1997 Project Abstract
For the Period Ending June 30, 1999
This project was supported by the Environment and Natural Resources Trust Fund

: 17 (n) Minnesota County Biological Survey - Continuation
Project Manager: Carmen Converse
Organization: Department of Natural Resources
Address: Box 25, 500 Lafayette Road
St. Paul, Minnesota 55155
Web Site Address: http://www.dnr.state.mn.us
Legal Citation: ML 1997, Ch. 216, Sec. 15, Subd. 17(n)
Appropriation Amount: $1,200,000

The Minnesota County Biological Survey (MCBS) is a systematic inventory of rare biological features that began in 1987 in response to the need to determine the status of biological diversity in Minnesota. The goal of MCBS is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals and natural communities.

Statement of Objectives
1. Systematically collect information on Minnesota's rare natural resources.
2. Expand and improve the Natural Heritage Information System in order to effectively integrate Minnesota County Biological Survey data with other natural resource data.
3. Promote the protection and ecological management of sites with rare resources identified by MCBS the through the distribution and interpretation of data, maps, publications and other products.

Overall Project Results
Since July 1997, field surveys for rare features and significant natural areas were completed in Carver, Hennepin, Le Sueur, Scott, and Wright counties that encompass most of the Big Woods subsection. The Survey was also completed in Stearns County. Field ecologists and biologists are continuing their work in counties within the Mille Lacs Uplands and Glacial Lake Superior Plain ecological subsections and portions of adjacent subsections. The counties within this area include Aitkin, Benton, Carlton, Crow Wing, Kanabec, Mille Lacs and Pine. Surveys began and are near completion in nine counties bordering the Minnesota River (Blue Earth, Brown, Chippewa, Nicollet, Redwood, Renville, Sibley, Swift and Yellow Medicine).

New records of 1358 locations of rare features were added to the Rare Features Database. Since MCBS began in 1987, surveys have been completed in 35 counties and 10292 new records have been added to the Database by MCBS. Since 1987, MCBS has documented nine species of native plants and one species of amphibian not previously recorded in the state. In cooperation with other survey and classification efforts, vegetation data on forest types were compiled and analyzed leading to the revision of the forest types in *Minnesota's native vegetation: a key to natural communities version* 1.5, a product scheduled for delivery in the next biennium. MCBS added 427 vegetation samples (releves) to the Releve Database during this biennium and contributed to data analysis of samples of forest types. The Releve Database currently includes 5916 Minnesota samples and 676 samples obtained primarily from Canada and Wisconsin.

Project Results Use and Dissemination
Recent publications of MCBS include two new wall maps displaying results of the Survey in five counties (Hennepin, Carver, Scott, Traverse and Wilkin). Published maps are now available for 22 counties where the Survey is completed. Other publications include a notebook (*Cass County Biological Survey 1992-1995*) that presents the results of survey work in Cass County and related information that was distributed to local land managers. A report, *Survey of Biological Features in Whitewater State Park, Winona County, Minnesota* resulted from cooperative work with DNR Parks. Another report, *Minnesota's Railroad Rights-of-Way Prairie: a Report to the 1999 Legislature* was the outcome of coordination of MCBS work with a survey of active railroad rights-of way. Staff wrote two articles on native Minnesota habitats (The Big Woods and The Aspen Parkland) that were featured in the *Minnesota Conservation Volunteer.*

MCBS staff continued to work towards the conservation and ecological management of sites with rare resources through interpretation and distribution of data. Since 1987, thirty-seven tracts in sites recommended by MCBS have become Scientific and Natural Areas including H.W. Cater Homestead Prairie (Sherburne County), Goliath Cave (Fillmore County), Alexander Woods (Morrison County), Zumbro Falls Woods (Wabasha County) and Quarry Park (Stearns County). Other conservation activities include ongoing collaboration with Aitkin County in the development of an Ecological Classification System, coordination with the Forest Service in the planning process for the Chippewa and Superior National Forests, review of the US Fish and Wildlife Service Northern Tallgrass Prairie Habitat Protection Area EIS, and participation in public education events related to the resources of the Minnesota River Watershed.

Date of Report : July 1,1999
Date of Work Program Approval: 1997
Project Completion Date: This work program outlines activities and products to be completed during the 6 year duration of this funding (ending June 30, 1999). This is a continuation project so data generated from activities of the Minnesota County Biological Survey (MCBS) in previous biennia will be applied to the proposed outcomes, and data and procedures derived from work this biennium will be applied to future surveys and products.

LCMR Final Work Program Update Report

I. PROJECT TITLE: Minnesota County Biological Survey-Continuation

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Total Biennial Project Budget: $1,200,000

$ LCMR:	**1,200,000**
-$ LCMR Amount Spent:	**1,200,000**
=$LCMR Balance:	**$0**

A. Legal Citation: ML 1997, Chap. 216, Sec.15, Subd. 17(n).

Appropriation Language: This appropriation is from the trust fund to the commissioner of natural resources for the sixth biennium of a proposed 12-biennium project to accelerate the county biological survey for the systematic collection, interpretation, and distribution of data on the ecology of rare plants, animals and natural communities.

B. Status of Match Requirement: N/A

II. PROJECT SUMMARY AND RESULTS (July 1, 1997)

The Minnesota County Biological Survey (MCBS) is a systematic survey of rare biological features that began in 1987 in response to the need to determine the status of biological diversity in Minnesota. The goal of MCBS is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals and natural communities.

