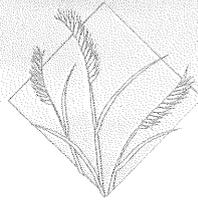
Surveys of rare plants and animals are usually conducted when the targeted species is most detectable—while in full bloom or in fruit, during the breeding season, or during periods of high activity or high population densities. Survey techniques and timing are often modified due to the species habitat or by changes in weather that alter typical patterns. For example, the documentation of Louisiana waterthrushes and wood turtles is best accomplished by canoeing along rivers. A sudden change in weather, such as a thundershower, might create an ephemeral rock outcrop pool that provides habitat for a brief appearance of plants such as mudwort (*Limnosella aquatica*). Botanists and zoologists must carefully plan field seasons based on their knowledge of the species life history, yet adapt schedules and



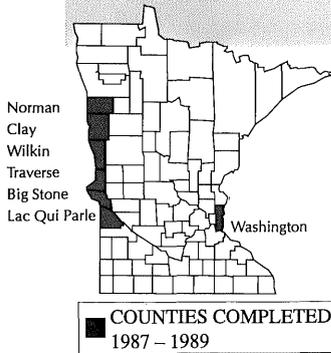
*Field survey of the highest quality sites by trained biologists is crucial to the success of the Survey.*

techniques to changing conditions.

Standardized forms are used to document the location, number, distribution and condition of all rare species. Collected plant specimens are deposited in the University of Minnesota herbarium, and animal specimens are deposited in the Bell Museum of Natural History or in the entomological collection at the University of Minnesota. The location and ecological data on all rare species and high quality sites are added to the Natural Heritage Information System.



## RESULTS OF THE PILOT SURVEY 1987-1989



### 1. DATA COLLECTION AND INFORMATION MANAGEMENT

All data collected during the pilot phase has been entered into several component databases of the Natural Heritage Information System.

- The number of known rare feature locations in the first seven counties surveyed more than doubled as a result of the survey. Survey staff added 1,437 locations of rare features to the **Rare Features Database**. This represents over 20% of the total records statewide.
- A **Geographic Information System (GIS)** using ARC/INFO was implemented that is compatible with systems within DNR and with those of the University of Minnesota and the State Planning Agency. Digital map records of survey results now exist for three counties in preparation for county map publication, and custom reporting.
- **Bearing tree data** for each survey county were compiled from 1847-1907 land survey records in preparation for computerization. Computer analysis of these data will allow ecologists to more readily evaluate changes in natural vegetation since the time of settlement.
- **Checklists of vascular plants** for each survey county have been prepared in cooperation with the University of Minnesota herbarium. These computerized lists assist botanists in collecting specimens in each county in order to update distribution and range maps of each species.
- **Relevé Database**—A standardized plot method for sampling vegetation called a relevé was used by plant ecologists in order to assist with the characterization of larger vegetation units. The addition of 40 relevés to a computerized system will allow for enhancement of the Natural Heritage Program vegetation classification through data analysis.

#### HIGHLIGHTS OF THE WASHINGTON COUNTY SURVEY

##### Natural Communities

Falls Creek is one of two MCBS sites in Washington county receiving protection as a Scientific and Natural Area (SNA) because of exemplary natural communities identified during the survey. Falls Creek SNA contains St. Croix River bluffs and ravines covered by white pine and deciduous forests. The site supports populations of Louisiana waterthrush (*Seiurus motacilla*), ginseng (*Panax quinquefolium*), red-shouldered hawk (*Buteo lineatus*), and kitten-tails (*Besseyia bullii*).

##### Rare Plants

Bog bluegrass (*Poa paludigena*), a state endangered species, was known from one Minnesota location prior to the survey. Four additional populations in Washington county were identified in seepage fens along the St. Croix River.

##### Rare Animals

Individuals representing 10 to 12 breeding pairs of Louisiana waterthrush were documented along the St. Croix River. Most were located in relatively steep-sided valleys with permanent, swiftly flowing streams, or in association with seepage fens.

## HIGHLIGHTS OF THE SURVEY OF WESTERN COUNTIES

### Natural Communities

Ecologists identified 43,300 acres of prairie in these six counties. This represents 1.6% of the original prairie vegetation in these counties. Significant new data were collected on some of Minnesota's last prairie landscape areas that contain complexes of prairie, wetland and aquatic vegetation.

