



Environment and Natural Resources Trust Fund

2022 Request for Proposal

General Information

Proposal ID: 2022-247

Proposal Title: Minnesota Biodiversity Atlas - Phase 3

Project Manager Information

Name: Timothy Whitfeld

Organization: U of MN - Bell Museum of Natural History

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Project Basic Information

Project Summary: We propose to expand the Minnesota Biodiversity Atlas, an online natural resource management tool, to include 2.5 million records by integrating expert observations and specimen records from multiple organizations

Funds Requested: \$593,000

Proposed Project Completion: August 31 2025

LCCMR Funding Category: Foundational Natural Resource Data and Information (A)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Extensive records of Minnesota biodiversity, past and present, are the product of ongoing biological surveys by agencies and organizations beginning with the Public Land Survey in 1848. The problem is that data are scattered and unavailable for simple comparison. The Minnesota Biodiversity Atlas (<http://bellatlas.umn.edu/>) addresses this by integrating diverse sources in a robust data management system, compatible with the highest national and international standards for expert-verified records of biodiversity.

The Atlas is a publicly accessible web application enabling users to map species distributions, create species lists, use digital images for identification, and search for historical records. This information is the basis for natural resource decision-making at all levels. It is a source of material for curricula from K-12 to higher education and a tool for informal learning. The Atlas serves these needs by pulling together contemporary and historical records of biodiversity from across the state.

Phases 1 and 2 of this ENRTF project made accessible >1.7 million biodiversity records and >400,000 high-resolution digital images of museum specimens. However, large datasets from several institutions have yet to be digitized and one of the most environmentally important groups - the insects- has yet to be integrated.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

We will unify Minnesota biodiversity data and fill major gaps in the state-wide Atlas coverage by adding insect records, new institutional partners, and historical data.

(1) Integrating a subset of the University of Minnesota insect collection (UMSP) allows us to rapidly improve the Atlas coverage of this important group. Our focus will be to incorporate existing records and new digital images.

(2) Expanding our network of partner institutions will cover gaps in the Atlas, with a particular focus on plants and animals from northwestern Minnesota. For example, collections at Concordia College and Minnesota State University Moorhead include specimens of plants, birds, mammals, and insects that are not currently accessible.

(3) Incorporating historical data helps to inform current management and conservation decisions. These datasets come from Minnesota state agencies in addition to the University of Minnesota and the US Department of Agriculture. Furthermore, repatriating 220,000 plant and animal records from out-state institutions holding specimens originating from Minnesota is an efficient way to dramatically improve coverage of the Atlas. We propose to unite these disparate records under the umbrella of the Minnesota's Biodiversity Atlas.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

Sustained growth of the Atlas with new data and institutional partners enhances our capacity to interpret, preserve and enjoy the diverse biological resources of our state. For example, integrating historical and contemporary records helps to model pest outbreaks and predict biotic responses to climate and land use change. Expanding the database also increases our capacity to track invasive species and prioritize management decisions. It improves documentation of rare species and patterns of biodiversity to inform conservation strategies. Furthermore, an expanded, more complete Atlas provides teachers with extensive statewide data to enrich educational opportunities for K-12 and undergraduate students.

Activities and Milestones

Activity 1: 1.Digitize the largest insect collection in the state

Activity Budget: \$166,000

Activity Description:

The importance of insects cannot be overstated. Insects include major pests of agriculture and forestry, vectors of human and veterinary disease, and destructive exotic species. They shape ecosystems as decomposers, herbivores, parasites, and prey of wildlife. They are pollinators and good indicators of soil and water quality.

The University of Minnesota Insect Collection (UMSP), founded in 1879, includes at least 4 million specimens. We propose to publish 180,000 records already digitized and 6,000 high-resolution digital images of drawers containing pinned specimens. Each drawer contains hundreds of specimens such that up to 1.6 million will be visible online. However, it will take years to turn these images into searchable records of individual specimens.

