

**Environment and Natural Resources Trust Fund  
2014 Request for Proposals (RFP)**

---

**Project Title:**

**ENRTF ID: 003-A**

Online Access to Minnesota's Biodiversity for Environmental Management

---

**Category:** A. Foundational Natural Resource Data and Information

---

**Total Project Budget: \$** 342,428

**Proposed Project Time Period for the Funding Requested:** 3 Years, July 2014 - June 2017

**Summary:**

Online access to specimen records of plants and animals will help control invasive species by tracking their spread and enable conservation of native species by predicting responses to environmental change.

---

**Name:** Keith Barker

**Sponsoring Organization:** U of MN

**Address:** 1987 Upper Buford Cir  
St. Paul MN 55108

**Telephone Number:** (612) 624-2737

**Email** barke042@umn.edu

**Web Address**

---

**Location**

**Region:** 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 _____%   |



**PROJECT TITLE: Online Access to Minnesota's Biodiversity for Environmental Management**

**I. PROJECT STATEMENT**

This project offers open access to records and images of plant and animal specimens that are the foundation for our collective knowledge of Minnesota's biodiversity. Such information is often needed by state agencies and citizens throughout Minnesota but can be difficult to locate. Specimen records serve to document the spread of invasive species, to guide habitat restoration, and to forecast species' responses to environmental change. Minnesotans also want to know what lives, or once lived, in their neighborhoods, fields, forests, and lakes. Museum records serve these purposes but are not always accessible to agencies or the public.

The Bell Museum was established by the Legislature as the State Museum of Natural History in 1872 to preserve specimens of Minnesota's plants and animals, many collected by ENRTF-supported projects such as the DNR Biological Survey. Accompanying each specimen is a record of habitat, location, and date of collection, providing unique information on Minnesota's environmental history. Many states have made their biological specimen data available online, whereas many of our plant and animal specimen records still reside in museum drawers and on hand-written labels. Understanding the risks of invasive species and the responses of native species to environmental change requires a regional perspective. Integration of our historical and contemporary specimen data with those from neighboring states will empower managers to respond to invasive species, to guide restoration projects, and to anticipate future environmental challenges.

This proposal builds upon prior ENRTF support and MN DNR and MN PCA survey activity by enabling public access to Bell Museum specimen databases. First, digital photography will capture images of plant and animal specimens. Second, data will be transcribed from labels into electronic databases. Third, an online, searchable interface will deliver images, mappable records, species lists, and links to additional resources. Images of museum specimens are often essential for resource managers to accurately identify species of special concern. Mappable records of species will enhance agency efforts, including DNR and PCA, to monitor and forecast the distribution of invasive and native species. Historic records of native species distribution will inform efforts to improve our environment by defining appropriate restoration targets. Coordinated, freely available access to these resources and other tools also serve to better inform and engage the public.

**II. DESCRIPTION OF PROJECT ACTIVITIES**

**Activity 1: Digital imaging of museum specimens and records**

**Budget: \$81,809**

The Bell Museum houses tens of thousands of specimens that document Minnesota's past and present biodiversity. Although some of the data associated with these specimens is available (to professionals only), much more is not. We will digitally photograph or scan specimens (including herbarium specimens, bird and mammal preparations) and accompanying labels for subsequent data capture (see Activity 2). These images will also be integrated into electronic databases for online access (see figure).

| Outcome   | Completion Date |
|---|-----------------|
| 1. Digital images of 28,000 Minnesota vertebrate specimens and labels | July 2016       |
| 2. Digital images of 75,000 Minnesota herbarium specimens             | July 2017       |

**Activity 2: Digital data processing and geo-referencing**

**Budget: \$161,810**

Generating images of specimens and labels is only the first step in enabling access to specimen data. The information on these labels must be systematically captured, curated, and made available for use. Since much of this information is hand-written, data capture depends on human interpretation. We will minimize error in this process by developing an automated online data capture tool and training museum staff in its use. This method leverages modern "crowd-sourcing" technology, facilitating public participation in science. Crowd-



## Environment and Natural Resources Trust Fund (ENRTF)

### 2014 Main Proposal

#### Project Title: Online Access to Minnesota's Biodiversity for Environmental Management

sourcing—the coordination of massive volunteer effort over the web—offers a way to efficiently verify label data. For example, volunteers have identified African wildlife, discovered new planets, and mapped the surface of the moon by interpreting images and data posted online. Natural history museums are now using this tool to digitize specimen data. Following this model, we will recruit citizen scientists (including teachers, students, and lifelong learners) from Minnesota and worldwide to verify specimen label data. In particular, at least 5 participants will transcribe each label and data will only pass specification if verified by a majority. Our staff will use these compiled data to generate mappable coordinates using established mapping standards.

