

**Environment and Natural Resources Trust Fund
2012-2013 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 011-A

Modeling to Prioritize Efforts to Improve Trout Streams

Topic Area: A. Fisheries & Wildlife Research

Total Project Budget: \$ 422,043

Proposed Project Time Period for the Funding Requested: 3 yrs, July 2013 - June 2016

Other Non-State Funds: \$ 0

Summary:

Project will quantify thermal regimes, trout diets, winter macroinvertebrates (SE MN 12 streams; Stearns County 9 streams), to prioritize areas for landscape and streambed habitat BMPs to improve fishing industry.

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Sponsoring Organization: U of MN

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Location

Region: Central, SE

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

City / Township:

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



Environment and Natural Resources Trust Fund (ENRTF)

2012-2013 Main Proposal

PROJECT TITLE: *Modeling to Prioritize Efforts to Improve Trout Streams*

I. PROJECT STATEMENT: *Provide a summarizing overview statement that clearly and succinctly states:*

1. **Why Project is Important:** Inputs of groundwater to small streams produce thermal regimes that are strongly buffered relative to air temperatures, resulting in stretches of stream that remain colder in summer and warmer in winter than streams without similar inputs of groundwater. Thermally buffered streams support sustaining populations of trout, which form the basis of a recreational sport fishing resource that is economically important in areas of southeast Minnesota where geological conditions of the Driftless Region result in substantial inputs of groundwater to small streams.

The Minnesota DNR manages trout streams as part of its agency mandate and has focused management efforts on habitat and thermal conditions during warmer months, when highest water temperatures can be critical for trout survivorship and reproduction. They also have determined there is substantial variation in trout growth during winter among streams. This project is designed to provide a comprehensive understanding of the critical role of winter dynamics in trout growth, leading to better-informed decisions for improving and sustaining SE Minnesota's recreational economy.

As part of our current work on streams of the Driftless Region, we have developed a predictive, linear regression model that predicts mean weekly water temperatures based on mean weekly air temperatures, allowing us to identify stretches of stream where thermal conditions are best-suited for trout. The slope of the relationship enables quantitative comparisons among streams of the buffering effects of groundwater input, which are reflected in the slope of the regression line. Streams that are not strongly buffered have regression slopes that are higher (0.8 to 1.0), whereas the streams with strongly buffered thermal regimes have lower slopes (~ 0.3 to 0.8). In addition, the y-intercept in our model predicts the water temperature when mean weekly air temperatures are at freezing (0°C). The y-intercepts of non-buffered streams are about 0°-2°C, while strongly buffered stream segments are about 5° to almost 8°C. Our field results show brown trout grow fastest during winter in streams with lower regression slopes and higher y-intercepts. In addition, sections of stream with lower slopes and higher intercepts correspond to stretches with the greatest abundances of winter-developing aquatic insects, which our diet studies show form the predominant food items consumed by the brown trout. Although our modeling is based on streams in the Driftless Region, we anticipate that the approach is sufficiently robust to be able to predict areas of streams located in other parts of Minnesota that are best-suited and, therefore, should be targeted for management for sustainable trout populations.

Over the past few decades, several Best Management Practices (BMP's) have been implemented in Stearns County in areas that may benefit water quality of the local streams. The MN DNR lists 11 Stearns County streams that historically had, or currently sustain populations of brook trout and/or brown trout. Ten of the streams have been studied during summer since 2001, and a substantial database of water temperature readings exists for nine of them. These data can serve as input for our modeling efforts, allowing quantitative comparison among streams to help prioritize streams most-likely to benefit from future BMP's and in-stream habitat modification to improve trout survivorship, growth, and population sustainability. However, information about winter thermal conditions, dynamics of trout feeding and availability of aquatic insects during winter would improve the prioritization process. Landscape-level and in-stream management plans based on winter dynamics could increase the quality of recreational trout fishing in the county and result in improved recreational trout sport fishing income and local jobs in Stearns County and adjacent areas.

