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

Project Title: **ENRTF ID: 234-F**

Reducing Sediment Loading and Temperatures in Northshore Streams

Category: F. Methods to Protect, Restore, and Enhance Land, Water, and Habitat

Sub-Category:

Total Project Budget: $ 383,744

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

Summary:

This project will determine riparian vegetation best management practices to enhance habitat in the Northshore trout streams and reduce contaminant loading to Lake Superior.

Name: William Herb

Sponsoring Organization: U of MN

Job Title: Dr.

Department: St. Anthony Falls Lab, College of Science and Engineering

Address: 2 Third Ave SE

Minneapolis MN 55414

Telephone Number: (612) 624-5147

Email herb0003@umn.edu

Web Address:

Location:

Region: Northeast

County Name: Cook, Lake, St. Louis

City / Township:

Alternate Text for Visual:

Figures showing a larger stream shaded by trees and a smaller stream shaded by grasses.

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

PROJECT TITLE: Reducing Sediment Loading and Temperatures in Northshore Streams

I. PROJECT STATEMENT

The goal of this project is to determine riparian vegetation best management practices to reduce both sediment loading and water temperatures in the Lake Superior tributaries.

The Problem: The trout fisheries in the Lake Superior North Shore tributaries face multiple threats, including excess sediment loading and increasing water temperatures. Excess sediment is a source of impairment in ten streams along the Lake Superior North Shore, including streams in Duluth (Amity Creek and Lester River) and streams along the Northshore (Knife and Poplar Rivers). Excess sediment loading impacts fish habitat in the streams, but also impacts the near-shore waters of Lake Superior by transporting nutrients, bacteria, and other contaminants into the lake. The combination of land development, increasing air temperatures, and the lack of deep groundwater aquifers also make these streams very susceptible to increasing water temperatures, which impacts trout reproduction and survival.

The Solution: Managing riparian vegetation cover (vegetation near a stream or river) is a viable best management practice for reducing sediment inputs from a watershed and for reducing water temperatures. In addition to enhancing stream bank stability and reducing erosion, riparian vegetation can trap sediment and nutrient loading from watershed-based sources (e.g., forest harvest, residential development) and reduce water temperatures by blocking solar radiation. However, a single type of vegetation cover may not be effective for reducing both sediment loading and reduce water temperatures. For example, riparian areas with mature forest cover and minimal understory vegetation provide good shading, but may not provide sufficient stream bank stability and runoff filtering in watersheds with development. Riparian areas with native grass vegetation provides less shading than trees, but may provide better bank stability and runoff filtering capacity.

This study will determine the best strategies for managing riparian vegetation to both reduce sediment loading and reduce water temperatures. The data and guidelines developed in this project will also be useful for other regions of the state, such as the trout streams in the Twin Cities metro region.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Stream sediment and water temperature measurements

Available suspended sediment, water temperature, and flow data will be reviewed, including data associated with TMDLs and WRAPS. Based on the available data, a set of 3 to 4 study watersheds will be selected, including both impaired and unimpaired watersheds. Additional total suspended sediment (TSS) and temperature monitoring sites will be set up in the study watersheds. Suspended sediment samples will be taken in the study watersheds to verify the TSS monitoring and characterize the sediment load (particle sizing). Water temperature loggers will be installed to monitor stream temperature.

ENRTF BUDGET: $99,494

Outcome	Completion Date
1. Site selection and measurement plan	*4/2021*
2. Quantify sediment loading and stream temperature in the study watersheds	*12/2022*

Activity 2: Field Assessment of Riparian Vegetation and Bank Erosion

The current riparian vegetation will be assessed for a set of sub-catchments within the study watersheds, over a range of stream sizes. Measurements will include characterization of the tree canopy, shading conditions and presence of grassy vegetation. Stream bank erosion will also be assessed in a subset of stream reaches.

ENRTF BUDGET: $133,091

Outcome	Completion Date
1. Riparian vegetation and shading maps	*9/2022*
2. Bank erosion maps	*9/2022*

Activity 3: Guidelines for Managing Sediment and Temperature using Riparian Vegetation

Based on the data taken in the study watersheds in Activities 1 and 2, the current shading and temperature conditions will be assessed, and the relationships between riparian vegetation, bank erosion, and sediment loads will be explored. The effects of different riparian vegetation types on sediment loading and water temperature will be summarized over a range of stream sizes and land cover conditions. LiDAR-based vegetation maps (ongoing MNDNR/USEPA project) will be used to extend the results of the study outside of the study watersheds.

