

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

Project Title:

ENRTF ID: 015-A

Restoring Prairie Biodiversity and Pollinator Habitat with Haying

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 458,362

Proposed Project Time Period for the Funding Requested: 4 years, July 2018 to June 2022

Summary:

This project will test how the frequency and timing of haying, used alone or combined with prescribed burning, can promote biodiversity and pollinator habitat in prairie.

Name: Hernández Daniel

Sponsoring Organization: Carleton College

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Location

Region: Northwest

County Name: Becker, Mahnomen

City / Township: numerous

Alternate Text for Visual:

Prairie haying restoration project location (Lake Agassiz Beach Ridges Prairie Region) and schematic showing the basic experimental design.

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

PROJECT TITLE: Restoring Prairie Biodiversity and Pollinator Habitat with Haying

I. PROJECT STATEMENT

Virtually all of Minnesota's threatened bird and invertebrate species depend on endangered prairie ecosystems, yet prairie is the least protected ecosystem in the state. Prairie is essential habitat for pollinators. Prairie also provides key nesting areas for species of waterfowl and game birds such as pheasants and greater prairie-chickens. The preservation and restoration of prairie is challenging because the now-fragmented prairies must be actively managed with regular disturbance to prevent encroachment by woody plants and maintain populations of sensitive species. Historically, this management has been performed with prescribed burning. However, prescribed burning is costly and logistically challenging, requiring trained burn crews and ideal weather conditions that are not available during most of the year. To expand prairie restoration capacity across Minnesota, additional cost-effective strategies such as haying must be investigated to increase habitat quality for all prairie-dependent species.

Can haying increase prairie habitat quality and reduce costs relative to burning? Many prairie species are adapted to, and can only persist with, frequent disturbance. Haying can provide this disturbance by removing plant biomass, increasing light availability, and removing nutrients from the system. Therefore, similar to burning, haying prairie may increase native plant diversity and floral resources for pollinators, while being economically and logistically favorable. The 2011 Minnesota Prairie Conservation Plan states that enhancement and restoration of prairie (using burning, haying, or grazing) is needed on over 500,000 acres of prairie for long-term conservation. Thus, our findings will inform best management practices on hundreds of thousands of acres of prairie across western Minnesota.

Our GOAL is to determine whether haying can be used alone or in combination with burning to promote prairie biodiversity and pollinator habitat. This proposal builds upon a recent LCCMR project ("*Biofuel production and wildlife conservation in working prairies*") that reported best management practices of haying for bioenergy. Our project will determine how haying can be used as a tool for restoration enhancement.

The **OUTCOMES** we plan to achieve are to:

- 1) Quantify the effectiveness of haying in promoting restoration success, defined here as increased native plant diversity (particularly the abundance of native forbs), increased floral abundance and diversity to enhance pollinator habitat, and decreased soil nutrient content;
- 2) Understand how the timing of haying and interactions with burning affect restoration success; and
- 3) Communicate findings to both scientific and land management communities via peer-reviewed publications and a restoration strategies report and brochure for land managers.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Establish an experiment to test the impacts of haying on prairie

Budget: \$ 124,539

Our experiment will target 10 privately-owned conservation properties in the Agassiz Ridges region (see Map) that represent a range in habitat quality. We have already contacted managers at the selected sites and confirmed their willingness to perform burning and haying treatments at no cost to the project. The experiment will consist of six treatments that include all combinations of Burning treatments (unburned or burned) and Haying treatments (not hayed, annually hayed, or hayed every other year; see Figure). Five of the ten sites will be burned in 2018, the other half will be burned in 2019. Each treatment area will be large enough to determine effects on habitat quality, while minimizing the unmanaged footprint (since lack of any burning or haying could have negative effects on prairie habitat quality).

In heavily degraded prairies, disturbance alone may not be sufficient to restore plant communities. Therefore, we will also include a seed addition experiment. Seed will be added to sub-plots of each burning and haying treatment in three different mixtures (diverse prairie mix, CRP mix, and a mix designed to promote pollinators). Seed additions will allow us to test whether disturbance alone (via haying or burning) or in combination with increased seed is needed to maximize restoration success.