We aim to prioritize capturing 70,000 records from three economically and ecologically important groups. Mosquitoes (Diptera: Culicidae) are a nuisance and vectors of diseases such as La Crosse encephalitis, West Nile virus, equine encephalitis and bird malaria. We propose to digitize 22,000 mosquito records. Weevils (Coleoptera: Curculionidae) are key players in forest ecosystems and pests of timber and grain. In addition to 40,000 weevils, we propose to digitize 8,000 stink bugs (Hemiptera: Pentatomidae), a household nuisance and source of invasive

Activity Milestones:

Description	Completion Date
Develop a pipeline for data sharing between the UMSP insect database and the Atlas	December 31 2022
Publish 180,000 insect specimen records and 6,000 digital images to the Atlas	August 31 2023
Release 70,000 newly digitized records of economically & environmentally important insects	August 31 2024

Activity 2: 2.Expand biodiversity data sharing to ten partner organizations state-wide

Activity Budget: \$294,000

Activity Description:

We propose to expand upon existing data sharing that includes six organizations by involving four additional organizations. Activity 2 will add a total of 324,000 new biodiversity records to the Atlas through new and ongoing partnerships. New partners include Concordia College (5,500 plants, 36,000 insects, 1,000 birds, and 2,000 mammals), Minnesota State University Moorhead (10,000 plants, 500 mammals, 900 birds) and the Minnesota Ornithological Union (120,000 records of birds breeding in Minnesota from 1966-present).

We also request renewed support for the Science Museum of Minnesota to digitize 10,000 bird and mammal specimens and the University of Minnesota- Duluth to digitize 46,000 insect specimens. Lastly, we will integrate datasets from 200 historic surveys of aquatic plants in Minnesota lakes from the University of Minnesota (1936-1938) with 6,000 surveys by the MN DNR Lake Ecology, Fisheries and Wildlife Units (2000-2020). Altogether we estimate that these datasets will contribute 93,000 records of aquatic plants to the Atlas.

Activity Milestones:

Description	Completion Date
Publish 120,000 records of breeding birds in Minnesota	December 31 2022
Publish 93,000 records of aquatic plants in Minnesota lakes	August 31 2023

Digitize 46,000 insect records from the University of Minnesota -Duluth	August 31 2024
Digitize 44,000 plant and animal records from Concordia College	August 31 2024
Digitize 11,000 plant and animal records from Minnesota State University Moorhead	August 31 2025
Digitize 10,000 bird specimen records from Science Museum of Minnesota	August 31 2025

Activity 3: 3.Repatriate records of Minnesota biodiversity residing beyond the state

Activity Budget: \$133,000

Activity Description:

Additional specimens of Minnesota's biodiversity exist in various institutions outside the state and observations have also been collected by federal agencies overtime. With this in mind, we will repatriate records of Minnesota Biodiversity deposited at museums across the United States for which data are already available in the Integrated Digitization Portal (iDigBio). This online portal aggregates digitized natural history data from around the world. For Minnesota, iDigBio includes 220,000 records of birds, mammals, fish, reptiles, amphibians, arthropods, mollusks, crustaceans, plants and fungi that are not already recorded in the Biodiversity Atlas. Furthermore, the US Geological Survey's North American Breeding Bird Survey includes 155,000 observation records of birds that breed in Minnesota. In addition, the US Department of Agriculture surveyed 500 Minnesota Lakes between 1917 and 1939 and we plan to integrate the associated 7,000 aquatic plant observation records into the Atlas.

