

**Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 112-B

Assessing Human Exposure Risk to Harmful Algae Blooms

Category: B. Water Resources

Sub-Category:

Total Project Budget: \$ 529,632

Proposed Project Time Period for the Funding Requested: June 30, 2023 (3 yrs)

Summary:

Developing needed economic framework and tools for communities so they can assess the associated health risk and costs of chronic exposure to harmful algal blooms poisoning in lakes and ponds

Name: Shahram Missaghi

Sponsoring Organization: U of MN

Job Title: Dr.

Department: Extension

Address: 4100 220th Street W.

Farmington MN 55024

Telephone Number: (952) 221-1333

Email miss0035@umn.edu

Web Address:

Location:

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

It shows that we will use field data to develop HABs' Exposure Risk Maps to determine potential human health risk that will make the MN communities more resilient to HABs

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____ %



Environment and Natural Resources Trust Fund (ENRTF)
2020 Main Proposal

PROJECT TITLE: Assessing Human Exposure Risk to Harmful Algae Blooms

I. PROJECT STATEMENT

There is too much at stake to ignore the threat of **Harmful Algae Blooms (HABs)** in MN lakes where they pose serious risk and **problems** to ecosystems and specifically to human health. We have the **opportunity** to develop an economic framework, tools, and **solutions** for Minnesota (MN) communities to assess the health costs associated with chronic exposure to HABs in lakes and ponds. Over 170 possible cases of illness are associated with Cyanotoxins, a toxin and a potential carcinogen produced by freshwater blue-green HABs, which can cause gastrointestinal diseases (diarrhea, abdominal pain, nausea, vomiting, fever or abdominal cramps) in HAB-related water recreational exposures. What is missing, is a framework and the necessary tools to assess the health risks and costs of human exposure to regularly occurring and persistent HABs in lakes and ponds. After completion of this project, the MN policy makers, health, and environmental managers will:

- have access to tools that can assess and minimize public health risk of HABs exposure at public beaches, water recreational activities, and drinking water supplies (25% of MN population), and
- be better suited to fight HABs' impending and increasing presence and become resilient to the negative environmental, economic, and health threats of HABs poisoning.

How will we achieve our goals? Our team will monitor three healthy and three algae infested lakes in northern, central, and southern regions of the State. We will gather pre-identified health data and metrics (such as the occurrence of asthma or the common cold) for each lake region to develop the associated HABs-linked health cost values. Ultimately, past and current research will be incorporated to create tools for assessing HABs' exposure risk and mitigation. Our unparalleled approach is one of the first work to document cost assessment of human health poisonings by HABs in MN communities.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Launching, staging, and getting the project off the ground

Objectives: partners meet, finalize plans, establish monitoring protocols, and initiate community engagement. Finalize 6 HAB infested and healthy lakes in northern, central, and southern MN regions. Prepare drone (DJI Matrice 100) with spectral-Tetracam and water temperature sensor. Deploy the autonomous continuous water quality monitoring station (buoy). Hire a graduate student to operate drones, conduct literature reviews, and prepare the pre-tested computer model for producing exposure risk maps.

ENRTF BUDGET: \$ 245,952

Outcome	Completion Date
1. Initial partners in-person meeting, finalizing monitoring and sampling plans/protocols	11/1/2020
2. Contact, visit, and engage with communities surrounding selected lakes	11/1/2020
3. Equipment, materials procurement, configurations, and field preparation	2/1/2021

Activity 2: All hands on deck with lake monitoring, laboratory analysis, and modeling

Objectives: conduct field investigation to produce field verified chronic exposure risk maps. Use buoy and drones to intensely monitor selected HAB infested lakes to produce and field verify HAB exposure risk maps that demonstrate the seasonal and accumulative potential human exposure to HABs. Sustain community engagements.



