

2013 Project Abstract

For the Period Ending June 30, 2015

PROJECT TITLE: Minnesota Biological Survey

PROJECT MANAGER: Bruce Carlson

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FUNDING SOURCE: Environment and Natural Resources Trust Fund

LEGAL CITATION: M.L. 2013, Chp. 52, Sec. 2, Subd. 03a

APPROPRIATION AMOUNT: \$2,650,000

Overall Project Outcomes and Results

The need to protect and manage functional ecological systems, including ecological processes and component organisms continues to accelerate with increased demands for land, water, and energy, continued habitat fragmentation, loss of species and genetic diversity, invasive species expansion, climate change, and other changing environmental conditions.

Since 1987 the Minnesota Biological Survey (MBS) has systematically collected, interpreted and delivered baseline data on the distribution and ecology of plants, animals, native plant communities, and functional landscapes. These data help prioritize actions to conserve and manage Minnesota's ecological systems and critical components of biological diversity.

Since July 2013, MBS contributed 1,326 new rare features records to the Rare Features Database, surveyed 72 lakes for rare plants and vegetation, and added 439 vegetation plots (relevé) to the statewide database. Since 1987, MBS has added a total of 21,478 new rare feature records statewide; MBS botanists have documented 1,245 rare aquatic plants during targeted surveys of 1,983 lakes in 46 counties; MBS plant ecologists have contributed 5,392 of the 10,269 vegetation plot records in the DNR's relevé database. Statewide 10,734 MBS sites of Biodiversity Significance and 83,913 polygons of native plant communities are now publically available on the Minnesota Geospatial Commons.

During this project period baseline surveys continued, focused in northern Minnesota (see map) within large functional landscapes of forests, peatlands, wetlands, and undeveloped lakes and streams. Highlights include helicopter-assisted field surveys of the most remote areas within northwest Minnesota's patterned peatlands, remote-access-only vegetation and botanical field surveys of the Border Lakes, and the discovery of a new state-record species of sedge, (*Carex tinctoria*), along with numerous other examples of new and expanded distribution data for native plant species.

MBS continued monitoring to measure the effectiveness of management and policy activities. For example, as part of DNR's forest certification high conservation value forest sites in southeastern Minnesota have been targeted as monitoring sites with field survey efforts focused on detailed rare plant surveys. This work provided updates to existing data that is often more than 20 years old, set a foundation from which to more precisely track target species' populations through time, and improved the relevance of MBS data to monitoring needs.

Project Results Use and Dissemination

MBS data are stored primarily in the Division of Ecological and Water Resources information systems, which are increasingly linked to other databases in the MN DNR. For example, MBS, in collaboration with other DNR

partners, developed and operationalized a DNR-wide native plant community GIS database that integrates native plant community mapping by all DNR Divisions. In addition, MBS procedures, updates, recent maps, and links to related data are presented on the DNR website. Many MBS GIS datasets are delivered to clients through the Minnesota Geospatial Commons. MBS regularly provides vegetation plot data from the relevé database to researchers at academic institutions and other agencies and organizations. Non-public rare species data are available through agreements with the requesting agency and the DNR.

MBS publishes and distributes survey results in a variety of formats for various audiences. Many products are available on the DNR website, including GIS shape files of native plant communities and MBS sites, native plant community field guides, and guides to sampling techniques such as vegetation plot data collection using the relevé method. MBS web pages are updated with new information and have links to associated resources. <http://www.dnr.state.mn.us/eco/mcbs/index.html>

The DNR and Legislative libraries and other local information repositories (such as libraries within counties) have access to published products, including books, maps, reports, field guides and digital media. MBS has published several books and field guides and the publication of a natural history book based on MBS data collected in the northwestern prairie region and Red River Valley is underway. Based on local collaborator interest and the results of regional focus groups, this book will include a guide to selected natural areas of the region. A Minnesota publisher has agreed to publish this book.

Staff routinely make presentations that describe MBS methodologies and results to a wide range of audiences including county boards, local planning groups, citizen advisory groups, other biologists, land managers, and students. MBS staff provide local planners with ecological interpretations describing important sites of biodiversity identified during the Survey to assist with management plans. Staff lead or participate in technical workshops and field trips to exchange ideas on survey methodology and provide training in the application and interpretation of the data. For example, in 2014-15, MBS botanists and plant ecologists in collaboration with partners delivered nine field workshops to over 200 natural resource professionals. These field workshops focused on plant identification, native plant community classification, and how these skills can be used to inform management decisions.

Physical collections are deposited at Minnesota repositories, primarily at the University of Minnesota's J.F. Bell Museum of Natural History and at the Science Museum of Minnesota, St. Paul. As part of a larger network of museums and herbaria, these cooperators are essential to the documentation and sharing of MBS results. MBS and museum staff meet periodically to address curatorial, data management, and interpretive needs. During this project period, MBS deposited over 2,000 plant specimens to the Bell Museum Herbarium.

MBS also delivers data through an international organization, NatureServe, and also shares data with cooperators at colleges and universities and with others in ecological regions where surveys are ongoing or completed.



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2013 Work Plan Final Report

Date of Status Update Report: 08/31/2015

Final Report

Date of Work Plan Approval: 03/25/2013

Project Completion Date: 06/30/2015

PROJECT TITLE: Minnesota Biological Survey

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Location:

Baseline surveys located in: Beltrami, Clearwater, Lake, St. Louis, Koochiching and Lake of the Woods counties. These include portions of the Border Lakes (212La), Nashwauk Uplands (212Lc), Littlefork Vermillion Uplands (212Ma), Agassiz Lowlands (212Mb), Chippewa Plains (212Na), St. Louis Moraines (212Nb), Tamarack Lowlands (212Nb), Hardwood Hills (222Ma), and Aspen Parklands (223Na) ecological subsections.

Monitoring: Selected sites statewide

Total ENRTF Project Budget:

ENRTF Appropriation: \$2,650,000

Amount Spent: \$2,630,176

Balance: \$19,824

Legal Citation: M.L. 2013, Chp. 52, Sec. 2, Subd. 03a

Appropriation Language:

\$2,650,000 the first year is from the trust fund to the commissioner of natural resources for continuation of the Minnesota biological survey to provide a foundation for conserving biological diversity by systematically collecting, interpreting, monitoring, and delivering data on plant and animal distribution and ecology, native plant communities, and functional landscapes.

I. PROJECT TITLE: Minnesota Biological Survey

II. PROJECT STATEMENT: The need to protect and manage functional ecological systems, including ecological processes and component organisms continues to accelerate with increased demands for clean water, energy and arable land. Habitat fragmentation, loss of plant and animal species and genetic diversity, changing landscape patterns, contamination of water resources and invasive species expansion require data and analytical tools to optimize conservation of the most functional systems and provide guidance and monitoring to maintain or restore declining systems.

Since 1987, the Minnesota Biological Survey (MBS) has systematically collected, interpreted and delivered data on the distribution and ecology of plants, animals, native plant communities and functional landscapes. These data help prioritize actions to conserve, manage, restore and monitor Minnesota's ecological systems and critical plant and animal habitats. For example MBS data and monitoring efforts inform implementation and outcomes of plans for sustainable prairie, forest and watershed management. MBS data are used to help target high quality landscapes for parks and natural areas by entities such as counties and lakeshore associations. MBS has documented the most recent benchmark data on many of the elements of the state's native biological resources now being used in vulnerability assessments related to changes in Minnesota's landscape.

Surveys will continue in northern Minnesota to move towards completion of the statewide baseline data collection. Monitoring will be expanded at targeted locations in the state to measure the effectiveness of management and conservation efforts and to work with others to establish permanent reference plots.

Museums providing repositories for MBS plant and animal collections are important partners in the coordination of related database development. MBS species and vegetation databases are also part of national information system networks and this project period includes several opportunities for significant collaborative updates to those efforts. Improved access and delivery of MBS data continues to be a priority. Delivery through web-based products, publications, and professional technical assistance is an important outcome of this project period. Decision support systems that provide analytical tools to assess multivariate data will be explored to integrate MBS data with other data to optimize conservation goals.

III. PROJECT STATUS UPDATES:

Project Status as of January 31, 2014

Since July 2013 new records of 134 rare features were added to the Rare Features Database. Since 1987, MBS has added a total of 20,152 new rare feature records statewide. Rare aquatic plants and vegetation in 39 lakes were surveyed since July, 2013. Since 1987, botanists have documented 1,232 rare aquatic plants during targeted surveys of 1,911 lakes in 44 counties. Since 1987, MBS has contributed 5,056 of the 9,580 vegetation plot records in the DNR's Relevé (vegetation plot) Database. Statewide 10,192 MBS sites of Biodiversity Significance and 63,232 polygons of native plant communities are publically available on the DNR's Data Deli.

MBS coordinated with planning and assessment activities to ensure that MBS data are used to inform products. A few examples include: implementation of the Prairie Conservation Plan, an assessment of potential Lakes of Biological Significance, selected watershed planning efforts, the Strategic Groundwater Management team, the Scientific and Natural Area plan, the update to the State Wildlife Action plan, the DNR's vulnerability assessment plan, Forest Certification, School Trust stewardship parcel identification, Potlatch land assessment, and strategic land asset management planning.

Staff organized a vegetation classification session at the annual meeting of the Ecological Society of America held in Minneapolis in August, was featured at a regional Patch-Burn grazing conference that highlighted MBS monitoring activities at a western MN prairie being patch-burn grazed, provided updates on orchid monitoring at the Midwest Regional Federal endangered species meeting held in Minnesota, and assisted with relocation of western Jacob's ladder populations that included county coordination.

Project Status as of October 31, 2014

Since July 2013 956 new rare features records were added to the Rare Features Database. Since 1987, MBS has added a total of 21,108 new rare feature records statewide. Rare aquatic plants and vegetation in 39 lakes were surveyed since July, 2013. Since 1987, botanists have documented 1,232 rare aquatic plants during targeted surveys of 1,911 lakes in 44 counties. Since 1987, MBS has contributed 5,157 of the 9,681 vegetation plot records in the DNR's Relevé (vegetation plot) Database. Statewide 10,570 MBS sites of Biodiversity Significance and 78,248 polygons of native plant communities are now publically available on the DNR's Data Deli.

Field surveys were completed in the Tamarack Lowlands and the Littlefork Vermilion Uplands subsections of St. Louis County, and in Clearwater County in 2014. MBS sites and native plant community polygons were added to the public Data Deli for three counties (this includes a map layer of native plant communities totaling 577,105 acres).

A summary of some applications of MBS data in 2014:

- Review of State School Trust Lands
- Superior National Forest Projects - plan implementation
- DNR Strategic Land Asset Management (SLAM) - sales and exchanges and making more strategic acquisitions
- Scientific and Natural Area Plan
- Minnesota Prairie Conservation Plan
- Great Lakes Biodiversity Plan
- Forest Certification and High Conservation Value Forests (External Audit in Fall 2014)
- State Wildlife Action Plan revision
- Review of Wildlife Management Area grazing plans
- Restoration guidelines and Best Management Practices for pollinators
- Review of St. Louis County "special site" designation
- Prairie plant field identification workshops to train 150 participants
- Contribution to DNR project to start statewide identification of lakes of biological significance
- Organization/presentations at a national meeting of the Center for Plant Conservation (with MN Landscape Arboretum)

Project Status as of March 31, 2015

Since July 2013, 1,154 new rare features records were added to the Rare Features Database. Since 1987, MBS has added a total of 21,306 new rare feature records statewide. Since 1987, MBS has contributed 5,298 of the 10,534 vegetation plot records in the DNR's Relevé (vegetation plot) Database. Statewide 10,734 MBS sites of Biodiversity Significance and 78,766 polygons of native plant communities are now publically available on the Minnesota Geospatial Commons.

Lakes of Biological Significance are now being used to guide watershed and other landscape planning efforts including the update of the State Wildlife Action Plan.

Data on native plants and native plant communities were used to develop web-accessible pollinator habitat restoration guidelines.

Prairie plant identification classes in 2014 were so successful that three field sessions are planned for 2015.

Overall Project Outcomes and Results

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fragmentation, loss of species and genetic diversity, invasive species expansion, climate change, and other changing environmental conditions.

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MBS continued monitoring to measure the effectiveness of management and policy activities. For example, as part of DNR's forest certification high conservation value forest sites in southeastern Minnesota have been targeted as monitoring sites with field survey efforts focused on detailed rare plant surveys. This work provided updates to existing data that is often more than 20 years old, set a foundation from which to more precisely track target species' populations through time, and improved the relevance of MBS data to monitoring needs.

PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Field Surveys

Description:

Data on the distribution and ecology of plants, animals, native plant communities and functional landscapes will be collected, providing a basis for the maintenance of elements of biological diversity and ecological systems through ecological management, planning, research, and critical habitat acquisition.

Data review and Survey site identification (see Map): Plant ecologists, botanists and zoologists review existing relevant natural resource data and record information using Geographic Information Systems and other DNR information systems to consolidate and organize data. Examples of these data include forest inventories, wetlands inventories, aquatic plant surveys, wildlife habitat inventories, park surveys, soil surveys, land-use data, historical public land surveys, academic research, and records from museum collections. Using these data, supplemented by the interpretation of aerial photography or other imagery, staffs identify MBS sites and species habitats for targeted surveys.

Coordination: Staff notify and coordinate activities when possible with other divisions within the DNR, universities, counties, municipalities, surveys and monitoring efforts of tribal governments, watershed districts, federal natural resource agencies, conservation organizations, corporations, and individual landowners. This is critical to the success of data consolidation and field surveys.

Field Surveys: Ground surveys to assess MBS site and native plant community quality and condition include the collection of vegetation samples in coordination with other sampling (soils, water chemistry etc.) when possible. Aerial surveys continue to be especially important to the survey of the large peatlands where ground access is extremely challenging. Additional specialized techniques are used during field seasons to survey selected rare species or groups of species (e.g., plants, birds, mammals, reptiles, amphibians, insects, fishes).

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 900,000
Amount Spent: \$ 893,725
Balance: \$ 6,275

Activity Completion Date:

**Overall budget estimate based on past MBS projects*

Outcome (see also attached map-subsection referenced by letter)	Completion Dates	Budget*
1. Field survey Lake County: Border Lakes subsection	Fall 2013	
2. Field survey St Louis County: Border Lakes subsection	Continue	
3. Field survey St Louis County: Tamarack Lowlands subsection	Fall 2014	
4. Field survey St Louis County: Littlefork-Vermillion Uplands subsection	Fall 2015	
5. Field survey: Beltrami & Clearwater counties (all subsections)	Fall 2015	
6. Field survey Lake of the Woods County (all subsections)	Continue	
7. Field survey Koochiching County (all subsections)	Continue	

Activity Status as of January 31, 2014

Data review, site identification and coordination

In the Border Lakes subsection a review of the 2013 field season surveys resulted in a 2014 work plan focused on native plant community and site surveys on the portions of the subsection that are outside of Voyageurs National Park and the Boundary Waters Canoe Area Wilderness. Surveys in Lake of the Woods, northern Beltrami and Koochiching County include plans for helicopter access to selected remote areas.

Coordination with the Superior National Forest (SNF) continues and in the winter of 2014, MBS staff will provide an update regarding 2014 field survey plans to biologists from Voyageurs National Park.

Coordination with the Red Lake Department of Natural Resources continued in the field season of 2013 and animal survey staff discussed plans for 2014 surveys at a meeting in January 2014. Coordination with Nett Lake is also in progress.

During the 2013 field season staff from MBS and the St. Louis County Lands and Minerals Department met to discuss the initiation of survey efforts in new portions of the county.

The DNR's interdisciplinary Forest Management Coordination Framework requires the delivery of a GIS cover of MBS preliminary sites for review by DNR regional staff in Forestry, Wildlife, Fisheries and Ecological and Water Resources. GIS covers of MBS preliminary survey sites continue to be updated and provided for review as new data are processed.

A presentation on the status of MBS surveys was part of a presentation at a statewide meeting of the Division of Ecological and Water Resources in October and at an EWR Northeastern Region staff meeting in January 2014.

Survey work planning includes addressing the changes presented in the new state list of Endangered Threatened and Special concern species that became effective in August 2013.

Two MBS plant ecologists organized a successful half-day session related to vegetation classification that was part of a national meeting of the Ecological Society of America (ESA) held in Minneapolis in August 2013. The session was entitled *The development of regional plot-based vegetation classifications: How classifications based on large sets of plot data further our understanding of vegetation ecology and conservation*. Three of the presentations were related to the development of the Minnesota terrestrial and aquatic classification and another presentation featured application of these data for forest management.

In addition, ecologists participated in an ESA workshop entitled *Vegetation Databases and the Development of the National Vegetation Classification*. Plot data from adjacent areas of Minnesota and Ontario were featured in a process to synthesize data from different projects and databases in order to inform the US and Canadian National Vegetation Classifications. The Ontario ecologists also met with the Minnesota staff to discuss the hemi-boreal forests that cross the international border. Further correspondence with ecologists at NatureServe indicates an interest in the establishment of regional data centers for vegetation plot data.

A field training day in western Minnesota included participants from South Dakota interested in learning about vegetation plot data collection and prairie evaluation.

Staff coordinate with Minnesota museums and herbaria related to their curation of specimens and database documentation. Review of existing physical collections informs surveyors about species identification, distribution and phenology to improve field survey efficiency.

Minnesota bryologist Jan Janssens continues to work with MBS to record significant updates on the state's distribution of bryophytes and is the primary source of information to help create a state list of mosses. The mosses on this list are used in recording species in vegetation samples and will enhance results especially in native plant communities such as peatlands, currently a focal system in MBS work. Mosses are dominant organisms but often poorly recorded by botanists and plant ecologists more familiar with vascular plants.

MBS continued coordination with various other planning and assessment activities in the DNR so that participants in those efforts are aware of survey status of MBS and are aware of recent data that could inform their products. A few examples include: implementation of the Prairie Conservation Plan, an assessment of potential Lakes of Biological Significance, selected watershed planning efforts, the Strategic Groundwater Management team, the Scientific and Natural Area plan, the update to the State Wildlife Action plan, the DNR's vulnerability assessment plan, Forest Certification, School Trust stewardship parcel identification, Potlatch land assessment, and strategic land asset management planning.

Field Surveys

Field surveys were completed in the Border Lakes Subsection of Lake County in 2013 and will continue in the St. Louis County and Koochiching County portions in 2014. Surveys will continue in the St. Louis County portion of the Littlefork-Vermilion Uplands Subsection and in the Tamarack Lowlands Subsection in 2014. Completion of the survey in the Tamarack Lowlands Subsection in fall 2014 as scheduled is anticipated. Surveys are continuing in Lake of the Woods and Koochiching counties. In Clearwater and Beltrami counties, field surveys remain to be completed only for targeted animals and their associated habitats.

Highlights Northeastern Minnesota

Much of the 2013 work in the Border Lakes Subsection involved extended canoe- access-only trips into the Boundary Waters Canoe Area Wilderness (BWCAW).

