

# Environment and Natural Resources Trust Fund 2016 Request for Proposals (RFP)

**Project Title:****ENRTF ID: 162-F**

Measuring Prairie Fragment Connectivity: Pollen and Seed Dispersal

**Category:** F. Methods to Protect, Restore, and Enhance Land, Water, and Habitat**Total Project Budget:** \$ 556,000**Proposed Project Time Period for the Funding Requested:** 3 years, July 2016 to June 2019**Summary:**

Habitat connectivity is unknown in prairie fragments. Our project measures plant movement by pollen and seeds, determines connectivity, and informs agencies and the Prairie Conservation Plan how far species move.

**Name:** Lauren Sullivan**Sponsoring Organization:** U of MN**Address:** 100 Ecology Building, 1987 Upper Buford Circle

St. Paul MN 55108

**Telephone Number:** (612) 301-1056**Email** lsulliva@umn.edu**Web Address****Location****Region:** NW**County Name:** Clay**City / Township:****Alternate Text for Visual:**

Our map shows how we can take what we learn about dispersal distances of pollen and seed for each species, and use those distances to understand how far species move between fragments or down corridors. This information will inform the Minnesota Prairie Conservation Plan and other state and federal agencies how close fragments should be and how large corridors need to be to promote healthy, connected prairies. This information can inform about connectivity in prairies across the state.

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



**PROJECT TITLE: Measuring prairie fragment connectivity: pollen and seed dispersal**

**I. PROJECT STATEMENT**

**WHY:** Connections among habitat fragments are changing across Minnesota. These changes help some plant species while impairing others. Unfortunately, it is not always desirable species that benefit and undesirable species that are harmed. The **GOALS** of this project are to measure prairie plant connectivity to 1) promote the movement of desirable (e.g.: native) species by natural processes, or proper corridor creation, by 2) providing essential information about movement to the Minnesota Prairie Conservation Plan (MPCP).

This project will achieve the following **OUTCOMES**:

1. Measure the pollen and seed dispersal distances for 8 representative native Minnesota prairie species.
2. Determine connectivity of prairie fragments, which informs:
  - a. Restoration practices for Minnesota conservation agencies.
  - b. Decisions about the appropriate distances for sources of local-ecotype seed.
3. Provide conservation agencies and the MPCP with tools that they can use to determine the degree of habitat connectivity and the necessary size of corridors, to promote the spread of desirable species.

**HOW:** By measuring plant pollen and seed movement among habitat fragments, we can quantify habitat connectivity. This project will increase the success of the MPCP and other Minnesota restoration projects by understanding how well habitat corridors, and prairie fragments function to move species.

**Background:** Since 1908, Minnesota has lost 99% of its 18 million acres of remnant prairie. In addition to the overall loss in area, the prairie habitat has also become fragmented into increasingly smaller pieces. Prairie habitat can only persist as long as prairie plant and animal species are able to move among fragments, ensuring their connectivity. Having sufficient connectivity is important for maintaining important ecological and human services including habitat for pollinators and other wildlife, soil stability, water quality, and high quality land for hunting and other recreational activities. It is necessary to know how far plant species move by pollen or seeds, in order to critically evaluate how well Minnesota conservation projects connect prairie habitats.

Minnesota is currently investing large amounts of money and effort into prairie restorations and corridor creation, through the MPCP. However, this project was created by making assumptions of how far plants and animals move down corridors and between fragments. Since it is unknown how far plants move between restored areas, it is difficult to determine how successful these restoration projects will be. Our project will supply the MPCP and other conservation agencies with crucial movement information that can be immediately implemented by the MPCP to improve the quality of prairie corridors and other restorations across the state.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Measure pollen and seed dispersal distances for native prairie species** **Budget: \$346,000**

Our project will focus on 8 target native species, like Butterfly Milkweed and Pale Purple Coneflower, with different movement mechanisms (e.g.: pollen and seeds that move by wind, pollinators, or other animals). These species will be representative of many prairie species, so we can extrapolate our results to other, similar species. Recent advances in genetic techniques makes it possible to determine how far pollen and seeds move by locating individuals, performing genetic parentage analysis, and determining which plant is the father (pollen donor) and the mother (seed donor). The pollen and seed dispersal distances are calculated by measuring the distance between each parent plant, and the offspring. We will spatially locate, and genetically sample, all individual plants of our target species within one large prairie fragment, and several adjacent fragments.

Outcome	Completion Date
1. Field collections of spatial and genetic data on individual plants	Nov 2016
2. Perform genetic parentage analysis	Dec 2017
3. Determine pollen and seed dispersal distances	March 2018



## Environment and Natural Resources Trust Fund (ENRTF)

### 2016 Main Proposal

#### Project Title: Measuring prairie fragment connectivity: pollen and seed dispersal

#### Activity 2: Determine connectivity of prairie fragments in NW Minnesota

Budget: \$207,000

Once dispersal distances are measured, we will determine the connectivity of Minnesota remnant prairie fragments, focusing on Clay County in northwest Minnesota because it contains large swaths of continuous native prairie, as well as smaller fragments. We will extensively survey plant cover in many prairie fragments across this county. Using this survey data, and the dispersal data, we will use models to quantify prairie fragment connectivity, determine which types of species are sensitive to fragmentation, and develop strategies for promoting the spread of these species. This information can be used by federal and state agencies to determine the appropriate scale for collecting local-ecotype seeds of these target species.

