

**Environment and Natural Resources Trust Fund
2011-2012 Request for Proposals (RFP)**

LCCMR ID: 006-A1

Project Title: Online Guides to Minnesota Plants, Fungi, & Lichens

Category: A1. Natural Resource Data and Information: Collection

Total Project Budget: \$ \$373,000

Proposed Project Time Period for the Funding Requested: 4 yrs, July 2011 - June 2015

Other Non-State Funds: \$ 0

Summary:

>150,000 Minnesota plant, fungal, and lichen records (geographic information and digital imagery) will be served on the web as maps and field guides for resource managers, educators, and the public.

Name: George Weiblen

Sponsoring Organization: U of MN

Address: 250 Biological Sciences Center, 1445 Gortner Ave
Saint Paul MN 55108

Telephone Number: 612-624-3461

Email: gweiblen@umn.edu

Web Address: _____

Location

Region: Statewide

Ecological Section: Statewide

County Name: Statewide

City / Township:

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ Employment	_____ TOTAL _____%

2011-2012 MAIN PROPOSAL

PROJECT TITLE: Online Guides to Minnesota Plants, Fungi, and Lichens

I. PROJECT STATEMENT

Climate change, habitat loss, invasive species, and a citizenry committed to preservation and enjoyment of natural resources motivate this project to serve information accumulated in the University Herbarium since 1890 when it became the official repository for Minnesota botanical information. This collection contains all primary information on the diversity of Minnesota plants, fungi, and lichens. Knowing what species comprise a woodland, wetland or prairie is challenging. Advances in data processing, digital imagery, and geographic information combined with innovative online tools can provide immediate access to photographs and distribution maps.

Plants dominate the landscape and are touchstones for Minnesota environments. Lichens are important indicators of environmental quality. Fungi, while often hidden, interact in critical ways with plants as decomposers that influence soil composition, as parasites, and as root symbionts, that are important for ecosystem health. Identification of the 5,000 plant, lichen, and fungal species thus far recorded in Minnesota is a major challenge for the public and experts alike. New technology has the potential to make Minnesota's biological diversity information accessible to all. Internet search engines linked to image-rich, geo-referenced databases can instantly provide up-to-date, illustrated guides to particular areas. Such technology can simultaneously serve the diverse needs of resource managers, educators, and citizens. A resource manager might locate records of a fungal pathogen, whereas a visitor to a natural area might identify wildflowers in the field using the internet via a hand-held wireless device.

To achieve these goals we need to upgrade and integrate our electronic records of these organisms such that specimen data, photographs, and maps are presented through a user-friendly interface. We propose to (1) overhaul geographic information by geo-referencing specimens in a format compatible with state and global standards, (2) digitize an extensive collection of photos and specimens, and (3) serve these data to the public through a searchable, dynamic web interface that instantly generates up-to-the-minute, site-specific maps and field guides on request. The concept is outlined in the attached illustration.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Geo-referencing herbarium specimen records **Budget:** \$ 84,000

A project manager will collate specimen geographic information in a form compatible with guidelines of the Office of Enterprise Technology and the Global Biodiversity Information Facility (<http://www.gbif.org/>). Currently, this information exists in heterogeneous formats. We will geo-reference all Minnesota plant, fungal, and lichen records in a standardized format, assigning each record its nearest level of spatial resolution depending on the precision of its locality information. The outcome is a geographic information system for plants, lichens, and fungi served through a web-based map interface, such as GoogleMaps, to provide up-to-the-minute access to distribution records and compliment the spatial data of the MN DNR. The Rocky Mountain herbarium illustrates the concept (<http://www.rmh.uwyo.edu/data/search.php>).

Outcome	Completion Date
1. Geo-referencing fungi (ca. 12,000 records)	June, 2012
2. Geo-referencing lichens (ca. 20,000 records)	June, 2013
3. Geo-referencing plants (ca. 150,000 records)	June, 2015

Activity 2: Digital imaging of Minnesota plants, fungi and lichens **Budget:** \$ 97,000
 A graduate student assistant will (1) digitize an extensive, existing collection of field photographs of flowers, fruits, leaves, mushrooms, and lichens, and (2) scan herbarium specimens at high resolution. These images will be served online through the interface developed in Activity 3. This outcome, in contrast to much unreliable information on the web, will link imagery to actual specimens, geographic information, and up-to-date taxonomy, as served through the interface described in Activities 1 & 3. This will provide instant, illustrated guides for particular locations, including State Parks and Natural Areas.

