

**Environment and Natural Resources Trust Fund
2015 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 009-A

Effects of Grazing Versus Fire for Prairie Management

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 414,064

Proposed Project Time Period for the Funding Requested: 3 years, July 2015 - June 2018

Summary:

This proposal is the first study to compare effects of grazing and fire on tallgrass prairie plants and pollinators in Minnesota. The outcome will be a better-informed land management community.

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Sponsoring Organization: U of MN

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

The figure shows the hypothesized direction and strength of relationships between management actions (grazing and fire) and prairie plants and pollinators.

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



I. PROJECT STATEMENT

Why this project is important: Minnesota’s tallgrass prairies depend on disturbance (e.g., fire, grazing, drought), without which they would rapidly transition to woodland and forest. Drought alone will not maintain prairies in Minnesota, so land managers use prescribed fire and “conservation grazing” (the use of grazing by domestic animals to achieve conservation goals) to preserve prairie plant communities and the many pollinators, birds, and mammals that depend on them. Although effects of fire on northern tallgrass prairies are well documented, there are *no* studies of the effects of conservation grazing on Minnesota prairies in the published literature, and gradients in temperature and precipitation make extrapolation from studies to the west and south of Minnesota risky. Yet, because prescribed fires are expensive, require significant personnel numbers and time, can only be completed during specific windows of time, and may have negative effects on some pollinators, managers have turned to conservation grazing, *despite its unknown consequences*. The study proposed here aims to address this knowledge gap.

Goal: Our primary goal is to conserve and enhance Minnesota’s tallgrass prairies by providing the tools necessary for federal, state, local, and private land managers to be effective stewards of prairie plant communities and the pollinators and other animals that depend on them. We will accomplish this goal by:

1. Assessing the effects of grazing intensity and prescribed fire on native plant species richness and diversity and the prevalence of invasive grasses;
2. Assessing the direct and indirect effects of grazing and fire on pollinator species richness (native bees and butterflies), because pollinating insects are sensitive to both management (direct effects) and plant species composition (indirect effects); and
3. Providing land managers with unbiased information on the implications of fire and grazing for Minnesota’s tallgrass prairies that they can use to achieve their management goals.

The ultimate outcome of this work will be a well-informed management community that will understand the relative and varying effects of fire and conservation grazing on Minnesota’s prairie resources.

How we will achieve the goal: Fortunately, Minnesota is home to thousands of acres of prairies with a wide variety of known management histories. We will work with the land management community to identify prairie tracts that have been managed predominantly with fire or predominantly with grazing throughout the tallgrass prairies of Minnesota. Field surveys will evaluate the outcome of these management practices in terms of native plant species composition and richness, invasive grass abundance, and species richness of pollinators and native butterflies. Because of their known importance in determining plant and insect composition, we will also consider rates of nitrogen cycling, soil characteristics, and surrounding land use. The attached figure illustrates potential pathways of direct and indirect effects of management on key prairie characteristics; our research will allow us to evaluate the relative importance of these pathways.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Identify prairie tracts, collect management histories, assemble GIS layers in preparation for field work **Budget: \$50,000**

We will work with federal, state, local, non-profit, and private land managers to select at least 75 tallgrass prairie tracts with known management histories that include regularly applied burning, grazing, or a combination of the two. GIS layers for soil types and surrounding land use will be assembled from publicly-available GIS data.

Outcome	Completion Date
1. GIS map layers for each prairie tract	May 2016
2. Spreadsheet of management actions and dates for each prairie tract	May 2016

Activity 2: Compare effects of grazing and fire on native plant species richness and composition and abundance of invasive grasses (Kentucky bluegrass (*Poa pratensis*), reed canary (*Phalaris arundinacea*), smooth brome (*Bromus inermis*)). **Budget: \$182,032**

Using the prairies identified in Activity 1, we will conduct surveys to assess plant species richness, exotic grass cover, and soil nitrogen dynamics. All sites will be surveyed in summer 1, and we will re-survey some sites in



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summer 2 to assess year-to-year variation. We will relate plant species richness and abundance of invasive grasses to management history and grazing intensity, while taking into account nitrogen dynamics, and soil and landscape characteristics.

