

# **Environment and Natural Resources Trust Fund**

# 2026 Request for Proposal

## **General Information**

Proposal ID: 2026-342

Proposal Title: Algal Blooms in Minnesota Lakes from Wildfires

# **Project Manager Information**

Name: Beatriz Baselga Cervera Organization: U of MN - College of Biological Sciences Office Telephone: (651) 219-9195 Email: bbaselga@umn.edu

# **Project Basic Information**

**Project Summary:** Minnesotans live the lake life, taking pride in protecting their lakes. We will explore connections between wildfires and harmful algal blooms, to help guarantee our lakes' permanent health and value.

ENRTF Funds Requested: \$682,000

Proposed Project Completion: June 30, 2029

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.

Wildfires and algae are parts of nature, and help shape Minnesota's prairies, forests, and lakes. Blooms of blue-green algae have been rare, but now are increasingly common, polluting our lakes and ponds. They threaten wildlife and recreation because of the toxins they produce and the oxygen they consume. Perhaps surprisingly, there is a connection between wildfires and algal blooms. Wildfire ash can enter and harm nearby water bodies, and wildfire smoke often travels long distances with large regional effects. The length, frequency, and total burn area have risen within the state, and smoke advisories from Canada's wildfires have increased. While it is widely accepted that wildfires increase biological activity in lakes, their effect on lakes is understudied. Wildfires are associated with elevated nutrient deposition, which can act as a "multivitamin" and trigger further algal blooms. There are strong reasons to believe that wildfires can lead to harmful consequences. Moreover, while controlled fires reduce the risk of uncontrolled wildfires and improve wildlife habitat, they can potentially affect nearby lakes. In summary, algal blooms are a fact, and wildfires and prescribed burning must be better understood. This proposal will show how much we should be worried and what we might do.

# 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 are taking a comprehensive approach to understand how ash affects algae growth. From studying lakes to conducting experiments, we aim to confirm what we observe and piece together the puzzle to improve how we manage and prevent algae blooms related to wildfires. By working with Itasca Biological Station, Cedar Creek Ecosystem Science Reserve, and public-private partners, we will monitor algae blooms before, during, and after wildfire smoke events. We'll also conduct experiments to understand the risks of harmful algal blooms caused by ash exposure. Our pristine study sites are located near the headwaters of the Mississippi River, in Itasca, and Bloms Lake at Section 17 of Toad Lake Township, Cedar Creek provides a rural setting, while the Twin Cities metro area represents an urban environment. The data we collect will be shared with Ramsey County's Environmental Services, Lake Management, to inform their managing efforts. To test the effect of ash on algae, we'll capitalize on Cedar Creek's annual prescribed burns of savannas and prairies. We'll run controlled field experiments with natural and created algal communities to see how ash affects them. Additionally, we'll study the impact of ash in the lab under various relevant environmental aspects.

# 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 survey algal communities present before, during, and after wildfire smoke advisories across a gradient of lakes expanding from pristine to urban ecosystems by generating DNA data. We will design controlled field experiments to test the link between smoke nutrient deposition and algae blooms by testing two types of prescribed fire biomes, oak savanna, and prairie. We will test the impact of ashes by conducting laboratory experiments on natural and synthetic bloom-forming algal communities. We will gather both observational and experimental data on the effect of wild and prescribed fires and test the links with harmful algal blooms.