Overall Status of Survey: As of July 1, 1997, MCBS has completed surveys in a total of 29 counties, is continuing in 12, and is expanding into 10 new counties. MCBS has added 8934 records of locations of rare features and over 2300 vegetation samples (releves) to the Natural Heritage Information System since the Survey began in 1987. Nine species of plants and one hybrid of amphibians not previously recorded in the state have been documented by MCBS. Analysis of vegetation data is in progress for revision of *Minnesota's native vegetation: a key to natural communities*, scheduled for distribution in 1998. Since 1987, MCBS has produced 39 publications, including one book, *Minnesota's St. Croix River and Anoka Sandplain: a guide to native habitats*, and wall maps displaying the results of the Survey for 17 counties. The information gathered by MCBS serves as a foundation for the conservation of critical components of Minnesota's biological diversity through ecological monitoring, environmental review, planning, and critical habitat protection. Within some of the highest quality sites identified by MCBS, 30 tracts have become part of Scientific and Natural Areas.

Procedure: A multi-level procedure is used in the Survey, beginning with the evaluation of existing inventory data, and interpretation of air photos and satellite imagery to identify potential natural areas. This is followed by an assessment of the quality and condition of selected areas using aircraft and ground survey, and by specialized field surveys of selected rare species or groups of species. Data are entered into the DNR's Natural Heritage Information System, Minnesota's most comprehensive repository of rare features information. The primary repository of collected specimens is the Bell Museum of Natural History. The application and development of Geographic Information Systems (GIS) and other computerized delivery systems enables MCBS to efficiently enter and manage data for distribution to organizations and agencies with diverse natural resource goals. Private and public protection and ecological management of significant natural areas and sites of rare resources identified by MCBS are promoted through the distribution and interpretation of data, maps and publications. MCBS is contributing to the revision of *Minnesota's native vegetation: a key to natural communities*. Other publications will feature results of MCBS in the Minnesota River Valley, and selected sites in the Mille Lacs Uplands and Aitkin County. MCBS will begin a major publication based on data collected in two ecological subsections where the Survey is now completed.

Scope of Work (see map): During FY98-99, surveys that began in five counties in the Big Woods subsection in the previous biennium will be completed (Carver, Hennepin, LeSueur, Scott, and Wright counties). Work will begin in nine additional counties bordering the Minnesota River (Blue Earth, Brown, Chippewa, Nicollet, Redwood, Renville, Sibley, Swift, and Yellow Medicine counties). Surveys will also begin and are scheduled for completion in Stearns County. Rare plant and natural community surveys will be completed in the Mille Lacs Uplands and Glacial Lake Superior Plain subsections (including Aitkin, Carlton, Benton, Crow Wing, Kanabec, Mille Lacs, and Pine counties). In the northern forested region, procedures to evaluate existing natural resource inventory data will continue to be refined and expanded in order to assist in the identification of important areas of biodiversity. The addition of a northern MCBS coordinator will accelerate this process and provide for increased coordination with other related surveys.

III. PROGRESS SUMMARY (July 1, 1999):

Overall Status: Since July 1997, field surveys for rare features and significant natural areas were completed Carver, Hennepin, Le Sueur, Scott, and Wright counties that encompass most of the Big Woods subsection. The Survey was also completed in Stearns County. Field ecologists and biologists are continuing their work within the Mille Lacs Uplands and Glacial Lake Superior Plain ecological subsections and portions of adjacent subsections. The counties within this area include Aitkin, Benton, Carlton, Crow Wing, Kanabec, Mille Lacs and Pine counties. Surveys began and are near completion in nine counties bordering the Minnesota River (Blue Earth, Brown, Chippewa, Nicollet, Redwood, Renville, Sibley, Swift and Yellow Medicine).

New records of 1358 locations of rare features were added to the Rare Features Database. Since MCBS began in 1987, surveys have been completed in 35 counties and 10292 new records have been added to the Database by MCBS. Since 1987, MCBS has documented nine species of native plants and one species of amphibian not previously recorded in the state. In cooperation with other survey and classification efforts, vegetation data on forest types were compiled and analyzed leading to the revision of the forest types in *Minnesota's native vegetation: a key to natural communities version* 1.5, a product scheduled for delivery in the next biennium. MCBS added 427 vegetation samples (releves) to the Releve Database during this biennium and contributed to data analysis of samples of forest types. The Releve Database currently includes 5916 Minnesota samples and 676 samples obtained primarily from Canada and Wisconsin.

Recent publications of MCBS include two new wall maps displaying results of the Survey in five counties (Hennepin, Carver, Scott, Traverse and Wilkin). Published maps are now available for 22 counties where the Survey is completed. Other publications include a notebook (*Cass County Biological Survey 1992-1995*) that presents the results of survey work in Cass County and related information that was distributed to local land managers. A report, *Survey of Biological Features in Whitewater State Park, Winona County, Minnesota* resulted from cooperative work with DNR Parks. Another report, *Minnesota's Railroad Rights-of-Way Prairie: a Report to the 1999 Legislature* was the outcome of coordination of MCBS work with a survey of active railroad rights-of way. Staff wrote two articles on native Minnesota habitats (The Big Woods and The Aspen Parkland) that were featured in the *Minnesota Conservation Volunteer.*

MCBS staff continued to work towards the conservation and ecological management of sites with rare resources through interpretation and distribution of data. Since 1987, thirty-seven tracts in sites recommended by MCBS have become Scientific and Natural Areas. As a recent example of the input of MCBS staff in this process, the plant ecologist in Stearns County provided interpretation of features in Quarry Park at public field tours and meetings with staff from the City of St. Cloud, the City of Waite Park and Stearns County. Other conservation activities include ongoing collaboration with Aitkin County in the development of an Ecological Classification System, coordination with the Forest Service in the planning process for the Chippewa and Superior National Forests, review of the US Fish and Wildlife Service Northern Tallgrass Prairie Habitat Protection Area EIS, and participation in public education events related to the resources of the Minnesota River Watershed.