| Outcome  | Completion Date |
|--|-----------------|
| 1. Online tool for data capture from digital images of Minnesota specimens | July 2015       |
| 2. Database of mappable coordinates for each Minnesota specimen            | July 2016       |

#### Activity 3: Online delivery of Minnesota specimen data and images

**Budget: \$98,809**

Data on the distribution of Minnesota plants and animals can best inform management and conservation needs if they are accessible and interpreted in a regional context. We will accomplish this by: 1) integrating our data with existing regional and national data networks, and 2) distributing Minnesota data through a convenient, “one stop” online source. Existing data networks are invaluable resources that put our data in a global context, but they are difficult for non-specialists to use. A single, easy-to-use public interface to Minnesota plant and animal records, images, and links will meet important needs. Among other applications, information from this interface can be used to understand the historic distribution of species of conservation concern, to predict the spread of invasive species, and to identify species using high resolution imagery. Links to other resources including the DNR (e.g., the Rare Species Guide), MN-PCA, USDA, USFWS, *Encyclopedia of Life*, and *Wikipedia* will provide additional critical environmental data. This project will ensure that products of the Trust Fund will be available to resources managers from now into the future.

| Outcome   | Completion Date |
|---|-----------------|
| 1. Specimen data integrated with biodiversity data networks       | July 2016       |
| 2. Launch of searchable online database of Minnesota biodiversity | July 2017       |

### III. PROJECT STRATEGY

#### A. Project Team/Partners

Team: Bell Museum curators will contribute taxonomic expertise including Keith Barker (birds), Anita Cholewa (plants), Sharon Jansa (mammals), Andrew Simons (fishes), and George Weiblen (plants). Minnesota Supercomputing Institute personnel will provide database and programming expertise including Benjamin Lynch (project management) and Trevor Wennblom (software development). Lynch, Wennblom and student curatorial assistants will be supported by ENRTF whereas others are supported by the University of Minnesota.

#### B. Timeline Requirements

This is a three-year project. Activities 1 and 2 will commence and proceed in parallel during year 1. Activity 3 will commence in year 2, with all project goals completed by the end of year 3.

#### C. Long-Term Strategy and Future Funding Needs

This proposal builds upon an ENRTF award from 1991 that databased some Minnesota biodiversity records. The Bell Museum is committed to maintaining and serving this information for the long-term. It continues to support collections through the University budget, federal grants, and contracts for services. Outcomes from this LCCMR-funded work will leverage a future grant proposal to improve Bell collections for \$300,000, targeting the US National Science Foundation in October 2016.

## 2014 Detailed Project Budget

**Project Title:** Dynamic Access to Minnesota Biodiversity Information

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

| <b>BUDGET ITEM</b>  | <b>AMOUNT</b>    |
|---|------------------|
| <b>Personnel:</b> Database administrator/developer (Wennblom, MSI) at 25% FTE for three years. Base salary \$76,000 per annum plus 36% fringe.  | \$76,152         |
| <b>Personnel:</b> Information technology specialist (Research Informatics Support, MSI) at 25% in years 2 and 3. Base salary \$86,000 per annum plus 36% fringe.                                    | \$57,448         |
| <b>Personnel:</b> Project Manager (Lynch, MSI) at 5% FTE for three years. Base salary \$91,000 per annum plus 36% fringe.   | \$18,236         |
| <b>Personnel:</b> Graduate student curatorial assistant at 50% FTE for two years. Base stipend \$21,000 per annum plus 78% benefits including fringe and tuition. Stipend covers a 50% FTE.         | \$75,752         |
| <b>Personnel:</b> Six undergraduate student curatorial assistants at 10 hours per week at 50 weeks per year for three years. Salary \$12.50 per hour. Amount is 100% salary (no fringe or tuition). | \$112,500        |
| <b>Services:</b> Data hosting of approximately 180,000 digital images (three terabytes) at \$260 per terabyte year for three years.   | \$2,340          |
| <b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>  | <b>\$342,428</b> |

