



## Environment and Natural Resources Trust Fund

### 2022 Request for Proposal

#### General Information

**Proposal ID:** 2022-216

**Proposal Title:** Shifting Savannas: Assessing Management of At-Risk Sites

#### Project Manager Information

**Name:** Matthew Kaproth

**Organization:** Minnesota State Colleges and Universities - Minnesota State University Mankato

**Office Telephone:** (607) 280-0158

**Email:** matthew.kaproth@mnsu.edu

#### Project Basic Information

**Project Summary:** We propose to survey unmapped Central and Southern Minnesota savannas to develop localized management recommendations for habitats at risk of degradation due to climate change and invasive species.

**Funds Requested:** \$194,000

**Proposed Project Completion:** June 30 2025

**LCCMR Funding Category:** Small Projects (H)

**Secondary Category:** Methods to Protect, Restore, and Enhance Land, Water, and Habitat (F)

#### Project Location

**What is the best scale for describing where your work will take place?**

Region(s): SE, SW, Central,

**What is the best scale to describe the area impacted by your work?**

Region(s): SE, SW, Metro, Central,

**When will the work impact occur?**

During the Project and In the Future

## Narrative

### **Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.**

While savannas are widespread in the state, they are not of focus in most conservation efforts. Savannas have both forest and prairie components - but are distinctly neither. Savannas provide ecosystem services exclusive to their open canopy structure and require management balancing control of 1) fire/drought disturbance, 2) invasive species encroachment, and 3) regeneration. Our work will provide survey Methods to Protect or Restore Land and Habitat to identify areas of need and successful methods of savanna stewardship that encourage (pollinator) biodiversity, habitat health and resilience. Using efficient survey tools (remote sensing and GIS), the work will focus on land that had received public money (e.g., CRP, CREP and RIM easements) but are at risk of degrading due to expiration of funding and pressure from climate change and management deficiencies. Additionally, while the ongoing MN Prairie Conservation Plan is working on western prairies, our focus will be on unique central and southern regions not currently being addressed. This work has not been completed before – and a sweeping regional survey with unified methodology for assessing savannas is needed to detect priorities to ensure long term preservation of ecosystem services from these unique habitats.

### **What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.**

Savannas historically have an open canopy structure (<50% forest). We propose that the effort to map and assess these sites could be reduced using GIS (Geographic Information Systems) and remote sensing imagery. We aim to work closely with ongoing projects – using existing state data (GIS/imagery), sharing methods from established restoration assessments and LCCMR restoration monitoring requirements to provide managers a metric of a site's current health and specific deficiencies. To do so, we will:

- Work with private stakeholders that received public funding to identify areas of need in management assessment.
- Coordinate methods and data reporting with agencies to complement statewide efforts (LCCMR, Minnesota Biodiversity Atlas, The Prairie Enthusiasts).
- We will survey savannas in Southern and Central MN (Anoka Sand Plain) using Vegetation Monitoring Protocol and ground truth remote sensing imagery. Current savannas are largely unmapped.
- Identify plant and pollinator species only served by savannas - at risk of losing their habitat and not adapted to a changing climate.
- Archive surveys so the methods of successful land management can be identified and used elsewhere (long-term dissemination of current science to practitioners).
- Provide demonstrations and publications to move knowledge into circles beyond original groups for regional use.

### **What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?**

In total, more than \$700 million has been invested in savanna/prairie restoration by three programs alone (CRP, CREP and RIM easements). Despite interest of stakeholders (e.g., The Prairie Enthusiasts (TPE), Pheasants Forever, MN DNR, US Fish and Wildlife Service), permanent easement holders have had limited contact with resource professionals to assess management needs such as prescribed fires & invasive species control – especially after public money has run out. This project will help to aid practitioners with best methods training and develop a convention for determining conservation success in savannas, with aim of providing continuing returns from public money investments.

## Activities and Milestones

### Activity 1: Assess site functions & link management to successful outcomes

**Activity Budget:** \$105,136

**Activity Description:**

Savannas historically have an open canopy structure (<50% forest). We propose that the effort to map and assess these sites could be reduced using existing state GIS and remote sensing imagery. We will measure the savanna canopy structure, biodiversity, and health of at least twenty sites not addressed by the MN Prairie Conservation Plan, primarily in three major outstate regions (Central, SW & SE). This statewide survey will allow us to connect how the open savanna canopy may provide distinct functions than other communities in the state. Compared to western prairies, these regions have wetter environments and host oak trees with companion plant species. They may also host pollinator species and ecosystem services not present in other habitats.