### Examples of Prairie Landscape Areas:

|  |              |
|--|--------------|
| Rothsay Prairie (Wilkin county)                  | 5,830 acres  |
| Felton Prairie (Clay county)                     | 9,360 acres  |
| Lac Qui Parle Prairie (LQP & Big Stone counties) | 50,400 acres |
| Bluestem Prairie (Clay county)                   | 3,040 acres  |
| Cupido-Twin Valley Prairie (Norman county)       | 3,000 acres  |
| Big Stone Moraine Prairie (Big Stone county)     | 2,090 acres  |

### Rare Plants

In Minnesota, eared gerardia (*Tomanthera auriculata*) typically inhabits wet prairies at the base of river bluffs where groundwater is discharged. All four collections of this state endangered species have been made in the Minnesota River Valley including a new location in Big Stone county.

### Rare Animals

Flight periods of the Dakota skipper (*Hesperia dacotae*) were greatly altered by the unusually warm and dry weather in 1988. However, it was found on 13 of the 39 prairies identified for survey as potential habitat.

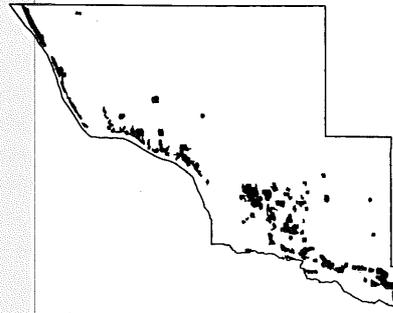


C. Thiesen

In Big Stone and Lac Qui Parle counties, granite outcrops exposed by the Glacial River Warren 10,000 years ago, provide habitat for seven rare plant and animal species. Stone quarrying of the largest outcrops is a threat to their continued existence in the Minnesota River Valley.



Big Stone county in the 1850's prior to intensive settlement. The black area represents prairie that covered 94% of the county (316,947 acres). The hatched portion represents oak openings and barrens, and the white areas indicate lakes.



Big Stone county today. Only 2.6% (8,335 acres) of the native prairie habitat now remains as determined by the Minnesota County Biological Survey (black indicates remaining prairie).

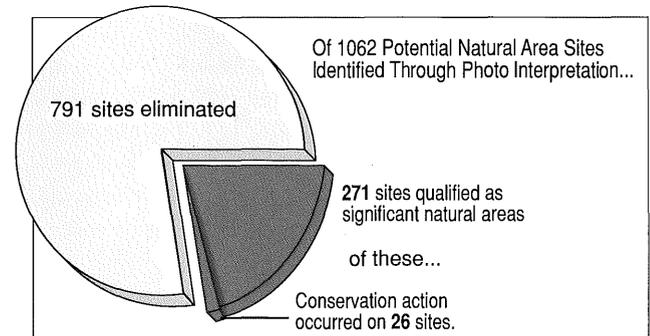
## 2. IMPLEMENTATION OF CONSERVATION GOALS AND STRATEGIES

### Conservation Planning

The MCBS identified 271 sites in the first seven counties as significant natural areas. Examples from the 26 sites receiving some level of protection follow:

- Lost Valley Prairie in Washington county was acquired and designated as a Scientific and Natural Area (SNA). Over 200 people visited the SNA during the 1990 Prairie Day to learn more about the bluff prairie, and the associated rare Hill's thistle (*Cirsium hillii*) and rock sandwort (*Arenaria dawsonensis*) found at the site.
- Five high quality prairies in Big Stone and Clay counties were enrolled in the Prairie Bank Program. These provide habitat for upland sandpipers, poweshiek skipper butterflies, prairie chickens, and small white lady's-slippers (*Cypripedium candidum*)—species that are rare primarily because of loss of prairie habitats.
- Bayport Wildlife Management Area was surveyed and a portion will become an SNA to protect its dry oak savanna and associated state endangered plant populations. It supports one of three known populations of James' polania (*Polania jamesii*) in Minnesota.

Conservation Action Within The Minnesota County Biological Survey Area  
July 1987 – June 1990\*



\*Big Stone, Clay, Lac Qui Parle, Norman, Traverse, Washington and Wilkin Counties

- The proposed Regional Park Reserve, Big Marine/Maple Island, was surveyed and protection recommendations were made by MCBS ecologists to the Metropolitan Council and Washington county parks.

