Project Title: **ENRTF ID:**   149-D

Testing a New Method for Eradicating Dwarf Mistletoe

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: $ 352,000

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

Summary:

This projects seeks to use new technology that gives natural resource managers another tool to maintain healthy and productive black spruce forests across Minnesota.

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Sponsoring Organization: U of MN

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Location

Region: Northwest, Northeast

County Name: Chippewa, Cook, Hubbard, Isanti, Itasca, Kanabec, Koochiching, Lake, Lake of the Woods, Roseau, St. Louis

City / Township:

Alternate Text for Visual:

Mortality pocket caused by dwarf mistletoe in a black spruce stand in northern Minnesota spreads at a rate of 2.4 feet a year, causing mortality pockets of 2.25 acres over a rotation.

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

PROJECT TITLE: Testing a New Method for Eradicating Dwarf Mistletoe

I. PROJECT STATEMENT

Eastern spruce dwarf mistletoe (ESDM) is one of the most damaging pathogens of black spruce with up to 59% of stands infected in Minnesota. ESDM is a native pathogen that quickly kills black spruce, creating mortality pockets which can transition a forest stand into an open grassland or brushland. It is hypothesized that historically ESDM was partially controlled by severe stand replacing fires that were part of the natural disturbance dynamics. However, these fires are no longer typical or practical. **New management tools must be developed which can balance the multiple ecosystem services which black spruce forests provide.**

Black spruce is an ecologically and economically important species. It is one of few species that can thrive on very wet, nutrient poor sites in Minnesota, filling an important ecological niche. Black spruce forests provide important wildlife habitat for several Species of Great Conservation Need, such as spruce grouse, and act as an important nutrient filter for water quality. Timber products from black spruce are an important component of northern Minnesota's rural economy with over 250,000 cords harvested annually across state, private, and federal lands. Partnering with forestry activities provides the only feasible way of restoring this habitat.

Current management practices in black spruce infected with ESDM call for a clearcut harvest with the removal of all residual trees greater than 5 feet in height. This, however, is not adequate, because any infected residuals that remain after a harvest will continue to spread the pathogen and will quickly kill the regenerating trees. Spread from each infected residual over the next 90 years will lead to the loss of at least 2.25 acres of habitat (and timber). Treatment to remove residuals is done by a contractor using a bulldozer with a brush clearing (KG) blade. However, this piece of equipment is rare (only 3 in northern Minnesota), heavy (must have frozen ground), and is inefficient in treating individual stands. These factors result in few stands being treated, which means residual infected black spruce remain on the site, and ultimately the site may convert to grass or brush.

This project will test and evaluate a new technology, a track loader with a brush cutting head or a mulching head (see figure), to eradicate ESDM in infected residual black spruce. Track loaders have a few benefits over the traditional KG blade treatments, namely that (1) they are numerous, (2) they are light and faster and are able to operate on snow and unfrozen ground, and (3) are an important tool during warmer winters.

The overarching goal of this project to test the effectiveness and efficiency of this new technology (the track loader) compared to traditional KG implementation. This will give natural resource managers another tool to maintain healthy and productive black spruce forests.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1. Develop GPS tracking/guidance and protocols for use in the trackloader.   Budget $60,000
Currently, an entire stand is treated after harvest because the mistletoe location is not known. We will develop programming for a portable GPS device, which can be temporarily installed in a track loader. This device will display the machine location, as well as the area to be treated. The operator will be able to see the path, and avoid missing spots within the treatment area, much like a farmer using precision agriculture equipment. Such equipment has not been developed for forestry work. The application need not be as complicated, as a human will always operate the machine. In addition to reducing the area to be treated and treatment costs, we anticipate a reduction in the cost and effort of administering the contract. Upon completion of the project the GPS unit and programming will be given to DNR Forestry in Littlefork.

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Outcome	Completion Date
1. Selection of GPS unit/bracket	*August 1 2018*
2. GPS programming, field testing	*December 1 2018*

Activity 2. Assessment of track loader efficiency and effectiveness compared to a KG blade. Budget $292,000
Working with DNR and County foresters, we will identify 20 stands with ESDM on state or county land that are scheduled for treatment. Half of the stands will be treated with traditional methods (KG blade) and half will be treated with the track loader. Our field crew will traverse each stand at 200-yard intervals recording mistletoe locations with the GPS. This information will be used to simulate mistletoe impacts in the current stand, and in the next stand, providing information on the economic impacts of ESDM and the return on investments of eradication. We will then work with DNR Forestry to contract for a track loader with a brushcutting or mulching head. We are budgeting $200/acre, and, at the scale of this project, we can treat 75 acres per year. We will spread this over as many stands as are available. This will give an adequate indication of the effectiveness of the equipment over a wide variety of stand, snow and other operating conditions. Finally, to evaluate treatment effectiveness we will measure if the machine covered the entire infested area, and if the machine killed the infected residuals. To evaluate machine coverage, we will examine the correspondence between the GPS path of the machine and the treatment area and calculate the percentage of area covered and the number of areas missed per treated acre. Economic assessment will compare the cost of treatment with the value of the timber saved.