For example, one seven day trip was based out of a camp in Jackfish Bay, Basswood Lake from which field forays were conducted. Highlights from that trip included recording of eight relevés and documentation of new locations of Katahdin sedge (*Carex katahdinensis*), American shoreweed (*Littorella uniflora*), adder's tongue

(*Ophioglossum pusillum*), Vasey's pondweed (*Potamogeton vaseyi*), small green wood orchid (*Platanthera clavellata*), New England violet (*Viola novae-angliae*), and several uncommon blackberry (*Rubus*) species. Another 15 day survey trip was based near Basswood Falls. Highlights included collection of nine relevés and documentation of new locations of bog white violet (*Viola lanceolata*), St. Lawrence grapefern (*Botrychium rugulosum*), dissected grapefern (*B. dissectum*), Katahdin sedge (*Carex katahdinensis*), American shoreweed (*Littorella uniflora*), small capsule dung moss (*Splachnum ampullaceum*), Vasey's pondweed (*Potamogeton vaseyi*), slender watermilfoil (*Myriophyllum tenellum*), New England violet (*Viola novae-angliae*), and big bluestem (*Andropogon gerardii*).

In addition to the above species plant ecologists and botanists documented other notable plants during survey work in the Littlefork Vermillion Subsection and the Border Lakes subsections. These included cuckoo flower (*Cardamine pratensis*), small white waterlily (*Nymphaea leibergii*), lavender bladderwort (*Utricularia resupinata*), white adder's mouth (*Malaxis monophyllos* var. *brachypoda*), coastal sedge (*Carex exilis*), beach heather (*Hudsonia tomentosa*), eastern hemlock (*Tsuga canadensis*), bog rush (*Juncus stygius* var. *americanus*), montane yellow-eyed grass (*Xyris montana*), Lapland buttercup (*Ranunculus lapponicus*), brown beaksedge (*Rhynchospora fusca*), few-flowered spikerush (*Eleocharis quinqueflora*), northern oak fern (*Gymnocarpium robertianum*), elegant groundsel (*Packera indecora*), brown beaksedge (*Rhynchospora fusca*), and russet buffaloberry (*Shepherdia canadensis*). The Bug-on-a-stick moss (*Buxbaumia aphylla*) was a particular highlight in the Border Lakes.

Highlights Northwestern Minnesota

The first field season in eastern Lake of the Woods County consisted of surveys conducted primarily in peatlands with additional surveys in rock outcrops, beaches of Zippel Bay State Park, the Rapid River floodplain forest, upland areas of natural-origin jack pine and other upland forest types.

Notable plant species documented during northwestern surveys included McCalla's willow (*Salix maccalliana*), adder's tongue (*Ophioglossum pusillum*), bog rush (*Juncus stygius* var. *americanus*), ram's head orchid (*Cypripedium arietinum*), coastal sedge (*Carex exilis*) and northern oak fern (*Gymnocarpium robertianum*), along with numerous bryophytes that were submitted to moss expert Jan Janssens for verification of identification since they likely were never previously documented for the county.

Aquatic Plant Surveys

Aquatic vegetation surveys were conducted in 39 lakes where vegetation lists were recorded and 38 rare plants were documented. This included surveys in the Tamarack Lowlands and Nashwauk Uplands ecological subsections of St. Louis County and final surveys in Lake County.

Animal Surveys are largely funded by a State Wildlife Grant. A report detailing activities is forthcoming and will be referenced in the next update.

Activity Status as of October 31, 2014

Data review, site identification and coordination

Survey work continued in northern Minnesota that included additional review of resources such as color-infrared photography and rare species changes due to 2013 revision of the state list of endangered, threatened and special concern species. In addition, several staff were trained in the use and application of LiDAR data useful both in preparing for surveys and for displaying results. 2014 work plans were developed for the Border Lakes Subsection of St Louis and Koochiching counties and for the Tamarack Lowlands and Littlefork-Vermillion subsections of St Louis County. Some specific coordination activities in this region included communication with landowners, especially on Pine Island in Lake Vermillion; meetings with the St. Louis County Lands and Minerals Department; notification of other DNR divisions about survey plans; and coordination with the Superior National

Forest, Meriwether Minnesota Land and Timber, and Potlatch regarding permits to conduct surveys on their lands. Staff also met with representatives of the Bois Forte Band to discuss potential surveys on Nett Lake tribal lands. An update on the status of MBS was well-received at a northern Minnesota County Commissioner's meeting held in St Paul.

Surveys in Lake of the Woods, Beltrami, and Koochiching counties included planning for helicopter access to selected remote areas. This required extensive negotiations within and outside of the DNR to secure the most effective and safe transport. Specific site selection was needed to inform the pilot of suitable landing sites near or in the extensive peatland landscape. Considerations included refueling locations, communications in remote areas, tree cover and the need to train staff biologists to learn how to safely exit/enter a helicopter when landing was not possible on soft, wet peat. Coordination of a large array of staff and volunteers with survey targets ranging from vegetation samples to documentation of dragonflies was also required to maximize a week-long effort centered at the Waskish airport.

The DNR's interdisciplinary Forest Management Coordination Framework requires the delivery of a GIS cover of MBS preliminary sites for review by DNR regional staff in the divisions of Forestry, Fisheries and Wildlife, and Ecological and Water Resources. GIS covers of MBS preliminary survey sites continue to be updated and provided for review as new data are processed.

Staff continued to coordinate with Minnesota museums and herbaria related to review of targeted species and, this winter, the collection of data related to specimens of species newly listed on the state's list of endangered, threatened and special concern species.

MBS engaged several specialists in limited surveys of certain groups of organisms including mosses, sedges, fungi and moonworts (*Botrychium* spp.). In addition to challenging access in the peatlands, some Border Lakes Subsection surveys included extended canoe-access only trips into the Boundary Waters Canoe Area Wilderness (BWCAW) and adjacent remote U.S. Forest Service property.

Field Surveys

Field surveys were completed in the Tamarack Lowlands and the Littlefork Vermilion Uplands subsections of St. Louis County and in Clearwater County in 2014. Surveys were conducted and continue in Koochiching, Lake of the Woods, and Beltrami counties, and in the Border Lakes Subsection of St. Louis County.

Highlights Northern Minnesota

MBS vegetation survey work continued in the Border Lakes in 2014 with much of the work conducted outside of the BWCAW. Examples include Purvis Lake southeast of Ely and Ash Lake north of Orr. Vegetation samples (relevés) were collected at Purvis Lake and new locations of humped bladderwort (*Utricularia gibba*) and small capsule dung moss (*Splachnum ampullaceum*) were documented. An extended canoe-based wilderness trip into the BWCAW (Fourtown Lake) resulted in the collection of 12 relevés and new locations of several rare plants: sooty-colored beak moss (*Rhynchospora fusca*), ambiguous sedge (*Carex conoidea*), American shore-plantain (*Littorella americana*), slender water milfoil (*Myriophyllum tenellum*), and slender naiad (*Najas gracillima*).

During this time, the identification of a 2013 collection of a species of rare sedge, *Carex tinctoria*, was confirmed by an expert. This is the first record in Minnesota of the sedge, which is considered rare and local in the Great Lakes with only two other known locations in Michigan and Wisconsin. The collection was made in Basswood Lake.

In northeastern Koochiching County, surveys were conducted in a wide range of native plant communities, including forested peatlands, acid peatlands, wet forests, and bedrock communities. Notable plant species documented included a surprising find of the state endangered bog adder's mouth (*Malaxis paludosa*) that represents a significant range extension for the species in Minnesota. Other rare species included Siberian

yarrow (*Achillea alpina*), spike rush (*Eleocharis nitida*), ram's head orchid (*Cypripedium arietinum*) and the second location in the state of the moss, low sphagnum (*Sphagnum compactum*).

Surveys of the Vermilion Bedrock Complex of the Border Lakes Subsection included an eight-day survey trip on Lake Vermilion. Some of the notable plants observed in the subsection included cuckoo flower (*Cardamine pratensis*), Lapland buttercup (*Ranunculus lapponicus*), white adder's mouth (*Malaxis monophyllos* var. *brachypoda*) and five different species of moonworts (*Botrychium* spp.). The only known population of ram's head lady's-slipper (*Cypripedium arietinum*) in St. Louis County (last observed 23 years ago) was relocated. The number of individual plants in the population has declined since the first observation.

In August the helicopter-supported week-long survey of peatlands in Koochiching and Lake of the Woods counties was especially productive in documenting flora and vegetation in remote areas not previously surveyed by botanists. An example was a remote rock outcrop located in the midst of the vast peatland. New locations of rare species such as English sundew (*Drosera anglica*) and bog rush (*Juncus stygius*) were collected. Assistance from volunteer botanists and *Odonata* (dragonfly) specialists yielded many new records of species locations. For example, the North Black River Peatland supports one of the rarest dragonflies in North America, the Quebec emerald (*Somatochlora brevicincta*), which has only been recorded previously in two other locations in Minnesota.

Other survey highlights

A limited survey of fungi was supported in an area of the peatlands of Beltrami County that yielded collections of about 65 species with about 60% of these representing new locations for the county.

Contractual botanists completed selected surveys of moonworts (*Botrychium* species) in 48 northwestern Minnesota locations. Nine different species were collected of this notoriously difficult to identify group of plants. Notable were three new sites for the state endangered upswept moonwort (*Botrychium ascendens*), two new locations for the state endangered common moonwort (*Botrychium lunaria*), and five new sites for Michigan moonwort (*Botrychium michiganense*), currently in the process of description as a new species to science.

Animal Surveys are largely funded by a State Wildlife Grant. The most recent report of activities is the State Wildlife Grant Interim Report entitled Survey of Minnesota's Wildlife and Habitat Resources and Information Management, Minnesota Grant Number: T-5-R-4, F12AF00950.

Activity Status as of March 31, 2015

Data review, site identification and coordination

2015 work plans are being finalized for the Border Lakes Subsection of St. Louis and Koochiching counties, and for Beltrami and Lake of the Woods counties. Surveys will also continue in the Littlefork Vermilion Uplands Subsection of St. Louis County—this a correction from the October 2014 report.

Communication continues with others in the DNR, the Superior National Forest, Meriwether Minnesota Land and Timber, and Potlatch regarding permits to conduct surveys on their lands.

Staff have also been coordinating with NRCS regarding Soils Survey information now available for northern Lake and northern St. Louis counties, where NRCS has been actively working recently. For example, recent research on Lake Agassiz stages and interpretation as related to the Border Lakes Subsection has been provided to the northern Minnesota staff, some of which has been converted to GIS files that will inform field surveys.

MBS continues to deliver a GIS cover of MBS preliminary sites for review by DNR regional staff in the divisions of Forestry, Fisheries and Wildlife, and Ecological and Water Resources.

The Department native plant community polygon database is operational and training sessions led by MBS plant ecologists continue. A similar coordinated effort within the Department to establish a statewide habitat plot monitoring system is underway with leadership by MBS ecologists.

Staff continued to coordinate with Minnesota museums and herbaria related to review of targeted species, sharing of data, and database development as related to specimens.

MBS continues to work with specialists for selected surveys of certain groups of organisms including mosses, sedges, and moonworts (*Botrychium* spp.).

Coordination with the members of the Minnesota Prairie Conservation Plan has resulted in identification of several core areas where additional field survey updates are needed. Staff have also coordinated with other DNR divisions in the identification of Lakes of Biological Significance, development of Strategic Groundwater Management plans, completion of the Scientific and Natural Area plan, the update to the State Wildlife Action plan, continued implementation of Forest Certification, School Trust stewardship parcel identification, and strategic land asset management planning.

Field Surveys

Various reports were prepared during this time reporting outcomes of 2014 field surveys. Both Potlatch and Molpus (Merriweather) companies provided permits that required reports on outcomes. A report to Molpus on lands surveyed in Koochiching County included a description of the process and results. Results included records of plant locations on Molpus lands ranging from rare orchids to common species that were collected for the museum for the first time in the region, such as-turtle-head (*Chelone glabra*).

Animal Surveys are largely funded by a State Wildlife Grant. The most recent report of activities is the Minnesota State Wildlife Grant Final Report-Project: Survey of Minnesota’s Wildlife and Habitat Resources and Information Grant Number: T-5-R-4, F12AF00950.

Final Report Summary

Activity 1 Final Summary

Proposed Outcome (see also attached map)	Proposed Completion Date	Final Report Summary
1. Field survey Lake County: Border Lakes subsection	Fall 2013	Completed 2013
2. Field survey St Louis County: Border Lakes subsection	Continue	Continued
3. Field survey St Louis County: Tamarack Lowlands subsection	Fall 2014	Completed 2014
4. Field survey St Louis County: Littlefork-Vermillion Uplands subsection	Fall 2015	Continued
5. Field survey: Clearwater County (all subsections)	Fall 2015	Completed 2014
6. Field survey: Beltrami County (all subsections)	Fall 2015	Continued
7. Field survey Lake of the Woods	Continue	Continued

County (all subsections)		
8. Field survey Koochiching County (all subsections)	Continue	Continued

Data review, site identification and coordination

Data review continued for northern Minnesota that included review of resources such as modern color-infrared aerial photography, LiDAR, soil and geologic survey products, historical aerial photography, Public Land Surveyor notes, and many others critically important to planning, executing and reporting on field surveys.

MBS field survey during this project period often involved accessing some of Minnesota’s most remote areas. Surveys of the vast peatlands in Lake of the Woods, Beltrami, and Koochiching counties included helicopter access to selected remote areas while field survey of the extensive intact landscapes of the Border Lakes Subsection often required extended canoe-access only trips into the Boundary Waters Canoe Area Wilderness (BWCAW). The peatland helicopter field surveys required complex coordination among aviation professionals and a large array of biological staff with survey targets ranging from vegetation to dragonflies. The Border Lakes field surveys required ongoing coordination and collaboration with Superior National Forest.

Survey work prioritization addressed changes presented in the 2013 revision to the state list of Endangered Threatened and Special concern species.

MBS outreach and coordination continued with County land departments, DNR, USFS, tribal natural resource departments, private landowners, the public, and other external partners. Specific coordination activities included coordination with landowners on Pine Island in Lake Vermillion regarding field survey access and survey results; coordination and collaboration with the St. Louis County Lands and Minerals Department regarding field survey prioritization, access, and interpretation of survey results; coordination with other DNR divisions about survey plans; and coordination with the Superior National Forest, Meriwether Minnesota Land and Timber, and Potlatch regarding permits to conduct surveys on their lands and follow-up communication of survey results. Staff also continued to coordinate with the Red Lake Department of Natural Resources regarding field survey on tribal lands and Bois Forte Band on potential field surveys on Nett Lake tribal lands.

Various field survey outcome reports were prepared. Both Potlatch and Molpus (Merriweather) companies provided permits that required field survey outcome reports. A report to Molpus on lands surveyed in Koochiching County included a description of the process and results. Results included records of plant locations on Molpus lands ranging from rare orchids to common species collected for the first time in the region, such as turtle-head (*Chelone glabra*). An update on the status of MBS was well-received at a northern Minnesota County Commissioner’s meeting held in St Paul.

Two MBS plant ecologists organized a successful half-day session related to vegetation classification that was part of a national meeting of the Ecological Society of America (ESA) held in Minneapolis in August 2013. The session was entitled *The development of regional plot-based vegetation classifications: How classifications based on large sets of plot data further our understanding of vegetation ecology and conservation*. In addition, ecologists participated in an ESA workshop entitled *Vegetation Databases and the Development of the National Vegetation Classification*. Plot data from adjacent areas of Minnesota and Ontario were featured in a process to synthesize data from different projects and databases in order to inform the US and Canadian National Vegetation Classifications.

MBS engaged several specialists in limited surveys of certain groups of organisms including mosses, sedges, fungi and moonworts (*Botrychium* spp.). For example, Minnesota bryologist Jan Janssens continued to work with MBS to record significant updates on the state’s distribution of bryophytes and is the primary source of information to help create a state list of mosses. The mosses on this list are used in recording species in vegetation samples and will enhance results especially in native plant communities such as peatlands, currently

a focal system in MBS work. Mosses are often dominant organisms but often poorly recorded by botanists and plant ecologists more familiar with vascular plants. See also Activity 1 Field Survey Final Report Summary Prairie Highlights for specialist work on *Botrychium* species.

MBS continued coordination with various other planning and assessment activities in the DNR so that participants in those efforts are aware of survey status of MBS and are aware of recent data that could inform their products. A few examples include: implementation of the Prairie Conservation Plan, an assessment of potential Lakes of Biological Significance, selected watershed planning efforts, the Strategic Groundwater Management team, the Scientific and Natural Area plan, the update to the State Wildlife Action plan, the DNR's climate change vulnerability assessment plan, Forest Certification, School Trust stewardship parcel identification, and strategic land asset management planning. See also Activity 4 Final Report Summary.

The DNR's interdisciplinary Forest Management Coordination Framework requires the delivery of a GIS cover of MBS preliminary sites for review by DNR regional staff in Forestry, Wildlife, Fisheries and Ecological and Water Resources. GIS covers of MBS preliminary survey sites continued to be updated and provided for review as new data are processed.

The Department native plant community polygon database is operational and training sessions led by MBS plant ecologists continued. A similar coordinated effort within the Department to establish a statewide habitat plot monitoring system is underway with leadership by MBS ecologists.

Staff coordinated with Minnesota museums and herbaria related to their curation of specimens and database documentation. Review of existing physical collections continued that informs surveyors about species identification, distribution and phenology to improve field survey efficiency and efficacy.

Field Survey

Since July 2013, MBS field survey contributed 439 new vegetation plot records to the DNR's relevé database. At least 46 distinct native plant communities were recorded from 13 broad native plant community systems: acid peatland, fire-dependent forest, floodplain forest, forested rich peatland, lakeshore, mesic hardwood forest, marsh, open rich peatland, rock outcrop, upland prairie, wet forest, wet meadow, and wet prairie.

Northern Highlights

MBS Border Lakes subsection field survey occurred in Lake and St. Louis counties in areas inside and adjacent to the Boundary Waters Canoe Area Wilderness (BWCAW). Notable botanical discoveries included: Katahdin sedge (*Carex katahdinensis*), American shoreweed (*Littorella uniflora*), adder's tongue (*Ophioglossum pusillum*), Vasey's pondweed (*Potamogeton vaseyi*), small green wood orchid (*Platanthera clavellata*), New England violet (*Viola novae-angliae*), several uncommon blackberry (*Rubus*) species, bog white violet (*Viola lanceolata*), St. Lawrence grapefern (*Botrychium rugulosum*), dissected grapefern (*B. dissectum*), slender watermilfoil (*Myriophyllum tenellum*), sooty-colored beak moss (*Rhynchospora fusca*), ambiguous sedge (*Carex conoidea*), slender water milfoil (*Myriophyllum tenellum*), and slender naiad (*Najas gracillima*), big bluestem (*Andropogon gerardii*) and small capsule dung moss (*Splachnum ampullaceum*). Dozens of relevés were also collected.

