

**Environment and Natural Resources Trust Fund**

# 2021 Request for Proposal

## **General Information**

**Proposal ID:** 2021-424

**Proposal Title:** Improving Pollinator Conservation by Revealing Habitat Needs

## **Project Manager Information**

**Name:** Colleen Satyshur

**Organization:** U of MN - College of Biological Sciences

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## **Project Basic Information**

**Project 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.

**Funds Requested:** $614,000

**Proposed Project Completion:** 2024-06-30

**LCCMR Funding Category:** Foundational Natural Resource Data and Information (A)

## **Project Location**

**What is the best scale for describing where your work will take place?** Statewide

**What is the best scale to describe the area impacted by your work?** Statewide

**When will the work impact occur?** During the Project

## **Narrative**

**Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.**

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. 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. We have the opportunity to conduct a large scale project building off recent working relationships with citizen scientists corps, Three Rivers Parks District, MN Master Naturalists, SNA and other networks, in order to to reveal the plants bees use in their nests and allow more specific protection and enhancement of bee pollinator habitat across the state.

**What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.**

Our innovative approach takes advantage of a fortuitous convergence of projects. Using the platform of the successful ENRTF project “Minnesota Native Bee Atlas” M.L. 2015, Chp. 76, Sec. 2, Subd. 03g 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 existing 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 collect and 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 three-year grant. That would allow one complete bee nesting and sequencing cycle. However, we plan to expand that by taking advantage of some bonus nests from the Minnesota Bee Atlas which could be deployed in the following growing season, allowing for two years of data in the three-year grant.

**What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state’s natural resources?**

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 Extension, UMN Bee Lab and, through scientific articles. Our statewide bee species data will be maintained by the Minnesota Biodiversity Atlas hosted and accessible through the Bell Museum and added to data compiled through the ENRTF Minnesota Bee Atlas project. 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.

## **Activities and Milestones**

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

**Activity Budget:** $282,000

**Activity Description:**We will recruit volunteers from all around Minnesota, through the successful Minnesota Bee Atlas corps, as well as Master Naturalist, and other programs. Volunteers will be trained in our field methods and will each be given a nest trap to hang at their site. In the first spring we will send out standard economical nest traps as used in the Minnesota Bee Atlas from which we can still obtain some nest materials. A small subset of traps, up to 16, will be designed or acquired to facilitate greater in-nest plant matter collection. This easy-open subset will be placed in select locations projected to return especially high quality results, while the project as a whole will continue to seek bee populations in semi-natural sites. We will update current Bee Atlas websites to continue to receive volunteer seasonal observations, track nests and disseminate results. In the second spring we will take advantage of bonus nest traps from the Minnesota Bee Atlas to send out a smaller round of nest traps within the scope of what can be reared and identified before the grant end date.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Standard economical and easy-open nest traps built or acquired, website prepared, volunteer manual written | 2022-02-28 |
| Volunteers recruited and trained, nest traps deployed (year 1) | 2022-04-30 |
| Standard and easy-open traps returned for rearing and nest plant matter collection (year 2) | 2022-11-30 |
| Bonus nest traps built and deployed (year 2) | 2023-04-30 |
| Bonus nest traps returned and nest plant matter collected (year 3) | 2023-11-30 |

### **Activity 2: Jun 2024**

**Activity Budget:** $332,000

**Activity Description:**Nests will be reared to identify bee species. Leaf plant matter will be collected from as many bee nests as possible in the standard traps, as well as from nests in the easy-open traps. We anticipate up to 100 nests in year one and 15-20 bonus nests the following year. DNA will be extracted from leaf samples, and submitted for amplification and sequencing preparation of 2-3 gene regions through the services of the UMN Microbiome Institute. Sequencing will be done using Next Generation technologies, such as Illumina, through the UMN Genomics Center. We will match the resulting sequence data to existing plant databases or reference samples to obtain plant identification. Resin will be collected from up to 10 additional bee nests traps and resin fingerprinting and identification will be accomplished using untargeted metabolomic analysis by ultra-performance liquid chromatography-mass spectrometry. Resin analysis requires a reference collection, so this includes driving to up to 10 sites to nondestructively collect tree resin.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Nest plant matter samples collected. leaf: 80/year-1, resin: >8 | 2023-02-28 |
| Bees nests reared to adulthood in lab, year 1 | 2023-05-31 |
| Nest matter samples receive analyses year 1 | 2023-10-31 |
| Bees emerging from nests will be identified to species, year 1 | 2023-12-31 |
| Nest plant matter samples collected. leaf: 15-20/year-2 | 2023-12-31 |
| Nest matter samples receive analyses year 2 | 2024-05-31 |
| Bees nests reared to adulthood in lab, year 2 | 2024-05-31 |
| Final results prepared; database contributions complete | 2024-06-30 |
| Bees emerging from nests will be identified to species, year 2 | 2024-06-30 |

## **Project Partners and Collaborators**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Organization** | **Role** | **Receiving Funds** |
| Dr. Jerry Cohen | University of Minnesota | will provide resin analysis methods and expertise, lab space for resin work and access to equipment. | No |
| Dr. Declan Shroeder | University of Minnesota | will provide molecular methods and bioinformatics expertise and analysis assistance. | Yes |
| Dr. Clarence Lehman | University of Minnesota | will provide advice and assistance on data management and archiving and provide laboratory bench and nest rearing space in the Ecology building. | Yes |
| Dr. Marla Spivak | University of Minnesota | will provide advice on citizen science and bee science as needed and the MN Bee Lab will provide lab space for molecular work. | No |
| Dr. Rob Blair | University of Minnesota | will provide advice on citizen science and bee science as needed | No |
| Britt Forsberg | University of Minnesota-Extension | 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. | Yes |

## **Long-Term Implementation and Funding**

**Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?**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 and sequence data archived in an appropriate open access database. 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.

