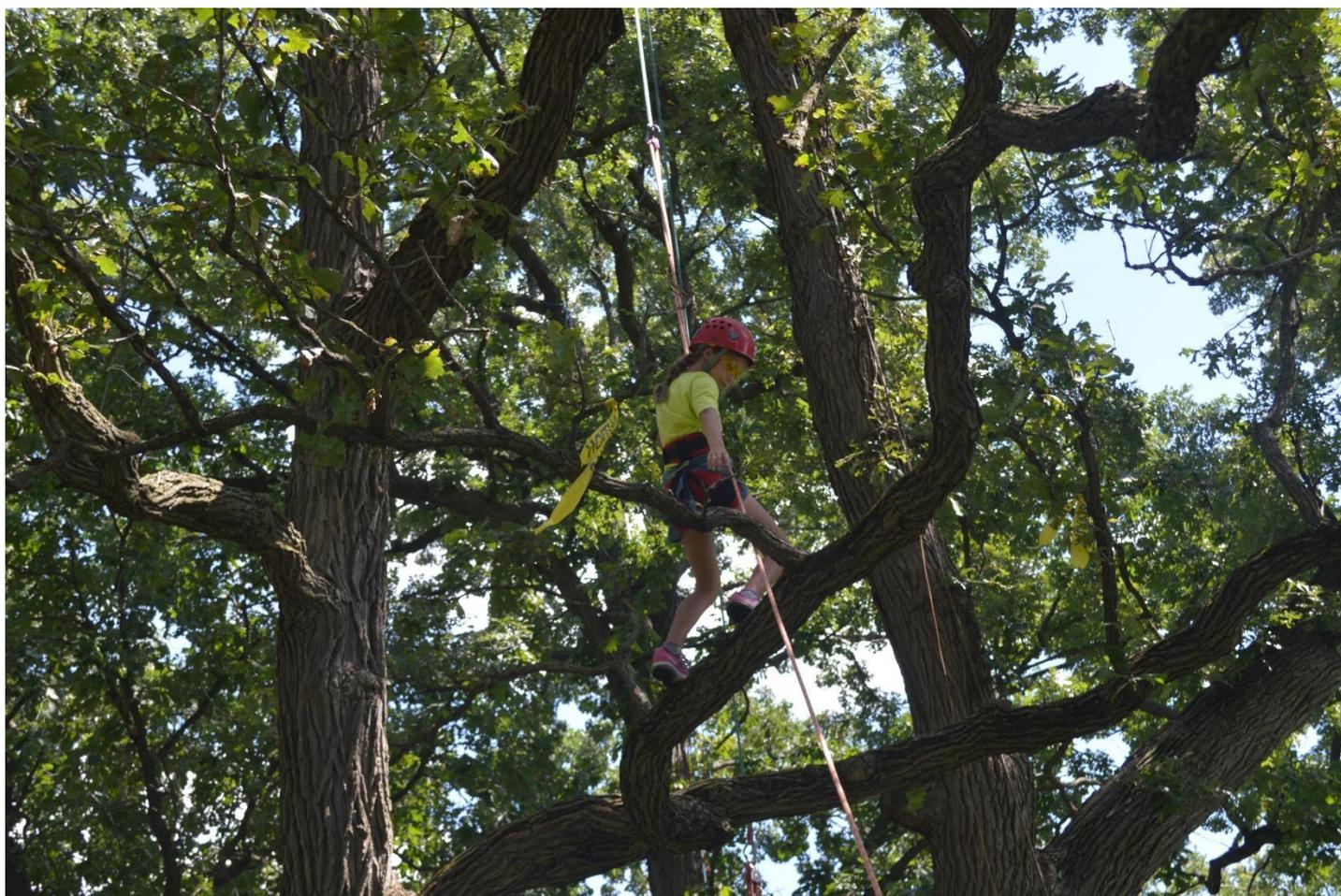


**2018 University of Minnesota Proposal to MTGF for  
Teaching, Research, and Outreach Programs at  
the Urban Forestry, Outreach, Research & Extension (UFore) Nursery and Lab  
and a Report of Accomplishments in 2017**

Principal Investigators: Gary Johnson and Chad Giblin  
Department of Forest Resources – 1530 Cleveland Ave. N, 115 Green Hall

