

**Environment and Natural Resources Trust Fund
2010 Request for Proposals (RFP)**

LCCMR ID: 024-A3

Project Title:

Assessing the Cumulative Impacts to Near-Shore, In-Water Habitat

LCCMR 2010 Funding Priority:

A. Water Resources

Total Project Budget: \$ \$402,876

Proposed Project Time Period for the Funding Requested: 3 years, 2010 - 2013

Other Non-State Funds: \$ \$0

Summary:

Research for future efforts for near-shore, in-water restoration and model development that predict outcomes of human activities to guide lake managers toward sustainable lake-shore development.

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Sponsoring Organization: U of MN

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Location:

Region: Statewide

County Name: Aitkin, Becker, Cass, Crow Wing, Douglas, Hubbard, Morrison, Otter Tail, Todd

City / Township:

_____ Knowledge Base	_____ Broad App.	_____ Innovation
_____ Leverage	_____ Outcomes	
_____ Partnerships	_____ Urgency	_____ TOTAL

MAIN PROPOSAL

PROJECT TITLE: Assessing the cumulative impacts to near-shore, in-water habitat

I. PROJECT STATEMENT

Shoreline development alters near-shore, in-water habitats of lake ecosystems. Littoral area (less than 4 meters deep) often contains most of the vegetation and is generally the spawning area for fish. Human structures related to development, such as, docks, boatlifts, and other structures, and disturbance from recreational activity may have a cumulative impact on aquatic ecosystems. Despite ongoing concerns about the rate of shoreline development, the extent of near-shore, in-water habitat alterations, and expansion of in-lake structures, few studies have addressed the effects of these incremental changes on lake ecosystems. The lack of scientific knowledge on the cumulative effects of human activities on aquatic habitat, water quality, and fish populations has hindered regulatory authorities and lake managers who need better information to guide landowners toward lower impact practices.

This project will:

- (1) assess the extent of near-shore vegetation, fish, and macroinvertebrates along a gradient of shoreline development,
- (2) delineate a framework for assessing the cumulative impacts of human development on the whole lake ecosystem, and
- (3) provide shoreline owners and lake managers with information about the cumulative impacts of development on aquatic ecosystems. Lakeshore managers may use this information to guide shore land management practices and to focus protection strategies on sensitive areas.

We will examine the cumulative effects of near-shore, in-water habitat alterations of ~100 lakes at the lake scale by using aerial photos and existing DNR data to measure disturbances and seek thresholds where accumulating small-scale changes affect the lake as a whole. We will also conduct detailed assessments of a subset of lakes (~30) at the lot size scale, to quantify specific impacts along a gradient of development and shoreline types. Our goal is to understand the ecological consequences of development and associated activity on near-shore lake ecosystems and is directed toward the 2010 LCCMR RFP targeted issue area 3: Aquatic Habitat Protection, specifically shoreland and near-shore, in-water habitat. This project addresses the Statewide Conservation and Preservation Plan (SCPP) habitat recommendations of: overall research on land and aquatic habitats (9), and research on near-shore habitat vulnerability (10). The results of this project may be used to direct resources for other SCPP habitat recommendations, such as: to protect critical shore lands (2), and to protect and restore critical in-water habitat (6).

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Assess near-shore, in-water habitat on lake ecosystems

Budget: \$127,000

Since lake ecosystems are affected by their inherent productivity, as well as their watersheds, we will statistically control these two factors to isolate the effects of near-shore, in-water habitat alterations by restricting study lakes to the Northern Lakes and Forests Ecoregion with forested watersheds. We will acquire aerial photographs for each study lake to assess the number buildings and in-water structures per kilometer of shoreline and assess the coverage of aquatic vegetation. Using existing DNR data, we will explore relationships among shoreline development, coverage of aquatic vegetation, and aspects of the fish community.

Deliverable

Completion Date

1. Provide a measure of the number and coverage of in-water structures from a subset of lakes with and without shoreline structures in north-central Minnesota. *June 2012*
2. Develop and evaluate models that relate the amount of shoreline development to aquatic vegetation and fish communities.

Result 2: Assess impacts of shoreline development on near-shore habitat **Budget: \$221,000**

We will conduct detailed assessments in a subset of lakes at the building lot scale, to quantify specific near-shore impacts along a gradient of development and shoreline types.

