Environment and Natural Resources Trust Fund
2015 Request for Proposals (RFP)

Project Title: **ENRTF ID:** 024-A

Hydrologic Effects of Contemporary Forest Practices in Minnesota

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: $ 201,296

Proposed Project Time Period for the Funding Requested: 3 years, July 2015 - June 2018

Summary:

Hydrologic monitoring stations will be installed and used to collect water quantity and quality data from lands managed for timber production. Hydrologic effect of timber harvest will be evaluated.

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Sponsoring Organization: U of MN

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Web Address

Location

Region: NE

County Name: Itasca, Koochiching, St. Louis

City / Township:

Alternate Text for Visual:

This map indicates UPM-Blandin timber property ownership and highlights candidate study sites.

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

PROJECT TITLE: Hydrologic Effects of Contemporary Forest Practices in Minnesota

I. PROJECT STATEMENT

Lack of understanding exists in Minnesota and the Lake States region regarding the effects of contemporary forest harvest practices on water resources. In forested landscapes, runoff amount and timing and sediment concentration and load are the major water quality concerns[1]. Previous studies in the region were conducted decades ago[2] and their results have been widely applied beyond the conditions under which they were conducted. For example, the strong preference for winter timber harvest is based on these previous studies and assumes certain temperature, soil, and other hydrologic conditions will occur. Climate, as measured by temperature and precipitation, has shifted and will likely continue to shift in the region causing further changes in watershed response to vegetation change. Additionally, forest health is further affected by pests, such as the Emerald Ash Borer (EAB), and fire, such as the Pagami Creek Fire of 2011. In order to make effective, science-based forest management decisions, water quantity and quality information is needed. Such information is difficult to find on managed timberlands within the state outside of the Marcell Experimental Forest. In order to understand the effects of timber harvests as they are currently conducted, this project will establish water resource monitoring sites for stream flow and associated fine sediments on lands managed for timber.

Monitoring the hydrologic effects of contemporary forest harvest practices is necessary to evaluate the relationship between these practices and water resources under shifting climates and impending threats to forest health. Furthermore, the proposed project would provide critical monitoring information against which to assess (a) effects of different harvest practices, including timing, in light of current and predicted future climates and (b) the source of sediments in the waterways following landscape change and large rainfall events.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Site Selection and Instrumentation **Budget: $85,556**

Specific research sites will be selected from possible candidates on industry and state lands actively managed for timber in northeastern Minnesota (for example UPM-Blandin lands shown in Map attachment). Two sites will be located in close proximity to each other with similar soil and vegetation types, and geologic setting. They will be similarly instrumented to monitor stream stage (water level), suspended sediment concentration, and turbidity, thereby establishing a control and treatment pair.

Outcome	Completion Date
1. Compiled list of active state and private timberlands with previous aquatic research	*October 1, 2015*
2. Selection of final sites	*October 1, 2015*
3. Instrumentation of sites to monitor stream stage with a pressure transducer, turbidity with an optical sensor, and suspended sediment with an automatic sampler.	*May 31, 2016*

Activity 2: Pre-treatment Monitoring **Budget: $76,134**

[1] Knife River-Turbidity TMDL Project, 2010. Deer Creek Turbidity TMDL Project, 2013. Nemadji River-Turbidity TMDL Project, ongoing. Poplar River –Turbidity TMDL Project, 2013. Information online: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/tmdl-projects/lake-superior-basin-tmdl/lake-superior-basin-tmdls.html

[2] Summarized in Verry, E. S. (2004), Land Fragmentation and Impacts to Streams and Fish in the Central and Upper Midwest, in *A Century of Forest and Wildland Watershed Lessons*, edited by G. G. Ice and J. D. Stednick, pp. 129–154, Society of American Foresters, Bethesda, MD.

Water stage and quality will be monitored in the paired research sites for a minimum of 1-2 years prior to timber harvest. Water quality will be evaluated using total suspended solids on at least a weekly basis and continuous turbidity measurements. Stage measurements will be converted to stream discharge, and will be used with water quality data to calculate sediment loads exiting the watersheds. Additional measurements will be taken during storm events.

Outcome	Completion Date
1. Time series data set of water level in two sites	*February 2018*
2. Time series data of suspended sediment and turbidity at same two sites	*February 2018*
3. Hydrologic calibration of the two sites to each other	*March 2018*

Activity 3: Timber Harvest Treatment Monitoring **Budget: $39, 606**

This project will monitor flow and sediment export responses to timber harvest, conducted by the landowner according to the contemporary practices in one of the two sites during the late winter months. Monitoring will continue during and after the harvest in order to compare any changes in the harvested site to the unharvested site and evaluate the effect of the harvest on water resources.

