



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-272

Proposal Title: Protecting Minnesota's Native Pondweeds

Project Manager Information

Name: Ya Yang

Organization: U of MN - College of Biological Sciences

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Project Basic Information

Project Summary: The state-wide study will clarify species identification and detect hybrids in pondweeds, one of Minnesota's largest groups of aquatic plants that are critical for wildlife habitats and water recreation.

ENRTF Funds Requested: \$300,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Small Projects (G)

Secondary Category: Fish and Wildlife (D)

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.

About 1/3rd of Minnesota's underwater plant species are in the pondweed family Potamogetonaceae. These plants occur statewide and are often the dominant underwater plants within a lake. Pondweeds are morphologically diverse and provide a wide diversity of underwater habitat for aquatic invertebrates and fish. Flowers and fruits above the water surface and starchy tubers underground produced by pondweeds are important sources of food for waterfowl and other wildlife. Several species of pondweeds are intolerant of turbidity and serve as indicators for declining water clarity. Six of the 27 native pondweed species in Minnesota are state-listed as endangered. As a result, monitoring the health of pondweed populations is critical to protecting Minnesota's aquatic ecosystems. Recently, the highly invasive curly-leaf pondweed has spread across the state, likely through the movement of watercraft. It forms dense mats that compete with native aquatic plants and prohibit wildlife nesting and water recreation. What is worse, potential hybrids between curly-leaf pondweed and native species create "cryptic invaders", challenging questions for lake management. However, pondweeds are morphologically variable, and hybrids are particularly difficult to identify, even for experts. Therefore, the extent to which hybridization threatens our native pondweeds and our aquatic ecosystems is unknown.

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.

We propose to apply state-of-the-art DNA sequencing techniques to provide a baseline understanding of the diversity of pondweeds in Minnesota. The data-rich genetic tests will provide sufficient resolution to not only clarify species identification but also pinpoint the hybrid parents and evaluate the extent of hybridization across the state. Zacc Ramm has designed a genetic test to evaluate hybrids in pondweeds during his Master's degree at the University of South Alabama. He has completed genetic tests across the Southern and Eastern US, including all pondweed species recorded in the United States. However, sampling in the upper Midwest region, including Minnesota, has been spotty so far. Now, as a Ph.D. student in Prof. Yang's Lab at the University of Minnesota, he plans to further optimize the genetic test and conduct a statewide survey of pondweeds to understand the diversity and hybrid threats to native pondweeds in Minnesota. We propose to 1) Conduct a statewide survey of the genetic diversity of pondweeds and detect hybrids. 2) Improve species identification in the field backed by genetic data, and 3) develop publicly available genetic tests for ongoing monitoring of hybrids.

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?

1. Statewide data on pondweed diversity, including cryptic species and new locations for rare species.
2. Mapping the extent to which hybridization occurs, especially involving invasive and/or rare species.
3. Species identification photo guide backed by genetic data
4. Publicly available DNA test service for ongoing genetic monitoring of new hybrids and confirming species identity to inform management of both aquatic plants and wildlife

Activities and Milestones

Activity 1: Conduct a statewide survey of the genetic diversity of pondweeds and detect hybrids.

Activity Budget: \$210,000

Activity Description:

Minnesota has 27 native pondweed species, one non-native invasive species, plus two formally named hybrids. The project team will survey statewide for all known pondweed species and hybrids and detect new hybrids. We will sequence pondweeds from the Bell Museum collections, the bulk of which are from the DNR aquatic survey over the past 30+ years. We will conduct field surveys targeting gaps in previous DNR survey work, as well as areas with suspected hybrids. The field survey will be statewide, with special foci on the Twin Cities metro area, the Central, and the North Central areas of the state, where pondweeds are most diverse (see map in the attached visual aid). In addition, pondweed species often have vastly different environmental requirements, ecological roles, and sensitivities to factors such as water quality and pollution. However, existing lake water quality data are collected at the lake center and do not reflect conditions around the plant. Therefore, water quality data will be collected during field surveys to understand the factors affecting pondweed distribution and help inform management strategies. At least 300 Pondweed samples from at least 80 sites statewide will be analyzed from a combination of field survey and museum specimens.