MBS Border Lakes field survey resulted in the discovery of a new state record plant species. A sedge species, *Carex tincta*, considered rare and local in the Great Lakes with only two other known locations in Michigan and Wisconsin, was confirmed from Basswood Lake northeast of Ely.

MBS field survey in the Littlefork Vermillion Uplands (LFVU) subsection and Border Lakes subsection outside of the BWCAW occurred in St. Louis County. LFVU field surveys focused on large landscapes of peatlands and adjacent intact native plant communities. Border Lakes field survey focused on bedrock-controlled forested upland landscapes with embedded wetlands, peatlands, rivers and lakes. Notable botanical discoveries included cuckoo flower (*Cardamine pratensis*), small white waterlily (*Nymphaea leibergii*), lavender bladderwort

(*Utricularia resupinata*), white adder's mouth (*Malaxis monophyllos* var. *brachypoda*), coastal sedge (*Carex exilis*), beach heather (*Hudsonia tomentosa*), eastern hemlock (*Tsuga canadensis*), bog rush (*Juncus stygius* var. *americanus*), montane yellow-eyed grass (*Xyris montana*), Lapland buttercup (*Ranunculus lapponicus*), brown beaksedge (*Rhynchospora fusca*), few-flowered spikerush (*Eleocharis quinqueflora*), northern oak fern (*Gymnocarpium robertianum*), elegant groundsel (*Packera indecora*), brown beaksedge (*Rhynchospora fusca*), russet buffaloberry (*Shepherdia canadensis*), humped bladderwort (*Utricularia gibba*), five different species of moonworts (*Botrychium* spp.), small capsule dung moss (*Splachnum ampullaceum*), and Bug-on-a-stick moss (*Buxbaumia aphylla*). The only known population of ram's head lady's-slipper (*Cypripedium arietinum*) in St. Louis County (last observed 23 years ago) was relocated and found to have declined since the first observation. New relevé locations were collected from a range of native plant communities including dry jack pine, northern wild rice (*Zizania palustris*) aquatic communities, poor fen, black spruce swamp, natural origin old-growth red and white pine forest, and floodplain forest along the Littlefork and Sturgeon rivers in St. Louis County.

MBS Koochiching County field surveys were conducted in forested peatlands, acid peatlands, wet forests, and bedrock communities. Notable plant species documented included bog adder's mouth (*Malaxis paludosa*; a significant MN range extension for the species), Siberian yarrow (*Achillea alpina*), spike rush (*Eleocharis nitida*), ram's head orchid (*Cypripedium arietinum*), Laurentian tiger beetle (*Cicindela denikei*) and the second and third MN locations of low sphagnum (*Sphagnum compactum*).

MBS initiated the year of field survey in eastern Lake of the Woods County. Native plant communities surveyed included peatlands, rock outcrops, Lake of the Woods lakeshore, Rapid River floodplain forest, natural-origin jack pine, and other upland forest types. Notable botanical discoveries included McCalla's willow (*Salix maccalliana*), adder's tongue (*Ophioglossum pusillum*), bog rush (*Juncus stygius* var. *americanus*), ram's head orchid (*Cypripedium arietinum*), coastal sedge (*Carex exilis*) and northern oak fern (*Gymnocarpium robertianum*), along with numerous bryophytes of which many were new county records.

MBS helicopter-supported peatland field survey in Koochiching and Lake of the Woods counties documented flora and vegetation in remote areas not previously surveyed by botanists. An example was a remote rock outcrop located in the midst of a vast peatland. New locations of rare species such as English sundew (*Drosera anglica*) and bog rush (*Juncus stygius*) were collected. Assistance from volunteer botanists and *Odonata* (dragonfly) specialists yielded many new records of species locations. For example, the North Black River Peatland supports one of the rarest dragonflies in North America, the Quebec emerald (*Somatochlora brevicincta*), which has only been recorded previously in two other locations in Minnesota.

A limited survey of fungi was supported in an area of the peatlands of Beltrami County that yielded collections of about 65 species with about 60% of these representing new locations for the county.

Prairie Highlights

MBS prairie botanists located the state's largest known population of the State-threatened tuberous Indian-plantain (*Arnoglossum plantagineum*) located adjacent to Kasota Prairie SNA (LeSueur County).

Contractual botanists completed selected surveys of moonworts (*Botrychium* species) in 48 northwestern Minnesota locations. Nine different species were collected of this notoriously difficult to identify group of plants. Notable were three new sites for the state endangered upswept moonwort (*Botrychium ascendens*), two new locations for the state endangered common moonwort (*Botrychium lunaria*), and five new sites for Michigan moonwort (*Botrychium michiganense*), currently in the process of description as a new species to science.

Wetland Highlights

MBS contributed to a contract to develop and deliver GIS datasets that delineate and describe high quality shallow wetlands of the Anoka Sand Plain. This wetland type and its significance for rare plant species was discovered after MBS completed Anoka County.

Southeast Highlights

In Fillmore County (MBS monitoring field work - see also Activity 2) field survey occurred in a series of seepage wetlands that resulted in documentation of one of the state's largest populations of smooth-sheathed sedge (*Carex laevivaginata*). This field survey also resulted in MBS technical guidance delivered to a locally-based restoration ecologist who does a lot of work in seepage wetlands of this type. MBS provided instruction on the look-alike characteristics between the rare smooth-sheathed sedge and the much more common awl-fruited sedge (*Carex stipata*).

Aquatic Highlights

Aquatic vegetation surveys were conducted in 72 lakes where vegetation lists were recorded and at least 38 rare plants were documented. This included surveys in the Tamarack Lowlands and Nashwauk Uplands ecological subsections of St. Louis County and final surveys in Lake County.

MBS aquatic plant surveys discovered new locations for rare plant species with very limited MN distribution. Examples include:

- a population of Jointed Rush (*Juncus articulatus*) in Koochiching county that was previously known from only four MN lakes.
- a population of Oake's pondweed (*Potamogeton oakesianus*) in St. Louis county previously documented from only about six MN lakes.

Other

MBS field survey also occurred elsewhere in MN as part of monitoring (see Activity 2) and a limited amount in the course of providing guidance for conservation and management (statewide; see Activity 4).

Animal Surveys are largely funded by a State Wildlife Grant. The most recent report of activities is the Minnesota State Wildlife Grant Final Report-Project: Survey of Minnesota's Wildlife and Habitat Resources and Information Grant Number: T-5-R-4, F12AF00950.

ACTIVITY 2: Monitoring

Description:

MBS will conduct selected monitoring activities in collaboration with others in response to needs identified in various plans and assessments. Monitoring needs have been highlighted in a number of recent initiatives such as the Minnesota Prairie Conservation Plan: A Habitat Plan for Native Prairie, Grassland, and Wetlands in the Prairie Region of Western Minnesota (Minnesota Prairie Plan Working Group 2011) and the associated Implementation plan (2013-2017); the State of Minnesota's Forest Certification process (DNR 2005); the revision of the State's Wildlife Action Plan (DNR 2006); and the State's Watershed Framework for environmental improvement and conservation. Monitoring of outcomes complement many of the critical land protection goals identified in the Statewide Conservation and Preservation Plan (2008).

A number of sites were selected for monitoring of plant and animal species in 2011 associated with Forest Certification. In conjunction with work proposed related to the current State Wildlife Grant, MBS native plant communities and selected rare plant and animal populations will continue to be monitored in selected locations.

The establishment of permanent vegetation sampling plots that document the "central concept" of vegetation classes as described in *Minnesota's Native Plant Community Classification (Version 2.0)* will continue with a geographic focus in southeastern and northeastern forested landscapes and the rare, but significant forests of

southwestern Minnesota. Historic vegetation monitoring sites were re-sampled in the Patterned Peatlands in the previous biennia. Additional sites and monitoring protocol will be considered as work continues in this large landscape. The State’s Watershed Framework for environmental improvement and conservation is in the process of identifying selected lakes where MBS will collaborate in vegetation monitoring efforts.

In the prairie region, monitoring will continue to assess impacts of policies and management activities on various components of ecological systems and species populations in the Tallgrass Aspen Parklands and the Prairie Parkland Ecological provinces. In a number of recent plans including the Minnesota Prairie Conservation Plan, the Aspen Parkland Important Bird Area and the State Wildlife Action Plan guidance is provided for the identification of measures of successful conservation and management. Prairie vegetation sampling and species survey protocols have been implemented and are proposed to continue in 3-5 prairie landscape areas to assess specific fire and grazing management activities.

Monitoring began in 2011 of populations of small white lady’s-slipper (*Cypripedium candidum*), an orchid species identified as an important ecosystem measure in the Minnesota Prairie Conservation Plan. This species is listed as a state special concern plant. Minnesota harbors the world’s largest populations of this orchid which inhabits high quality prairie and wetlands, some of which are associated with groundwater discharge zones, making it a candidate for one measure of watershed health that considers groundwater resources. In the Prairie Parkland Province, monitoring will be continued at selected high-quality prairie/wetland sites containing populations of small white lady’s-slipper.

Summary Budget Information for Activity 2:

ENRTF Budget: \$ 300,000
Amount Spent: \$ 295,952
Balance: \$ 4,048

Activity Completion Date:

**Overall budget estimate based on past MBS projects*

Outcome (see also attached map)	Completion Dates	Budget*
1. Identify permanent vegetation sampling plots	January 2014	
2. Sample selected permanent vegetation plots	2013 (10); 14 (20)	
3. Sample up to 5 prairie sites to assess specific management activities	Continue	
4. Monitoring of sensitive prairie plant species	Continue	
5. Sample selected sites related to sustainable forest management	Continue	

Activity Status as of January 31, 2014

Vegetation sampling plots

Building on the over 5,000 relevé plots that have been central to MBS documentation of native plant communities, a MBS plant ecologist coordinated an effort in the fall of 2013 to establish permanent vegetation plots representing native plant communities/ecological land types ranging from high to low quality in condition that would include contributions from all DNR resource Divisions. The intent is to coordinate data collection at these locations to include methods/metrics important for assessing vegetation and wildlife habitats. Examples of existing DNR efforts that could be combined at these sites include vegetation relevés/transects, breeding bird point counts, browse indexes, and other metrics associated with Forest Inventory, High Conservation Value Forest Monitoring, Forest Age-Class Monitoring, Wetland Assessment and Monitoring, Grassland Monitoring and Aquatic Plant Monitoring. A proposal also included the design and development of a robust, department-wide information management system to store and deliver monitoring data. This would require the development of standards so that basic metrics (surveyor name, date, location, slope, aspect, basal area, etc.) collected by multiple divisions/programs at each site are relatable and data entry is streamlined. The idea was well-received in the Department but possible supplemental funding sources will not be available until 2015.

MBS permanent plot establishment is going forward in anticipation of implementation of a DNR coordinated effort. Permanent plots have been established and sampled in the Patterned Peatlands. Additional peatland locations and locations in other habitats in northern Minnesota are being selected for the 2014 field season. Over 35 vegetation plots were established and sampled during this period.

Prairie management activities

Lac Qui Parle Wildlife Management Area Chippewa Prairie Project: Established plots were sampled between July 24 and August 1 by two experienced plant ecologists working with (and training) two highly motivated students working on contracts. A data entry program designed in Access by another MBS ecologist for use on a field tablet worked well and reduced data entry time and error in transcription. It appears that ecological staff will increasingly need to learn programming skills for such applications due to the lack of time (and the expense) of MN.IT staff to direct their agency resources on “low-priority” applications.

The Division of Wildlife provided good logistical support and transportation for the project but modifications in management plans could influence results. A progress report entitled *Plant Community Monitoring at the Lac Qui Parle WMA/Chippewa Prairie Patch-Burn-Graze Project* was prepared in fall 2013 that presents results from two years of vegetation monitoring of 25 pairs of vegetation plots at the Lac Qui Parle/Chippewa Prairie Patch-Burn-Graze project. This project is partially funded by the MBS ENRTF. For full report see:

http://files.dnr.state.mn.us/eco/mcbs/chippewa_prairie_pbg_veg_monitoring_14jan2014.pdf

Report Summary (Lac Qui Parle Wildlife Management Area Chippewa Prairie Project): The plots were distributed over 5 management units within Lac Qui Parle WMA and Chippewa Prairie Preserve. One plot within each pair was randomly selected and enclosed within a 20-m diameter enclosure constructed of cattle panels. In 2011, the vegetation was sampled before cattle were released into the project area. Grazing was started in 2012. The second year of vegetation sampling was in 2013. Unit 1 was burned in 2010, unit 5 was burned in 2012, and unit 4 was burned in 2013. In 2013, unit 5 was required to be fenced off from the rest of the patch burn graze project. Also in 2013, a 90 acre portion of unit 5 was fenced off from the rest of the unit and grazed in order to examine the effects of two consecutive years of grazing on sweet clover. Two years are not enough time to assess management impacts on systems composed primarily of long-lived, perennial plants and all vegetation sampling results must be seen as preliminary.

Hole in the Mountain Wildlife Management Area Project: Locations of monitoring plots related to a second grazing assessment were established prior to “treatment” and 15 pairs of plots were sampled in August 2013, again using a field tablet. Half the plots are in smooth brome-prairie transitions on upper slopes and half are in brome-prairie transitions on lower slopes. (Smooth brome-*Bromus inermis* is an invasive grass). This project is partially funded by the MBS ENRTF.

Sensitive prairie plant species

In the Prairie Parkland Province, monitoring continued at selected sites containing populations of small white lady’s-slipper. A progress report is available for this project:

http://files.dnr.state.mn.us/eco/mcbs/2013_cypripedium_candidum_report.pdf

Monitoring also continued for the federally threatened western prairie fringed orchid (*Platanthera praeclara*). Minnesota has some of the largest populations of this species and the best expression of geographic range of all of the states and provinces of known populations. This species has been specifically identified as an indicator in the Minnesota Prairie Conservation Plan and some funding from the ENRTF enabled this project to expand into other realms of assessment including the potential relationship of mycorrhizal fungi to population viability and potential genetic variation across the north south geographic gradient that is well-expressed within the state

(Blue Mounds State Park to Pembina Trail Preserve in northwestern MN). This additional sampling will help inform potential adaptation of the species to changing conditions and habitat management. Land managers have been close partners in these orchid monitoring efforts.

Sustainable forest management

In response to Forest Certification monitoring needs, MBS staff coordinated with DNR regional ecologists to continue rare plant population assessments at several forested sites in southeastern Minnesota. For example at the Shattuck Creek site in Fillmore County, improved data on the extent and abundance was collected of the rare plants known to occur at the site, especially Sullivant's coolwort (*Sullivantia renifolia*) and James' sedge (*Carex jamesii*). In addition plant ecologists documented the effects of major flooding (June 2013) to the cliff-dwelling Sullivant's coolwort populations.

Monitoring at Whitewater State Wildlife Management Area involved assessment and mapping of prairie fameflower (*Talinum rugospermum*), the highest priority and most sensitive rare plant species at the site. The highly trained ecologists and botanists involved in the high conservation value forest monitoring project recognized the benefit of returning to the southeast part of the state to collect more detailed data using better survey and mapping technology than was available over 20 years ago when the area was first surveyed by MBS. This more detailed assessment of ten of the highest biodiversity sites within state forests and wildlife management areas is providing new information. For example, botanists documented new populations of eastern green-violet (*Hybanthus concolor*), Carey's sedge (*Carex careyana*), James' sedge (*Carex jamesii*), spreading sedge (*C. laxiculmis*), needle beaksedge (*Rhynchospora capillacea*), great Indian plantain (*Arnoglossum reniforme*), and upland boneset (*Eupatorium sessilifolium*), all state threatened or endangered species. These data will provide managers with more specific information to guide management planning for sites of high conservation value. The project will continue in 2014.

Activity Status as of October 31, 2014

Vegetation sampling plots

Establishment by MBS of permanent vegetation plots continues although anticipated funding for a DNR-wide project to establish permanent vegetation plots is not in place.

In the northern patterned peatlands, helicopter access in 2014 provided for the establishment of new permanent vegetation (relevé) plots. Staff also resampled older permanent plots previously established by University of Minnesota peatland researchers in the 1980s. A total of 24 relevé plots now are permanently marked across this large landscape. Additional vegetation sampling plots were established in a remote lowland conifer system in a peatland area of Lake of the Woods County in conjunction with a University of Minnesota fire study.

Prairie Activities

As part of a patch-burn grazing project, 35 wetland basins were sampled at the Chippewa Prairie in western Minnesota. In August 25 pairs of permanent upland vegetation plots were sampled to track the composition of plants in the grazed and ungrazed prairie.

As an outcome of the Prairie Conservation Plan implementation, additional mapping of "core areas" was accomplished. The purpose was to assess connectivity and recovery potential of some of the vegetation found within the core areas. This included field surveys, collection of relevés and mapping of native plant communities in the Glacial Lakes, Lake Christina, and part of the Agassiz Beach Ridges core areas. Mapping included a broad array of native plant community types (included some forests, for example) and inclusion of some lower quality grasslands than those mapped by MBS in the 1980s. About 11,000 acres of native plant communities were added to the statewide GIS data layer.

Sensitive prairie plant species

In the Prairie Parkland Province, monitoring continued at selected sites containing populations of small white lady's-slipper (*Cypripedium candidum*). In 2014, two levels of sampling intensity were explored to determine the most effective approach for data collection that would provide a reasonable estimate of the long-term viability of the Minnesota populations.

Level 1: This approach focused on relocation of 47 known populations across the range of the plant in the state by staff and volunteers. They recorded numbers of flowering plants in each population and updated databases with more accurate mapped locations. Populations were relocated at 36 sites with numbers of flowering plants ranging from less than 10 flowering individuals to several thousand in a population. In northwestern Minnesota, yellow lady's-slippers (*Cypripedium parviflorum*) were observed growing with the small white lady's-slippers. Hybridization of the two species appeared likely in some populations. Small white lady's-slippers were not observed at 11 previously known populations but were documented for the first time at eight new sites. Finally 10 new sites with potential habitat were searched without success.

Level 2: Seven sites were visited to field test more intensive techniques developed in consultation with a biometrician. These sites were located across the species range in the state. This level of detailed data collection required substantial resources (time and people) not sustainable in the near future. It did establish a sampling protocol for more rigorous monitoring of selected populations in the future.

Small white lady's-slipper has a relatively short blooming period in late May and early June and occupies a large geographic area ranging from the southern to northern borders of western Minnesota. To accomplish this work, MBS relied on assistance from others. Staff from the U.S. Fish & Wildlife Service and regional plant ecologists from the DNR assisted with some of the sampling but much of the work was performed by several teams of volunteers led by MBS botanists. At least 10 volunteers assisted with surveys and data recording for a total of more than 200 hours of time during the peak bloom. Volunteers were trained, and then worked independently using GPS and field forms to record data at each site. Other volunteers assisted with surveying large (some greater than 80 acres in size) sites in northwestern Minnesota.

In addition, MBS botanists advised hydrologists on the placement of new groundwater monitoring wells at Prairie Storm Waterfowl Production Area in western Stearns County. This WPA was chosen as a control due to its high quality wet-mesic prairie remnants and the presence of a large population of small white lady's-slipper.

