Environment and Natural Resources Trust Fund
2016 Request for Proposals (RFP)

Project Title: **ENRTF ID: 152-E**

Identifying Best Seed Sources for Forest Tree Planting

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

Total Project Budget: $ 396,843

Proposed Project Time Period for the Funding Requested: 3 years, July 2016 to June 2019

Summary:

Climate change threatens Minnesota's future forests by stressing young seedlings. This project improves forest productivity and ecological services by determining the best seed sources for future reforestation efforts.

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Sponsoring Organization: U of MN

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Web Address

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Minnesota's six seed zones and the four planting locations (1-Ely, 2-Grand Rapids, 3-East Bethel and 4-Waseca) where white pine, white spruce and bur oak seedlings from each seed zone will be tested. Inset box indicates that all seed zones from all species are represented at each planting location.

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

PROJECT TITLE: Identifying best seed sources for forest tree planting

I. PROJECT STATEMENT

Climate change is altering the environmental conditions of Minnesota's forests, threatening their ecological integrity and economic importance. We hypothesize that this environmental stress lowers the survival and growth rates of planted tree seedlings. Landowners and nurseries in Minnesota need to know the best seed sources for future reforestation efforts. ***The overarching goal of this project is to improve forest productivity and protect the ecological and economic benefits that derive from healthy forests by providing seed source recommendations based on seedling survival and growth data.*** These data-driven recommendations will be available to any organization or company in the state that plants or grows tree seedlings. This project will test the survival and growth of white spruce, white pine and bur oak seedlings collected from six different seed zones across the state at four field trial sites along a north-south gradient (Figure 1). This type of test, called a "common garden trial", is a classic research method used to assess the suitability of seedlings for planting in areas other than where they were collected.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Prepare and Fence Four Test Sites **$110,012**

We have verbal commitments from each of the four locations to host a test site (UM Southern Research and Outreach Center, Waseca; UM Cedar Creek Biological station, East Bethel; UM North Central Research and Outreach Center, Grand Rapids; and Superior National Forest, Ely area). The four test sites must be prepared and fenced prior to planting seedlings. We will use a local contractor to do site preparation and then fence each site to protect seedlings from deer and rabbits. Once site preparation and fencing is accomplished the sites are ready to plant.

Outcome	Completion Date
1. Physically locate a 6 acre site at each of the 4 locations	August 2016
2. Prepare four sites for planting; requires herbicide, disc, till	May 2017
3. Fence four sites	May 2017

Activity 2: Acquire Seedlings, Plant Seedlings and Site Maintenance **$66,145**

Seedlings of white pine and white spruce from the appropriate seed zones can be purchased from the DNR Nurseries which track seedlings by seed zone. These two species can be planted in spring 2017. Bur oak acorns will be collected and grown in a greenhouse prior to planting. We will solicit help from our network of foresters (MN DNR, county land departments, consulting foresters, and industry partners) to identify 120 bur oak mother trees across the six seed zones, and collect acorns in fall 2016. Acorns will be grown in a greenhouse for one year and planted in spring 2018. Maintenance of weeds and competing vegetation is expected for two years post planting. Once all sites are established the seedlings are in a free-to-grow state.

Outcome	Completion Date
1. Plant a total of 3,000 white pine and 3,000 white spruce seedlings at four sites	May 2017
2. Collect bur oak acorns from 120 mother trees grow in greenhouse and plant at 4 sites	May 2018
3. Site maintenance (mow, herbicide) 2-3x/year to control weeds/grass/shrubs at 4 sites	May 2019

Activity 3: Data Collection, Data Analysis and Reporting **$220,686**

Data on survival and growth traits will be taken at 6,12,18,24 and 36 months from establishment. Data will be analyzed and results reported at formal and informal professional meetings throughout the life of the project. Results will take the form of specific seed source recommendations to maximize survival and growth of seedlings.

Outcome	Completion Date
1. Data collection ongoing at 6,12,18,24 and 36 months	June 2019
2. Data analysis ongoing at 6,12,18,24 and 36 months	June 2019
3. Reporting results formally at 2 conferences; informally with forest professionals	June 2019

Total All Activities **$396,843**

III. PROJECT STRATEGY

A. Project Team/Partners

The project team consists of four University of Minnesota employees with over 60 years collective experience in designing, establishing, measuring, analyzing and reporting on seedling trials. A. David provides project oversight and report writing, C. Pike field coordination and statistical assistance, J. Warren and E. Humenberger field assistance/data collection, Graduate Student (TBD) data collection, analysis, reporting. University of Minnesota outstate locations to provide 3 of 4 planting sites, US Forest Service the other. Project team receives funding from ENRTF through University of Minnesota.

