



Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-227

Proposal Title: Seasonal Water Quality Effects of Commercial Peat Harvesting

Project Manager Information

Name: Lucy Rose

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: Hydrologic monitoring will compare surface water quality in a commercial peat harvesting site with water in an unharvested peatland during high-intensity and seasonal runoff events (snowmelt, fall/summer rain storms).

Funds Requested: \$204,000

Proposed Project Completion: 2024-06-30

LCCMR Funding Category: Water Resources (B)

Project Location

What is the best scale for describing where your work will take place?

Region(s): NE, NW, Central,

What is the best scale to describe the area impacted by your work?

Region(s): Central, NE, NW,

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Minnesota has more peatland resources than all U.S. states except Alaska. Commercial peat harvesting requires significant alterations to peatland hydrology, through ditching and draining of harvest sites and vacuum-removal of surface peat layers. Peatland draining diverts water away from peat at the surface— where younger, more “fresh” vegetation grows— into deeper layers of older, more degradation-resistant organic matter. Surface and deep peat layers differ in their chemical properties. Because organic carbon readily leaches from peat as water flows through it, changes in water depth due to ditching and draining could alter the chemical properties of dissolved organic carbon (DOC) in water draining harvested peatlands. As DOC binds and sequesters nutrients and metals to varying degrees depending on the amount and type of DOC in natural waters, harvesting-induced changes in DOC properties— and associated changes in the interactions among DOC, nutrients, and metals— could affect habitats and water quality in areas receiving peatland runoff. The relative importance of these water quality impacts can also vary across seasonal and hydrologic conditions. For example, although spring snowmelt and summer/fall storms are relatively short in duration, large proportions of total annual DOC, nutrient, and metal export from watersheds occur during these events.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

The proposed project addresses uncertainties about the direct and indirect effects of peat harvesting on surface water quality. This project would provide two years of data on hydrologic and water quality responses to typical industry practices in a commercially harvested peatland during the spring, summer, and fall. Concurrent monitoring would also occur in a natural (unharvested) peatland, with water samples collected across a wide range of hydrologic conditions. Through this comparative monitoring, the proposed project would evaluate: 1) the effects of harvesting-induced hydrologic changes on the amount and type of DOC exported from harvested peatlands, and 2) the changes in nutrient and metal export to surface waters resulting from changes in peatland hydrology and/or changes in nutrient and metal interactions with DOC. Surface water monitoring would reflect a range of seasonal (e.g. spring snowmelt, summer/fall storms) and hydrologic (e.g. baseflow, storm events) conditions to develop a comprehensive understanding of the timing, magnitude, and duration of peat harvesting effects on water quality under current industry standards and practices. By clarifying the influence of water flow conditions and seasonality on water quality, insights from this project will inform and improve regulatory monitoring and decision-making efforts.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state’s natural resources?

Project outcomes will address the protection of Minnesota’s water resources and aquatic habitats by evaluating the changes in surface water quality due to alterations in peatland hydrology during commercial peat harvesting. Importantly, this project will assess these effects under hydrologically relevant conditions and timescales. Rather than sporadic, “spot check” sampling, this project will evaluate changes in water quality at high temporal resolution and across a range of flow rates, runoff event magnitudes, and seasonal conditions. This will provide a comprehensive understanding of the seasonal and hydrologic conditions under which peat harvesting impacts are most significant.

Activities and Milestones

Activity 1: Site Selection and Instrumentation, Water Monitoring and Collection

Activity Budget: \$125,136

Activity Description:

Peat, Inc. supports this project by granting access to a harvested peatland site near Cromwell, MN for monitoring; similarly, the US Forest Service also grants access to an unharvested peatland site in the Marcell Experimental Forest near Grand Rapids, MN (both shown in the Visual Component Attachment). In this arrangement, the unharvested peatland serves as a “control” site and the harvested peatland serves as a “treatment” site. Monitoring locations in each peatland will be selected to maximize similarities between sites with respect to drainage areas and vegetation types. Both sites will be continuously monitored for water level, flow rate, water temperature, and specific conductivity. Additionally, automated water samplers at each site will be programmed to initiate the collection of a series of water samples when flow rates increase during spring snowmelt or sufficiently large rainfall events. Water sampling frequency will be adjusted at each site to ensure that the full range of hydrologic conditions is captured during these runoff events, beginning at the very onset of elevated flow and continuing until flow returns to pre-event rates. Water monitoring and collection will occur over two complete cycles of spring, summer, and fall to ensure that seasonal dynamics are adequately characterized.