Deliverable

1. Develop an index of shoreline development by measuring a number of variables that reflect human activity including buildings, terrestrial vegetation, physical alterations such as riprap, and in-lake structures.
2. Measure characteristics of aquatic vegetation, woody debris, macroinvertebrates, and fish communities at these sites.

Completion Date

June 2013

Result 3: Development of cumulative impacts model

Budget: \$55,000

We will delineate a framework for assessing the cumulative impact of human development on lakes by linking our fine-scale data on near-shore habitat changes to the whole lake impacts.

Deliverable

1. Develop a framework for assessing the cumulative impact of development that will allow lake managers to model consequences of different development scenarios.

Completion Date

June 2013

III. PROJECT STRATEGY

A. Project Team/Partners

Project team members from the University of Minnesota (U of M) and the US Geological Survey (USGS) Bruce Vondracek (USGS and U of M) will be the project leader and direct and advise two graduate students, who will collect and analyze the aerial photographs, vegetation, fish and macroinvertebrates. Specialist (6L) with the Minnesota Department of Natural Resources, supervised by Peter Jacobson with Section of Fisheries will compile and evaluate fish community data and collaborate with field data collection and model evaluation.

B. Timeline Requirements

The entire project will be completed in 2013. Collection and analysis of aerial photographs will be completed in 2012. The collection and analysis of vegetation, fish and macroinvertebrates will be completed in 2013.

C. Long-Term Strategy

The work outlined in the proposal might lay the groundwork for future efforts for lakeshore restoration. Future work could concentrate on the effects of lakeshore restoration if the cumulative effects of human development activities can be modeled reliably at the whole lake scale. Models could be developed that predict outcomes of human activities to reliably guide lake managers toward sustainable near-shore, in-water development.

Project Budget

PROPOSAL BY: *Vondracek*

Assessing the cumulative impacts to near-shore, in-water habitat

IV. TOTAL PROJECT REQUEST BUDGET ([3] years)

BUDGET ITEM	AMOUNT
Personnel: One graduate student (masters) 3 years plus tuition and benefits	\$ 103,810
One graduate student (Ph.D.) 3 years plus tuition and benefits	\$ 105,788
one undergraduate student (fulltime in summer and 10 hours week during academic year)	\$ 35,148
Contracts: one Specialist (6L) with the Minnesota Department of Natural Resources for 2.5 years	\$ 110,730
Rental of State vehicle for 3 months + 4000 miles and travel for Specialist @ \$7500/year	\$ 22,500
Equipment/Tools/Supplies: Preservative for specimens	\$ 600
Sample jars to preserve and store specimens	\$ 5,000
Nets, mask snorel, and fins	\$ 400
Acquisition (Fee Title or Permanent Easements):	\$ -
Travel: 10 trips to study areas per year 800 mi @0.60 mi for Federal vehicle	\$ 14,400
Per Diem \$50.00/day per person for graduate and undergraduate students for 30 days per year	\$ 4,500
Additional Budget Items:	
TOTAL PROJECT BUDGET REQUEST TO LCCMR	\$ 402,876

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period: /	\$ -	
Other State \$ Being Applied to Project During Project Period:	\$ -	
In-kind Services During Project Period: Assistance from DNR as needed and use of electrofishing boat	\$ -	
Remaining \$ from Current Trust Fund Appropriation (if applicable):		
Funding History:	\$ -	

Bruce Vondracek has maintained an active research program focusing on aquatic ecology for 34 years, and is a specialist in the ecology of streams, specifically interactions of fish, macroinvertebrates, hydrology, water quality, and geomorphology. He is the assistant unit leader-fisheries for the US Geological Survey, Minnesota Cooperative Fish and Wildlife Research Unit (1991-2009) and an adjunct professor in the Department of Fisheries, Wildlife, and Conservation Biology at the University of Minnesota (2002-2009). He has published 61 articles on research he and graduate students have conducted across a spectrum of systems from small streams in California to the Great Lakes. He has been PI or Co-Pi on 2.575 million dollars of grant-funded research projects since 2004, with current or past funding from the NSF, US Geological Survey, US Environmental Protection Agency, US Forest Service, and National Council for Air and Stream Improvement.