Without disturbance management (e.g., fire, grazing), savannas will have encroachment of woody plants and invasive species. While climate change will cause dramatic droughts in these systems, it is unclear how these disturbances may alter healthy species communities. Working with restoration partners (The Prairie Enthusiasts (TPE)), we will develop qualities of measurable functions (biodiversity, drought resistance, canopy structure). The field surveys will employ one graduate student in biology and three junior scientists (students/assistants) and include recording and archiving site management histories.

**Activity Milestones:**

Description	Completion Date
Map and assess savannas with existing GIS and remote sensing imagery (& ground truth fieldwork)	May 31 2023
Survey 20 sites for plant/pollinator biodiversity & ecosystem quality across central & southern savannas	September 30 2024
Archive field collections in Minnesota State University's Herbarium & digitize for the Minnesota Biodiversity Atlas	May 31 2025

### Activity 2: Develop recommendations for future site management

**Activity Budget:** \$88,864

**Activity Description:**

The combined assessments of Activity 1 will be used to correlate site management histories and current site health to prescribe methods for savanna improvement. Recommendations will guide future management and help identify vital habitat for plant and pollinator species at risk due to a changing climate. We will conduct demonstrations of supported stewardship methods in partnership with The Prairie Enthusiasts (TPE) - this training and implementation of community-based efforts will lead to conserving natural resources not within the DNR Prairie Conservation Plan. Using our research data, we will create a Minnesota State University (MSU)/TPE website with a central online repository of digitized surveys and educational materials on management and disturbance such as fire to promote savanna biodiversity and health for regional land. This activity focuses on sites that may require unique disturbance restoration methods due to wetter environments (these methods are not highlighted in the University of Minnesota's Ecological Management Certificate Program Webinars). Our publications and demonstration workdays would focus on Minnesotan landowners and practitioners. Archived data and publications of current science will move knowledge into circles beyond original groups for regional use.

**Activity Milestones:**

Description	Completion Date
Develop recommendations for future sites: Correlate survey data of site health with management methods	May 31 2025
Digitize surveys and educational materials on partner websites focused on savanna management	May 31 2025
Publish findings and hold workdays demonstrating management methods that promote native species	June 30 2025

## Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Debra Behrens	The Prairie Enthusiasts	Executive Director for a non-profit prairie and savanna restoration practitioner group. The organization would provide site knowledge, workday sites, and a forum for education. They also have insurance for prescribed fires.	No
Randy Schindle, MS	Many Rivers Chapter, MN (The Prairie Enthusiasts)	Forestry expert, with deep knowledge of savanna restorations, suitable sites, and management activities.	No
Anna Schweiger, PhD	University of Zurich	Remote sensing biodiversity expert. Minnesota and worldwide knowledge of oak savanna and prairie systems.	No

## Long-Term Implementation and Funding

**Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?**

Understanding the health and resilience of our savannas will guide management of these unique habitats. After years of projects investing in lands and restorations, there is a danger of savannas degrading without continued disturbance management. We are also forecasted to lose oak canopy structure and function with increasing droughts – shifting savannas into prairies. Our identification of savanna sites, and specifically their structure, biodiversity and practices used to maintain these ecosystems will be used to create efficient recommendations for successful continued management (Activity 1). We will teach practitioners with community-workdays, publications, and accessible data (see Activity 2). No long-term funding required.

## Project Manager and Organization Qualifications

**Project Manager Name:** Matthew Kaproth

**Job Title:** Associate Professor

**Provide description of the project manager's qualifications to manage the proposed project.**

Dr. Kaproth has 17 years of research experience in prairies, oaks and related systems (plant ecology, environmental science, invasive species biology, plant biology, sustainability science). His work has been published in 11 publications on oak/savanna and prairie species, invasive plant species/management and biodiversity. He has presented >20 research projects at regional, national and international meetings. He has hired, trained and mentored >20 technicians and students on ecological, environmental science and/or plant biology projects.