Monitoring also continued for the federally threatened western prairie fringed orchid (*Platanthera praeclara*). Minnesota has some of the largest populations of this species and the best expression of geographic range of all of the states and provinces of known populations. This field season's work will be summarized in a report in December 2014. A related publication is listed in activity 4.

Sustainable forest management

In response to DNR Forest Certification monitoring needs, MBS staff coordinated with DNR regional staff in southeastern Minnesota to continue rare plant population assessments at nine high conservation value forest sites, building on the 2013 work accomplished at six sites. Focal areas in 2014 were Shattuck Creek, Diamond Creek-Whitewater South Fork, Partridge Creek, Coolridge Creek, and Perched Valley Wildlife Management Area. Highlights included new locations for the following species: eastern green violet (*Hybanthus concolor*), goldenseal (*Hydrastis canadensis*), reniform sullivania (*Sullivantia sullivantii*), and narrow-leaved spleenwort (*Diplazium pycnocarpon*).

Shattuck Creek: Staff located and produced detailed maps of a new population of green violet, two new populations of reniform sullivania and two new populations of goldenseal.

Diamond Creek: Staff located new colonies of Carey's sedge (*Carex careyana*), smooth-sheathed sedge (*Carex laevivaginata*), narrow-leaved spleenwort, silvery spleenwort (*Deparia acrostichoides*) and a new population of goldenseal.

Whitewater South Fork: Staff relocated goldenseal and twinflower (*Jeffersonia diphylla*), resulting in an improved map of the extent of the populations of these species compared to the original data collected at the site. A visit to the site by DNR managers and ecologists resulted in descriptions of new populations of false mermaid (*Floerkea proserpinacoides*), ginseng (*Panax quinquefolius*), and stemless tick trefoil (*Desmodium nudiflorum*).

Partridge Creek: Rare plant surveys were conducted with DNR Forestry personnel and a regional plant ecologist. The group relocated and improved mapping of populations of rare plant species including false mermaid (*Floerkea proserpinacoides*) and Wood's sedge (*Carex woodii*) and found a new location of glade mallow (*Napaea dioica*).

Coolidge Creek: Management activities at this site included a proposal to salvage ash and a proposal to remove levees to restore trout stream. A site visit was made with regional staff to relocate and better map known populations of rare plants, note new garlic mustard patches (an invasive species) and discuss future management plans.

Also in southeastern Minnesota a reported population of the state threatened fernleaf false foxglove (*Aureolaria pedicularia*) was confirmed in the Whitewater savanna.

Activity Status as of March 31, 2015

Vegetation sampling plots

Establishment by MBS of permanent vegetation plots continues and MBS staff have taken leadership on the promotion of a Department-wide effort. For example, permanent plots will be established in 2015 at Rushford Sand Barrens and Whitewater WMA.

Monitoring of management activities

Monitoring of outcomes of conservation grazing will continue in 2015 with work focused in Caribou WMA in northwestern Minnesota and Hole-in-the-Mountain WMA in southwestern Minnesota.

As related to management of critical habitats in southeastern Minnesota, plans include continuation of annual monitoring of fernleaf false foxglove (*Aureolaria pedicularia*) at Whitewater WMA. In addition, monitoring plots at Perched Valley WMA are planned in advance of prescribed burns. Male fern (*Dryopteris filix-mas*) was identified as a new state record location during monitoring efforts in southeastern Minnesota in 2014.

Sensitive prairie plant species

Small white lady's slipper: In the Prairie Parkland Province, monitoring is being planned for continuation in 2015 for populations of small white lady's-slipper (*Cypripedium candidum*). In 2014, two levels of sampling intensity were tested in 2014.

Level I monitoring continued to be successful and with the added assistance from volunteers, many sites were visited across the species' range in 2014. This included Pembina Wildlife Management Area, which is also considered high conservation value under Forest Certification. The plan for 2015 is to continue to inventory sites with the assistance of volunteers. Some sites have not been revisited in decades so updated records of

population locations, size, and viability will benefit from better mapping tools and provide information that is more useful to managers.

For Level 2 monitoring there was field testing of several different sampling techniques, but following consultations with a biometrician this level of monitoring will be discontinued due to the expense.

Western prairie fringed orchid: A portion of MBS staff have contributed to the monitoring of this Federally protected species. This project also informs the outcomes of the implementation of the Minnesota Prairie Conservation plan.

The Executive Summary of the 2014 report, *Platanthera praeclara* Recovery Activities (Western Prairie Fringed Orchid) as Minnesota Federal Aid Section 6 Project E-15-R-1 F13AP00927, follows:

“All level I, II, and III monitoring was carried out during peak anthesis in 2014. There were no Level I monitoring updates during the project period (p. 5). Level II, census of flowering plants, occurred across the range by DNR Staff, volunteers and various other agencies (pp. 6-7, 27). During the project period, two of our volunteers augmented Minnesota counts by counting plants at Hayden Prairie, Iowa, but this work was not funded by grant E-15-R-1. Demographic monitoring (Level III) occurred at Blue Mounds State Park, Burnham Wildlife Management Area (WMA), Crookston Prairie State Natural Area (SNA), and Lake Bronson SNA. The Goose Lake State Trust land was searched but no plants were observed in the area of the monitoring plots (pp. 7-10, 23-26). Numbers of both flowering and vegetative plants in monitored plots were down in 2014.

Phenological research was carried out by volunteer Jeanne Prekker at Blue Mounds State Park in southwestern Minnesota, and by a combination of DNR staff, volunteers, and contractors at Pembina Trail Preserve and Burnham WMA in northwestern Minnesota. Data collected on the emergence, growth, and seed capsule development were captured by repeat visits to the same plants through the growing season (pp. 10-13, 26-28). Because hail damaged the majority of plants at Pembina Trail, we conducted post anthesis phenology at Burnham WMA.

We installed and retrieved on-site soil and air temperature data from Maxim iButtons installed at three sites. The more detailed information gained from these tools will be used to look at microclimate differences between sites that may not be gleaned from general regional weather stations (pp. 12, 29-30).

There were no additional site surveys requested during the project period. It was discovered late in the field season that a change in ownership occurred with one private population in Polk County. Effort will be made in future years to obtain permission to survey and update the population information of this site.

During the project period, we funded genetic analyses conducted by Dr. Steven Travers at North Dakota State University (pp. 13-14, Appendix 1), made spring collections of roots for fungal analyses, and assisted Dr. Jyotsna Sharma with her summer and fall mycorrhizal sampling (p. 14).

We published an article, *Phenological Monitoring Aids Management of Threatened Plant*, in the Natural Areas Journal. This research was based largely on data collected by citizen scientists in southwestern Minnesota (Appendix 2). The July meeting of the international Native Orchid Conference at Itasca State Park provided us with an opportunity to present updated information on *P. praeclara* life history and research. In conjunction with this meeting, we hosted several days of field trips and established follow up monitoring to document potential impacts of heavy visitation (p. 14-15)”.

Final Report Summary

Activity 2 Final Summary

Proposed Outcome (see also attached map)	Proposed Completion Dates	Final Report Summary
1. Identify permanent vegetation sampling plots	January 2014	Completed.
2. Sample selected permanent	2013 (10); 14 (20)	Completed.

vegetation plots		Established >35 plots.
3. Sample up to 5 prairie sites to assess specific management activities	Continue	Continued.
4. Monitoring of sensitive prairie plant species	Continue	Continued.
5. Sample selected sites related to sustainable forest management	Continue	Continued.

Vegetation sampling plots

MBS plant ecologists provided leadership to a Department effort during the project period to better coordinate, expand and improve ecological monitoring within the Department. MBS led discussions on a proposed project (that would build upon existing MBS monitoring efforts) to establish permanent vegetation plots representing native plant communities/ecological land types ranging from high to low quality in condition that would include contributions from all DNR resource Divisions. The intent was to coordinate data collection at these locations to include methods/metrics important for assessing vegetation and wildlife habitats. Examples of existing DNR efforts that could be combined at these sites include vegetation relevés/transects, breeding bird point counts, browse indexes, forest inventory, High Conservation Value Forest Monitoring, Forest Age-Class Monitoring, Wetland Assessment and Monitoring, Grassland Monitoring, and Aquatic Plant Monitoring. Also included is the design and development of a department-wide information management system to collect, store and deliver monitoring data and establish associated data standards. The project has been well-received in the Department and by external partners and included, in part, in two current DNR LCCMR ML2016 funding proposals.

MBS permanent plot establishment continued in anticipation of implementation of a DNR coordinated effort. In the northern patterned peatlands, helicopter access in 2014 provided for the establishment of new permanent vegetation (relevé) plots. MBS resampled older permanent plots established by University of Minnesota peatland researchers in the 1980s. A total of 35 relevé plots now are permanently marked across this large landscape. MBS also established vegetation sampling plots in a remote lowland conifer system in a peatland area of Lake of the Woods County in conjunction with a University of Minnesota fire study.

Prairie management activities

MBS continued to establish vegetation monitoring plots and assess results as part of a prairie management patch-burn-graze project in collaboration with DNR Wildlife. Project sites were located at Lac Qui Parle Wildlife Management Area (WMA) Chippewa Prairie, Caribou WMA, and Hole in the Mountain WMA. At least 40 pairs of plots were established and sampled that span a range of upland prairie quality and experience one of three management practices (burn, graze, grow). 35 prairie wetland basins, snakes, and moths were also sampled as part of this effort.

A progress report entitled *Plant Community Monitoring at the Lac Qui Parle WMA/Chippewa Prairie Patch-Burn-Graze Project* was prepared that presents results from two years of vegetation monitoring of 25 pairs of permanent upland vegetation plots at the Lac Qui Parle/Chippewa Prairie Patch-Burn-Graze project. Two years are not enough time to assess management impacts on systems composed primarily of long-lived, perennial plants and all vegetation sampling results must be seen as preliminary. This project is partially funded by the MBS ENRTF. For full report see:

http://files.dnr.state.mn.us/eco/mcbs/chippewa_prairie_pbg_veg_monitoring_14jan2014.pdf

MBS contributed to Prairie Conservation Plan implementation in regards to an identified need for additional mapping of “core areas”. The purpose was to assess connectivity and recovery potential of some of the vegetation found within the core areas. This included field surveys, collection of relevés, and mapping of native plant communities in the Glacial Lakes, Lake Christina, and part of the Agassiz Beach Ridges core areas. Mapping included a broad array of native plant community types (included some forests, for example) and inclusion of

some lower quality grasslands than those mapped by MBS in the 1980s. About 11,000 acres of native plant communities were added to the statewide native plant community GIS data layer as a result of this effort.

MBS prairie monitoring capacity is slated to benefit from MBS native plant community data delivered as part of a Joint Powers Agreement between MN DNR and South Dakota State University. One deliverable to MBS is a spatial interpretation of MBS prairie polygons against Farm Service Agency historical cropping records. This type of information presented in this format will greatly assist MBS interpretations of past, present and future prairie conditions.

Sensitive prairie plant species

In the Prairie Parkland Province, MBS continued monitoring small white lady's-slipper (*Cypripedium candidum*) and western prairie fringed orchid (*Platanthera praeclara*).

A 2013 progress report for small white lady's-slipper monitoring is available:

http://files.dnr.state.mn.us/eco/mcbs/2013_cypripedium_candidum_report.pdf

In 2014, Small white lady's slipper monitoring explored two levels of monitoring: a Level 1 approach with many sites sampled with lesser intensity versus a Level 2 approach with fewer sites sampled more intensively. Level 1 was determined to strike a better balance between feasibility and data integrity than Level 2 did. The Level 2 approach was of interest for more rigorous monitoring efforts than current budgets allow and needs demand.

Small white lady's-slipper has a relatively short blooming period in late May and early June and occupies a large geographic area ranging from the southern to northern borders of western Minnesota. To accomplish this work, MBS relied on assistance from others. Staff from the U.S. Fish & Wildlife Service and DNR regional plant ecologists assisted with some of the sampling but much of the work was performed by several teams of volunteers led by MBS botanists. During the project period, more than 400 volunteer-hours assisted with surveys and data recording during the peak bloom across 52 sites, some of which had not been revisited in decades. Updated records of population locations, size, and viability benefited from modern field survey tools and methods that add precision and improve data utility.

A large population of small white lady's-slipper within a high quality wet-mesic prairie remnant in Stearns County was chosen as a control site for new groundwater monitoring wells at Prairie Storm Waterfowl Production Area. MBS botanists advised hydrologists on the placement of new groundwater monitoring wells.

Western prairie fringed orchid has been specifically identified as an indicator in the Minnesota Prairie Conservation Plan and funding from the ENRTF enabled MBS to expand upon federally funded work. Added realms of assessment are discussed in a 2014 report, *Platanthera praeclara* Recovery Activities (Western Prairie Fringed Orchid) as Minnesota Federal Aid Section 6 Project E-15-R-1 F13AP00927, and include the potential relationship of mycorrhizal fungi to population viability, potential genetic variation across the north south geographic gradient that is well-expressed within the state (Blue Mounds State Park to Pembina Trail Preserve in northwestern MN), and additional field survey of sites not otherwise funded. This additional sampling will help inform potential adaptation of the species to changing conditions and habitat management. MBS monitoring of western prairie fringed orchid involved volunteers and coordination with various land management partners to accomplish monitoring efforts across a large geographic area within a short period of time.

MBS botanists coauthored a Natural Areas Journal article that centers on western prairie fringed orchid:

Lori A. Biederman, Judith Beckman, Jeanne Prekker, Derek Anderson, Nancy P. Sather, Rolf Dahle. 2014. Phenological monitoring aids habitat management of threatened plant. Natural Areas Journal 34:105-110.

MBS botanists presented updated information on *P. praeclara* life history and research and co-hosted several days of related field trips at a meeting of the international Native Orchid Conference at Itasca State Park. Monitoring data collection was part of the field trips with a focus on assessing heavy visitor use.

Sustainable forest management

In response to Forest Certification monitoring needs, MBS staff coordinated with DNR regional plant ecologists to continue rare plant monitoring and population assessments at several forested MBS sites in southeastern Minnesota. MBS sites surveyed included Shattuck Creek, Diamond Creek, South Fork Whitewater, Whitewater Savannas, South Fork Root River, Partridge Creek, Coolridge Creek, and Perched Valley Wildlife Management Area.

Existing MBS field survey data for southeast MN is often at least 20 years old and based on field survey and data management methods that lacked the precision and detail available with modern GPS and GIS technologies. This project has focused on resurvey of known rare species locations and executing focused field survey within a defined area using modern technologies. This more detailed assessment is providing new and more precise information.

For example, in addition to improving documentation of existing rare species locations, MBS botanists documented new populations of eastern green-violet (*Hybanthus concolor*), Carey's sedge (*Carex careyana*), James' sedge (*Carex jamesii*), spreading sedge (*C. laxiculmis*), needle beaksedge (*Rhynchospora capillacea*), great Indian plantain (*Arnoglossum reniforme*), upland boneset (*Eupatorium sessilifolium*), smooth-sheathed sedge (*Carex laevivaginata*), Jame's sedge (*Carex jamesii*), American ginseng (*Panax quinquefolius*), beaked snakeroot (*Sanicula trifoliata*), stemless tick trefoil (*Desmodium nudiflorum*), yellow pimpernel (*Taenidia integerrima*), snow trillium (*Trillium nivale*), smooth rock cress (*Arabis laevigata*), goldenseal (*Hydrastis canadensis*), reniform sullivantia (*Sullivantia sullivantii*), false mermaid (*Floerkea proserpinacoides*), glade mallow (*Napaea dioica*), fernleaf false foxglove (*Aureolaria pedicularia*), silvery spleenwort (*Deparia acrostichoides*), and narrow-leaved spleenwort (*Diplazium pycnocarpon*). Male fern (*Dryopteris filix-mas*) was identified as a new state record location during monitoring efforts in southeastern Minnesota. New locations for the invasive plant species, garlic mustard, were also documented.

In addition, new and improved data on fameflower (*Talinum rugospermum*), among the highest priority monitoring targets, was collected as was data on Sullivant's coolwort (*Sullivantia renifolia*) populations affected by major flooding (June 2013).

Activity 3: Information System Expansion

Description:

MBS will provide data and specimens to museums and information systems. This results in long-term storage of collections and databases for analysis and distribution of information to individuals, organizations, and agencies with diverse natural resource goals.

Procedure: Data collected by MBS are entered into manual and computerized files in the DNR's information systems. Key databases include those tracking locations of plants and animals, rare features, relevés (vegetation plot samples), aquatic plant lists/lakes, MBS sites, native plant community polygons (GIS), and animal aggregations. Locations of native plant communities and MBS sites are mapped using ArcGIS and procedures are in progress to provide for updates to these shape files. Shape files of native plant communities and MBS sites are available on the DNR's Data Deli, accessible through the website.

Targeted species locations are entered into an Observation Database that is connected to Biotics, an information system developed by NatureServe, an international organization with a major focus on the storage, distribution, and interpretation of biodiversity data. Photographic vouchers, imagery, and other digital media are stored at

the DNR, St. Paul. Field data sheets or data collected on field data recorders are filed electronically (scanned) and/or manually.

Data generated by monitoring activities are entered into the databases listed above or in related databases that provide for analysis. For example, the Observation Database can be modified to store the results of repeated visits to populations of small white lady’s slipper where more detailed population information is collected such as number of plants per area, number in bloom or fruit, etc. These data are linked to an updated map of the spatial extent of the population in the prairie/wetland site using GIS. Monitoring data collected for animals might include timed searches, point counts, and plot counts, which are also stored in the Observation Database.

Monitoring data will be provided to be linked to management databases currently in use or being developed in the DNR (Divisions of Fish and Wildlife, Forestry, Ecological and Water Resources and Parks and Trails). In addition, data will be accessible to other partners in prairie/grassland and forest management who maintain adaptive management databases associated with specific managed areas.

Information System Development: The collection and management of data continues to improve through the use of GIS, global positioning systems, tools/products accessible on the web, and field data recorders. MBS participates in the DNR’s efforts to maintain data standards and quality of data, to integrate databases, and to improve information delivery on the web. Data delivery using the web requires heightened attention to data standards, data security, metadata, and other documentation.

MBS also coordinates with other state and national information system developments. For example, recent collaboration with the Bell Museum on developments related to collections management and information access is anticipated to continue, with specific attention to the rapidly changing taxonomy of flora and fauna. Long-term monitoring of species and habitats is especially influenced by the need to “crosswalk” new and old names of species, which is critical to reliable analysis, interpretation and communication of results. An installation of NatureServe’s Biotics (Biotics 5) that was delayed during 2012 will be completed.

Preparation of Collections: All plant and animal specimens are identified and collections are prepared for permanent storage and deposited in appropriate repositories at the University of Minnesota’s J.F. Bell Museum of Natural History and at the Science Museum of Minnesota.