### Environmental Review

MCBS provided critical data necessary to respond to environmental review requests. Examples of environmental review projects utilizing MCBS data include:

- Afton township strategic plan (Washington county)
- Grasshopper Control (townships in all counties)
- Ulen Wastewater Treatment Plant (Clay county)
- Proposed Landfill site, Lake Elmo Regional Park (Washington county)

## Collaborators, Clientele and Cooperative Projects

*MCBS has worked with other DNR programs to more effectively implement natural resource planning activities:*

- Division of Forestry: MCBS staff cooperated in the development of a DNR Geographical Information System (GIS) and Ecological Classification System (ECS).
- Division of Parks and Recreation: State parks were sites of MCBS public education events. Parks staff cooperated in executing the survey within five state parks, and promoting integration of results into park planning.
- Division of Trails and Waterways: MCBS staff provided interpretive information on natural features encountered along hiking and bicycling routes recommended in the *Trail Explorer*.
- Division of Fish and Wildlife: MCBS conducted surveys of rare features in Wildlife Management Areas and evaluated potential additions, such as three sites that are now part of Lac Qui Parle WMA through Reinvest in Minnesota's Critical Habitat Match.

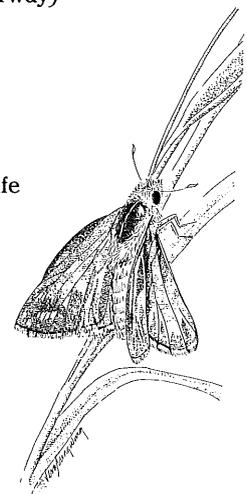


*Upland sandpiper nesting habitat is protected through private landowner participation in Prairie Bank, prairie tax exemption, and land registry programs.*

*The MCBS has collaborated with numerous other resource agencies and environmental programs to exchange information on rare features and to work toward their conservation. A selection of these organizations is listed below:*

Barlage Center for Science  
Board of Soil and Water Resources  
Carpenter Nature Center  
Minnesota Department of Transportation  
Minnesota Herpetological Society  
Minnesota Native Plant Society  
Minnesota Ornithologists' Union  
Moorhead State University  
National Park Service (St. Croix National Scenic Riverway)  
Science Museum of Minnesota  
The Nature Conservancy  
U.S. Army Corps of Engineers  
University of Minnesota:  
    James Ford Bell Museum of Natural History  
    Department of Plant Biology  
    Department of Entomology, Fisheries and Wildlife  
    Department of Ecology, Evolution, & Behavior  
    College of Forestry, Remote Sensing Lab  
U.S. Fish and Wildlife Service:  
    National Wetlands Inventory  
    Office of Migratory Birds  
    Office of Endangered Species  
    Big Stone National Wildlife Refuge  
Warner Nature Center  
Washington County Parks

*Dakota skipper  
(Hesperia dacotae).*

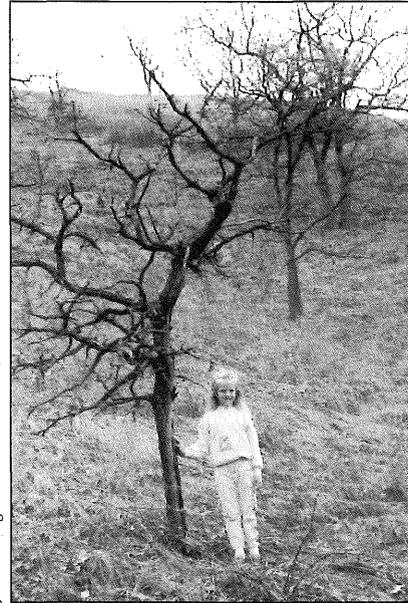


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### 3. EDUCATIONAL EVENTS (June 1987–June 1990)

MCBS has been featured at 119 public education events as of June 1990. A sampling follows:

- **Sherburne County Environmental Education Days**—Provided natural area interpretation for over 300 sixth graders.
- **“Spring Fling”**—Organized presentations and wildflower hikes in Rice county’s Cannon River Wilderness Area.
- **Felton Prairie**—MCBS ecologist led field trip for University of Minnesota class.
- **The Bell Museum of Natural History**—Participated in public seminar entitled *The Prairie: Minnesota’s View Through the Tall Grass*.
- **The Lac Qui Parle Regional Expo**—Conducted prairie wildflower hikes and introduced the survey in western Minnesota through displays.
- **The Great Lakes Regional ARC/INFO (Geographic Information System) Users conference**—Made presentation on GIS applications relating current MCBS natural vegetation surveys to those of original land surveyors.
- **Lee and Rosa Warner Nature Center**—Conducted workshop on Minnesota’s peatlands and bogs that included a field trip to a local bog.

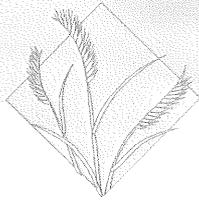


Protection of natural landscapes for conservation education is essential in developing an awareness of the importance of biological diversity.

