



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2017 LCCMR Work Plan

Date of Submission: 9/14/16
Date of Next Status Update Report: 12/31/17
Date of Work Plan Approval: 06/07/2017
Project Completion Date: 6/30/20
Does this submission include an amendment request? No

PROJECT TITLE: Enhancing Spawning Habitat Restoration in Minnesota Lakes

Project Manager: William Herb

Organization: University of Minnesota

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Location: Statewide

Total ENRTF Project Budget:	ENRTF Appropriation:	\$294,000
	Amount Spent:	\$0
	Balance:	\$294,000

Legal Citation: M.L. 2017, Chp. 96, Sec. 2, Subd. 08e

Appropriation Language:

\$294,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, St. Anthony Falls Laboratory, in cooperation with the Department of Natural Resources to enhance efforts to increase natural reproduction of fish in Minnesota lakes by assessing wave energy impacts on near-shore spawning habitat. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Prioritizing shoreline habitat restoration in Minnesota lakes

II. PROJECT STATEMENT:

Fishing is big business in Minnesota, with over 1.5 million anglers spending more than 1.4 billion dollars each year. A key to maintaining healthy fish populations in Minnesota lakes is to maintain quality near-shore and shoreline habitat. Natural fish reproduction in MN lakes is threatened by watershed and lakeshore development activities, which increase erosion, sediment loading, and nutrient loading to lakes. For walleye, successful reproduction in a lake requires gravel to cobble substrates for egg incubation in near-shore waters. Development activities in a watershed or on a lakeshore can impact fish spawning habitat by increasing fine sediment and nutrient loading to a lake, filling in the substrates with fine sediment and decaying organic matter.

There are a number of ways in which healthy near-shore habitat in lakes is strongly linked to wind and wave energy.

Examples include:

- Walleye spawning gravel substrates can be kept clean of fine sediment by wave energy.
- Wave energy affects the distribution of submersed aquatic plants that provide juvenile habitat for some fish species.
- Shoreline erosion is driven mainly by wind-generated wave energy.

As a result, successful lake habitat restoration requires good information on wind and wave energy, and this information is currently not available. The Minnesota DNR has approached the University of Minnesota to develop tools to provide better predictions of wave energy and near-shore habitat in Minnesota lakes.

The main goal of this project is to create easily accessible information on wave energy and near-shore habitat, to enable successful habitat restoration projects and increase natural fish reproduction in Minnesota lakes. The deliverable product will be maps (GIS-based) that can be used by lake managers to map different classes of near-shore habitat in a lake. The project will focus on walleye habitat, but the information created in this study will be applicable to many other fish species and to more general shoreline wildlife habitat restoration and erosion reduction efforts.

This project will take advantage of the experience of the Minnesota DNR in assessing and managing lake habitat, of the U of M St. Anthony Falls Lab (SAFL) in waves, sediment transport, and lake modeling, and of the UMD Natural Resources Research Institute in habitat assessment, spatial analysis, and management tools. Although wave energy models already exist for ocean coastline and large lakes, a key piece of the project will be to determine how wind-sheltering from surrounding hills and trees reduce wind speeds and wave energy on lakes of different sizes and shapes in Minnesota. Wind sheltering models previously developed at SAFL can use ENRTF-funded LiDAR data to accurately determine wind-sheltering and the corresponding reduction in wave energy. This study will take advantage of, and add to, the extensive lake data set generated by the ENRTF-funded SLICE (Sustaining Lakes in a Changing Environment) program, and will use Sentinel lakes as case study lakes.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of *December 31, 2017*:

Project Status as of *June 30, 2018*:

Project Status as of *December 31, 2018*:

Project Status as of *June 30, 2019*:

Project Status as of *December 31, 2019*:

Project Status as of *June 30, 2020*:

Project Status as of *December 31, 2020*:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: *Wave energy and habitat mapping for Minnesota Lakes*