### V. OTHER FUNDS

| <b>SOURCE OF FUNDS</b>  | <b>AMOUNT</b> | <b>Status</b> |
|---|---------------|---------------|
| <b>Other Non-State \$ Being Applied to Project During Project Period:</b> \$60,000 USDA funding (National Institute of Food and Agriculture) to employ graduate assistants in geo-coding of herbarium specimen records over two years. \$12,000 National Science Foundation grant to employ undergraduate assistants in digital photography of herbarium specimens over one year. | \$72,000      | Pending       |
| <b>Other State \$ Being Applied to Project During Project Period:</b>   | \$ -          | NA            |
| <b>In-kind Services During Project Period:</b> Bell Museum (University of Minnesota) curatorial effort including Barker, Cholewa, Jansa, Simons, Weiblen at 5% FTE for each for three years. Includes 5% base salary per annum plus fringe.   | \$83,384      | Secured       |
| <b>Remaining \$ from Current ENRTF Appropriation (if applicable):</b>   | NA            |               |
| <b>Funding History:</b> LCMR, A computerized database for plants of Minnesota, 1991-1993, \$130,000<br>LCMR, Improved Minnesota fungus collection and database, 1999-2001, \$79,000   | \$ 209,000    |               |

# Project activities

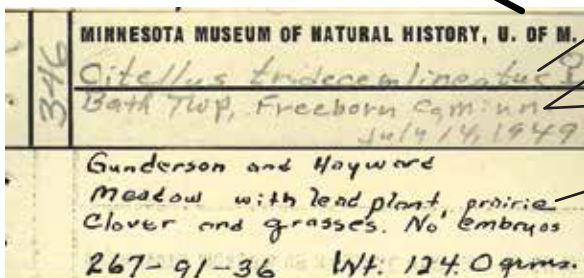
1. Photograph specimens and labels



Goldy Gopher  
*Citellus tridecemlineatus*



2. Capture label information for database



|                   |   |
|-------------------|---|
| Museum number     | 346   |
| Genus             | Citellus  |
| species           | tridecemlineatus                                    |
| Date Collected    | 14 July 1949  |
| County            | Freeborn  |
| Specific locality | Bath Township                                       |
| Habitat           | Meadow with lead plant, prairie clover, and grasses |
| Latitude          | 43.7990   |
| Longitude         | -93.3590  |

3. Create searchable, online specimen database



Mappable records for predicting species distributions

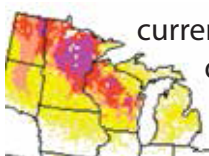
Species lists from any locality

Links to natural history and management information

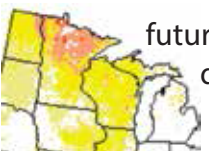
Specimen images to aid identification



existing records



current modeled distribution



future predicted distribution

- PLANTS
- Abies balsamea
  - Acer rubrum
  - Acer saccharum
  - Acer spicatum
  - Achillea millefolium
  - Achillea ptarmica
  - Aconitum napellus
  - Acorus americanus
  - Acorus calamus
  - Actaea pachyphloea
  - Actaea rubra
  - Adiantum pedatum
  - Adiantum species
  - Adiantum species



# Project outcomes

## **Project Manager Qualifications and Organization Description**

### **F. Keith Barker**

**Address:** Department of Ecology, Evolution and Behavior, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, Minnesota, 55108, Fax 612-624-6777, Tel 612-624-2737, E-mail barke042@umn.edu

#### **Professional preparation:**

Reed College, Portland, Oregon B.A. in Biology, 1993  
University of Chicago, Ph.D. in Evolutionary Biology 1999

#### **Professional appointments:**

Bell Museum of Natural History, University of Minnesota, Minneapolis, Minnesota  
Curator of Genetic Resources (2008-present)  
Department of Ecology, Evolution and Behavior, University of Minnesota, St. Paul, Minnesota  
Professor (2008-present)  
American Museum of Natural History, New York, NY  
Research Associate in Ornithology (2003-present)

#### **Qualifications:**

The project manager currently oversees database development for the scientific collections of the Bell Museum. During his career he has published over 37 peer-reviewed scientific articles. He has also received several grants with budgets up to \$334,000.

#### **Synergistic activities:**

- Member, North American Check-list Committee, American Ornithologists' Union (2008-Present)
- Editorial Board, Systematic Biology (January 2001-January 2008, October 2011-present)

#### **Organization description:**

The Bell Museum of Natural History was established by state legislative mandate in 1872 to collect, preserve, skillfully prepare, display, and interpret our state's diverse animal and plant life for scholarly research and teaching and for public appreciation, enrichment, and enjoyment. Its governance belongs, by state legislative designation, to the University of Minnesota.

The exceptional scientific collections of the Bell Museum continue to grow as state agencies deposit biological specimens annually. Nearly 4 million specimens of mammals, birds, fishes, plants, mollusks, insects and fungi provide opportunities for research and learning. The Museum houses the world's largest collection of Minnesota biodiversity. Academic curators are internationally known researchers with expert knowledge spanning the tree of life. The unique synergy of research, teaching, and public engagement, possible only on the campus of a great university, distinguishes the Bell Museum as a cradle of innovation in environmental science.