### 4. PUBLICATIONS

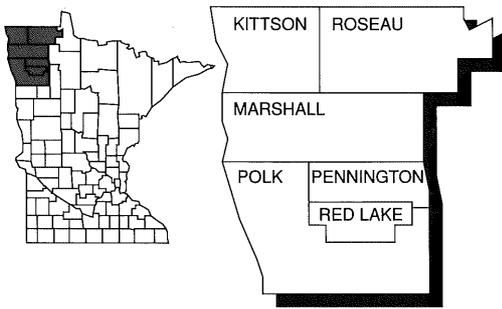
MCBS has been featured in over 50 periodical articles (such as the *Minnesota Horticulturalist*, the *Wheaton Gazette*, the *Minnesota History Interpreter* and *The Loon*.)

- **Technical reports** documenting procedures and results of rare animal surveys have been completed for mammals, butterflies, birds, and amphibians and reptiles in seven counties. Botanical reports have been completed for the prairie moonwort (*Botrychium campestre*), and are in press for the flora of the Red River Valley and the flora of Washington county.
- The MCBS has published a **Washington county map** displaying rare features.
- A **MCBS brochure** describing survey objectives and methodology has been produced and distributed statewide.
- An **educational poster on native prairie** has been distributed to schools statewide.



## STATUS OF THE EXPANDED COUNTY SURVEY 1989-1991

**I**n 1989, MCBS expanded into thirteen new counties in northwestern Minnesota, in the southeastern blufflands, and in the northern twin cities metropolitan area. Some of the current activities, and preliminary results follow.



### NORTHWESTERN COUNTIES

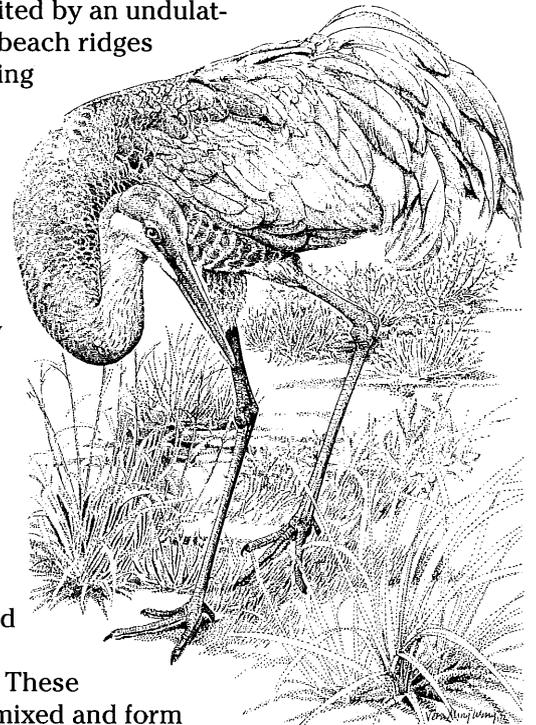
In the 1850's the natural landscape of this six-county survey area was mostly covered by upland prairie, prairie wetlands, and aspen/oak parklands. It also included a transition zone between these western prairies and parklands, and the forests and peatlands to the east.

Over 99 percent of Minnesota's original 18 million acres of native prairie, or grassland, has been cultivated. The loss and deterioration of native prairie habitat has reduced the populations and geographic distribution of many prairie species. Over 30 percent of the state's legally listed rare species inhabit native prairie.

Some of the largest areas of remaining native prairie and aspen parkland in North America are located in the Red River Valley. The central part of the valley, due to its deep fertile soils, is

nearly continuous cropland. However, toward the eastern margin of the valley, cultivation was inhibited by an undulating landscape of dry beach ridges and wet swales marking former Glacial Lake Agassiz shorelines. Within this interbeach area, thousands of acres of savannas, prairies, and wetlands still exist as privately owned pastures and hay fields, or as public land.

In the eastern portions of the six counties, the vegetation comprises deciduous and coniferous forests and swamps, shrub wetlands, fens and bogs. These types are often intermixed and form large vegetational complexes in remote areas. In order to more rapidly assess these immense and often very inaccessible landscapes, MCBS has modified typical procedures to incorporate the use of Landsat's Thematic Mapper satellite imagery, computerized classification of vegetation, Geographic Information Systems, and helicopters. During the field seasons of 1989 and 1990, MCBS ecologists conducted preliminary ground surveys of more than 200 sites of selected vegetation types in northwestern Minnesota to provide data to assist with computerized classification. Final survey of the most significant natural areas and rare species will be conducted in 1991.