2. **Overall GOALS of the Project:** The goal is to generate new information about winter thermal regimes, winter diets of trout, and assessments of winter-developing aquatic insects. We will study two streams per year in SE MN in which Trout Unlimited (TU) has installed BMP's to enhance in-stream habitat for brown trout, and two per year that are scheduled for implementation of BMP's by TU in the near future. In Stearns County, we will use existing historical data generated by MN DNR for non-winter months to identify and prioritize areas of stream where landscape BMP's and in-stream habitat

improvements will most-likely result in improvements in the quality of recreational trout fishing. We will also assess three streams/year using the same fish and invertebrate protocols we have developed for us in SE MN so all data will be comparable, and will record water temperatures at several new sites in each stream to develop additional and more spatially-explicit models.

3. **HOW Project will Achieve the Goals:** We will achieve project goals by continuing to collaborate with DNR and TU in SE MN. In Stearns County, we will establish collaborations with the Montrose Area DNR office, TU, staff of appropriate Watershed Districts, county and city government leaders, to obtain land access, assistance in obtaining historical data, and opinions and recommendations related to installing future BMP's and in-stream habitat improvements. Our role will be to provide quantitative data and model predictions based on winter dynamics to help prioritize future management plans.

II. DESCRIPTION OF PROJECT ACTIVITIES--- **ACTIVITY 1:** We will locate and use historical water temperature data collected by DNR to develop predictive linear regressions models for each of the nine trout streams in Stearns County. The methodology used will be identical to the approach in Krider *et al.* (submitted). **Budget:** \$ 23,250

ACTIVITY 2: We will select two streams per year in SE MN where TU has used BMP's to enhance in-stream habitat for brown trout, and two where TU has scheduled BMP implementation in the near future. We will use sample sites within, up-stream of, and downstream of the BMP areas to test for improvements in trout growth. We will quantify diets using gastric lavage and isotopic analysis of mucus. We will use electroshocking, pit-tagging and recapture to determine trout growth as a function of BMP, diet and food-availability. **Budget:** \$ 109,799

ACTIVITY 3: We will quantify winter-developing macroinvertebrates to determine food availability and diet choice of trout. We will use standard quantitative field methods, employing Hess samplers, dip nets (following MPCA protocols) and collections of surface-floating pupal exuviae following protocols developed and refined in our lab for assessing emergence composition and timing. **Budget:** \$ 99,950

ACTIVITY 4: Similar to Activity 2, for three streams/year, located in Stearns County. **Budget:** \$ 86,710

ACTIVITY 5: Similar to Activity 3, for three streams/year, located in Stearns County. **Budget:** \$ 74,334

ACTIVITY 6: Similar to activity 1, but models will be based on newly collected data from locations other than the historical studies by DNR, to provide greater breadth of model coverage, which will allow us to prioritize areas for in-stream BMP's in the future. **Budget:** \$ 28,000

Outcome	Completion Dates
1. Develop predictive linear regression models from historical data, Stearns County	2014
2. Quantify diet/growth of trout in winter, 4 streams/yr, Driftless Region	2014, 2015, 2016
3. Quantify winter-developing macroinvertebrates, 4 streams/yr, Driftless Region	2014, 2015, 2016
4. Quantify diet/growth of trout in winter, 3 streams/yr, Stearns County	2014, 2015, 2016
5. Quantify winter-developing macroinvertebrates, 3 streams/yr, Stearns County	2014, 2015, 2016
6. Develop predictive linear regression models with new winter data, Stearns Co.	2016

III. PROJECT STRATEGY

A. Project Team/Partners: Our project team consists of three faculty in the College of Food, Agricultural and Natural Resource Sciences at the University of Minnesota (Ferrington, Perry, Vondracek), two Graduate Research Assistants and up to six undergraduate technicians, interns and/or volunteers. Ferrington will be responsible for overall project management and tasks related to activities 3 & 5. Perry will manage tasks related to activities 1 & 6. Vondracek will manage tasks related to activities 2 & 4. Individual tasks will be completed by Graduate Research Assistants and undergraduates.

B. Timeline Requirements: Our project will require 3 full years to complete. Activity 1 will be completed in the first four months, and activity 6 during the last four months. Each year we will complete activities 2-5 for 4 streams in SE MN and 3 streams in Stearns County (total of 12 and nine streams per area).

