Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-455

Proposal Title: Inventory Aquatic Resources in Minnesota's Scientific/Natural Areas

Project Manager Information

Name: Mark Edlund

Organization: Science Museum of Minnesota - St. Croix Watershed Research Station

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Project Basic Information

Project Summary: We will survey water quality, identify aquatic bioindicators, and share the the amazing diversity of Scientific and Natural Areas across Minnesota to insure long-term management support for these treasured resources.

ENRTF Funds Requested: $699,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Water (B)

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.

Minnesota's 170 Scientific and Natural Areas (SNAs) protect unique landforms, ecosystems, habitats, plants, and wildlife throughout our state. The charismatic landscapes and lifeforms in the SNAs are well known, but what is often missing are baseline data on SNA aquatic resources especially important microbial diversity and water quality measures. Over 140 of the SNAs are water-based sites with their wildlife production, fisheries, habitat diversity, and ecosystems supported by water. However, data collection efforts have not yet been able to collect program-wide water quality and aquatic resource information for long-term SNA management success. Notably water quality is less frequently monitored than many other resources, and key aquatic bioindicator groups have not been inventoried across Minnesota's SNAs. One group of bioindicators, the diatom algae, have long been used to monitor change in Minnesota aquatic ecosystems, to set nutrient standards for all of the state's lakes, and can serve as bioindicators of ecosystem health for the SNA program. Coupled with water quality monitoring and analysis of environmental history at SNAs, this project will generate the first ever statewide survey of SNA water quality, biotic survey of a key bioindicator group, and guide future aquatic enhancement/management efforts in our state's renowned SNA program.

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

The project focuses on four key areas in support of LCCMR and SNA priorities: enhance water resources, biodiversity survey, effectiveness monitoring, and education and outreach. Over 80% of the SNAs have an aquatic component—creeks, wetlands, lakes, bogs, fens, pools—but we know less of their biodiversity and how they support SNA health. The biodiversity survey will focus on the diatom algae; they are excellent bioindicators, offer undiscovered diversity, and form the base of aquatic foodwebs. Coupled with paleolimnological survey of the nearly 20% of SNAs with lake or pond habitats, their indicator value will be extended to understand longer term history, recent trends, and modern threats to SNAs. The survey will also include water quality monitoring of the SNAs to provide recent and/or baseline data on how our SNAs are doing. Together these data will provide a foundation guiding future management of SNA water resources. Last, the landscape, diversity, and habitat protection offered by SNAs opens new avenues of outreach and education at macro AND microscopic levels. We'll partner with the DNR, the Master Naturalists, and unleash the power of the Science Museum's STEMEd programming to reach audiences, train naturalists in microbial diversity, and appreciate Minnesota's SNAs.

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?

We will 1) census and publish the water quality conditions that are supporting the SNAs, 2) publish an survey atlas of the microbial diversity of Minnesota water-based SNAs, and 3) use sediment analysis to determine the history and potential future challenges the SNAs may face 4) guide management recommendations to support preservation of water quality for each SNA region or unit. We'll partner with DNR-SNA, Master Naturalists, and create educational outreach with the Science Museum of Minnesota to share the importance of SNAs so together we might protect the future integrity, diversity, and resource value they hold for our state.

Activities and Milestones

Activity 1: Test water quality, document aquatic biodiversity, and assess environmental threats to aquatic resources in Minnesota's Scientific and Natural Areas

Activity Budget: $426,329

Activity Description:
Minnesota's 170 Scientific and Natural Areas protect amazing places, habitats, and diversity across the state. Most of the sites have some connection to surface waters; however, water quality and aquatic biodiversity are not regularly sampled. We will target the140 water-based SNAs by 1) measuring water quality in the surface waters of the SNAs including lakes, ponds, streams, springs, marshes, and pools; 2) collecting microbial samples to document and share the biodiversity of the SNAs using microscopic and molecular techniques; and 3) retrieving sediment cores from up to 20 of the lake-based SNAs to analyze (radioisotopic dating, diatoms, nutrient history) and understand historical condition, periods of change, and current trends in biodiversity and water quality. We will coordinate site selection and priorities in collaboration with MN DNR SNA staff. Together this activity will provide a first-ever whole state census of diversity, a baseline or effectiveness check on water quality, and inform Activity 3 to understand threats and develop management plans to protect diversity and water quality in our SNAs.