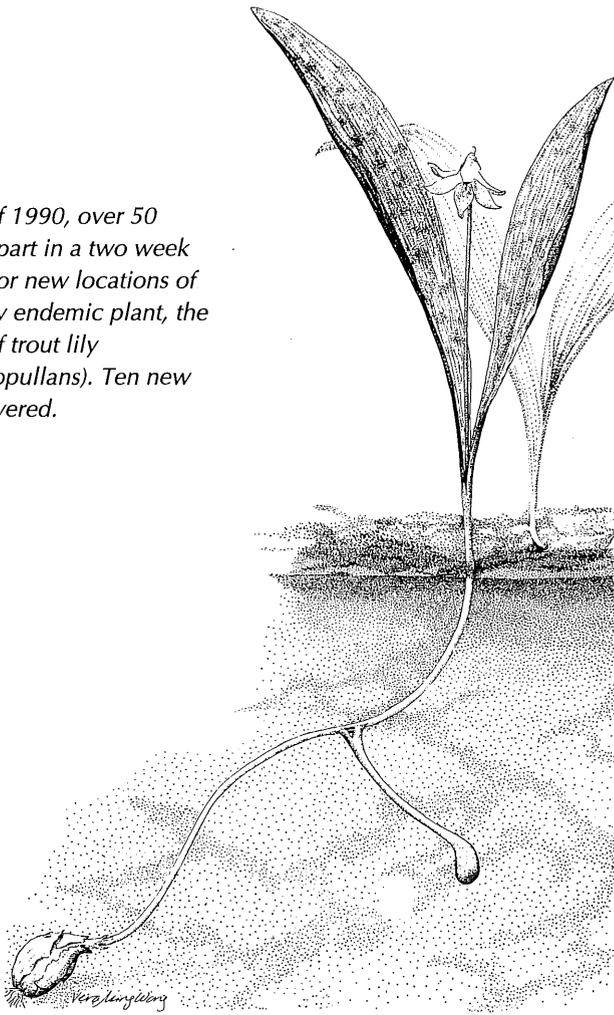


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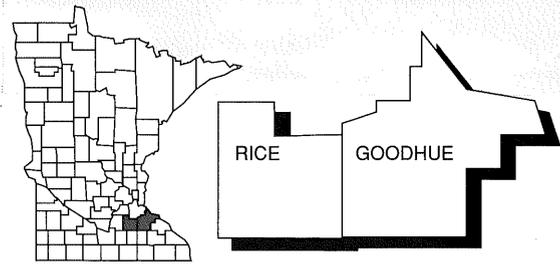
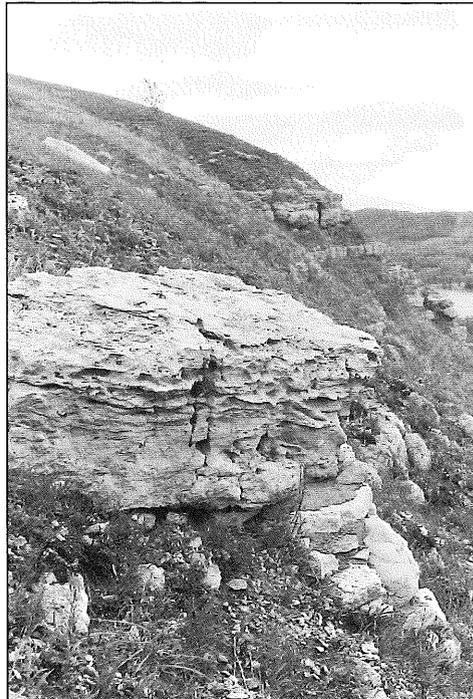
*Field investigations of the state's largest sandhill crane populations are being expanded by the use of computer classification in a cooperative project between the U of M remote sensing lab, DNR's Nongame research staff, and MCBS staff.*

In early spring of 1990, over 50 volunteers took part in a two week foray to search for new locations of Minnesota's only endemic plant, the Minnesota dwarf trout lily (*Erythronium propullans*). Ten new sites were discovered.

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Bedrock bluff prairies are threatened by housing development, and the encroachment of trees and shrubs in the absence of fire.



## SOUTHEASTERN BLUFFLANDS

The spectacular bluffs of the Mississippi River have historically inspired praise by observers.

“From the summit of the Grange the view of the surrounding scenery is surpassed, perhaps, by very few, if any, of a similar character that the country and probably the world can afford. The sublime and beautiful are here blended in the most enchanting manner....”—Major Stephen H. Long, Barn Bluff, Red Wing 1817.