The following provides more detail about activities related to cooperative and collaborative efforts, field survey highlights, information system development, products and presentations, site conservation activities, staffing, and future Survey plans.

Cooperation/collaboration: MCBS continues to cooperate and/or collaborate with other surveys that are collecting data beneficial to the refinement of procedures and expedient completion of the Survey. The following activities exemplify these efforts:

- Cooperation with DNR's Division of Parks and Recreation and the Ecological Classification System (ECS) program to produce more detailed ecological descriptions and maps for selected state parks. MCBS collected vegetation data as part of this effort in Savanna Portage State Park, St. Croix State Park, and Mille Lacs Kathio State Park, and helped coordinate collection of soils data in Mille Lacs Kathio State Park. Similar cooperative work is in progress at Jay Cooke State Park in Carlton County. MCBS staff also participated in discussions concerning additional work in parks along the North Shore in anticipation of MCBS expansion into that region in the next biennium.

-Collaboration with the ECS program and Aitkin County to sample vegetation as part of Aitkin County's ECS development and SmartWood Certification.

-Collaboration with the ECS program, local DNR staff, John Kotar (Wisconsin) and the White Earth Reservation in Mahnomen County in ECS development on the Reservation as a follow-up to survey work completed in the county.

- Contribution to the refinement of landtype association boundaries in Minnesota as part of DNR's ECS project.

- Coordination with DNR's Division of Forestry by providing ground survey data to verify vegetation types as part of the GAP Analysis project.

- Collaboration with the ECS program and the Natural Heritage and Nongame Research Program in data collection and analysis as part of an effort to update the forest community types in *Minnesota's native vegetation: a key to natural communities* version 1.5. A plan was developed to cross-walk vegetation types resulting from this analysis with the results from habitat typing projects of Boise-Cascade Corporation and Blandin Paper Company in a region of northern Minnesota. Due to the extensive dataset that was part of the analysis, an updated publication has been delayed until the next biennium.

- Assistance with data collection and analysis as part of a vegetation mapping project in Voyageurs National Park. Continued discussions about future assistance with animal survey work in preparation for their monitoring plans.

-Cooperation with the U.S. Forest Service on the continued development of the Forest Plans for the Superior and Chippewa National Forests. Met with the Superior NF Ecologists and Biologists regarding survey needs in Northeastern Minnesota in anticipation of expansion of MCBS into that region. MCBS and the Superior NF are cooperatively funding rare plant and plant community surveys in the Rove Formation (partially within the BWCAW on the Superior NF).

- Collaboration with the US Fish and Wildlife Service (USFWS) on bird surveys of selected Waterfowl Production Areas and with Cerulean warbler *(Dendroica cerulean)* status surveys. Also worked with USFWS and DNR Fisheries on the survey of paddlefish (*Polyodon spathula*) in the Minnesota River.

- Continued coordination with the University of Minnesota Bell Museum regarding specimen preparation and curation that now includes museum associate status for some MCBS staff.

- Discussions with the Science Museum regarding cooperative survey work in central Minnesota in counties proposed for 2000 and the development of interpretive items related to the progress of MCBS.

Collaboration with the Natural Resources Research Institute on the development of GIS products used by The Nature Conservancy in their preliminary planning for their work in the North Shore Subsection.

Selected highlights from the field:

-Sixteen new locations of the state endangered lichen, *Buellia nigra* were documented bringing the total of known locations in the state to 18. Most of these locations are in association with rock outcrops in the Minnesota River Valley. The only other known locations of this species outside of Minnesota are in North Dakota and South Dakota, where there is one location in each state.

- Lake surveys for rare aquatic plants in targeted survey counties were completed for more than 210 lakes resulting in the identification of 197 new locations of rare aquatic plants. This included a verifiable record of a species not previously confirmed to occur in the state, Robin's spike rush (*Eleocharis robbinsii*). The Minnesota habitats of many of these aquatic rare plants were not well understood prior to MCBS work. Lake surveys for rare plant species have now been extensive enough to use other data such as water clarity and total alkalinity to make some correlations of these physical conditions with the presence/absence of certain rare aquatic plant species, improving the ability of botanists to better target habitats for certain species.

-Another major outcome of botanical surveys was the documentation of many new locations of fern species primarily in central Minnesota in the taxonomically difficult genus *Botrychium* (moonworts or grapeferns). These collections, in combination with other Minnesota collections in the University of Minnesota herbaria (about 600 total) were annotated (identifications confirmed or corrected) by the authority on the genus (Dr. Warren H. Wagner Jr.), as part of a coordinated effort between Dr. Wagner, the MN DNR, and the University of Minnesota (Bell Museum and UM-Duluth). This resulted in a better understanding by MCBS botanists of the distribution of this group and the continued need for additional documentation.

-As part of an expansion of animal surveys to include rare fish, staff worked with DNR Fisheries and US Fish and Wildlife biologists to conduct surveys for selected rare fish in the Minnesota River Valley, in Stearns County and counties in the Big Woods subsection, resulting in new locations of the pugnose shiner (*Notropis anogenus*), the least darter (*Etheostoma microperca*), and the black buffalo (*Ictiobus niger*).

-487 miles of native prairie and 137 rare species locations were identified as part of a survey of active railroad rights-of-way in the two western Minnesota ECS provinces that was conducted in conjunction with MCBS and in coordination with the railroad companies.