Outcome	Completion Date
<i>1. Preliminary analysis of first field season completed; status report sent to cooperators.</i>	<i>May 2017</i>
<i>2. Data analysis from both field seasons completed</i>	<i>December 2017</i>
<i>3. Information dissemination via web site, workshops, and fact sheet</i>	<i>June 2018</i>

Activity 3: Compare effects of grazing and fire on pollinator species richness.

Budget: \$182,032

Using a random subset of prairies identified in Activity 1, we will perform field surveys for pollinators using pan traps and hand netting (for solitary bees), and observation transects (for butterflies and bumble bees). We will conduct surveys in both summers at the same sites, and visit each site three times, spreading sampling intervals to account for insect flight times. We will identify insects collected during the field surveys during the winter, and relate pollinator species richness to management history, taking into account plant community structure. Because their presence indicates insect community health, this assessment will include cleptoparasitic bees (which lay their eggs in other species' nests).

Outcome	Completion
<i>1. Preliminary analysis of first field season completed; status report sent to cooperators.</i>	<i>May 2017</i>
<i>2. Data analysis from both field seasons completed; list of pollinator species sent to cooperators</i>	<i>December 2017</i>
<i>3. Information dissemination via web site, workshops, and fact sheet</i>	<i>June 2018</i>

III. PROJECT STRATEGY

A. Project Team/Partners: **Diane Larson**, Research Scientist, U.S. Geological Survey (research foci are invasive species and pollination mutualisms), will oversee vegetation research and co-advise graduate students. **Karen Oberhauser**, Professor in Fisheries, Wildlife and Conservation Biology at the University of Minnesota (focus is conservation of Lepidoptera), will oversee funds within the University, provide butterfly identification expertise, and co-advise graduate students. **Sam Droege**, U.S. Geological Survey (foci are survey methods and taxonomy of hymenoptera) will oversee insect identification. Both the USGS and the University of Minnesota will receive funds, and contribute space and time to the project.

B. Project Impact and Long-Term Strategy

We will communicate our results to managers and the general public in the form of manuscripts in the published literature and a management-oriented fact sheet. Additionally, we will create a website that summarizes our findings, hosted at the Northern Prairie Wildlife Research Center and linked to the University of Minnesota Extension website. In cooperation with the Minnesota Chapter of The Wildlife Society, we will conduct workshops for interested land managers throughout the state. Our dissemination goal is to provide these managers with a framework for designing a disturbance regime that will achieve their management goals for prairie plant and pollinator diversity. By soliciting managers' input during site selection, we can capitalize on their continued interest and involvement in the study to insure the results are put to use. The continued involvement of USGS and University of Minnesota personnel with Minnesota land managers, along with audience-appropriate dissemination vehicles, will ensure access to these results in the long-term. Because we are able to take advantage of existing variation in site management strategies, we anticipate that two field seasons will suffice, and do not foresee the need for ongoing funding

C. Timeline Requirements

Site and graduate student selection will begin in July 2015, or when funds are secured. Two field seasons are required. Field teams will be hired in March 2016, and field work will occur during the 2016 and 2017 growing seasons, with insect identification and statistical analysis during the subsequent fall, winter, and spring seasons. All dissemination vehicles (reports, manuscripts, website and workshops) will be completed by June 2018.

