

**Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 017-A

Improving Pollinator Conservation by Revealing Habitat Needs

Category: A. Foundational Natural Resource Data and Information

Sub-Category:

Total Project Budget: \$ 615,000

Proposed Project Time Period for the Funding Requested: June 30, 2023 (3 yrs)

Summary:

Wild pollinators must survive outdoors during our harsh Minnesota winters. We aim to help them persist by discovering habitats they require for shelter through statewide citizen scientists and novel analyses

Name: Colleen Satyshur

Sponsoring Organization: U of MN

Job Title: _____

Department: Ecology, Evolution and Behavior

Address: 140 Gortner Laboratory, 1479 Gortner Avenue
St. Paul MN 55108

Telephone Number: (608) 215-0679

Email csatyshu@umn.edu

Web Address: _____

Location:

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Showing components of bee habitat: food resources, nesting substrate, and the largely unknown nest building materials, and the process by which statewide volunteers will result in identification of nesting materials

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



**Environment and Natural Resources Trust Fund (ENRTF)
2020 Main Proposal Template**

PROJECT TITLE: Improving pollinator conservation by revealing habitat needs

I. PROJECT STATEMENT

Overall goals: Pollinators have two main needs -- food and shelter. The overall goal of this project is to understand the largely unknown needs that wild bee pollinators have for shelter. Next-generation genetic sequencing will reveal for the first time on a large scale which plants pollinating bees need to build their nest and overwintering shelters throughout Minnesota.

Need: Efforts to protect pollinators have properly focused on which flower species provide their food. But to effectively help pollinators persist we also must preserve the species of plants they need for nesting and overwintering. Small, solitary, and secluded wild bee nests are hard to find and difficult to study, resulting in the current lack of foundational data. Our native bees survive the winter inside their nests, which are often built with plant materials the bees have chewed up and compacted. This plant material is integral to nests, but what plant species are used is unrecognizable by sight. This project would work to reveal the plants bees use in order to allow more specific protection and enhancement of their habitat across the state.

Specific outcomes: The identities of plants used for nesting and overwintering shelters, paired with bee species, will be made available to land managers and citizens through the UMN Bee Lab and scientific articles. Our statewide bee species data will be added to the MN Biodiversity Atlas data compiled through the ENRTF MN Bee Atlas project and curated by and accessible through the Bell Museum. In addition, citizen volunteers across the state will be trained in our methods and receive our latest information on how they can help bees in their area.

Process: Our innovative approach will take advantage of a fortuitous convergence of projects. Using the momentum of the successful ENRTF project "The Minnesota Bee Atlas" and leveraging DNA sequencing methods developed in the University of Minnesota Future's grant "The Art and Science of Nesting Bees," we will deploy nest traps statewide through an enthusiastic citizen science volunteer base. Nest traps are a widely used method for studying the numerous wild bee species that nest in dead wood and stems. Bees will bring their outside plant matter into the traps to build nests, which we will rear to adulthood for bee species identification. Plant matter in traps will be identified by applying Next Generation genetic sequencing and molecular techniques. Because bees only nest in spring and summer and do not reach adulthood until the following spring or summer, we are asking for a 3-year grant. That would allow one complete bee nesting and sequencing cycle. However, we hope to expand that by taking advantage of bonus nests deployed by MN Bee Atlas volunteers in the last partial summer of that project. Bonus nests could then complete their lifecycles in the first year of this proposal, providing two full years of data for this project within the 3-year grant cycle.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 Title: Development and deployment of nest traps, volunteer recruitment.

Description: We will recruit volunteers from the successful MN Bee Atlas, as well as Master Naturalist, and other programs around the state. Volunteers will be trained in our field methods and be given a nest trap to hang at their site. The first year we hope to take advantage of bonus nests deployed in the last partial summer of the MN Bee Atlas, the second year we will send out nest blocks designed to facilitate in-nest plant matter collection. Bee populations in semi-natural sites will continue to be sought. We will update current Bee Atlas websites to continue to receive volunteer seasonal observations, track nests and disseminate results.

