**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**

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| **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**

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| **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**

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| **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.