

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

Project Title:

ENRTF ID: 131-D

Winning the Dutch Elm Disease Battle - Phase 2

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: \$ 330,187

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

Summary:

This project will identify and test 50 native elms from throughout Minnesota for resistance to Dutch elm disease so hardy disease resistant trees can be made available to the public

Name: Robert Blanchette

Sponsoring Organization: U of MN

Address: 1991 Upper Buford Circle, 495 Borlaug Hall, University of Minnesota
St. Paul MN 55108

Telephone Number: (612) 625-0202

Email robertb@umn.edu

Web Address

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Map of Minnesota with locations of surviving elms to be tested and photos showing a few these trees

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



PROJECT TITLE: Winning the Dutch Elm Disease Battle Phase II

I. PROJECT STATEMENT

There is new hope in fighting Dutch elm disease, one of the most devastating invasive tree diseases to enter Minnesota. This project builds on our successful ENRTF project 2013-06-06 and will identify and test 50 additional elm selections from throughout Minnesota for resistance, establish field plantings for our best selections and facilitate large scale propagation so the trees can be released to the public.

Dutch elm disease has moved through Minnesota over the past 50 years killing millions of elms. As this ecological disaster has unfolded, the disease has resulted in a natural selection process with some of the trees remaining showing resistance to infection. Over the past two years we have been selecting and screening Minnesota elms that survived and may be resistant to the disease. We have had an extraordinary response from arborists, city officials and the public with information on the location of elms that have survived in areas with high disease pressure. At present, we have over 175 elms from throughout the state that have been identified and need to be tested. With our current grant, which expires in 2016, we will be able to propagate and test 25 of these trees. From this group only a few trees will survive our rigorous testing and will be out planted for field resistance and to determine growth characteristics and other attributes of the selection. Although our past research has successfully found a few elms that appear to have good resistance, it is exceedingly important to obtain more genetically diverse elm trees that are disease tolerant. Having a diverse genetic stock of hardy, resistant and native Minnesota elms is vital to win the fight against this deadly fungus. Since there is no more beautiful or well suited tree for urban conditions than the elm, our selections will help restore this magnificent tree back into the landscape. We are also focusing our selections not only on American elm but also on other native elm species such as red and rock elm. These elm species are very important for municipalities outside the Minneapolis and Saint Paul metropolitan area and for northern forested areas. In addition, American, red and rock elms have long been regarded as some of the best trees to tolerate harsh environmental conditions. Minnesota and many other regions of the United States are experiencing a strong demand for trees that are adapted to varying climatic conditions. New selections can be used to replace urban trees killed or threatened by other invasive pests such as the emerald ash borer. Our proposed work would:

- 1. Identify and propagate resistant Minnesota native elm trees.** Each season, stems will be collected for cuttings, making grafts and for tissue culture micropropagation. Research will continue to explore the most efficient and productive ways to propagate native elms to promote commercial availability.
- 2. Disease resistance testing.** Testing Dutch elm disease resistance in propagations of selected trees is a critical and necessary step in this project. Trees grown in the greenhouse and the field will be subjected to the fungal pathogen (by injecting spores of the fungus into the stem) and rated as compared to susceptible wild types.
- 3. Study mechanisms of infection.** How do resistant elms tolerate Dutch elm disease infection? This question remains unanswered but would be pivotal in the battle against this invasive disease. These studies will involve chemical, genetic and physical mechanisms involved in infection. Determining mechanisms of resistance will also aid in the selection of additional native resistant elms.
- 4. Field Trial Research Plots.** Field trials of elm selections are a key component to test winter hardiness and tree performance throughout the state. Trials at University of Minnesota Research and Outreach Centers, the Minnesota Landscape Arboretum and partnerships with Minnesota DNR Parks and Trails and Three Rivers Parks District will be utilized to trial trees in a variety of sites throughout Minnesota.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Identify and propagate 50 resistant elm trees from the native population Budget: \$123,430

Newly identified elms will be visited and propagated during three different activity periods. Winter propagation will focus on grafted clone generation and summer propagation will make use of softwood stem material for vegetative stem cuttings propagation. Where possible, seed will be collected for seedling production.

Outcome	Completion Date
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1. Identify and collect 50 new elms	12/2017
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Activity 2 : Disease resistance testing of elms from throughout Minnesota

Budget: \$84,214

Established inoculation protocols will be used to inoculate propagated seedlings from selected trees with possible resistance to Dutch elm disease, after which they will be monitored and rated. Replicated studies in the greenhouse and field will screen and test selections.