Activity Milestones:

Description	Approximate Completion Date
Preliminary genetic tests from Bell Museum specimens	May 31, 2028
State-wide field survey of pondweed from 30 sites	September 30, 2028
DNA sequencing and analysis from a total of 50 sites from field and museum samples	May 31, 2029
Sample from 30 remaining sites	September 30, 2029
Finish data analysis and reporting; project results submitted for peer-reviewed publication	May 31, 2030

Activity 2: Improve species identification in the field backed by genetic data

Activity Budget: \$60,000

Activity Description:

Of ~8,000 lake surveys since 1993, DNR staff found that in 40% of them, at least one pondweed could not be identified to the species level. In addition, due to the high morphological similarity among many species, the rate of misidentification is likely high. This uncertainty and error in species identification can lead to inaccurate ecological assessment, undetected population changes, and poor management decisions. To clarify the field identification of pondweeds backed by genetic data, we will collect morphological data and take high-quality photos both in the field and from museum specimens that we sequenced. The resulting photos will be curated and made publicly available through the Minnesota Biodiversity Atlas. Together with photos from our partners in DNR, verified iNaturalist photos, and other reputable sources, we will produce an updated photo identification guide for all pondweed species in Minnesota, including hybrids, for the public and natural resources professionals. We will seek feedback from DNR staff and make these resources available through workshops and presentations to the Minnesota Native Plant Society. The final product will be made available to the public through the DNR website, Minnesota Biodiversity Atlas, and the Minnesota Wildflower website.

Activity Milestones:

Description	Approximate Completion Date
Morphological data and photos compiled	May 31, 2029
Draft field ID guide internally tested	September 30, 2029

Activity 3: Develop genetic tests for ongoing monitoring of hybrids

Activity Budget: \$30,000

Activity Description:

There is increasing public interest and demand for genetic tests to identify potential invasive, rare, and hybrid pondweeds. We will optimize our genetic tests and make them publicly available as a service for a small fee. We will work with a DNA test facility, such as the University of Minnesota Genomics Center or a commercial facility, to optimize the lab protocol. Land managers, natural resources professionals, and researchers will submit plant samples to the DNA test facility for lab analysis. We will optimize a data analysis pipeline to process the resulting DNA sequencing data and produce a report. The report will contain both technical and non-technical information on the genetic composition of the submitted sample. The genetic test will reveal the species identity of the sample and, if it is a hybrid, identify the hybrid parent. Species and hybrid identification is achieved by comparing it to the baseline genetic survey data we collected in Activity 1 of this project. The service will be publicly available through a link on the DNR website.

Activity Milestones:

Description	Approximate Completion Date
Internal tests and optimization of the DNA test	May 31, 2028
Limited offering and optimize the public-facing side	May 31, 2029
Protocols published and publicly available service is up and running	May 31, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Donna Perleberg	Minnesota Department of Natural Resources	Provide technical assistance, including suggesting priority species and collection sites, help with applying for collecting permits, and provide logistical support for accessing some sites; coordinate, and collect a subset of samples.	No
Courtney Schirmers	Minnesota Department of Natural Resources	Provide technical assistance, including suggesting priority species and collection sites, help with applying for collecting permits, and provide logistical support for accessing some sites.	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.

1. DNA test protocols and results from this work will be made publicly available through two rigorously peer-reviewed publications.
2. DNR will incorporate information from this study into future training and use the testing tool developed for confirming species identification in problematic cases; information on species distribution, especially rare or invasive species, will be submitted to DNR for management and conservation purposes; new locations will be submitted to the Natural Heritage information systems.
3. Photos and field identification guide will be made publicly available through the Minnesota Biodiversity Atlas and the Minnesota Wildflower website.
4. The pondweed DNA test service will be made available beyond this project, managed by the Yang Lab. We will charge a small fee to cover the lab and labor costs to make it sustainable.
5. Any project publication and communication will acknowledge the Environment and Natural Resources Trust Fund.

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?

The genetic test developed in this project will continue to be offered to the public beyond this project for a small fee to cover the cost of lab work and data analysis. The test protocol will be made public. Information on species distribution, especially hybrids and rare and invasive species, will be used by the Minnesota DNR for management planning. All specimens will be deposited at the University of Minnesota Herbarium at the Bell Museum. Photos and associated specimen and habitat information generated in this project will be curated in the Minnesota Biodiversity Atlas.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Preserving Minnesota Wildflower Information	M.L. 2024, , Chp. 83, Art. , Sec. 2, Subd. 03t	\$199,000

Project Manager and Organization Qualifications

Project Manager Name: Ya Yang

Job Title: Associate Professor, University of Minnesota; Curator of Plants, Bell Museum

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

Dr. Ya Yang is an Associate Professor at the University of Minnesota and Curator of Plants at the Bell Museum. Her expertise includes field collection of plants, plant genetic analysis, detecting hybrids, and curation of plant specimens. She teaches General Botany at the University of Minnesota.

