

**Environment and Natural Resources Trust Fund
2012-2013 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 019-B

Finding Disease Resistant Elm Trees in Minnesota

Topic Area: B. Forestry/Agriculture/Minerals

Total Project Budget: \$ 431,000

Proposed Project Time Period for the Funding Requested: 3 yrs, July 2013 - June 2016

Other Non-State Funds: \$ 0

Summary:

Native Minnesota elms resistant to Dutch elm disease exist and represent a valuable resource that can be used to fight this invasive disease and restore elms to their previous grandeur.

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Sponsoring Organization: U of MN

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Location

Region: Statewide

County Name: Statewide

City / Township:

<input type="checkbox"/> Funding Priorities	<input type="checkbox"/> Multiple Benefits	<input type="checkbox"/> Outcomes	<input type="checkbox"/> Knowledge Base
<input type="checkbox"/> Extent of Impact	<input type="checkbox"/> Innovation	<input type="checkbox"/> Scientific/Tech Basis	<input type="checkbox"/> Urgency
<input type="checkbox"/> Capacity Readiness	<input type="checkbox"/> Leverage	<input type="checkbox"/> Employment	<input type="checkbox"/> TOTAL <input type="checkbox"/> %



Environment and Natural Resources Trust Fund (ENRTF) 2012-2013 Main Proposal

PROJECT TITLE: Finding Disease Resistant Elm Trees in Minnesota

I. PROJECT STATEMENT

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Dutch elm disease has killed millions of elms in Minnesota over the past five decades. So many trees have died people have just about given up hope for this tree. Losses from this invasive and exotic pathogen have been devastating and it has caused an ecological disaster. Elms are magnificent trees. There is no tree more beautiful or well suited for urban conditions than the elm. They tolerate salt, pollution and other stresses better than other trees. Removing and disposing of diseased trees and other control programs are expensive. Municipal budget constraints over recent years have meant that less funds are available for control and elm mortality has increased steadily. We now find other introduced pests, such as the Emerald Ash Borer, threatening Minnesota ash trees and the need for new trees to be used for replanting in urban areas is greater than ever. Elms also play a vital part in the ecology of Minnesota's forests. Their seed provides important food for wildlife, they are excellent trees for wetlands and add to the biodiversity of a healthy forest (for example, 213 species of moths and butterflies are supported by elms). Elms can also be used for making furniture, boxes, crates and other wood products.

There is new hope for the elm! We have observed that some elms have survived the disease and these survivors appear to have special characteristics making them resistant to Dutch elm disease. In our preliminary work, seedlings were grown from these trees and were injected with the fungus. Results show some trees survive. Having a large genetic stock of hardy and resistant native Minnesota elms is vital to fight this deadly fungus. Our proposed project would:

- 1. Survey and identify resistant elm trees.** From preliminary research supported by the Minnesota Turf and Grounds Foundation we identified and tested several elms and found 3 with different levels of resistance. We have information from arborists and city foresters about many other candidate elms from throughout Minnesota that appear to be resistant. They survive where all other elms have died. Screening (injecting with the fungus in greenhouse and field trials) will identify which of these trees are truly resistant. Once trees are selected they will be propagated using methods we recently developed.
- 2. Screen selected trees.** To determine if trees are resistant, rigorous testing is needed. This is done in two steps by injecting trees with the fungus in greenhouse studies followed by additional field testing. The preliminary data shows that elms resistant to Dutch elm disease exist in Minnesota. Our testing will show which trees are resistant and with state wide screening we expect to find a large number of them.
- 3. Study defense mechanisms in resistant trees.** What makes an elm resistant to disease? Chemical and physical barriers are produced by trees to stop invading pathogens. This work will identify the tree's defense mechanisms. Once this is known, these characteristics can be looked for in new selections resulting in a rapid method of screening trees with resistance.
- 4. Field testing of elms.** Our goal is to obtain a diverse selection of elms from Minnesota that are genetically different but all have resistance. Field testing is essential and will be done on trees from our preliminary research as well as new selections made from this project. Field testing will also be used to identify trees with the best growth and hardiness characteristics.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Identify and grow resistant Minnesota elms for testing.

Budget: \$113,000

With the help of landowners, park and city personnel, arborists and our surveys of the Minnesota landscape we will identify large, mature elms that have survived heavy pressure from Dutch elm disease.

Cuttings will be taken from the growing tips of these trees and rooted and/or grafted to obtain propagates sufficient numbers of each tree for disease screening. Local arborists will be employed to help in obtaining the branch cuttings needed from the growing tips of these surviving large trees.

Outcomes	Completion Date
1. Find and propagate 20 Minnesota elms that appear to have disease resistance	6/2014
2. Find and propagate an additional 30 Minnesota elms with disease resistance	6/2015

Activity 2: Screen selected elms for resistance

Budget: \$118,000

Using previous successful methods, replicated studies of selected seedlings will be grown in the greenhouse. The Dutch elm disease fungus will be injected into these trees and disease monitored.