Haying treatments are designed to consider impacts of biomass removal on pollinators and other grassland species. Haying will be applied according to best management practices to minimize impacts on pollinators and nesting birds. Haying will occur in mid to late summer, after nesting season for most grassland birds. When feasible, haying will only target a portion of the total site area (less than 80 acres, as recommended by best management practices) to maintain cover and floral resources for pollinators throughout the season.

| Outcome | Completion Date |
|--|-------------------------------|
| 1. Establish experimental plots and sampling locations | Summer 2018 |
| 2. Conduct initial prescribed burning treatments | Spring 2018, 2019 |
| 3. Sow seeds for seed addition project | Fall 2018, 2019 |
| 4. Perform haying treatments | Summer-Fall 2018 through 2021 |

Activity 2: Quantify the impacts of haying and burning on prairies

Budget: \$283,674

Over 4 years our project team, field assistants, and trained botanists will measure the effects of haying and burning treatments on plant diversity and soil health. We will measure changes in plant diversity, floral abundance, and light levels, as well as soil composition and nutrient availability. We will publish our results in the scientific literature.

| Outcome | Completion Date |
|---|--------------------------|
| 1. Plant diversity, floral abundance, and light availability sampled annually | August 2018 through 2021 |
| 2. Soil sampling completed annually | August 2018 through 2021 |
| 3. Data set produced and results published | June 2022 |

Activity 3: Disseminate results to land managers

Budget \$50,149

We will maximize the Haying Project’s educational impact from implementation to publishing results.

The findings will add significantly to scientific understanding of the effects of restoration strategies (via peer-reviewed publications) and directly inform on-the-ground management (via a manager-oriented report and brochure we will produce and help distribute through colleagues in the conservation community). The report and brochure will describe the effectiveness of haying and the estimated costs associated with implementation. We will also organize site visits for private land owners and land managers from the US Fish and Wildlife Service, the Minnesota Department of Natural Resources, and The Nature Conservancy to discuss project outcomes.

| Outcome | Completion Date |
|--|-------------------------------|
| 1. Management report and tri-fold brochure produced and shared | June 2022 |
| 2. Site visits for public and private land managers | August 2022 through June 2022 |

III. PROJECT STRATEGY

A. Project Team/Partners

- Daniel Hernández (Associate Professor, Carleton College) will oversee the project. Receiving funds.
- Forest Isbell (Associate Director of Cedar Creek ESR, U of Minnesota). Not receiving funds.

B. Project Impact and Long-Term Strategy

Our results will guide efforts by state and federal agencies and conservation organizations to restore prairie ecosystems and promote pollinator habitat. Our project takes place on conservation lands to ensure that the experiment can be maintained for the entire study period. However, our results will be directly relevant to prairie restoration on hundreds of thousands of acres of both public and private lands throughout the state.

C. Timeline Requirements

The proposed project will require 4 years to test the effects of haying on prairie plant diversity, floral abundance, and soil health, and to produce a brochure to highlight our research findings to state agencies, NGOs, and local private landowners. Four years is necessary for us to monitor each prairie for at least two years post-burn and to complete two haying treatments in the areas hayed every other year.

