Environment and Natural Resources Trust Fund
2014 Request for Proposals (RFP)

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Project Title:

Better Trout Fishing Through Better Stream Restoration Planning

Category: F. Methods to Protect, Restore, and Enhance Land, Water, and Habitat

Total Project Budget: $ 615,464

Proposed Project Time Period for the Funding Requested: 3 Years, July 2014 - June 2017

Other Non-State Funds: $ 0

Summary:

Groundwater inputs to SE Minnesota streams support healthy trout populations and fisheries. We will explore this link (landscape features, food production, trout diet/growth) in support of restoration activities and management.

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Sponsoring Organization: U of MN

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Web Address www.paulventurelli.net

Location

Region: Southeast

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

City / Township:

MP: 0613-2-142-proposa
Budget: 0613-2-142-bud
Qual: 0613-2-142-qualifi
Map: 0613-2-142-map-fi
Resolution:
List:

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

PROJECT TITLE: Better trout fishing through better stream restoration planning

I. PROJECT STATEMENT

The overall goal of this project is to provide information for decision-makers (e.g., DNR, landowners, Trout Unlimited) to prioritize conservation, management, and development activities as they relate to the growth and survival of brook trout and brown trout in SE Minnesota.

This project builds on previous work in 40 SE Minnesota streams (ML 2010 Chap. 362, Sec. 2, Subd. 5i) showing that groundwater
- buffers stream temperatures from summer heat and winter cold,
- supports year-round abundance of invertebrates (the trout food base), and
- ultimately promotes trout growth and abundance.

We will intensively map and sample 6 streams that span a range of groundwater input intensities, leading to management guidance. Specifically, we will
- **identify specifically how groundwater, air temperature, geology and streambed conditions interact to determine trout habitat;**
- **understand how changes in human activity, geology, groundwater, and vegetation affect stream temperature and therefore trout productivity; and**
- **suggest ways to enhance trout productivity via changes that protect or improve stream temperature.**

Trout in Minnesota's nearly 700 designated streams have great economic, sport and aesthetic importance. Trout depend on cold, clean stream water, a resource that is threatened by gradual warming (e.g., as a result of agriculture, climate change, resource extraction, urbanization). Minnesota's managers and landowners need ways to understand what actions can reduce the impacts of warming and by how much.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: *Build on Calvin Alexander's spring mapping work and leverage the MN DNR's Long Term Monitoring program to understand how groundwater inputs along 6 streams interact with geology and streambed conditions to buffer trout streams from summer heat and winter cold* **Budget: $196,092**

This activity allows us to predict the thermal suitability of a stream for trout and will enable managers to position restoration efforts to have the greatest impact in extending the moderating influence of groundwater on stream temperature. We will use air and water temperatures and water chemistry (10 samples/stream, 5 sampling events/year for 2 years) to map groundwater inputs at fine spatial scales, and quantify local geology and streambed conditions at coarse spatial scales. We will relate these conditions in a statistical model for identifying highest-priority management actions.

Outcome	Completion
1. Data to relate water temperature to air temperature and groundwater inputs along 6 streams	*June 2015*
2. Quantification of the moderating effects of local geology and streambed conditions	*June 2016*
3. A statistical tool that uses outcomes 1 and 2 to predict water temperature along a stream	*June 2017*
4. Identification of high-priority locations for restoration efforts	*June 2017*

Activity 2: *Relate changes in insect abundance and genetics along 6 streams to seasonal water temperatures (Activity 1)* **Budget: $227,048**

This activity links stream conditions to trout through food availability and quality. Given that many food species look the same, we will use a type of DNA (MtDNA) to efficiently and accurately identify those insects that provide the most reliable energy to trout in summer and winter. We will determine how genetic patterns of numerically dominant insects differ among the most abundance insects, and if genetic variability aligns with

water temperatures and seasons along 6 streams. We will then vary temperature and diet within a trout growth simulation model to determine how temperature can benefit trout indirectly through effects on food.

Outcome	Completion
1. Assessment of genetic variability of the most abundant invertebrate species	*June 2015*
2. Determination of spatial patterns of populations with high genetic variability along 6 streams	*June 2016*
3. A descriptive model of seasonal patterns of population densities for the invertebrate species that are most abundant and have the highest genetic variability in 6 streams	*June 2017*
4. Quantitative determination of the extent to which invertebrates species with high genetic variability contribute to the simulated diet and growth of trout	*June 2017*

Activity 3: *Relate trout growth and genetics in 6 streams to in-stream habitat quality (temperature and food from Activities 1 and 2) and season* **Budget: $192,325**

This activity provides managers and landowners with information to translate restoration and management efforts into trout productivity and availability. In collaboration with MN DNR, we will focus on the three main drivers of trout growth within and among study streams: temperature, diet, and genetics. We will measure growth using trout scales and recaptured individuals, estimate diets using stable isotopes, and use this information to infer fine-scale patterns of habitat use. Because growth can be constrained by genetics, we will determine how genetic variability varies with thermal habitat, diet, and growth.

