Environment and Natural Resources Trust Fund
2014 Request for Proposals (RFP)

Project Title: **ENRTF ID: 113-E**

Mitigating Drought and Windstorm Impacts on Minnesota's Forests

Category: E. Air Quality, Climate Change, and Renewable Energy

Total Project Budget: $ 270,000

Proposed Project Time Period for the Funding Requested: 3 Years, July 2014 - June 2017

Summary:

Project assesses strategies for mitigating impacts of drought and windstorms on Minnesota's forests. Results will quantify effectiveness of forest management at sustaining forest health and growth during extreme weather events.

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Sponsoring Organization: U of MN

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Location

Region: Statewide

County Name: Statewide

City / Township:

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

PROJECT TITLE: Mitigating drought and windstorm impacts on Minnesota's forests

I. PROJECT STATEMENT

Extreme weather events, including droughts and windstorms, present an enormous challenge for forest conservation and management efforts in Minnesota and elsewhere. Forest managers are increasingly being tasked with developing strategies to prepare for these events so as to minimize their impacts on the many values forests provide to the state. Increases in drought and windstorm frequency and intensity, in particular, may reduce forest productivity and increase tree mortality in Minnesota's forests. These impacts could 1) reduce carbon storage, 2) greatly alter wildlife habitat, 3) negatively impact water quality, and 4) compromise the long-term sustainability of forest industry.

Forest thinning and managing mixed forests that include understory tree seedlings have been suggested as potential strategies to reduce drought and windstorm impacts (Figure 1); however, these approaches have not been formally tested. This proposed project will directly assess the ability of these management practices at enhancing the resistance and resilience of Minnesota's forests to drought and windstorm events by:

- Identifying a network of long-term forest plots to assess the effectiveness of forest thinning and mixed species management at mitigating drought and windstorm impacts
- Quantifying the ecological impacts of past drought and windstorms on Minnesota forests
- Projecting the ability of forest management to mitigate future drought and windstorm impacts.

To achieve these goals, we will make use of an extensive network of long-term forest research plots with known management histories located throughout central and northern Minnesota and containing data records often extending back over 50 years. These data records, coupled with tree-ring analyses, will allow us to determine what forest conditions (species composition and densities) have been most resistant and resilient to past droughts (e.g., 1988 and 2006-06 droughts) and windstorms (e.g., 1995 windstorm). This information will be used to develop recommendations for MNDNR, County, Federal, and private land managers for mitigating the impacts of future extreme weather events on the ecology, health, and productivity of Minnesota's forests. This proposed study builds on an established study that is examining the effectiveness of thinning at minimizing the ecological impacts of drought on red pine forests in Minnesota. Through this study, we have established the sampling protocol and details of analyses, meaning that the proposed project can be undertaken swiftly and efficiently and applied to other important forest types, including oak, northern hardwoods, aspen, and spruce-fir.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Identify network of existing long-term forest plots and collect field data **Budget: $90,000**

We will locate at least 40 long-term forest plots, representing the predominant forest types in Minnesota and a range of species mixtures and thinning intensities, with the assistance of MNDNR, counties, and the US Forest Service (USFS). For each plot, we will compile existing data on past management and disturbance and forest conditions. At each site, we will remeasure current forest ecological conditions and we will extract increment cores (for tree-ring analyses), which will provide a record of tree growth for many decades in the past.

Outcome	Completion Date
1. Work with MN-DNR, counties, and USFS to identify long-term forest plots	August 2014
2. Compile forest, management, and disturbance data	November 2014
3. Collect field data (tree-ring cores and ecological data) from existing study sites	June 2015

Activity 2: Quantify the impacts of drought and windstorms on ecological health and productivity for each forest type **Budget: $115,000**

To assess the impacts of drought and extreme weather events on forest ecological health and productivity and the effectiveness of management at mitigating these impacts, we will examine growth, mortality, and ecological trends in response to past extreme weather events. In particular, we will focus on growth responses and mortality rates during well-documented drought periods (e.g., 1988 and 2005-06) and wind events (e.g., 1995, 1999). Comparisons of growth responses, mortality rates, and ecological conditions across different management regimes and stand conditions will allow us to determine the strategies best poised to mitigate the impacts of future extreme events. Results will be conveyed to managers through outreach activities, including workshops and informational pamphlets and publications.

Outcome	Completion Date
1. Analyze tree-ring data to assess growth response to weather events	December 2015
2. Analyze long-term changes in mortality rates in response to past events	February 2016
3. Final report of activity results submitted	July 2016

Activity 3: Project the ability of management to mitigate impacts of future extreme weather event **Budget: $ 65,000**

We will integrate findings from Activity 2 into a well-validated, commonly used computer model (Climate-Forest Vegetation Simulator) to simulate how forest ecological health and productivity respond to different mitigation strategies under a range of future climate conditions. Results will be summarized in public project reports and conveyed to managers through outreach activities.