Activity Milestones:

Description	Completion Date
Instrumentation of sites to monitor water level, flow rate, water temperature, conductivity, and water quality	2021-08-31
Selection of monitoring sites	2021-08-31
Collection of water samples at high temporal resolution during spring, summer, and fall runoff events	2024-04-30

Activity 2: Chemical Analysis of Water Samples

Activity Budget: \$78,864

Activity Description:

Water samples collected from the harvested and unharvested peatland sites will undergo chemical analysis to determine the concentrations of DOC, nutrients (e.g., nitrate, phosphate), metals (e.g., aluminum, iron, arsenic, manganese), and additional solutes (including sulfate, chloride, calcium, and magnesium; these solutes are useful for differentiating between groundwater and precipitation inputs to surface water to aid in characterizing patterns in site hydrology). Changes in DOC, nutrient, metal, and other solute concentrations will be evaluated in conjunction with continuous measurements of water depth and flow to identify associations between specific hydrologic conditions and observed changes in water quality. In addition, the chemical composition of DOC (i.e., abundance of humic acids, fulvic acids, proteins) in water samples will be analytically determined. DOC concentration and composition will be evaluated against nutrient and metal concentrations in the harvested and unharvested peatlands to identify differences in organic matter-nutrient and organic matter-metal interactions between sites. All measurements of solute concentration, DOC composition, and their interactions will be assessed across the full range of seasonal and flow conditions to gain an ecologically and hydrologically relevant understanding of the effects of commercial peat harvesting on water quality.

Activity Milestones:

Description	Completion Date
Quantified interactions among DOC, nutrients, and metals across a range of seasonal and hydrologic conditions	2024-05-31
High-frequency time-series dataset of dissolved nutrient and metal concentrations at two peatland sites	2024-05-31

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Diana Karwan	University of Minnesota Twin Cities, Department of Forest Resources	This project collaborator will consult on the final selection of water sampling locations and on analysis and interpretation of project data. Dr. Karwan will also allow access to her laboratory facilities at the University of Minnesota to facilitate the completion of the proposed work.	Yes
Dr. Randy Kolka	US Forest Service, Northern Research Station	This project collaborator is the Acting Project Leader and a Research Soil Scientist at the Marcell Experimental Forest near Grand Rapids, MN. He has agreed to allow water sampling in an unharvested peatland site at Marcell for comparison to the harvested peatland site.	No
Bill Pelto	Peat, Inc.	This project collaborator is a Plant Manager for Peat, Inc. and has agreed to assist with the establishment of a suitable location for water sampling in the harvested peatland near Cromwell, MN.	No
Steve Zoubek	EHS Compliance, Inc.	This project collaborator manages environmental issues and safety for Peat, Inc. and has agreed to allow site access for water sampling at an active peat harvesting site near Cromwell, MN.	No

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

Perceptions about water quality can be strongly influenced by the seasonal and hydrologic conditions under which water samples are collected, especially when sample collection is infrequent and fails to capture a range of flow conditions. This project will clarify the effect of seasonal and hydrologic factors on water quality; this has direct relevance to the monitoring programs of regulatory agencies (e.g., MPCA, MN DNR). Long-term monitoring will be important to evaluate the water quality effects of post-harvest peatland restoration. Continued collaboration and funding will be sought with project partners for continued monitoring throughout the post-harvest peatland restoration phase.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Hydrologic Effects of Contemporary Forest Practices in Minnesota	M.L. 2015, Chp. 76, Sec. 2, Subd. 03r	\$150,000

Project Manager and Organization Qualifications

Project Manager Name: Lucy Rose

Job Title: Researcher 6

Provide description of the project manager's qualifications to manage the proposed project.