B. Project Impact and Long-Term Strategy

Information about how seedlings live and grow is by necessity a long-term process. Having access to the best seed sources is crucial to improving the productivity, competitiveness and ecological services of Minnesota's forests which are experiencing a changing climate. We will generate useful information and results from project initiation through year 20 which will be shared state-wide with any organization that plants or sells tree seedlings. We will report results on a continuous basis as data is collected and analyzed providing the most current findings based on current survival and growth data. Results would be presented verbally at meetings where nursery growers, forest industry, governmental agencies and individual growers are in attendance and in written form in reports and relevant journals The cost to establish this project is modest (site preparation, fencing, mowing, seedlings) and the improvements in survival and growth will save regeneration dollars and result in more fully stocked forests. Once the seedlings are above the competition (estimated 2 years post planting) no maintenance is necessary so a single ENRTF funding cycle is sufficient. We anticipate additional funding opportunities through other grantors especially for biological responses of white pine and bur oak to changes in climate. Measurements and reports beyond the initial 3 year phase can be accomplished by the project team in conjunction with the other grantors.

C. Timeline Requirements

The project will require the entire 36 month period to get the seedlings above the competition in a free-to-grow condition. Months 0-6 months will be used to prepare and plant sites. Months 6-30 will be used to control weeds/grass/shrubs. Months 6-36 will be for continuous data collection, analysis and report writing. Project requires a bur oak acorn crop in 2016 or 2017 to provide bur oak seedlings for planting. We anticipate the project will continue to provide useful information through year 20.

2016 Detailed Project Budget

Project Title: Identifying Best Seed Sources for Forest Tree Planting

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel: Andrew David, Project Supervisor, 8.33%, 3 years, salary $28177 fringe $9552 Carolyn Pike, Field Coordinator/Statistics, 8.33%, 3 years, salary $15694 fringe $5320 James Warren, technical support, 16.6%, 3 years, salary $21,698 fringe $7356 Egon Humenberger, technical support, 16.6%, 3 years, salary $27158 fringe $7170 Graduate Student (TBD), analysis report writing, 50%, 2.5 years, $87500 Hourly Labor, field & greenhouse, 1370 hours, salary $16440	$ 226,065
Professional/Technical/Service Contracts: 4 local farmers (TBD) to prepare 4 sites for planting: herbicide, disk, till field ($1200 ea. site) UMN Greenhouse supplies and space fee (300ft2 for 14 months)	$ 8,034
Equipment/Tools/Supplies: Fence 4 sites @ 6 acres ea. 2200 lineal ft + gate ea. @ $10/lineal ft ($88,000) Pine and spruce seedlings 6,000 total ($3,240) Ventrac 3200 tractor and brush attachment (quote per website - $16,929) fuel for mowing ($1,000)	$ 109,169
Travel: *(Round trip travel to 4 sites is 835 miles @ .575/mile; per diem $46; lodging $85)* Travel statewide to identify bur oak and collect acorns ($5,500) Travel to 4 sites to erect fence ($9,712) Travel to 4 sites to plant pine, spruce and oak seedlings ($8,761) Travel to 4 sites to control weeds/grass (3x/yr) ($10,841) Travel to 4 sites for data collection (6,12,18,24&36 months) ($9,361) Travel to 2 instate conferences to present findings ($1,400)	$ 45,575
Additional Budget Items: Rent tractor and post auger for fencing ($2000/wk x 1week x 4 sites) phone quote Casper Rental Grand Rapids	$8,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 396,843

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	NA	
Other State $ To Be Applied To Project During Project Period:	NA	
In-kind Services To Be Applied To Project During Project Period:	NA	
Funding History:	NA	
Remaining $ From Current ENRTF Appropriation:	NA	

