

**Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 016-A

Cascading Effects of Wolf Recolonization

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 398,000

Proposed Project Time Period for the Funding Requested: 3 years, July 2017 - June 2020

Summary:

Investigating costs and benefits of a new wolf pack recolonizing Cedar Creeks well-studied ecosystems near the Metro by tracking wolves and testing their impacts on wildlife, biodiversity, and ecosystem functioning.

Name: Forest Isbell

Sponsoring Organization: U of MN

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Location

Region: Metro

County Name: Anoka, Isanti

City / Township: East Bethel

Alternate Text for Visual:

(A) Map showing changes over time in wolf range in Minnesota, as well as locations of Cedar Creek and the Twin Cities (source: MN DNR). (B) Map showing Cedar Creek (source: Google Earth). (C) Photo of one long-term field experiment at Cedar Creek (source: Jacob Miller). (D) Photo of a citizen science website similar to the one we propose to develop (source: www.snapshotserengeti.org).

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



PROJECT TITLE: Cascading Effects of Wolf Recolonization

I. PROJECT STATEMENT

Minnesota's wolves are expanding southward, and a new pack has recently become established at Cedar Creek Ecosystem Science Reserve (henceforth Cedar Creek), which is one of the best-studied ecosystems worldwide, located just north of the Twin Cities (Fig. 1). Our **GOALS** are to assess the potential costs (e.g., unwanted impacts on wildlife, pets, or livestock) and benefits (e.g., potential enhancement of biodiversity and ecosystem functioning, educational opportunities) of this unassisted wolf recolonization.

OUTCOMES are to:

1. determine wolf movements inside and outside Cedar Creek, including dispersal to establish new packs;
2. measure the impacts of wolves on wildlife, biodiversity, and ecosystem functioning; and
3. provide wolf-related educational programming to K-12 students.

We would achieve these goals and outcomes by:

1. using GPS collars to track wolves;
2. establishing a network of trail cameras to assess wolf impacts on wildlife abundances and locations;
3. using existing data and new measurements to assess wolf impacts on plants and soils; and
4. bringing K-12 students to Cedar Creek for field trips and developing a website for citizen scientists.

During 2015, for the first time in approximately a century, a breeding pair of wolves had at least eight pups in a den at Cedar Creek. This new wolf pack is much further south and closer to the Twin Cities than other known packs (Fig. 1). This new wolf pack has remained at Cedar Creek, as indicated by frequent observations of the wolves, their tracks, and their scat. As members of this pack disperse to establish new packs in coming years, it will be important to assess both the benefits and costs of having wolves so close to a major metropolitan area. Furthermore, Cedar Creek is an ideal site to study the ecological impacts of wolf recolonization because of its decades of comprehensive ecological research, including data from thousands of plots in dozens of multi-decadal studies across the property. The proposed research will combine existing long-term data with new data on the local abundances and spatial distributions of animals, plants, and soil nutrients.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Use GPS collars to track wolf movements inside and outside Cedar Creek Budget: \$89,000

The project will use GPS collars to track wolf movements inside and outside Cedar Creek to determine the full range of wolf activity and impacts inside and outside Cedar Creek, including dispersal to establish new packs. During May 2016, we will collect pilot data by collaring at least two wolves. Subsequently, the proposed project would collar and track two to four wolves annually for at least three consecutive years (2017 - 2019).

Outcome	Completion Date
1. Collar at least two wolves each year (collars record multiple locations per day for one year)	May 2017-2019
2. Analyze and report location data from wolf collars	May 2020

Activity 2: Establish camera trap network to determine wolf impacts on wildlife Budget: \$143,000

The proposed project will also establish a network of motion-sensing camera traps throughout Cedar Creek to determine the impacts of wolves on the local abundances and spatial distributions of Cedar Creek's diverse animal community, which includes wolf prey (e.g., whitetail deer) and competitors (e.g., black bear). Recent advances allow camera trap networks to provide an efficient way to comprehensively sample diverse animal communities and to determine animal responses to the presence and movements of top predators.

