

**Environment and Natural Resources Trust Fund  
2020 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 223-F**

Mississippi Gorge Veteran Oaks: Mapping and Preservation

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**Category:** F. Methods to Protect, Restore, and Enhance Land, Water, and Habitat

**Sub-Category:**

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**Total Project Budget: \$** 239,907

**Proposed Project Time Period for the Funding Requested:** June 30, 2023 (3 yrs)

**Summary:**

We will identify and map veteran bur oaks above the Mississippi Gorge, and develop conservation arboriculture techniques to preserve and retain legacy trees while minimizing urban park public safety risk.

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**Name:** Daniel Griffin

**Sponsoring Organization:** U of MN

**Job Title:** Professor

**Department:** College of Liberal Arts

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Minneapolis MN 55455

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**Email** griffin9@umn.edu

**Web Address:** \_\_\_\_\_

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**Location:**

**Region:** Metro

**County Name:** Hennepin, Ramsey

**City / Township:** Minneapolis, St. Paul

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**Alternate Text for Visual:**

Study area map and imagery to illustrate project activities: Tree-ring sampling and dating, aerial photo and GIS analysis, stem integrity analysis and canopy mapping, fungal pathogen detection.

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



**PROJECT TITLE:** Mississippi Gorge veteran oaks: mapping and preservation

**I. PROJECT STATEMENT**

**OVERALL GOALS:** In this three three-year pilot project focused on the bluffs above the Mississippi Gorge between St. Anthony Falls and Pike Island (see map), we will 1) identify, determine ages, and map precise locations of long-lived veteran bur oak trees on public property, and 2) develop arboricultural strategies for monitoring, management, and preservation of significant trees identified as “at risk” from construction impacts, old age decline, and fungal pathogens. Bur oak is now and was historically the dominant overstory tree species in much of this area, and preliminary observations suggest that a large concentration of old, veteran bur oak survive there today. These are public lands with heavy recreational use and some trees showing signs of decline. Balancing priorities of tree preservation and public safety risk management poses a significant challenge to several management jurisdictions, municipal and federal. The Mississippi Gorge is a unique natural area at the core of the Twin Cities Metro, with a diverse set of stakeholders and substantial value for ecosystem services.

**APPROACH:** Veteran tree identification will combine land manager consultation, GIS analysis of existing tree and historical aerial photo datasets, and boots on the ground search for physical traits associated with old age. Targeted candidates and randomly selected trees will be mapped, measured, photographed, and aged with tree-ring dating. A cohort of at least 12 at-risk and/or in-decline veteran trees will be selected for application of tree preservation treatments using techniques of conservation arboriculture: retrenchment pruning, selective canopy reduction, and supplemental support systems. High-tech methods will be used to quantify stem integrity and before/after tree canopy effects of pruning. Treatment effects on fungal populations will be studied to develop tools for management of pathogenic and decay fungi using cultural and chemical methods.

**SIGNIFICANCE:** Numerous veteran bur were recently documented by project lead Griffin in two Metro area urban parks, with individual trees up to 270 years old. However, little is currently known about the ages of the abundant bur oak trees in public park lands near the Mississippi Gorge. Bur oaks in this area comprise a unique, undervalued and critical component of Minnesota’s historic, pre-settlement biodiversity, but are also at substantial risk from exotic invasive fungal pathogens and continued impacts of urbanization and heavy recreational use. **This work presents an opportunity to establish foundational information on veteran bur oaks (Funding Priorities F & A) and to develop and test arboricultural preservation techniques to sustain heritage trees in the urban environment, while also minimizing public safety risk (Funding Priority F). This pilot project a first step in our long term goal to improve understanding and appreciation for the historical, environmental, cultural, and aesthetic significance of old-growth bur oaks in urban forests and park lands across MN.**

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Mapping and aging of veteran bur oaks in the Mississippi Gorge.**

**Description:** Prospective veteran bur oaks will be identified through consultation with public land managers, analysis of existing GIS data, interpretation of historical aerial photos, and field observation of the physical traits of old trees. Of the most promising trees, approximately 300 will be mapped, measured, photographed, and dated with non-destructive tree ring analysis. General population age characteristics will be determined with a randomized, size class stratified sample of an additional 200 bur oak trees. A primary deliverable of this work will be tree-ring based ages and GIS metadata for veteran bur oaks on the publicly owned bluff lands above to the Mississippi Gorge. We will work with land managers to develop interpretive materials for education and outreach.