Dr. Lucy Rose has over 15 years of management and research experience focusing on hydrology, biogeochemistry, and forest ecology. In addition to her current focus on natural resources-related research in the Department of Forest Resources at the University of Minnesota, she has also conducted academic research in the Department of Geology and Planetary Science at the University of Pittsburgh, and Department of Natural Resources and Environmental Sciences at the University of Illinois and collaborated with the U.S. Forest Service and The Nature Conservancy on research projects

related to fire ecology. Dr. Rose's work spans spatial scales ranging from individual trees to large watersheds and temporal scales ranging from a single hour to decades. She has authored or co-authored peer-reviewed publications on the topics of hydrology, nutrient cycling, fire ecology and management, and anthropogenic nitrogen pollution in the atmosphere and forest ecosystems. At the University of Minnesota, Dr. Rose is currently coordinating and conducting field research in St. Louis County examining seasonal changes in dissolved organic carbon concentration and composition under a range of flow conditions in the West Swan River, as well as field research on phosphorus and sediment impairments in the Plum Creek agricultural watershed in northeastern Wisconsin.

Organization: U of MN - College of Food, Agriculture and Natural Resource Sciences

Organization Description:

The University of Minnesota is a land-grant institution and research university with a long history of education and service to the state of Minnesota and beyond. The University's College of Food, Agricultural, and Natural Resource Sciences (CFANS) supports research and innovation across 13 academic departments and 10 research and outreach centers, focusing on food safety and security, agricultural innovation and advancement, and the responsible and sustainable management of natural resources. The University of Minnesota, and CFANS in particular, strives to establish Minnesota as a leader and innovator in the fields of food, agriculture, and natural resources through the development and implementation of science-based solutions to state, national, and global issues of resource availability and protection.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Principal Investigator		Primary project leader			36.5%	1.5		\$116,638
Co-Principal Investigator		Co-leader of the project			36.5%	0.12		\$21,143
1 research staff		To assist with sample collection in the field and sample analysis in the laboratory			0%	0.45		\$13,440
							Sub Total	\$151,221
Contracts and Services								
CFANS Research Analytical Laboratory	Internal services or fees (uncommon)	This entity will conduct chemical analyses of water samples for concentrations of DOC, metals, nutrients, and other solutes.				0		\$18,800
Arnold Research Laboratory	Internal services or fees (uncommon)	This entity will provide laboratory services for the determination of DOC chemical composition in water samples.				-		\$800
							Sub Total	\$19,600
Equipment, Tools, and Supplies								
	Equipment	2 automated water samplers	To collect sequential water samples at high frequency from peatland sites					\$8,500
	Equipment	2 Conductivity/Temperature/Depth sensors with dataloggers	To provide continuous measurements of water conductivity, temperature, and depth at project sites. Empirical relationships between water depth and discharge will be established for each study site to estimate discharge based on water depth.					\$2,300

	Tools and Supplies	consumable laboratory supplies (nitrile gloves, water sample bottles, filters, chemicals for sample preservation and analysis)	These items are necessary for the collection, preservation, analysis, and storage of water samples collected during the project.					\$4,029
							Sub Total	\$14,829
Capital Expenditures								
		1 Discharge sensor with datalogger	To provide continuous discharge measurements at an ungaged water sampling location					\$8,350
							Sub Total	\$8,350
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	University vehicle rental, mileage, and fuel costs for travel to project sites	Round-trip travel between the Twin Cities and Cromwell, MN or Grand Rapids, MN is necessary to install monitoring equipment and collect water samples during project years 1-3.					\$9,500
	Conference Registration Miles/ Meals/ Lodging	Conference fee for Minnesota Water Resources Conference in St. Paul, MN (October 2024)	To present project findings to Minnesota water resources professionals, managers, and scientists in project year 3.					\$300
	Miles/ Meals/ Lodging	Meetings with project collaborators	Travel to collaborator offices near Cromwell, MN and Grand Rapids, MN for project meetings and updates					\$200
							Sub Total	\$10,000
Travel Outside Minnesota								
							Sub Total	-

Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$204,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Attachments

Required Attachments

Visual Component

File: [2ebc6eb5-85b.pdf](#)

Alternate Text for Visual Component

Aerial photo and location in Minnesota of potential harvested peatland (Fon Du Lac State Forest, Carlton County) and unharvested peatland (Chippewa National Forest, Itasca County) monitoring sites for the proposed work.

Optional Attachments

Support Letter or Other

Title	File
Peat, Inc. Letter of Support	1c4d3dcd-57d.pdf
US Forest Service Letter of Support	8ca4df02-89a.pdf
University Authorization	5048dfb9-c40.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

Does your project include research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Seasonal Water Quality Effects of Commercial Peat Harvesting: Monitoring Sites