Activity Milestones:

Description	Completion Date
Publish 7,000 historical records of aquatic plants in Minnesota's lakes	August 31 2023
Publish 220,000 records of Minnesota biodiversity from out-state institutions	August 31 2024
Publish 155,000 records of breeding birds in Minnesota	August 31 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Keith Barker	Bell Museum, University of Minnesota	co-PI	No
Timothy Whitfeld	Bell Museum, University of Minnesota	Project coordinator	Yes
Katie Noren	Bell Museum, University of Minnesota	Technical assistant	Yes
Michael Milligan	Minnesota Supercomputing Institute, University of Minnesota	Software developer	Yes
Thomas Prather	Minnesota Supercomputing Institute, University of Minnesota	Software developer	Yes
Ralph Holzenthal	Department of Entomology, University of Minnesota	co-PI	No
Robin Thomson	Department of Entomology, University of Minnesota	Project site coordinator	Yes
Amanda Grusz	University of Minnesota, Duluth	co-PI	No
Gretchen Meier	University of Minnesota, Duluth	Project site-coordinator	Yes
Katherine Early	Science Museum of Minnesota	co-PI	No
Charlie Iverson	Science Museum of Minnesota	Project site-coordinator	Yes
Joseph Whittaker	Concordia College	project site coordinator	No
Donna Stockrahm	Minnesota State University, Moorhead	Project site coordinator	No
Lee Pfanmuller	Minnesota Ornithological Union	Contributor of breeding bird datasets	No
Donna Perleberg	Minnesota DNR	Contributor of aquatic plant datasets	No
Bruce Carlson	Minnesota DNR	Coordinator for Minnesota Biological Survey data	No

George Weiblen	Bell Museum, University of Minnesota	Principal Investigator	No
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Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

The continued growth of the Atlas is of immediate, practical use to natural resource professionals, researchers, educators and the public. The Bell Museum and the University of Minnesota Libraries are committed to long-term expansion and maintenance of this tool as part of an ongoing, constructive relationship with agencies and academic partners. The Digital Repository at the University of Minnesota (DRUM), where project data are archived, sets the highest standard for format-independent, archival preservation of digital data. The Bell Museum is also engaged in national and international biodiversity digitization initiatives and to philanthropic fundraising in support of these activities.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Minnesota Biodiversity Atlas for Enhanced Natural Resource Management	M.L. 2015, Chp. 76, Sec. 2, Subd. 03d	\$340,000
Interactive Water Resource Programs for Planetariums in Minnesota	M.L. 2017, Chp. 96, Sec. 2, Subd. 05c	\$500,000
Minnesota Biodiversity Atlas - Phase 2	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 03c	\$350,000

Project Manager and Organization Qualifications

Project Manager Name: Timothy Whitfeld

Job Title: Science Director and Professor

Provide description of the project manager's qualifications to manage the proposed project.

Timothy Whitfeld reports to principal Investigator George Weiblen, the Science Director of the Bell Museum and a curator of plants. As a Distinguished McKnight University Professor, Weiblen holds tenure in the Department of Plant and Microbial Biology and teaches in the College of Biological Sciences. He attended the Minneapolis public schools and earned a Bachelor's Degree from Reed College in Portland, Oregon. He received his Masters and PhD degrees from Harvard University in 1999 and he was a research associate of the National Museum of Natural History, Smithsonian Institution, Washington, DC (2001-2010).

Weiblen has co-authored more than 80 peer-reviewed scientific articles. His work has been supported by more than 25 grants and research contracts totaling over \$5 million dollars from sources including the National Science Foundation, the National Institutes of Health, the Minnesota Department of Agriculture, and the Environment and Natural Resources Trust Fund. He was recognized in 2017 as the University of Minnesota President's Community Engaged Scholar for his efforts in public engagement and science communication. He served on the team that designed and developed the new Bell Museum and the Minnesota Journeys main exhibit on the St. Paul campus of the University. He and his colleagues at the Bell Museum developed the Minnesota Biodiversity Atlas with support from ENRTF.

Organization: U of MN - Bell Museum of Natural History

Organization Description:

We are Minnesota's official natural history museum, established by the legislature in 1872 and held in trust by the University of Minnesota. For over a century, the museum has preserved and interpreted our state's rich natural history and served learners of all ages. Additionally, our scientific collections contain over one million specimens, representing every county in Minnesota and various locales around the globe. Collections are a source for Minnesota's biodiversity record, scientific research, and teaching materials for all levels of education. As Minnesota's state natural history museum, our mission is to ignite curiosity and wonder, explore our connections to nature and the universe, and create a better future for our evolving world. Our vision is to energize a community that embraces the transformative nature of science.