Outcome	Completion Date
1. Incorporate findings from long-term forest plots into forest computer models	September 2016
2. Analyze effectiveness of mitigation strategies at minimizing impacts of future extreme weather events on over 7 million acres of Minnesota's forests	February 2017
3. Final report of activity results submitted	June 2017

III. PROJECT STRATEGY

A. Project Team/Partners

The research team will be led by scientists at the University of Minnesota, Department of Forest Resources, including Dr. Anthony D'Amato and Dr. Shawn Fraver, and a scientist at the U.S. Forest Service (USFS) Northern Research Station, namely Dr. Brian Palik. Cooperators will include the Minnesota Department of Natural Resources, several Minnesota Counties, and the USFS. Research funds will be received by Dr. Anthony D'Amato.

B. Timeline Requirements

The duration of the project is three years. The requested time is necessary to identify sites, conduct field work (over two seasons), analyze tree-ring data, and determine optimal management approaches that promote long-term productivity and minimize vulnerability resistance.

C. Long-Term Strategy and Future Funding Needs

Results and recommendations from this work will serve to promote more resilient forests to drought and windstorm events and will create healthier, more productive forest habitats in the face of future extreme weather events. Findings will be disseminated to state, county, federal, and private stakeholders through workshops, presentations, tours, reports, and publications. This proposed project complements our team's focus on the ecological impacts of climate and natural disturbance on the management and conservation of Minnesota's forests. To advance this line of research, team members are actively seeking additional funds from other sources, including the USDA and USDOI Climate Science Center.

2014 Detailed Project Budget

Project Title: Mitigating drought and windstorm impacts on Minnesota's forests

PIs: Dr. Anthony D'Amato, Dr. Shawn Fraver, University of Minnesota; Dr. Brian Palik, USDA Forest Service

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM *(See "Guidance on Allowable Expenses", p. 13)*	**AMOUNT**
Personnel: One month of faculty summer salary and fringe (0.1934) for three years(D'Amato, PI; 0.1FTE)	$ 33,999
Post-doctoral researcher examining ecological impacts of drought and windstorms for two years (1.0 FTE); salary and fringe (0.1812).	$ 107,903
Research associate coordinating and collecting field data on ecological impacts of drought and windstorms for two years (1.0 FTE); salary and fringe (0.3230)	$ 95,681
Salary and fringe (0.0743) for a work-study undergraduate student for 3 years	$ 17,793
Equipment/Tools/Supplies: Equipment includes Haglof distance measuring equipment ($700), stake whiskers for marking subplots ($110), increment borers for collecting tree-ring samples ($650), and supplies for processing tree-ring samples ($350)	$ 1,810
Travel: Due to the high number of study sites and logistics associated with establishing the harvest treatments and baseline data collection, $12,814 is budgeted for domestic travel within Minnesota. This money will be used to pay for mileage (75%) and lodging (25%) for researchers, the field technician, and undergraduate students. Mileage costs are associated with rental of a field vehicle through the University of Minnesota motorpool for two field seasons. Travel reimbursement will follow University of Minnesota protocols.	$ 12,814
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 270,000

V. OTHER FUNDS

SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $ Being Applied to Project During Project Period: U.S. Department of Interior, Northeast Climate Science Center. Funds from this source will be used to develop methodology for quantifying ecological impacts of drought and will directy complement the research proposed in this LCCMR project. In addition, funds from this source will be used to develop outreach materials.	$ 365,000	Secured
U.S. Forest Service Experimental Forest Monitoring Project. Funds from this source will be used to pay for technician time sampling long-term Forest Service experiments in Minnesota.	$ 70,000	Secured
In-kind Services During Project Period: In-kind salaries provided by U.S. Forest Service Researchers (0.5 FTE; B. Palik), as well as in-kind use of Forest Service ATV, vehicle, and trailer	$ 45,000	Secured