- Dr. Kaproth has managed logistics and reported progress on 10 projects awarded from various funding sources: Federal (USDA, NSF), State (UMN UROP, WV View) or private/organizational (The Prairie Enthusiasts, MANK herbarium, MSU, UMN). He also directs research and curation of the Darlene & William Radichel Herbarium (MANK) with a \$110,000 endowment and has mentored several graduate students on projects related to the proposed work.
- Dr. Kaproth has published relevant research on plant-environment studies offered below:

Peterson, A. and M Kaproth, 2020. Prairie vegetation surveys in southern Minnesota: Management, invasive species and future directions. Master's thesis, Minnesota State University, Mankato. Cornerstone: <https://cornerstone.lib.mnsu.edu/etds/1072>

Cavender-Bares, J, S Kothari, JE Meireles, MA Kaproth, et al., 2018. The role of diversification in community assembly of the oaks (*Quercus L.*) across the continental U.S. *American J. of Botany* 105(3):565-586 10.1002/ajb2.1049

Theis, AR and MA Kaproth 2017. *Prairie Flora Guide to Blue Earth County*. Minnesota State University, Mankato. ISBN 0-9729134-5-9

Cavender-Bares, J, JE Meireles, J Couture, MA Kaproth, et al., 2016. Associations of leaf spectra with genotypic and phylogenetic variation in oaks: Prospects for remote detection of biodiversity. *Remote Sensing* 8(3): 221 10.3390/rs8030221

Kaproth, MA, and J Cavender-Bares, 2016. Drought tolerance and climatic distributions of the American oaks. *International Oaks* 27:49-60

**Organization:** Minnesota State Colleges and Universities - Minnesota State University Mankato

**Organization Description:**

MSU's Department of Biological Sciences introduces students to a broad spectrum of topics related to the study of living things and helps them develop specializations that lead to a wide range of career opportunities. Faculty advisors work closely with biology majors as they identify and pursue their specialties through real-world research opportunities in our well-equipped labs.

Minnesota State University, Mankato is an educational institute delivering courses, research and training for future practitioners. Set in outstate, it's mission is to promote learning through effective undergraduate and graduate teaching, scholarship, and research in service to the state, the region and the global community. Within the university, the College of Science, Engineering and Technology (CSET) has a specific mission - As educational leaders in science, technology, engineering, and mathematics (STEM), our accessible faculty advances student scholarship through innovative teaching, research expertise, and the exploration of new technologies and ideas. We prepare our students for professional careers and advanced study, while connecting with local, regional and global communities. We strive to provide a mentored educational experience to every student in our college, develop the most qualified engineers, scientists and STEM teachers, and establish our college as the preferred Master's degree provider in Minnesota.

## Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
<b>Personnel</b>								
Dr. Matthew Kaproth		Project Director			22%	0.15		\$22,256
Graduate Student		Graduate Research Assistant for remote sensing/GIS work, ground truthing surveys, analysis and publications			32%	1.5		\$36,932
Student Personnel		Undergraduate student field assistants for site surveys and educational workdays/data entry; website work. 2 per year.			7.65%	0.9		\$22,249
Technical Assistant		junior scientist to organize pollinator surveys, fieldwork teams, education materials and archive data for Activities 1 & 2			38%	1.5		\$87,898
							<b>Sub Total</b>	<b>\$169,335</b>
<b>Contracts and Services</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Equipment, Tools, and Supplies</b>								
	Tools and Supplies	Field supplies for Activity 1	Reference books, plant press material for herbarium collections and plant/pollinator collections, field waterproof gear, fisheye lens for canopy structure measurements					\$3,000
	Tools and Supplies	Citizen workday supplies for Activity 2	Demonstrate recommended management methods on a 10-acre site: Burn crew clothes and safety equipment, fuel for prescribed fires, shovels, flappers, clippers, native prairie seed, gloves.					\$700
	Tools and Supplies	Lab supplies for Activities 1 & 2	Remote sensing image acquisition (ground-truth verification, \$3000); Plant drought stress tolerance testing: lab osmometer standards					\$3,500

							<b>Sub Total</b>	<b>\$7,200</b>
<b>Capital Expenditures</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Acquisitions and Stewardship</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Travel In Minnesota</b>								
	Miles/ Meals/ Lodging	60 fieldcrew trips within 100 mile radius, \$0.49/mile	Field site surveys to savanna/prairie sites in MN for Activities 1&2					\$2,940
	Other	30 2-day fieldcrew trips >100 miles, \$55/day	MSU fleet rental for in-state field surveys >100 miles for Activities 1&2					\$3,300
	Miles/ Meals/ Lodging	Field station rates; \$65/2-day trips, 3 people, 30 trips	Field surveys room & board for Activities 1&2					\$5,850
							<b>Sub Total</b>	<b>\$12,090</b>
<b>Travel Outside Minnesota</b>								
	Conference Registration Miles/ Meals/ Lodging	2 meetings, 3 people (1-overnight trips within 300 miles)	Conference presentations for Activities 1&2; The Prairie Enthusiasts annual meetings	X				\$3,000
							<b>Sub Total</b>	<b>\$3,000</b>
<b>Printing and Publication</b>								
	Publication	Publication fees	Publication of results					\$750
	Printing	Printing services for educational handouts, mailings	Distribution of results/educational materials for better site stewardship					\$500
							<b>Sub Total</b>	<b>\$1,250</b>
<b>Other Expenses</b>								



