

**Environment and Natural Resources Trust Fund  
2015 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 005-A**

Integrating Minnesotas Biodiversity Data: a Comprehensive, Dynamic Atlas

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

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**Total Project Budget:** \$ 339,750

**Proposed Project Time Period for the Funding Requested:** 3 years, July 2015 - June 2018

**Summary:**

The Minnesota Biodiversity Atlas, integrating over 600,000 biodiversity records and 300,000 specimen photographs, will serve critical agency needs ranging from guiding field surveys to enabling conservation planning.

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**Name:** Keith Barker

**Sponsoring Organization:** U of MN - Bell Museum of Natural History

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St. Paul MN 55108

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**Web Address** http://www.bellmuseum.umn.edu/

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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**Alternate Text for Visual:**

The Minnesota Biodiversity Atlas: a critical tool for use of biodiversity data in management

<input type="checkbox"/> Funding Priorities	<input type="checkbox"/> Multiple Benefits	<input type="checkbox"/> Outcomes	<input type="checkbox"/> Knowledge Base
<input type="checkbox"/> Extent of Impact	<input type="checkbox"/> Innovation	<input type="checkbox"/> Scientific/Tech Basis	<input type="checkbox"/> Urgency
<input type="checkbox"/> Capacity Readiness	<input type="checkbox"/> Leverage	<input type="checkbox"/> TOTAL	



**I. PROJECT STATEMENT**

*We propose to create a resource management tool, the Minnesota Biodiversity Atlas. This online, searchable interface will integrate an extensive set of data (over 600,000 records) on birds, mammals, fishes, plants, and fungi, and associated imagery (up to 300,000 high-resolution digital photographs).* This interface will enhance agencies' capacity to perform a range of activities from biological surveys to conservation planning. As Minnesota's State Natural History Museum, it is our statutory mandate to preserve and make available all of our biodiversity data, including historic and ongoing contributions (both specimens and data) from the Bell Museum as well as from agency partners like the Minnesota Biological Survey and the Minnesota Pollution Control Agency. These critical data, including ~30,000 high-resolution digital photographs and more than 250,000 records currently ready to be loaded into the system, as well as nearly 450,000 currently inaccessible Bell Museum records, are the basis for the tool we seek to create.

Our agency partners have many information needs both at the office and in the field. For instance, the Minnesota Department of Natural Resources (in particular the Biological Survey) requires: 1) accurate species lists, 2) specimens confirming the identity and distribution of species, and 3) distribution data for species of critical concern and for invasive species for use in conservation planning. The Biodiversity Atlas will serve these and other needs by integrating Bell Museum and agency data into a single, easily usable tool. This tool will provide users with species lists for any geographic area based on the latest and most accurate information. Specimen imagery will allow agency biologists to check identifications and verify distributional details from the office or the field at any time, without the constraints of visiting the Bell Museum collections during business hours. Finally, updates to our specimen databases done as part of this project will allow creation of the most complete distribution information for both current and future species of conservation concern. These are critical data for planning of species recovery and management, and for environmental impact assessment.

The Pacific Northwest Herbarium (<http://www.pnwherbaria.org/>) illustrates what is possible but not currently available for Minnesota. This web interface enables users to search for distribution maps of plants or browse digital images and historic records from across their region. Although similar specimen data for Minnesota birds, mammals, fishes, amphibians, reptiles, fungi, and plants are stored in the Bell Museum and in cooperating agency databases, a large portion of these data are not currently available, need to be digitized, and have not been integrated into a single comprehensive source. This project will improve access to biodiversity data by making them instantly and directly available online through a tool easily usable by resource managers, researchers, and citizens alike. Once constructed, this tool will also enable future integration of data from other providers (e.g., the UMN Duluth Herbarium, MN Breeding Bird Atlas).

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Creation of the Minnesota Biodiversity Atlas, a tool for management** **Budget: \$128,955**

We will create a centralized, online Atlas of Minnesota's biodiversity. This point of access to Minnesota animal, fungal, and plant data will integrate diverse sources of information in ways never before possible. Among other functions (see above), this Atlas will be used to: 1) dynamically generate species checklists for user defined areas, 2) create distributions of individual species over time and across the state, 3) access a rich library of imagery and species information pages (including descriptions, classification, distribution maps, field images, etc.), and 4) assist in specimen identification using interactive keys.