Outcomes	Completion Date
1. Complete field screening of elms found resistant at the U of MN nursery	4/2017
2. Complete greenhouse disease screening of 50 new elm selections	4/2018
3. Complete field screening of the selected 50 elms	7/2019

Activity 3 : Study mechanisms of infection

Budget: \$60,114

Elm trees that resist infection from Dutch elm disease pathogen will have specific defense mechanisms in place to defend against or evade the pathogen. These investigations will look at chemical, morphological and physiological defenses produced by the selected trees. Results will also provide more rapid and efficient ways of identifying resistant elm trees.

Outcome	Completion Date
1. Morphological, chemical and physiological mechanisms of resistance identified from selected resistant elms	6/2018

Activity 4: Field Trial Research Plots

Budget: \$62,429

Trees will be selected from the research program to establish field trials at the MN Landscape Arboretum, the Three River Parks District and other locations throughout Minnesota. This will allow broad hardiness and field performance data as well as exposure to disease in many different locations and conditions.

Outcome	Completion Date
1. Establish field trial plots throughout the state for disease screening and performance	6/2019

III. PROJECT STRATEGY

A. Project Team/Partners

Dr. Robert Blanchette (Co-PI, University of Minnesota) is a professor and Dr. Benjamin Held (Co-PI, UMN) is a research scientist in the Department of Plant Pathology. They will take part in the screening and disease testing of resistant elms, as well as studies to elucidate infection processes and to find better ways to screen for resistant trees. Dr. Gary Johnson (Co-PI, University of Minnesota) is a professor and Chad Giblin (Co-PI, UMN) is a research fellow in the Department of Forest Resources. They will take part in collecting, propagating and field planting of resistant elms for disease testing and in selection trials for evaluating best growth and hardiness characteristics. Additional partners include arborists, park and city foresters and landowners throughout the state.

B. Project Impact and Long-Term Strategy

The main goals of this research is to find better more efficient ways to propagate elms, screen these trees to ensure they have a high level of resistance, evaluate them in field selection trials and make selections available for Minnesota nurseries. Testing for resistance must be rigorous and thorough and field plot inoculations are essential. This research is part of an ongoing effort to select Minnesota-native American, red and rock elms for disease resistance. Other funding sources are also helping in this effort, including annual support of \$15,000 to \$20,000 from the Minnesota Turf & Grounds Foundation.

C. Timeline Requirements

The time line of 36 months will allow selection and propagation of elms to occur, screening of the materials in the greenhouse and establishing field trials.

2016 Detailed Project Budget

Project Title: Winning the Dutch Elm Disease Battle Phase II

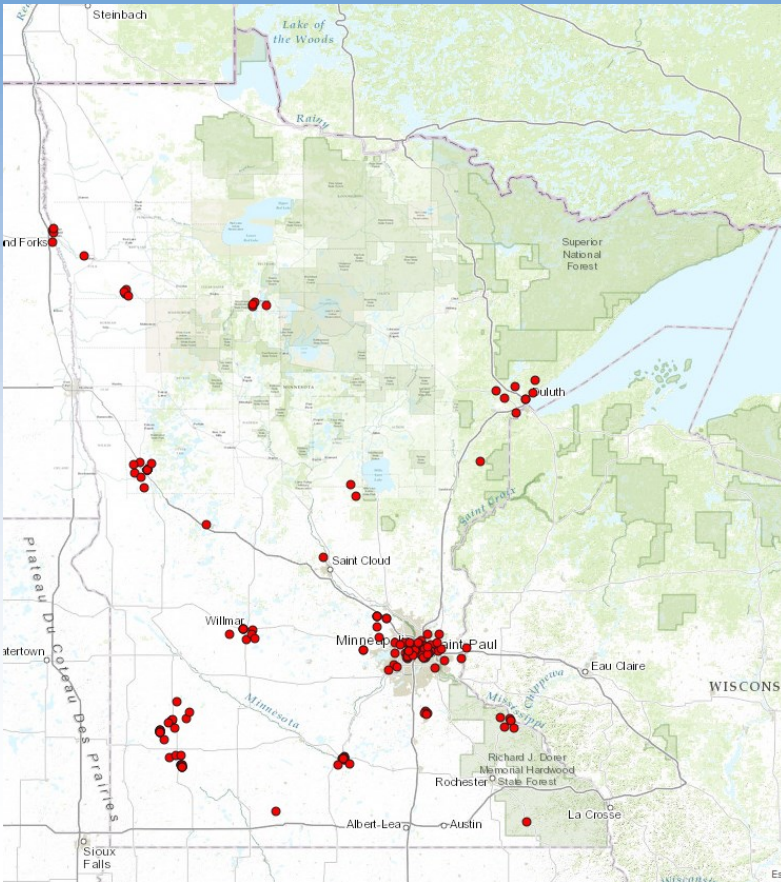
IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	
3 Undergraduate Students. 100% salary, 0% benefits. 30% FTE each year for 3 years	\$45,000
1 Graduate Student. 56% salary, 44% benefits 50% FTE each for 3 years	\$88,000
1 Research Fellow. 66% salary, 34% benefits 50% FTE for 3 years	\$102,859
1 Research Scientist. 73% salary, 27% benefits 25% FTE for 3 years	\$64,428
Professional/Technical/Service Contracts:	N/A
Equipment/Tools/Supplies: Field supplies (pots, stakes, pruning supplies, fertilizers, container substrate, \$2100/yr, 3 yrs). Laboratory Supplies (microbiology and inoculation materials microscopy, cytology, fungal genotyping, \$2200/yr, 3yrs)	\$12,900
Travel: Milage to field sites throughout Minnesota for collecting of resistant elms and to set up field plantings of selected and tested elms	\$ 8,000
Additional Budget Items: bucket truck use from local units or city foresters for sampling large trees , climbers for getting cuttings from mature trees, greenhouse fees for propagation and inoculation of elms.	\$ 9,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 330,187