-In east central Minnesota, six new locations of native four-toed salamanders (*Hemidactylium scutatum*) were documented extending the Minnesota range of this species south and east from the first confirmed record of the species in the state (In the Chippewa National Forest during MCBS work there in 1994). These new county records were documented in 1999 in Pine, Mille Lacs, Carlton and Aitkin Counties.

Information Systems

A significant development in data management was the application of ARC/VIEW (a geographic information system linked to ARC/INFO) by survey staff who used these tools in combination with digital air photos and classified satellite imagery to more efficiently map and quality control data. This is proving to be especially

effective in evaluating data from northern Minnesota where there are many electronic data layers relevant to survey preparation. This will also enable more effective delivery and exchange of electronic data to users. However, these procedures have raised issues related to equipment needs (electronic file size and processing speed) and the need for additional computer support personnel and documentation of new procedures. In addition, ecologists and biologists have had to learn a new technology and balance the investment of time into this aspect of their work with other tasks.

-MCBS is now providing an increased amount of staff assistance to the Bell Museum in order to keep up with the preparation and accession of museum collections.

Selected Products/Presentations:

-Maps displaying the results of MCBS were published for five counties: Traverse, Wilkin, Carver, Hennepin, and Scott. A map of Stearns County will be printed by August 1999.

-A notebook (*Cass County Biological Survey 1992-1995*) containing results of survey work in Cass County and related information was compiled, presented at a meeting in Walker and distributed to local land managers.

-Two articles were written by MCBS plant ecologists for the *Minnesota Conservation Volunteer* magazine: "Last stands of Big Woods"(July-August 1998) and "Tallgrass Aspen Parkland" (Jan-Feb 1999).

-A paper was presented at the 1998 American Society of Mammalogists, co-authored by Gerda Nordquist, MCBS animal survey coordinator and utilizing MCBS data: "Small mammal assemblage composition in Minnesota: Ecogeographic versus ecological influences."

-The results of MCBS activities was presented at county board meetings in Olmsted, Wabasha, Fillmore and Dakota counties. The Survey was introduced at county board meetings in six counties in the Minnesota River Valley and at a meeting of the St. Louis County Land Department. In anticipation of expansion of MCBS into additional counties in Western Minnesota, staff introduced the Survey at county board meetings in Grant, Stevens, Otter Tail, Becker and Chippewa Counties.

-A report entitled *Survey of Biological Features in Whitewater State Park, Winona County, Minnesota* (Biological Report No. 60) was completed and distributed (April 1999).

-A 1999 report entitled *Minnesota's Railroad Rights-of-Way Prairie: a Report to the 1999 Legislature* (Biological Report No. 61) was produced and distributed. Additional resources are being compiled for delivery to individual railroads that include company-specific data and maps and management resources.

-In Northern Minnesota presentations were made introducing MCBS to Northern Counties Land Use Coordinating Board and to the Landscape Assessment and Monitoring group of the Forest Resources Council

-Introduction of MCBS to the Grand Portage Indian Reservation Natural Resources staff in anticipation of expansion of the Survey into the North Shore subsection.

- A proposal for a natural history book on the southeastern blufflands based on MCBS results was presented to the University of Minnesota Press. There was a favorable response, and reallocation of MCBS staff responsibilities is in progress to allow for time to complete the publication.

-A final draft of a floristic publication related to new locations of *Buellia nigra* in the Minnesota River has been completed, is currently being reviewed and will be submitted to a botanical journal in 1999.

CBS staff is participating in a revision of the Web site for the Section of Ecological Services with the intent of providing more frequent and accessible updates on the progress of MCBS.

Site conservation activities:

MCBS staff continued to work towards the protection and ecological management of sites with rare resources through interpretation and distribution of data. Some examples follow:

-Since 1987 thirty-seven tracts in sites recommended by MCBS have become Scientific and Natural Areas. Examples of these include: Grey Cloud Dunes (Washington County), Oronoco Prairie (Olmsted County), Prairie Smoke Dunes (Norman County), H.W. Cater Homestead Prairie (Sherburne County), Goliath Cave (Fillmore County), Alexander Woods (Morrison County), Zumbro Falls Woods (Wabasha County) and Quarry Park (Stearns County). As a recent example of the input of MCBS staff in this process, the plant ecologist in Stearns County provided interpretation of features in Quarry Park at public field tours and meetings with staff from the City of St. Cloud, the City of Waite Park and Stearns County. This resulted in the integration of MCBS results into the comprehensive planning process and eventually a Scientific and Natural Area within Quarry Park. Within this SNA rare features of particular interest include a population of the state endangered tubercled rein-orchid (*Platanthera flava*), red-shoudered hawks (*Buteo lineatus*) and Acadian flycatchers (*Empidonax virescens*).

Staff made presentations and conducted field trips at two conferences sponsored by the Minnesota River sin Joint Powers Board to demonstrate how MCBS information could be used in relationship to watershed planning.

-MCBS staff attended meetings organized by The Nature Conservancy to discuss how TNC will use data collected/compiled from Minnesota's North Shore as related to their larger Great Lakes ecoregional planning process.

-Staff reviewed the Northern Tallgrass Prairie Habitat Protection Area EIS (USFWS) and participated in a "scorecard" process with other DNR staff and The Nature Conservancy to discuss appropriate conservation action at primarily prairie sites in the northwestern portion of the state.

-Assistance was also provided to the DNR Division of Parks and Recreation Land Study to ensure that data collected by MCBS would be incorporated into habitat protection considerations within state parks.

- Discussions continue concerning the identification of potential Research Natural Areas as part of the US Forest Service planning process in the Superior and Chippewa National Forests.

