



Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-294

Proposal Title: Lake Restoration, Outreach, and Algae Commoditization

Project Manager Information

Name: Matthew Julius

Organization: Minnesota State Colleges and Universities - St. Cloud State University

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Project Basic Information

Project Summary: Applying novel algal harvesting technology to restore lake ecosystems and produce a high value organic fertilizer for agricultural application. Experimentation involves public, and private institutions with community and corporate partners.

Funds Requested: \$255,000

Proposed Project Completion: July 31, 2026

LCCMR Funding Category: Methods to Protect, Restore, and Enhance Land, Water, and Habitat (F)

Project Location

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

Region(s): SW, Central,

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

Statewide

When will the work impact occur?

In the Future

Narrative

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

Lake eutrophication is a major global water quality issue and phosphorus loading is a major factor in creating eutrophic lakes. Eutrophication is defined as enrichment of waters by nutrients through either man-created or natural means. Our current knowledge of lake eutrophication indicates that phosphorus is responsible for the nutrient imbalance within lakes as well as their watersheds. When excess nutrients are added to a system, the aquatic flora is flooded with an overabundance of nutrients that creates competition between native and invasive species occurs. Our current concern with eutrophication is primarily in connection to anthropogenic activity as it causes the successional process to increase which, in turn, shortens the life cycle of the lake. Phosphorus removal occurs by primarily by assimilation via flora and fauna in the aquatic system.

We hope to quantify the effect of the algae community composition on the quality of the fertilizer. We will synthesize our findings to improve effectiveness of algal cultivation for managing nutrients and improving water quality. Generating new knowledge linking on-farm algal application to manage the nitrogen cycle will also be of great interest to natural resource managers and industry partners.

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.

This project was developed in a group effort that brought together high school students, educators, researchers, farmers, and industry personnel. Algae blooms have become a serious issue in many water bodies in MN because of nutrient runoff from industry, urban areas, and agricultural fields. Remediation of impaired water systems is very difficult and, in many cases, cost prohibitive. New technologies are emerging which can make lake water reclamation a reality by harvesting algae and cyanobacteria from impaired lakes. However, there are many questions on how to handle the harvested biomass from those lakes. One potential use is field application for crop production. This three-part project incorporates algae harvesting technology with the goal of improving water quality, educational integration with the goal of involving high school youth, and research with the goal of field testing algae biomass as a soil enhancement product. The long-range goal is to assess the harvested algae for commercial value. Algae is a very versatile product used in food, feed, fuel, plastics, nutraceuticals, pharmaceuticals, and soil enhancements.

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 demonstrate algae harvesting technology with beneficial reuse of reclaimed nutrients and water as a sustainable practice to reduce nutrient export from urban runoff and agricultural operations.

Goals are to:

1. Demonstrate the efficiency of an advanced DAF (dissolved air flotation) technology to physically remove nutrients assimilated by algae from on-farm irrigation water runoff
2. Evaluate reuse of the reclaimed nutrients as a fertilizer.
3. Evaluate and enhance the quality of the treated water as a source.
4. Effectively communicate and engage farmers and decision-makers to promote adoption and implementation of the technique as a BMP (best management practice).

Activities and Milestones

Activity 1: Algae Harvesting

Activity Budget: \$200,000

Activity Description:

Harvest algae from eutrophic lake system (Clear Lake, Sigel Township Brown County) using AECOM technology and pellet biomass into material suitable for broadcast application. Evaluate nutrients removed from Clear Lake via algal removal.

Activity Milestones:

Description	Approximate Completion Date
Harvesting	September 30, 2024
Pelleting	September 30, 2024
Aquatic Nutrient Assessment	October 31, 2024

Activity 2: Fertilizer Evaluation

Activity Budget: \$25,000

Activity Description:

Use replicated trials to investigate whether the use of algae as a soil amendment will maintain/enhance corn productivity conducted at the Southwest Research and Outreach Center. The nitrogen and phosphorus concentration in the algae biomass will be determined using standard laboratory procedures for total N and P at the MVTL lab in New Ulm and this lab result will be used to help identify the required amount of algae biomass needed to layout the treatments described below. To assess the N and P availability from the algae biomass will require the development of a N (0, 50, 100, 150, and 200 lbs. N/ac, as urea) and a P (0, 30, 60 and 90 lbs./ac, as TSP) response curves in the replicated trial. Algae biomass will be applied in amounts that would supply equivalent amounts of N and P as those used in the response curve mentioned above. Grain samples will be collected and tested for total N and P uptake. Corn will be the test crop and will be planted after small grains on a soil with a low-test P (below 10 ppm).

Activity Milestones:

Description	Approximate Completion Date
Nitrogen and Phosphorus Assay	February 28, 2025
TSP Response Curves	February 28, 2025
Crop (corn) assessment	October 31, 2025

Activity 3: Crop Plot Demonstration

Activity Budget: \$30,000

Activity Description:

Demo plots using selected treatments will be set up at the collaborating farmer's field and extension activities will be planned. All team members will be used on this goal.

Activity Milestones:

Description	Approximate Completion Date
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Plant replicate plots	June 30, 2025
Fertilizer Applications	September 30, 2025
Harvest and Evaluaton	July 31, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Tom Byrne	CarlsonSV LLP	Algal Commercialization Advisor	No
Dan Levy	AECOM	Corporate partner with commercial algal harvesting technology being deployed in lake systems	Yes
Dr. Paulo Pagliari	University of Minnesota Southwest Research and Outreach Center	Agricultural nutrient specialist coordinating ag research with algal based fertilizers.	Yes
Mary Beth Botz	St. Mary's Catholic Schools - Sleepy Eye, MN	Outreach Coordinator and K-12 Education	Yes
Jesse Zeig	Sigel Township Brown County	Farmer providing access to fields for research	Yes

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?