Much of the native Big Woods, tallgrass prairie, and oak openings of the level to rolling till plains and moraines of Rice and Goodhue counties have long been fragmented by agricultural conversion. The areas that contain most of the remaining native bluff prairies, floodplain forests, and maple basswood forests often border rivers. Many of the state's rarest species, including the bald eagle, the Minnesota dwarf trout lily, and wood turtle are inhabitants of these river systems. Bald eagles use portions along the Mississippi River for wintering grounds. The Minnesota dwarf trout lily is found only in the Cannon River and Zumbro River watersheds, and nowhere else in the world. Wood turtles favor stony, fast-water river bottoms with convenient sandbar nesting areas. Water pollution, recreation, logging and housing increasingly threaten the natural riverine habitats in this area. In recognition of this problem, conservation planners, citizens groups and agencies are now cooperating to direct the growth of this area with the Cannon River watershed as the focus for development of an ecologically sound plan. This process includes the protection and enhancement of important natural area sites identified by MCBS.

The surveys of natural communities, and the rare plant and animal species they contain were undertaken simultaneously during the 1990 field season in Rice and Goodhue counties. MCBS biologists identified new locations of the following state listed rare species and imperiled natural communities.\*

| Birds                 | Amphibians and Reptiles | Mammals      |
|-----------------------|-------------------------|--------------|
| Bald eagle            | Blue racer              | Prairie vole |
| Forster's tern        | Bullsnake               |              |
| Loggerhead shrike     | Fox snake               |              |
| Louisiana waterthrush | Milksnake               |              |
| Osprey                | Snapping turtle         |              |
| Red-shouldered hawk   | Timber rattlesnake      |              |
| Upland sandpiper      | Wood turtle             |              |

**Plants**

- Bladder pod (*Lesquerella ludoviciana*)
- Ginseng (*Panax quinquefolium*)
- Glade mallow (*Napaea dioica*)
- Kitten-tails (*Besseyia bullii*)
- Minnesota dwarf trout lily (*Erythronium propullans*)
- Prairie bush clover (*Lespedeza leptostachya*)
- Rock Sandwort (*Arenaria dawsonensis*)
- Snow trillium (*Trillium nivale*)

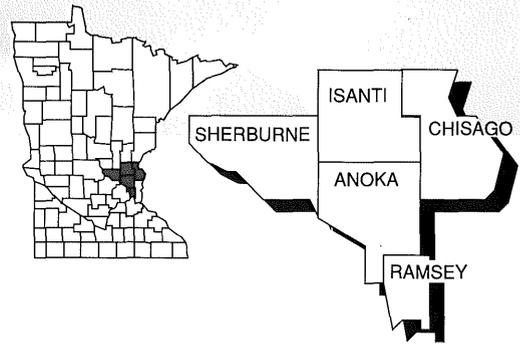
**Natural Communities**

- Prairies and Savannas
  - Dry Hill Prairie
  - Dry Bedrock-Bluff Prairie
  - Oak Savanna
- Upland Forests
  - Southern Mixed Oak Woodland
  - Southern Maple-Basswood Forest
  - Southern Oak Forest
  - Southern White Pine Forest
- Lowland Forests and Wetlands
  - Black Willow-Cottonwood Floodplain Forest
  - Sedge Meadow
  - Seepage Fen
  - Silver Maple Floodplain Forest
  - Southern Lowland Hardwoods
- Primary Communities
  - Dry Cliff
  - Moist Cliff

An extensive forest of sugar maple, elm, basswood, white oak and red oak once covered large portions of Rice and western Goodhue counties. Distribution is now restricted mostly to moist, protected sites on steep slopes, where grazing and logging activities have been limited.



\* Information on the identification, habitat, and status of rare species is available in the illustrated book: *Minnesota's Endangered Flora and Fauna*, edited by Barbara Coffin and Lee Pfanmuller, 1988.