Description: This activity focuses on developing shoreline wave energy models for small lakes and large lakes with complex shorelines in Minnesota, taking into account wind sheltering effects from local terrain and trees. Previously developed models for wind sheltering will be combined with existing wave models. Wind and wave height data will be collected at four lakes for model verification. To develop relationships between wave energy and near-shore lake habitat (substrates), laboratory tests will be conducted at SAFL to measure rates of sediment resuspension and sorting by wave action, with emphasis on substrates favorable for walleye spawning (gravel/cobble). The laboratory data will be combined with existing DNR field surveys of near-shore substrate composition and plant communities, to develop models relating wave energy to nearshore fish habitat. The fetch, wave energy, and substrate models will be applied to a set of lakes across Minnesota. GIS-based maps of shoreline wave energy and habitat classes will be generated for a set of 500+ lakes in the state.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 294,000
Amount Spent: \$ 0
Balance: \$ 294,000

Outcome	Completion Date
<i>1. Assemble preliminary models for predicting nearshore wave height and energy.</i>	<i>3/2018</i>
<i>2. Experimental wave tank data for nearshore sediment resuspension and transport.</i>	<i>6/2018</i>
<i>3. Collect field data set for wind, waves, and nearshore water velocities.</i>	<i>12/2018</i>
<i>4. Add sediment resuspension models to wave model to predict lake substrate types.</i>	<i>3/2019</i>
<i>5. Complete nearshore habitat models.</i>	<i>12/2019</i>
<i>6. State-wide wave energy map for 500+ lakes; hold information sessions for lake managers.</i>	<i>6/2020</i>

Activity 1 Status as of December 31, 2017:

Activity 1 Status as of June 30, 2018:

Activity 1 Status as of December 31, 2018:

Activity 1 Status as of June 30, 2019:

Activity 1 Status as of December 31, 2019:

Activity 1 Status as of June 30, 2020:

Activity 1 Status as of December 31, 2020:

Final Report Summary:

V. DISSEMINATION:

Description: We will disseminate the results of our project in several ways. Scientific results from Activity 1 will be published in peer-reviewed journals, and presented at regional conferences, e.g. the Minnesota Water Resources Conference, and Minnesota DNR meetings, e.g. the annual fisheries research meeting. In addition, we will hold several informational sessions for lake managers to describe the wave and habitat mapping products as the study concludes.

Status as of December 31, 2017:

Status as of June 30, 2018:

Status as of December 31, 2018:

Status as of June 30, 2019:

Status as of December 31, 2019:

Status as of June 30, 2020:

Status as of December 31, 2020:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. Preliminary ENRTF Budget Overview:

***This section represents an overview of the preliminary budget at the start of the project. It will be reconciled with actual expenditures at the time of the final report.**

Budget Category	\$ Amount	Overview Explanation
Personnel:	\$ 277,099	1 project manager at 28% FTE for 3 yrs (\$83,470); 3 research associates (SAFL and UMD) at 39% FTE 3 yrs (\$94,098), 15% FTE 3 yrs (\$42,513) and 5% FTE 3 yrs (\$14,086); 1 assistant scientist at 7% FTE for 3 yrs (\$15,679); 1 junior scientist at 6% time for 3 yrs (\$12,178); 1 undergraduate at 22% FTE for 3 yrs (\$15,075)
Equipment/Tools/Supplies:	\$ 12,825	6 ultrasonic distance sensors \$400 each (\$2,400), 6 anemometers \$375 each (\$2,250), 3 Data Loggers \$1625 each (\$4875), Tripods, Misc. field supplies (\$2700), Misc. Lab Supplies (\$600)
Printing:	\$300	Materials for informational seminars
Travel Expenses in MN:	\$3366	Travel to field sites (\$646), UMD personnel travel to Twin Cities for meetings (\$972), In-state conferences (\$924), Informational seminars (\$824).
Other:	\$410	NRRI GIS Lab fees (\$410)
TOTAL ENRTF BUDGET:	\$294,000	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than \$5,000: N/A

Total Number of Full-time Equivalent (FTE) Directly Funded with this ENRTF Appropriation: 3.6 FTEs

Total Number of Full-time Equivalent (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state			
	\$	\$	
State			
University of Minnesota (in-kind support)	\$152,880	\$	Unrecovered F&A at 52% MTDC
Minnesota DNR	\$45,000		The MN DNR will provide in-kind support as labor and expenses for ongoing collection of shoreline habitat data, and for testing and evaluation of the products produced in this study.
TOTAL OTHER FUNDS:	\$197,880	\$	