Robert A. Blanchette, Benjamin Held  
Department of Plant Pathology - 1991 Upper Buford Circle, 495 Borlaug Hall  
University of Minnesota, St. Paul, MN 55108-6030

Cooperators: Minnesota Turf and Grounds Foundation and Minnesota Urban Foresters and Arborists



**Youth Engagement in Arboriculture Summer Camp at the University of Minnesota (2017)**

**Youth outreach programs will be expanded in 2018 to reach nearly 250 school-age children in Minnesota. These programs will inspire and engage them to pursue academic careers in arboriculture and urban forestry and to bring a broader understanding of these fields to their families, peers, and communities.**

# **The 2018 University of Minnesota Urban Forestry Outreach Research and Extension (UFore) Nursery and Lab Proposed Program for Outreach and Research and the Report of Accomplishments for 2017**

## **Abstract**

Current and future threats to Minnesota's urban and community forests have created a unique opportunity for growth in the areas of academic research and outreach to industry professionals, school-age youth, and others. In addition to the continuation of our work to select, propagate, and screen American, red, rock, and introduced elms for Dutch elm disease (DED) resistance, we are actively growing two new areas of outreach and research. The first is the Youth Engagement in Arboriculture program hosted in the Department of Forest Resources. This outreach program is aimed at youth ranging from approximately 9 to 15 years old. The second is the launch of a new area of research exploring conservation arboriculture and retrenchment pruning - two areas of practice that are gaining interest in the United States thanks to practitioners in the UK and Europe - and that are aimed at preserving urban tree canopy via retention of the mature tree component of the urban forest.

## **Rationale, Benefits to Grounds Managers**

The UFore Nursery and Lab is poised to continue to provide high-quality instruction, research, and outreach programs to grounds managers, arborists, school-age youth, and the general public throughout 2018. Our studies focus on implementation of DED resistant elm selections in an effort to provide options for areas devastated by emerald ash borer (EAB) and DED. While it has been known for some time that resistance is present in some elms, the mechanisms for the resistance are not currently understood. We believe it is important to have a variety of species and genotypes of resistant elms to protect against losing large populations of trees with similar genetic background to a pathogen that readily changes in virulence. The goal of this work is to increase the availability these diverse, disease-resistant elm cultivars available for use in Minnesota landscapes and to help to preserve, promote, and maintain disease-resistant elms while striving to distribute them into native landscapes and urban and community forests throughout Minnesota.

Youth programs will broaden the understanding of urban forest programs and arboricultural practices while creating opportunities for youth to become personally engaged in certain aspects of tree care. This combination not only benefits Minnesota's green industries but also creates conditions that engage and inspire the next generation of practitioners. Finally, conservation arboriculture and retrenchment pruning research offers the opportunity to explore ancient - yet untested - tree maintenance and preservation practices which may lead to increasing the longevity and utility for some of the oldest and largest trees in Minnesota's urban and community forests.

## **Objectives**

1. University of Minnesota Elm Selection Program (UMESP)
2. Youth Engagement in Arboriculture Outreach Programs
3. Conservation Arboriculture & Retrenchment Pruning Research

### **1. University of Minnesota Elm Selection Program (UMESP)**

**Objectives:** Screen elm selections for Dutch elm disease resistance, study mechanisms of resistance, and maintain elm research plots for long term resistance screening.

**Materials & Methods:** Resistance screening is a long-term assessment that is essential to meet the goals of this project and these tests will ensure the selected resistant clones will perform well when they are released. Because we have many selections from around the state already in production, we plan on focusing our efforts on continuing to screen putatively resistant trees (clones) that have been out-planted in field plots at the University of Minnesota, the Minnesota State Capitol, and Minnesota Landscape Arboretum. The field space allocated to this project at the University of Minnesota has nearly doubled over the last two years and is

currently at seven acres. Field inoculated selections are continually assessed for disease symptoms to document recovery. A final assessment and study of material will be done from an inoculation study at the Minnesota State Capitol, further examining disease resistance in established 'Princeton' American elm at the World War II Memorial, which are slated to be removed this spring. Field inoculation trials at the Minnesota Landscape Arboretum are also testing large trees that were previously part of the National Elm Trial. This trial includes 14 unique genotypes that are currently in the nursery trade but have not been tested for Dutch elm disease resistance for over 12 years. We plan to continue to study trees that survived inoculations in 2016 by pruning any dead material and re-inoculating to further test resistance. Results from this trial will ensure confidence when urban foresters and landscape managers select disease resistant elms. Studies aimed at uncovering resistance mechanisms will continue by analyzing branch unions on trees that were branch inoculated in 2017. We hypothesize that size and angle may affect transmission of the pathogen to the main stem and could play a role in resistance.