Outcome	Completion Date
1. Integrated access to >250,000 records and >30,000 images currently on hand	December 2015
2. Integrated access to >600,000 records and ~300,000 images	June 2018

**Activity 2: Creating images for biodiversity data capture, verification, and identification** **Budget: \$68,481**



**Environment and Natural Resources Trust Fund (ENRTF)**

**2015 Main Proposal**

**Project Title: *Integrating Minnesota's biodiversity data: a comprehensive, dynamic atlas***

Among the four million specimens housed at the Bell Museum are more than 600,000 specimens of Minnesota wildlife, plants and fungi that span the entire period from the founding of our state in 1872 to the present. Although some of the data associated with these specimens are currently available, the majority are not. We will digitally photograph specimens (primarily plants and fungi) and their accompanying documentation. These photographs will be immediately useful for online verification of identifications and locality data (e.g., verifying county occurrences); in addition, they are a critical first step in subsequent data capture (see Activity 3).

Outcome	Completion Date
1. Capture and addition to the Atlas of up to 300,000 digital images	June 2018

**Activity 3: Translating specimen documentation into digital distribution data**

**Budget: \$142,314**

Generating images of specimens and accompanying documentation is only the first step in enabling access to high-quality specimen data. Documentation must be captured, curated, and then georeferenced (assigned accurate latitude and longitude coordinates). Since much of this documentation is hand-written, data capture depends on manual transcription. Crowd-sourcing, the coordination of massive volunteer effort over the web, will accelerate this work by enabling volunteer citizen scientists to efficiently enter and verify data. Our staff will then compile the data to generate coordinates using established mapping standards. In other projects, citizen scientists have identified African wildlife, discovered new planets, and mapped the surface of the moon by interpreting images and data posted online (see <http://www.zooniverse.org>). Natural history museums now use these same tools to process data on birds, fungi, insects, and plants (see <http://www.notesfromnature.org/#/archives>).

Outcome	Completion Date
1. Georeferencing as many as 325,000 records for inclusion in the Atlas	June 2018

**III. PROJECT STRATEGY**

**A. Project Team/Partners**

Team: Bell Museum curators will contribute taxonomic expertise including Scott Bates (fungi and Symbiota software management), Keith Barker (birds), Sharon Jansa (mammals), Andrew Simons (fishes), and George Weiblen (plants). Minnesota Supercomputing Institute personnel will provide database and programming expertise including Bart Gottschalk (UMN MSI project management) and Trevor Wennblom (software development). The University of Minnesota Library will support our image archiving needs, with experts including John Butler (UMN Library project management) and library staff under his supervision.

**B. Project Impact and Long-Term Strategy**

The Atlas proposed here will be of immediate, practical use to a diverse community of managers and scientists including field workers, ecologists, conservation planners, and policy-makers, as described above. The Museum is committed to the creation and long-term maintenance of this tool as part of our ongoing, constructive relationship with partner agencies including the Minnesota Biological Survey and Minnesota Pollution Control Agency (see letters). We are supported in this effort by the UMN Libraries, who will host the image data from this project according to archival standards. Outcomes from this LCCMR-funded work will leverage grant proposals to the US National Science Foundation for improving Minnesota's biological collections.

**C. Timeline Requirements**

This is a three-year project, and all activities will begin immediately upon project initiation. Since the Atlas is an integral part of our data capture and management plan, we expect that it will be completed and available (though not fully populated with data) by the end of year one. Data capture and processing will proceed throughout the course of the project.