Activity Milestones:

Description	Approximate Completion Date
Sample and analyze water quality and biodiversity in up to 60 SNAs, Yr 1	June 30, 2028
Collect and analyze sediment cores from 12 SNAs, Yr1	December 31, 2028
Sample and analyze water quality and biodiversity in up to 50 more SNAs, Yr 2	June 30, 2029
Sample and analyze water quality and biodiversity in up to 30 new SNAs, Yr 3	December 31, 2029
Collect and analyze sediment cores from 8 SNAs, Yr2	April 30, 2030

Activity 2: Share the remarkable aquatic biodiversity and habitat protection of our Scientific and Natural Areas with Minnesotans and beyond

Activity Budget: $174,271

Activity Description:
There have been no systematic surveys of aquatic diversity or water quality in Minnesota's Scientific and Natural Areas despite knowing that over 80% of the units having surface water connections that support them. Based on Activity 1 findings we will develop outreach/education activities to center appreciation of the diversity, ecology, and management value of diatoms that will reach audiences from kids to adults across Minnesota to scientific communities throughout the world. Outreach materials will be shared with all project partners for use at outreach events from community fairs to the State Fair. We leverage our successful partnership with the Story Scouts program in Grand Marais to develop a children's book on the SNAs. Targeted training of youth and lifelong learners will introduce them to microscopy and identification of our least known biodiversity through naturalist programming such as Master Naturalists, environmental learning centers, and bioblitzes. Our artist-in-residence program will invite artists to highlight the diversity and wonder of SNAs for all to enjoy. The science behind our biological analysis will be highlighted with a Twitch stream (Diatoms Attack) where viewers interact with scientists running electron microscope analysis as we describe new species.

Activity Milestones:

Description	Approximate Completion Date
Collaborate with up to four artists-in-residence at the SCWRS to connect art, science, and SNAs	December 31, 2029

Develop and share outreach/education activities highlighting the aquatic diversity, ecology, and value of SNAs	April 30, 2030
Coordinate with the Story Scouts to produce a children's book on SNA biodiversity and habitats	April 30, 2030
Teach lifelong learners the wonderful world of microscopy and algae identification through programming and training	April 30, 2030

Activity 3: Identify and prioritize management response for threats to SNA aquatic diversity and water quality

Activity Budget: $98,400

Activity Description:

Using modern biodiversity, water quality survey, and paleolimnological analyses (Activity 1) to identify high quality SNA habitats and diversity, emerging threats, and potential at-risk SNAs, we will collaborate with SNA resource management to develop management recommendations at regional and site-based levels. We'll communicate management recommendations and awareness content to audiences including resource managers, public, and recreational users through social media, professional presentation and publication, and lay-accessible content. Water quality data will be shared in our statewide database (EQuIS) and with SNA managers. A statewide microbial flora and each species bioindicator values will be generated, and all new and rare species will also be entered into the community curated website diatoms.org that provides open-access identification tools for diatom algae and voucher floras.

Activity Milestones:

Description	Approximate Completion Date
Convene SNA resource managers to review permitting, site selection, and management priorities Yr1	December 31, 2027
Convene SNA resource managers to review permitting, site selection, Yr1 data, and management priorities Yr2	December 31, 2028
Convene SNA resource managers to review Yr2 data, formulate management recommendations Yr3	April 30, 2030
Upload water quality data to the MN water quality database EQuIS	April 30, 2030
Develop and share reports, publications, and upload web content on SNA biodiversity, water quality, threats	June 30, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Judy Elbert	MN Dept of Natural Resources, SNA	SNA staff will provide logistical support for SNA sampling, prioritization of sampling, and context for management outcomes.	No
David Burge	Science Museum of Minnesota	David is an Assistant Scientist and another aquatic biologist at the museum. He has special expertise in algae, water quality, and data analysis.	Yes
Anne Brataas	Minnesota Children's Prss	Anne coordinates a children's outreach program in Grand Marais called Story Scouts. Kids work with scientists to learn about environmental issues and then create award-winning children's books to convey important messages to families. We've worked with Anne on past LCCMR projects and will now focus on the amazing Arrowhead SNAs.	Yes
Amy Rager	Minnesota Master Naturalists	As a member of the Minnesota Master Naturalist Work Group, Amy will use her team to help coordinate Edlund's efforts to develop important training and stewardship opportunities for Master Naturalists throughout the state.	No

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
From our project we anticipate that we will develop scientific publications, reports, informational and outreach material, publicly accessible databases, and engage social media to inform resource managers, the scientific community, speicalists (Master Naturalists), and lay-persons on the special aquatic diversity and water quality that supports Minnesota's Scientific and Natural Areas.