-MCBS staff participated in field visits to candidate old growth stands in southeastern Minnesota with an interdisciplinary team from DNR Region 5 and the Central Office and provided recommendations for designation or release of selected sites.

ffing: The staff of MCBS continues to be the most important resource to the successful completion of the urvey. During this time, three individuals who were very committed to the successful progress of MCBS left the program to pursue other activities between August and October 1998. All three made considerable

contributions to the program over many years (Barb Delaney, Janet Boe, and B.J. Farley) and replacing them with qualified staff has been challenging. Between November 1998 and June 1999, appointments were made of what appears to be an excellent selection of new staff plant ecologist/botanists. The additional appointment of a northern coordinator is anticipated to be finalized by August 1999. Beginning in 1998, the Division of Fish and Wildlife began a Hay Study in order to determine equity in equivalent positions. This was completed but the results will not be released until the completion of a similar study in another DNR Division in 1999. The results very likely will affect the future staffing and funding needs of MCBS.

Future MCBS Plans: Between July 1999 and June 2001, surveys are scheduled for completion in nine counties bordering the Minnesota River (Swift, Chippewa, Renville, Redwood, Yellow Medicine, Brown, Sibley, Nicollet, and Blue Earth). Surveys will be completed in at least four of the seven counties that make up most of the Mille Lacs Uplands and Glacial Lake Superior Plain ecological subsections (proposed for completion are Benton, Mille Lacs, Kanabec and Pine). Surveys will begin and are scheduled for completion in the remaining unsurveyed portions of the Red River Prairie subsection (Becker, Otter Tail, Stevens, and Grant). Surveys will expand into the northern portion of the Minnesota River Prairie subsection and portions of the Hardwood Hills subsection (Douglas, Kandiyohi, McLeod, Meeker, and Pope counties). In northern Minnesota, surveys will begin in Itasca County and in the North Shore subsection (portions of St. Louis, Cook and Lake counties). Work will continue on a book that provides interpretation of the results of the Survey in two ecological subsections--the Blufflands and the Rochester Plateau. For more detail refer to the 1999 LCMR work program.

IV. OUTLINE OF PROJECT RESULTS:

A. Result 1 The status and distribution of rare resources will be identified providing a basis for the maintenance of Minnesota's biological diversity through ecological management, planning, research, monitoring, and critical habitat acquisition.

Scope of Work (also see map): Surveys that began in five counties in the Big Woods subsection in the previous biennium will be completed (Carver, Hennepin, Le Sueur, Scott, and Wright counties). Work will begin in nine additional counties bordering the Minnesota River (Blue Earth, Brown, Chippewa, Nicollet, Redwood, Renville, Sibley, Swift and Yellow Medicine counties). Surveys will also begin, and are scheduled for completion in Stearns County. Rare plant and natural community surveys will be completed in the Mille Lacs Uplands and Glacial Lake Superior Plain subsections (including Aitkin, Benton, Carlton, Crow Wing, Kanabec, Mille Lacs, and Pine counties). In this region, animal surveys will extend into the next biennium. All of Benton, Crow Wing, Aitkin and Carlton counties will be included as part of the survey of the Mille Lacs Uplands and Glacial Lake Superior Plain, including those portions located partially within other subsections. This landscape also includes portions of counties already surveyed (Chisago, Isanti, Sherburne, Morrison, and Washington). In the northern forested region, procedures to evaluate existing natural resource inventory data will continue to be refined and expanded in order to assist in the identification of important areas of biodiversity. Regional coordination with counties, U. S. Forest Service, other divisions within the Department of Natural Resources, universities, tribal governments and others is critical to the success of this effort. The addition of a northern MCBS coordinator (1997 General Fund) to a regional office in Grand Rapids will assist with this evaluation, and provide for increased coordination with other related surveys.

Procedure: A multi-level survey process is followed. This consists of interpretation of aerial photography or other imagery for the identification of potential natural areas-places where the land and vegetation have not been altered significantly by human-related activities, such as cultivation, grazing,

and urban development. This is followed by aircraft and ground surveys to assess natural area and natural community quality and condition. Additional specialized techniques are used during the second and third years to survey selected rare species or groups of species (e.g., plants, birds, mammals, reptiles and amphibians). As a part of the process, data are incorporated from other existing surveys such as forest inventory, minerals surveys, wildlife habitat inventories, metropolitan parks surveys, soil surveys, specimens from museum collections and geographic files stored at LMIC. The use of digital orthophotoquads and the results of the statewide land use mapping project are planned for incorporation into this review. This typical procedure will be followed in Stearns County, the counties of the Minnesota River Valley and Big Woods, and with modifications discussed below, in the northern forested region.

In the northern forested region (roughly the ecological region of the Laurentian Mixed Forest Province), the above method has been modified to include the development of specialized procedures to evaluate and incorporate existing relevant natural resource databases into the survey process. This region contains some of the most extensive vegetation data in the state, most notably timber stand data maintained by state, county, federal, tribal and private entities. It also encompasses many expansive and remote areas, making efficiency in field inventory critical to the success of the inventory.

Selected existing natural resource inventory data are being analyzed using a modification and further development of GIS procedures first used in conjunction with the MCBS surveys of Roseau and Pine counties. In these counties, DNR forestry cover types were crosswalked with the vegetation classification used by MCBS (*Minnesota's native vegetation: a key to natural communities version 1.5*) using computerized programs and GIS. Application of this and similar procedures in the evaluation of existing wetlands data (such as the National Wetlands Inventory) and forest inventory data (counties, tribal, and U.S. Forest Service) is being tested as part of this project. In the Mille Lacs Uplands and the Glacial Lake Superior Plain, this evaluation is now being compared to the results of classified satellite imagery vegetation types developed as part of the GAP analysis project and the Forest Bird Diversity Initiative. In 1995-1996, plant ecologists reviewed maps generated from preliminary cross-walks, air photos and the products of satellite imagery interpretation in order to identify core areas within the Mille Lacs Uplands and Glacial Lake Superior Plain for 1996 field reconnaissance. They also assisted in the refinement of the mapping of Land Type Association boundaries (lower level of the Ecological Classification System) that will assist with final survey in these subsections.