Outcome (all for translating restoration/management into trout abundance and size)	Completion Date
1. A statistical tool for predicting trout size from stream temperature	*June 2017*
2. A statistical tool for predicting trout size from food availability	*June 2017*
3. A statistical tool for predicting trout size from genetics	*June 2017*

III. PROJECT STRATEGY

A. Project Team/Partners: The **project team** to be funded by the ENRTF consists of Principal Investigator (PI) Paul Venturelli (University of Minnesota, Activity 3) and co-PIs Leonard Ferrington (UMN, Activity 2), Emi Ito (UMN, Activity 1), and a post-doc (project wrap-up/synthesis and trout genetics), 3 graduate students, and field assistants. Non-funded team members are Jim Perry (UMN, Activity 1) and Bruce Vondracek (Minnesota Cooperative Fish and Wildlife Research Unit, Activity 3).
Project partners not to be funded: the Minnesota DNR Division of Fish and Wildlife (Doug Dieterman, SE Research Biologist), and Trout Unlimited (Jeff Hastings, Project Manager, Driftless Area Restoration Effort).

B. Timeline Requirements – 3 years: This project requires three field seasons so that we can intensively survey and sample all 6 streams and develop the statistical tools for translating management and restoration efforts into trout productivity and availability.

C. Long-Term Strategy and Future Funding Needs: This project will help to support decisions and prioritize activities that affect trout streams in SE Minnesota (e.g., in-stream restoration, agriculture, resource extraction and exploration, urbanization). We will disseminate our findings to the public through Trout Unlimited, the National Trout Center (Preston, MN), and the Minnesota Master Naturalist program, and to technical audiences (researchers, managers, policymakers) through state conferences and meetings with the MN DNR. This project is part of a larger, long-term effort by the UMN, the MN DNR, and Trout Unlimited to understand, preserve, and enhance trout streams and trout fishing in SE Minnesota. This project builds on our previous effort (ML 2010 Chap. 362, Sec. 2, Subd. 5i), that established the importance of groundwater to healthy trout populations in SE Minnesota. By determining how groundwater and trout are linked, the proposed project will help to understand how human changes (e.g., restoration) will affect trout.

2014 Detailed Project Budget

Project Title: Better trout fishing through better stream restoration planning

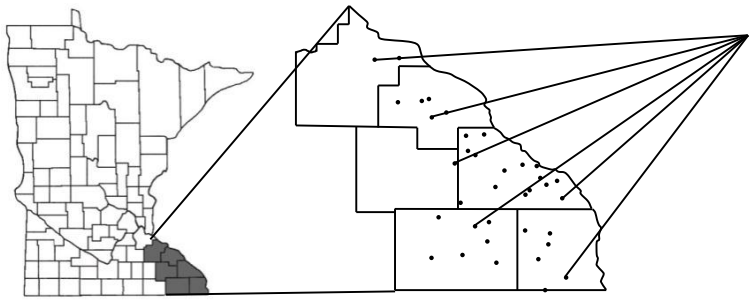
IV. TOTAL ENRTF REQUEST BUDGET *3* years