## NORTHERN TWIN CITIES METROPOLITAN AREA

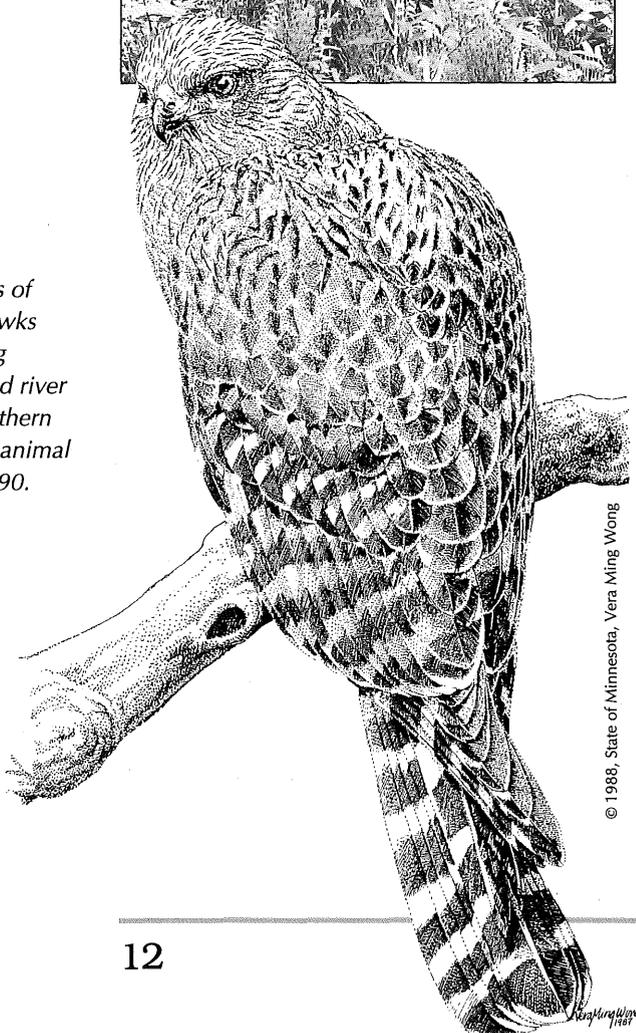
Diversity of plants and animals is high in the Northern Metropolitan Area because three major biomes are represented: deciduous forest, conifer-hardwood forest, and prairie. Prominent landscape features are the Anoka Sand Plain and the terraces and valleys of the Mississippi and St. Croix Rivers. On the sandy, glacial outwash plain, important natural communities are bur oak savanna, sand prairie, and a wide variety of wetland habitats. Floodplain forests, deciduous forests, dry oak forests, bluff prairies, and rocky cliffs border the St. Croix and Mississippi Rivers. A rare type of hardwood swamp occurs where groundwater seeps onto terraces of the St. Croix River.

Planning and development decisions made in the next few years are critical in determining whether future generations will ever watch a Blanding's turtle at a quiet pond, hear the loud cry of red-shouldered hawks, or see the first flowers of spring at a skunk cabbage seep. The MCBS is identifying the north metropolitan area's most significant natural features, so that conservation and development planners can work together to direct the growth of the counties while protecting the highest quality natural areas.

*Seepage fens, common at the base of St. Croix River bluffs, contain horsetails, skunk cabbage, marsh ferns and rare plant species such as bog bluegrass and false mermaid.*



*More than 20 pairs of red-shouldered hawks were located along lowland woods and river bottoms of the northern metro area during animal surveys in June 1990.*



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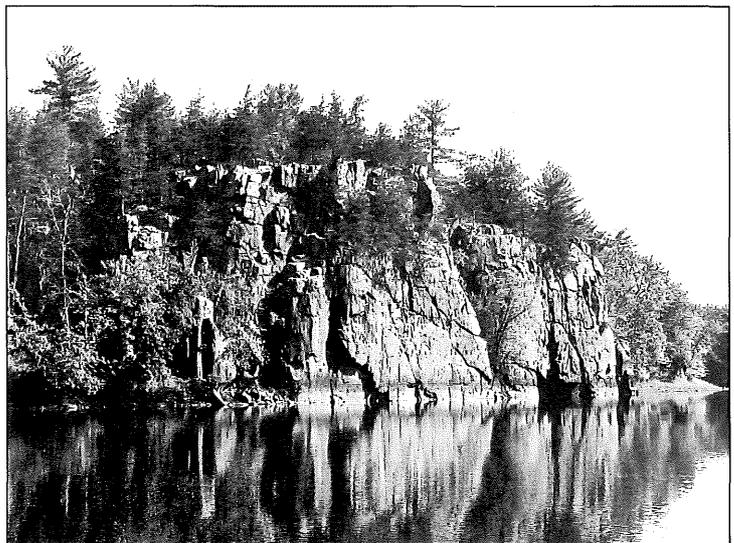
**M**CBS biologists identified new locations of the following state listed rare species and imperiled natural communities in this area during the 1990 field season.