# Activities and Milestones

## Activity 1: Monitor algal blooms during and after wildfire smoke advisories in Minnesota Lakes.

Activity Budget: \$194,000

#### **Activity Description:**

Lakewater samples will be collected before, during, and after wildfire smoke advisories over three years (wildfire seasons 2026, 2027, 2028). We will survey pristine (Elk and Itasca Lake, Itasca, and Bloms Lake), rural (Fish and Cedar Bog Lakes, Cedar Creek), and urban lakes (Como and Johanna lakes, Twin Cities Metro). From lake samples, algae, and other microorganisms would be identified and quantified via optical microscopy. DNA sequencing techniques will support the identification of microorganisms and toxicity genes. Water chemistry and quantification of algae toxins will be analysed when appropriate. Collected data will be interpreted alongside relevant metrics gathered from other monitoring sources (i.e., primary production or UV light penetration). We will work together with partners to monitor and collect lake samples throughout wildfire smoke advisories. Given the unpredictable nature of these episodes, the partnership network provides support to ensure timely and consistent sample collection, reducing traveling or in-site long-term stays. Partners will be informed of the results in real time to ensure success in implementing work plans (i.e., algae bloom advisories). This activity aims to identify temporal correlations between wildfire smoke advisories and the onset, duration, and risk of algae blooms to inform preventive and adaptive decision-making practices.

#### **Activity Milestones:**

Description	Approximate Completion Date
Lakewater samples collection before, during and after wildfire smoke advisories (wildfire seasons 2026,2027,2028)	October 31, 2028
Sample analyses and species identification	November 30, 2028
Chemical and Toxicity assays	November 30, 2028
DNA extractions and sequencing	December 31, 2028
DNA sequences analyses	February 28, 2029
Publication/Dissemination	June 30, 2029

# Activity 2: Identify bloom-forming algae response to prescribed burning smoke in field experiments.

#### Activity Budget: \$289,000

#### **Activity Description:**

Algal blooms are a particularly complicated problem, multiple microorganisms can potentially participate in causing a bloom. We have an opportunity to use Cedar Creek prescribed burning infrastructure to expose different algal communities to fire smoke and quantify ash deposition. Using different tanks in an experimental pond array, bloom-forming algal species combined with other microorganisms and fresh lake water samples will be assessed, sorted, and then identified by sequencing. Microbial communities will be studied before and after smoke exposure. Smoke-influenced water will be analyzed for different chemicals. Here, we will apply a recently developed protocol to track microbial populations via different sorting and culturing techniques. PI Prof. Baselga-Cervera has access to a flowcam and a flow cytometer, and collaborator Prof. Travisano has access to a Coulter Counter Multisizer to count cells. Algae toxin will be quantified with commercial detection tests. We will extract DNA to account for other microbes that would be hard to short and track toxicity genes. Results will identify bloom-forming algae species and microbial assemblages whose growth is triggered by ash to generate predictions. The experimental setting provides opportunities for further investigations targeting other factors (i.e., both smoke and ashes) and provides opportunities to study algae blooms.

#### **Activity Milestones:**

Description	Approximate
	Completion Date
Set up field experiment tanks	March 31, 2027
Run the ash assays	November 30, 2027
Shorting, analyses, DNA extractions, and sequencing	February 28, 2028
Sequence analysis: Identification of microorganisms	July 31, 2028
Publication/Dissemination	June 30, 2029

## Activity 3: Ash laboratory experiments on bloom-forming algal communities

#### Activity Budget: \$199,000

#### **Activity Description:**

Ash from fire is rich in nutrients and can trigger algal blooms by feeding the algae. In addition, ash can also affect other physical and chemical water parameters that, combined with other variables (i.e., increase in water temperature or shading of ultraviolet light), can foster harmful algal blooms. We aim to determine when and under which conditions microorganisms are active and when algal blooms are triggered. in laboratory settings using both lake samples and synthetically assembled microbial communities. Leveraging from robust and extensive datasets, such as historical data sets provided by the Capitol Region Watershed District from 5 Twin cities lakes, we will select different experimental variables. Ash will be obtained from Cedar Creek prescribed burning of different biomes. Investigators will explore various algal and microbial communities under different environmental conditions and ashes. This activity is independent from the previous activities proposed in this project, but data obtained in Activity 1 and 2 will provide information regarding relevant environmental variables (i.e., ash deposition, water temperature, or Ultraviolet light). Microorganisms identification, analyses, and microbial identification would use the same proposed methodology as previous activities. Results from this activity will inform decision making and buffer management techniques.