Outcome	Completion Date
1. Identify ESDM infected stands	*December 1 2018*
2. Complete surveys of infested stands	*January 1 2019*
3. Contract for track loader treatments	*February 1 2020*
4. Assessment of treatment and economics	*May 1 2020*

III. PROJECT STRATEGY
A. Project Team/Partners
Dr. Matthew Russell, University of Minnesota Forest Resources, will lead the project and contribute expertise in forest health assessments and monitoring. Dr. Marcella Windmuller-Campione, University of Minnesota Forest Resources department, will assist in silvicultural implications. Dr. Fred Baker, University of Minnesota Forest Resources department, will train the crew and provide overall guidance with mistletoe and simulation modeling. He will also coordinate with Harold Thistle, USDA Forest Service Forest Protection – Forest Health Technology Enterprise Team, to develop the GPS system. The University of Minnesota will receive the funding.

B. Project Impact and Long-Term Strategy
This project will provide information that can be used to evaluate the economics of investments in management of ESDM. It will also provide a thorough examination of the feasibility and effectiveness of potentially useful treatment which foresters have never had. Assessment of this technology can open the door for many more acres of black spruce to be successfully treated after harvest and allow for a wider range of silvicultural treatments to be implemented in black spruce stands (more than just clearcuts).

C. Timeline Requirements
For this project, we are requesting three years since access to the stands is weather dependent, frequently possible only when the ground is frozen (Late December – mid-March).

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2018 Detailed Project Budget

Project Title: Testing a New Method for Eradicating Dwarf Mistletoe

IV. TOTAL ENRTF REQUEST BUDGET *two* years

BUDGET ITEM	AMOUNT
Personnel:	$ -
Dr. Matthew Russell, University of Minnesota (66.5% salary, 33.5% benefits); 4% FTE each year for 2 years summer salary	$ 17,845
Dr. Marcella Windmuller-Campione, University of Minnesota (66.5% salary, 33.5% benefits); 4% FTE each year for 2 years summer salary	$ 17,714
UMN 1 graduate research assistants to collect, analyze, and evaluate data. Salary and fringe (0.82) for 2 years each (0.5 FTE)	$ 122,419
UMN Research associate coordinating collection of vegetation and forest health data; Salary and fringe (0.214) for 2 years (0.75 FTE)	$ 104,222
1 UMN undergraduate work study students to assist with summer data collection and processing. Salary and fringe (0.077) for 2 years (.25 FTE)	$ 16,800
Professional/Technical/Service Contracts:	
Fred Baker Training, simulation modelling, field supervisor	$ 10,000
Trackloader contract $30,000, with RFP.	$ 30,000
Development of GPS, software	$ 7,000
Equipment/Tools/Supplies:	
Forest inventory equipment and supplies - handheld gps unit, measuring tapes, flagging, snowshoes, clalipers, and pin flags	$ 2,500
Travel:	$ -
Estimate of $7,500 per year for 2 years since sites are remote and difficult to access. This includes costs of rental vehicle from UMN fleet services, per diem, and housing	$22,500
In-state conference registration, travel, and per diem to present results from study during the study - $500 each year (2 years)	$1,000
Additional Budget Items:	N/A
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 352,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	$ -	
USDA Forest Service STDP Project	$ 93,849	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:	$ -	
Fred Baker will donate an additional 15 days at $400/day to the project.	$ 6,000	*Secured*
Unrecovered indirect costs@ 54% (2018, 2019) of total direct cost $668,003	$ 190,080	*Secured*
Funding History:	N/A	*N/A*
Remaining $ From Current ENRTF Appropriation:	N/A	*N/A*

Testing a New Method for Eradicating Dwarf Mistletoe

Mortality pocket caused by Dwarf Mistletoe in a black spruce stand in northern MN spreads at a rate of 2.4 feet a year, causing mortality pockets of 2.25 acres over a rotation.

Traditional treatment: bulldozer with KG blade – heavy, inefficient, and not widely available

New Treatment: track loader with brush cutting head – efficient, can be used under wider conditions, readily available

Can new technology help maintain healthy and productive black spruce forests?

PROJECT MANAGER QUALIFICATIONS AND ORGANIZATION DESCRIPTION

Project Manager:	Matthew B. Russell
Affiliation:	Department of Forest Resources, College of Food, Agricultural and Natural Resource Sciences, University of Minnesota
Title:	Assistant Professor/Extension Specialist

Contact: 1530 Cleveland Ave. N
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Qualifications: Matthew Russell has a Ph.D. in forest resources from the University of Maine, an M.S. in forestry from Virginia Tech, and a B.S. in forestry from Paul Smith's College. He specializes in forest ecosystem health and is the team lead for the Forest Ecosystem Health program in the University of Minnesota's Extension Center for Agriculture, Food and Natural Resources. His research and Extension interests focus on managing natural resources in the face of environmental changes. From 2008-2012, he was Forest Data Manager for the US Forest Service Penobscot Experimental Forest, a long-term experiment focused on evaluating the ecological and environmental impacts of varying forest management techniques. From 2008-2009 he was Forest Data Manager for the Cooperative Forestry Research Unit, a forest industry-university research cooperative established at the University of Maine. He is an active member of the Society of American Foresters and Forest Products Society.

Organization: The mission of the Department of Forest Resources located at the University of Minnesota is to advance the science and management of forests and related natural resources, develop future leaders in forest and natural resource management through undergraduate and graduate education, and to serve citizens through outreach.