		Training curriculum: Restoring Minnesota Ecological Restoration Online Courses - Site Assessment and Monitoring Ecological Restoration	Training for 3 junior scientists; \$375/course					\$1,125
							<b>Sub Total</b>	<b>\$1,125</b>
							<b>Grand Total</b>	<b>\$194,000</b>

## Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
<b>Travel Outside Minnesota</b>	Conference Registration Miles/Meals/Lodging	2 meetings, 3 people (1-overnight trips within 300 miles)	The Prairie Enthusiasts annual conference meetings are held in neighboring states (or sometimes in MN). We will present our findings.

## Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
<b>State</b>				
In-Kind	MSU match (12% overhead) - Negotiated in-direct rate with Dept. of Health and Human Services	All equipment matched by MSU Mankato (12% overhead: computers, video recording and editing, data achieve and hosting, analysis software, labs, freezers, student volunteer/internships, award administration, MSU Technical Assistant office/phone)	Secured	\$23,280
			<b>State Sub Total</b>	<b>\$23,280</b>
<b>Non-State</b>				
Cash	Private donations (through MSU, The Prairie Enthusiasts)	Supplement field surveys and herbarium work for students	Secured	\$1,250
Cash	Darlene & William Radichel Herbarium Endowment, MSU, Mankato, MN (MANK)	Supplement student work on herbarium specimen archival and management	Secured	\$4,000
In-Kind	Randy Schindle, The Prairie Enthusiasts local chapter	Consultations, records, access to sites, practitioner training/videos, demonstration expertise	Secured	\$20,000
In-Kind	The Prairie Enthusiasts and private landowners	Demonstration site access, management expertise, prescribed fire burn crew equipment/insurance	Secured	\$30,000
			<b>Non State Sub Total</b>	<b>\$55,250</b>
			<b>Funds Total</b>	<b>\$78,530</b>

## Attachments

### Required Attachments

#### *Visual Component*

File: [421bcadb-c67.pdf](#)

#### *Alternate Text for Visual Component*

Savannas host unique plants and pollinators in the state of Minnesota and serve as a buffer between prairies and forests with their open canopy structure. We will assess the health and ecosystem services of at least 20 savanna sites across the state using efficient remote sensing and GIS techniques and working with community partners that are practicing stewards for conservation in these ecosystems. We will publish our findings and hold demonstrations of methods found to support healthy savan...

### Optional Attachments

#### *Support Letter or Other*

Title	File
Letter of Support from The Prairie Enthusiasts (TPE)	<a href="#">dc348688-284.pdf</a>