ENRTF BUDGET: \$280,000



Outcome	Completion Date
1. <i>Bonus nest traps returned for rearing and nest plant matter collection (year 1)</i>	Oct 2020
2. <i>Easy-open nest traps designed and built, website prepared</i>	Feb 2021
3. <i>Volunteers recruited and trained, nest traps deployed</i>	April 2021
4. <i>Easy-open traps returned for rearing and nest plant matter collection (year 2)</i>	Nov 2021

Activity 2 Title: Nest rearing and material analysis

Description: Bees from the nests will be reared to identify their species and what plant species they use. Specimens will be contributed to the UMN insect collection. Leaf plant matter will be collected from the same bee nests. We anticipate 20 bonus nests in year one and 100 in the year two. Next generation Illumina sequencing will be applied to leaf plant matter samples. Up to 10 additional bee nests will receive resin analysis and identification using chromatogram analyses. Resin analysis requires a reference collection, so this includes driving to 10 sites to nondestructively collect tree resin. Bee and plant species identifications will be returned to volunteers along with our latest information on bee science and conservation.

ENRTF BUDGET: \$335,000

Outcome	Completion Date
1. <i>Nest plant matter samples collected. leaf: 20/year-1, 100/year-2, resin: >10</i>	Feb 2021, Feb 2022
2. <i>Bees nests reared to adulthood in lab, year 1, year 2</i>	May 2021, May 2022
2. <i>Nest matter samples receive analyses</i>	Oct 2021, Oct 2022
2. <i>Bees emerging from nests will be identified to species in year 1 and 2</i>	Dec 2021, Dec 2022
3. <i>Final results prepared; database contributions complete</i>	Jun 2023

III. PROJECT PARTNERS AND COLLABORATORS:

Colleen Satyshur will be lead project coordinator and will hire a volunteer coordinator and bee nest rearing assistant. Britt Forsberg, current project coordinator of MN Bee Atlas, will contribute her expertise in this area either as project personnel or in an advisory role. Drs. Rob Blair, Dan Cariveau and Marla Spivak will provide advice on citizen science and bee science as needed and the MN Bee Lab will provide lab space for molecular work. Erin Treiber, current molecular science post doc on MN Future’s grant, will contribute her expertise on genetic sequencing methods in an advisory role. Expertise in resin analysis will be sought (eg Dr. Mike Wilson a collaborator on a previous pilot project) and collaboration with DNR (eg Megan Benage, who contributes to the MN Bee Atlas) as needed. Citizen scientists will contribute volunteer manpower needed to conduct this large-scale study. We will collaborate with MN Master Naturalist, SNA and other networks as appropriate. Dr Clarence Lehman will contribute to data management and provide lab space in the Ecology building.

IV. LONG-TERM IMPLEMENTATION AND FUNDING:

The long-term strategy for the project is to discover what plants and habitats bees use for shelter and provide this data in open-access form so that land managers and citizens can apply it in the conservation of Minnesota’s wild bees. Plant identification data will be maintained through the UMN Bee Lab. Bee specimens will be deposited for long term curation in UMN Insect collection, and bee species data will be added to the Biodiversity Atlas housed at the Bell Museum.

Attachment A: Project Budget Spreadsheet
 Environment and Natural Resources Trust Fund
 M.L. 2020 Budget Spreadsheet