Outcome	Completion Date
1. Survey plant cover in many habitat fragments	Dec 2017
2. Determine connectivity of prairie fragments and appropriate size of corridors	Dec 2018

#### Activity 3: Directly inform the MPCP and create conservation connectivity tools.

Budget: \$3,000

In order to make this project as broadly useful as possible, we will create open-source, user-friendly models that federal and state agency members can use to determine habitat connectivity of many species. We will do this by extrapolating dispersal distance measured in activity 1 to species that are similar to the target species. This information will then be provided to the MPCP to help determine how big corridors need to be, and how close fragments need to be, in order to maintain plant connectivity. We will make our models available to anyone in a conservation agency that has prairie plant survey data from multiple prairie fragments, and is interested in learning how to prioritize locations for prairie restorations. We will hold virtual workshops to help agency members learn how to use these tools to analyze the connectivity of their landscape. Private land owners interested in restoring prairie can also benefit from this tool and participate in workshops.

Outcome	Completion Date
1. Develop models that measure connectivity for any species.	Dec 2018
2. Inform and update the MPCP based on dispersal distances collected here.	March 2018
3. Hold virtual workshops to train federal and state agency members how to use these models to determine connectivity of their own prairie fragments.	June 2019

### III. PROJECT STRATEGY

**A. Project Team:** Lauren Sullivan (Postdoctoral Researcher - UMN) will oversee project and conduct all research, Allison Shaw (Assistant Professor – UMN) will assist with modeling and determining connectivity, and David Moeller (Assistant Professor – UMN) will assist with genetic analysis. **Project Partners:** Greg Hoch (MN DNR) and Steve Chaplin (The Nature Conservancy (TNC)) will assist with site selection, promote workshops, and incorporate information gathered into the MPCP to make real change for Minnesota prairies.

**B. Project Impact and Long-Term Strategy:** This project will provide important conservation information that multiple federal agencies can incorporate into their prairie restoration programs, across the state. We have contacted the MN DNR, the BWSR, and TNC, and they have indicated that they would be very interested in attending the trainings and that this project would provide important information that would be immediately useful to existing programs. This project is extremely timely because it will increase the success of the MPCP, and will be immediately implemented into the upcoming re-evaluation of the MPCP. This project complements an LCCMR proposal by Daniel Cariveau (UMN) titled “Data driven pollinator conservation” that also seeks to understand habitat connectivity and its importance for native pollinators. This work will be long-lasting as information will be incorporated into the MPCP, and help create more successful habitat corridors and prairie restorations for many years to come.

**C. Timeline Requirements:** Activity 1 will require 2 years, activity 2 will require 2.5 years, and activity 3 will require half a year, but could be continued into the future if agencies were interested.