ENRTF BUDGET: $151,159

Outcome	Completion Date
1. Summary of vegetation-sediment loading relationships	*12/2022*
2. Regional workshop for riparian vegetation management	*3/2023*
3. Guidelines document for riparian vegetation management	*6/2023*

III. PROJECT PARTNERS AND COLLABORATORS:

The project team will include:
Dr. William Herb (UMN, St. Anthony Falls Lab) (Principal Investigator)
Dr. John Gulliver (UMN, Department of Civil, Environmental and Geo- Engineering)
Dr. Lucinda Johnson (UMD, Natural Resources Research Institute)
Dr. Valerie Brady (UMD, Natural Resources Research Institute)
Dr. Meijun Cai (UMD, Natural Resources Research Institute)

Herb, Johnson, Gulliver, and Brady will lead the project. Herb will be the lead P.I. and perform some of the analysis work, along with Cai. NRRI staff will perform the field measurements and data quality control. Site selections and monitoring efforts will be coordinated with the MN DNR (John Jereczek), the MPCA (Tom Estabrooks), and the South St. Louis SWCD (Kate Kubiak). Results of an ongoing project by John Jereczek (MN DNR), Tom Hollenhorst (USEPA) and Clint Little (MN DNR) to map riparian vegetation using MN state LiDAR data will be used for extend the results of the project to unsurveyed streams.

Several SAFL and NRRI research staff involved with this project, including Herb and Cai, have a significant fraction of their time funded by ENTRF. They are not teaching faculty and depend on grant monies to pay their salaries.

IV. LONG-TERM IMPLEMENTATION AND FUNDING:

This project will provide guidelines for managing riparian vegetation to reduce both sediment loading and water temperatures in the Duluth/Northshore tributaries. These guidelines can feed directly into TMDL implementation plans and the regional WRAPS (Watershed Restoration and Protection Strategy), to help guide stream restoration projects such as bank stabilization and shading augmentation in impaired watersheds, working through the Soil and Water Conservation districts. While this study will focus on the Northshore region, the data and guidelines developed in this project will be useful for other regions of the state, such as the trout streams in the Twin Cities metro region (e.g. Vermillion River, Brown's Creek). In addition to working with MPCA and DNR personnel to develop and publicize the information, we will also work with UMN extension staff.

Attachment A: Project Budget Spreadsheet
Environment and Natural Resources Trust Fund
M.L. 2020 Budget Spreadsheet
Legal Citation:
Project Manager: William Herb
Project Title: Reducing Sediment Loading and Water Temperatures in Northshore Streams
Organization: Regents of the University of Minnesota
Project Budget: $383,744
Project Length and Completion Date: 3 years, June 2023
Today's Date: 4/15/2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	$ 359,132	$ -	$ 359,132
Herb (PI): Management, data analysis, 28% FTE, 74% Salary, 26% benefits, 36 months ($95,036)			
Johnson (co-PI):Project management, 5% FTE, 74% Salary, 26% benefits, 36 months ($33,947)			
Gulliver (co-PI): Project planning, 3% FTE, 74% Salary, 26% benefits, 36 months ($22,875)			
Brady (co-PI): Field work management, 4% FTE, 74% Salary, 26% benefits, 36 months ($14,575)			
Cai (co-PI): Data analysis, 17% FTE, 74% Salary, 26% benefits, 36 months ($51,987)			
Hell, Field data collection, 23% FTE, 77% Salary, 23% benefits, 36 months ($46,566)			
Hanson, Field data collection, 23% FTE, 77% Salary, 23% benefits, 36 months ($34,112)			
Dumke, Data collection and QC, 20% FTE, 74% Salary, 26% benefits, 36 months ($52,943)			
Temporary Tech Staff, Field data collection, 7% FTE,92% Salary, 8% benefits, 36 months ($7,091)			
Note: Herb, Cai, Hell, Hanson, and Dumke have a significant fraction of their time funded by ENTRF. They are soft-funded staff and depend on grant monies to pay their salaries.			
Professional/Technical/Service Contracts			
	$ -	$ -	$ -
Equipment/Tools/Supplies			
8 TSS sensors ($8800), 2 data loggers ($1300), Misc. Field Supplie ($1250)	$ 11,350	$ -	$ 11,350
Capital Expenditures Over $5,000			
	$ -	$ -	$ -
Fee Title Acquisition			
	$ -	$ -	$ -
Easement Acquisition			
	$ -	$ -	$ -
Professional Services for Acquisition			
	$ -	$ -	$ -
Printing			
	$ -	$ -	$ -
Travel expenses in Minnesota			
Field staff travel ($7,797), meetings ($1,991), in-state conference for outreach ($1,614). All costs per University of Minnesota travel policies	$ 11,402	$ -	$ 11,402
Other			
Water sample testing (120 samples)	$ 1,860	$ -	$ 1,860
COLUMN TOTAL	$ 383,744	$ -	$ 383,744

SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		$ -	$ -	$ -
State:		$ -	$ -	$ -
In kind: Unrecovered UMN Indirect costs (54% MTDC)		$ 207,222	$ -	$ 207,222