Nutrient mitigation in context of lake management has been a concern in urban and rural environments for over 50 years. Novel technological approaches have been limited during this time-period. This project will demonstrate a novel technology for nutrient removal and will add the benefit of market forces to the process. Shifting common barriers of who will adsorbs cost of restoration by commoditizing nuisance species. Additionally, activities will model public/corporate partnerships in to communities will involving 9-12 students in activities that promote novel bio-business curricula.

Project Manager and Organization Qualifications

Project Manager Name: Matthew Julius

Job Title: Professor of Aquatic Sciences

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

Dr. Matt Julius received his Ph.D. from the University of Michigan in 2000. After leaving Michigan in 2000 he accepted a professorship at St. Cloud State University in central Minnesota, U.S.A. He leads the anaerobic digestion and biomass production team at St. Cloud State. His primary research interests involve the systematics and evolution of diatoms (a group of microscopic algae). He has authored and co-authored several papers with manuscripts appearing in many algae focused publications along with non-algae based journals including Aquatic Toxicology and the Journal of Zoology. His long-term research goals are focused on utilizing his evolutionary expertise with microorganisms for applied applications. Collaborations in these efforts involve projects with academic and corporate partners globally with special focus in the U.S., Japan, Northern Ireland, and Nigeria. Together these research teams are identifying novel organisms for biomass production for use in nano-material, dietary supplement, nutraceutical, and pharmaceutical applications.

Organization: Minnesota State Colleges and Universities - St. Cloud State University

Organization Description:

St. Cloud State University makes a positive, long-term impact on the lives of our students. We provide rigorous and

relevant academic experiences with engaged, active learning opportunities in an intellectually vibrant, inclusive and diverse campus community. Our graduates are well-prepared to act as responsible global citizens and professionals who remain actively connected with our university.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
							Sub Total	-
Contracts and Services								
AECOM	Professional or Technical Service Contract	Transport and Deploy Algal Harvesting Technology				6		\$200,000
							Sub Total	\$200,000
Equipment, Tools, and Supplies								
	Tools and Supplies	Nutrient Assay Materials	Supplies for assaying water and fertilizer composition					\$30,000
	Tools and Supplies	Pelleting Process (Centrifuge Operation)	To pellet and dry harvested algal biomass					\$5,000
	Tools and Supplies	Outreach Materials for 9-12 Outreach	Supply and materials to support outreach educaton					\$10,000
							Sub Total	\$45,000
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
							Sub Total	-

Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Presentation with partners at Algal Biomass Summit 7 total participants.	Present project finding at the industry/ science symposium	X				\$7,000
							Sub Total	\$7,000
Printing and Publication								
	Publication	Scientific Research Article - 2	Two anticipated publications one on fertilizer/ ag outcomes and one on lake restoration					\$3,000
							Sub Total	\$3,000
Other Expenses								
							Sub Total	-
							Grand Total	\$255,000

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	Presentation with partners at Algal Blomass Summit 7 total participants.	Promote and disseminate research findings

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Acquisition and Restoration

Parcel List

Name	County	Site Significance	Activity	Acres	Miles	Estimated Cost	Type of Landowner	Easement or Title Holder	Status of Work
Clear Lake	Brown	Lake	Restoration	-	-	-			
Totals				0	0	-			

Restoration

1. Provide a statement confirming that all restoration activities completed with these funds will occur on land permanently protected by a conservation easement or public ownership.

All restoration activities will occur on public access waters

2. Summarize the components and expected outcomes of restoration and management plans for the parcels to be restored by your organization, how these plans are kept on file by your organization, and overall strategies for long-term plan implementation.

All research activities and findings will be retained and archived by St. Cloud State University via university archive system.

3. Describe how restoration efforts will utilize and follow the Board of Soil and Water Resources “Native Vegetation Establishment and Enhancement Guidelines” in order to ensure ecological integrity and pollinator enhancement.

All activities and monitoring will follow best practices as directed by state and federal guidelines.

4. Describe how the long-term maintenance and management needs of the parcel being restored with these funds will be met and financed into the future.

N/A

5. Describe how consideration will be given to contracting with Conservation Corps of Minnesota for any restoration activities.

N/A

6. Provide a statement indicating that evaluations will be completed on parcels where activities were implemented both 1) initially after activity completion and 2) three years later as a follow-up. Evaluations should analyze improvements to the parcel and whether goals have been met, identify any problems with the implementation, and identify any findings that can be used to improve implementation of future restoration efforts at the site or elsewhere.

N/A

Attachments

Required Attachments

Map

File: [4c39a2bf-b6c.pdf](#)

Alternate Text for Map

Clear Lake DNR Description...

Administrative Use

Does your project include restoration or acquisition of land rights?

Yes: Restoration,

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?

Yes

Does the organization have a fiscal agent for this project?

No

Does your project include the design, construction, or renovation of a building, trail, campground, or other capital asset costing \$10,000 or more?

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?

Yes

Do you certify that background checks are performed for background check crimes, as defined in Minnesota Statutes, section 299C.61, Subd. 2, on all employees, contractors, and volunteers who have or may have access to a child to whom children's services are provided by your organization?

Yes