Organization: U of MN - College of Biological Sciences

Organization Description:

The College of Biological Sciences is located at the Twin Cities campus of the University of Minnesota system. The college has ~150 faculty members in five departments, with over 2,500 undergraduate and graduate students in 8 undergraduate majors and 6 graduate programs. Research at the college ranges from molecules to ecosystems, with world-class facilities and research expertise.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Graduate student worker: Zacc Ramm		Lead field survey, lab work, data analysis, and curation of data and samples.			24.2%	1.35		\$127,028
1 undergraduate student worker		Assist with field work, lab work, specimen processing, and data analysis			0%	1.35		\$46,454
Bell Museum collections manager		Curate specimens and manage their accessioning, mounting, and databasing; provide specimens for DNA sampling			26.79%	0.09		\$11,955
Project lead summer salary		The project lead, Prof. Yang, will manage the budget and reporting, mentor students, and coordinate lab, field, and herbarium work.			26.8%	0.09		\$14,432
							Sub Total	\$199,869
Contracts and Services								
University of Minnesota Genomics Center or a commercial sequencing service provider	Service Contract	DNA sequencing. As the DNA sequencing technique evolves quickly, we will compare the price and quality of service to determine the service provider for DNA sequencing. \$150 per sample for 300 samples, or \$90 per sample for 500 samples.				0		\$45,000
University of Minnesota Supercomputing Institute	Internal services or fees (uncommon)	Sequence data storage and backup; high-performance computational resource for data analysis				0		\$2,000
Dive Guys Aquatic Weed Removal	Service Contract	Divers from Dive Guys remove aquatic weeds for private homeowners statewide. Although the lakes are state-owned, these sites are difficult for us to access due to privately owned lakefronts. Partnering with Dive Guys will expand the number of sampled sites, obtain whole-plant samples, and support community outreach to homeowners.				0		\$7,686
							Sub Total	\$54,686

Equipment, Tools, and Supplies								
	Tools and Supplies	Lab and field supplies	Field collection supplies, including plant press, sampling envelopes, silica gel; waders, life jackets, consumables for water quality measurements, consumables for DNA extraction (\$20 per sample for 500 extractions), and sample storage					\$15,000
	Equipment	Kayaks	Two foldable kayaks with paddles to allow lake access without having to rent a trailer					\$1,200
	Equipment	Water testing probe	To quantify water quality					\$545
	Tools and Supplies	Herbarium consumables, including mounting paper, glue, specimen folders, archival paper for labels, and other mounting supplies	For processing specimens collected in this study to be deposited to the Bell Museum collection					\$1,000
							Sub Total	\$17,745
Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	10 day trips and 10 overnight trips by two to three project personnels	Collect samples from 30 sites statewide; samples from the 50 remaining sites will be from partners and museum specimens.					\$20,000
							Sub Total	\$20,000
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Attending one national conference per year for one project personnel during year 2 and 3.	To present project findings and receive feedback from colleagues. \$1500 per conference, including registration, travel, and lodging.	X				\$3,000

							Sub Total	\$3,000
Printing and Publication								
	Publication	Open source publication cost for two peer-reviewed publications from this project	To ensure that the protocols and results of this study are searchable, publicly available, rigorously reviewed by experts outside Minnesota, and therefore credible.					\$3,000
	Printing	Paper and toner for printing	Printing for research protocols, training materials, herbarium labels, and research materials					\$500
							Sub Total	\$3,500
Other Expenses								
		Shipping	Mailing samples to outside service providers; shipping samples from out-of-state collaborators and herbaria for DNA analyses					\$500
		Field safety training	16-hr Wilderness First Aid training for two project personnel, as the project involves sampling in remote areas with no cell service, and we are working with student workers. \$350 per person for two people					\$700
							Sub Total	\$1,200
							Grand Total	\$300,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Attending one national conference per year for one project personnel during year 2 and 3.	Professional conferences on conservation genetics and the latest sequencing techniques are held out of state. We attend one national research conference each year to ensure we adopt state-of-the-art techniques in our work.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	Minnesota Department of Natural Resources (MN DNR)	100 hours of staff time from DNR aquatic plant ecologist Donna Perleberg and 60 hours from DNR aquatic botanist Courtney Schirmers over 3 years. DNR staff will provide technical assistance and coordinate sample collection for 10 sites. See form attached.	Secured	\$8,000
In-Kind	University of Minnesota	Unrecovered indirect costs of this award (54% of \$300,000 UMN direct costs)	Pending	\$162,000
			State Sub Total	\$170,000
Non-State				
			Non State Sub Total	-
			Funds Total	\$170,000

Total Project Cost: \$470,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [02f4e620-cc6.pdf](#)

Alternate Text for Visual Component

Pondweeds are abundant and ecologically important, but are difficult to identify due to hybridization and cryptic diversity. A map shows the distribution of pondweed statewide, followed by solutions that include DNA sequencing, field identification tools, and a public genetic testing service to improve conservation and management of plants and wildlife....

Supplemental Attachments

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

Title	File
Endorsement letter from University of Minnesota	c70e7591-f95.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 UMN Policy on travel 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?

Yes, Sponsored Projects Administration

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:

Zacc Ramm, Ph.D. student, College of Biological Sciences, University of Minnesota

Lori Nicol, accountant, College of Biological Sciences, University of Minnesota

Donna Perleberg, Research Scientist II / Aquatic Plant Ecologist, Minnesota Department of Natural Resources

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