Summary Budget Information for Activity 3:

ENRTF Budget: \$ 870,000
Amount Spent: \$ 865,957
Balance: \$ 4,043

Activity Completion Date:

**Overall budget estimate based on past MBS projects*

Outcome	Completion Dates	Budget*
1. Survey data entered and managed in DNR’s information systems	Continue	
2. Preparation & delivery of plant & animal collections to museums	Continue	
3. Monitoring data entered and analyzed (DNR Info Systems)	Continue	
4. Programming to improve long-term data storage, analytical tools, & data transfer	Continue	

Activity Status as of January 31, 2014

Since July 2013 new records of 134 rare features were added to the Rare Features Database. Since 1987, MBS has added a total of 20,152 new rare feature records statewide. Rare aquatic plants and vegetation in 39 lakes were surveyed since July, 2013. Since 1987, botanists have documented 1,232 rare aquatic plants during targeted surveys of 1,911 lakes in 44 counties. The aquatic botanist has also reported a total of 220 non-native aquatic species locations encountered during surveys. Since 1987, MBS has contributed 5,056 of the 9,580

vegetation plot records in the DNR's Relevé (vegetation plot) Database. Statewide 10,192 MBS sites of Biodiversity Significance and 63,232 polygons of native plant communities are now publically available on the DNR's Data Deli.

MBS delivered 2790 plant collections (museum specimens) to the Bell Museum of Natural History herbarium.

MBS biologists are coordinating with museums to ensure that existing collections of species added to the new state list of Endangered Threatened and Special Concern species (list was effective in August 2013) are included in the Rare Features Database of DNR's Natural Heritage Information System. This effort began with review of plant collections by botanists at various herbaria in the state and exchange of electronic data. The process has been slow due largely to database exchange issues but cooperation has been very forthcoming from the several key institutions such as the University of Minnesota Duluth and the University of Minnesota in Minneapolis/St Paul (The Bell Museum of Natural History-the primary repository of MBS collections) and also from smaller collections such as those at St Cloud State University, St John's University and the Science Museum of Minnesota.

As related to documentation of species collections, biologists consult with other experts in specific taxon to whom they send specimens to ensure that identification is accurate and the conservation issues are properly addressed. A few examples of plants: 1) Hudson Bay eyebright (*Euphrasia hudsoniana* var. *ramosior*): Collections are currently being determined by Galina Gusarova, the author of this group for the Flora of North America (FNA). This is part of a collaboration to document and interpret Minnesota's *Euphrasia* taxa and evaluate potential conservation concerns regarding Hudson Bay eyebright (e.g. hybridization). 2) New England violet (*Viola novae-angliae*): Leaf samples were provided for genetic analysis to Harvey Ballard, Associate Professor of Plant Systematics and Evolution to assist in his ongoing research and to further the understanding of *Viola* species diversity and phylogeny. 3) *Gymnocarpium* (a group of ferns) diversity in Minnesota: Kathleen Pryer (FNA authority for *Gymnocarpium* and professor at Duke University) also uses leaf tissue to determine chloroplast and nuclear sequences. The results are used for verifying species identification and furthering understanding of species origins and interspecific/intraspecific relationships. Duke's morphological determinations have verified the occurrence of northern oak fern (*Gymnocarpium robertianum*) at Lake Vermillion State Park. 4) Aquatic plants: In response to a request for information on watermilfoils (*Myriophyllum*) species, collections by MBS in Minnesota were sent to Robin Scribailo, Purdue University, who is completing final edits on his treatment of the family Haloragaceae for Flora of North America. Aquatic vegetation data collected in July and August using an I-pad Mini data recorder were loaded into the MBS Lakes Database for all lakes surveyed in St. Louis and Lake Counties as well as those surveyed in Isanti, Sherburne and Anoka Counties as part of a coordinated effort in the Rum River Watershed Project.

Monitoring data from the work related to high conservation value forests in Southeastern Minnesota, the small white lady's-slipper monitoring project and the prairie vegetation sampling plots related to the patch-burn grazing project in western MN have been entered into DNR databases. Vegetation data collected for the patch-burn project were successfully entered in the field using a data tablet to expedite data transfer to an Access Database that was used for analyses. See the patch-burn monitoring report for results of preliminary analysis. Results of DNA testing and mycorrhizal associations related to Western Prairie Fringed orchid are forthcoming.

MBS continues to work towards better integration of electronic data related to collections both locally and internationally that is challenging given the profusion of various databases and confounding issues related to validation of identification, taxonomic changes, data security and adherence to state policy and procedures related to the release of locational information on rare species

Work continues on the application of a state list of plants that now includes bryophytes (mosses and liverworts) that includes tools to deal with taxonomic re-classification (such as synonymy) that influence collection of vegetation plot data and monitoring activities that extend over a long period of time.

A review of existing DNR online image libraries began with the intent to more effectively store images. Consultation is underway with DNR media experts, including members of the Communications and Outreach Committee, to determine image storage protocol and recommendations. MBS staff need to be assigned to help improve management of the image library, to understand the status of the collection and to identify needs for improvement of the DNRs databases.

Continued adjustment to MN.IT as a new agency has created additional delay and expense in programming of products and has required more time investment by MBS staff in information system development.

A specific product detailed below is a highlight of a positive outcome of the new relationship to MN.IT

DNR wide native plant community polygon enterprise database

Several divisions within the MN DNR currently map native plant communities (NPC's) in a GIS using the DNR's native plant community classification version 2.0 and have created separate databases to store these NPC polygons and their division specific attributes along with other non-NPC spatial features specific to each division. A unified Department-wide spatial database containing a consensus set of native plant community polygons with consistent data standards and attributes was determined to be desirable for rapid and accurate statewide application of the state's native plant community resources by internal and external users.

The intent of the project:

- To create a unified, department-wide spatial database of native plant community polygons, classified in native plant community classification version 2.0, with coverage mostly limited to state owned lands, to assist with analysis, planning, and management of the state's resources.
- A unified, department-wide spatial database of native plant community polygons provides:
 - Statewide consistency in delivery of NPC polygons to customers.
 - Simplified coordination and efficiency across divisions in conducting field efforts and data creation.
 - A NPC mapping standard needed for the DNR-wide master contract
 - Data to assist with the creation of geographically specific keys
 - A means to fill in spatial data gaps
 - Information to improve the SFRMP process
 - Information for legally required products
 - Improved map creation using the Data Deli

Audience:

- The users of this database ultimately will include a variety of internal and external projects and stakeholders:
 - State, Federal, County, Municipal and Tribal planners and land managers
 - Public and private conservation, recreation and restoration project planners and managers
 - Development project managers with Environmental Review requirements
 - Researchers and educators within and outside of the DNR
 - Contractors, environmental consultants

A MBS plant ecologist is the project manager for the above project that was beta tested in Grand Rapids beginning in the fall of 2013 eventually followed by a series of six training session for users between November and December 2013 such that it is now operational for four DNR divisions. A specific outcome for MBS is that plant ecologists can more readily enter spatial data and provide updated, standardized GIS layers of native plant community data.

Activity Status as of October 31, 2014

Since July 2013, 956 new rare features records were added to the Rare Features Database. Since 1987, MBS has added a total of 21,108 new rare feature records statewide. Rare aquatic plants and vegetation in 39 lakes were surveyed since July, 2013. Since 1987, botanists have documented 1,232 rare aquatic plants during targeted

surveys of 1,911 lakes in 44 counties. The aquatic botanist has also reported a total of 220 non-native aquatic species locations encountered during surveys. Since 1987, MBS has contributed 5,157 of the 9,681 vegetation plot records in the DNR's Relevé (vegetation plot) Database. Statewide 10,570 MBS sites of Biodiversity Significance and 78,248 polygons of native plant communities are now publically available on the DNR's Data Deli.

The relevé database was upgraded from a very old platform to a newer one. In addition, moss and liverwort species have been added to the list of plants used for the database through a connection to MNTaxa (see below). Recently the relevé locations and site information have become available throughout the DNR to ArcGIS users who have permission to access the Natural Heritage Information System. Since some of the relevé samples contain rare plant species, there continues to be the issue of how to effectively release these data more widely. Data have been provided to numerous outside users upon request. For example the Natural Resources Research Institute used the data for assessment of boreal bird habitat in the Agassiz Lowlands Subsection, the Natural Resources Conservation Service used relevés to develop Ecological Site descriptions for Minnesota, and the Superior National Forest worked with MBS to secure vegetation samples at northern long-eared bat monitoring sites.

The plant database known as MNTaxa also has been updated with lichen species, additional bryophytes and with information on rarity status based on the new Minnesota list of rare plant species. Staff continue to coordinate with University of Minnesota Bell museum staff to learn and understand their SPECIFY data system that tracks physical museum collections. This coordination is moving slowly due to other obligations of knowledgeable university staff. DNR staff is working with a volunteer programmer who is also a botanist to assist with the project.

MBS biologists continued to visit herbaria to ensure that existing collections of species added to the new state list of Endangered, Threatened, and Special Concern species (the new list was effective in August 2013) are included in the Rare Features Database of the DNR's Natural Heritage Information System. As one example, in the spring of 2014 MBS botanists reviewed collections at the University of MN Duluth herbarium to verify locations of some of the newly listed species.

Monitoring data from the work related to high conservation value forests in southeastern Minnesota, the small white lady's-slipper monitoring project, and the prairie vegetation sampling plots related to the patch-burn grazing project in western Minnesota continue to be entered into DNR databases.

DNR wide native plant community polygon enterprise database

Several divisions within the MN DNR now have staff mapping native plant communities in a GIS using the department wide enterprise database. Training sessions for users were held in the spring of 2014, and for many users the system is a great improvement over previous mapping approaches. Future maintenance agreements are in progress but very likely this data system will require at least some of an ecologist's time to provide oversight on maintenance and upgrades of the system.

Status as of March 31, 2015

Since July 2013, 1,154 new rare features records were added to the Rare Features Database. Since 1987, MBS has added a total of 21,306 new rare feature records statewide. Since 1987, MBS has contributed 5,298 of the 10,534 vegetation plot records in the DNR's Relevé (vegetation plot) Database. Statewide 10,734 MBS sites of Biodiversity Significance and 78,766 polygons of native plant communities are now publically available on the Minnesota Geospatial Commons (previously housed in the DNR Data Deli).

In 2014, MBS delivered 2,197 plant collections (museum specimens) to the Bell Museum of Natural History herbarium.

A review of the Minnesota plant collections at the Bell Museum indicate that botanists from MBS are responsible for about 40% of the estimated 66,300 Minnesota plants collected between 1985 and 2013. (In addition, Welby Smith contributed 28,855 specimens as the botanist with the former Natural Heritage Program).

The database storing names and distribution data on Minnesota plants (known as MNTaxa) continues to be updated for bryophytes (mosses and liverworts) due in part to the work of a contractor who is verifying the identification of some museum specimens and new MBS collections. A test of a related product that effectively creates standard labels from MNTaxa for MBS herbarium collections is now under review. Coordination with the University of Minnesota Bell museum staff has resulted in a more efficient process for regular electronic data exchanges.

In January, MBS botanists met with herbarium staff at the University of MN Duluth to review some of northern Minnesota’s highlighted plant species.

A Floristic Quality Index is being developed for prairie plant species in response to clients in the prairie region of the state.

The DNR statewide native plant community polygon enterprise database continues to evolve and was selected by the Department as a pilot Data Governance project. Several divisions within the MN DNR now have staff mapping native plant communities in GIS using the department-wide database.

<https://gisdata.mn.gov/group/biota>

The DNR Relevé (vegetation sampling sites) ArcMap layer located in DNR’s Quick Layers is being updated weekly, providing surveyors with the best current information on relevé locations.

Monitoring data from the work related to high conservation value forests in southeastern Minnesota, the small white lady’s-slipper monitoring project, and the prairie vegetation sampling plots related to the patch-burn grazing project in western Minnesota continue to be entered into DNR databases.

Final Report Summary

Activity 3 Final Completion Summary

Proposed Outcome	Proposed Completion Dates	Final Report Summary
1. Survey data entered and managed in DNR’s information systems	Continue	Continued
2. Preparation & delivery of plant & animal collections to museums	Continue	Continued
3. Monitoring data entered and analyzed (DNR Info Systems)	Continue	Continued
4. Programming to improve long-term data storage, analytical tools, & data transfer	Continue	Continued

MBS Data Contributions Summary

Data	# of MBS records added since July, 2013	# of MBS records added since 1987
Rare features	1,326	21,478
Lake plant surveys	72	1,983
Rare aquatic plants	>39	1,245
Relevé (vegetation plot)	439	5,392

Native Plant Community GIS polygons	TBD	83,913
Sites of Biodiversity Significance GIS polygons	TBD	10,734
Invasive aquatic plants	TBD	220
Plant specimens deposited at the Bell Museum	>2,790	>28,000

MBS sites of biodiversity significance and native plant communities are publically available on the Minnesota Geospatial Commons.

A review of the Minnesota plant collections at the Bell Museum indicate that MBS botanists are responsible for about 40% of the estimated 66,300 Minnesota plants collected between 1985 and 2013. (In addition, Welby Smith contributed 28,855 specimens as the botanist with the former Natural Heritage Program).

MBS biologists coordinated with museums to ensure that existing collections of species added to the new state list of Endangered Threatened and Special Concern species (effective August 2013) are included in the Rare Features Database of DNR's Natural Heritage Information System. This effort began with review of plant collections by MBS botanists at various herbaria in the state and exchange of electronic data. The process has been slow due largely to database exchange issues but cooperation has been very forthcoming from the several key institutions such as the University of Minnesota Duluth and the University of Minnesota in Minneapolis/St Paul (The Bell Museum of Natural History-the primary repository of MBS collections) and also from smaller collections such as those at St Cloud State University, St John's University and the Science Museum of Minnesota.

As related to documentation of species collections, biologists consult with other experts in specific taxa to whom they send specimens to ensure that identification is accurate and the conservation issues are properly addressed. A few examples of plants:

- 1) Hudson Bay eyebright (*Euphrasia hudsoniana* var. *ramosior*): all MBS 2013 Hudson Bay eyebright (*Euphrasia hudsoniana* var. *ramosior*) have been determined, annotated, and returned to MBS by Flora of North America (FNA) *Euphrasia* author, Galina Gusarova (Oslo Herbarium). This is part of a collaboration to document and interpret Minnesota's *Euphrasia* taxa and evaluate potential conservation concerns regarding hybridization within this genus. MBS specimens were reviewed just in time for Gusarova's final *Euphrasia* treatment for FNA.
- 2) New England violet (*Viola novae-angliae*): Leaf samples were provided for genetic analysis to Harvey Ballard, Associate Professor of Plant Systematics and Evolution at Ohio University, to assist in his ongoing research and to further the understanding of *Viola* species diversity and phylogeny.
- 3) *Gymnocarpium* (a group of ferns) diversity in Minnesota: Kathleen Pryer (FNA authority for *Gymnocarpium* and professor at Duke University) also uses leaf tissue to determine chloroplast and nuclear sequences. The results are used for verifying species identification and furthering understanding of species origins and interspecific/intraspecific relationships. Duke's morphological determinations have verified the occurrence of northern oak fern (*Gymnocarpium robertianum*) at Lake Vermillion State Park.
- 4) Aquatic plants: In response to a request for information on watermilfoils (*Myriophyllum*) species, collections by MBS in Minnesota were sent to Robin Scribailo, Purdue University, who is completing final edits on his treatment of the family Haloragaceae for Flora of North America.

MBS continued to work towards better integration of electronic data related to collections both locally and internationally that is challenging given the profusion of various databases and confounding issues related to validation of identification, taxonomic changes, data security and adherence to state policy and procedures related to the release of locational information on rare species.

MBS continued to coordinate with University of Minnesota Bell museum staff to learn and understand their SPECIFY data system that tracks physical museum collections. The purpose is to achieve improved streamlining between Bell Museum databases and related MBS databases such as MNTAXA.

MBS participated in a review of existing DNR online image libraries with the intent to more effectively store and retrieve images. Consultation continued with DNR media experts, including members of the Communications and Outreach Committee, to determine image storage protocol and recommendations.

MBS field data from the work reported in Activities 1 and 2 have been entered into DNR databases. MBS continued to expand data collection via tablets to expedite data transfer for permanent ascension to DNR databases.

DNR wide native plant community polygon enterprise database

The DNR statewide native plant community polygon enterprise database was used extensively during the project period and continued to improve. MBS provided project management and data standards leadership to a project team who successfully completed its obligations to the Data Governance project (see March 31st update). This added value to the project by creating a Governance Framework that documented the roles and responsibilities needed to keep the database a viable and successful authoritative DNR data asset. MBS was in routine collaboration with MN DNR Divisions who now have staff mapping native plant communities using the department-wide database. A specific outcome for MBS is that plant ecologists can more readily enter spatial data and provide updated, standardized GIS layers of native plant community data.

<https://gisdata.mn.gov/group/biota>

MBS mapping of native plant communities and sites of biodiversity significance continued with particular progress in Itasca, St. Louis, Cass, Beltrami and Lake of the Woods counties. During this reporting period, collaboration among MBS plant ecologists and Chippewa National Forest soil scientists continues for MBS mapping in Cass and Itasca counties. This effort has been fruitful in developing improved cohesion and efficiencies between the two parties' mapping systems.

Work continued with updates and improvements to the state plant list and database, MN TAXA, that now includes bryophytes (mosses and liverworts) and advancements that address taxonomic re-classification (such as synonymy) that influence vegetation plot and monitoring data collection that extends over long periods of time. Related is the development of a database designed for creating plant specimen herbarium labels. The database creates herbarium labels, stores individual plant records in a standardized format for future database crosswalking, and creates a rare species template for Biotics (i.e. the rare species database) submission. The integration of MN TAXA and a herbarium label database greatly improves the efficiency and accuracy of MBS plant specimen processing, herbarium submissions, and communication of botanical information.

The relevé database was upgraded from a very old platform to a newer one. Relevé locations and site information became available throughout the DNR to ArcGIS users who have permission to access not-public data in the Natural Heritage Information System. Data have been provided to numerous outside users upon request:

- Natural Resources Research Institute used releve data for assessment of boreal bird habitat in the Agassiz Lowlands Subsection;
- Natural Resources Conservation Service used relevés to develop Ecological Site descriptions for Minnesota;
- NatureServe for driftless area mapping projects;
- EPA for terrestrial monitoring in the Lake Superior basin;
- Superior National Forest for northern long-eared bat monitoring.

Activity 4: Guidance for Conservation and Management

Description:

MBS will provide interpretation of results through products and technical assistance to guide conservation and management of ecological systems, rare resources, and sites of biodiversity significance.

This activity includes website development; book publications; participation in conservation and management planning and implementation efforts; delivery of information to agencies, landowners and tribal organizations; updates to policy changes such as the state list of endangered and threatened species; and monitoring of management activities. (See also dissemination section).

As part of the State’s Watershed Plan Framework, decision support systems (DSS) are being utilized to assess ecological data in combination with social and economic data to achieve realistic conservation goals within a specific watershed. The use of this tool will be explored to integrate MBS data within a selected project area and to identify high quality reference lakes to inform both conservation and monitoring activities.