2015 Detailed Project Budget

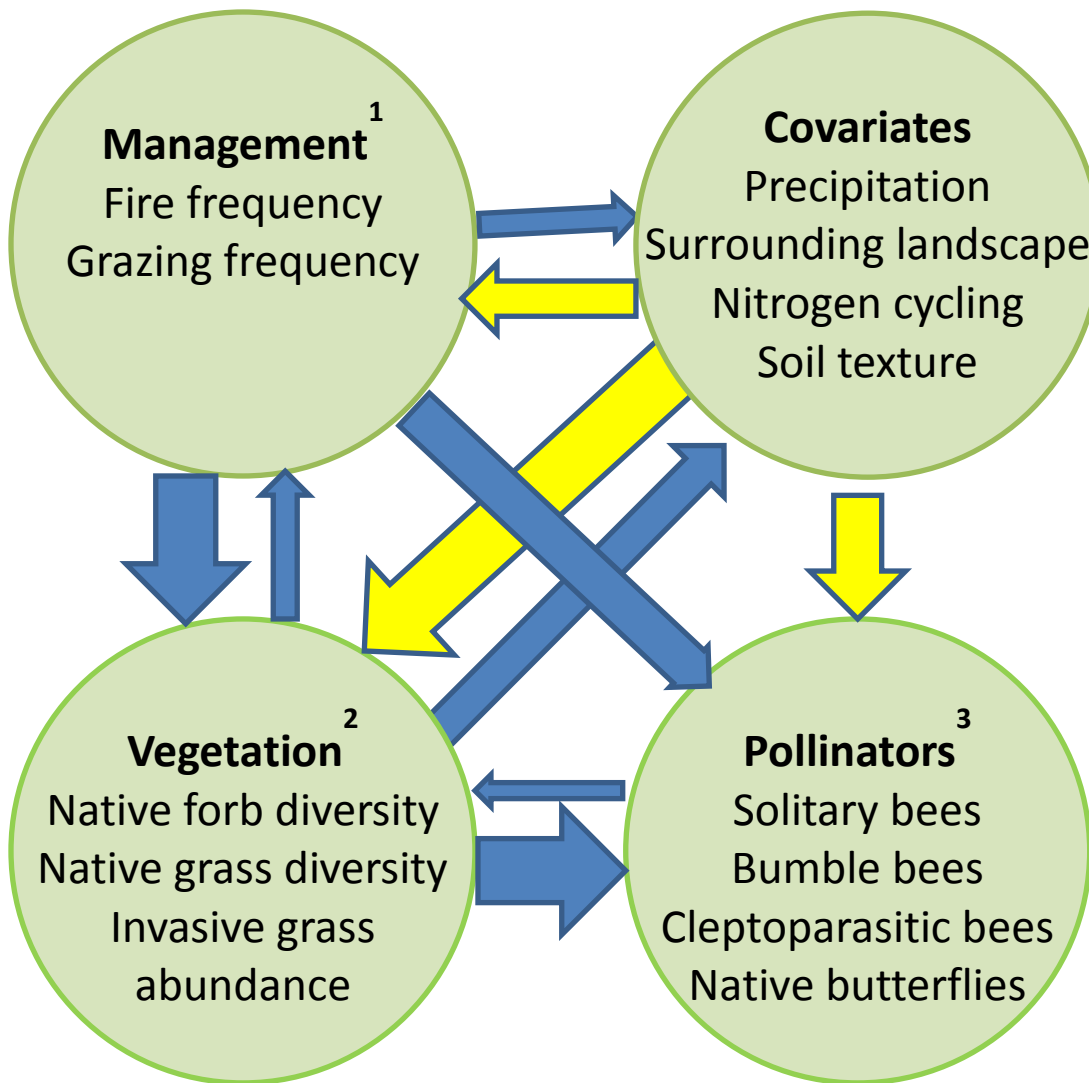
Project Title: *Effects of grazing versus fire for prairie management*

IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel	
Karen Oberhauser (Co-PI); 8.3% FTE for 3 years	\$40,845.00
University of Minnesota Master's Students (2 @ \$21767 salary and \$17330 fringe, which includes tuition, year-round for 3 years)	\$234,582.00
Student research assistants, 2 at 50% FTE/year for 2 years	\$72,841.60
Jennifer Larson (temp/casual at U of M), Quality Assurance and Project coordination, 10% FTE for 2 years	\$12,656.00
Equipment/Tools/Supplies	
Field Supplies	\$2,800.00
Lab Supplies	\$1,820.00
U of M soil lab costs for nitrogen determinations	\$12,000.00
Travel	
Field crew travel	\$17,940.00
Larson and Oberhauser travel for training and supervision of field crew	\$2,580.00
Additional Budget Items	
field vehicle (2, U of M owned, 2 field seasons)	\$12,000.00
Workshop and Fact Sheet costs	\$4,000.00
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$414,064.60