BUDGET ITEM	AMOUNT
Personnel: Ferrington, Co-PI (2 weeks summer salary + fringe for 3 years assuming 3% annual inflation; 8% effort)	$ 17,313
Ito, Co-PI (2 weeks summer salary + fringe for 3 years assuming 3% annual inflation; 8% effort)	$ 19,549
Venturelli, PI (2 weeks summer salary + fringe for 3 years assuming 3% annual inflation; 8% effort)	$ 15,223
one postdoctoral researcher ($45,000 salary, $9,338 fringe; total for 1 year; fish genetics and project wrap-up/synthesis)	$ 54,338
three graduate students (1/activity) at 50% time for 3 years; salary $57,341 each plus $52,049 benefits (15.7% health insurance, plus tuition); total for 3 years assuming 3% annual inflation.	$ 328,170
three undergraduate assistants (1/activity) for 3 years at 32 weeks/year, 20 hrs/week, and $10.75/hour; total for 3 years assuming 3% annual inflation	$ 63,796
Equipment/Tools/Supplies: passive integrated transponder tags for tracking, identifying and recapturing fish (500 fish at $5.25/fish)	$ 2,625
automotic water temperature data loggers (5/stream, 6 streams, $123 each)	$ 3,690
internal fish temperature loggers (6 streams, 15 logers/stream at $250/tag)	$ 14,400
vials, jars, and preservative for insect samples (2 cases at $450, 2 cases at $378, 25 jugs at $21.98)	$ 1,377
slides, cover slips, mounting medium for insect work (2 cases at $279; 25 packs at $90.35; 6 jugs at $68)	$ 3,224
racks, boxes, and vial drawers for insect sample storage (120 at $10.60)	$ 2,182
misc. field and lab supplies; ~$500/activity/yr (e.g., stable isotope tins, sample containers and preservatives for activities 1 and 3, lab buffers and reagents, forceps, field notebooks, insulated waders and gloves, binders and clipboards, first aid kit)	$ 4,557
Travel: 5, 3-day trips to the field to collect samples @ 300 miles/trip and $0.55/mile; accommodation (2 rooms for 10 nights at $70/night); per diem for a 5-person crew for 5 full days at $46/day and 10 part days at 75%	$ 5,100
Additional Budget Items: water chemistry monitoring and analysis (10 samples/stream @ $60/sample, 6 streams sampled 5 times/yr for 2 yrs). Includes alkalinity, dissolved oxygen, nitrogen, inorganic and organic carbon, stable isotopes, elemental composition. Conducted at UMN	$ 36,000
fish stable isotope analysis in 6 streams (20 fin + 20 mucous + 10 prey and primary productivity), $8/sample. Conducted at UMN	$ 2,400
fish genetics (6 streams, 80 samples/stream at $10/sample). Conducted at UMN	$ 4,800
insect genetics (6 streams, 660 samples/stream at $3/sample). Conducted at UMN	$ 36,720
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 615,464

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: Perry, 1% Co-PI salary/fringe for 3 years. Because the project is overhead-free, laboratory space, electricity, and other overhead costs are provided in kind. The University of Minnesota overhead rate is 52% (~$300,000)	$ 305,174	*Effort secured, overhead estimated*
Remaining $ from Current ENRTF Appropriation (if applicable): ML 2010 Chap. 362, Sec. 2, Subd. 5i to Ferrington	$ 16,000	*Unspent (estimated)*
Funding History: ML 2010 Chap. 362, Sec. 2, Subd. 5i to Ferrington	$ 300,000	

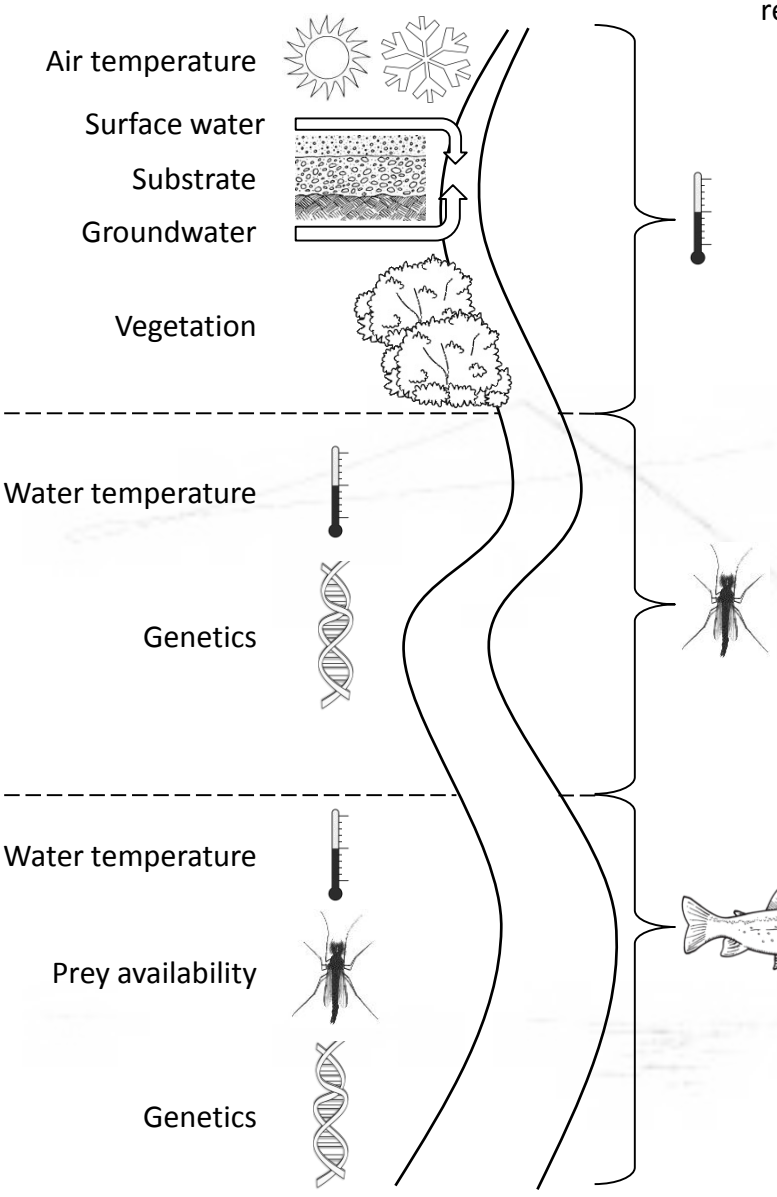
Previously, we sampled trout and insects in 40 streams in SE Minnesota (ML 2010 Chap. 362, Sec. 2, Subd. 5i)