**ENRTF BUDGET:** \$85,171

Outcome	Completion Date
1. GIS analysis of existing tree inventory and historical aerial photo datasets.	12/2020
2. Tree-level data and core sample collection.	5/2022
3. Finalize results, report, and outreach materials on veteran tree mapping.	6/2023



**Activity 2: Apply conservation arboriculture techniques for long-term preservation.**

**Description:** *Candidates for tree preservation will be selected from at risk individuals identified in Activity 1. Using canopy reduction and retrenchment methods, trees will be pruned to enhance longevity and to reduce risk of failure. Three-dimensional digital canopy modeling will quantify canopy extent before and after pruning. This will allow assessment of the net effects of treatments through quantitative measurement of the subject trees' structures. Decay assessment of the trunk and major branches will be conducted to determine areas of concern. This will allow application of directed management techniques to avoid catastrophic failure of these major canopy components and/or the main trunk. Conservation arboriculture strategies tested during this phase should be broadly transferable to public and private tree-care professionals.*

**ENRTF BUDGET:** \$122,483.

Outcome	Completion Date
1. Select and treat six trees in the Mississippi Gorge.	4/2022
2. Select and treat six trees in the Mississippi Gorge.	4/2023
3. Workshop and/or presentations on tree preservation techniques.	4/2023

**Activity 3: Fungal diversity research and management techniques establishment.**

**Description:** *Fungi populations will be sampled and studied in selected trees to develop tools for management of pathogenic and decay fungi and their control using cultural and chemical methods. If fruit bodies decay fungi are present, small sections will be placed on a select media allowing only mushroom forming fungi to grow to obtain a pure culture for DNA sequencing. Other branch and tree material will be sampled by cutting small sections from the samples and placing it on various selective media for pathogenic, decay, and saprophytic fungi. Once pure cultures are obtained, DNA will be extracted and pathogenic and decay fungi will be identified for further studies and to examine their response to pruning activities conducted in Activity 2.*

**ENRTF BUDGET:** \$32,253.

Outcome	Completion Date
1. Sample and identify fungi from six trees in the Mississippi Gorge.	5/2022
2. Sample and identify fungi from six trees in the Mississippi Gorge.	5/2023

**III. PROJECT PARTNERS AND COLLABORATORS:**

The project brings together Daniel Griffin of the Department of Geography, Chad Giblin of the Department of Forest Resources, and Benjamin Held of the Department of Plant Pathology at the University of Minnesota. Mapping and tree age analysis will be carried out by the Griffin Lab, conservation arboriculture will be carried out by Giblin's group, and fungal research will be conducted by Held and his technicians. This work will leverage existing relationships and collaborative projects between the project partners and managers of park lands near the Mississippi Gorge, namely the Minneapolis Parks & Recreation Board and the City of Saint Paul.

**IV. LONG-TERM IMPLEMENTATION AND FUNDING:**

Veteran bur oaks survive but are at risk on urban park lands across Minnesota, including a great many parks beyond the Twin Cities Metro Area. In future phases of this work, we would seek to expand outward to counties and towns across the prairie-forest transition in Minnesota. A long-term benefit of this pilot project should be improved understanding for and retention of long-lived bur oaks in the urban forest. This pilot phase of work will lead to improved strategies for identification and mapping of this legacy environmental resource. The practices of conservation arboriculture we will develop should be highly transferable to public and private arborists and land managers seeking to balance public safety risk assessment and the retention of heritage, legacy, and veteran trees in urban environments across the state.