Outcome	Completion Date
1. Establish network of 125 cameras to continuously sample the diverse animal community	Sep. 2017
2. Analyze and report local abundance and spatial distribution data from camera traps	May 2020



Activity 3: Resample plants and soils inside and outside exclosures to determine cascading impacts of wolves on biodiversity and ecosystem functioning **Budget: \$96,000**

We will use a BACI (before-after-control-impact) study design to test for possible cascading impacts of wolves on plant communities and soil nutrients. Specifically, we will compare previous (before) and new (after) measurements of plants and soils inside (control) and outside (impacted) existing exclosures (small fences) throughout Cedar Creek. These exclosures experimentally eliminate the top-down cascading effects of wolves and mammalian herbivores on plants and soil nutrients, before and after wolf recolonization. This provides a rigorous test of whether, how, and where recolonizing wolves alter plant biodiversity and ecosystem functioning, including plant productivity and nutrient cycling.

Outcome	Completion Date
1. Resample plant community and soil nutrients inside and outside existing exclosures	Sep. 2019
2. Analyze and report plant and soil data from BACI (before-after-control-impact) study	May 2020

Activity 4: Develop citizen science website and share results with students and visitors **Budget: \$70,000**

A new *Snapshot Cedar Creek* website will be developed to train and utilize citizen scientists to identify wildlife caught on cameras. This website will teach Minnesotans how to identify the wildlife of our state, and will also provide our project with a cost-effective and sustainable method for classifying the large volume of images that will be generated by the camera trap network. For reference, a similar website, *Snapshot Serengeti*, engaged over 28,000 registered users and approximately 40,000 unregistered users to classify more than 10.8 million images with 96.6% accuracy for wildlife species identifications. Results from the proposed project, and curriculum previously developed by the International Wolf Center, will be incorporated into the Cedar Creek Education and Outreach program, which serves thousands of K-12 students and visitors each year. The project will also provide research training for undergraduate and graduate students, and a postdoctoral researcher.

Outcome	Completion Date
1. Train and utilize more than 10,000 citizen scientists via the Snapshot Cedar Creek website	May 2020
2. Provide on-site educational programming for more than 10,000 K-12 students and visitors	May 2020

III. PROJECT STRATEGY

A. Project Team/Partners:

- Dr. Forest Isbell (Associate Director, Cedar Creek ESR, UMN), Project Manager, oversee entire project
- Dr. David Mech (Senior Research Scientist, USGS and adjunct professor, UMN), Co-investigator, co-lead Activity 1
- Dr. Craig Packer (Professor, UMN), Co-investigator, co-lead Activity 2
- Dr. Caitlin Barale Potter (Cedar Creek ESR Education and Outreach Coordinator), Collaborator, co-lead Activity 4

B. Project Impact and Long-Term Strategy:

Results from the project will inform policy decisions regarding the protection of wolves by the US FWS or the management of wolves by the MN DNR, as well as the role of top predators in the restoration of ecosystems by many state and federal agencies and conservation organizations. This project is extremely timely given that expanding wolf populations have for the first time in a century become established on the north side of a major Minnesota metropolitan area. To sustain the proposed project long after 2020, we will seek additional funding from the National Science Foundation (NSF), the National Geographic Society, and other organizations. A related proposal is currently pending at NSF. Cedar Creek is world renowned for conducting high-impact long-term ecological research.

C. Timeline Requirements:

Three years of support are needed to collect and analyze data, and to report and disseminate results.