Summary Budget Information for Activity 4:

ENRTF Budget: \$ 580,000
Amount Spent: \$ 574,542
Balance: \$ 5,458

Activity Completion Date:

**Overall budget estimate based on past MBS projects*

Outcome	Completion Dates	Budget*
1. DNR’s website provides updated and accurate survey & monitoring procedures, results and tools (Examples given at right--not an exhaustive list)	Improved data portals for:-Vegetation plot data (2013), MBS site data (2014). Add GIS data for at least two counties to the Data Deli (2014). Contribute to DNR native plant community integration project (2015) Contribute biodiversity data to DNR lake websites for up to 200 lakes. Update Rare Species Guide for up to 50 species by 2015 pending revision of the state list of endangered and threatened plants.	
2. Ecological Evaluations (EE) are reports describing attributes of sites of biodiversity significance to guide conservation, management & monitoring	Write 5 EEs (Winter 2013) Write 10 EEs (Winter 2014)	
3. Prairie & forest monitoring preliminary results delivered	See outcomes for Activity 2	
4. Technical assistance: e.g. Forest Service planning, restoration of native plant communities, peatland conservation etc.	Throughout project period	
5. Aspen Parkland-Red River Valley guide book	Manuscript delivered by June 2014	
6. Two projects related to the State’s Watershed Plan Framework will utilize a DSS to inform watershed plan implementation and identification of reference lakes.	June 2015	

Activity Status as of January 31, 2014

Improved data portals for Vegetation plot data/ Contribute to DNR native plant community integration project: See description of the DNR wide native plant community polygon enterprise database project highlighted in activity # 3.

Contribute biodiversity data to DNR lake websites The aquatic botanist contributed data on vegetation and rare plants in 39 lakes and is currently working with programmers to prepare handicapped accessible MBS lake reports for all lakes surveyed to be added to DNR's application Lakefinder. This will make the data from the 2013 field season available in a timely manner and in an easily accessible format on the DNR website.

<http://www.dnr.state.mn.us/lakefind/index.html>

A DNR project began in January 2014 to review a number resources related to the identification of lakes of high biodiversity significance. Data from MBS related to nongame fish and vegetation are being utilized as part of this process.

Update Rare Species Guide A botanist began preparing content for all of the plants listed as special concern in the new state list (August 2013) of endangered, threatened and special concern species.

Technical Assistance examples

Northern staff shared information about 2013 survey efforts and old growth stands adjacent to a St Louis County "special site" in the Lost Lake Peatlands area. This included a field day with a county forester and others to the site known as the Polemonium Bog where the county manages a population of the very rare western Jacob's-ladder (*Polemonium occidentale* subsp. *lacustre*). They also coordinated another field day with a researcher from the University of Wisconsin who is studying this species in its Wisconsin and Minnesota range.

A plant ecologist/botanist with past research experience with the rare species of beachgrass, American beachgrass (*Ammophila breviligulata*), provided advice on the population and its Lake Superior dune ecosystem/native plant communities to others in the DNR and the City of Duluth that included a site visit to help them identify distinguishing traits of local and nonlocal beachgrass genotypes.

Other ecologists assisted with rare plant surveys along proposed reroute of Border Route Trail and worked with DNR Parks and Trails staff to assess a MBS site of high biodiversity significance which will contain a portion of the Virginia OHV Expansion Project. An ecologist provided field observations related to the proposed Zippel Bay remote beach campsites to the regional DNR Parks Natural Resource manager and Park Manager.

Prior to surveys in northeastern MN, an ecologist organized a field day with several private landowners who own land within a preliminary survey site in order to communicate information about the survey and to provided technical guidance regarding native plant communities and species on their properties.

The Superior National Forest received information on new SNF locations of the endangered species, floating marsh marigold (*Caltha natans*), which may be impacted by pending management activities. Ecologists consulted with Red Lake Wildlife management area staff on upcoming timber sales on land recently surveyed by MBS.

Staff assisted with the SFI/FSC Forest Certification external audit field site visit that was focused in northern Minnesota in the fall of 2013.

Northern staff participated in conservation planning related to priorities for Scientific and Natural Areas, the Trust for Public Land/Superior National Forest and assessment of the relative value of Potlatch parcels being offered for sale. Other staff conferred with the Wolf Ridge Environmental Learning Center about the significance of a site with "high" biodiversity value and others about a proposed Elephant Lake Wildlife Management Area. Staff continue to work with the Superior National Forest regarding invasive species

management at Fish Fry Lake (an important MBS site). Another ecologist compiled a list of plant species recorded in the Sax-Sim IBA during MBS thus far and provided this to the Friends of the Sax-Zim Bog.

MBS took part in the Aldo & Leonardo: A Wilderness Science and Art Collaboration project that featured the BWCAW. <http://aldoandleonardo.blogspot.com/>. Collaborators included the Superior National Forest, the Aldo Leopold Wilderness Research Center, Colorado Art Ranch (Katherine Ball-artist) and the Wolf Ridge Environmental Learning Center.

MBS ecologists continue their participation in the implementation of the Prairie Conservation Plan and continue to work with the partners to assure that native prairie is maintained in good condition. This included coordination with DNR wildlife managers on three WMAs where management monitoring sites are being established. A DNR procedure for writing grazing plans includes consultation with EWR prairie ecologists to identify management practices that consider vulnerability of sensitive and rare features on prairies.

Presentations and publications

The Ecological Society of America annual meeting was held in Minneapolis in August 2013. MBS staff helped organize and lead a field trip to Minnesota's Ordway Prairie Preserve. Other staff organized a morning long session related to vegetation classifications: *The development of regional plot-based vegetation classifications: How classifications based on large sets of plot data further our understanding of vegetation ecology and conservation*. Several Minnesota presentations were a part of this session.

Staff presented monitoring work being conducted by MBS at Chippewa Prairie/Lac Qui Parle WMA as a featured field trip at a September 25-26 Patch-burn grazing meeting sponsored by the Prairie Coteau Habitat partnership.

The 2013 Federal Endangered Species State Midwest Regional meeting was held in Minneapolis in December providing an opportunity for staff to discuss status and monitoring of rare species shared with other Midwestern states. MBS staff presented monitoring and survey outcomes related to western prairie fringed orchid (*Platanthera praeclara*), small white lady's slipper (*Cypripedium candidum*), bats and prairie Lepidoptera. One example was *Responses of the threatened Platanthera praeclara to environmental triggers and damage*.

MBS continues to update field events using News from the Field
<http://www.dnr.state.mn.us/eco/mcbs/news2013.html>

The November-December 2013 issue of the Minnesota Conservation Volunteer (volume 76, number 451) featured an article, *Life in the Landscape* that included essays by MBS field biologists and ecologists.

A Minnesota Biological Survey Update-25 years of bird surveys was a presentation at the December 2013 annual meeting of the Minnesota Ornithologists' Union.

Work continues on the natural history guide book *Minnesota's Red River Valley and Aspen Parkland*.

Activity Status as of October 31, 2014

A summary of some applications of MBS data in 2014:

- Review of State School Trust Lands
- Superior National Forest Projects - plan implementation
- DNR Strategic Land Asset Management (SLAM) - sales and exchanges and making more strategic acquisitions
- Scientific and Natural Area Plan
- Minnesota Prairie Conservation Plan

- Great Lakes Biodiversity Plan
- Forest Certification and High Conservation Value Forests (External Audit in Fall 2014)
- State Forest Resource Planning
- State Wildlife Action Plan revision
- Climate change planning
- Review of Wildlife Management Area grazing plans
- Restoration guidelines and Best Management Practices for pollinators
- Assistance with the future direction of the Center for Plant Conservation (U of M Arboretum)
- Review of St. Louis County “special site” designation

Some specific activities:

MBS sites and native plant community polygons were added to the DNR Data Deli for three counties (this includes a map layer of native plant communities totaling 577,105 acres).

Improved data portals for Vegetation plot data/Contribute to DNR native plant community integration

project: The relevé database was converted from an old Dataflex database to one that is now accessible to DNR users. In addition the species lists now include updated information on bryophytes (mosses and liverworts). The DNR wide native plant community polygon enterprise database highlighted in Activity #3 is adding new mapped data to the Data Deli that can be accessed on the DNR web.

MBS site database

A new, more comprehensive, MBS “site report” can now be generated by DNR staff. In the past, reports for MBS Sites of Biodiversity Significance were generated solely from information entered in the MBS Site database. Currently site reports contain many additional pieces of information, gained from other datasets that intersect MBS Sites. When a user is viewing an MBS Site of Biodiversity Significance, they can “click” on an embedded hyperlink or a site polygon to view the following data:

- Description of the site (from the MBS site database)
- Vegetation plot data (from the relevé database)
- MBS aquatic plant data (from the MBS lakes and aquatic plant database)
- High conservation value forest (HCVF) data
- Rare feature, source feature and observation data (Biotics database - includes locations of rare features)
- Ecological Evaluations related to the site polygon
- Native plant community polygons (from NPC database).

Due to the sensitive nature of some data, this tool is available only to DNR staff with access to “Quick Layers” in ArcGIS. However some of the same GIS spatial data are available to all users on the DNR Data Deli (some examples below).

Contribute biodiversity data to DNR lake websites

The aquatic botanist prepared a handicapped accessible report from all 1,911 lakes surveyed by MBS from 1995-2013 and submitted them for posting on DNR’s Lakefinder. All MBS lake survey reports are currently posted on the DNR website and these are updated at the completion of each field season.

<http://www.dnr.state.mn.us/lakefind/index.html>

A DNR project began in January 2014 to review a number of resources related to the identification of lakes of biological significance. Data from MBS related to nongame fishes, birds, amphibians and vegetation are being utilized as part of this process. Draft criteria have been developed by an interdisciplinary team so that selected lakes are placed into one of three classes: Outstanding, High, and Moderate. This classification is similar to MBS’s Sites of Biodiversity Significance model with current draft criteria more highly influenced by the available data for the lake and by other recreational values (game species in particular). A draft list of 1,260 lakes includes

623 ranked Outstanding, 324 High, and 313 Moderate. The draft list has lakes distributed across the state and it includes a wide range of lake sizes from ponds to Lake Superior.

Update of Rare Species Guide

A botanist continued preparing content for all of the plants listed as special concern in the new state list (August 2013) of endangered, threatened and special concern species. Drafts of all the newly listed endangered and threatened plant species were completed. The newly listed special concern species are the next group to be written.

Technical Assistance examples

An ecologist coordinated a field day with a St. Louis County forester to visit a high-quality upland site in the Lost Lake Peatlands. The county received a summary of data collected over 2013-14 and analyses that were conducted for potential rare native plant communities. A MBS ecologist provided additional guidance related to landscape context and state/regional significance of features observed. There was a discussion of expansion of the St. Louis "Special Site" designation to include all of the upland old-growth forest.

The Superior National Forest requested MBS Sites of Statewide Biodiversity Significance data to inform a forest implementation plan (Stony Project Area). This area includes 14 MBS sites that are (all or partly) within the project area. Forest Service staff have access to *An Evaluation of the Ecological Significance of the Ninemile Lakes and Ridges Area*, which covers the two MBS Outstanding Sites in the Area. The report is available online at http://www.dnr.state.mn.us/eco/mcbs/evaluations/212_lb/ninmile.html. Other staff commented on the Mesabi Project Area.

Boundary Waters Canoe Area Wilderness staff requested assistance with a Superior National Forest Wilderness Character Mapping process for the Area. Based on their experience in the area, several provided recommendations for measures and data sources (including use of preliminary MBS data) associated with several indicators of wilderness character, such as plant and animal species and communities and biophysical processes.

At Hemlock Ravine SNA, MBS staff were asked to evaluate the quality of adjacent private land for a potential addition to the preserve. Staff provided advice on two other potential northeastern Minnesota SNAs (Littlefork River, Pike River).

An ecologist assisted with orientation of a graduate student studying hemlock (*Tsuga canadensis*) genetics of the two populations in Duluth.

MBS reviewed the issues document for the Lake County Soil and Water Conservation District (SWCD) Water Management Plan 2015-2025 and submitted comments to DNR Regional Environmental Review for delivery to the county office.

Staff provided consultation on potential effects of proposed expansion of the Wolf Ridge Environmental Learning Center farm complex on native plant communities and wildlife.

As related to groundwater a MBS ecologist assisted DNR regional staff with review of the calcareous fen at Anna Gronseth preserve in Wilkin County, which is threatened by groundwater pumping for center pivot irrigation. In southwestern Minnesota, information was provided to the USFWS related to a proposed conservation easement in the Chanarambie Creek Valley due to its potential for a location of a calcareous fen.

Dinner Creek was recommended in Becker County as a natural area and the MBS plant ecologist who surveyed the area discussed issues related to access and timber harvest on DNR Forestry-administered Trust Fund land at the site.

Plant ecologists provided advice to the SNA program on jack pine management at the new Badoura Jack Pine Woodland SNA, a site that had been recommended for acquisition by MBS.

Staff assisted with the SFI/FSC Forest Certification external audit in the fall of 2014.

MBS ecologists continue their participation in the implementation of the Prairie Conservation Plan. For example, as part of the implementation of the DNR's Wildlife Management Areas Grazing Operational Plan 2014, a MBS prairie plant ecologist reviewed and commented on drafts of WMA grazing plans for Hole in the Mountain WMA (Lincoln County), SEM WMA (Marshall County), and Pomroy Pastures WMA (Kanebec County).

A prairie plant ecologist helped to organize and train over 150 agency and organization staff in the identification of prairie plant species through a series of 4 field training sessions held in western Minnesota during the summer of 2014.

Staff provided technical assistance to Wisconsin Natural Heritage Program staff on criteria for biodiversity significance and MBS procedures.

Presentations and publications

The North American association of amateur and professional orchid enthusiasts held a national meeting at Itasca State Park. A MBS botanist made a presentation and helped organize a visit to populations of the federally protected plant, Western prairie fringed orchid. They ensured that the orchid populations were not harmed during field trips that were enjoyed by over 80 people.

The Minnesota Landscape Arboretum recently became a Midwest center for the national Center for Plant Conservation. The national meeting was held in the spring in Minnesota and MBS staff delivered talks, presented posters and helped to lead a Minnesota dwarf trout lily field trip to populations in Faribault and Nerstrand Big Woods State Park.

MBS has conducted rare aquatic plant searches in nearly 2,000 of Minnesota's lakes over the last 20 years. In the course of these surveys several new species have been added to Minnesota's flora: the purple flowered bladderwort (*Utricularia purpurea*), the Beautiful pondweed (*Potamogeton pulcher*), Oakes' pondweed (*Potamogeton oakesianus*) and Robbin's spikerush (*Eleocharis robbinsii*). In the course of these aquatic plant surveys, over 60,000 aquatic and emergent plant species locations have been recorded. These records have been useful in research projects and improving knowledge of global distribution. For example, a Finnish researcher, Janne Alahuhta, studies the wide-scale distribution patterns of aquatic macrophytes at regional and global scales. MBS data were requested to be used as part of a global data set to study how lentic macrophyte species richness changes along latitudinal gradients. Data from Finland, Sweden, Poland, Hungary, Italy, Denmark, Germany, Spain, Brazil, Argentina, Uruguay, Canada and the United States (Minnesota, Florida, Wisconsin, and Illinois) are so far included in the study. MBS data were paired with water chemistry data for the lakes for the study.

MBS plant ecologists and botanists assisted with the development of the DNR's Pollinator Best Management Practices and Habitat Restoration Guidelines. Plant ecologists and entomologists used the native vegetation classification to provide more specific guidelines for use managers to achieve the desired outcomes on state managed lands. To view an online booklet that includes prairie plants with pollinator values see http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet_single.pdf

MBS staff contributed to a publication related to western prairie fringed orchid:
Biederman, L. A., J. Beckman, J. Prekker, D. Anderson, N. P. Sather, R. Dahle. 2014. Phenological Monitoring Aids Habitat Management of Threatened Plant. *Natural Areas Journal* 34(1):105-110.

Work continues on the natural history guide book *Minnesota's Red River Valley and Aspen Parkland*.

Activity Status as of March 31, 2015

Reports, Maps, Presentations and publications

MBS staff continue to provide updates and reports to the public in DNR's *Minnesota Conservation Volunteer* publication. The following link displays MBS contributions since 1988:

http://www.dnr.state.mn.us/eco/mcbs/mcbs_pubs.html

A featured DNR reading of a *Minnesota Conservation Volunteer* article by a MBS plant ecologist is available on YouTube: <https://www.youtube.com/watch?v=mCbnoeEH97M&feature=youtu.be>

MBS continues to record and document new native species to Minnesota's flora and fauna:

<http://files.dnr.state.mn.us/eco/mcbs/staterecords.pdf>

Documents were created from MBS data to assist with development of Pollinator Guidelines:

http://www.dnr.state.mn.us/pollinator_resources/index.html

http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf

Phytocoenologia is a journal dedicated to publishing papers on vegetation surveys. MBS has been requested to submit a paper describing how vegetation plot data were used in the development of Minnesota's current native plant community classification.

Work continues on the natural history guide book *Minnesota's Red River Valley and Aspen Parkland*. The University of Minnesota Press has agreed to an extension on the project. The site guide section layout was recently reviewed by MBS staff and the University of Minnesota Press. An example site (Pembina WMA) was presented to discuss formatting, map size and font. Another topic was the design of charts and graphs.

Update of Rare Species Guide

A botanist continues to prepare content for the Update of DNR's Rare Species Guide with a current focus on the plants newly listed as special concern in the new state list of endangered, threatened and special concern species (August 2013). A project manager for the Rare Species Guide update is proposed to be hired by the DNR in the spring to incorporate these descriptions in an updated system.

Watershed Planning

A project to identify Lakes of Biological Significance has completed a list and map of a first version based on available data from a variety of sources that include MBS data. Criteria were developed by an interdisciplinary team so that selected lakes are placed into one of three classes: Outstanding, High, and Moderate. These lists are currently being used to guide watershed and other landscape planning efforts including the update of the State Wildlife Action Plan.

Technical Assistance examples

The 2014 prairie plant identification classes were so well received that staff are preparing for three sessions in the summer of 2015. These will address the most commonly requested training needs: basic plant identification and prairie management.

A prairie plant ecologist reviewed and commented on drafts of WMA grazing plans for Hole in the Mountain WMA (Lincoln County), Sem WMA (Marshall County), and Pomroy Pastures WMA (Kanebec County).

Following a 2009 Major Corrective Action Request (Forest Certification) related to Representative Sample Areas (RSA) the Department had set both short-term and long-term goals for RSAs. MBS has been asked to provide information on native plant communities to assist with meeting both short-term and long-term goals.

Staff contributed information and comment on a Park Rapids sandplain area that was undergoing an EAW. Much of the information contributed by MBS related to the Jack Pine Woodlands in the area.

Staff commented on the DNR’s draft Lowland Conifer Old Growth complexes for the portion of northern Minnesota where MBS has recently conducted surveys.