## 2016 Detailed Project Budget

**Project Title:** Measuring prairie fragment connectivity: pollen and seed dispersal

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

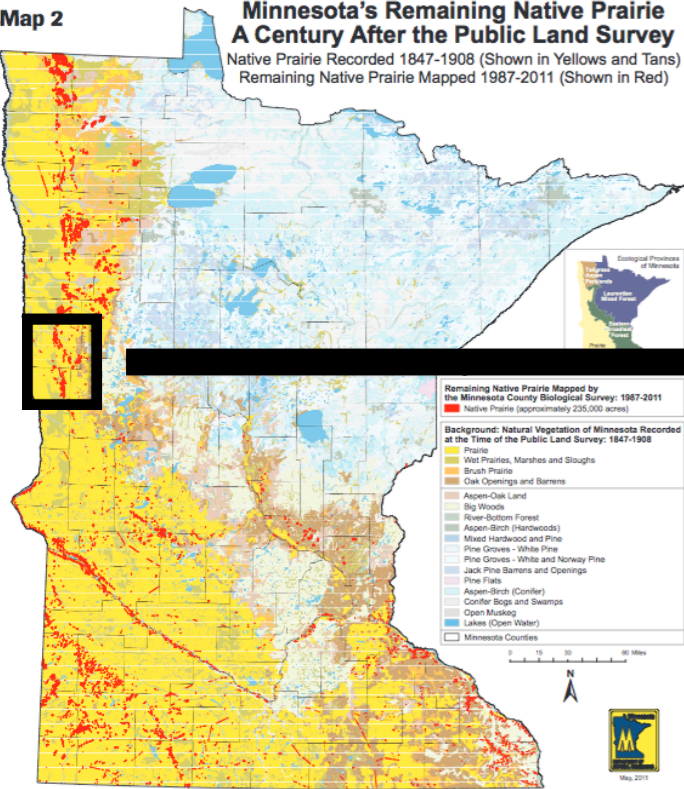
<b>BUDGET ITEM</b>	<b>AMOUNT</b>
<b>Personnel:</b> Dr. Lauren Sullivan, Postdoctoral Researcher. Twelve months salary per year is requested for supervision of and full time participation in the research. (82% salary, 18% benefits)	\$ 159,000
<b>Personnel:</b> Dr. Allison Shaw, Assistant Professor. One months summer salary per year is requested for participation in the sampling and development of connectivity models throughout the project. (75% salary, 25% benefits)	\$ 37,000
<b>Personnel:</b> Dr. David Moeller, Assistant Professor. One months summer salary per year is requested for participation in the sampling and parentage analysis throughout the project. (75% salary, 25% benefits)	\$ 40,000
<b>Personnel:</b> Two undergraduate students will be paid to work on the project for 12 weeks for the first summer, and one undergraduate student for 12 weeks for the second summer. These students will assist with habitat fragment sampling and plant sample collection. (100% salary)	\$ 19,000
<b>Personnel:</b> One civil service lab technician will be paid to work for the first two years on the project, assisting with lab work: DNA extraction to prepare samples for analysis. (78% salary, 22% benefits)	\$ 81,000
<b>Personnel:</b> One civil service bioinformatician will be paid to work for the third year on the project, assisting with parentage analysis of data. (78% salary, 22% benefits)	\$ 47,000
<b>Professional/Technical/Service Contracts:</b> N/A	\$ -
<b>Equipment/Tools/Supplies:</b> Field supplies include material for tagging plant locations, gathering and storing plant samples. Lab supplies include lab reagents, tubes for storing samples, 96-well plates, and a bar code system for labelling samples.	\$ 3,000
<b>Equipment/Tools/Supplies:</b> Supplies to run and conduct workshops for local managers (supplies include printed information and food for event).	\$ 1,000
<b>Acquisition (Fee Title or Permanent Easements):</b> N/A	\$ -
<b>Travel:</b> Travel within Minnesota to sites for sampling and measurements. Budgeted amounts are based on standard rates for the University of Minnesota.	\$ 27,000
<b>Travel:</b> Modest travel funds for workshop participants to encourage attendance	\$ 2,000
<b>Additional Budget Items:</b> Lab services for genotyping plant samples to determine paternity (8 species * 250 samples / species the first year, and 4 species * 200 samples/species the second year = 2800 samples @ \$50 per sample = \$140,000).	\$ 140,000
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 556,000</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> Indirect Costs (52% MTDC) associated with this proposal	\$ 288,000	secured
<b>Funding History:</b> N/A.	\$ -	
<b>Remaining \$ From Current ENRTF Appropriation:</b> N/A	\$ -	N/A

**Measuring pollen and seed dispersal distance**

**to determine prairie habitat connectivity and proper corridor size**



**seed dispersal distance**



**pollen dispersal distance**



**From: the Minnesota  
Prairie Conservation Plan**

**Project Manager Qualifications: Lauren L Sullivan**

Postdoctoral Associate, Department of Ecology, Evolution, and Behavior, University of Minnesota

**Education and Research Experience**

B.A. Biology	2007	University of Michigan, MI
Field Researcher	2008	Archbold Biological Station, FL
Field Researcher	2009	The Corridor Project, SC
Ph.D. Ecology and Evolutionary Biology	2014	Iowa State University, IA
Post-doctoral in Ecology	2015	University of Minnesota, MN

My career focuses on plant ecology, conservation and restoration. I research fundamental questions related to environmental factors that influence plant reproduction and seed dispersal. I am particularly interested in how this seed dispersal influences restoration success. I worked at several biological field stations, one in particular focused on research related to the costs and benefits of habitat corridor creation. Here, I researched the movement of plant parasites in corridor systems (*Sullivan et al. 2011*), and this work was insightful for our proposed project. As a graduate student I secured funding and created a 4-acre prairie restoration that was used to ask questions about how common grassland herbivores like voles and deer influence the movement of native plant species from high diversity cores to areas where those species were not planted. This work was aimed at helping people interested in prairie conservation build restorations of maximum diversity for minimum cost, as native prairie seeds can be expensive (*Sullivan et al. – in review*). Through this project I worked directly with conservation agencies, and developed practical prairie restoration skills. I am continuing my work on plant dispersal and conservation as a postdoctoral researcher. I am learning how to use mathematical and computer models to take data collected by field biologists, and scale it up – making it applicable to restorations on the larger scale. These skills I am gaining will be directly applicable to the proposed project.

**Organization Description:** I work for the Department of Ecology, Evolution, and Behavior at the University of Minnesota. This department strives to understand fundamental ecological and evolutionary principles, to improve the environment and human well being in Minnesota, and the world. This goal is achieved through the research conducted by faculty and students within the department.

(<https://www.cbs.umn.edu/explore/departments/eeb>).