We believe education is a journey and we delight in the process of hands-on discovery. We believe in authenticity to engage curiosity. We reflect and respect diversity. We seek to preserve knowledge and biodiversity for the future. We value our visitors and partners and seek collaboration to enrich learning. We strive for excellence in all that we do and we are principled in the way we take care of our

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Michael Milligan		Systems administration & software development (\$102,000 annual salary with 0.025 FTE/year)			36.5%	0.09		\$11,000
Tom Prather		Systems administration & software development (\$115,000 annual salary with 0.15 FTE/year)			36.5%	0.45		\$71,000
Timothy Whitfeld		Project coordinator (\$58,000 annual salary with 0.10 FTE/year)			36.5%	0.3		\$24,000
Katie Noren		Remote digitization manager (\$37,000 annual salary with 0.36 FTE/year)			31.8%	1.08		\$53,000
Robin Thomson		On-site digitization manager (\$64,000 annual salary with 0.25FTE/year)			36.5%	0.75		\$66,000
Gretchen Meier		On-site digitization manager (\$35,000 annual salary with 0.25 FTE/year)			31.8%	0.75		\$35,000
University of Minnesota students		Insect label transcription (\$10.50/hour at \$0.70/record for 15 records/hour with 70,000 specimens)			0%	2.4		\$52,000
University of Minnesota, Duluth students		Insect label data transcription (\$10.50/hour at \$0.70/record for 15 records/hour with 46,000 specimens)			0%	1.47		\$32,000
University of Minnesota students		Vertebrate specimen imaging & label transcription (\$10.50/hour for \$5/record at 2 records/hour with 10,000 specimens)			0%	2.25		\$50,000
							Sub Total	\$394,000
Contracts and Services								
Minnesota Supercomputing Institute services	Professional or Technical Service Contract	Data hosting & server support (6TB/year at \$300/year for data & \$2,600/year for server)				0.6		\$9,000
Specify software consortium	Professional or Technical Service Contract	Technical support for UMSP collection database (\$1000/year)				0.3		\$3,000

Charlie Iverson, Science Museum of Minnesota	Sub award	On-site digitization manager: \$55,500 annual salary, 42.2% benefits with 0.25 FTE/year plus \$500/year for supplies				2.25		\$61,500
Concordia College	Sub award	Specimen imaging and label transcription (\$12.00/hour with 44,500 specimens of vertebrates, insects & plants)				2.1		\$58,000
Minnesota State University Moorhead, undergraduate students	Sub award	Specimen imaging and label transcription (\$12.00/hour with 11,500 specimens of vertebrates, insects & plants)				1.5		\$31,000
							Sub Total	\$162,500
Equipment, Tools, and Supplies								
	Tools and Supplies	Boxes and storage containers	Materials for specimen imaging, repair and storage					\$8,500
	Tools and Supplies	Barcode labels and printed specimen tags	Pre-printed labels and tags for tracking specimens, images and records of 180,000 specimens: \$0.05/label					\$9,000
							Sub Total	\$17,500
Capital Expenditures								
		2 digitization stations	For imaging insect specimens at UMSP and for imaging plant and animal specimens at Concordia College and Minnesota State University Moorhead	X				\$13,000
							Sub Total	\$13,000
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								

	Miles/ Meals/ Lodging	Roundtrip Duluth-St. Paul at 300 miles & and Moorhead-St. Paul at 500 miles at \$0.575 per mile	Training for project staff					\$2,000
	Miles/ Meals/ Lodging	Two persons from each project site to Bell Museum & two persons from Bell Museum to each project site per year. \$187 lodging plus meals for Duluth, \$149 for Moorhead & \$206 for St. Paul	Training for project staff					\$3,000
							Sub Total	\$5,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
		Shipping costs	Cost associated with shipping specimens and supplies between project sites					\$1,000
							Sub Total	\$1,000
							Grand Total	\$593,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Expenditures		2 digitization stations	<p>A dedicated desktop PC is required to operate the digital camera and barcode scanner with a commercial software package for image processing. Each desktop PC is entirely dedicated to digital image processing and will not be used for any other activity.</p> <p>Additional Explanation : Each station includes a camera, light-box, barcode scanner, and a dedicated desktop computer for capturing digital images of specimens during the full term of the project. The lifetime of these electronics with advancing technology and depreciation is three years such that the expenditure will have no resale value at the end of the project.</p>