In response to implementation of project management in the Superior National Forest, staff provided MBS data and ecological interpretations for MBS Sites related to the Stony Project Area and the Barker Project Area during the “Scoping” (info gathering) phase for these project areas. The Forest Service has a copy of the report: *An Evaluation of the Ecological Significance of the Ninemile Lakes and Ridges Area*, which covers the two MBS Outstanding Sites (38-103 and 38_104) in the Stony Project Area. The report is available online at: http://www.dnr.state.mn.us/eco/mcbs/evaluations/212_lb/ninmile.html. Additional MBS information available within the Stony Project Area includes relevé vegetation plot data, rare species data, and a GIS cover of the MBS Native Plant Community mapping (Outstanding and High sites). Some features characterizing the area include the ecological integrity (quality) of lowland white cedar forests, white cedar swamps, cliff and talus complexes, rich fens, hydrologic processes and physical properties of lakes and streams, habitat for known locations of rare species, and the predominance of minimal forest fragmentation.

The Red Lake Peatlands is currently under consideration for recommendation as an international Ramsar site, a designation designed to recognize important wetland areas throughout the world.

Staff provided information to assist with development of the Lake Superior Biodiversity Conservation Strategy. The Lake Superior Binational Program and LAMP partners developed the draft Strategy in 2014, and are currently developing 20 corresponding regional plans. Together, these documents will provide a common framework for implementing actions all around Lake Superior to meet a goal of protecting and restoring Lake Superior’s habitat and species.

Staff assisted with a reroute of the Border Route Trail in eastern Cook County to protect the rare resources of a Natural Area Registry site. The work is planned to be done by the Border Route Trail Club.

Final Report Summary

Final Activity Summary

Proposed Outcome	Proposed Completion Dates	Final Activity Summary
1. DNR’s website provides updated and accurate survey & monitoring procedures, results and tools (Examples given at right--not an exhaustive list)	Improved data portals for:-Vegetation plot data (2013), MBS site data (2014).	Completed
	Add GIS data for at least two counties to the Data Deli (2014).	Completed
	Contribute to DNR native plant community integration project (2015)	Completed
	Contribute biodiversity data to DNR lake websites for up to 200 lakes.	Completed
	Update Rare Species Guide for up to 50 species by 2015 pending revision of the state list of endangered and threatened plants.	Completed

2. Ecological Evaluations (EE) are reports describing attributes of sites of biodiversity significance to guide conservation, management & monitoring	Write 5 EEs (Winter 2013) Write 10 EEs (Winter 2014)	Incomplete
3. Prairie & forest monitoring preliminary results delivered	See outcomes for Activity 2	Completed
4. Technical assistance: e.g. Forest Service planning, restoration of native plant communities, peatland conservation etc.	Throughout project period	Continued
5. Aspen Parkland-Red River Valley guide book	Manuscript delivered by June 2014	Extension granted by MN Press
6. Two projects related to the State's Watershed Plan Framework will utilize a DSS to inform watershed plan implementation and identification of reference lakes.	June 2015	Completed

Improved data portals for vegetation plot and site data/ Contribute to DNR native plant community

integration project: See also description of the DNR wide native plant community polygon enterprise database project highlighted in activity # 3. The relevé database was converted from an old Dataflex database to one that is now accessible to DNR users. The species lists (MNTAXA) now include updated information on bryophytes (mosses and liverworts). The DNR native plant community polygon enterprise database highlighted in Activity #3 is adding new mapped data to the Geospatial Commons and DNR QuickLayers.

MBS sites and native plant community polygons were added to the Geospatial Commons and DNR QuickLayers for three counties totaling 577,105 acres.

MBS site database

A new, more comprehensive and accessible, MBS “site report” can now be generated by DNR staff. In the past, reports for MBS Sites of Biodiversity Significance were generated solely from information entered in the MBS Site database and delivered upon request. New and improved site reports contain many additional pieces of information gained from other datasets that intersect MBS Sites. The MBS Sites of Biodiversity Significance GIS layer now contains a hotlink to a MBS site report:

- Description of the site (from the MBS site database)
- Vegetation plot data (from the relevé database)
- MBS aquatic plant data (from the MBS lakes and aquatic plant database)
- High conservation value forest (HCVF) data
- Rare feature, source feature and observation data (Biotics database)
- Ecological Evaluations related to the site polygon
- Native plant community polygons (from NPC database).

Lakes, watersheds, aquatic plants

MBS has conducted rare aquatic plant searches in nearly 2,000 of Minnesota’s lakes over the last 20 years. In the course of these surveys several new species have been added to Minnesota’s flora (see October 31, 2014 Activity Status) and over 60,000 aquatic and emergent plant species locations have been recorded. These records have been useful in lake plans, conservation, research projects, and improving knowledge of global distribution.

The MBS aquatic botanist prepared a handicapped accessible report from all 1,911 lakes surveyed by MBS from 1995-2013 and submitted them for posting on DNR’s Lakefinder. All MBS lake survey reports are currently posted on the DNR website and these are updated at the completion of each field season:

<http://www.dnr.state.mn.us/lakefind/index.html>. Loading of 20 years' worth of MBS MN lake and aquatic plant images to the DNR Image Gallery was completed.

MBS contributed to a DNR project to identify lakes of biological significance. Data from MBS related to nongame fishes, birds, amphibians and vegetation are being utilized as part of this process. Criteria have been developed by an interdisciplinary team so that selected lakes are placed into one of three classes: Outstanding, High, and Moderate. This classification is similar to MBS's Sites of Biodiversity Significance model with current draft criteria more highly influenced by the available data for the lake and by other recreational values (game species in particular). A list of 1,260 lakes includes 623 ranked Outstanding, 324 High, and 313 Moderate. The list has lakes distributed across the state and it includes a wide range of lake sizes from ponds to Lake Superior. These lists are currently being used to guide watershed and other landscape planning efforts (e.g. State Wildlife Action Plan).

MBS contributed lake plant data to a Finnish researcher, Janne Alahuhta, who studies the wide-scale distribution patterns of aquatic macrophytes at regional and global scales. MBS data were requested to be used as part of a global data set to study how lentic macrophyte species richness changes along latitudinal gradients. Data from Finland, Sweden, Poland, Hungary, Italy, Denmark, Germany, Spain, Brazil, Argentina, Uruguay, Canada and the United States (Minnesota, Florida, Wisconsin, and Illinois) have been reviewed in the study. MBS data were paired with water chemistry data for the lakes for the study.

MBS plant ecologist/botanist provided technical input on MBS sites of biodiversity significance, native plant communities and rare/unique flora to the Crow River Watershed planning effort.

MBS assisted DNR regional staff with review of the calcareous fen at Anna Gronseth preserve in Wilkin County, which is threatened by groundwater pumping for center pivot irrigation.

In southwestern Minnesota, information was provided to the USFWS related to a proposed conservation easement in the Chanarambie Creek Valley due to its potential for a location of a calcareous fen.

MBS reviewed the issues document for the Lake County Soil and Water Conservation District (SWCD) Water Management Plan 2015-2025 and submitted comments to DNR Regional Environmental Review for delivery to the county office.

A summary of some MBS data applications during the project period:

- Review of State School Trust Lands
- Superior National Forest
 - Forest plan implementation: Stony Project Area, Mesabi Project Area
 - BWCAW: wilderness character mapping project
- DNR Strategic Land Asset Management (SLAM) - sales and exchanges and making more strategic acquisitions
- Scientific and Natural Area Plan, potential acquisition reviews, site management
- Minnesota Prairie Conservation Plan
- DNR pollinator products and outreach
- Lake Superior Biodiversity Conservation Strategy
- Forest Certification: High Conservation Value Forests, Representative Sample Areas
- State Forest Resource Planning
- State Wildlife Action Plan revision
- Climate change planning
- Review of Wildlife Management Area grazing plans
- Restoration guidelines and Best Management Practices for pollinators

- Assistance with the future direction of the Center for Plant Conservation (U of M Arboretum)
- Technical input to St. Louis County “special site” designation
- Wisconsin Natural Heritage Program – review of MBS biodiversity ranking procedures

Technical Assistance

MBS shared information with St. Louis County about survey efforts, rare species, and old growth forest stands. MBS provided data and technical guidance on St. Louis County’s “Special Site” designation and site selection process.

MBS led a field day with a St. Louis County forester and botanists from the MN Landscape Arboretum to the site known as the Polemonium Bog where the county manages a population of the very rare western Jacob's-ladder (*Polemonium occidentale* subsp. *lacustre*). They also coordinated another *Polemonium* field day with a researcher from the University of Wisconsin who is studying this species in its Wisconsin and Minnesota range.

A MBS plant ecologist/botanist with past research experience with the rare species of beachgrass, American beachgrass (*Ammophila breviligulata*), provided advice on the population and its Lake Superior dune ecosystem/native plant communities to others in the DNR and the City of Duluth that included a site visit to help them identify distinguishing traits of local and nonlocal beachgrass genotypes.

MBS assisted with rare plant surveys along proposed reroute of Border Route Trail and worked with DNR Parks and Trails staff to assess a MBS site of high biodiversity significance which will contain a portion of the Virginia OHV Expansion Project. An ecologist provided field observations related to the proposed Zippel Bay remote beach campsites to the regional DNR Parks Natural Resource manager and Park Manager.

Prior to surveys in northeastern MN, a MBS ecologist organized a field day with several private landowners who own land within a preliminary survey site in order to communicate information about the survey and to provide technical guidance regarding native plant communities and species on their properties.

MBS provided Superior National Forest with information on new SNF locations of the endangered species, floating marsh marigold (*Caltha natans*), which may be impacted by pending management activities. MBS continued to work with the SNF regarding invasive species management at Fish Fry Lake (an important MBS site).

MBS ecologists consulted with Red Lake Wildlife management area staff on upcoming timber sales on land recently surveyed by MBS.

MBS contributed information and comment on a Park Rapids sandplain area that was undergoing an EAW. Much of the information contributed by MBS related to the rare Jack Pine Woodlands native plant communities in the area.

Staff commented on the DNR’s draft Lowland Conifer Old Growth complexes for the portion of northern Minnesota where MBS has recently conducted surveys.

MBS assisted with the SFI/FSC Forest Certification external audit field site visits when site visits intersected MBS sites of biodiversity significance or other MBS-originated data.

MBS participated in conservation planning related to priorities for Scientific and Natural Areas, the Trust for Public Land/Superior National Forest, and Potlatch parcels being offered for sale.

MBS conferred with the Wolf Ridge Environmental Learning Center about the value of a site with high biodiversity significance relative to site and facility planning and development.

MBS compiled a list of plant species recorded in the Sax-Sim IBA and provided this to the Friends of the Sax-Zim Bog.

MBS ecologists continue their participation in the implementation of the Prairie Conservation Plan and continue to work with the partners to assure that native prairie is maintained in good condition. This included coordination with DNR wildlife managers on three WMAs where management monitoring sites are being established. A DNR procedure for writing grazing plans includes consultation with EWR prairie ecologists to identify management practices that consider vulnerability of sensitive and rare features on prairies.

The MBS photo archive is routinely called upon for photos of individual species, plant communities and landscapes for publications, reports, and online information delivery. One example is the inclusion of MBS plant photos in a new forest plant ID companion to the DNR *Field Guide to Native Plant Communities* developed by the DNR Ecological Classification System Program.

MBS coordinated with Scientific & Natural Area program staff. Examples include reviewing content to be publicly displayed on SNA kiosks and maps; reviewing content and design of an SNA site guide for tablets, iPads, e-books; technical input to a potential addition to the Rushford Sand Barrens SNA; technical guidance on Badoura Woodlands SNA forest management; technical input to TNC lands adjacent to the Brainerd Arboretum that SNA is discussing.

MBS participates as subject matter experts in various DNR forest coordination teams and processes. Examples include DNR's continuing work on Forest Certification High Conservation Value Forests and site-level technical guidance. Examples include:

- MBS field survey experience input regarding a ram's head orchid (*Cypripedium arietinum*) location relative to forest management in the vicinity.
- MBS technical input to the inter-agency MFRC Manitou Forest Collaborative. During this reporting period this involved discussions with DNR Area forestry and wildlife, TNC, and Superior National Forest regarding land management in a portion of the Ninemile Lakes and Ridges MBS Site of Outstanding Biodiversity Significance. MBS plant ecologist lead a field component that included ranking a forest for its level of earthworm impact and a survey of an old-growth wet cedar forest that resulted in the discovery of a large patch of Lapland buttercup (*Ranunculus lapponicus*) in full anthesis.
- Active coordination among MBS and Forestry, F&W, and Parks & Trails on field survey and mapping of native plant communities.

MBS peatland ecologists are providing analysis (underway) of bryophyte species data as part of a review of indicator species values used to designate calcareous fens.

Presentations and publications

Work continued on the natural history guide book *Minnesota's Red River Valley and Aspen Parkland*. The University of Minnesota Press has agreed to an extension on the project. Progress has been made during this reporting period on prototype maps and illustrations, site profiles, photograph collection and selection, and main document text editing. Video is also being collected as part of this project for potential web or e-book components.

The Ecological Society of America annual meeting was held in Minneapolis in August 2013. MBS staff helped organize and lead a field trip to Minnesota's Ordway Prairie Preserve. Other staff organized a morning long session related to vegetation classifications: *The development of regional plot-based vegetation classifications: How classifications based on large sets of plot data further our understanding of vegetation ecology and conservation*. Several Minnesota presentations were a part of this session.

Staff presented monitoring work being conducted by MBS at Chippewa Prairie/Lac Qui Parle WMA as a featured field trip at a patch-burn grazing meeting sponsored by the Prairie Coteau Habitat partnership.

The 2013 Federal Endangered Species State Midwest Regional meeting was held in Minneapolis providing an opportunity for MBS staff to discuss status and monitoring of rare species shared with other Midwestern states. MBS staff presented monitoring and survey outcomes related to western prairie fringed orchid (*Platanthera praeclara*), small white lady's slipper (*Cypripedium candidum*), bats and prairie Lepidoptera. One example was *Responses of the threatened Platanthera praeclara to environmental triggers and damage*.

MBS continued to update field events using News from the Field website:

2013: <http://www.dnr.state.mn.us/eco/mcbs/news2013.html>

2014: <http://www.dnr.state.mn.us/eco/mcbs/news2014.html>

2015: <http://www.dnr.state.mn.us/eco/mcbs/news2015.html>

MBS staff continue to provide updates and reports to the public in DNR's *Minnesota Conservation Volunteer* publication. The following link displays MBS contributions since 1988:

http://www.dnr.state.mn.us/eco/mcbs/mcbs_pubs.html

- The November-December 2013 issue (volume 76, number 451) featured an article, *Life in the Landscape* that included essays by MBS field biologists and ecologists.
- A featured DNR reading of a *Minnesota Conservation Volunteer* article by a MBS plant ecologist is available on YouTube: <https://www.youtube.com/watch?v=mCbnoeEH97M&feature=youtu.be>

MBS continues to record and document new native species to Minnesota's flora and fauna:

<http://files.dnr.state.mn.us/eco/mcbs/staterecords.pdf>

Documents were created from MBS data to assist with development of Pollinator Guidelines:

http://www.dnr.state.mn.us/pollinator_resources/index.html

http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf

A Minnesota Biological Survey Update-25 years of bird surveys was a presentation at the December 2013 annual meeting of the Minnesota Ornithologists' Union.

MBS staff coauthored a publication related to western prairie fringed orchid:

Biederman, L. A., J. Beckman, J. Prekker, D. Anderson, N. P. Sather, R. Dahle. 2014. Phenological Monitoring Aids Habitat Management of Threatened Plant. *Natural Areas Journal* 34(1):105-110.

Outreach Examples

MBS launched a new and improved web portal for American ginseng (*Panax quinquefolius*).

MBS provided additions and corrections to the Grassland Bees, Pollinator, and Pollinator Resources DNR websites. This included finalizing content for 75 native plant community classes for which MBS has gathered pollinator data.

MBS plant ecologists and botanists assisted with the development of the DNR's Pollinator Best Management Practices and Habitat Restoration Guidelines. Plant ecologists and entomologists used the native vegetation classification to provide more specific guidelines for use managers to achieve the desired outcomes on state managed lands. To view an online booklet that includes prairie plants with pollinator values see

http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet_single.pdf

MBS collaborated with a private contractor on the development and production of booklets on common Minnesota prairie grasses and common sedges of the Agassiz Beach Ridges region. MBS also produced booklet

versions (excerpted from the *Trees & Shrubs of Minnesota*) for the willow genus (*Salix*). Booklets were provided to attendees at MBS-led prairie plant ID and native plant community field workshops.

MBS created illustrations differentiating Mudpuppy from Easter Tiger Salamander for use in a DNR news release.

MBS aquatic plant species lists for about 2,000 MN lakes continue to be added and made available to the public via DNR's online Lakefinder.

MBS aquatic botanist routinely provides technical guidance on aquatic plant and native plant community ID to DNR fisheries biologists, lake associations, and the public (e.g. responses to DNR public information help line).

Update on Rare Species Guide

At the end of this project period, a project manager for the Rare Species Guide update was hired by the DNR. The initial MBS focus of this project will develop species accounts for newly listed species. A MBS botanist began preparing (for newly listed species) and reviewing (for existing listed species) DNR Rare Species Guide content for all of the plants listed as endangered, threatened and special concern species.

Native Plant Community Condition Ranking Guidelines

MBS launched and leads a revision to DNR's 1990s-era NPC Condition Ranking Guidelines to bring them up-to-date in content and form consistent with DNR's *Field Guides to Native Plant Communities*. These guidelines facilitate an ecological integrity ranking for individual NPC occurrences using a report-card scoring system (e.g. A quality = highest ecological integrity, D quality = lacking ecological integrity).

Field Workshops

A MBS prairie ecologist collaborated with the Laverne Chamber of Commerce to lead a public field tour for to rock outcrop pools at Blue Mounds State Park and Touch the Sky National Wildlife Refuge. A MBS herpetologist also helped lead the tour, as Blue Mounds has a species of snake, the Lined snake, which occurs nowhere else in Minnesota. MBS was interviewed by a local radio station two days in advance of the tour. About 45 people were in attendance.

MBS lead or co-lead six prairie field workshops in collaboration with DNR regional plant ecologists and assistance from U of MN graduate students, a private ecological consultant, and DNR volunteers. Agendas focused on plant ID and native plant community classification. The target audience was natural resource professionals. Workshops filled to capacity (often with significant waitlists) for a total of 210 participants. Attendee affiliations included NRCS, SWCD, USFWS, DNR various divisions, BWSR, MN Dept. of Agriculture, MN State-Moorhead, University of North Dakota, Dakota County, Pheasants Forever, MN Land Trust, Ducks Unlimited, private consultants, and SNA volunteer Site Stewards. Field workshops occurred at various locations:

- June 17, 2014: Hole in the Mountain, Lincoln County
- June 19, 2014: Chanarambie Creek area, Murray County
- July 8, 2014 : Glacial Ridge-Ordway Prairie, Pope County
- July 10, 2014: Tympanuchus WMA, Polk County
- June 17-19, 2015: Prairie Marshes WMA and private land sites in SW Minnesota near Marshall
- June 23-25, 2015: Bicentennial Prairie and private land sites, Clay County.

