Environment and Natural Resources Trust Fund
2018 Request for Proposals (RFP)

Project Title: **ENRTF ID: 019-A**

Downstream Effects of Contemporary Forest Practices: Phase 2

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: $ 294,000

Proposed Project Time Period for the Funding Requested: 3 years, July 2018 to June 2021

Summary:

Hydrologic data collection and report writing to trace hydrologic and sediment effects of contemporary timber harvest from site to stream and through river network in St.Louis County.

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Sponsoring Organization: U of MN

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Location

Region: Metro, Northeast

County Name: Ramsey, St. Louis

City / Township:

Alternate Text for Visual:

Two figures show small stream and larger river in area of active forest management.

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

PROJECT TITLE: Downstream Effects of Contemporary Forest Practices: Phase 2

I. PROJECT STATEMENT

The forests of northern Minnesota have some of the state's best surface water quality as well as communities that depend on both forest and water resources. Managing multiple resources relies on information about how they interact. In order to make effective, science-based forest management decisions, on-the-ground and in-the-stream water quantity and quality information is needed to assess if and how activities on timber harvest sites move downstream to receiving water bodies. Many timber harvests are on the order of 100 acres, while many watershed plans, such as for water quality compliance with the Total Maximum Daily Load (TMDL) program, cover tens to hundreds of square miles. *Information on water flow, erosion, and sediment movement are needed to see if any hydrologic effects, such as runoff and soil erosion, move down tributaries to larger streams and rivers at or immediately after the time of harvest.*

My group is currently monitoring two stream stations near an upcoming timber harvest in St. Louis County with funding from LCCMR (Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 03r) and the National Council for Air and Stream Improvement. These sites and the upcoming schedule of timber harvests are uniquely well positioned to expand from next-to-harvest-site monitoring to the downstream river networks. Our monitoring has shown a large range of stream flow conditions prior to timber harvest (see Figure attachment). Along an intermittent tributary, high and low flows over a single year are several feet higher under high flow than low flow – indicating connections between upstream harvest sites and downstream rivers could be different under high and low flow conditions.

We propose a new project that will leverage our current work, expand monitoring and allow us to assess if/how runoff and sediments from an individual, lowland harvest area enter and move downstream through the stream network. The Phase 2 harvest areas are on primarily lowland forest, drain to an intermittent small stream which flows into the river we currently monitor. *The sequencing of these harvests in space and time provides a unique opportunity to gather data along a hydrologic network to evaluate how far downstream the effects of site level harvests can be detected.* Furthermore, the proposed project would provide critical monitoring information against which to assess the downstream effects of timber harvest and the source of sediments in the waterways following landscape change.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Water level and Tributary Data Collection with Timber Harvest **Budget: $144,100**

To quantify the hydrologic effects of lowland timber harvest in its current form under shifting winter timelines, my team monitor water level in the soil and adjacent tributary before, during, and after a timber harvest according to best practices. Measurements will include:

- water level in ~10 shallow wells in the lowland / wetland harvest area,
- assess erosion on harvest area,
- measure soil bulk density throughout harvest site,
- water level, stream discharge, turbidity, and dissolved organic carbon in ~3 intermittent stream sites draining the harvest area.

Outcome	Completion Date
1. *Install water level monitoring equipment surrounding upcoming harvest site*	*November 30, 2018*
2. *Time series data set of water level, including: soil/wetland water table surrounding new harvest site and water level in intermittent tributary linking site to receiving water body.*	*June 30, 2021*
3. *Time series data of erosion potential including noticed erosion and soil bulk density*	*June 30, 2021*

across season and harvest activity.	
4. Report outlining if/how site-scale water level and quality change with timber harvest.	*June 30, 2021*

Activity 2: Tracing Water Quality Concerns Downstream **Budget: $149,900**

My team will link the measurements and information from Activity 1 to the downstream river (West Swan River). We will:

- Collect high frequency water level, stream discharge, turbidity and dissolved organic carbon at 2 sites in the downstream river,
- Track sediment, using geochemical sediment fingerprint methods, to determine of the harvest area contributes sediment to the first tributary near the site and/or the downstream river,
- Use dissolved ions (e.g. salts) in the water to determine water flow times from the harvest site to the tributary and downstream river.