We will build on this knowledge through in-depth study of 6 trout streams that vary in groundwater input

Results will link trout abundance and growth to stream temperature and prey

This link will help decision-makers to evaluate and prioritize activities that affect trout streams (e.g., stream restoration, resource exploration/extraction, agriculture)



Activity 1: how do these factors contribute to trout stream temperatures?

Activity 2: how do these factors affect trout prey quality and quantity?

Activity 3: how do these factors affect trout abundance and growth?

PROJECT MANAGER QUALIFICATIONS AND RESPONSIBILITIES

Dr. Paul Venturelli
Assistant Professor, Department of Fisheries, Wildlife and Conservation Biology, University of Minnesota, Twin Cities (2011 to present)

B.S.	York University	Environmental Science	2000
M.S.	University of Alberta	Environmental Biology and Ecology	2003
Ph.D.	University of Toronto	Ecology and Evolutionary Biology	2009

Paul will be responsible for overall project coordination (development and planning, hiring, liaising with project partners, ensuring that the project is on-time and on-budget, assisting in the preparation of progress reports and final reports, etc.). To date, Paul has coordinated ~16 projects and dozens of personnel. He has studied fish ecology, population dynamics, and management for 13 years, and is an expert on the effects of temperature on fish growth.

Dr. Len Ferrington (UMN) is an expert in stream invertebrate taxonomy and ecology with 32 years of research experience. His laboratory has shown that aquatic insects important to trout in SE Minnesota are adapted to colder temperatures and most abundant in spring-fed streams. Len has developed Rapid Bioassessment Protocols for use in Biological Monitoring and Impact Assessment, and worked with numerous local, state and federal agencies to define responses of aquatic invertebrates to various types of water pollution.

Dr. Emi Ito (UMN) is an expert in surface water-groundwater interactions and has a background in rock-water interaction and low-temperature weathering processes that is relevant in determining groundwater chemistry. Emi primarily uses geochemical techniques in her studies with 34 years of research experience. Her laboratory has shown that a small amount of groundwater discharging to lakes and streams will affect invertebrate diversity and abundance.

Dr. Jim Perry (UMN) is a Morse-Alumni Distinguished University Professor who studies water quality management, aquatic ecology, environmental policy and management decision making. For 31 years he has collaborated with international, federal, and state agencies/organizations on projects related to water quality monitoring, assessment, and regulation at the level of landscapes, watersheds, lakes, and streams.

Dr. Bruce Vondracek (Minnesota Cooperative Fish and Wildlife Research Unit) is an expert in stream ecology and restoration with over 40 years of research experience. His laboratory focuses on the interactions among management, water quality, and fish and invertebrate communities to assess ecosystem health in relation to land use and restoration.

ORGANZATION DESCRIPTION: The University of Minnesota is one of the largest and most recognized public research universities in the United States. Its mission is to 1) "**conduct high-quality research**, scholarship, and artistic activity that benefit students, scholars, and communities **across the state**, the nation, and the world"; 2) "share that knowledge, understanding, and creativity by providing a broad range of educational programs … and **prepare graduate, professional, and undergraduate students**…for active roles in a multiracial and multicultural world"; and 3) extend, apply, and **exchange knowledge between the University and society** by applying scholarly expertise to community problems, by helping organizations and individuals respond to their changing environments, and by making the knowledge and resources created and preserved at the University accessible to the citizens of the state, the nation, and the world.