MBS co-lead three forest plant and native plant community ID field workshops in collaboration with DNR regional plant ecologists and DNR Forestry regional Ecological Classification System specialists. Agendas focused on plant ID, native plant community classification, soils, and forest management applications. The target audience was natural resource professionals. Workshops filled to capacity (often with waitlists) for a total of 90 participants. Attendee affiliations included various County land departments, USFS, NRCS, SWCD, Tribal natural

resource departments, University of Minnesota Duluth, DNR various divisions, DNR SNA volunteer Site Stewards, Master Naturalists. Field workshops occurred in northeast MN:

- June 9-10, 2015: Audubon Center of the Northwoods near Sandstone,
- June 16, 2015: Blackhoof WMA near Carlton,
- June 18, 2015: Superior National Forest near Lutsen.
- The knowledge and expertise of MBS botanists in these workshops was a point of recognition by participants at all three workshops.

The North American association of amateur and professional orchid enthusiasts held a national meeting at Itasca State Park. A MBS botanist made a presentation and helped organize a visit to populations of the federally protected plant, Western prairie fringed orchid. They ensured that the orchid populations were not harmed during field trips that were enjoyed by over 80 people.

The Minnesota Landscape Arboretum recently became a Midwest center for the national Center for Plant Conservation. A national meeting was held in Minnesota and MBS staff delivered talks, presented posters and helped to lead a Minnesota dwarf trout lily field trip to populations in Faribault and Nerstrand Big Woods State Park.

Ecological Evaluations

MBS did not submit final ecological evaluation reports during the project period due, in part, to a decision to prioritize native plant community and site mapping that is often the basis for writing these reports. Several early draft ecological evaluations were developed during the project period.

V. DISSEMINATION:

Description:

MBS data are stored primarily in the Division of Ecological and Water Resources information systems, which are increasingly linked to other databases in the MN DNR. In addition, MBS procedures, updates, recent maps, and links to related data are presented on the DNR website. Many GIS datasets are delivered to clients through the web. MBS regularly provides vegetation plot data from the relevé database to researchers at academic institutions, other agencies and organizations. Non-public data on rare species are available through agreements with the requesting agency and the DNR. For data on locations or rare features, a data request form is available via the web: <http://www.dnr.state.mn.us/eco/nhnrp/nhis.html>

MBS publishes and distributes survey results in a variety of formats for various audiences. Many products are available on the DNR website, including GIS shape files of native plant communities and MBS sites, native plant community field guides, and guides to sampling techniques such as vegetation plot data collection using the relevé method. MBS web pages are updated with new information and have links to associated resources. <http://www.dnr.state.mn.us/eco/mcbs/index.html>

The DNR and Legislative libraries and other local information repositories (such as libraries within counties) have access to published products, including books, maps, reports, field guides and digital media. MBS has published several books and field guides and the publication of a natural history book based on MBS data collected in the northwestern prairie region and Red River Valley is underway. Based on local collaborator interest and the results of regional focus groups, this book will include a guide to selected natural areas of the region. A Minnesota publisher has agreed to publish this book.

Staff routinely make presentations that describe MBS methodologies and results to a wide range of audiences including county boards, local planning groups, citizen advisory groups, other biologists, land managers, and students. MBS staff provide local planners with ecological interpretations describing important sites of biodiversity identified during the Survey to assist with management plans. Staff lead or participate in technical

workshops and field trips to exchange ideas on survey methodology and provide training in the application and interpretation of the data.

Physical collections are deposited at Minnesota repositories, primarily at the University of Minnesota's J.F. Bell Museum of Natural History and at the Science Museum of Minnesota, St. Paul. As part of a larger network of museums and herbaria, these cooperators are essential to the documentation and sharing of MBS results. MBS and museum staff meet periodically to address curatorial, data management, and interpretive needs.

MBS also delivers data through an international organization, NatureServe and also shares data with cooperators at colleges and universities and with others in ecological regions where surveys are ongoing or completed. *See activity #4.*

Status as of January 31, 2014

Status as of October 31, 2014

Status as of March 31, 2015

Final Report Summary

MBS data are stored primarily in the Division of Ecological and Water Resources information systems, which are increasingly linked to other databases in the MN DNR. In addition, MBS procedures, updates, recent maps, and links to related data are presented on the DNR website. Many GIS datasets are delivered to clients through the web. MBS regularly provides vegetation plot data from the relevé database to researchers at academic institutions, other agencies and organizations. Data on rare species are available through agreements with the requesting agency and the DNR. For data on locations or rare features, a data request form is available via the web: <http://www.dnr.state.mn.us/eco/nhnrp/nhis.html>

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VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget:

Budget Category	\$ Amount	Explanation
Personnel:	\$ 2,117,530	Biologists, Ecologists for surveys, monitoring, technical assistance and interpretation, Information Managers and Officers
Professional/Technical/Service Contracts:	\$ 162,000	Survey and monitoring will require contractual agreements following standard DNR procedures for contract processing for activities such as vegetation sampling. It also includes service level agreements for application development and some other information management system support needs following procedures required by MNIT.
Direct and necessary services*	\$ 219,699	DNR costs for the appropriation
Equipment/Tools/Supplies:	\$ 7,771	Field equipment/supplies. Equipment is used from previous survey periods when at all possible (For example-GPS units, canoes, cameras, communication equipment etc.) Electronic field data recorders are improving and will potentially reduce data entry time. Costs are between \$500 and \$1500 per unit. In additions, items such as batteries, collecting materials, paddles, and aerial photography need to be replaced or updated.
Travel Expenses in MN:	\$ 143,000	This is largely related to field survey and monitoring. Travel expenses are subject to State of Minnesota labor agreements and DNR policy. Most travel expense is related to the 4-5 months of time when staff are conducting field work that requires food, transport in seasonal DNR fleet vehicles and lodging (The preferred and least expensive options are locally rented "field houses" or camping and the most expensive are motels). The current work in the large peatlands of north-central MN requires some helicopter transport. In contrast, canoe transport in the Border lakes region requires a vehicle to transport the canoe to an entry point, then up to 10 days of canoeing/camping in order to conduct surveys.
TOTAL ENRTF BUDGET:	\$2,650,000	

*Direct and Necessary expenses include both Department Support Services (Human Resources, IT, Financial Management, Communications, Procurement and Facilities) and Division Support Services. Department Support Services are described in agency Service Level Agreements, and billed internally to

divisions based on indices that have been developed for each area of service. Department leadership (Commissioner’s Office and Regional Directors) are not assessed. Division Support Services include costs associated with Division and regional leadership, business offices, and clerical support. Those elements of individual projects that put little or no demand on support services such as large single-source contracts, large land acquisitions, and funds that are passed-thru to other entities are not assessed Direct and Necessary costs for those activities.

Explanation of Use of Classified Staff: Any classified staff position paid for by ENRTF will either:
 1) Be backfilled with a new position OR 2) The work done by this position will be delayed, eliminated, or completed by the start of the project. The activities of all or portions of the following four classified staff are directly related to this work program.

A portion of the time of two plant ecologists (2.00 FTE) is directed to the authorship of the Aspen Parkland-Red River Valley natural history/guide book that is specifically identified in Activity #4. Due to decades of their field experience and investigation in the prairie and parkland region, these ecologists bring knowledge and perspectives that will result in a professional and accessible publication.

A botanist (1.0 FTE) is needed to verify identification of plants collected by MBS botanists and plant ecologists, to coordinate with the repositories of these collections (herbaria), to help plant monitoring and to assist with the update of the rare plant species guide identified in Activity #4. Some of the botanist’s previous responsibilities have been assigned to others or are included in projects that have been completed or eliminated from Divisional priorities. Another data manager (.2FTE) is a specialist in botany needed for MBS plant data entry.

Explanation of Capital Expenditures Greater Than \$3,500:
 NA

Number of Full-time Equivalent (FTE) estimated to be funded with this ENRTF appropriation: 14.6 FTE are proposed to be funded each of the two years described in this work program.

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state			
State Wildlife Grant-Federal grant –pending	\$ 500,000	\$648,619	Animal surveys, data management and monitoring.
State			
General Funds--pending	\$ 420,000,	\$586,731	Office rent, salary of supervisor
Heritage Enhancement Account (Lottery-in-lieu) and RIM Critical	\$1,162,000	\$1,103,818	Salaries, contracts, supplies, office rent
Game & Fish Fund	--	\$140,287	Prairie management monitoring, salaries and field expenses
TOTAL OTHER FUNDS:	\$2,082,000	\$2,479,455	

VII. PROJECT STRATEGY:

A. Project Partners: The following are some of the primary partners related to this project: The Bell Museum, the Science Museum, the Superior National Forest, and Voyageurs National Park. Red Lake Reservation lands are being surveyed in collaboration with Red Lake Department of Natural Resources. NatureServe provides guidance in database structure, collection, and distribution standards.

B. Project Impact and Long-term Strategy: Funding for an ongoing Minnesota Biological Survey will be requested to address: **1) Data Gaps**, including survey of areas where weather conditions, life-history cycles, lack of experts, etc. left data gaps (e.g., invertebrates) and acceleration of the identification of exemplary aquatic landscapes (lakesheds, watersheds, groundwater systems). **2) Re-Survey** of landscapes altered due to habitat fragmentation, development, and invasive species, especially where MBS was conducted in the 1980s–1990s. **3) Additional Expansion of Monitoring** of ecological conditions in sites of biodiversity significance to assess impacts of policies and management activities on ecological systems and species populations (e.g., prairie grazing, recreational activities, groundwater use, sustainable forest management, climate change, energy, and invasive species). **4) Use of new technology** in remote sensing, data collection, analyses, modeling, and information delivery; these will be combined with traditional survey methods (field biologists) and communication pathways (e.g., personal contacts by professionals, publications).

C. Spending History:

Funding Source	FY08-09	FY 2010-11	FY 2012-13
ENRTF	1,500,000 <i>Subd.6a</i>	2,100,000 <i>Subd.3a</i>	2,250,000 <i>Subd.(03a)</i>
General Fund	700,000	700,000	520,000
State Wildlife Grant	400,000	500,000	500,000
Heritage Enhancement	1,159,000	1,159,000	934,000
RIM Critical Habitat			226,500

VIII. ACQUISITION/RESTORATION LIST: NA

IX. MAP: (see attached)

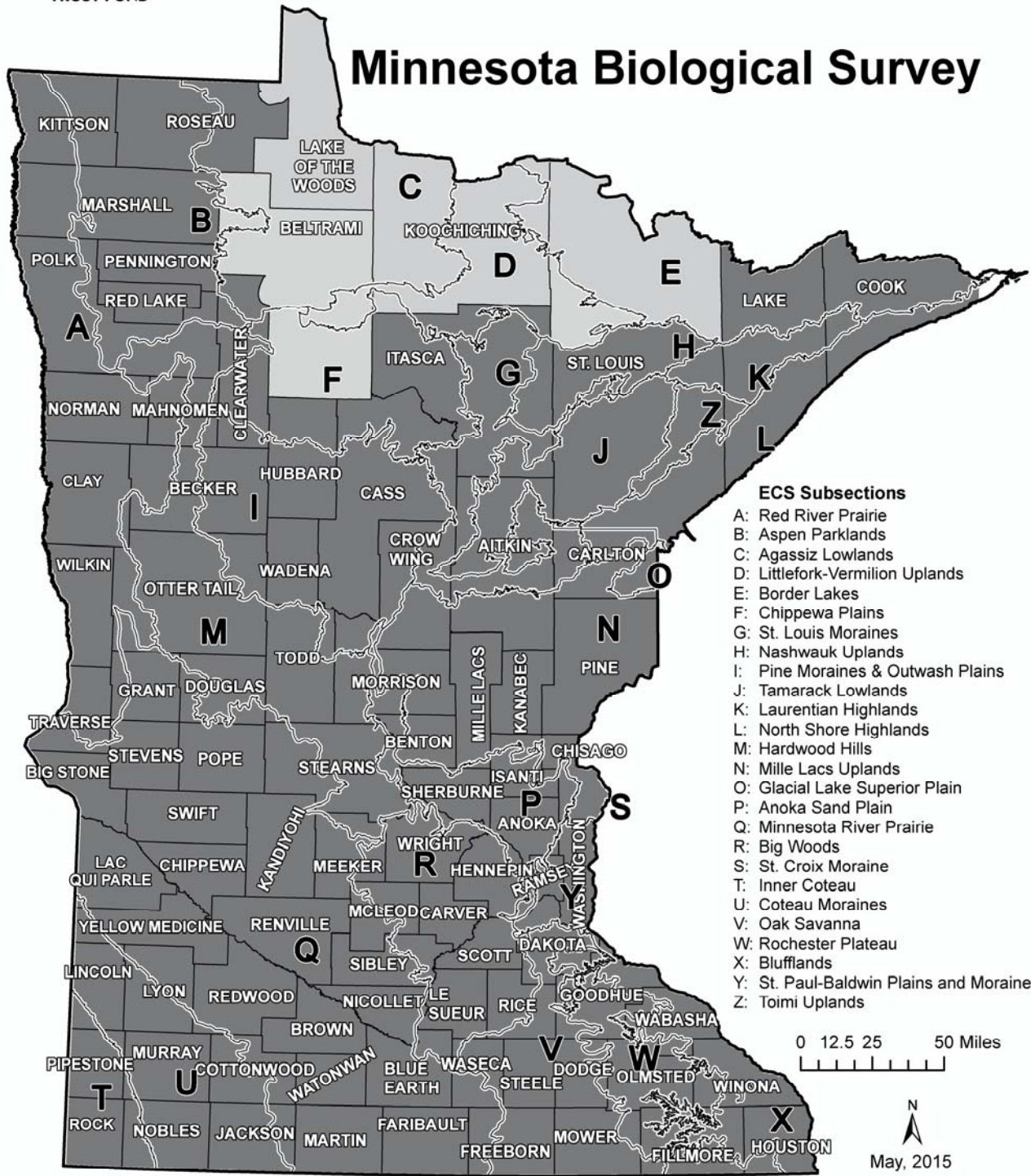
X. RESEARCH ADDENDUM: NA

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted not later than January 31, 2014, October 31, 2014, and March 31, 2015. A final report and associated products will be submitted between June 30 and August 15, 2015 as requested by the LCCMR.

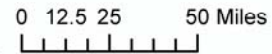


Minnesota Biological Survey



ECS Subsections

- A: Red River Prairie
- B: Aspen Parklands
- C: Agassiz Lowlands
- D: Littlefork-Vermilion Uplands
- E: Border Lakes
- F: Chippewa Plains
- G: St. Louis Moraines
- H: Nashwauk Uplands
- I: Pine Moraines & Outwash Plains
- J: Tamarack Lowlands
- K: Laurentian Highlands
- L: North Shore Highlands
- M: Hardwood Hills
- N: Mille Lacs Uplands
- O: Glacial Lake Superior Plain
- P: Anoka Sand Plain
- Q: Minnesota River Prairie
- R: Big Woods
- S: St. Croix Moraine
- T: Inner Coteau
- U: Coteau Moraines
- V: Oak Savanna
- W: Rochester Plateau
- X: Blufflands
- Y: St. Paul-Baldwin Plains and Moraines
- Z: Toimi Uplands



Survey completed 1987-2014
 Survey proposed 2015-2017

Final Attachment A: Budget Detail for M.L. 2013 Environment and Natural Resources Trust Fund Projects														
Project Title: Minnesota Biological Survey														
Legal Citation: M.L. 2013, Chp. 52, Sec 2, Subd. 03a														
Project Manager: Bruce Carlson														
M.L. 2013 ENRTF Appropriation: \$ 2,650,000														
Project Length and Completion Date: 06/30/ 2015														
Date of Update: 08/31/2015														
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Balance	Activity 2 Budget	Amount Spent	Balance	Activity 3 Budget	Amount Spent	Balance	Activity 4 Budget	Amount Spent	Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM														
Personnel: (17 positions;14.6 FTE proposed for each of the two fiscal years of the project). These are State of MN employees. Salary and fringe are included in this budget item. Most positions require specialized professional skills in plant and animal surveys (understanding of taxonomy, behavior, field survey techniques, statistics, sampling design, specimen preparation and documentation/data management). In addition, use of remote-sensing equipment, interpretation of aerial imagery, understanding of soils, geology, hydrology, and landscape processes are critical to accomplishing many required tasks. Staff skills focused on the communication of results is especially needed during this project period to meet deadlines for web-based, published products and technical assistance.														
	\$680,230	\$676,065	\$4,165	\$218,000	\$216,652	\$1,348	\$798,250	\$794,207	\$4,043	\$421,050	\$418,355	\$2,695	\$2,117,530	\$12,251
Botanist: \$166,000 (1 classified @100% time)														
Botanists: \$274,000 (2 unclassified @100% time)														
Ecologists: \$333,000 (2 classified @100% time)														
Ecologist: \$85,000 (1 unclassified @80% time)														
Ecologists: \$949,700 (7 unclassified @100% time)														
Information officer: \$140,000 (1 unclassified @90% time)														
Information GIS manager: \$129,000 (1 classified @50% time)														
Data manager: \$21,530 (1 classified @20% time)														
student worker: \$18,500 (1 @20% time)														
Professional/Technical/Service Contracts:														
TBD: Survey, monitoring, assessment														
	\$20,000	\$17,890	\$2,110	\$35,000	\$32,300	\$2,700							\$55,000	\$4,810
TBD: Information system products														
										\$107,000	\$104,237	\$2,763	\$107,000	\$2,763
Direct and Necessary Services for the Appropriation														
	\$80,999	\$80,999	\$0	\$15,000	\$15,000	\$0	\$71,750	\$71,750	\$0	\$51,950	\$51,950	\$0	\$219,699	\$0
Equipment/Tools/Supplies: Field supplies to conduct biological surveys, including GPS units, data recorders, cameras, communication safety equipment (especially in Border Lakes and remote peatlands), plant and animal specimen collecting and preservation supplies, water chemistry sampling supplies, batteries, air photos, maps, water resistant note books, etc.														
	\$5,771	\$5,771	\$0	\$2,000	\$2,000	\$0							\$7,771	\$0
Travel: In-state travel, including food and lodging expenses when in travel status. Especially used by field staff where vehicle mileage is paid for temporary use of DNR vehicles during the summer field surveys. Vehicles are often trucks due to need for access to remote locations and the need to transport canoes and kayaks (especially for aquatic plant surveys and surveys in Border Lakes, including the Boundary Waters Canoe Area Wilderness). Aerial flights also used (especially in large peatlands).														
	\$113,000	\$113,000	\$0	\$30,000	\$30,000	\$0							\$143,000	\$0
COLUMN TOTAL	\$900,000	\$893,725	\$6,275	\$300,000	\$295,952	\$4,048	\$870,000	\$865,957	\$4,043	\$580,000	\$574,542	\$5,458	\$2,650,000	\$19,824