With the collaboration of individuals, landowners, city officials, arborists and foresters throughout Minnesota, we have dozens of selections that have been made, propagated and planted in the UFore nursery for disease screening inoculation trials. American elm (*Ulmus americana*), rock elm (*U. thomasii*), red elm (*U. rubra*), and elms from European and Asian origin are all well-represented in our collections.

**Anticipated Results:** Research plots at the University of Minnesota UFore nursery and expanding plots at the Minnesota Landscape Arboretum will continue to be maintained and used for maintenance demonstrations and trials. Selecting for disease resistance is just one part of the process when selecting elms for public, private, and institutional landscapes. Young elms provide incredible challenges for maintenance personnel during the first 10-15 years of their life and providing maintenance at the correct time and dose is critical to the survival of the young trees. Research conducted in the city of Saint Paul in 2015 and 2016 (Giblin and Johnson, 2017) has shown that disease resistant American elms are failing in wind-loading events at a rate that sometimes exceeds 10 times that of other species. This rate of failure is also occurring at a size that is less than one-third that of other species. These results have helped confirm the need for additional research and continuing education for arborists and landscape managers to help select the best elm species and cultivars and maintain them.

**Publishing Plan:** Publication and presentation plans will continue to promote the University of Minnesota Elm Selection Program and the support received by MTGF. Presentations have been made at the American Elm Restoration Workshop, MASMS State Conference, MTGF Super Tuesday, MNLA Northern Green, Minnesota Shade Tree Short Course, Minnesota Shade Tree Advisory Committee forums, and at various workshops and meetings in the plant pathology, urban forestry, and arboriculture communities.

#### **Publications from 2016 Funding**

Beier, G. L., B. W. Held, C. P. Giblin, J. Cavender-Bares and R. A. Blanchette. 2017. American elm cultivars: Variation in compartmentalization of infection by *Ophiostoma novo-ulmi* and its effects on hydraulic conductivity. *Forest Pathology* 47:8.

Beier, G. L., B. W. Held, C. P. Giblin, and R. A. Blanchette. 2017. Effects of inoculation timing on symptom development in *Ulmus americana* L. In: *Proceedings of the American Elm Restoration Workshop 2016*. U.S. Forest Service General Technical Report NRS-P-174, pages 30-36.

Giblin, C.P. and G. Johnson. 2017. Pruning Cycles and Storm Damage: Are Young American Elms Failing Prematurely? In: *Proceedings of the American Elm Restoration Workshop 2016*. U.S. Forest Service General Technical Report NRS-P-174, pages 122 -132.

## 2. Youth Engagement in Arboriculture Outreach Programs

**Objectives:** Continued development of a youth engagement and recruitment program that includes development of skills and knowledge related to urban forestry and arboriculture, technical tree climbing, and methods of rope access used to safely enter and explore tree canopies in three dimensions.

**Materials & Methods:** The UMN Forest Resources Youth Engagement in Arboriculture (YEA) is an outreach program designed to welcome and inspire metro-area youth, especially those from underrepresented minority communities, to pursue careers in arboriculture. Part of this goal is to encourage them to start by attending the College of Food, Agricultural and Natural Resource Sciences (CFANS). The Department of Forest Resources proposes to partner with the Minnesota Turf & Grounds Foundation, the Minnesota Society of Arboriculture, professional arborists in the Twin Cities area, and other professional organizations to help host students from local elementary and high schools. Organizations and volunteer arborists will provide direct and in-kind funding as well as staffing support and technical assistance for this program. When on-site visits to the University of Minnesota are not possible, the YEA program will be delivered via local parks, cooperating school grounds, or other locations deemed appropriate by program staff and faculty.