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period		
Other State \$ To Be Applied To Project During Project Period		
In-kind services to be applied to project during project period		
Salary for Sam Droege, U.S.G.S., 3.8% FTE for 3 years	\$8,976.00	Secured
Salary for Diane Larson, U.S.G.S., 20% FTE for 3 years	\$86,923.20	Secured
Salary for Karen Oberhauser, University of Minnesota; 1% FTE for 3 years	\$4,921.00	Secured
Funding History		
Remaining \$ From Current ENRTF Appropriation		



Hypothesized effects of management on response variables (vegetation and pollinators). Each arrow represents a potential causal pathway, with arrow width representing hypothesized relative importance of the pathway. Pathways shown by blue arrows are the focus of our study; yellow arrows represent other factors that could affect the focus variables and thus must be taken into account in the analysis.

¹Frequency includes intervals between events, number of events in past 10 or 20 years (depending on management history data), time since last event

²Vegetation response variables: native species richness and diversity indices, total exotic cover, cover of individual invasive grasses

³Both species richness and diversity indices will be calculated for all pollinator groups

Project Manager Qualifications:

Dr. Karen Oberhauser is a Professor of Fisheries, Wildlife, and Conservation Biology in the College of Food, Agriculture and Natural Resource Science at the University of Minnesota. She conducts research on monarch butterflies and insect conservation, and is the director of the Monarch Larva Monitoring Project (<http://www.mlmp.org>), a National Science Foundation funded and internationally recognized citizen science project. In 2013, she was recognized at the White House as a “Champion of Change for Citizen Science” for this effort. She will lead the butterfly surveys and co-lead the pollination study. Dr. Oberhauser and Dr. Larson will co-advise the master’s students who work on this project.

Dr. Diane Larson is a Research Wildlife Biologist with U.S. Geological Survey, Northern Prairie Wildlife Research Center, located at the University of Minnesota, St. Paul, where she has adjunct appointments in Ecology, Evolution and Behavior and Horticultural Science. The focus of Dr. Larson’s research combines aspects of restoration and pollination ecology. She works closely with U.S. Department of Interior land managers to address their questions through carefully designed research protocols. Recent studies have evaluated techniques for prairie reconstruction and resilience to invasive plants and the use of pollination networks to guide management of rare plant species. Dr. Larson will lead the vegetation component of the proposed study and co-lead the pollination study with Dr. Oberhauser, assisted by Sam Droege.

Sam Droege M.S., is a Wildlife Biologist with U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD. He is internationally recognized as a leader in survey methodology, with more than 50 publications on the topic, many of which involve pollinators. Mr. Droege has collaborated with Dr. Larson on prior studies of pollinators at Badlands National Park, as well as with other scientists across the United States on surveys to document Hymenoptera diversity. He will insure correct taxonomic identification of pollinators in the current study.

Jennifer Larson, M.S., is an Ecologist currently working with Dr. Larson. She will participate in quality assurance on an appointment with the University of Minnesota. Ms. Larson has provided taxonomic expertise for prairie plants and has led field crews for prairie restoration studies in Minnesota, Iowa, and South Dakota. She will coordinate work between the University of Minnesota and U.S. Geological Survey and prepare soil samples for submission to the Soil Analytical Lab.

Organization Description:

This project will be managed by **University of Minnesota** and formally housed in Oberhauser’s lab. Graduate students will be recruited from the University’s Entomology; Conservation Biology; and Ecology, Evolution and Behavior programs. We will coordinate efforts and share data with relevant government agencies and non-government institutions.

The U.S. Geological Survey (USGS) is a science organization that provides impartial information on the health of our ecosystems and environment, the natural hazards that threaten us, the natural resources we rely on, the impacts of climate and land-use change, and the core science systems that help us provide timely, relevant, and useable information. The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.