2017 Detailed Project Budget

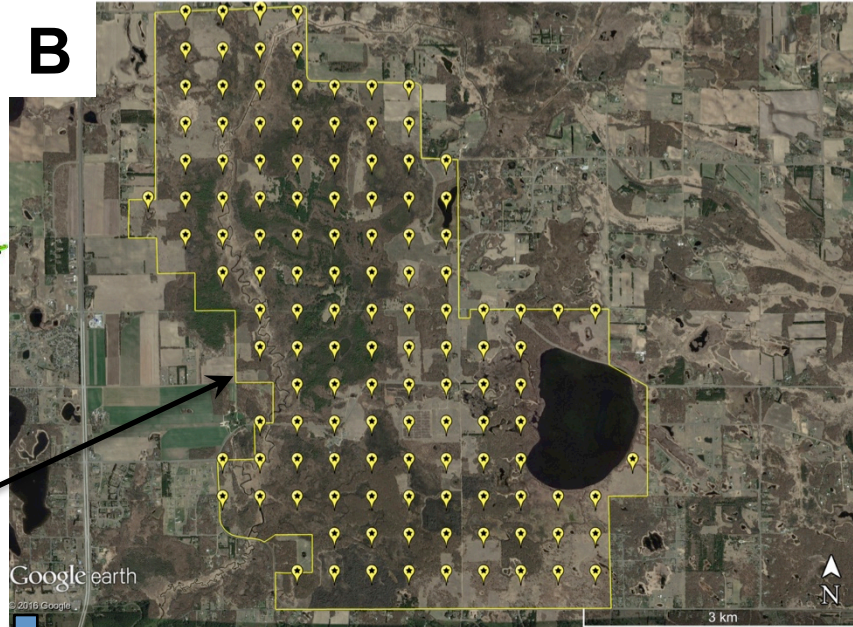
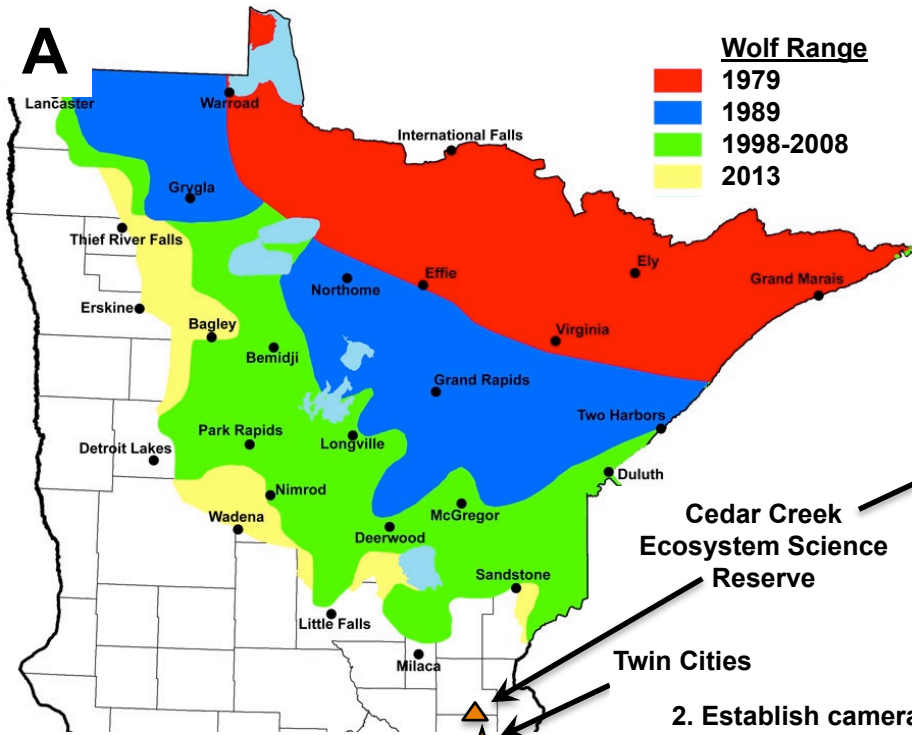
Project Title: *Cascading Effects of Wolf Recolonization*

IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	
Postdoctoral Scholar: one postdoc at 100% FTE for two years (82% salary, 18% fringe). Will lead all field data collection and analysis efforts and publish papers.	\$ 109,000
Graduate Student Field Assistants: one graduate student at 50% FTE for three years during the summer (85% salary, 15% benefits). Will sample the plant community and soil nutrients.	\$ 25,000
Undergraduate Student Field and Lab Assistants: three undergraduate students at 100% FTE for 12 weeks during the summer for three years (100% salary, 0% benefits). Will assist with collaring wolves, establishing and maintaining cameras, and sampling the plant community and soil nutrients.	\$ 67,000
Temporary and Casual: one temporary employee at 100% FTE for 4 weeks to assist with collaring wolves (93% salary, 7% benefits). Will assist with collaring wolves.	\$ 11,000
Professional/Technical/Service Contracts:	
GIS Analyst and Web Developer: one highly trained data manager. Will process data and metadata from collars and cameras, and will develop the citizen science website.	\$ 70,000
Equipment/Tools/Supplies:	
GPS collars (\$2,700 x 6 collars), telemetry receiver, and datalogger to track wolf movements	\$ 19,000
Camera traps (\$550 x 140 cameras) to determine animal local abundances and spatial distributions	\$ 77,000
Handheld GPS units to locate and relocate camera traps	\$ 2,000
Supplies: camera batteries, memory cards, and security devices (\$4,000); fencing materials to mount cameras (\$1,000); vegetation clippers (\$1,000)	\$ 6,000
Additional Budget Items:	
Soil Sample Lab Analyses: \$4,000 per year for three years	\$ 12,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST	\$ 398,000

