Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2018 ENRTF Work Plan (Main Document)

Today's Date: February 16, 2018

Date of Next Status Update Report: January 31, 2019

Date of Work Plan Approval:

Project Completion Date: June 30, 2022

Does this submission include an amendment request? No

PROJECT TITLE: Develop Strategies for Timber Harvest to Minimize Soil Impacts to Maintain Healthy and Diverse Forests

Project Manager: Robert Slesak

Organization: University of Minnesota

College/Department/Division: Department of Forest Resources

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City/State/Zip Code: Saint Paul, MN 55108

Telephone Number: 651-603-6756

Email Address: raslesak@umn.edu

Web Address:

Location: All counties in the NE Region of Minnesota in addition to Crow Wing Co., Cass Co., Wadena Co., Mille Lacs Co. Hubbard Co. Clearwater Co., Beltrami Co., Lake of the Woods Co., and Roseau Co.

Total Project Budget: $200,000

Amount Spent: $0

Balance: $200,000

Legal Citation: M.L. 2018, Chp. xx, Sec. xx, Subd. xx

Appropriation Language:

I. PROJECT STATEMENT:

Managed forests are essential to maintain clean water, promote wildlife habitat, and regenerate tree species which require disturbance, but only if forest management activities minimize impacts to soils and the critical functions they control. In Minnesota, soil compaction during forest harvesting is a common concern because it can degrade soil and reduce future site productivity. Because of this, logging during winter when soil is frozen is one of the most common approaches to protect soil when harvesting timber. However, compaction can still occur during winter if insufficient frost is present, and there is limited information on what a sufficient level of frost is and under what conditions it will form. In addition, focus on winter harvesting constrains the supply of timber during summer months and may inhibit establishment of certain desirable cover types. Past work and field experience indicates that harvesting can be safely conducted during summer on certain soil types and soil conditions. However, our current ability to predict the soil types and conditions where impacts are minimized during summer harvesting is surprisingly limited.

This project will quantify the factors that control soil operability in summer and winter across a range of soil types, soil conditions, and regional weather patterns. Understanding how these factors control soil operability will allow us to identify soil types and threshold conditions when harvesting can be conducted without degrading the soil and forecast when these situations will exist. We will use the project findings to develop practices and tools that minimize soil impacts and maximize benefits of forest resources including wildlife habitat and the supply of high-quality timber. Specific products that will be developed include a GIS-based soil operability metric and a tool that can be used in the field to directly assess soil operability. The potential impact of this work is large because the products can be easily used by land managers (e.g., the DNR, County land departments, forest industry, and federal agencies) and loggers to identify suitable site operating conditions and reduce uncertainty related to soil impacts. The findings and products will be widely used by the forestry community to increase site access for management and promote a wide range of benefits associated with working forest lands and the communities they support.

II. OVERALL PROJECT STATUS UPDATES:

First June 30, 2019
Second Update June 30, 2020,
Third Update June 30, 2021
Final Update June 30, 2022

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Assess the influence of different soils and weather on operability across a range of site conditions
Description: We will develop a network of seven research sites along a temperature gradient and across a range of soil textures in northern Minnesota. Soil texture is a key property that influences soil operability because it controls soil moisture and frost dynamics – the primary factors influencing soil strength and susceptibility to compaction during summer and winter, respectively. For this project we will focus on fine to medium textured soils because these typically are most susceptible to degradation and have the most constraints influencing soil 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 a three year time period. Results will be used to identify thresholds of soil strength associated with soil moisture levels and frost depth for a range of soil textural classes.

ENRTF BUDGET: $ 175,500

Outcome	Completion Date
1. Initial site evaluation completed and site selection finalized (7 total)	Sept. 2018
2. Pretreatment field measurements and soil sensors installed	Oct. 2018
3. Assessment of soil conditions (soil strength, water content, frost, etc.) for 3 years	Oct. 2021
4. Data synthesis complete and final report completed	June 2022

First June 30, 2019
Second Update June 30, 2020,
Third Update June 30, 2021
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Activity 2: Develop GIS-based soil operability metric and a field measurement tool
Description: Results from Activity 1 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. Specifically, we will develop a GIS-based metric that assigns a given soil type into an operability class (low, medium, high) based on estimated soil conditions (i.e., soil moisture or frost depth). The metric will utilize the soil strength-soil condition relationships identified in Activity 1 in combination with publically-available spatial soil and weather datasets. A field tool, based on relationships between mass and soil strength, will also be developed for direct assessment of real-time conditions by loggers and managers. We will also develop strategies and recommendations to enhance operability under subpar conditions including post-storm rain events and early season snowfall.

