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

Project Title: **ENRTF ID: 189-F**

Increasing Timber Availability and Habitat with Soil Management

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

Total Project Budget: $ 396,000

Proposed Project Time Period for the Funding Requested: 4 years, July 2018 to June 2022

Summary:

Develop strategies and practical tools to identify conditions that minimize impacts to soil across a wide range of conditions to promote regeneration of diverse forests, wildlife habitat, and timber availability.

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Sponsoring Organization: U of MN

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Impacts to soil such as rutting (upper left picture) can occur if soil conditions are not optimal during forest harvesting. We want to promote regeneration of diverse forests and wildlife habitat (picture at right) by determiningn how key factors (shown in the lower pictures) influence optimal soil conditions and develop practical tools for assessment

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

PROJECT TITLE: Increasing timber availability and habitat with soil management

I. PROJECT STATEMENT

The overarching goal of this project is to quantify the factors that influence soil degradation during forest harvesting and develop practical tools to avoid negative impacts while enhancing habitat and increasing timber availability. Managed forests are essential to maintain clean water, promote wildlife habitat, and regenerate species which require disturbance, but only if management is conducted to minimize impacts to soils and the critical functions they control.

- Logging during winter when soil is frozen is one of the most common methods prescribed to protect soil when harvesting timber, but impacts (e.g., soil compaction) still occur if there is insufficient frost penetration. Summer harvesting can cause similar impacts for certain soils at or near water saturation, but can also be beneficial to regeneration and native plant communities.
- Our current ability to predict when soil conditions are optimal to minimize impacts is surprisingly limited. This uncertainty limits the times when loggers are allowed to harvest timber on public lands. At the same time, public land managers are under pressure to increase wood supply because of increased demand from established and new wood-using industries in greater Minnesota.
- Understanding the mechanisms that control soil operability will allow us to forecast when harvesting can be conducted without degrading the soil and develop practices to promote favorable operating conditions, which will allow us to manage forests for a variety of benefits including high quality wildlife habitat and timber.

Our project will quantify the factors that control soil operability in summer and winter across a range of soil types and weather conditions, which will be used to predict optimal harvesting conditions and develop practices and tools that minimize impacts and maximize benefits of forest resources. This information is critically important now because MN DNR has committed to increasing annual harvest levels while at the same time weather patterns have decreased operating conditions during the winter when most timber is cut.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: **Empirically model the influence of weather on soil operability** **Budget: $ 129,000**

We will utilize a 50+ year dataset from the Marcell Experimental Forest (located in the Chippewa National Forest) that includes data on climate, soil moisture, frost, and snow depth across forest cover types and soils of northern Minnesota. We will use this dataset to empirically model soil operability as a function of soil properties, weather patterns, and other pertinent variables. Model results will be used to classify each soil type into an operability class and develop diagnostic criteria for changes in operability throughout the year.

Outcome	Completion Date
1. Climate-operability models developed	Dec. 2019
2. Models checked and validated with real-time weather data	Apr. 2021
3. Effects of weather variation incorporated into management strategies	June 2022

Activity 2: Assess the influence of different soils and weather on operability across a range of site conditions for 3 years **Budget: $ 210,000**

We will develop a network of 10 research sites along a temperature gradient and across a range of soil textures. Soil texture is a key property that influences soil operability because it controls soil moisture dynamics – a primary factor influencing operability. Experimental treatments that manipulate soil moisture during the

summer and snow depth during the winter will be replicated at each site. Treatments will be applied throughout the project period to assess the influence of inter-annual variability in weather on soil operability. We will measure and analyze the effect of these treatments on soil temperature and moisture, frost occurrence and depth (during winter), soil strength, and variation in response over time.

Outcome	Completion Date
1. 10 sites identified that span the range of climate and soils in MN	Dec. 2018
2. Measurement of treatment effects on soil properties completed	Oct. 2021
3. Effect of soil moisture, snow depth, and texture on soil strength determined.	June 2022

Activity 3: Develop soil operability guidelines and a field measurement tool **Budget: $ 57,000**

Results from Activities 1 and 2 will be used to identify key factors and conditions influencing soil operability, and develop guidelines on when operations may occur for a given set of weather scenarios. We will also develop strategies and recommendations to enhance operability under subpar conditions including post-storm events and early season snowfall. **Practical tools, including a GIS-based operability framework and a measurement device that can be used in the field to assess soil operability, will be developed for use by foresters and loggers.** We will communicate our findings to agencies, policy organizations, land managers, and loggers.

Outcome	Completion Date
1. Findings from Activities 1 and 2 synthesized and key factors identified	Mar. 2022
2. Guidelines for operability across a range of soil and climate conditions developed	Apr. 2022
3. Best practices to enhance operability and measurement tool developed	June 2022
4. Final report and communication of findings completed	June 2022

III. PROJECT STRATEGY

A. Project Team/Partners

Team members who will contribute time and effort to the project are Dr. Robert Slesak (MN Forest Resources Council; receives funding), Dr. Charlie Blinn (University of Minnesota; receives funding), Dan Hanson (DNR Forestry; no funding), and Drs. Randy Kolka and Stephen Sebestyen (US Forest Service; no funding). The Forest Service will also contribute additional in-kind funds to the project in the form of Drs. Kolka's and Sebestyen's salary, equipment use, and data sets. The Minnesota Department of Natural Resources is also cooperating by providing their lands for study treatments, and will work closely with the project team on Activity 3 to incorporate findings directly into DNR operations and policies.