## Administrative Use

**Does your project include restoration or acquisition of land rights?**

No

**Does your project have potential for royalties, copyrights, patents, or sale of products and assets?**

No

**Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?**

N/A

**Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?**

N/A

**Does your project include original, hypothesis-driven research?**

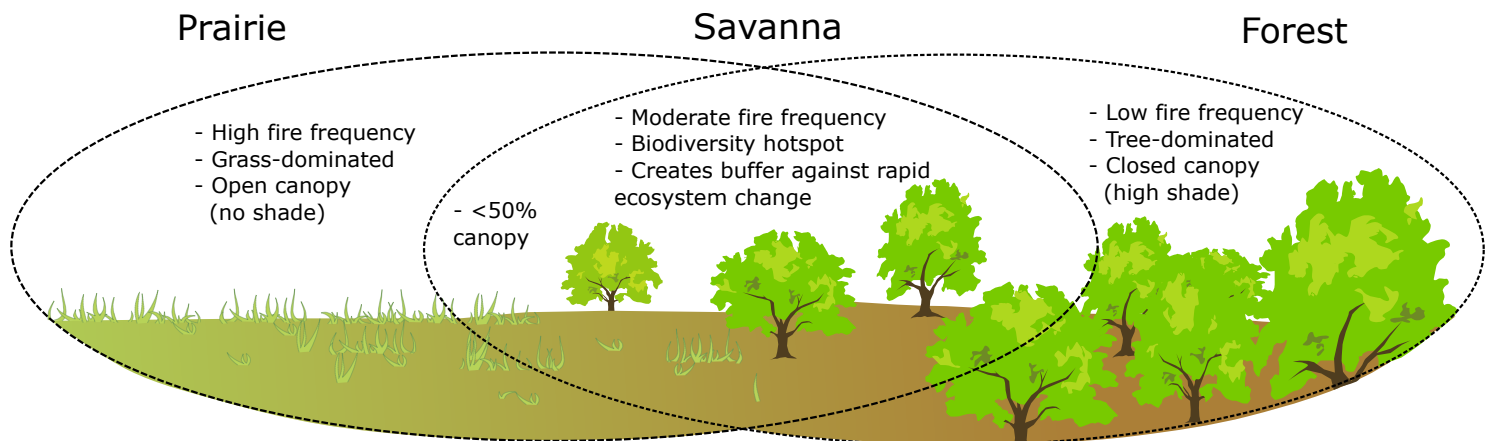
Yes

**Does the organization have a fiscal agent for this project?**

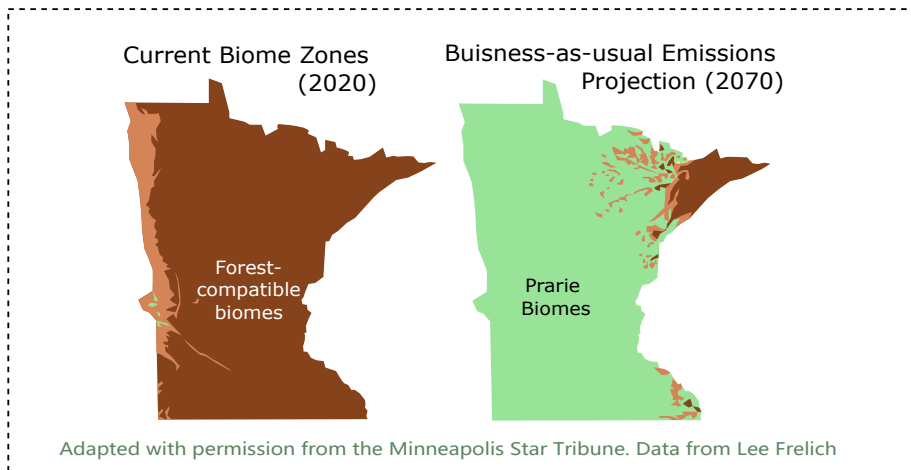
No

# Shifting Savannas: Assessing Management of At-Risk Sites

Savannas have both forest and prairie components - but are distinctly neither. Savannas provide ecosystem services exclusive to their unique open structure, but require management to balance 1) regeneration, 2) invasive encroachment and 3) fire/drought disturbance.



Recent studies agree that MN will undergo rapid ecosystem shift due to climate change - increased savanna management provides a needed buffer.

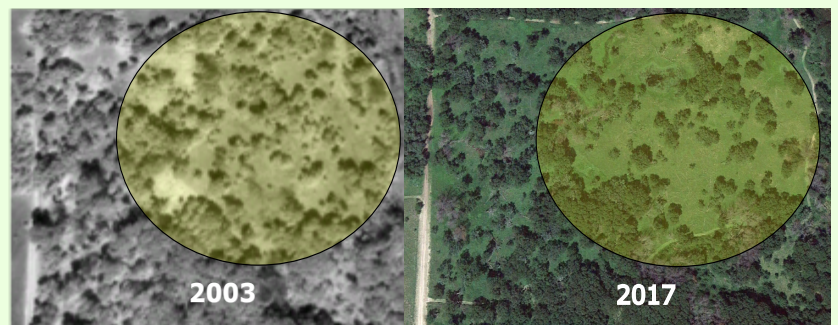


We propose to survey previously unmapped Central and Southern MN savannas to develop localized management recommendations for sites at risk of degradation due to climate change & invasive species encroachment.

## Activity 1: Assess site functions & link management to successful outcomes

### 1. Map and assess savanna structure with existing GIS and remote sensing imagery

Remote sensing/GIS data can accurately track changes in canopy density, as visible in this fire-managed savanna. [Photo: USDA]



### 2. Survey 20 sites for biodiversity, ecosystem quality



Plant Biodiversity



Pollinator Biodiversity

### 3. Archive field collections in MSU's Herbarium & digitize for the Minnesota Biodiversity Atlas

## Activity 2: Develop recommendations for future site management

1. Correlate survey data with site health and management methods
2. Digitize surveys & educational materials on partner websites focused on savanna management
3. Publish findings & hold workdays demonstrating management methods that promote native species