ENRTF BUDGET: $ 24,500

Outcome	Completion Date
1. Field tool prototype completed	Apr. 2021
2. Initial development of GIS-based metric completed	Oct. 2021
3. Beta testing of GIS metric completed and updates incorporated into final product	June 2022
4. Specifications for field tool completed	June 2022
5. Strategies and recommendations to improve operability incorporated into final report	June 2022

First June 30, 2019
Second Update June 30, 2020,
Third Update June 30, 2021
Final Update June 30, 2022

IV. DISSEMINATION:

The products developed from this project are intended to be used by practitioners in a variety of operational settings. A final report will document relationships among soil conditions and soil operability in both winter and summer. Recommendations on optimal soil operability related to these relationships will be included in the report. This report will be made available on the webpages of the Department of Forest Resources and the Minnesota Forest Resources Council. Spatial data products will disseminated directly to primary stakeholders (e.g., DNR, Forest Service, County land departments) and will also be uploaded to the Minnesota Geospatial Commons (https://gisdata.mn.gov/) for general access. In addition, several manuscripts will be written based on this research and submitted for publication in peer-reviewed journals. Results and related recommendations will be also be presented directly to public forest management agencies, forest industry and logging trade

organizations, and other forestry professionals in cooperation with the Sustainable Forestry Education Cooperative. All reports and publications from this project will be made available via the Department of Forest Resources web site.

Description:

First June 30, 2019
Second Update June 30, 2020,
Third Update June 30, 2021
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V. PROJECT BUDGET SUMMARY:

The total recommended budget request is $200,000 over a four year period. Salary (1.0 FTE) and fringe (0.335) is budgeted for a Research Associate for approximately 2 years. The research associate will be responsible for field work associated with Result 1 including site identification, treatment application, and data collection. Salary and fringe (0.15 + 19.32/hr tuition; no summer tuition) is budgeted for one year for 1 graduate student, who will conduct field work, analyses, and interpretation of study data associated with Result 1. The student will begin in the second year of the project so that data is immediately available to them. Work associated with Result 2 will be conducted by the graduate student and members of the project team. The $24,000 budgeted for supplies includes funds for soil temperature and moisture sensors, dataloggers, tipping bucket rain gauges, a soil penetrometer, snow tube and scale, and miscellaneous supplies for treatment application including rainout shelters and shovels. The $15,000 budgeted for travel includes costs associated with mileage (75%) and lodging (25%) within Minnesota for researchers, the research associate, and graduate student to the project sites. A large numbers of visits will be required because sites will be located around the state and require periodic visits following snow and rain events.

A. Preliminary ENRTF Budget Overview: See attached budget spreadsheet

Explanation of Capital Expenditures Greater Than $5,000: N/A

Explanation of Use of Classified Staff: N/A

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 2.5

Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

B. Other Funds:

SOURCE OF AND USE OF OTHER FUNDS	Amount Proposed	Amount Spent	Status and Timeframe
Other Non-State $ To Be Applied To Project During Project Period:			
In-kind salary from R. Slesak (0.1 FTE) , R. Kolka (0.05 FTE) and S. Sebestyen (0.05 FTE)	$ 76,900	$	Secured

VI. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
Robert Slesak	Program Manager/researcher	UMN / MFRC	Project Manager, principle investigator (PI)
Charlie Blinn	Professor	UMN	Co-PI

B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Role
Randy Kolka	Research Scientist	USDA Forest Service – North. Research Station	Co-PI
Stephen Sebestyen	Research Scientist	USDA Forest Service – North. Research Station	Co-PI
Dan Hanson	ECS Program Coordinator	DNR Forestry	Co-PI

VII. LONG-TERM- IMPLEMENTATION AND FUNDING:

Initial implementation of the GIS metric should go smoothly since members of the forestry community have consistently requested this information and it will be provided in a GIS format that is widely used and accessible. However, future refinements of the metric will likely be needed in response to user feedback and new field data that can be used to improve calibration equations. We will work closely with forestry stakeholders to demonstrate the utility of the metric, and to provide resources needed for its improvement. Further, we expect that the soil operability metric will change with changing weather patterns and climate, so additional work will be needed in the future to maintain overall utility. Funding requests for these efforts will be targeted at state agencies, federal agencies, and forest industry. For the field tool, we will explore working with UMNs Minnesota Innovation Partnerships to identify opportunities for product development. Once the tool becomes available, we will partner with UMN Extension and the MN logger Education Program to train field foresters and loggers in its use.