Attachment A: Project Budget Spreadsheet  
 Environment and Natural Resources Trust Fund  
 M.L. 2020 Budget Spreadsheet



Legal Citation:

Project Manager: Daniel Griffin

Project Title: Mississippi Gorge veteran oaks: mapping and preservation

Organization: The University of Minnesota

Project Budget: \$239,907

Project Length and Completion Date: Three years, June 30, 2023

Today's Date: April 11, 2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
<b>BUDGET ITEM</b>				
<b>Personnel (Wages and Benefits)</b>				
Daniel Griffin, Project PI, overseeing and participating in all aspects of the research, primary responsibility for GIS, field mapping & tree-ring data analysis (64% Salary, 36% benefits); 8.3% FTE for years 1 & 2, 4.15% FTE for year 3.		\$ -	\$ -	\$ -
Chad Giblin, Project Co-I, participating in all aspects of the research, primary responsibility for overseeing conservation arboriculture research and practice, including supervising technician work (64% Salary, 36% benefits); 10% FTE for year 1, 25% FTE for years 2 & 3.		\$29,891		
Ben Held, Project Co-I, primary responsibility for overseeing fungal pathogen fieldwork and laboratory analysis, including supervising technician work (64% Salary, 36% Benefits); 5% FTE for year		\$50,032		
Graduate Student Research Assistant, manage field data collection, assistance with data analysis & GIS mapping (83.9% Salary, 16.1% benefits); 13.5% FTE for years 1 & 2, 6.7% FTE for year 3.		\$26,796		
Arborist Technician (Brian Luedtke), responsible for implementation of conservation arboriculture research techniques and job site supervision (92% Salary, 8% Benefits); 5% FTE for years 2 & 3		\$18,279		
Arborist Technician (Kiley Mackereth), responsible for implementation of conservation arboriculture research techniques (92% Salary, 8% Benefits); 5% FTE for years 2 & 3		\$7,271		
3 Undergraduate Research Assistants, assist with mapping, data collection and processing of samples, and conservation arboriculture (100% Salary, 0% benefits); each at 14% FTE for year 1, 17% FTE for year 2, and 20% FTE for year 3.		\$5,194		
		\$46,004		
<b>Professional/Technical/Service Contracts</b>				
Canopy modeling services provide by the University of Minnesota Unmanned Aircraft Systems (UAS) Laboratory. Includes drone missions before and after pruning treatments, including follow-up missions to assess leaf-on canopy during the following growing season (\$1,000/each tree selected.)		\$ 12,000	\$ -	\$ 12,000
<b>Equipment/Tools/Supplies</b>				
Dendrochronology research supplies: 2-thread increment borers (6x 16", 2-thread increment borers, \$294 each ; 4x 20" increment borers, \$ 484 each; and 2x24" increment borers \$594 each), sanding supplies (\$500), and wooden mounts for increment cores (\$400).		\$ 5,698	\$ -	\$ 5,698
Pathology lab supplies including plates and medium for culturing fungal specimens, tools and hardware used in the lab and for sample collection. Arboricultreual equipment, tools, and supplies required to ascend trees to perform pruning treatments, collect samples, perform decay analysis, and to provide supplementary support.		\$ 5,000	\$ -	\$ 5,000
<b>Capital Expenditures Over \$5,000</b>				
SMARTBORER(R) Smart increment borer (SmartborerTM, PAT. P.) is a device for automatic sampling of increment cores. It adapts a drill to traditional increment borers and converts the high-speed, low-torque input from a battery-operated Makita electric wrench to a low-speed, high-torque output via planetary gear system.		\$ 6,756	\$ -	\$ 6,756
ARBOTOM(R) Series 5 sonic tree tomography device. This 20 sensor device will be used to construct three-dimensional models of tree trunks and branches to perform risk assessments and inform pruning treatment decisions. This package includes the device and all necessary hardware and software for this type of decay analysis.		\$ 20,986	\$ -	\$ 20,986
<b>Travel expenses in Minnesota</b>				
Vehicle mileage and vehicle rental for travel to field sites (personal vehicle mileage at \$0.58/mile and UMN Fleet Services vehicle rentals at \$51.00/day plus \$0.37/mile)		\$ 6,000	\$ -	\$ 6,000
<b>Other</b>				
		\$ -	\$ -	\$ -
<b>COLUMN TOTAL</b>		\$ 239,907	\$ -	\$ 56,440
<b>SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT</b>				
	Status (secured or pending)	Budget	Spent	Balance
<b>Non-State:</b>		\$ -	\$ -	\$ -
<b>State:</b>		\$ -	\$ -	\$ -
<b>In kind:</b>		\$ -	\$ -	\$ -
<b>Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS</b>				
	Amount legally obligated but not yet spent	Budget	Spent	Balance
		\$ -	\$ -	\$ -