#### **Activity Milestones:**

Description	Approximate		
	Completion Date		
Perform a robust analysis of existing data sets	September 30, 2027		
Set up laboratory microcosmos and quantify ash' chemical composition	December 31, 2027		
Test different variables of interest (i.e., temperature or ultraviolet light)	December 31, 2028		
Validate the results with field experiments and monitoring observations	June 30, 2029		
Publication/Dissemination	June 30, 2029		

# **Project Partners and Collaborators**

Name	Organization	Role	Receiving Funds
Prof. Michael Travisano	University of Minnesota	Prof. Travisano (Scientific partner) will provide complementary strengths and roles in the science aspect. Travisano's lab will provide facilities and equipment to run specific microbial analyses (i.e., Coulter Counter Multisizer). He will support the experimental aspect of the proposal.	Yes
Dr. Caitlin Potter	Cedar Creek Science Ecosystem Reserve(CCSER)- University of Minnesota	Dr. Potter acts as CCSER station support. She will provide support to obtain the station's sampling permissions, help articulate safety plans for sampling during wildfire smoke advisories, and prescribed fire field experiments. She will coordinate logistics regarding prescribed fire field experiments and provide access to the station.	No
Prof. Jonathan Schilling	Director of Itasca Biological Station and Laboratories (IBSL)-University of Minnesota	Dr. Schilling, as the Director of IBSL, will provide access to the properties and laboratory facilities, facilitate communication and permits with Itasca State Park, assist in monitoring wildfire smoke events, and support the identification of sampling locations.	No
Lake Johanna Improvement Society	Lake Johanna Improvement Society	"See something, say something" notifications, using iNaturalist.	No
John Manske	Ramsey County Environmental Services, Lake Management	John Manske serves as liaison with Ramsey County Lake management, providing information on urban lakes that includes chemical analysis of phosphorus, nitrogen, and Chlorophyll A as well as phytoplankton and zooplankton community assessments.	No
Mr and Ms Lehman	Blom lake privete owners	They would provide access to Blom lake and help record observations, take samples, and assist in any other ways with your important project.	No

# 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?

We will continue collaborating with Itasca, Cedar Creek, Ramsey County, and other partners to provide recommendations within the existing policies and procedures, including prescribed fire management policies; monitoring algae blooms after a wildfire smoke advisory; and complementing existing Lake monitoring datasets. Relevant findings will be communicated in scientific venues —publications, conferences, and university talks—, shared with government representatives, and presented in public forums (i.e., NatSci at Itasca State Park). We will seek future grant appropriations by targeting large-scale federal opportunities such as the NSF, EPA or USDA, private companies and foundations (i.e., The Water Research Foundation).

# Project Manager and Organization Qualifications

#### Project Manager Name: Beatriz Baselga Cervera

Job Title: Assistant professor

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

Beatriz Baselga Cervera is a principal investigator of ecological ideas at the School of Biology at the University of Minnesota. For the past thirteen years, Beatriz has investigated freshwater microbial communities. Her doctoral degree focused on the study of the rapid adaptation of microalgae and bacterial communities in mining ponds. During her postdoctoral work, she investigated the adaptation in microalgae, cyanobacteria, and yeast to pollutants and other

selective pressures. Her lab focuses on the integration of experiments and field observations to address biological diversity, toxicology, pollution and ecological questions of freshwater microbial communities. She is the main author of multiple publications in scientific journals (i.e., Journal of Phycology, Aquatic Toxicology, Scientific Reports or Ecotoxicology), two patents, and participated in several scientific projects (i.e., "Cyanotoxin Bioremediation with Microbes" or "Selection and adaptation of a toxicity test for microcystin: assistance at early warming levels".). Her expertise spans project management, experimental design, data collection, dissemination, mentoring, and funding acquisition. In the present proposal, she will act as the principal investigator as well as the aquatic microbiologist, and she will coordinate the different partnerships, hire the research personnel, and lead the experimentation and other necessary operations.

