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

LCCMR ID: 026-A3

Project Title:

Predicting and Mitigating Vulnerability of Trout Streams

LCCMR 2010 Funding Priority:

A. Water Resources

Total Project Budget: $ $434,238

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

Other Non-State Funds: $ $0

Summary:

Cold-water trout streams are vulnerable to warming climates. GIS and land-use analyses will identify vulnerable SE Minnesota streams. Quantify trout feeding, growth and cold-adapted aquatic insects that are essential food.

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Sponsoring Organization: U of MN

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Location:

Region: SE

County Name: Fillmore, Goodhue, Houston, Wabasha, Winona

City / Township:

_____ Knowledge Base _____ Broad App. _____ Innovation

_____ Leverage _____ Outcomes

_____ Partnerships _____ Urgency _____ TOTAL

PROJECT TITLE: Predicting and Mitigating Vulnerability of Trout Streams

I. PROJECT STATEMENT

Minnesota has more than 680 designated trout streams that represent a valuable natural resource with high economic, sport and esthetic importance. Fishing activities in trout streams annually provide more than $150 million dollars in direct expenditures to local economies in Minnesota and $654 million throughout the Driftless Region of MN, WI, IL and IA (Trout Unlimited, 2008). With re-circulating dollars this represent more than one-billion dollars of economic stimulus to local economies.

Global climate change models predict Minnesota streams and lakes will warm to levels that can change the composition and productivity of fish and organisms they eat. Trout streams located in extreme SE Minnesota are presently marginal habitats for cold-water fish such as trout to tolerate warm water temperatures in summer. With warming climates these trout streams will likely undergo decreased productivity and yield, and may even experience extirpation of trout populations. Presently, water in the most productive trout streams is thermally buffered by input from groundwater and springs at 9°C. During winter, water temperatures in these streams range from 2° through 8°C and the streams harbor unusual, cold-adapted aquatic insects that the trout eat. However, the cold-adapted aquatic insects do not survive well above 10°C. Many of these streams are popular DNR winter trout fishing streams and although the summer conditions are relatively well-understood, what we know about the warmer months does not adequately account for substantial amounts of the variability in growth and yield of trout. ***We hypothesize (1) that the abundances of aquatic insects in winter are important to trout growth, but (2) increases in water temperatures in winter will severely affect the trout because of reduced populations of cold-adapted insects resulting from warmer water temperatures related to climate warming and (3) changes in the cold-adapted insects will be a good predictor of detrimental change in trout sport fisheries.***

Slowing or reversing conditions associated with global climate change may require a decade or more to develop and implement strategies to protect trout streams. Our proposal is focused on learning how to identify the characteristics of the most vulnerable streams in SE Minnesota so agencies can prioritize conservation and management activities, rather than allowing the streams to deteriorate while trying to reverse large-scale patterns of climate change. We propose the following objectives in 36 streams: (1) investigate the role of stream bank vegetation and adjacent land use as potential modulators or controlling factors to minimize changes in stream temperature conditions in relation to potential climate change; (2) determine the winter diets (November-March) and growth of trout populations; and (3) determine species composition, abundances and timing of growth patterns of cold-adapted insects that are essential to the winter diets of trout.

This proposal is designed as a three-year project. We will examine 12 streams per year; six streams with fast-growing trout populations and six streams with slow-growing populations. We have consulted with DNR fisheries biologists and local chapters of Trout Unlimited to obtain recommendations for streams to be analyzed. Each result will be achieved for each stream in each year and each result will be managed by one of the three principal investigators.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: GIS, stream morphology and land use **Budget:** $ 174,746

GIS, stream morphometric analyses and hydrologic modeling will be used to quantify the adjacent stream bank vegetation and associated land use patterns and relate them to in-stream

temperature conditions, water quality and habitat quality across a gradient of land-uses to assess the importance of these parameters relative to patterns of trout abundance and growth.

Deliverable	Completion Date
1. Identify highly vulnerable streams with high trout productivity and diverse cold-adapted, winter developing insects	June 2013

Result 2: Determine winter diets and growth of trout **Budget:** $ 159,746

Growth will be determined by tagging individual fish. Diets will be determined using the gastric-lavage technique (commonly used by DNR in summer) with modifications we have developed for use in winter. Sampling will be monthly to collect, tag, measure length, weight and obtain stomach contents for fish in each stream on each sample date.

Deliverable	Completion Date
1. Comparison of growth and diet of trout in high and low growth streams to correlate with streams potentially vulnerable to climate change.	June 2013

Result 3: Evaluate cold-adapted aquatic insects **Budget:** $ 99,746

Determine kinds of species, abundances and growth patterns of cold-adapted insects. We will use standard techniques to estimate density and biomass of insects monthly (November-March). We will compare these data with the diet from Result 2 to determine whether trout are selectively feeding on the insects. We will also determine substrate and microhabitat conditions that influence development of highest densities of the species so that stream rehabilitation techniques can be modified to enhance populations of the insects fed on by trout in winter.

Deliverable	Completion Date
1. Evaluate differences in composition, abundance and biomass of insects in streams with fast- and slow-growing brook trout populations.	June 2013

III. PROJECT STRATEGY

A. Project Team/Partners

Describe the project team and partners that will be carrying out the proposed activities. Leonard Ferrington- Team leader and supervise work on Result 3; Bruce Vondracek- Supervise work on Result 2; Jim Perry- Supervise work on Result 1. All team partners are researchers in the College of Foods, Agricultural & Natural Resources Sciences (U of MN) with more than 75 years cumulative research experience in stream ecology.