Environment and Natural Resources Trust Fund (ENRTF)
2020 Main Proposal

ENRTF BUDGET: \$ 139,590

Outcome	Completion Date
1. Deploy buoy, conduct drone flights, carry out HAB toxin testing-1st-year field sampling	5/1/2021
2. Monitoring data analysis, calibrating and validating the site-specific 3D HAB prediction model, and producing and verification of the human health HAB-exposure risk maps.	2/1/2022

Activity 3: The product - developing an economic framework to assess associated health costs of HABs

Objectives: to generate a framework to assess HAB costs that will inform policy-makers and management. We will develop health cost estimates for the state of Minnesota by conducting a review of the HAB and water body valuation literature, and a statistical economic analysis on health data relating to concerns such as Alzheimer's, asthma, the common cold, and pet poisonings on three lakes which commonly experience HABs in the summer, and three lakes which do not experience HABs (as a control). We will purchase sales data for products related to treatment (such as cold medicine and inhalers), in order to estimate health spending. We will also use available data for such as county hospital intake records to estimate Alzheimer's rates and animal poison control data for pet poisonings. With data generated in Activity 1 and Activity 2, we will create a HAB health prediction model. The prediction model will be combined with the economic health cost estimates to generate a framework to assess HAB costs at specific lakes, which will inform policy and management. We will also 1) create a lake algae and toxin monitoring website, 2) create exposure maps, 3) provide drinking water intake designs, and 4) make all data and protocols available online.

ENRTF BUDGET: \$ 144,090

Outcome	Completion Date
1. Literature Review and Economic Data Collection and Assessment	12/30/2021
2. Health Data Collection and Analysis and Prediction Model Development	7/30/2022
3. Economic Framework Development	7/30/2022
4. Outreach: Website, map, and designs generated and made available	12/30/2022
5. Data analysis, compiling reports, and write publications	12/30/2022

III. PROJECT PARTNERS:

Name	Title	Affiliation	Role
A. Partners receiving ENRTF funding			
Shahram Missaghi, PhD	Extension Professor	UoM Extension	Principal Investigator
Lucia Levers, PhD	Research Associate	UoM WRC	Co-Principal Investigator
Miki Hondzo, PhD	Professor	UoM SAFL	Co-Principal Investigator

IV. LONG-TERM- IMPLEMENTATION AND FUNDING:

The occurrences and intensities of harmful algae blooms are on the rise. Beyond ecological damages they also pose a serious human health risk, which has economic consequences. This project will create tools that for the first time, allow communities around the infested lakes to assess the health cost associated with HABs and to become stronger and more resilient to HABs occurrence. The project sponsor currently leads the Minnesota HABs Group and will continue to nurture collaboration among all stakeholders, promote original discoveries, develop research supported educational materials, and to train water resources' professionals and communities.

V. TIMELINE REQUIREMENTS:

The project is for 3 years: starting on July 1, 2020, and ending on June 30, 2023. Periodic project status update will be submitted January 1 and July 1 of each year with a final report submitted by June 30, 2023.

Attachment A: Project Budget Spreadsheet
 Environment and Natural Resources Trust Fund
 M.L. 2020 Budget Spreadsheet

Legal Citation:

Project Manager: Shahram Missaghi

Project Title: Assessing Human Exposure Risk to Harmful Algae Blooms

Organization: Regents of the University of Minnesota

Project Budget: \$529,632

Project Length and Completion Date: 36 months, 6/30/2023

Today's Date: April 11, 2019



ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
BUDGET ITEM				
Personnel (Wages and Benefits)		\$ 448,632	\$ -	\$ 448,632
Principal Investigator \$46,230 (74% salary, 26% fringe) 15% FTE yrs 1 & 2, 10% FTE yr 3				
Professor \$55,057 (74% salary, 26% fringe) 10% FTE yr 1, 5% FTE yrs 2 & 3				
Researcher \$80,685 (74% salary, 26% fringe) 30% FTE each year for 3 yrs				
Grad Student (Academic Term) \$105,090 (47% salary, 53% fringe) 50% FTE each year for 3 years				
Grad Student (Summer term) \$19,040 (86% salary, 14% fringe) 50% FTE each year for 3 years				
Grad Student (Academic Term) \$105,090 (47% salary, 53% fringe) 50% FTE each year for 3 years				
Undergraduate student \$18,720 (100% salary, % fringe) 25% each year for 3 years				
Undergraduate student \$18,720 (100% salary, % fringe) 25% each year for 3 years				
Professional/Technical/Service Contracts		\$ -	\$ -	\$ -
Equipment/Tools/Supplies		\$ 61,500	\$ -	\$ 61,500
Buoy maintenance: wind cup, vane anemometer, thermistors, temperature & RH sensors (\$15,000)				
HABs & water quality 3D modeling: 1 time site registration + maintenance license (\$10,000) to obtain and install the latest compiled software and tailor for this project. The model has been repeatedly tested and proven in MN				
Toxic testing kit (Microcystin ELISA kit) (\$12,000) The purpose of the testing is to identify, detect, and assess the toxicity of the various blooms; 24 kits @ \$471/kit + \$45 shipping				
Consumable supplies: Field supplies, chemical and nutrient buffers, etc (\$10,500)				
Data purchase (\$4,000)				
Website expenditures (\$10,000) develop a project website that has written, visual, and video instructions and training on how to use the tools developed from this project. Plus, offer readily available project results in text and infographics.				
Capital Expenditures Over \$5,000		\$ -	\$ -	\$ -
Fee Title Acquisition		\$ -	\$ -	\$ -
Easement Acquisition		\$ -	\$ -	\$ -
Professional Services for Acquisition		\$ -	\$ -	\$ -
Printing		\$ 4,500	\$ -	\$ 4,500
Publications				
Travel expenses in Minnesota		\$ 15,000	\$ -	\$ 15,000
Travel within MN: Travel to and from site locations for data collection; will cover mileage and lodging. All expenses will be in accordance with the University of Minnesota Travel and Reimbursement policies				
Other		\$ -	\$ -	\$ -
COLUMN TOTAL		\$ 529,632	\$ -	\$ 529,632
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		\$ -	\$ -	\$ -
State:		\$ -	\$ -	\$ -
In kind:			\$ -	\$ -
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance
		\$ -	\$ -	\$ -

Assessing Health Cost of Human Exposure to Chronic Harmful Algae Blooms (HABs)

We will chose both HAB infested and healthy lakes to study

And
use

And
use

Drones

Buoy

Students

To
create

**HAB Exposure
Risk Maps**

OUTCOMES

Risk Management
Tools
&
Minnesota
Communities Resilient
to HABs

**Health
Expenditures**

**Disease
Rates**

**Literature
Review**

To
estimate

**HAB Human Health
Costs**

Project Manager Qualifications and Organization Description

Shahram Missaghi, Extension Professor. Minnesota Extension, University of Minnesota

Education: B.S. (1986), and M.Sc. (1988), Biology, Bemidji State University, Bemidji, MN. Post B.S. Certificate, Stream Restoration, 2009, University of Minnesota, Twin Cities, MN. Ph.D., Limnology, 2014, University of Minnesota, Twin Cities, MN, United States.

Dr. Missaghi will be the project manager and responsible for project administration, management, budgeting, procuring new equipment, and outreach. He develops research supported water resources education and training for the current and the next generation water resources professionals and communities. He will also be responsible for the 3D computer modeling to produce the harmful algal blooms (HABs) exposure maps. Dr. Missaghi is published and has over 20 years of experience in lake management and outreach education, with the past 10 years focused on HABs research.

He currently leads the MN Harmful Algal Bloom Group and the 2019 Minnesota Water Conference – Special HAB Session. He is also a member of the 12 central states' North Central Region Water Network HABs Project Team and the 2020 North American Lake Management Society Conference – HAB Track. Dr. Missaghi has also developed the MN HAB webpage (<http://HAB.umn.edu>) and the HAB Mobil Educational Trailer which both of these educational tools will be used in the extension of this project.

Organization Description

The University of Minnesota Extension Water Resource team connects community needs and University resources to address Minnesota's critical water resource issues. We model effective education to ensure safe and sustainable water resources. And we provide expertise and collaborative support for watershed and water basin resources, stormwater education, shoreland education, and sewage treatment education for homeowners, communities, and professionals. University of Minnesota Extension takes into account diverse views and multiple land uses by drawing on our expertise in agriculture, natural resources, and citizen leadership.

Working with local communities, Extension employs a balanced, research-based, solution-focused approach, providing a trusted source of accurate information and to provide evaluation and technical expertise in areas of safe drinking water, aquatic invasive species, drainage, water valuation, nutrient management, and program evaluation. Much of the proposed field and laboratory research will be also conducted in collaboration by the St. Anthony Falls Laboratory (SAFL), University of Minnesota – a well-known facility that is equipped with chemistry and biological laboratory, drones, buoy, incubators, and the necessary materials and supporting equipment and staff needed to carry out the proposed research.