Another major activity in the review of existing data is the collection and analysis of vegetation samples in preparation for publication of a new version of *Minnesota's native vegetation: a key to natural communities* in cooperation with the Natural Heritage and Nongame Research Program and DNR's Ecological Classification System (ECS) project. In December 1995, a plan was developed to obtain statewide vegetation samples that are similar to releves (As described in *A handbook for collecting releve data in Minnesota,* 1987 Draft) for analysis in order to refine the forested types in the vegetation key. Over 40 potential sources of these vegetation samples were identified, and staff made contacts to obtain these data. During the 1996 field season MCBS plant ecologists collected releves in under-represented types for analysis to be completed in 1997, and publication and distribution of a new version of the key is planned for 1998. MCBS ecologists have collected over 2300 releves, representing 55% of all of the samples in the database. Preliminary results indicate that the releve method has been an effective sampling tool in most forested types for the purposes of classification. The use of releves for vegetation sampling by MCBS will continue.

In the northern forested region, the overall effort to collect, synthesize and evaluate existing data obviously extends beyond two years. A successful outcome requires assessment of this development

phase to determine the appropriate balance between investment in field work and computer analysis of relevant existing data to best identify the status and distribution of rare resources and potential areas of high biodiversity.

Aircraft and ground surveys are usually conducted between April and October. Review and evaluation of existing resources, photo interpretation, specimen verification and data analysis typically occur between October and April.

Budget: $ 480,000 **Balance; $ 0**

B. Result 2 The Natural Heritage Information System will be expanded by additions to the component databases, including entry of information into a Geographic Information System. This will result in the distribution of information to individuals, organizations, and agencies having diverse natural resources goals.

All data collected by MCBS are entered into the related map, manual and computerized files that make up the Natural Heritage Information System. Data collected by MCBS are entered into the following computerized databases: rare features (geographic), releve´ (vegetation samples), county flora check-list, MCBS site, eagle, colonial waterbird, bat concentration and bearing tree (from Public Land Survey notes 1847-1907). Locations of rare features are mapped on U.S.G.S. topographic maps, and both site and rare features data are digitized using ARC/INFO and ARC/VIEW geographic information systems (GIS). Data are entered continuously, with most entry occurring between October and April each year. The structure of the Natural Heritage Information System continues to be improved to provide for more efficient data management through the use of related databases, networks, laptop computers, multi-user systems and GIS. MCBS cooperates in DNR's efforts to develop data and mapping standards, as well as in national efforts, including the Association for Biodiversity Information, US Geological Survey, and the Nature Conservancy. Internet connections and transfer of selected digital files is being developed in coordination with the Natural Heritage and Nongame Research Program. Continued development of these systems is essential to achieve MCBS goals, and requires ongoing investment to satisfy the increasingly complex and diverse demands of users and the related needs for data standards, data security, documentation, data synthesis and analysis, and interpretation.

All plant and animal specimens are identified, prepared for permanent storage and most are deposited at the Bell Museum of Natural History. As of July 1, 1997, the Bell Museum includes the collections of the University of Minnesota herbarium, St. Paul. Photographic vouchers, color slides, video tapes and other photography are identified, labeled and stored at the DNR, St. Paul. Field data sheets are filed manually in preparation for archiving. This work takes place primarily between October and April each year.

Budget: $ 440,000 **Balance; $ 0**

C. Result 3 Private and public protection and ecological management of sites with rare resources identified by MCBS will be promoted through the distribution and interpretation of data, maps, and other publications.

General Results: The increase in awareness of environmental issues related to endangered resources has resulted in more demands by the public and natural resource professionals for interpretation of the ecological information collected by MCBS. Whenever possible, results are generated as summaries directly from the Natural Heritage Information System. Standard reports and maps are distributed to other agencies and organizations (schools, libraries, nature centers, universities, county boards, planning boards, consulting firms). Other requests are coordinated through the standard request procedures of the Natural Heritage and Nongame Wildlife programs. As needed, biologists also prepare written conservation and management recommendations for selected high quality sites in response to requests from within and outside the agency. The highest quality sites identified are proposed for scientific and natural area protection.

Three community ecologist positions have been funded (1997 General Fund) for incorporation into the Natural Heritage and Nongame Research program, the program responsible for the long-term maintenance and delivery of data collected by MCBS. These ecologists will provide significant assistance in the delivery of ecological data generated by MCBS.

Specific Results: MCBS staff are participating in a major revision of *Minnesota's native vegetation: a key to natural communities* scheduled for completion in fall 1998. Other publications will feature MCBS results in the Minnesota River Valley and in selected sites in the Mille Lacs Uplands and Aitkin County. (March 1999). MCBS will also begin a major publication that incorporates and interprets the results of MCBS in two ecological subsections, with publication proposed for late 1999. The areas being considered are the Rochester Plateau and Blufflands, or the Aspen Parklands and Red River Prairie.

Budget: $ 280,000 **Balance; $ 0**

V. DISSEMINATION:

The Natural Heritage Information System is the major repository of data collected by MCBS. *A user' s guide to the Minnesota Natural Heritage Information System* is provided to those requesting data along with a user request form. Brief descriptions of the major component databases of this Information System are available through the Web sites indicated on page one. GIS datasets are delivered to selected users (such as a county planning boards) though a license agreement with the requesting agency and the Natural Heritage and Nongame Research Program.