2018 Detailed Project Budget

Project Title: Restoring Prairie Biodiversity and Pollinator Habitat with Haying

IV. TOTAL ENRTF REQUEST BUDGET: 5 years

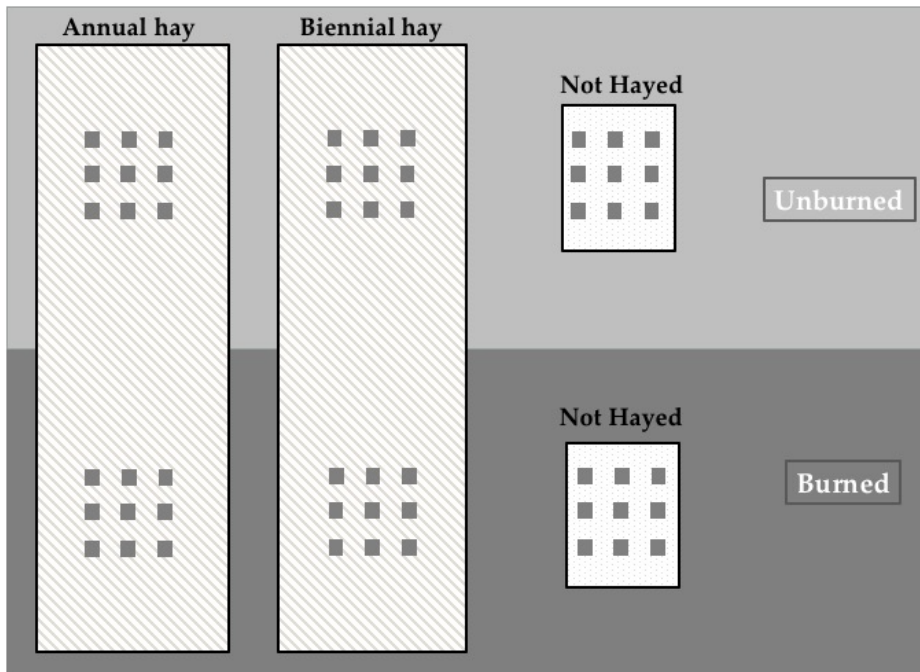
| BUDGET ITEM (See "Guidance on Allowable Expenses", p. 13) | AMOUNT |
|---|-------------------|
| Personnel | |
| <i>Project Director, Prof. Dan Hernández</i> : Summer stipend for three years (4% of FTE, based on nine-month academic-year salary + 36% benefits + 3% annual increase). | \$ 16,418 |
| <i>Project Director</i> : benefits at 7.65% of summer stipend | \$ 1,256 |
| <i>Postdoctoral Scholar (1)</i> : 100% FTE for 2 years (\$50,000 salary + 36% benefits + 3% annual increase). Will help to establish experiment (Activity 1) and support field data collection efforts & manage field research team (Activity 2) | \$ 104,545 |
| <i>Postdoc</i> : benefits at 36% of salary | \$ 37,636 |
| <i>Research Technician</i> : 100% FTE for five years (\$31,054 salary + 36% benefits + 2.25% annual increase). Will help to establish experiment in year 1 (Activity 1), support field data collection efforts & manage team of undergrad researchers (Activity 2), and contribute to project outreach in year 4 (Activity 3) | \$ 128,472 |
| <i>Research Technician</i> : benefits at 36% of salary | \$ 46,250 |
| <i>Undergraduate Student Field and Lab Assistants (3)</i> : three undergraduate student researchers in each summer of the project for four years (\$4600 stipend each). Will assist with field data collection and laboratory analyses of soil samples | \$ 55,201 |
| <i>Field & Lab Assistants</i> : benefits at 7.65% of wages | \$ 4,223 |
| Professional/Technical/Service Contracts | |
| <i>Trained botanists (2)</i> : to assist with vegetation and floral surveys for 4 weeks each summer for 5 years (\$20 per hour for 160 hours each person each summer + 0% benefits) | \$ 25,600 |
| Equipment/Tools/Supplies (all one-time costs) | |
| Handheld GPS units to locate and relocate permanent plot locations | \$ 500.00 |
| Light meter for measuring light availability (Li-Cor 191R and 250A data logger) | \$ 3,000.00 |
| Seeds for seed addition (approximate amount for 1 acre of seeding of each of the three seed types) | \$ 7,000.00 |
| Field Supplies: plot markers, measuring tapes, soil corers, sieves | \$ 3,000.00 |
| Travel | |
| 6 trips per year for Project Director and Research Technicians from Northfield (Carleton College campus) to field sites near Detroit Lakes: each trip = 300 miles RT (including local travel) at Federal mileage rate of 53.5 cents per mile | \$ 3,852 |
| 6 trips per year for University of Minnesota partners (U of Minnesota campus) to field sites near Detroit Lakes: each trip = 250 miles RT (including local travel) at Federal mileage rate of 53.5 cents per mile | \$ 3,210 |
| Additional Budget Items | |
| Dissemination (Activity 3): Printing costs for educational brochures to private land owners and land managers | \$ 2,000 |
| Dissemination (Activity 3): Site visits for private land owners and land managers (travel and hosting costs) | \$ 3,000 |
| Soil Sample Lab Analyses (soil CN; Western Ag Innovations PRS nutrient probes): \$3,300 per year for four years: 10 prairies X 2 treatments X 6 samples per treatment = 120 samples per year. 1. CN Analysis: \$5 per sample X 60 samples = \$300. 2. Nutrient probes: \$50 per sample X 60 composite samples = \$3000 | \$ 13,200 |
| TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST = | \$ 458,362 |