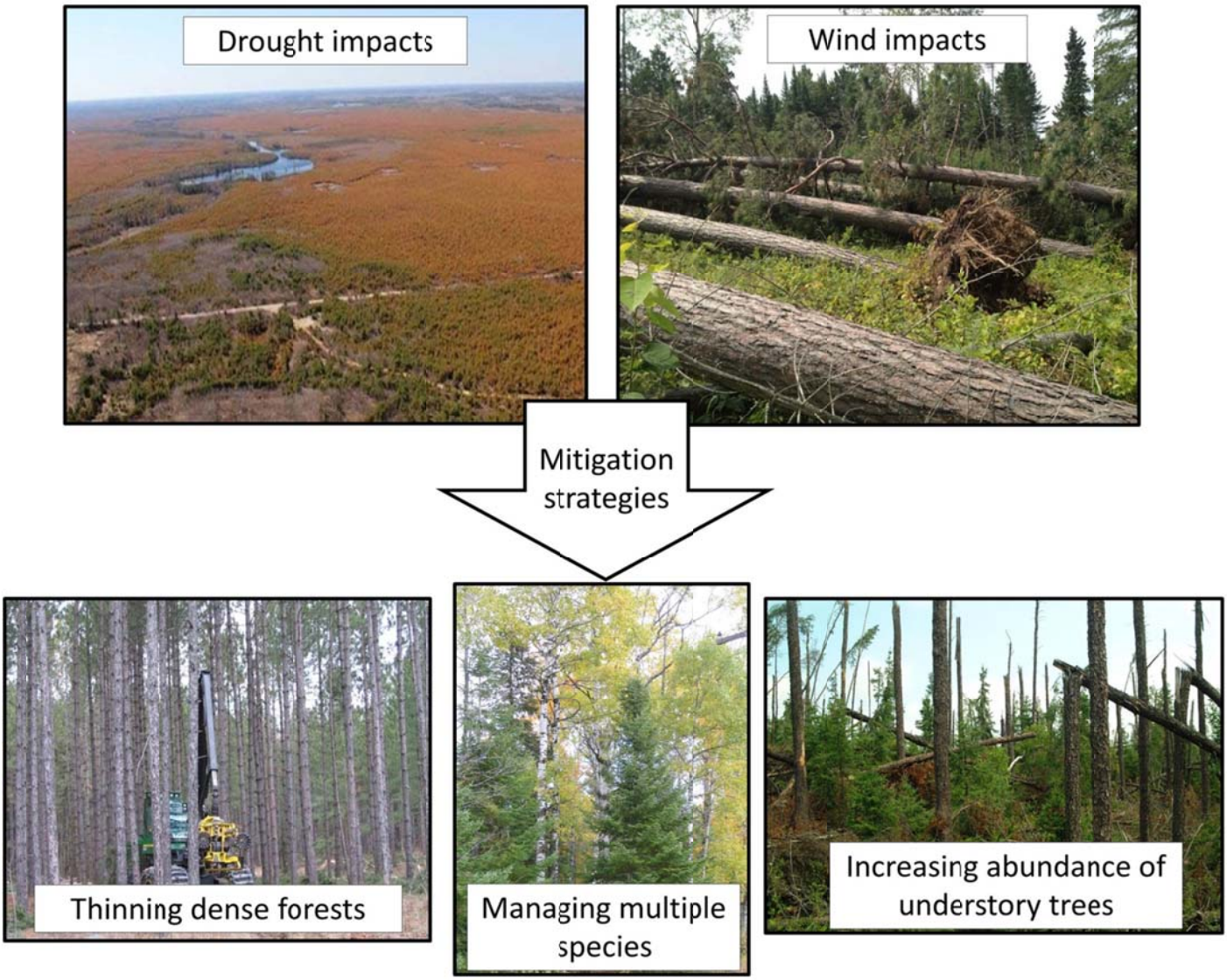

Figure 1. Suggested management strategies for reducing the ecological impacts of drought and windstorms. ***Thinning*** is applied to dense forests to increase water and nutrient availability during drought events and minimize impacts. ***Managing for multiple species*** reduces the vulnerability of forests to drought and wind given that each species has a unique drought and wind tolerance. Finally, ***maintaining understory trees*** ensures that forests quickly recover from windstorm impacts through the rapid growth and carbon sequestration of these understory individuals following blowdown of canopy trees by wind. **We will determine the ability of these strategies to minimize the ecological impacts of drought and windstorms on forest habitats covering over 7 million acres.**

Mitigating drought and windstorm impacts on Minnesota's forests

Project Manager Qualifications

Anthony W. D'Amato

Qualifications

Anthony is an Associate Professor of Silviculture and Applied Forest Ecology in the Department of Forest Resources, University of Minnesota. He conducts teaching, research, and participates in outreach/Extension programs. His research primarily focuses on traditional and experimental silvicultural strategies for meeting diverse forest management objectives ranging from the sustainable production of woody biomass for biofuels to increasing the resilience and resistance of forest ecosystems to future climate and disturbance impacts. His primary outreach audiences are natural resource managers.

Anthony has been the principal investigator and project manager on several large-scale projects aimed at evaluating the effectiveness of different management strategies at conferring resistance and resilience to future environmental changes. He has published numerous peer-reviewed and non-technical articles which address the impacts of climate, forest harvesting practices, and natural disturbances on forest growth and development and has been involved with several outreach programs focused on the development of strategies to mitigate the impacts of drought and other extreme events on forests. He was also involved in recent statewide vulnerability assessments of Minnesota forest ecosystems to climate change.

Responsibilities

As Project Manager, Anthony would coordinate and manage the overall project, coordinate the establishment of a network of long-term forest plots and collection of field data in Activity 1, provide oversight for assessments of the ecological impacts of drought and windstorms and the effectiveness of management at mitigating impacts (Activity 2), and provide oversight on the integration of research findings into long-term simulation models of the future response of forest ecological health to different mitigation strategies (Activity 3). In the coordination and management role, he would convene meetings of project participants throughout the life of the project to facilitate collaborative efforts, share results, discuss future directions, and identify additional outreach opportunities that could be pursued. His research would focus on quantifying the effectiveness of different management strategies at mitigating the impacts of drought and windstorms (Activity 2).

Organization Description

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