MCBS participates in the DNR's Natural Resources Inventories Communications Committee, established to better exchange data resources and technical skills between various survey efforts. MCBS delivers data as part of the Association of Biodiversity Information, an international consortium of Natural Heritage programs and Conservation Data Centers. Selected data from the Natural Heritage Information System are part of this network. MCBS also shares data with cooperators at the University of Minnesota and with others in ecological regions where surveys are ongoing or completed. In addition to rare features data, some examples of data that have been exchanged during the survey process include the classified imagery developed though the GAP analysis project, the National Wetlands Inventory data, bearing tree data, vegetation plot data from numerous individuals and academic institutions in the state, lakes data collected by the DNR Section of Fisheries, Cooperative Stand Assessment from DNR Division of Forestry and forestry stand data from the Chippewa National Forest and various counties.

Physical collections are deposited primarily at University of Minnesota repositories at the Bell Museum of Natural History. As part of a larger network of museums and herbaria, this cooperator is essential to the documentation and sharing of MCBS results. MCBS and museum and herbarium staff meet periodically to address curatorial, data management, and interpretive needs.

As discussed earlier, MCBS has invested considerable time in publishing and distributing results of the Survey in a variety of formats for various audiences. The DNR and Legislative libraries and other local information repositories (such as libraries within counties where relevant products are published) are routinely sent published products. MCBS continues to assess the effectiveness of current publications in preparation for additional major publications proposed for two ecological subsections where the Survey is nearly completed. MCBS staff also make presentations that describe the Survey goals, methodologies and results to a wide range of audiences that include county boards, local planning groups, citizen advisory groups, other biologists, land managers and students. Staff also lead or participate in technical workshops and field trips to exchange ideas on survey methodology. A limited amount of time is invested in providing interpretation of rare features data and of MCBS products as they apply to specific local planning, land protection and management situations. MCBS keeps records of Survey presentations and of recipients of published products.

VI. CONTEXT

A. Significance:. As a result of a systematic survey, the relative importance of natural areas can be assessed. Increased knowledge of the status and distribution of rare species leads to more informed natural area acquisition, and appropriate resource development and management decisions. Data collected by MCBS are entered into the Natural Heritage Information System. This System is managed by the Natural Heritage and Nongame Research Program (NHNGR), providing for the long-term maintenance and distribution of data generated by MCBS. NHNGR responsibilities include review of projects involving rare features, research and monitoring of rare features, and coordination of these efforts with other agencies and institutions. For example, NHNGR is a member of the Association for Biodiversity Information, an international consortium of Natural Heritage programs and Conservation Data Centers, that provides coordination of the distribution of rare features information. NHNGR is also responsible for coordinating recommendations for revisions to the state list of endangered, threatened and special concern species, and along with the Nongame Wildlife Program, provides technical assistance for issues concerning rare ecological features (e.g., old growth forests, calcareous fens, DNR plans, recovery plans for federally-protected species).

Prior to MCBS, much of the data that populated the Rare Features database of the Natural Heritage Information System were generated from review of collections of plant and animal specimens stored in museums and herbaria. Most previous surveys that reliably documented Minnesota's significant biological features were conducted for a variety of objectives and were limited in scope, so therefore do not collectively provide a uniform statewide perspective. Increasing pressure from land development and lack of information to adequately evaluate impacts to natural features necessitated the accelerated survey provided by MCBS in order to ensure the protection of the state's biological diversity. Several other Midwestern states had previously conducted inventories similar to MCBS (Wisconsin, Illinois, Michigan, Missouri). MCBS adapted and expanded upon their survey techniques such that now MCBS is recognized nationally as a model county survey. Since 1987, MCBS has been generating most of the state's new locational information on rare features. In a more limited capacity,

MCBS is providing additional resources for the maintenance of the Information System, produces and distributes interpretive products, and supplements the technical assistance capabilities of the DNR, specifically in the interpretation of MCBS findings, and in the area of botany and plant ecology.

B. Time: Since MCBS began in 1987, 8934 locations of rare features have been documented in 29 counties by the Survey. In most counties completed by MCBS over 50% of the total new records of rare features were recorded by MCBS. Future funding will be requested from the environmental trust fund, the general fund, the Nongame Wildlife Program, the Division of Parks and Recreation and other local or regional cooperators with the goal of completing the Survey by 2017.

C. Budget Context: LCMR recommended partial funding for the establishment of the Natural Heritage Program in FY 78-79. The pilot phase of MCBS in FY 88-89 was supported by LCMR with matching private dollars, and has received ongoing support (see budget history). Past funding of MCBS stimulated various other cooperative survey efforts that included work with the Minnesota Army National Guard (Camp Ripley), the U.S. Forest Service (Chippewa National Forest), and the DNR's Division of Parks and Recreation.