## 2015 Detailed Project Budget

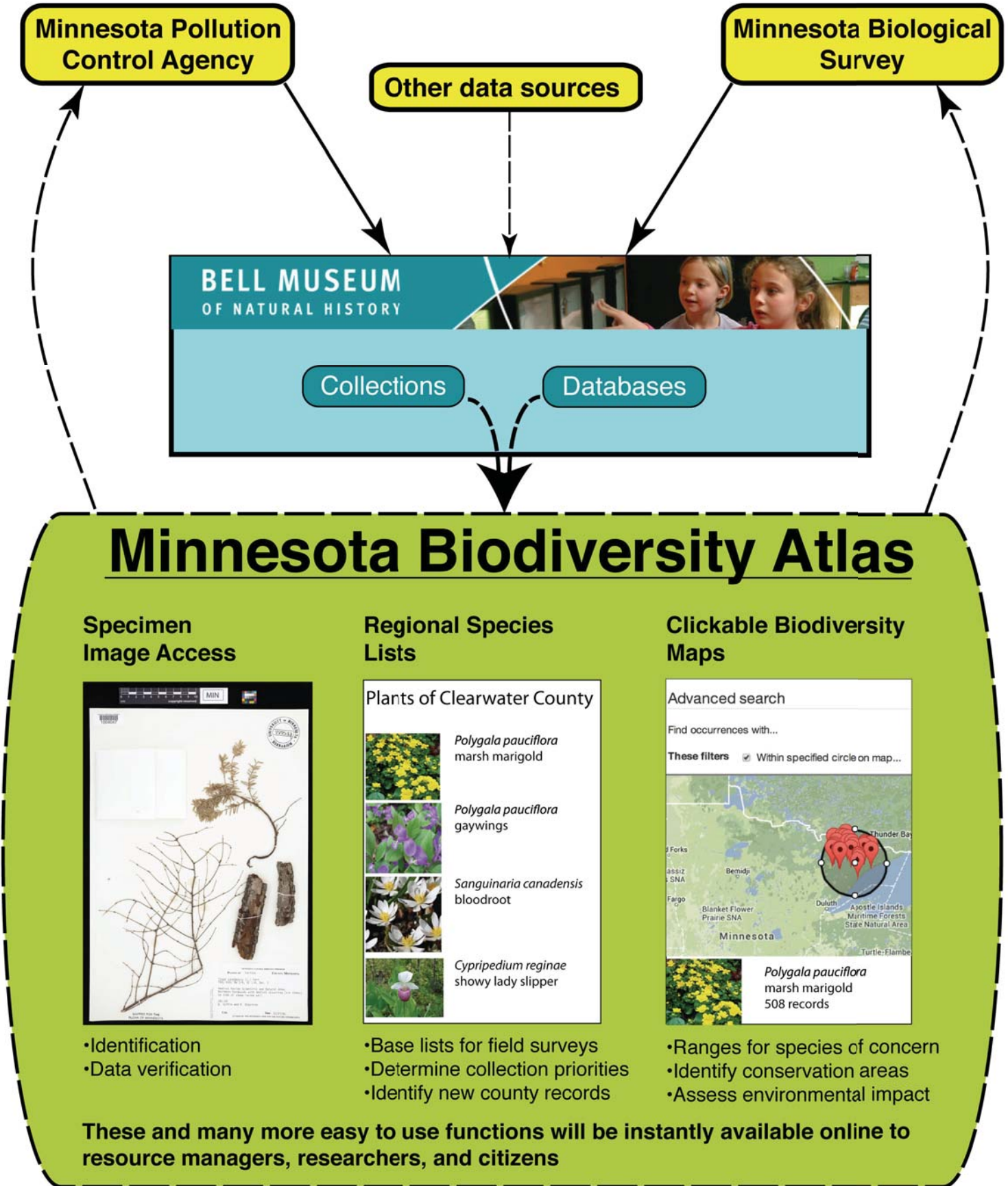
**Project Title:** *Integrating Minnesota's biodiversity data: a comprehensive, dynamic atlas*

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
<b>Personnel:</b> Database administrator and developer (Wennblom, MSI) at 20% FTE for three years.	\$64,973
<b>Personnel:</b> Information technology specialist (research informatics support, MSI) at 10% in years 1 and 2.	\$23,319
<b>Personnel:</b> Project Manager (Gottschalk, MSI) at 5% FTE for three years.	\$19,663
<b>Personnel:</b> Digital preservation and repository developer (Libraries) at 25% FTE in year 1.	\$28,454
<b>Personnel:</b> Digital preservation analyst (Libraries) at 25% FTE in year 1.	\$21,089
<b>Personnel:</b> Graduate student curatorial assistant at 50% FTE for two years.	\$75,752
<b>Personnel:</b> Five undergraduate student curatorial assistants at 10 hours per week for three years.	\$82,500
<b>Contracts:</b> Symbiota software development support. \$7,000 per annum over three years. The specific software development contractor will be determined upon funding.	\$21,000
<b>Equipment:</b> Two computer workstations for georeferencing work. The high volume of computer use during scanning and georeferencing the large number of specimens and records proposed here requires dedicated computing capacity not currently available in the Museum.	\$3,000
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$339,750</b>

### V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
<b>Other Non-State \$ Being Applied to Project During Project Period:</b> \$30,000 Hatch funding (National Institute of Food and Agriculture) to employ graduate assistants in geocoding of herbarium specimen records over two years. \$74,000 National Science Foundation grant to employ undergraduate assistants in digital photography of bryophyte specimens over two years. \$46,476 National Science Foundation grant to digitize records of aquatic invasives.	\$150,476	Secured
<b>Other State \$ Being Applied to Project During Project Period:</b>	\$ -	NA
<b>In-kind Services During Project Period:</b> Personnel: Bell Museum (University of Minnesota) curatorial effort including Barker, Bates, Cholewa, Jansa, Simons, Weiblen at 2% FTE for each for three years. Includes 2% base salary per annum plus 36% fringe. Libraries (University of Minnesota) management and coordination by J. Nichols at 3% for each of three years. Services: Archival digital preservation storage infrastructure (2 managed copies plus geo-replicated disaster recovery copy) for 10TB primary source files (\$850/TB/year) for three years.	\$ 77,435	Secured
<b>Funding History:</b> 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	
<b>Remaining \$ from Current ENRTF Appropriation (if applicable):</b>	\$ -	NA



— Solid lines represent existing agencies and relationships

- - - Dashed lines represent services and relationships to be developed in the proposed work

## **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.