Outcomes	Completion Date
1. Complete disease screening for elms obtained during the first year	9/2015
2. Complete disease screening for second year elm selections	3/2016

Activity 3: Study tree defense mechanisms to better understand disease resistance

Budget: \$99,000

Trees with resistance have mechanisms that help defend against the invading fungus. These can include chemical and physical barriers formed in the tree as well as genetic differences. These investigations will identify the mechanisms involved and use them as screening tools for more rapid selection of additional trees having these characteristics associated with resistance.

Outcome	Completion Date
1. New tools obtained to rapidly screen future elms for resistance	6/2016

Activity 4: Field testing of selected clones with resistance.

Budget: \$101,000

Field plantings and evaluations will be done to the selected test trees in a natural setting to insure they are resistant, evaluate growth characteristics and determine their suitability for planting throughout Minnesota.

Outcome	Completion Date
1. Field planting and field screening of selected elms	6/2016

III. PROJECT STRATEGY

A. Project Team/Partners

Dr. Robert Blanchette (Co-PI, UMN) is a professor and Benjamin Held (UMN) is a research scientist in the Department of Plant Pathology. They will take part in the finding and screening of resistant elms, as well as studies to elucidate resistance mechanisms.

Dr. Jeff Gillman (Co-PI, UMN) is an associate professor and Chad Giblin (UMN) is a research scientist in the Department of Horticulture Science. They will take part in finding, propagating and field planting of resistant elms. Additional partners include arborists, park and city foresters and landowners throughout the state.

B. 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.

C. Long-Term Strategy and Future Funding Needs

The main goal of this research is to identify and propagate resistant elms from Minnesota. Testing for resistance must be rigorous and thorough and field trials will be established. Although some information will be completed from the field, it can take 5-6 years for more comprehensive observations. These field trials will continue at the University Research Center after the project has ended. It will also take a few years to propagate the selected trees in sufficient numbers so they are available for release to the nursery industry and the public.

2012-2013 Detailed Project Budget

IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	
Graduate student 50% time (56%salary, 44% benefits, for 2 years)	\$ 86,000
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Scientist - pathology 50% time 71% salary, 29% fringe, for 3 years)	\$ 115,000
Scientist- horticulture 25% time (71% salary, 29% fringe, for 3 years)	\$ 48,000
4 Undergraduate student workers (100% salary, \$5000/year per student for 3 years)	\$ 60,000
Contracts: N/A	N/A
Equipment/Tools/Supplies: Field supplies (pots, stakes, pruning supplies, fertilizers, container substrate, \$2100/yr, 3 yrs)	\$ 6,000
Laboratory Supplies (microbiology and inoculation materials, microscopy, cytology, fungal genotyping, \$3200/yr, 3yrs)	\$ 9,000
Acquisition (Fee Title or Permanent Easements): N/A	N/A
Travel: Throughout MN for collection of resistant elms	\$ 8,000
Additional Budget Items: bucket truck contracting for sampling large trees , climbers for	\$ 4,000
Greenhouse maintainance costs (\$3000/yr, 3 yrs)	\$ 9,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 431,000

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period:	\$0	
Other State \$ Being Applied to Project During Project Period:	N/A	
In-kind Services During Project Period: Blanchette (co-PI) salary and fringe for one month per year for 3 years	\$41,900	
Gillman (co-PI) salary and fringe for one month per year for 3 years	\$36,900	
Remaining \$ from Current ENRTF Appropriation (if applicable):	N/A	
Funding History: Minnesota Turf and Grounds Foundation: for preliminary screening of elms to prove proof of concept.	\$60,000	

Finding Disease Resistant Elm Trees in Minnesota



Identify elms from the Minnesota landscape with possible resistance to Dutch elm disease



Obtain cuttings from identified trees for propagation



Inject seedlings with the pathogen



Select resistant trees after they have been injected



Study tree defense mechanisms in resistant trees



Propagate selected resistant seedlings and plant in field trials for additional testing and screening



The goal of this project is to have native resistant elms that can be grown throughout the Minnesota landscape and return this majestic tree to its previous grandeur

Project Managers Qualifications / Organization Description

Dr. Robert Blanchette (Co-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 microbes. In 2011, a selection of white pine that had been identified by his research group with disease resistance to white pine blister rust was released by the University of Minnesota.

Dr. Jeff Gillman (Co-PI) is an Associate Professor in the Department of Horticultural Science where he researches tree growth and transplanting. He holds a Ph.D. in horticulture and a master's degree in entomology. He is the author of five books and numerous scientific papers on a variety of tree and shrub related topics. He is also co-author of the book Pruning Young Elms by Chad Giblin. He teaches courses on plant propagation, nursery management and pesticide use in horticulture. He directs the University research nursery located on the St. Paul campus where research focused on improved nursery practices for maximizing growth and improving long term tree health in the urban environment takes place. He is also a member of the University of Minnesota's Urban Forestry & Horticulture Research Institute.

Organization Description – University of Minnesota

The Department of Plant Pathology and the Department Horticultural Science are in the College of Food, Agricultural and Natural Resource Sciences at the University of Minnesota St. Paul Campus. 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 Gillman 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.