B. Timeline Requirements

Timeline requirements are the project timeline being requested to carry out the project and the rationale, such as any particular conditions or stages required or assumed in order to carry out the project under the timeline. We will work on 36 trout streams, sequentially completing all work on 12 streams/year during each of the three years of this proposed project.

C. Long-Term Strategy

Is this proposal a component of a specific, larger or longer-term project or effort that will require additional investment over time than is being requested here? This project is specifically designed for trout streams in Minnesota. However, we have a pre-proposal submitted to the National Science Foundation (2.5 million dollars) to provide 5 years of additional research on trout streams in adjacent states. If funded, we will develop multi-disciplinary educational & research programs for undergrads and graduate programs to teach management of cold-water fisheries. This project will make us more competitive for National Science Foundation funding.

Project Budget

PROPOSAL BY: ***Ferrington, Vondracek and Perry***

IV. TOTAL PROJECT REQUEST BUDGET (Three years)

BUDGET ITEM *(See list of Eligible & Non-Eligible Costs, p. 13)*	**AMOUNT**
Personnel: Graduate Student Research Assistants (each for 50% employment, 56.9% salary, 33.5% fringe benefits, 9.6% tuition, for 3 years, and total of three graduate student research assistants)	$ 309,426
Personnel: Undergraduate lab technician (each for 25% employment, 100% salary, 0% fringe benefits, for 36 weeks per year, for 3 years, and total of three technicians)	$ 33,382
	$ -
Contracts: None	$ -
	$ -
Equipment/Tools/Supplies: Nets, seines, sieves, quantitative PIBS samplers for collecting aquatic insects, preservatives, field collection jar & bucket, portable electro-shocker, dip nets, museum storage jars for long-term storage of specimens, aspirators, microscope slides, coverslips, slide storage boxes, labels, computer back-up storage drives, user fee and rental agreement for GIS lab, subscription to Arc-View, data sheets, chestwader, field gloves, space-heaters and gastric lavage devices. preservatives and slide-mounting media.	$ 47,291
Acquisition: None	$ -
Travel: All is in-state travel (Per diem is 63%, vehicle mileage is 34%)	$ 44,138
Additional Budget Items: *In this column, list any additional budget items that do not fit above categories. List by item(s) or item type(s) and explain how number was reached.*	$ -
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 434,237

V. OTHER FUNDS

SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $: None	$ -	
Other State $ Being Applied to Project During Project Period: None	$ -	
In-kind Services During Project Period: None	$ -	
Remaining $ from Current Trust Fund Appropriation (if applicable): None	$ -	
Funding History: None	$ -	

Leonard C. Ferrington Jr. has maintained an active research program dealing with responses of aquatic invertebrates to water quality conditions for 29 years, and is a specialist in the ecology, taxonomy and systematics of aquatic insects. He is a professor in the Department of Entomology at the University of Minnesota (2000-2008) and co-director of the Environmental Sciences, Policy & Management undergraduate degree program in the College of Foods, Agricultural and Natural Resources Sciences. He previously served as Director of the Biological Water Quality and Freshwater Ecology Program, Kansas Biological Survey, University of Kansas (1986-2000) and as the Head of the Entomology Section of the Kansas Applied Mesocosm Program, University of Kansas (1989-2000). He has been PI or Co-Pi on 3.3 million dollars of grant-funded research projects, with current or past funding from the NSF, USGS, National Park Service, US EPA, US Department of Energy, SeaGrants and various private contract labs involved in environmental monitoring and assessment. He has published 76 peer-reviewed journal articles and 38 technical articles. He has contributed chapters to three editions of the Aquatic Insects of North America (the primary identification text for aquatic insects in North America) and wrote two sections in "*Freshwater Animal Diversity Assessment*" (Developments in Hydrobiology 198, 2008), a collective effort of 163 experts commissioned by the international Convention on Biological Diversity and funded by DIVERSITAS.

Bruce Vondracek has maintained an active research program dealing with aquatic 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 23 articles on research he and graduate students have conducted in southeast Minnesota. 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, USGS, US EPA, US Forest Service, and National Council for Air and Stream Improvement. He has published 38 journal articles, in addition to those focused on southeast Minnesota.

James A. Perry has maintained an active research program dealing with aquatic ecology for 28 years, and is a specialist in the ecology of streams, specifically with water quality, large spatial scale analyses and land-use relationships to stream geomorphology. He has collaborated with several other faculty members as well as Minnesota PCA and US EPA in developing new approaches to define reference conditions for impaired waters assessment. Presently leading a major effort for the United Nations Environment Programme to develop global capacity in Integrated Environmental Assessment. Collaborated with a range of faculty in a multi-year EPA-NSF sponsored project to assess watershed and ecoregion scale water quality in the Minnesota River Basin. Joined several other faculty members, as well as state and federal agency representatives in a 10-year experimental manipulation of a lake for assessment of acid deposition. Participated in a team of five faculty members assessing watershed scale water quality in SE Minnesota. Served for six years as Deputy Director of a multi-million dollar US AID project (the Environmental Training Project for Central and Eastern Europe).