Outcome	Completion Date
1. Monitoring data of water level and water quality at West Swan Upper and Lower sites	*June 30, 2021*
2. Monitor water level and hydrologic connectivity at ~3 sites along network from new harvest to West Swan River	*June 30, 2021*
3. Final report to evaluate the hydrologic connectivity, including sediment tracing, of new timber harvest site to receiving water body (West Swan River)	*June 30, 2021*

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. Partners include the private and state forest owners within Minnesota. UPM-Blandin Paper Company (Grand Rapids, MN) manages approximately 190,000 acres in northern Minnesota for forest products, subject to conservation easement. Dr. Karwan has worked in conjunction with UPM-Blandin to establish hydrologic and water quality monitoring on the West Swan River. They have agreed to continue facilitating this research through land access, discussions of harvest plans, etc. 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 have provided supplementary funds to this team in the past and have expressed interest in growing this monitoring.

B. Project Impact and Long-Term Strategy

This project will expand high frequency water quantity and quality monitoring in conjunction with forest management in Northern Minnesota in such a way to leverage and expand upon existing projects. With this new project, we are connecting individual harvest sites to the larger river network in order to assess how far downstream from an individual timber harvest the hydrologic effects, in the form of water flow and water quality, can be seen. Increased monitoring which links sites on the landscape to a network of streams and rivers following the harvest will be important to evaluate any sustained effect on water resources of forest management.

C. Timeline Requirements

The project, as described, would be conducted in 3 years.

2018 Detailed Project Budget

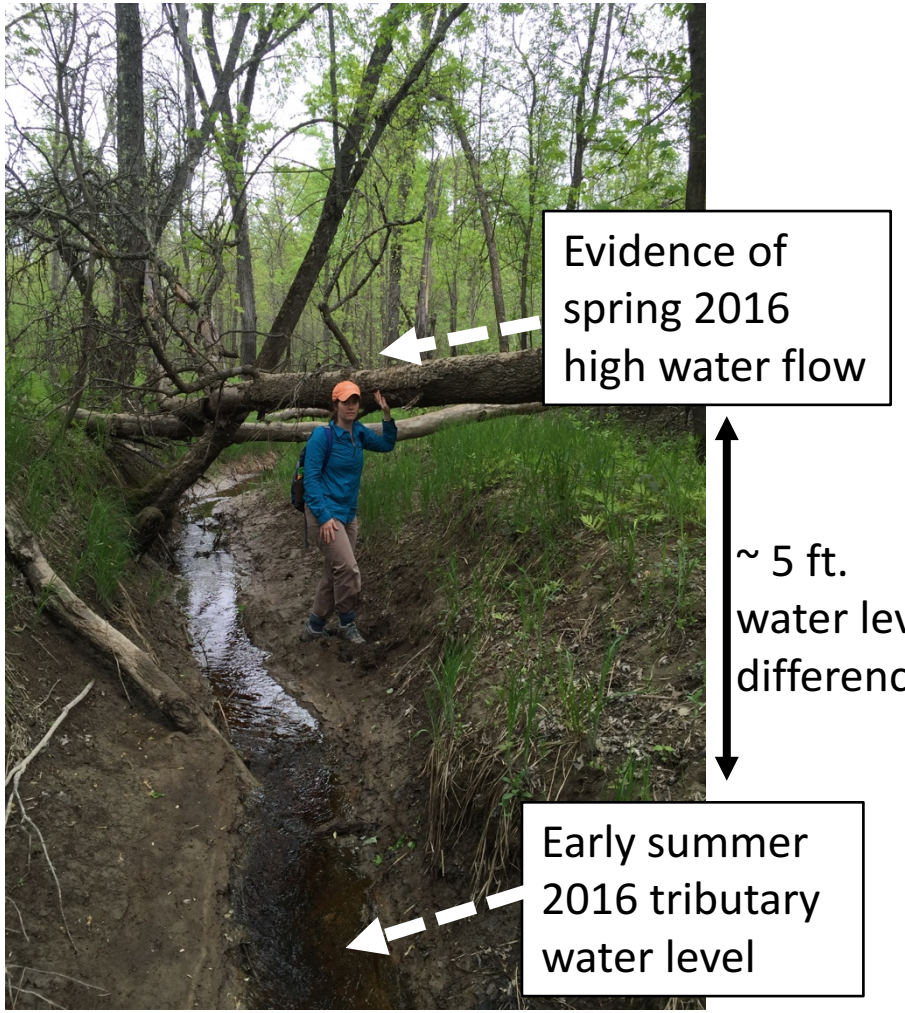
Project Title: *Downstream Effects of Contemporary Forest Practices: Phase 2*