V. OTHER FUNDS

| SOURCE OF FUNDS | AMOUNT | Status |
|---|---------------|---------|
| Other Non-State \$ To Be Applied To Project During Project Period | | |
| <i>Carleton College indirect costs</i> : 57% of all salary and wage figures for Project Director, Research Technician, and Undergraduate Student Field and Lab Assistants | \$ 114,051.49 | Pending |
| Other State \$ To Be Applied To Project During Project Period | \$ - | N/A |
| In-kind Services To Be Applied To Project During Project Period | \$ - | N/A |
| Past and Current ENRTF Appropriation | \$ - | N/A |
| Other Funding History | \$ - | N/A |

Prairie Haying Restoration Project

RIGHT: Map showing Minnesota's historic major ecological biomes. Only 1% of the Tallgrass Prairie still remains. The Lake Agassiz Beach Ridges Prairie Region, the focal area of our proposed research, is outlined in black. This region has a large concentration of remnant native prairie. However, much of this prairie is degraded and is in need of restoration.



LEFT: Schematic showing the basic experimental design that will be applied to each of the 10 prairie sites. Size of haying treatments (rectangles) are not to scale and will vary in size depending on the site. Each sampling location (gray squares) will consist of a permanent vegetation plot, soil sampling location, and floral abundance transect.

PROJECT MANAGER QUALIFICATIONS: DANIEL HERNÁNDEZ

Professional Appointments

| | |
|--------------|--|
| 2015-present | Associate Professor of Biology, Carleton College |
| 2009-2015 | Assistant Professor of Biology, Carleton College |
| 2008-2009 | Visiting Professor, Hamline University |
| 2007-2008 | Postdoctoral Scholar, University of California, Santa Cruz |

Professional Preparation

| | | |
|-------------------------|----------------------------------|-------------|
| University of Minnesota | Ecology, Evolution, and Behavior | Ph.D., 2007 |
| University of Kansas | Environmental Studies | B.S., 2001 |

Qualifications and Responsibilities

Daniel Hernández (Associate Professor, Carleton College) will oversee the project. His research focuses on the management and restoration of grassland ecosystems. He has studied grassland management in California serpentine grasslands, the restored prairies in the Carleton College Arboretum, and native prairies in western Minnesota. Hernández has published 14 articles, several of which have been co-authored with undergraduate students. He has received previous funding for his research from the National Science Foundation and the Kearney Foundation for Soil Science. Furthermore, Hernández is on the Advisory Board and serves as a Visiting Professor on the Doris Duke Conservation Scholars Program, a program designed to promote diversity in the field of Conservation Science.

Forest Isbell (Associate Director, Cedar Creek ESR, UMN) will co-supervise the postdoctoral researcher on the project and collaborate on all aspects of the research. Isbell’s studies the causes and consequences of biodiversity loss in ecosystems. Much of his previous research has been conducted at the University of Minnesota’s Cedar Creek Ecosystem Science Reserve. His work has been published in the world’s top scientific journals (more than 40 publications, including 8 in *Nature*, *Science*, or *PNAS*). Furthermore, Isbell is currently a Lead Author on both regional (Americas) and global assessment reports for the United Nations Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services.

Organization Description

Carleton College, Northfield, MN, founded October 12, 1866, enrolls about 2000 diverse students. Carleton's official mission is “to provide an exceptional undergraduate liberal arts education.” This educational mission is advanced most centrally by the colleges’ faculty (who number approximately 200) and is supported by a full range of professional staff who successfully manage grant projects such as the one here proposed. This support includes grants staff in Corporate & Foundation Relations, accounting staff in the Business Office, grounds and trades staff in Facilities, as well as others who collectively provide the requisite financial and managerial structures and controls. In addition, Carleton has the research facilities and human resources necessary to perform the proposed work.

Carleton’s most recent annual audit was completed by CliftonLarsonAllen and is available online at [Audited Financial Statements for the year ending June 30, 2016](#).