Organization: U of MN - College of Biological Sciences

#### **Organization Description:**

This project is a collaboration of three entities at the University of Minnesota College of Biological Sciences ((1) Ecology, Evolution, and Behavior (EEB) Department, (2) Cedar Creek Ecosystem Science Research Station (CCSER), and (3) Itasca Biological Station and Laboratories (IBSL)) and public-privete partnerships (Lake Johanna Improvement Society, privete lake owners and Ramsey County Environmental Services, Lake Management), with strengths in environmental, natural, ecological, monitoring and experimental Lakes studies. The University of Minnesota EEB Department will manage this project and it will be formally housed in the Baselga-Cervera laboratory. EEB department will provide office and laboratory space, laboratory operation and maintenance services, administrative support, investigation centers support and special rates, and access to several world-renowned experts in the field of ecology.

# Budget Summary

Category /	Subcategory	Description	Purpose	Gen.	%	#	Class	\$ Amount
Name	or Type			Ineli	Bene	FTE	Ified	
Personnel				gible	nts		Stall	
Principal		Overall project coordination lab and field			26.8%	0.45		\$85,000
Investigator-		experimental design support with high skills			20.070	0.45		<i>\$03,000</i>
Baselga Cervera		laboratory techniques training results curation						
		overseeing results analyses and data management.						
		developing dissemination materials.						
Scientific		Support with lab and field experimental designs,			26.8%	0.21		\$65,000
Collaborator-		results analyses, and developing dissemination				-		,,
Travisano		materials. Provide specific laboratory resources.						
Postdoctoral		Oversee others' laboratory and fieldwork, sampling			20.6%	2		\$184,000
associate		second and thrid year (2 people needed due to						
		simultaneus need of sampling of Itasca and						
		CCESR/Twin cities). Manage data and compile						
		results. High-level technical bioinformatics analysis						
		skills						
Graduate		Lead fieldwork, organize lab workflow, oversee			43.2%	2		\$129,000
student		other field/lab techs and students as needed,						
		organize and run equipment, and high-level						
		technical laboratory work (i.e., ELISA). Sampling						
		years 1 and 2 (2 people needed due to simultaneus						
		need of sampling of Itasca and CCESR/Twin cities).						
Research		Assist in fieldwork, lab work, data entry, curation,			24.4%	1		\$65,000
Specialist		labeling, sample preparation, long-term sample						
		storage. Support sampling years 1 and 2 (2 people						
		needed due to simultaneus need of sampling of						
		Itasca and CCESR/Twin cities). Position part-time						
		(20h/week) during the first and second year.						
Undergraduates		Assist with lab and field work, experiment			0%	0.75		\$12,000
		preparation and set-up, and enter data. One						
		undergradute summer support each year.						4
							Sub	\$540,000
							Total	
Contracts and								
U of M	Internal	UMN Genomic Center sequences DNA which would				0.03		\$48,000
genomics	services or	be used for shotgun metagenomics and other DNA				0.05		Ş40,000
center		analyses. Internal pricing for 200 shotgun DNA						