Edlund and project personnel are periodically invited to give presentations within their organizations, to agencies, at professional meetings, and to outside groups, and they will present this work upon invitation. We will communicate the findings of this study with the public through factsheets, blogs, and social media (Twitter, Facebook, Instagram) accounts associated with the St. Croix Watershed Research Station. We plan on publishing the results of this work as peer-reviewed publications in relevant scientific journals and communicating results at local, regional, state, and national meetings. All dissemination will include proper acknowledgement of LCCMR/ENTRF support.

The following specific deliverables will result from this project:
i) Final project report to LCCMR documenting results from Activities 1-3 including management recommendations to SNA program units
ii) Outreach and training materials for broad audiences summarizing the special aquatic diversity of the SNAs (DNR, Master Naturalist, SMM)
iii) Social media posts through the outreach mechanisms and communication specialists at the Science Museum of Minnesota (e.g. https://smm.org/blog/) including blogs, and field Facebook and Instagram posts
iv) A children's book for family-centered science education highlighting Minnesota's amazing SNAs
vi) Peer-reviewed publications (a minimum of 2 anticipated), presentations and technical assistance to local interest groups, county, state, and tribal agencies, and at local, state, or national meetings (e.g. Master Naturalists, MDNR, MN Water Resources Symposium, North American Diatom Symposium).
vii) Public-accessible databases (water qualiity, diatom flora of the SNAs, rare and new species) and collections (SMM diatom herbarium) of all environmental data and collections taken in this inventory.

We will acknowledge the Environment and Natural Resources Trust Fund through use of the trust fund logo or

attribution language on all project print and electronic media, publications, signage, and other communications and outreach. We will use attribution language and social media tags found in the ENRTF Acknowledgment Guidelines.

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 work be funded?

Project results will be implemented with professional publication and presentation of water quality and biodiversity survey, permanent collections and archived data, public awareness programming from our and project partner efforts (DNR, Master Naturalist program), and using the reach of the Science Museum of Minnesota's exhibit, virtual, and education programming to target everyone in Minnesota. The Department of Natural Resources, partners in this effort, recognize the importance of preserving water quality, habitat integrity, and biodiversity in the SNAs and will utilize these recommendations in future management planning efforts and decisions.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Salt Threatens Minnesota Water Quality and Fisheries	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 04l	$1,228,000
Didymo II – The North Shore Threat Continues	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 04k	$394,000

Project Manager and Organization Qualifications

Project Manager Name: Mark Edlund

Job Title: Senior Scientist

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

Edlund has served as an aquatic biologist with the Science Museum of Minnesota's St Croix Watershed Research Station for over 25 years. Edlund's work has centered on use of algae for analysis of ecological change in Minnesota's lakes and rivers. Much of this work has centered on analysis of sediment cores to understand historical changes in Minnesota's aquatic ecosystems. Importantly, these data have been used to inform Minnesota's lake standards, to develop remediation plans for bringing lakes back to good condition and guided policy development on border systems including the St Croix River and Lake of the Woods. He has managed grants totaling over six million dollars and published over 135 peer-reviewed manuscript and 85 agency reports and scientifically described over 70 new species.

Organization: Science Museum of Minnesota - St. Croix Watershed Research Station

Organization Description:

The Science Museum of Minnesota (SMM) is a private, non-profit 501(c)3 institution dedicated to encouraging public understanding of science through research and education. The St. Croix Watershed Research Station is the environmental research center of the SMM with the mission "we do the science that helps make our rivers and lakes clean" through research and outreach. The SCWRS supports an active year-round program in environmental research and graduate-student training, guided by a dedicated in-house research staff with direct ties to area universities and colleges. It collaborates closely with federal, state, tribal, and local agencies responsible for managing the St. Croix and upper Mississippi rivers and is a full partner with the National Park Service for resource management in parks of the western Great Lakes region. Its research has played a central role in setting management policy for the St. Croix and Mississippi rivers, Lake of the Woods, the Red Lakes, and for establishing water-quality standards for Minnesota lakes and for developing long-term monitoring plans for the National Park Service.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Senior Scientist		Project Manager, Microbial identification, Sediment analysis, Reporting			26%	1.2		$151,610
Assistant Scientist		Microbial identification, Sediment analysis, Data analysis and reporting			12%	1		$85,315
Laboratory Technician I		Fieldwork and lab support, sample preparation and analysis			26%	1		$61,169
Assistant Scientist		Fieldwork, molecular analysis, data analysis, reporting			26%	0.5		$47,990
Summer Environmental Intern		Fieldwork, Sample preparation and analysis			12%	0.5		$19,712
							Sub Total	**$365,796**
Contracts and Services								
UMGC Univ MN Genomics Center or competitive bid	Service Contract	Genetic sequencing of samples, 200 samples at $22.50 per, $4500				-		$4,500
Minnesota Children's Press	Subaward	Creation of a children's book including project management, research, writing with the Story Scouts, fact checking, legal registration with ISBN & Library of Congress, design, layout, color correction, line and copy editing, revisions up to 3 cycles, proofreading, pre-press production audit, print management, Web site content, design promotion, and education toolkit.				0.2		$18,400
Science Museum of Minnesota - St. Croix Watershed Research Station	Internal services or fees (uncommon)	210-Pb dating of 20 sediment cores ($2,400/core), Loss on ignition on 15 sediment cores ($800/core), diatom identification on 20 cores ($4000/core), Sediment TP on 20 cores ($450/core, water quality analysis on 250 samples ($174.25/sample)				0		$196,563
Science Museum of Minnesota/SCWRS Pine Needles	Subaward	Support travel, supplies, and artist stipend for two summers of the Pine Needles Artist in Residence program that connect science and art to bring visibilty and art to the incredible habitats and diveristy in our SNAs. The PNAiR program has				0		$12,000