VII. PROJECT STRATEGY:

A. Project Partners: Drs. William Herb and Heinz Stefan (*UMN-SAFL*) will be the overall lead in the project, develop wave energy and lake sediment models, relate wave energy to shoreline habitat features, and assist in the development of the habitat assessment tool. UMD-NRRI staff (Lucinda Johnson’s group) will assist in evaluating shoreline habitat features and in producing the deliverable maps. Herb, SAFL support staff, and NRRI staff will be funded by the ENRTF, while Stefan will contribute time to the project. All personnel funded by the ENRTF are soft-funded research staff and students.

The MN DNR will contribute in-kind staff time, equipment, and data for characterization of near-shore substrate composition and aquatic plant communities, coordinated by Tim Cross (Fisheries Research Scientist) and John Hiebert (Shoreland Habitat Manager).

Partners receiving ENRTF funding

- *University of Minnesota Duluth, NRRI (Lucinda Johnson’s group), \$56,600 for habitat mapping.*

Partners NOT receiving ENRTF funding

- *Tim Cross, Fisheries Research Scientist, Minnesota DNR, nearshore fish habitat assessment*
- *John Heibert, Shoreland Habitat Manager, Minnesota DNR, shoreline management*
- *Heinz Stefan, Emeritus Professor, University of Minnesota, assisting with technical management*

B. Project Impact and Long-term Strategy: Information on wave energy affecting shoreline habitats of Minnesota lakes is critical for lake managers using limited resources to improve sustainable lake habitat conditions. Using the study results to bolster critical natural reproduction processes for fish in lakes where shoreline habitats have been compromised is a likely outcome. The wave energy maps will have a number of applications, including, for example, mitigation of shoreline erosion for lake property owners and for reestablishing submerged and emergent aquatic plants in lakes. The results of this study may also form the basis for additional research on fish habitat, e.g. targeting particular sport fish or endangered species.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
Minnesota DNR, preliminary wave measurements and analysis	6/1/15 – 6/30/16	\$ 25,000
		\$
		\$

VIII. REPORTING REQUIREMENTS:

- **The project is for 3 years, will begin on July 1, 2017, and end on June 30, 2020.**
- **Periodic project status update reports will be submitted 6/30 and 12/31 of each year.**
- **A final report and associated products will be submitted between June 30 and August 15, 2020.**

IX. VISUAL COMPONENT or MAP(S): see attachment

X. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS:

A. Parcel List: N/A

B. Acquisition/Restoration Information: N/A

Environment and Natural Resources Trust Fund

M.L. 2017 Project Budget

Project Title: Enhancing Spawning Habitat Restoration in Minnesota Lakes

Legal Citation: M.L. 2017, Chp. 96, Sec. 2, Subd. 08e

Project Manager: William Herb

Organization: University of Minnesota

M.L. 2017 ENRTF Appropriation: \$ 294,000

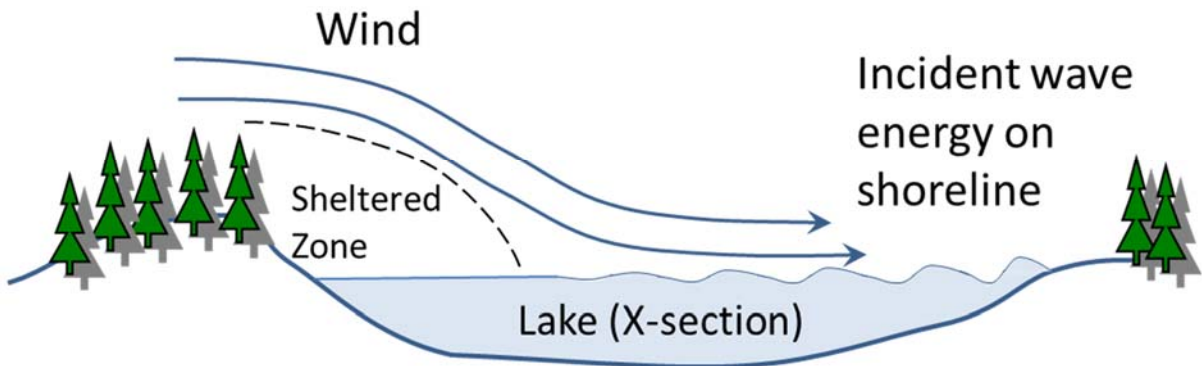
Project Length and Completion Date: 3 Years, June 30, 2020