Outcome	Completion Date
1. Harvest timber according to contemporary Best Management Practices	*Jan. – Feb. 2018*
2. Monitor water level, sediment, and turbidity data during and immediately following harvest in treatment and control sites	*June 2018*
3. Comparison of water level, sediment, and turbidity between treatment and control sites	*June 2018*

III. PROJECT STRATEGY

A. Project Team/Partners

The project will be led by Dr. Diana Karwan (University of Minnesota Department of Forest Resources), who receives funds from this request. Mr. Tim O'Hara (Minnesota Forest Industries), who does not receive funds from this project, will assist Dr. Karwan in identifying candidate research sites and with landowner communications. Partners will be sought among the private and state forest owners within Minnesota. For example, UPM-Blandin Paper Company (Grand Rapids, MN) manages approximately 190,000 acres in northern Minnesota for forest products, subject to conservation easement. UPM-Blandin has participated in past research projects and has shown interest in cooperating with additional research on their lands (see Map). The National Council for Air and Stream Improvement (NCASI) is an independent, non-profit research organization whose mission involves scientific research to enhance the technical, environmental, and sustainability understanding of forest management. They are interested in monitoring the hydrologic effects of forest management in the Lake States and have stated they see this project as a pilot on which to base a network of sites.

B. Project Impact and Long-Term Strategy

This project will establish research sites on actively managed timberlands and provide 1-2 years of baseline data, as well as hydrologic data on the immediate response to timber harvest under current management and climate conditions. Longer monitoring following the harvest will be important to evaluate any sustained effect on water resources. Additional partners and funding are sought (e.g. NCASI) to continue monitoring after the initial period and establish research in additional sites within the state. This project will establish sites in which monitoring can continue beyond the initial treatment, which can also assess future harvests and other natural and anthropogenic changes in managed timberlands.

C. Timeline Requirements

The project, as described, would be conducted in 3 years. Ongoing monitoring following the initial post-harvest will also be essential and other partnering funds are being sought to support this continued effort.

2015 Detailed Project Budget

Project Title: Hydrologic Effects of Contemporary Forest Practices in Minnesota

PIs: D.L. Karwan (UMN), T.O'Hara (MFI)

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel: Salary and fringe (0.981) for 1 PhD student for 3 years. Fringe rate includes graduate student tuition. Annual salary increase of 3% is assumed.	$ 112,456
Personnel: Salary for 1 month per year (0.1 FTE) and fringe (19.83%) for D. Karwan during each year of the project. Karwan will manage all aspects of the project. Annual salary increase of 3% assumed.	$ 35,395
Personnel: Hourly **s**alary for 1 undergraduate student 10 hours per week (0.25 FTE) without fringe during the academic year and with fringe (7.34%) during summer in years 2 and 3 pf project. Undergraduate will assist with field collection and analysis of water samples and hydrologic data. Annual increase of 3% in wage is assumed.	$ 4,945
Equipment/Tools/Supplies: Pressure / Water Depth Sensors ($4,000), turbidity sensors ($6,000), dataloggers ($4,000), in-stream monitoring structures ($10,000), automatic water samplers ($13,500); laboratory supplied for analysis of total suspended solids ($1,000)	$ 38,500
Travel: Travel for mileage (75%) and lodging (25%) within Minnesota for PI and Graduate Student to the project sites.	$ 10,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 201,296

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period: Application pending to the National Council for Air and Stream Improvement. Per B. Danehey: NCASI has strong interest in this project and would like to fund additional sites in future years.	$0	Future Pending
Other State $ To Be Applied To Project During Project Period:	N/A	N/A
In-kind Services To Be Applied To Project During Project Period: 1% (0.01 FTE) of Karwan's salary during project years provided by the University of Minnesota	$ 3,436	Secured
Funding History:	$ -	
Remaining $ From Current ENRTF Appropriation:	N/A	N/A