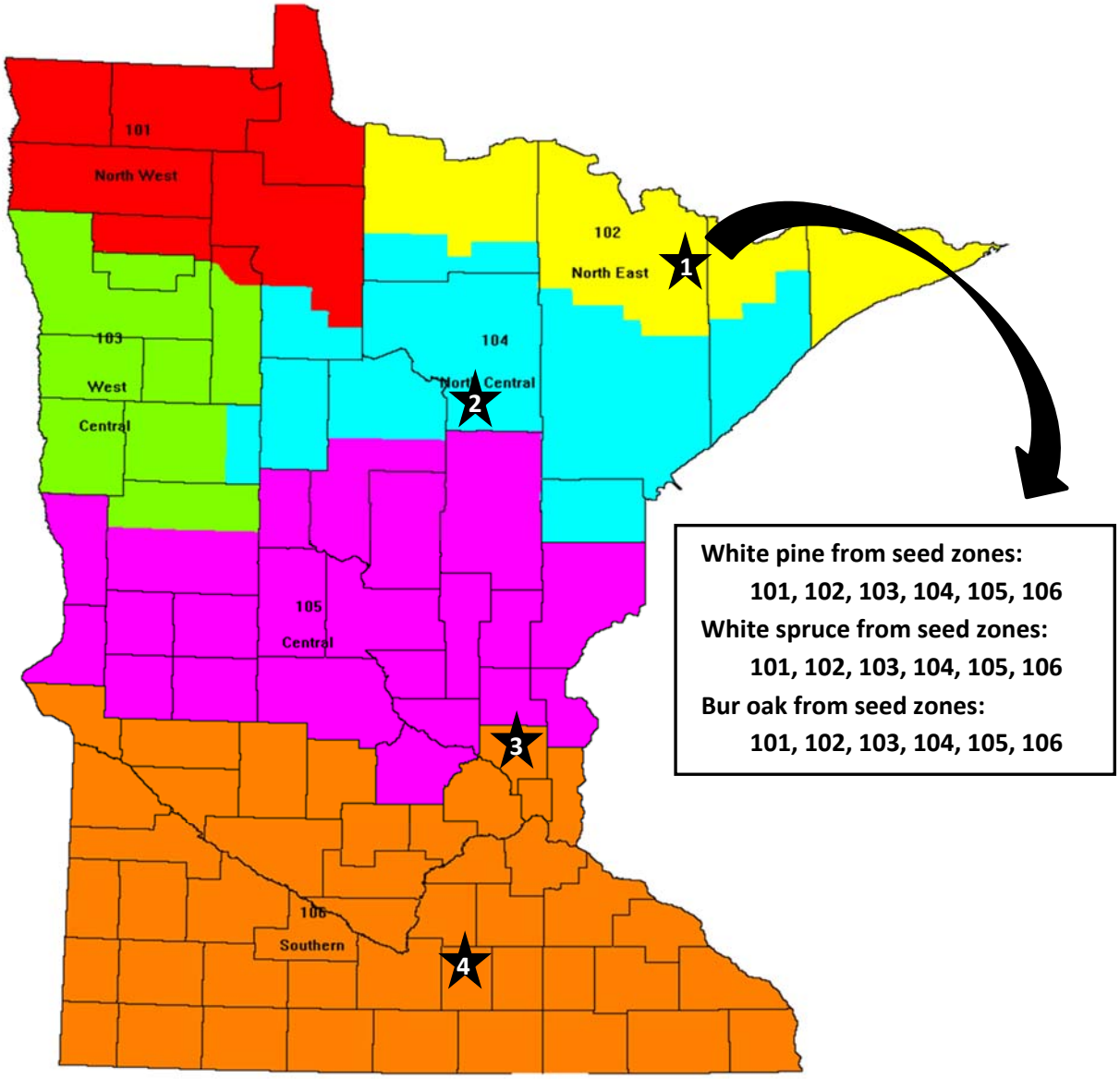

Figure 1. Minnesota's six seed zones and the four planting locations (1-Ely, 2-Grand Rapids, 3-East Bethel and 4-Waseca) where white pine, white spruce and bur oak seedlings from each seed zone will be tested. Inset box indicates that all seed zones from all species are represented at each planting location.

2016 LCCMR Project Manager Qualifications and Organization Description

Title: Identifying best seed sources for forest tree planting

Project Manager: Andrew David

Qualifications: Associate Professor of Forest Genetics in the Forest Resources Department at the University of Minnesota. He has been located in Grand Rapids at the University's North Central Research and Outreach Center since 1998. He has over 25 years' experience in tree improvement and forest genetics and 17 years as Director of the Minnesota Tree Improvement Cooperative. He has authored over 30 publications in both basic and applied outlets. His research interests include forest productivity and tree breeding, the effect of climate change on phonological traits in tree species, white pine blister rust resistance, gene conservation in ash species and silvicultural systems for establishing aspen.

Organization Description:

The University of Minnesota is a land-grant institution and research university with a strong tradition of education and service to the state. The Department of Forest Resources is the leading research and educational institution on forest related issues in Minnesota. For over 100 years the department has played a key role in discovering and fostering sustainable forest resource management activities in Minnesota.