

**Environment and Natural Resources Trust Fund  
2018 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 023-A**

Four Centuries of Wildfire in Red Pine Forests

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**Category:** A. Foundational Natural Resource Data and Information

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**Total Project Budget:** \$ 257,316

**Proposed Project Time Period for the Funding Requested:** 2 years, July 2018 to June 2020

**Summary:**

Tree-ring-based fire records will be used to reconstruct four hundred years of fire frequency, severity, seasonality, and climate relationships to inform future management of red pine forests in north-central Minnesota.

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**Location**

**Region:** Central, Northwest, Northeast

**County Name:** Becker, Beltrami, Cass, Clearwater, Hubbard, Itasca

**City / Township:**

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**Alternate Text for Visual:**

Schematic diagram illustrating how the records of fire from a single tree can be aggregated to inform fire occurrence over broader regions.

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



**PROJECT TITLE: Four centuries of wildfire in red pine forests**

**I. PROJECT STATEMENT**

We propose to develop a 400-year history of fire in the red pine forests of north-central Minnesota using information encoded in the annual rings of living and remnant trees. This record will provide a unique and important resource for the development and implementation of management plans regarding the occurrence, timing, and spatial extent of past fires in the region. The red pine forests of north-central Minnesota have been shaped by recurring fires over thousands of years, but the exclusion of fire over the past century has altered the character of this fire-dependent landscape and has led to the accumulation of fuels capable of uncharacteristic, high-severity fire. Large, catastrophic fires have the potential to devastate an area's natural and cultural resources, damage private properties in the wildland-urban interface, and can impinge recreation opportunities to the detriment of small communities that rely on tourism dollars. Moreover, pressures from invasive species are contributing to changes in Minnesota's iconic red pine landscapes. By restoring fire, a critical ecosystem process to these landscapes, many of the pressures facing these forests can be reduced. But restoring and using fire effectively requires an understanding of fires' characteristics prior to substantial human influence, information most forest managers currently lack. **The overarching goal of this project is to provide land managers actionable information that informs the careful application of fire as a restoration tool and provides a blueprint for the management of fire to better restore, preserve, and protect Minnesota's unique natural and cultural heritage.** This research provides a means by which past fire regime parameters can be identified and applied in management strategies.

This fire history effort will be used to: **1)** better understand the dynamics of historical fire regimes in shaping the landscape of north-central Minnesota; **2)** develop well-informed fire restoration targets for local-to-landscape level planning; **3)** add to a growing network of fire histories from state forests, National Parks, and National Forests in the Western Great Lakes to assess the relationship between past drought and fire; and **4)** investigate how climate shifts and concurrent fuel build-ups may influence the potential for catastrophic fire events in the future. Individually, site-based fire histories provide local information useful for on-the-ground management actions in specific parks and natural areas. The aggregation of sites at larger spatial scales can help management agencies plan for resource allocation during periods of active fire weather based on the patterns unveiled in the fire history reconstructions.

To complete this project we will use *dendrochronology*, the science of tree-ring analysis, to reconstruct the fire history of red pine-dominated sites across north-central Minnesota. Our work will primarily use dead red pine snags, stumps, and logs preserved on the landscape and regional ring-width patterns shared among these dead red pines and living trees to extend fire records multiple centuries back in time. Compilations of fire history such as ours provides local-to-regional rates of fire occurrence prior to fire suppression ca. 1900 and can be used to identify targets for fire-use as a restoration tool. Our work will target multiple state parks, forests and natural areas as well as federal and tribal lands that together will form a network of fire histories.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Field collection of fire history samples from multiple sites to compile the region's fire history and develop a database and fire statistics for managers** Budget: \$112,759

Our efforts will focus on the identification of areas within north-central Minnesota to collect fire-scarred tree samples to compile the dates of fire events over time. This is a time and labor-intensive process and accounts for the bulk of the work in developing a database of fire history for north-central Minnesota. At each of 10-20 locations we will collect samples from 8-10 stumps to identify the history of fire in a local area. Data will be



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**Project Title: Four centuries of wildfire in red pine forests**

collected during the snow-free season, and processed during the winter months. Identified fire dates will be compiled for each sampled area for site-specific fire histories and will be aggregated at the regional scale to examine the occurrence of large fire events. This activity forms the bulk of our research effort and will yield the baseline data necessary for informing management plans and guidelines for the reintroduction and use of fire to restore and manage red pine forests.

Outcome	Completion Date
1. Catalog the fire history of 20-30 discrete sites (State Parks, Natural Areas, National Forests) to provide to individual unit managers and develop a database of fire history.	October 2019
2. Analyze fire-climate interactions and produce statistical models to identify climate patterns that are most commonly associated with large fires in the north-central region.	January 2020
3. Engage land managers in local-to-landscape fire management conversations throughout the fire history field sampling process.	Autumn 2019

**Activity 2: Provide fire history information and analysis outcomes to various stakeholders individually and in a regional conference setting**

**Budget: \$94,601**

The culminating feature of our proposed research is the dissemination of our results to various stakeholder groups. We will organize multiple events (site visits, in-person conference, and webinar) to provide actionable information regarding the timing, frequency, and extent of past fires in Minnesota. We will provide guidance and interpretation for managers working to implement innovative plans involving the active management of fire.