UMN Forest Resources YEA intends to serve students from the following schools and grades for the 2017-2018 Academic School Year:

- Four Seasons A+ Elementary (Saint Paul, MN) (75 to 80 - 5th Grade Students)
- Great River School (Saint Paul, MN) (15 to 20 - 7th & 8th Grade Students)
- Hmong College Preparatory Academy (Saint Paul, MN) (30 - 10th Grade Students)
- Windom Dual Immersion Elementary (Minneapolis, MN) (75 to 80 - 5th Grade Students)
- UMN Recreation & Wellness Summer Youth Programs (Saint Paul, MN)
  - Two Five-Day Camps (20 Campers - 12-15 years old)
  - Two Two-Day Camps (20 Campers - 12-15 years old)

**Anticipated Outcomes:** Youth will learn how studying at the University of Minnesota can prepare them for careers in arboriculture. They will gain a tangible and memorable experience in arboriculture by safely and technically ascending trees assisted by professional arborists, University faculty, staff, and students. The Department of Forest Resources staff will connect the climbing activities to career paths by discussing the importance of education in preparing for a career in arboriculture.

Students will learn about CFANS admissions, academic and multicultural resources, and programs of study. Students will get the opportunity to climb and learn about campus trees and careers in arboriculture. The project aims to inspire these students, not only to envision themselves at the University of Minnesota, but as future professionals in the fields of urban forestry and arboriculture. These programs will strive to create a more diverse and inclusive campus atmosphere that becomes increasingly accessible and welcoming to students of color and those from currently underrepresented minority communities. University faculty, staff, and students will gain greater insight into methods of partnering with local schools and the creation of an inclusive atmosphere that increases campus diversity and access to undergraduate programs in arboriculture and natural resources.

**Publication Plan:** Publication and presentation plans will target events such as MNLA Northern Green, Minnesota Shade Tree Short Course (presentation in 2018), Minnesota Shade Tree Advisory Committee forums, and at various workshops and meetings in the urban forestry, and arboriculture communities.

### 3. Conservation Arboriculture & Retrenchment Pruning Research

**Objectives:** Large, mature, and damaged trees create uniquely difficult management considerations for urban forest managers. Due to perceived and actual risks as well as public perception of unacceptable risks, the lack of knowledge and training often prematurely condemns these trees. Mature trees have been shown to increase property value, provide significant wildlife habitat, clean air and water, reduce urban noise, and improve quality of life. Currently, tools and techniques are available to retain these trees and their benefits safely for many years. Unfortunately, these techniques have not yet been subjected to the rigor of replicated, scientific research, despite anecdotal evidence that these techniques have successfully increased the functional life of many trees.

**Materials & Methods:** Species of interest include cottonwood (*Populus deltoides*), bur oak (*Quercus macrocarpa*), White Oak (*Quercus alba*), boxelder (*Acer negundo*), willow (*Salix* spp), sugar maple (*A. saccharum*), Norway maple (*A. platanoides*), silver maple (*A. saccharinum*), and red maple (*A. rubrum*). The first component of this research will be the development and dissemination of a tree species profile survey. This survey will include approximately 15 questions for at least five (5) of the above-mentioned species and will be presented to urban forest managers and practitioners in the region. Survey results will be used to help develop species profiles for selected species that will be used to guide the development of tree retention tools and techniques on research trees. Additionally, practitioner protocols will be assessed that can be used to develop risk prevention, tree retention, and habitat retention stands for the included tree species profiles.

One or more selected specimens from the species profiled will be measured and assessed individually to determine the appropriate retention tools and techniques (including retrenchment pruning) that can be applied more broadly as this research continues and expands in the future. Individual trees and the surrounding area will be mapped and measured to track growth and environmental changes over time. Soil and plant tissue samples will be collected and analyzed for physical and chemical properties. Time to complete measurements and pruning treatments will be tracked. Any deadwood that is pruned out will be measured at the point of attachment and weighed. Increment bores will be taken at a specified frequency through the main stem and at select canopy components, where appropriate. Any area(s) where regular measurements and/or samples taken over time will be marked with foresters paint for future tracking. Twig extension and annual growth rings will be measured on collected samples.