Legal Citation:
 Project Manager: Colleen Satyshur
 Project Title: Improving pollinator conservation by revealing habitat needs
 Organization: University of Minnesota
 Project Budget: \$615,000
 Project Length and Completion Date: 3 years, completed June 2023
 Today's Date: March 15, 2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	\$ 510,000	\$ -	\$ 510,000
Colleen Satyshur, PI - overall project coordination, bee rearing and ID, nest plant matter collection and direction of molecular components, analysis of results. \$240,000 (74% Salary, 26% benefits), 100% FTE for 3 years			
Citizen science coordinator, education and outreach specialist. coordination-of citizen science outreach and logistics components. Including some coordination of molecular work. \$189,000 (74% Salary, 26% benefits), 100% FTE for 3 years			
Lab Assistant - assist with bee nest rearing, pinning, data entry, initial DNA extraction in preparation for sequencing on vegetation samples, plant resin database creation, travel to collect and ID vegetation/resin. \$67,000 (77% salary, 23% benefits), 75% FTE for 2 years			
Databasing and Archiving Assistance; \$14,000 (74% salary, 26% benefits), 5% FTE for years 1 & 2			
Professional/Technical/Service Contracts	\$ 10,000	\$ -	\$ 10,000
Witty Design: Citizen science web site maintenance and updates as needed, at ~\$80/hour; \$10,000			
Equipment/Tools/Supplies	\$ 27,000	\$ -	\$ 27,000
Blocks, signs, postage to mail them, etc. 100-120 blocks of modified design that allows them to be opened more easily. 1 year blocks. \$10,000			
Rearing supplies (eg insect cabinets and insect pins, bags, tubes, glue, label paper etc); \$8,000			
Molecular lab supplies for vegetation and resin sample acquisition and preparation (eg vials, tube, reagents, primers, general lab supplies, small lab equipment, etc). \$6,000			
Outreach and educational supplies (including printing); \$3,000			
Travel expenses in Minnesota	\$ 7,000	\$ -	\$ 7,000
Travel to collect blocks mid season and end of growing season (2 years) including hotel and mileage or vehicle rental. Travel to conduct volunteer trainings (1 year), attend conferences with study results. Travel to collect resin from 10 sites for resin tree ID, mileage or small vehicle rental from fleet 2 months/year.			
Other	\$ 61,000	\$ -	\$ 61,000
University of Minnesota Genomic Center: cost of expert labor to prepare three specific necessary gene regions of vegetation samples. Expert labor cost is currently \$200/ sample and is more economical than hiring additional project staff. Also includes sequencing with Illumina Next Generation Sequencing machine for 3 gene regions. \$54,000			
Metabolomics internal service organization to provide analysis by Liquid Chromatography Mass Spectrometer. For analysis of resin samples; \$7,000			
COLUMN TOTAL	\$ 615,000	\$ -	\$ 615,000

SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		\$ -	\$ -	\$ -
State:			\$ -	\$ -
In kind: Indirect costs associated with this proposal at 54% MTDC	secured	\$ 331,000	\$ -	\$ 331,000

Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance
		\$ -	\$ -	\$ -

Wild Bee Habitat Needs



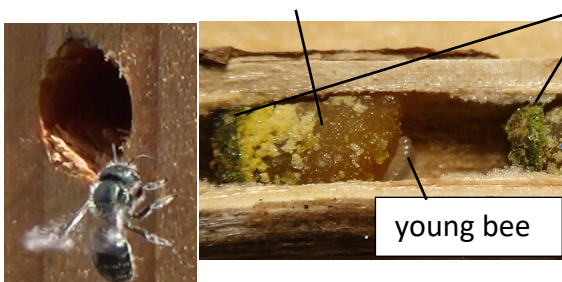
Substrate



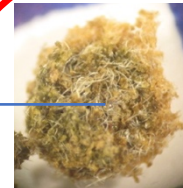
Food



Building material

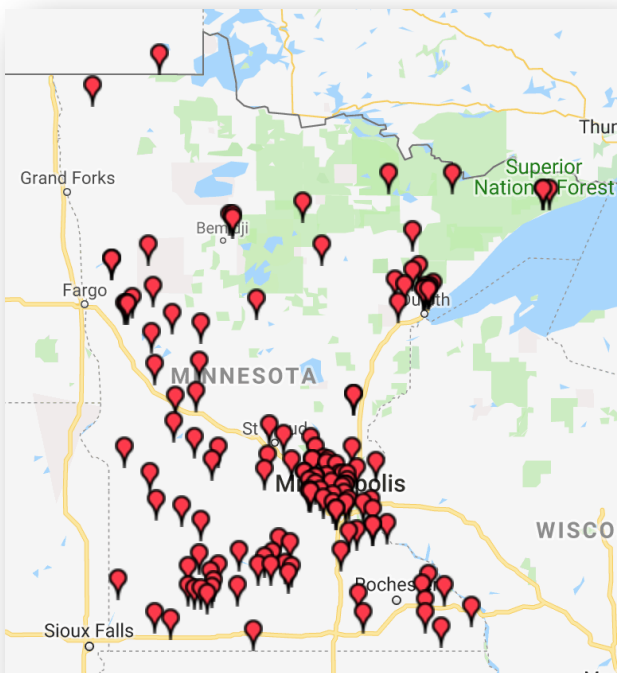


young bee

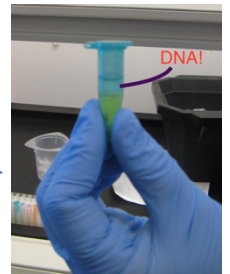


??
Habitat

Improving pollinator conservation by revealing habitat needs



Map of 2018 MN Bee Atlas bee block locations



UMN insect collection and Biodiversity Atlas



Statewide network of citizen science volunteers deploy and monitor nest traps

PROJECT TITLE: Improving pollinator conservation by revealing habitat needs

Additional component F. Project Manager Qualifications and Organization Description

Colleen Satyshur: is a principal investigator at the University of Minnesota. For the past five years Colleen has been investigating stem- and wood-nesting bees as a Project Coordinator in the College of Biological Sciences, working closely with the UMN Bee Lab. She has designed, implemented, and completed research on stem-nesting bees and grassland insect populations. Colleen has worked on three LCCMR projects -- Wildlife and Biofuels, Enhancing Pollinator Landscapes, and Minnesota Bee Atlas. She works as Principal Investigator for the Minnesota Futures Pollinator Project and as Entomologist on the MN Bee Atlas. Her work spans project management, scientific design, logistical implementation, laboratory management, data collection, and dissemination of results. On the present proposal she will act as principal investigator as well as entomologist and will hire one or more project personnel to coordinate with the public, bee rearing specialists, molecular analysts, and other necessary operations.

Britt Forsberg, current project coordinator and outreach specialist of MN Bee Atlas working in UMN Extension. She will contribute her expertise in this area either as project personnel or in an advisory role.

Erin Treiber: has a PhD in plant genetics and currently working on the MN Futures grant as molecular biologist post-doc under Dr. Marla Spivak in the Entomology Department of the University of Minnesota. She has expertise and institutional knowledge of genetic sequencing techniques proposed in this project. She helped develop these methods as part of her work for the MN Future's grant and will contribute her expertise in this area in an advisory role.

Drs. Rob Blair, Dan Cariveau and Marla Spivak will provide advice on citizen science and bee science as needed and the MN Bee Lab will provide lab space for molecular work.

Dr. Clarence Lehman will provide advice and assistance on data management and archiving and provide laboratory bench and nest rearing space in the Ecology building.

We will work with a web designer (such as **Amy Witty**, current web designer of UMN Bee Atlas) and as needed seek relationships with resin analysis specialists (such as **Dr. Mike Wilson**, former student of Marla Spivak), Bell Museum, and UMN Extension, MN DNR (such as **Megan Benage** a Regional Ecologist in MNDNR Ecological and Water Resources Division). We will collaborate with MN Master Naturalist and state SNA programs and other citizen or volunteer organizations

Organization Description: This project is a collaboration of entities with strengths in bee sampling and surveys (UMN Bee Lab); citizen science (MN Bee Atlas); volunteer recruitment and training (Minnesota Master Naturalist); outreach (UMN Extension, Bell Museum). This project will be managed by University of Minnesota Bee Lab and Ecology, Evolution and Behavior Department and formally housed in the Bee Lab and Bell Museum of Natural History as appropriate. Volunteers will be recruited heavily from the Minnesota Master Naturalist Program as well as other insect-oriented citizen groups. Technical support will be from Dr. Marla Spivak and Dr. Dan Cariveau's Bee Lab.