VIII. REPORTING REQUIREMENTS:

- **The project is for 4 years, will begin on July 1, 2018, and end on June 30, 2022.**
- **Periodic project status update reports will be submitted June 30th of each year.**
- **A final report and associated products will be submitted between June 30 and August 15, 2022.**

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

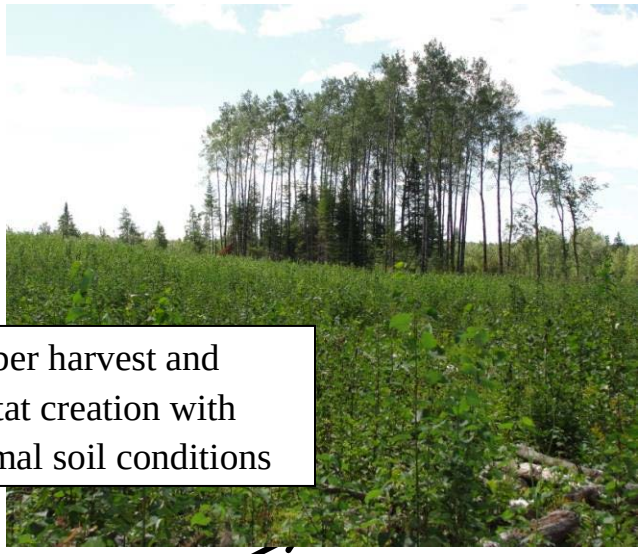
A. Budget Spreadsheet
B. Visual component
C. Research Addendum

Attachment A:
Environment and Natural Resources Trust Fund
M.L. 2018 Budget Spreadsheet

Project Title: Increasing timber availability and habitat with soil management
Legal Citation:
Project Manager: Robert Slesak
Organization: University of Minnesota
College/Department/Division: Department of Forest Resources
M.L. 2018 ENRTF Appropriation:
Project Length and Completion Date: 4 years, June 30, 2022
Date of Report: 12/8/17

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits) - Overall	$161,000	$0	$161,000
Research Associate - salary and fringe (0.335) for 2 years who will coordinate treatment application and data collection at the project sites for Activity 1 (Total estimated amount $118,858)			
Graduate student - Salary (0.5 FTE) and fringe (0.15) + 19.32/hr tuitionfor 1 year who will analyze data from Ativity 1 and develop recommendations and tools for Activity 2 (Total estimated amount $42,142)			
Equipment/Tools/Supplies			
Soil temperature and moisture sensors (80 totaling $12,000), dataloggers (16 totaling $8,000), snow tube and scale ($500), shovels, soil penetrometer ($1000), and misc. supplies for treatment application ($2500)	$24,000	$0	$24,000
Travel expenses in Minnesota			
Travel for mileage (75%) and lodging (25%) within Minnesota for researchers, the Research Associate, and Graduate Student to the project sites in Activity 1 and work in Activity 2. A large amount of travel will be requiried because sites will be located across northern Minnesota and require periodic visits following snow events and throughout the growing season	$15,000	$0	$15,000
COLUMN TOTAL	$200,000	$0	$200,000

Soil damage under suboptimal operating conditions



Timber harvest and habitat creation with optimal soil conditions

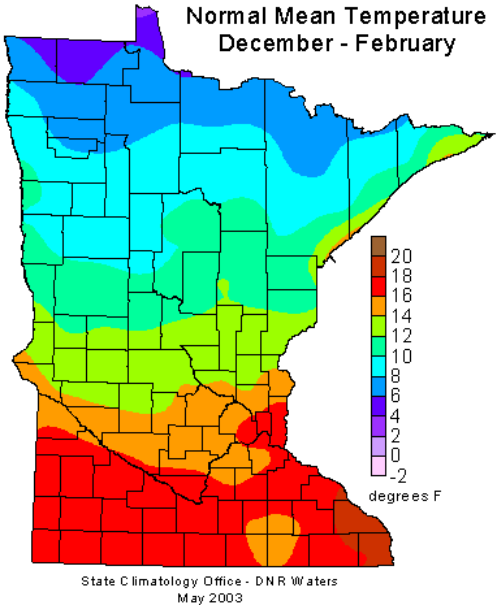
We want to <u>avoid this</u> and <u>increase this</u> by quantifying how these factors influence soil operability

<u>Soil properties</u>

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

Dependent on soil texture and density

<u>Air temperature</u>



Air temperature influences soil water and frost dynamics

Dependent on soil type and snow conditions

<u>Surface conditions</u>

Snow and forest floor influence frost development and soil water

Dependent on timing / intensity of rain and snow storms