|  |  |   |  |   |
|--|--|---|--|---|
| <p><b>Birds</b><br/>         American bittern<br/>         Bald eagle<br/>         Common moorhen<br/>         Forster's tern<br/>         Louisiana waterthrush<br/>         Osprey<br/>         Red-shouldered hawk<br/>         Sandhill crane<br/>         Upland sandpiper<br/>         Wilson's phalarope</p>  | <p><b>Amphibians and Reptiles</b><br/>         Blanding's turtle<br/>         Bullfrog<br/>         Bullsnake<br/>         Eastern hognose snake<br/>         Fox snake<br/>         Milksnake<br/>         Snapping turtle<br/>         Western hognose snake</p> | <p><b>Natural Communities</b></p> <table border="0"> <tr> <td data-bbox="852 367 1193 556"> <p><b>Prairies and Savannas</b><br/>           Bedrock Bluff Prairie<br/>           Dry Gravel Prairie<br/>           Oak Savanna<br/>           Sand Dune Prairie<br/>           Wet Brush Prairie<br/>           Wet Prairie</p> </td> <td data-bbox="1193 367 1502 577"> <p><b>Primary and Aquatic</b><br/>           Dry Cliff<br/>           Lake Beach<br/>           Lake Bed<br/>           Moist Cliff<br/>           River Beach<br/>           River Bed<br/>           Red Cedar Glades</p> </td> </tr> </table> <p><b>Upland Forests</b><br/>         Mixed Oak Woodland<br/>         Southern Maple-Basswood Forest<br/>         Southern Oak Forest<br/>         Southern Mesic Pine-Hardwood Forest<br/>         Southern White Pine Forest</p> | <p><b>Prairies and Savannas</b><br/>           Bedrock Bluff Prairie<br/>           Dry Gravel Prairie<br/>           Oak Savanna<br/>           Sand Dune Prairie<br/>           Wet Brush Prairie<br/>           Wet Prairie</p> | <p><b>Primary and Aquatic</b><br/>           Dry Cliff<br/>           Lake Beach<br/>           Lake Bed<br/>           Moist Cliff<br/>           River Beach<br/>           River Bed<br/>           Red Cedar Glades</p> |
| <p><b>Prairies and Savannas</b><br/>           Bedrock Bluff Prairie<br/>           Dry Gravel Prairie<br/>           Oak Savanna<br/>           Sand Dune Prairie<br/>           Wet Brush Prairie<br/>           Wet Prairie</p>   | <p><b>Primary and Aquatic</b><br/>           Dry Cliff<br/>           Lake Beach<br/>           Lake Bed<br/>           Moist Cliff<br/>           River Beach<br/>           River Bed<br/>           Red Cedar Glades</p>  |   |  |   |
| <p><b>Plants</b><br/>         American water-pennywort (<i>Hydrocotyle americana</i>)<br/>         Bog bluegrass (<i>Poa paludigena</i>)<br/>         False mermaid (<i>Floerkea proserpinacoides</i>)<br/>         Ginseng (<i>Panax quinquefolium</i>)<br/>         Halbred-leaved tearthumb (<i>Polygonum arifolium</i>)<br/>         Kitten-tails (<i>Besseyia bullii</i>)<br/>         Lance-leaved violet (<i>Viola lanceolata</i>)<br/>         Rhombic-petaled evening primrose (<i>Oenothera rhombipetala</i>)<br/>         Sea-beach-needlegrass (<i>Aristida tuberculosa</i>)<br/>         Small-leaved pussytoes (<i>Antennaria aprica</i>)<br/>         Tooth-cup (<i>Rotala ramosior</i>)<br/>         Walter's barnyard grass (<i>Echinochloa walteri</i>)<br/>         Water-willow (<i>Docodon verticillatus</i>)<br/>         Whorled nut-rush (<i>Scleria verticillata</i>)</p> |  | <p><b>Lowland Forests and Wetlands</b><br/>         Black Spruce Bog<br/>         Bulrush Marsh<br/>         Cattail Marsh<br/>         Mixed Hardwood Swamp<br/>         Open Bog<br/>         Rich Fen<br/>         Sedge Meadow<br/>         Seepage Fen<br/>         Shrub Carr<br/>         Shrub Fen<br/>         Shrub Meadow<br/>         Silver Maple Floodplain Forest<br/>         Southern Lowland Hardwoods<br/>         Tamarack Swamp</p>  |  |   |

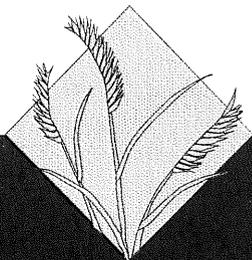
## FUTURE OF THE MCBS

**T**he Minnesota County Biological Survey provides a cost-effective mechanism to comprehensively assess the status and distribution of the rarest elements of Minnesota's natural diversity.

The success and widespread support of the MCBS during its first three years indicates that a systematic biological survey is needed in all of Minnesota's counties. Plans are now underway to expand the Survey into several additional counties in 1991 and, with additional funding, the survey will continue to identify and assess the unique features of Minnesota's natural environment.



St. Croix River Dalles.



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