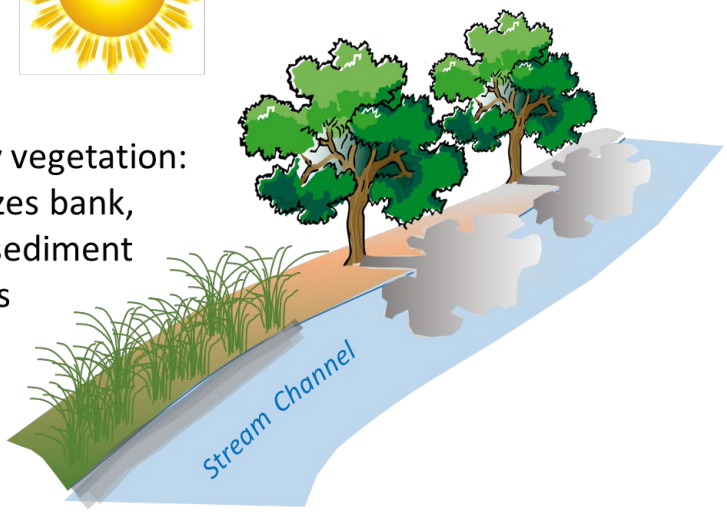
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance
		$ -	$ -	$ -

Project Goal: determine riparian vegetation best management practices to reduce both sediment loading and water temperatures in the Lake Superior tributaries.

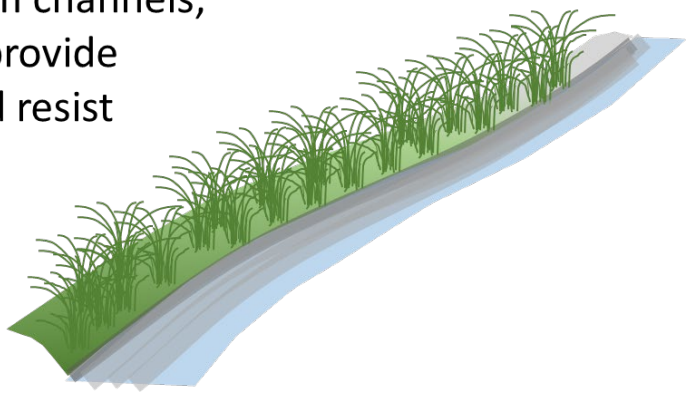
- Monitor stream temperature and sediment concentration
- Perform field surveys of vegetation and bank erosion
- Determine which riparian vegetation types perform best to reduce both water temperature and sediment loading

Trees: provides shading, reduces water temperature

Grassy vegetation: stabilizes bank, traps sediment inflows



For narrow stream channels, tall grasses may provide good shading and resist erosion



2020 LCCMR Project Manager Qualifications and Organization Description

William Herb, St. Anthony Falls Laboratory, University of Minnesota

Key Qualifications
William Herb has conducted research on lake and stream water quality and hydrology for the past seventeen years. His work has included a number of projects on stream temperature, including work on Miller Creek in Duluth, the Vermillion River, and on the Northshore trout streams. He is currently PI on the LCCMR project "Enhancing Spawning Habitat Restoration in Minnesota Lakes", was recently a PI on a MnDOT-funded project to study the transport of road salt through watersheds in Minnesota, and led a BWSR-funded project studying studying stream shading enhancements for Brown's Creek, in Stillwater, MN.

Education
M.S., Water Resources Science, University of Minnesota 2003
Ph.D., Mechanical Engineering, University of Minnesota 1996
M.S., Mechanical Engineering, University of Minnesota 1991
B.S., Mechanical Engineering, University of Wisconsin 1985

The **St. Anthony Falls Laboratory** (SAFL) is an interdisciplinary fluid mechanics research and educational facility of the College of Science and Engineering at the University of Minnesota. The mission of SAFL is 1) to advance fundamental knowledge in engineering, environmental, geophysical, and biological fluid mechanics, 2) to benefit society by implementing this knowledge to develop engineering solutions to major environmental, water, ecosystem, health, and energy-related problems, and 3) to disseminate new knowledge to University of Minnesota students, the engineering and scientific community, and the public.

The **Natural Resources Research Institute** (NRRI) is a part of the University of Minnesota Duluth. Its mission is to deliver research solutions to balance our economy, resources and environment for resilient communities. NRRI scientists have extensive experience in managing large, interdisciplinary projects. Major objectives include the development of tools for environmental assessment and resource management. NRRI's role is as a non-partial, science-based resource that develops and translates knowledge by characterizing and defining value-resource opportunities, minimizing waste and environmental impact, maximizing value from natural resource utilization and maintaining/restoring ecosystem function. Major outcomes include informing environmental management and policy and assisting industry and communities in defining and maintaining the social license to operate in natural systems.