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ To Be Applied To Project During Project Period:	none	
Other State \$ To Be Applied To Project During Project Period:		
Indirect cost associated with this proposal (53% in FY19, 54% in FY19 & FY20)	\$ 212,000	<i>Secured</i>
In-kind Services To Be Applied To Project During Project Period:	none	
Funding History:	none	
Remaining \$ From Current ENRTF Appropriation:	none	



4. Develop website, similar to Snapshot Serengeti, to train and use citizen scientists to identify wildlife observed in camera trap photos

1. Use GPS collars to track wolves inside and outside Cedar Creek
2. Establish camera trap network to determine wolf impacts on wildlife
3. Leverage existing data from long-term experiments that investigate plant biodiversity and ecosystem functioning



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05/07/2016

ENRT ID: 016

Color	Horns	Tail	Build
Genet			Porcupine
Giraffe			Reedbeak
Guinea fowl			Reptiles
Hare			Rhinoceros
Hartebeest			Rodents
Hippopotamus			Secretary bird
Honey-badger			Serval
Hyena (spotted)			Steenbok
Hyena (striped)			Topi
Impala			Vervet monkey
Insect/Spider			Vulture
Jackal			Warthog
Kori bustard			Waterbuck
Leopard			Wildcat
Lion (female or cub)			Wildebeest
Mongoose			Zebra
Ostrich			Zorilla
			Human



PROJECT TITLE: Cascading Effects of Wolf Recolonization

QUALIFICATIONS FOR PROJECT MANAGER FOREST ISBELL

Appointments

- 2015- present Associate Director of Cedar Creek Ecosystem Science Reserve and Adjunct Assistant Professor, Department of Ecology, Evolution and Behavior, University of Minnesota
- 2014 Haines Family Professor of Aboveground Ecology and Assistant Professor of Plant Biology, Department of Plant Biology, University of Georgia

Education and Professional Preparation

University of Minnesota	Ecology	Postdoc, 2011-2013
McGill University	Ecology	Postdoc, 2010-2011
Iowa State University	Ecology and Evolutionary Biology	Ph.D., 2010
University of Northern Iowa	Biology, <i>summa cum laude</i>	B.S., 2005
University of Northern Iowa	Chemistry Teaching, <i>summa cum laude</i>	B.A., 2005

Qualifications and Responsibilities

As Associate Director of Cedar Creek Ecosystem Science Reserve, Dr. Isbell designs, conducts, and reports independent ecological research; manages Cedar Creek's land, staff, and budgets; and supervises Cedar Creek's Education and Outreach program. Isbell has conducted field research at Cedar Creek for five years and is a co-Principle Investigator on the National Science Foundation's Long-Term Ecological Research project based at Cedar Creek. Isbell is an expert on biodiversity and ecosystem functioning. He was nominated by the US government to serve as a Lead Author on multiple assessments by the United Nations Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services. Isbell has published more than 40 peer-reviewed journal articles, including 8 publications in the world's top journals (*Nature, Science, PNAS*).

As Project Manager, Isbell will coordinate all proposed project activities. To collar and track wolves, Isbell will work closely with David Mech, who is a world expert on wolves with decades of experience using collars to track wolves. To establish the camera trap network and citizen science website, Isbell will work closely with Craig Packer, who is a world expert on combining data from GPS collars and camera trap networks to determine the impacts of top predators on wildlife. Isbell has extensive experience sampling plants and soils at Cedar Creek, and disseminating results via Cedar Creek's Education and Outreach program. Furthermore, Isbell recently helped develop a new analytical technique, spatial convergent cross mapping, which will test and quantify the strength of causal relationships among wildlife populations, including effects of wolves on prey, such as deer, and on competitors, such as black bear, based on the observed temporal and spatial fluctuations in abundances of wolves and other animals, as sampled by the camera trap network.

Organization Description

Cedar Creek Ecosystem Science Reserve is a University of Minnesota biological field station that is world renowned for its long-term ecological research. Its 5,500 acres includes many ecosystems and species found throughout the forests, grasslands, and wetlands of Minnesota and North America. Faculty, staff and students who work at Cedar Creek are dedicated to discovering sustainable solutions to environmental challenges. We do this by: (1) **investigating** the fundamental processes that govern the dynamics and functioning of ecological communities and ecosystems, and how human activities are changing ecosystems; (2) **sharing knowledge** gained at Cedar Creek with citizens of the state, the nation, and the world; and (3) **conserving natural ecosystems** as platforms for study and as examples of intact ecosystems.