# Mississippi Gorge veteran oaks: mapping and preservation

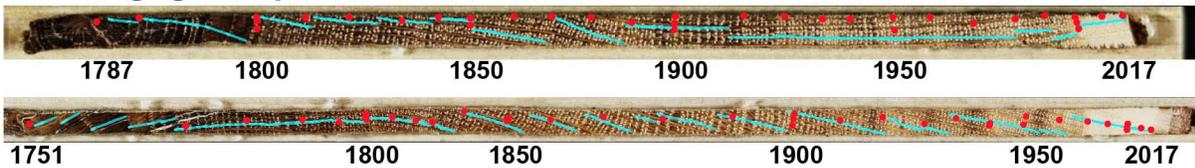
### Tree-ring sampling



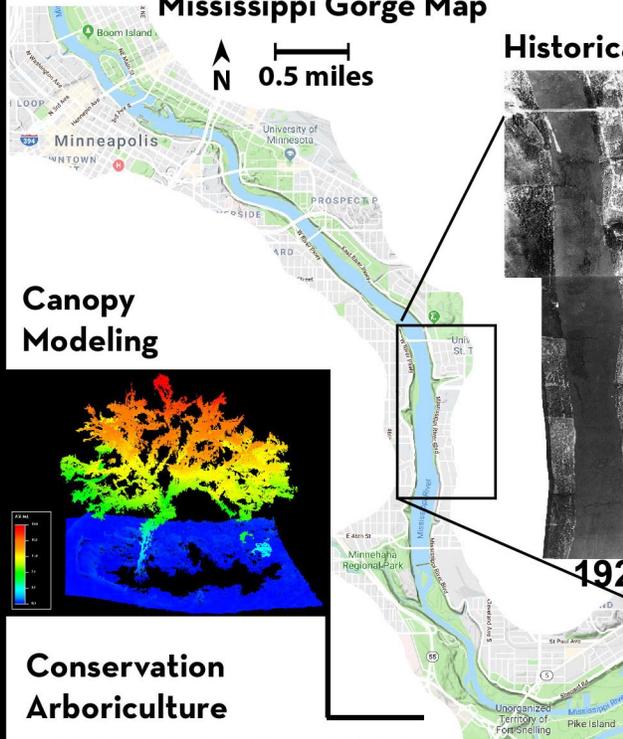
### Veteran bur oaks along West River Parkway



### Tree-ring age analysis



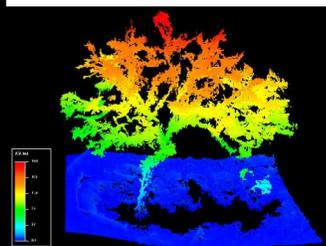
### Mississippi Gorge Map



### Historical Aerial Photo / GIS Analysis



### Canopy Modeling



### Conservation Arboriculture



### Fungal Pathology





### **Project Manager Qualifications and Organization Description**

Daniel Griffin is an expert in tree-ring dating and interpretation, he routinely partners with schools, museums, and management stakeholders on educational initiatives and public outreach that showcases the power of tree rings as a introductory gateway for environmental systems and science.

Griffin is a member of the faculty in the Department of Geography at the University of Minnesota - Twin Cities. He earned a PhD from the University of Arizona and Master's and Bachelor's degrees from the University of Arkansas. Griffin manages his own research lab, which has consistently trained and employed research assistants since his arrival to the University of Minnesota in 2014. He has a strong track record of project proposal and management, including field-based research in old-growth conifer forests and oak woodlands across North America since 2001. Griffin's research has been previously supported by funding from the U.S. National Science Foundation, the U.S. Environmental Protection Agency, the Woods Hole Oceanographic Institution, and the University of Minnesota. These grants have led to numerous publications in the peer-reviewed scientific literature. Griffin is the author or co-author of over 30 peer-reviewed studies in various journals including *Science*, *Environmental Research Letters*, *the Natural Areas Journal*, and *Tree-Ring Research*.