	July 1995-June 1997	**July 1997-June 1999**	**July 1999-2001**
	Prior expenditures on this project	**Proposed expenditures on this project**	**Anticipated future expenditures on this project**
1. LCMR	$ 900,000	$1,200,000	$1,200,000
2. Other State	$ 533,000	$ 678,300 (includes $140,000 from 1997 General Fund budget initiative)	$ 700,000
3. Nonstate Cash			
TOTAL	**$1,433,000**	**$1,878,300**	**$1,900,000**

Budget History:

	FY88-89	**FY90-91**	**FY92-93**	**FY94-95**	**FY96-97**
LCMR	171,500	150,000	1,000,000	900,000	900,000
TNC	171,500				
Gen		300,000	300,000	300,000	300,000
RIM		170,000	169,000	156,000	164,000
Nongame		100,000	80,000	80,000	69,000
Totals	**$ 343,00**	**$720,000**	**$1,549,000**	**$1,436,000**	**$1,433,000**

Total=$5,481,000

1997 LCMR project: All LCMR dollars would be used for Personnel as follows:

Full Time (12 positions):

7 Natural Resource Specialist Senior (Wildlife Research Biologist)
2 Natural Resource Specialist (Wildlife Research Biologist)
1 Natural Resource Specialist Senior (Nongame)
2 Natural Resource Specialist Intermediate (Nongame)

Part time:

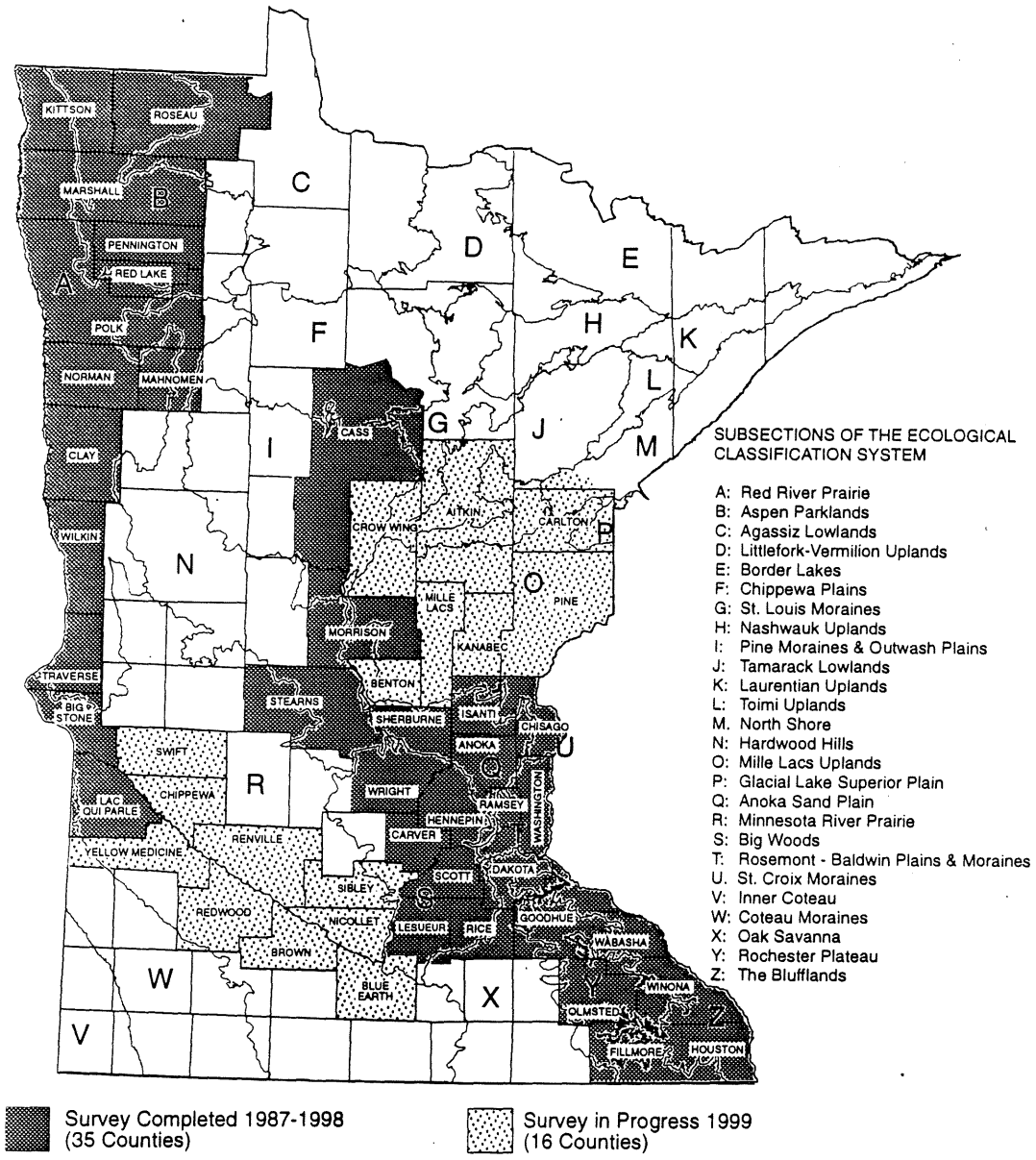
3 Natural Resource Specialist (Wildlife Research Biologist)

VII. COOPERATION:

University of Minnesota, Bell Museum of Natural History
Scott Lanyon, Director

The Bell Museum of Natural History at the University of Minnesota is the primary repository for specimens collected by MCBS. As of July 1, 1997, the University of Minnesota herbarium became a part of the Bell Museum of Natural History. The cooperation with the Museum is critical to MCBS because it provides for the long-term curation of most of the specimens collected by the Survey. One recent outcome of this cooperation is the revision of the state endangered and threatened species list that is supported by documentation found in the museum and herbarium collection. MCBS staff also benefit from access to the collections for purposes of species verification. MCBS has provided assistance in the preparation of specimens using methodology approved by the museum and herbarium staff.

VIII. LOCATION:



Subsection map was developed as part of DNR's Ecological Classification System and is current as of April 27, 1999.

IX. REPORTING REQUIREMENTS: Periodic work program progress reports will be submitted not later than January 1, 1998 and January 1, 1999. A final work program report and associated products will be submitted by June 30, 1999, or by the completion date set in the appropriation.

X. RESEARCH PROPOSALS: N/A