Outcome	Completion Date
1. Digitize plant photos (ca. 1200 species)	June 2012
2. Digitize fungal photos (ca. 2000 species)	June 2013
3. Digitize lichen photos (ca. 800 spp.)	June 2014
4. Scan specimens of plants, lichens, & fungi	June 2015

Activity 3: Upgrading the database and web interface **Budget:** \$ 192,000
 Design of a new web interface serving the University Herbarium database will enable multi-user access to plant, fungal and lichen data. At present, data entry and editing of mySQL tables for plants and fungi is performed offline using Specify (<http://specifysoftware.org/>) with sporadic online updates. We will upgrade to a dynamic php interface allowing for simultaneous data entry and public access. The lichen database, currently in Filemaker Pro, will migrate to mySQL, and be accessed through the php interface. Several models for the interface are available already (e.g. <http://atrium.andesamazon.org;> <http://www.mndnr.gov/rsg>). An information specialist/database programmer will review existing open-source models and adopt the one that best supports digital imagery, geographic information, taxonomic annotation, and real-time production of maps, checklists, and illustrated field guides. Our team of plant, fungal, and lichen experts will engage DNR and environmental educators in developing a user-friendly interface.

Outcome: Three separate databases (plants, lichens, and fungi) will be integrated under a single data model, relating taxonomic names (and synonyms) to specimens. Authorized users such as the DNR County Biological Survey, MN Pollution Control Agency, and MN Department of Agriculture will be able to access data, contribute and annotate collections through the web, and track name changes over time. The public will be able to search, assemble, and download maps and illustrated field guides.

Outcome	Completion Date
1. Select the data model and interface based on review of existing tools	Dec. 2012
2. Implement the data model and develop the web interface	June 2013

III. PROJECT STRATEGY

A. Project Team/Partners Team: curators of the University Herbarium including G. Weiblen (project coordination), D. McLaughlin (fungi), I. Schmitt (lichens), & A. Cholewa (plants), a project manager (activity 1), a graduate student (activity 2), and a database developer (activity 3). Partners: MN DNR County Biological Survey including C. Converse (project coordination) & N. Aaseng (Database).

B. Timeline Requirements Three activities will commence in parallel during the first year. Activity 1 requires four years. Outcomes 1-3 for activity 2 will be completed in two years whereas outcome 4 will require additional support (as sought below). Activity 3 will be completed in the first two years of the project.

C. Long-Term Strategy and Future Funding Needs A collections improvement grant from the US National Science Foundation will be sought to complete activity 2 and to expand the effort to include specimens from outside of Minnesota.

2011-2012 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET 4years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel: 1 project manager at 50% time for four years at \$21,000 per year (73% salary & 27% benefits according to the University fringe rate of 41.1% for non-academic employees); 1 informational technology specialist/database developer at 100% time for two years at \$96,000 per year (73% salary & 27% benefits); 1 graduate student assistant at 50% time for two years at \$41,000 per year (61% salary & 39% benefits according to a 2010-2011 rate including fringe plus tuition).	\$ 358,000
Contracts: Custom-modification of a high-resolution scanner to accommodate herbarium specimens (e.g. http://www.kew.org/data/herb_digitisation.html).	\$ 10,000
Equipment/Tools/Supplies: High-resolution scanner and peripherals for digital imaging of specimens	\$ 5,000
Acquisition (Fee Title or Permanent Easements):	\$ -
Travel:	\$ -
Additional Budget Items:	\$ -
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND \$ REQUEST	\$ 373,000

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period:	\$ -	
Other State \$ Being Applied to Project During Project Period:	\$ -	
In-kind Services During Project Period: University faculty effort devoted to the project (5% of salary per year for the three principle investigators over four years) plus a MN DNR plant ecologist at 50% time for the duration of the project.	\$ 48,128	
Remaining \$ from Current ENRTF Appropriation (if applicable):	\$ -	
Funding History: LCMR, A computerized database for plants of Minnesota, 1991-1993, \$130,000 LCMR, Improved Minnesota fungus collection and database, 1999-2001, \$79,000	\$ 209,000	

Online guides to Minnesota plants, fungi, & lichens



BELL MUSEUM
of Natural History

Search the database for any species or common name

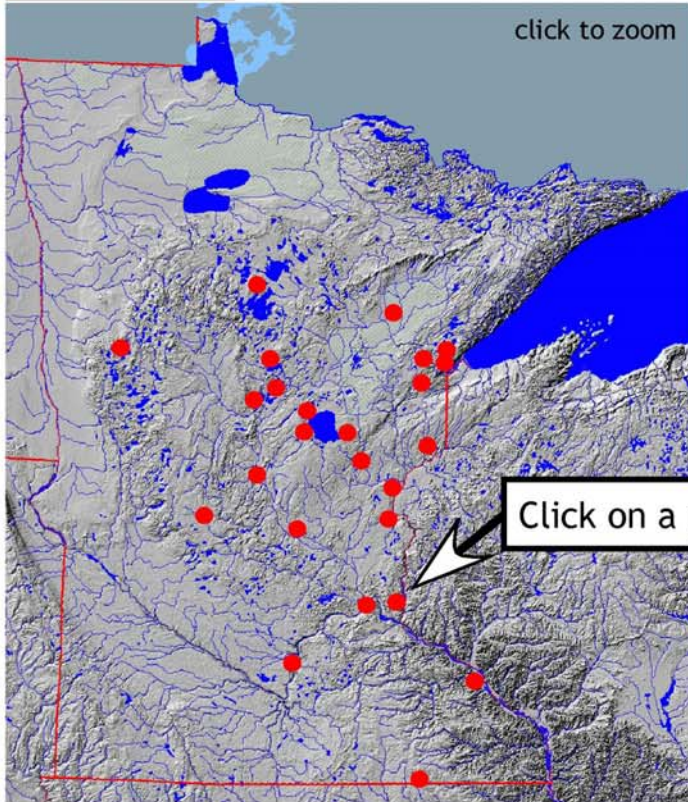
Trillium grandiflorum (Liliaceae)
White-Flowered Trillium