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ To Be Applied To Project During Project Period: Minnesota Turf and Grounds Foundation has provided \$15,000 to \$20,000 per year for this project and this support should be continuing.	\$ 20,000	Pending
Other State \$ To Be Applied To Project During Project Period:	N/A	
In-kind Services To Be Applied To Project During Project Period: Blanchette (co-PI) salary and fringe for one month per year for 3 years and Johnson salary and fringe for one month per year for 3 years.	\$ 70,835	Secured
Funding History: Current ENTRFT funding but to be expended before July 1, 2016.	\$ 200,000	
Remaining \$ From Current ENRTF Appropriation: Approximately one year of funding remains from 2013-06-06 project. This will be expended by July 1, 2016.	\$ 85,000	To be spent by July 1, 2016

Winning the Dutch Elm Disease Battle Phase II



Map of Minnesota showing locations of survivor elms waiting to be screened for DED resistance (left). Photos of a few trees showing their large and beautiful stature (right).



Cuttings and grafts are made from survivor elms and grown in the greenhouse and in field plots for disease screening and inoculation trials.

Research is exploring efficient and effective ways to propagate new selections with greater success which is needed for large scale production.

Resilient and adaptive native elms are needed to replace trees threatened by exotic diseases and pests

Project Manager Qualifications

Dr. Robert Blanchette (PI) is a professor in the Department of Plant Pathology. He has been involved with research and teaching of forest and landscape trees at the University for 30 years. His research accomplishments include 2 books, over 200 publications, 14 US Patents and numerous foreign patents. He has received several honors for research accomplishments including Fellow of the American Association for the Advancement of Science, Fellow of the American Phytopathological Society, Fellow of the International Academy of Wood Science, Hans Merensky Fellow for Wood Science and Distinguished Service Award from the American Society of Microbiology. He teaches undergraduate and graduate classes at the University of Minnesota on forest and shade tree diseases. Research interests are in the area of forest pathology and wood microbiology with research in tree defense mechanisms, deterioration processes of wood and biotechnological uses of forest fungi. Projects involve novel, interdisciplinary approaches to solving tree disease problems and understanding the biology and ecology of forest fungi. He serves as project manager for the successful ENRTF project 2013-06-06 which will end July 1, 2016.

Organization Description and team members– University of Minnesota

The Department of Plant Pathology and the Department Forest Resources are in the College of Food, Agricultural and Natural Resource Sciences at the University of Minnesota St. Paul Campus. Professor Gary Johnson and Research Fellow Chad Giblin from the Department of Forest Resources and Research Scientist Dr. Benjamin Held from the Plant Pathology Department will collaborate on this project. Modern research laboratories are available for this work and a 10 acre research field site on Campus can be used for the field trials proposed for this project. Professor Blanchette and also Professor Johnson will take an active part in this research and their salaries will be paid by the University of Minnesota. All equipment needed for this work is available in the PI's laboratories.