Outcome	Completion Date
1. Present final project results to federal, state, and tribal forest managers at 2-3 fire science forums including one remote webinar with the Lake States Fire Science Consortium (LSFSC), and convene a conference/workshop to share results with stakeholders.	Spring 2020

**III. PROJECT STRATEGY**

**A. Project Team/Partners Receiving Funds**

- Dr. Kurt F. Kipfmüller, University of Minnesota–Twin Cities (Project Lead and Analyst)
- Dr. Daniel Griffin, University of Minnesota–Twin Cities (Analyst)
- Lane B. Johnson, National Park Service (Project Field and Laboratory Coordinator, to be located at the UMTC)

**Project Partners Not Receiving Funds**

- Minnesota Department of Natural Resources (Itasca State Park, Division of Forestry –Northwest and Northeast Regions)
- Chippewa National Forest, US Department of Agriculture–Forest Service
- Division of Resource Management, Leech Lake Band of Ojibwe

**B. Project Impact and Long-Term Strategy**

This undertaking is designed to document ephemeral records of past forest fires to guide active fire management in the maintenance and restoration of red pine dominated forest types on state, federal, and tribal lands. Site-specific fire histories will provide tangible evidence of the fire-dependence of northern forests to stimulate new conversations around forest fire ecology, grow public support for new fire management efforts across administrative boundaries, encourage the growth of fire-adapted communities, and guide landscape-level forest resilience and protect resources and property.

**C. Timeline Requirements**

This is a stand-alone project without timeline requirements.

## 2018 Detailed Project Budget

**Project Title:** Reconstructing historical wildfire occurrence in Minnesota's pine timberlands

### IV. TOTAL ENRTF REQUEST BUDGET 2 years

<b>BUDGET ITEM</b>	<b>AMOUNT</b>
<b>Personnel:</b>	
Kurt Kipfmueller, Project PI, overseeing and participating in all aspects of the research, primary responsibility for data analysis (66.5% Salary, 33.5% benefits); 12.5% FTE for years 1 & 2	\$ 42,271
Dan Griffin, Development of reference chronologies to facilitate crossdating of samples (66.5% salary, 33.5% benefits); 8% FTE for years 1 & 2	\$ 23,399
1 Research Associate (Lane Johnson), manages field data collection and data processing, assistance with data analysis and GIS mapping (66.5% salary, 33.5% benefits); 100% FTE for years 1&2)	\$ 124,155
1 Undergraduate Research Assistant, assist with data collection and processing of samples (100% Salary, 0% benefits); 40% FTE for years 1 & 2	\$ 26,211
<b>Equipment/Tools/Supplies:</b>	
GPS Receiver and hand-held tablet for recording and mapping locations of field samples	\$ 1,400
Solar Charger for remote charging of equipment while conducting fieldwork	\$ 500
Maps and mapping tools (digital maps and imagery for field use)	\$ 500
Field and laboratory supplies (pallet wrap for samples, wood glue, sanding belts, replacement saw blades and chains, plywood for mounting samples, saw maintenance)	\$ 2,500
<b>Travel:</b>	
University of Minnesota Fleet Vehicle Rental (3 mos each in years 1 & 2) for travel to field sites	\$ 5,100
Vehicle Mileage (10,000 miles year 1, 5,000 miles year 2 @ \$0.37/mile) for travel to field sites	\$ 5,550
Per Diem (3 people for 45 days in each of years 1 and 2 @ \$51/day) while conducting fieldwork	\$ 13,770
Lodging (30 people nights for each of years 1 & 2) while conducting field work and not camping in campgrounds or remote areas	\$ 5,460
<b>Additional Budget Items:</b>	
Safety Training (Wilderness first responder and saw training for personnel)	\$ 2,000
Support to convene a culminating conference/workshop to share and discuss results with land management agencies and other stakeholders	\$ 2,500
Archival Support (support to cover costs associated with permanent archival of specimens including packaging and inventory database support)	\$ 2,000
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 257,316</b>

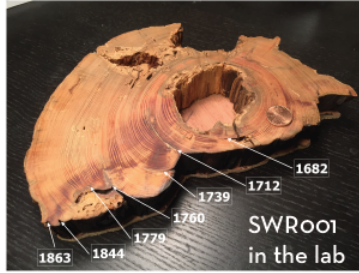
### V. OTHER FUNDS

<b>SOURCE OF FUNDS</b>	<b>AMOUNT</b>	<b>Status</b>
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b>	N/A	N/A
<b>Other State \$ To Be Applied To Project During Project Period:</b>	N/A	N/A
<b>In-kind Services To Be Applied To Project During Project Period:</b>	N/A	N/A
<b>Past and Current ENRTF Appropriation:</b>	N/A	N/A
<b>Other Funding History:</b>	N/A	N/A