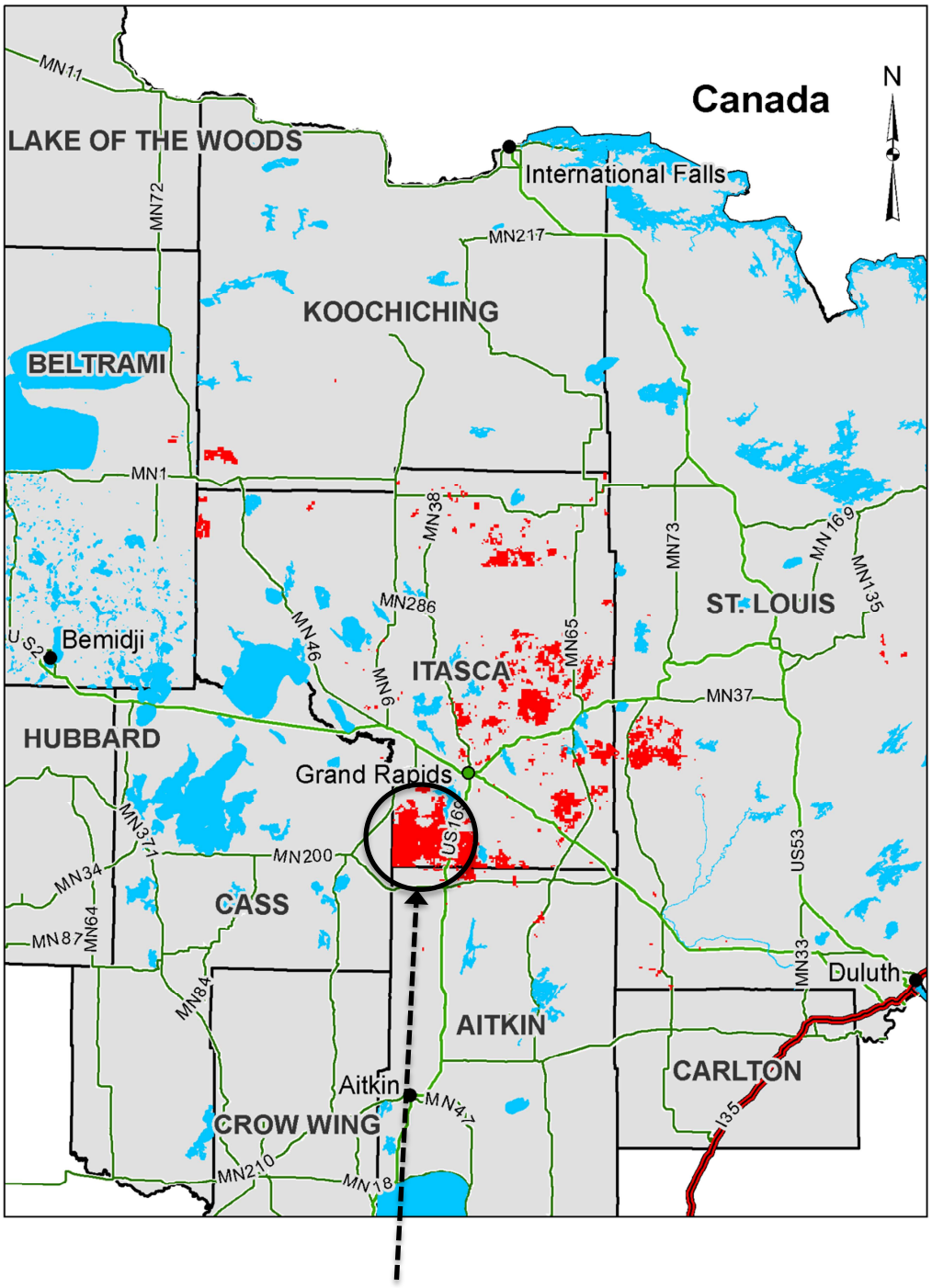

Figure 1 - UPM-Blandin lands shown in red. These are candidate lands for this study, in particular Pokegama Creek area (circled) has had previous riparian and hydrologic studies.

Project Manager Qualifications

Dr. Diana Karwan has over 10 years experience conducting and managing hydrologic research focusing on the effects of land cover change on water quantity, quality, and in-stream processes. She has authored peer-reviewed journal articles and given presentations at scientific conferences and for community groups on these studies (listed at http://www.forestry.umn.edu/People/DianaLKarwan/index.htm) as well as led large teams collecting water quantity and quality data in forest, agricultural, and suburban landscapes in response to recent hurricanes in the mid-Atlantic USA. Most appropriate to this request, her work includes the analysis of suspended sediment loads in response to timber harvest on industry lands (see Karwan and others, *Forest Science*, 2007). Karwan is currently an Assistant Professor in the Department of Forest Resources at the University of Minnesota. This project will establish sites within Minnesota to complement her other research on industry forests in Idaho and research forests in Pennsylvania.

Organization Description

The University of Minnesota is a land-grant institution and research university with a strong tradition of education and service to the state. The Department of Forest Resources is the leading research and educational institution on forest related issues in Minnesota. For over 100 years the department has played a key role in discovering and fostering sustainable forest resource management activities in Minnesota.