Date of Report: 9/14/2016

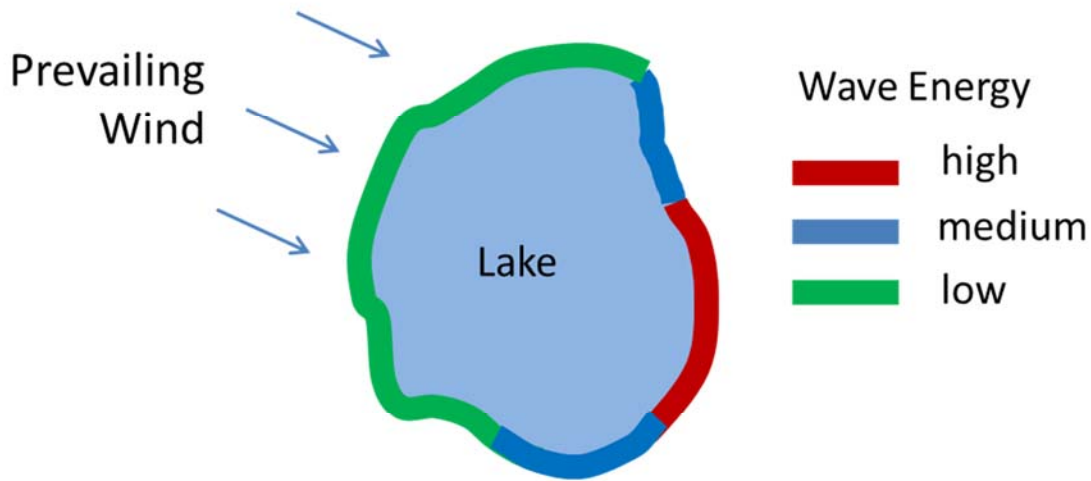


ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	<i>Wave energy and habitat mapping</i>				
Personnel (Wages and Benefits)	\$277,099	\$0	\$277,099	\$277,099	\$277,099
William Herb (PI): Project management, wave modeling, 28% fte, 66% Salary, 34% Fringe, 36 months (\$83,470)					
NRRI Res. Assoc.: Map development, 15% fte, 66% Salary, 34% Fringe, 36 months (\$42,513)					
Meijun Cai, Res. Assoc., Habitat model, 5% fte, 66% Salary, 34% Fringe, 36 months (\$14,086)					
Erickson, B., Assist. Scient.: Field measurements, 7% fte, 74% Salary, 26% Fringe, 36 months (\$15,679)					
Res. Assoc.: Wave modeling, 39% fte, 66% Salary, 34% Fringe, 36 months (\$94,098)					
Mielke, S., Jun. Scient.: Lab measurements, 6% fte, 74% Salary, 26% Fringe, 36 months (\$12,178)					
Undergrad: Lab and field measurements, 22% fte, 100% Salary, 0% Fringe, 36 months (\$15,075)					
Equipment/Tools/Supplies	\$12,825	\$0	\$12,825	\$12,825	\$12,825
6 ultrasonic distance sensors \$400 each (\$2,400), 6 anemometers \$375 each (\$2,250), 3 Data Loggers \$1625 each (\$4875), Tripods, Misc. field supplies (\$2700), Misc. Lab Supplies (\$600)					
Printing	\$300	\$0	\$300	\$300	\$300
Materials for informational seminars					
Travel expenses in Minnesota	\$3,366	\$0	\$3,366	\$3,366	\$3,366
Travel to field sites (\$646), UMD personnel travel to Twin Cities for meetings (\$972), In-state conferences (\$924), Informational seminars (\$824).					
Other	\$410	\$0	\$410	\$410	\$410

I. Create wave energy model



II. Map wave energy on each lake shoreline



III. MN DNR uses wave energy maps to manage fish habitat and shoreline restoration projects