C. Long-Term Strategy and Future Funding Needs: We expect to achieve all our project objectives during the project performance period. Consequently, our project effort will not require additional investment over a longer span of time than is being requested here.

2012-2013 Detailed Project Budget

Ferrington, Perry & Vondracek: "Modeling to Prioritize Efforts to Improve Trout Streams"

IV. TOTAL ENRTF REQUEST BUDGET: Three years

BUDGET ITEM (See list of Eligible and Non-Eligible Costs, p. 11)	AMOUNT
Personnel: <i>position. Two Graduate Research Assistants.</i> Each student will work 50% time for each of the three years grant. Their salary will be \$22,578 for the first year and increased by 3% in each of the following two years. Their fringe benefits will be \$4569 each for the first year and increased by 3% in each of the following two years. Four undergraduate technicians will work for 10 hours/week for 25 weeks/year at an initial wage of \$11.25/hour. The wage rate will increase by 3% per/year in each of the following two years. Tuition costs for Graduate Research Assistants is required to be provided for the graduate students. The initial cost will be \$13900/year. This cost will increase by 3% per year in each of the following two years. The total tuition costs summed across both students for all three years is listed in the box to the right. The total of salaries, FB and tuition costs for the personnel is listed in the box to the right.	\$ 288,517
Contracts: There will not be any contracts associated with this project.	\$ -
Equipment/Tools/Supplies: Supplies are summarized in this box by Activity. Activities 1-5 will be on-going for each of the three years of the project. Supplies for Activity 1 will cost \$5800. The first year costs for Activities 2-5 are \$7025, \$4675, \$5620 and \$3740 respectively. The supplies costs for activity 2-5 will increase by 3% per year. Supplies for Activity 6 one will cost \$1200 (and only be incurred during third year of project). The total supplies cost summed across all activities and all three years is listed in the box to the right.	\$ 72,094
Acquisition (Fee Title or Permanent Easements): There will be no acquisition fees associated with this project.	\$ -
Travel: Vehicle rental rates, number of rental days, miles driven, days in the field, lodging, and meals during field work will be identical in each year of the project. Vehicle rental for the first year is \$ 65/day for 30 days/year. Miles driven will be 7,500/year @ \$0.25/mile. Lodging will be \$75/person/day for 5 persons, for 30 days/year. Meals will be \$32/person/day for 5 persons, for 30 days/year. All costs will increase by 3% in each of the following two years. The total travel costs summed across all categories and all three years is listed in the box to the right.	\$ 61,432
Additional Budget Items: There will be no other costs associated with this project.	\$ -
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 422,043

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period: None are secured or pending at the present time.	\$ -	
Other State \$ Being Applied to Project During Project Period: Ferrington will commit 10% of time per year to manage grant and to supervise activities 3 and 5. Perry will commit 10% of time per year to manage activities 1 & 6, and provide technical support for activities 2 & 4. Total salary and fringe benefits cost for both Ferrington and Perry are summed across all three years in the box to the right	\$ 89,465	<i>Secured</i>
In-kind Services During Project Period: None are secured or pending at the present time.	\$ -	
Remaining \$ from Current ENRTF Appropriation (if applicable): Ferrington is currently the Principal Investigator on a 36 month grant of \$ 300,00 project dealing with winter dynamics in 36 streams of SE MN. This project runs from 1 July 2010-30 June 2013 and is currently on schedule and in it's 21st month. Approximately \$ 125,000 are unspent. All unspent dollars will be needed to finish the project, with completion date of 30 June 2013.	\$ 125,000	<i>Unspent but necessary for remainder of project</i>
Funding History: No history of previous funding for this project.	\$ -	

Leonard C. Ferrington Jr. has maintained an active research program dealing with responses of aquatic invertebrates to water quality conditions for 32 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 more than 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 81 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 37 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 more than 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, with several focused on SE Minnesota.

James A. Perry has maintained an active research program dealing with aquatic ecology for 31 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).

Organizational Statement: The Department of Entomology and the Department of Fisheries, Wildlife, and Conservation Biology are part of the University of Minnesota.