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel: Dr. Diana Karwan (0.04 FTE) Assistant Professor in the Department of Forest Resources at the Univ. of Minnesota - Twin Cities. She will oversee project design and implementation, facilitate discussion with forest managers, disseminate findings via written reports and meeting with partners and stakeholders. Amount accounts for two weeks of summer salary and fringe per UMN rates.	$ 20,000
Personnel: Post Doctoral Researcher / Research Associate (1 FTE) will be hired in order to manage day-to-day installations, field work, monitoring data, data analysis, and support report writing. Amount accounts for 1 FTE of salary and fringe per UMN rates.	$ 216,000
Personnel: Undergraduate research assistant (0.25 FTE) An undergraduate student will be hired in each project year to assist with field implementation, data collection; such a position serves as training for undergraduate students who in past have gone on to employment with state agencies and/or watershed districts. Amount accounts for part time work during academic year of each proect year per UMN rates.	$ 13,500
Equipment/Tools/Supplies: Water monitoring equipment: stream channel level-loggers including water temp and electrical conditivity with datalogger ($500/meter + $600/datalogger per unit x 3 units); batteries for dataloggers ($500); turbidity monitor ($1500/meter x 3 meters); level-loggers for shallow wells ($300/logger x 10 plus $300 for data transfer equipment); SD cards for data transfer and storage ($125); field cameras ($250 ea. X 3) and staff gages ($175 ea. X3) for stream-site monitoring	$ 13,000
Equipment/Tools/Supplies: field supplies for installation (PVC for shallow wells, hardware cloth, etc);	$ 300
Equipment/Tools/Supplies: Laboratory supplies to analyze 200 samples over 3 years for Total Suspended Solids ($2/sample), Ions ($30/sample) and Dissolved Organic Carbon ($15/sample) on	$ 9,400
Equipment/Tools/Supplies: Laboratory analytical costs (reagents, etc) associated with sediment chemistry (gamma counting of fallout radionuclides in Karwan lab,	$ 9,800
Travel: Travel for University vehicle (pick-up truck) between St. Paul and St. Louis County field sites, approx. 3 trips per month. A subset of these trips will require overnight lodging in the Hibbing area to conduce multiple-day field work, per University of Minnesota rates.	$ 12,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 294,000

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	N/A	*N/A*
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:	N/A	*N/A*
Past and Current ENRTF Appropriation: *LCCMR Funding for initial water quality monitoring (LCCMR M.L. 2015, Chp. 76, Sec. 2, Subd. 03r) Total: $150,000; As of January 31, 2017 $79,700 spend with $70,300 remaining*	$ 150,000	$70,300 unspent, $79,700 spent
Other Funding History: Prior funding 2015-2017 from National Council for Air and Stream Improvement for water quality monitoring ($70,000)	$ 70,000	*Secured*



Left: Tributary flow linking harvest area to larger West Swan River

Right: Managed forest along West Swan River in St. Louis County

PROJECT TITLE: Downstream Effects of Contemporary Forest Practices: Phase 2

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 several peer-reviewed journal articles on hydrology and sediment and given presentations at scientific conferences and for community groups on these studies (listed at https://www.forestry.umn.edu/people/diana-l-karwan) 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.

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.