A dynamometer will be used to measure branch loading reduction pre- and post-treatment when applicable. A Resistograph and/or tomograph will be used to track decay pre- and post-treatment, when applicable. A camera will be used to photo document trunk and canopy flora and fauna, features of interest, and treatments. Selected increment cores and branch tissue samples will be analyzed to examine fungal diversity at different points in the main stem and canopy. Potentially, a light meter will be used to assess impact of treatments on light reaching the inner canopy to assess the possibility to stimulate epicormic growth,

**Anticipated Outcomes:** Tree risk prevention, enhanced tree retention, post-construction therapy, habitat retention, and increasing species diversity. Data and outcomes will hopefully be of such quality as to allow continued research as well as supportive documentation for budget driven initiatives. By laying the groundwork for research-informed species-based tree retention profiles, this project will inform skilled professionals, improve urban tree diversity and retention, and inspire public awareness. This is one of many first steps towards decreased municipal costs, increased property value, and urban sustainability.

**Publication Plan:** Publication and presentation plans will target events such as MNLA Northern Green, Minnesota Shade Tree Short Course, Minnesota Shade Tree Advisory Committee forums, and at various workshops and meetings in the urban forestry, and arboriculture communities. Ultimately the goal is to gather enough data to prepare manuscripts for publication in peer-reviewed scientific journal articles and conference proceedings. Because of the nature of this research, the time frame of work, and hence the publication plan, must be on a very long-term schedule.

**2018 Budget****Johnson /Giblin - UFore Nursery & Laboratory**

|   |                    |
|---|--------------------|
| <b><u>UMESP Research Program</u></b>  |                    |
| Greenhouse Space (needed for propagation of elms \$100 month x 12 months)                   | \$1,200.00         |
| Nursery production equipment and supplies (production supplies, irrigation equipment, etc.) | \$2,500.00         |
| Field plot rental and maintenance fees  | \$800.00           |
| Personnel – Funds to pay for part-time undergraduate students                               | \$3,750.00         |
| Salary & Fringe for Research Technician (12 month position at 10% FTE)                      | \$5,665.00         |
| <b><u>Youth Engagement in Arboriculture Program</u></b>                                     |                    |
| Tree climbing equipment   | \$2,500.00         |
| Travel expenses (vehicle rental and mileage to visit schools)                               | \$500.00           |
| Personnel – Funds to pay for part-time undergraduate students and arborist honorariums      | \$1,250.00         |
| Salary & Fringe for Arborist Technician (12 month position at 5% FTE)                       | \$2,800.00         |
| <b><u>Conservation Arboriculture &amp; Retrenchment Pruning Research Program</u></b>        |                    |
| Travel expenses (vehicle rental and mileage to visit research tree locations)               | \$1,200.00         |
| Research equipment & supplies (25% Resistograph, Tree Check Decay Detector, etc.)           | \$4,250.00         |
| Personnel – Funds to pay for part-time undergraduate students                               | \$3,500.00         |
| Salary & Fringe for Arborist Technician (12 month position at 5% FTE)                       | \$2,800.00         |
| <b>Forest Resources Subtotal</b>  | <b>\$32,715.00</b> |

**Blanchette/ Held Forest Pathology Laboratory**

|  |                    |
|--|--------------------|
| <b><u>UMESP Research Program</u></b>   |                    |
| Research equipment & supplies (fungal culturing, DNA testing, etc.)                  | \$1,750.00         |
| Personnel – Funds to pay for part-time undergraduate students                        | \$1,500.00         |
| Salary & Fringe for Technician (12 month position at 10% FTE)                        | \$7,000.00         |
| <b><u>Conservation Arboriculture &amp; Retrenchment Pruning Research Program</u></b> |                    |
| Research equipment & supplies (fungal culturing, DNA testing, etc.)                  | \$1,250.00         |
| Personnel – Funds to pay for a part-time undergraduate students                      | \$2,000.00         |
| Salary & Fringe for Technician (12 month position at 5% FTE)                         | \$3,500.00         |
| <b>Plant Pathology Subtotal</b>  | <b>\$17,000.00</b> |
| <b>Total Budget</b>  | <b>\$49,715.00</b> |