B. Project Impact and Long-Term Strategy

The impact of this work will be large because there is strong support from the entire forestry stakeholder community including MN DNR, county land departments, the USFS, forest industry, environmental organizations, and many others. The findings will be widely used to reduce impacts to soil during harvesting, increase site access for management, and promote a wide range of benefits associated with working forest lands. Furthermore, the results will be used by governmental agencies for long-term planning efforts and development of related policies for addressing variability in weather patterns and summer wood supply. Findings will be broadly disseminated and incorporated into Minnesota's Forest Management Guidelines.

C. Timeline Requirements

The proposed project duration of four years is necessary to assess manipulative treatment effects for 3 growing seasons (May-Sept) to account for variability in weather conditions among years.

2018 Detailed Project Budget

Project Title: Increasing timber availability and habitat with soil management

PIs: R.A. Slesak (UMN), C. Blinn (UMN), D. Hanson (DNR), R. Kolka (USFS), S. Sebestyen (USFS)

IV. TOTAL ENRTF REQUEST BUDGET 4 years

BUDGET ITEM	AMOUNT
Personnel: Salary (0.5 FTE each) and fringe (0.15) + 19.32/hr tuition for graduate students for 3 years	$ 126,554
Personnel: Salary and fringe (0.335) for 1 Research Associate (1.0 FTE) for 3 years who will coordinate treatment application and data collection at the project sites	$ 173,307
Personnel: Salary and fringe (0.077) for 1 summer work study student for 3 years	$ 25,848
Equipment/Tools/Supplies: Soil temperature and moisture sensors (100 totaling $15,000), dataloggers (25 totaling $10,000), mobile soil pressure apparatus ($25,000), snow tube and scale ($500), shovels, water pump, and misc. supplies for treatment application ($1791)	$ 52,291
Travel: Travel for mileage (75%) and lodging (25%) within Minnesota for researchers, the Research Associate, and Graduate Student to the project sites. A large amount of travel will be requiried because sites will be located from southern to northern Minnesota and require periodic visits following snow events.	$ 18,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 396,000

V. OTHER FUNDS

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: In-kind salary from R. Slesak (0.1 FTE) , R. Kolka (0.05 FTE) and S. Sebestyn (0.05 FTE)	$ 76,900	*Secured*
Past and Current ENRTF Appropriation:	N/A	*N/A*
Other Funding History: Funds used to support Marcell Experimental Forest data collection over past 50 years	$ 100,000	*Secured*

Soil damage under suboptimal operating conditions

Timber harvest and habitat creation with optimal soil conditions

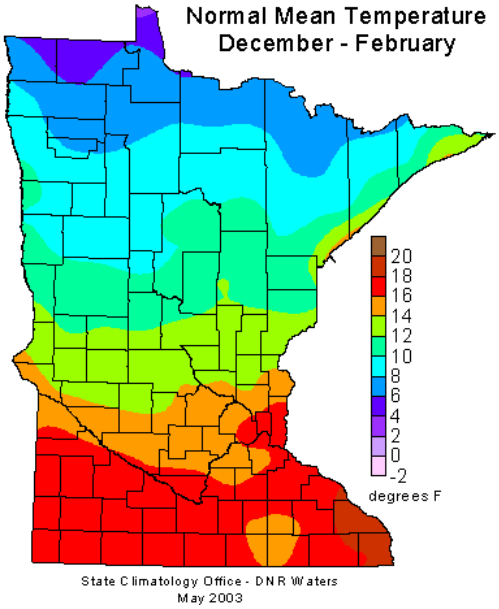
We want to <u>avoid this</u> and <u>increase this</u> by quantifying how these factors influence soil management

Soil properties

Soil water content is key factor controlling <u>soil strength</u>

Dependent on soil texture and density

Air temperature



Air temperature influences soil water and frost dynamics

Dependent on soil type and snow conditions

Surface conditions

Snow and forest floor influence frost development and soil water

Dependent on timing / intensity of rain and snow storms

Identifying optimal soil operability conditions for forest management

Project manager qualifications

Robert A. Slesak

Qualifications

Rob is Adjunct Assistant Professor in the Department of Forest Resources, University of Minnesota, and manager of the Site-level Program at the Minnesota Forest Resources Council. He is responsible for evaluation and development of Minnesota's Forest Management Guidelines, assessing their effectiveness with monitoring and research, and conducting research to address existing and emerging threats to sustainable forest management. Rob has extensive experience addressing complex forest resource issues including the identification of information needs for efficient and effective solutions to the challenges of sustainable forest management. He is a principal investigator and project manager on several ongoing projects related to invasive species, soil productivity, and forest sustainability, and has published a number of peer-reviewed journal papers related to these topics. Rob has a Ph.D in Forest Soils from Oregon State University, a M.S.in Forest Ecosystem Science from SUNY Environmental Science and Forestry (ESF), and a B.S. in Forest Resource Management from SUNY ESF. His research and professional interests are broadly focused on sustainable forest management, including identification of processes critical to ecosystem functions, evaluation of the potential for those processes and functions to be altered by management activities, and the application of management practices to restore degraded ecosystem functions.

Organization description

The Department of Forest Resources is part of the University of Minnesota.

The Minnesota Forest Resources Council was established by the Sustainable Forest Resources Act to promote long-term sustainable management of Minnesota's forests.