Artist in Residence program		been running for 25 yrs and has museum/gallery showings.						
							Sub Total	**$231,463**
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab and field supplies	General supplies for microscopy, water quality sampling kits, sediment coring, and molecular prep supplies					$19,244
	Tools and Supplies	Raw materials for fabrication of outreach kits for SMM and DNR	Provide outreach and educational kits for use in SMM and MN DNR outreach and education programming					$5,000
							Sub Total	**$24,244**
Capital Equipment								
		Five Leica DM750 light microscopes	Microscopes for outreach and use in Teaching/Training Master Naturalist courses and bioblitzes	X				$29,000
							Sub Total	**$29,000**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Fieldwork travel and sampling to 140 MN SNAs and teach Master Naturalist	Fieldwork to sample water quality, inventory aquatic diversity, and collect sediment cores from up to 140 MN SNAs, teach at Master Naturalist advanced training courses, 20 trips					$41,641
	Conference Registration Miles/ Meals/ Lodging	Attend and present at MN Water Resource Conf ($500 regist), MN Lake Mgmt Symposium ($90 regist), and Rainy-Lake of the Woods Forum ($110 regist), 5 total meetings, 6 attendees total, perdiem for 3 days for LoW Forum.	Attend and present findings at key Minnesota water meetings					$4,176
							Sub Total	**$45,817**
Travel Outside Minnesota								

	Conference Registration Miles/ Meals/ Lodging	Attend North American Diatom Symposium to present findings, 2028, 2 people, 5 days, registration $400 ea, travel and perdiem	Two staff attend 2028 North American Diatom Symposium to present findings	X				$2,680
							Sub Total	**$2,680**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$699,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Equipment		Five Leica DM750 light microscopes	Minnesota's Master Naturalist program has not focused on teaching or identification of microbial diversity such as aquatic algae. These organisms are key aquatic bioindicators and offer unique learning, outreach, and discovery opportunities offered nowhere else in MN **Additional Explanation :** Microscopes will continue to be used for future Master Naturalist programs, Science Museum and SNA outreach, and at statewide bioblitz events.
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Attend North American Diatom Symposium to present findings, 2028, 2 people, 5 days, registration $400 ea, travel and perdiem	Presenting to broader scientific audiences is critical to project critique and exposure especially to the community of diatomists who meet only every other year.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	Unrecovered indirects (48.73%) from Science Museum of Minnesota Direct expenses	Covering for overhead of facilities and administration	Pending	$340,622
			Non State Sub Total	**$340,622**
			Funds Total	**$340,622**

Total Project Cost: $1,039,622

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 57eed206-930.pdf

Alternate Text for Visual Component

Minnesota's Scientific and Natural Areas protect amazing habitats, wildlife, plants, and insects. But we know much less about the aquatic systems that support them. We will make the first ever program-wide inventory of water quality and aquatic biodiversity of SNAs. We'll share that information with Minnesotans–from agencies to kids!...

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Letter of Support-Science Museum of Minnesota	a64cb2ec-66c.pdf
SMM Federal Audit Report	8b80984f-314.pdf
SMM Good Standing State of Minnesota	e3d797e1-2f6.pdf
SMM 990 Form	384e113b-b23.pdf
Letter of Support Minnesota Children's Press	d2b6f5d4-878.pdf
Letter of Support MN Master Naturalists	b255b92c-39a.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the Commissioner's Plan applies.

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

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

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing $10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

No others involved expect project partners listed.

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Yes, I understand