				1	1		
	tees	samples (water origin) with library prep. is about					
	(uncommon)	\$13,782.40 (see quote)—estimate: 200 samples per					
		vear.					
		Other sequencing costs \$2000 per year					
LL of M	Internal	Including: Nitrate (Nitrite, total phosphorous, solids			0.02		¢10.000
		and 27 shares at a including such hur and increased			0.05		\$10,000
Research	services or	and 27 elements including sulphur and iron, and					
Analytical	tees	other chemical values and service; approx. \$166 per					
laboratory	(uncommon)	sample internal rate. Total: \$10,000 per 60 samples.					
						Sub	\$58,000
						Total	
Equipment.							
Tools and							
Supplies							
Supplies	To alla ave al	New Constalized Lab Colonatilia on Field Complian	These supplies are useded to some				¢60.000
	Tools and	Non-Capitalized Lab Scientific or Field Supplies	These supplies are needed to carry				\$60,000
	Supplies		out the field sampling, and both the				
			field and laboratory experiments. For				
			DNA extraction and lab work, for any				
			analyses needed, safety equipment.				
			ELISA kits to detect cvanotoxins. crvo				
			vials and curation supplies \$20,000				
			nor yoar				
							¢6,000
	Tools and	Equipment maintenance	Parts and service to keep necessary				\$6,000
	Supplies		instruments functioning				
						Sub	\$66,000
						Total	
Capital							
Expenditures							
•						Sub	-
						Total	
A						TOLAI	
Acquisitions							
and							
Stewardship							
						Sub	-
						Total	
Travel In							
Minnesota							
	Miles/Meals/	Mileage reimbursement for a subset of fieldwork at	For surveying Jakes (at Cedar Creek				\$14,000
	Lodging	70/mile (IPS standard rate) /a)Turin Cities mater	and Itasca) and urban lakes (Turin				Ş14,000
	Longing	. / o/ mile (IKS stanuaru rate). (a) I win cities metro	anu itasca) anu urban iakes (Twin				
		lakes (16 miles sampling roundtrip= \$11). (b)CCESR	Cities metro). For carrying out the				
		(70 miles sampling roundtrip=\$48) (c)Itasca (460	field experiment at Cedar Creek.				
		miles sampling roundtrip =\$322). Overnight lodging					
		and meals at approved rates (Itasca studio cabin					

		one person; \$45/night, full day meals \$42.00/person/day). Total trip and 2/nights=\$409. Sampling the 3 locations (one person each) = \$468. Total;\$468 x 9 samplings x3 years= \$12500. Field experiments at CCESR; \$48x30 trips=\$1500.				
					Sub Total	\$14,000
Travel Outside Minnesota						
					Sub Total	-
Printing and Publication						
	Publication	Scientific Publication	Open-source journals are available to anyone. Publications are key to advancing scientific knowledge, reporting observations, and inciting further research.			\$4,000
					Sub Total	\$4,000
Other Expenses						
					Sub Total	-
					Grand Total	\$682,000

# Classified Staff or Generally Ineligible Expenses

Category/Name Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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## Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	INDIRECT - 54% MTDC	Indirect costs associated with this proposal at 54% MTDC	Secured	\$346,000
			State Sub	\$346,000
			Total	
Non-State				
			Non State	-
			Sub Total	
			Funds	\$346,000
			Total	

#### Total Project Cost: \$1,028,000

This amount accurately reflects total project cost?

Yes

# Attachments

## **Required Attachments**

*Visual Component* File: <u>eecd9b17-2eb.pdf</u>

#### Alternate Text for Visual Component

A) Nutrient deposition from wildfires ash and smoke can act as a "multivitamin" and trigger algal blooms (Source: figure partially created with Biorender). (B) Detailed rivers and lakes map of Minnesota state, USA (Source: map source vidiani.com). Marked locations represent the seven lakes proposed to be surveyed....

#### Supplemental Attachments

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

Title	File
Approval Letter From UMN Board	4b563172-7b0.pdf
Lehman's letter of support	<u>2f98c776-8c4.pdf</u>
U of M Genomics Center service quote	d9a5b3d8-0af.pdf
Cedar Creek Science Ecosystem Reserve support letter	<u>3dca8676-c42.pdf</u>
Director of Itasca Biological Station and Laboratories support	202efa1c-13e.docx
letter	
Ramsey County Environmental Services, Lake Management	e00b2076-159.docx
support letter	

# 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?

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Yes, I understand the UMN Policy on travel applies.
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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?

Yes

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:

University of Minnesota and Dr. Michael Travisano (Scientific Partner)

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

N/A