Click for a description

Search *Trillium gran* GO

Map: 21 matching records of 197,251 in the database

Photo Gallery



click to zoom



click to zoom

Trillium grandiflorum (Liliaceae)
photo: G. D. Weiblen 14 May 2008
Eloise Butler Wildflower Garden



click to zoom

Trillium erectum (Liliaceae)
photo: G. D. Weiblen 10 May 2005
Eloise Butler Wildflower Garden

Click on a point to view a specimen record

Accession #	675434
Family	Liliaceae
Scientific Name	<i>Trillium grandiflorum</i>
Collector	Cholewa, A.F. & Engels, A.
Collector Number	1586
Collection Date	19 May 1989
County	Itasca
Township	Aitkin, 1 mi E of Hyw. 169
Locality	ridge, E side of Dinner Pail Lake
Lat/Long	44.783000° N 93.333000° W
Habitat	Birch woods, plants abundant with Uvularia, Pteridium & Hepatica.
Notes	Flowers white

Click on a location for an instant, illustrated guide

Field Guide to Plants, Fungi, & Lichens of Lake Itasca State Park

9 April 2010 checklist of 345 plant species, 67 fungi, & 18 lichens



Ranunculaceae
Polygala pauciflora
marsh marigold



Polygalaceae
Polygala pauciflora
gaywings



Papaveraceae
Sanguinaria canadensis
bloodroot



Brassicaceae
Dentaria laciniata
cut-leaved
toothwort



Sarraceniaceae
Sarracenia
pitcherplant



Liliaceae
Uvularia sessilifolia
sessileleaf bellwort



Ranunculaceae
Isopyrum thalictroides
rue-leaved



Betulaceae *Corylus cornuta* hazel

Print pdf, email, or
Send to 51201@bone

Specimen Image



click to zoom

Project Manager Qualifications and Organization Description

George D. Weiblen

Address: Department of Plant Biology, 250 Biological Sciences Center, 1445 Gortner Avenue, St. Paul, Minnesota, 55108, Fax 612-625-1738, Tel 612-624-3461, E-mail gweiblen@umn.edu

Professional preparation:

Reed College, Portland, Oregon B.A. in Biology, 1992

Harvard University, Cambridge, Massachusetts, A.M. in Biology, 1997, Ph.D. in Biology 1999

Professional appointments:

Plant Biology Department, University of Minnesota, St. Paul, Minnesota

Associate Professor (2006-present), Assistant Professor (2001-2005)

Bell Museum of Natural History, University of Minnesota, Minneapolis, Minnesota

Herbarium Curator (2001-present)

National Museum of Natural History, Smithsonian Institution, Washington, DC

Research Associate in Entomology and Botany (2001-present)

Significant publications (of 36 in total):

Craft, K. J., S. Pauls, K. Darrow, P. D. N. Hebert, L. Helgen, S. E. Miller, V. Novotny, and G. D.

Weiblen. 2010. Population genetics of ecological communities with DNA barcodes. *Proceedings of the National Academy of Science USA* 107, 5041-5046.

Datwyler, S. L. & G. D. Weiblen 2006. Genetic variation in hemp and marijuana (*Cannabis sativa* L.) according to amplified fragment length polymorphisms. *Journal of Forensic Sciences* 51, 371-375.

Synergistic activities:

- Development of web-based interactive keys for plant identification (<http://geo.cbs.umn.edu>)
- Development of an on-line digital herbarium for New Guinea plants (<http://atrium.ng.brit.org/>)

Organization description:

The University of Minnesota herbarium (MIN) is located in the Biological Sciences Center on the Saint Paul Campus. The MIN herbarium includes over 800,000 specimens of vascular plants, fungi, and lichens, and is associated with the Bell Museum of Natural History. Vascular plant specimens number over 600,000 samples of vegetative parts, cones, fruit, and seeds. The representation of Minnesota's flora is unparalleled, with over 160,000 plant specimens collected throughout Minnesota's history. Numerous recent specimens have been contributed by the MN Dept. of Natural Resources County Biological Survey. Dr. Weiblen's laboratory includes over 90 m² of finished laboratory space and adjoins the herbarium collection. The proximity of the laboratory to the herbarium is ideal for project oversight. One hundred m² of office space is equipped with ether-linked PC and Macintosh computers. Two Dell computers running Windows XP, a Macintosh G5 Power PC, and four Macintosh G4 Power PC computers dedicated to image processing and data analysis, HP LaserJet 4M, and other peripherals, Macintosh OSX with Virtual PC running Windows XP, and Image Pro Express software for image analysis.