Raw Data Forming the Base of Fire Histories

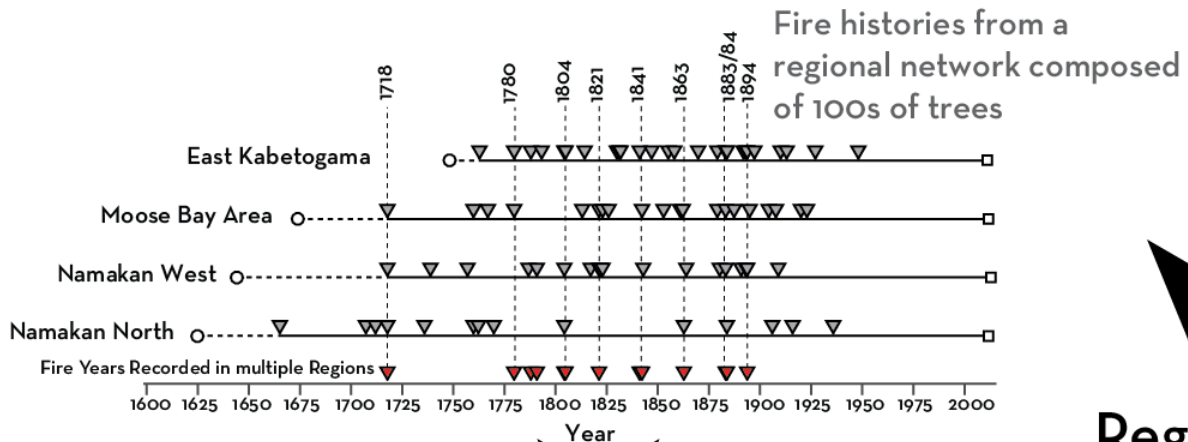
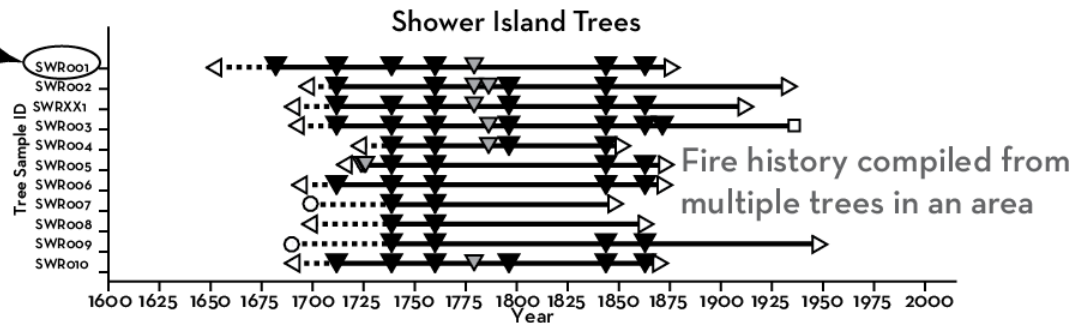
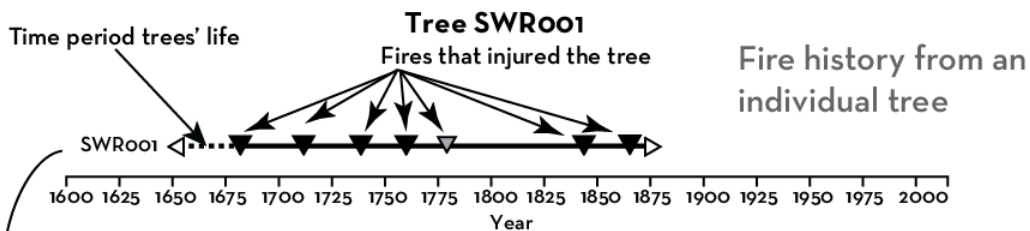


A fire-scarred dead red pine



Dates of fires that burned and injured the tree, preserving the dates of the fire in the annual rings.

Local Scale



Regional Scale

Fire Management Planning Informed By Local-to-Regional Scale Fire Histories

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

Dr. Kurt Kipfmueller is Associate Professor of Geography, Environment, & Society at the University of Minnesota–Twin Cities. Dr. Kipfmueller has extensive experience reconstructing fires using tree rings in a variety of forested landscapes. His most recent research efforts involve the reconstruction of fires in red pine forests of the Boundary Waters Canoe Area Wilderness, Voyageurs National Park, and along the Brule River (WI). He received his Ph.D. from the University of Arizona in 2003. His research has appeared in *Ecological Applications*, *Quaternary Research*, *Canadian Journal of Forest Research*, *Forest Ecology and Management*, and *Geophysical Research Letters*. He is founding and senior member of the Center for Dendrochronology at the University of Minnesota. He is also a member of the Academy of Distinguished Teachers at the University of Minnesota and has provided exceptional research partnerships with undergraduates in his laboratory group.