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	University of Minnesota	Unrecovered indirect costs (55% of \$464,000 UMN direct costs with indirect charged to the first \$25,000 of each of three subawards)	Pending	\$296,000
			State Sub Total	\$296,000
Non-State				
Cash	National Science Foundation	Grant for Digitizing lichens and bryophyte records from the Bell Museum Herbarium	Secured	\$50,000
Cash	National Science Foundation	Grant for digitizing North American tree records from the Bell Museum Herbarium	Pending	\$56,000
			Non State Sub Total	\$106,000
			Funds Total	\$402,000

Attachments

Required Attachments

Visual Component

File: [a973045f-743.pdf](#)

Alternate Text for Visual Component

The graphic illustrates the result of prior ENRTF support and what can be achieved with new support. Numbers of records in the Minnesota Biodiversity Atlas, 1.7 million in total, are listed for six partner institutions and seven major groups (e.g. birds, mammals, plants). The graphic then illustrates what will be added to the Biodiversity Atlas for each of three proposed activities. Activity one will add 296,000 insect specimen records from the University of Minnesota Twin Cites and Duluth. A...

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

No

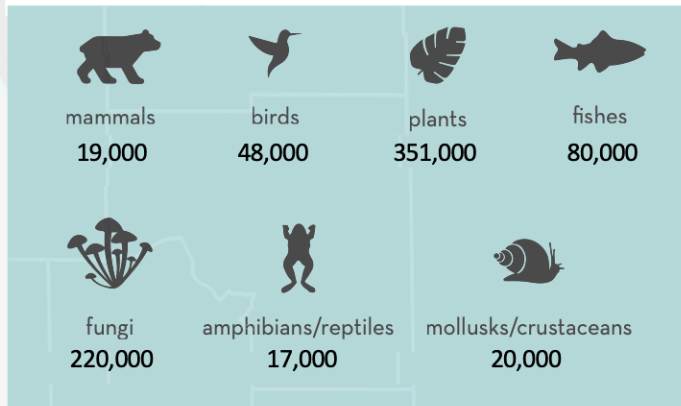
Does the organization have a fiscal agent for this project?

No

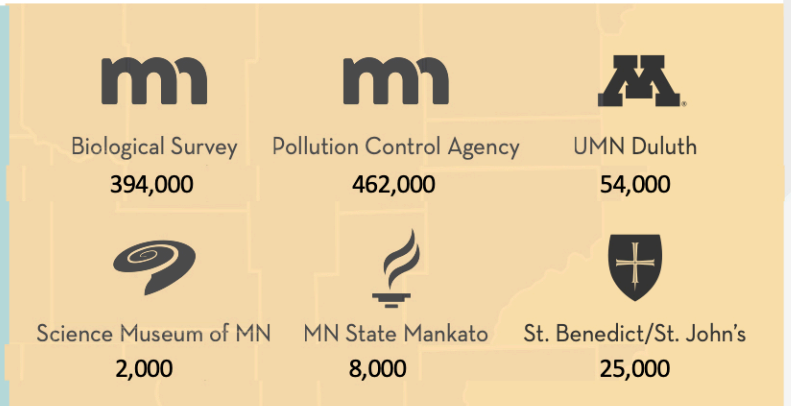
MINNESOTA BIODIVERSITY ATLAS

MAPPING CHANGE LOCALLY, GLOBALLY

Phase 1: Bell Museum



Phase 2: Institutional Partners



Phase 3: Adding Insects, Expanding Partnerships & Repatriating Data