## **Project Manager and Organization Qualifications**

**Project Manager Name:** Colleen Satyshur

**Job Title:** Researcher 5

**Provide description of the project manager’s qualifications to manage the proposed project.**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 coordinators with the public, bee rearing specialists, molecular analysts, and other necessary operations.

**Organization:** U of MN - College of Biological Sciences

**Organization Description:**The University of Minnesota is a land-grant institution dedicated to understanding -- through research and discovery, teaching and learning, and public service and interaction. The College of Biological Sciences applies these principles to all levels of organization, from molecules to ecosystems, seeking solutions that improve health and the environment locally, nationally and globally.

## **Budget Summary**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category / Name** | **Subcategory or Type** | **Description** | **Purpose** | **Gen. Ineli gible** | **% Bene fits** | **# FTE** | **Class ified Staff?** | **$ Amount** |
| **Personnel** |  |  |  |  |  |  |  |  |
| Principal Investigator |  | overall project coordination, bee rearing and ID, nest plant matter collection and basic laboratory work on molecular components, analysis of results, development of dissemination materials |  |  | 26.7% | 3 |  | $240,487 |
| Citizen Science Coordinator |  | Coordination of citizen science outreach and logistics components. Including necessary bee rearing and archiving work, as well as development of dissemination material |  |  | 26.7% | 3 |  | $189,859 |
| Lab assistant |  | assist with bee nest rearing and archiving, including: pinning, data entry. Assist with basic bee nest materials analysis, such as initial DNA extraction in preparation for sequencing on vegetation samples, plant resin database creation, travel to collect and ID vegetation/resin |  |  | 24.1% | 1.5 |  | $67,783 |
| Databasing and Archiving Assistance |  | Assist with genetic databasing |  |  | 26.7% | 0.03 |  | $3,972 |
| Molecular DNA sequencing and bioinformatics assistance |  | Provide high level sequencing and bioinformatics analysis assistance. |  |  | 26.7% | 0.03 |  | $4,416 |
|  |  |  |  |  |  |  | **Sub Total** | **$506,517** |
| **Contracts and Services** |  |  |  |  |  |  |  |  |
| Witty Web Design | Professional or Technical Service Contract | Citizen science web site maintenance and updates as needed. Witty Web Design was picked competitively for building the Minnesota Bee Atlas web site. Our work will build on the existing website instead of starting over. |  |  |  | 0 |  | $10,000 |
| Bioinformatics analyst | Professional or Technical Service Contract | Bioinfomatics analysis for resin or DNA sequences. Pay rate approximately equivalent to post doc level work at UMN but allows access greater expertise in some analysis which exists outside the UMN. ~$31/hr \*80 hours: |  |  |  | 0 |  | $2,500 |
|  |  |  |  |  |  |  | **Sub Total** | **$12,500** |
| **Equipment, Tools, and Supplies** |  |  |  |  |  |  |  |  |
|  | Tools and Supplies | 120 trap nesting blocks with signs and postage | Nests will attract native bees, modified design will allow for easier sampling | X |  |  |  | $10,000 |
|  | Tools and Supplies | Rearing supplies including collection tubes, glue, containment bags, insect cabinet for permanent storage, pins, bags, tubes, glue, label paper | to rear nests, collect, identify and archive adult bees, collect nest vegetation samples |  |  |  |  | $8,000 |
|  | Tools and Supplies | Molecular lab supplies including vials, tubes, bead-beater beads, pipettes and tips, reagents, and primers. | Supplies for vegetation and resin sample acquisition and preparation and initial DNA extraction |  |  |  |  | $6,200 |
|  | Tools and Supplies | Outreach and educational supplies | necessary materials for volunteers to participate |  |  |  |  | $463 |
|  |  |  |  |  |  |  | **Sub Total** | **$24,663** |
| **Capital Expenditures** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Acquisitions and Stewardship** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Travel In Minnesota** |  |  |  |  |  |  |  |  |
|  | Miles/ Meals/ Lodging | Travel expenses including hotel, mileage or vehicle rental | Travel to deliver or retrieve nest traps, conduct volunteer training (1/year), attend conferences with study results, collect resin from 10 sites for resin tree ID, mileage or small vehicle rental from UMN Fleet Services s months/year |  |  |  |  | $7,200 |
|  |  |  |  |  |  |  | **Sub Total** | **$7,200** |
| **Travel Outside Minnesota** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Printing and Publication** |  |  |  |  |  |  |  |  |
|  | Printing | volunteer manuals and other materials | printed supplies so volunteers can paticipate |  |  |  |  | $2,300 |
|  |  |  |  |  |  |  | **Sub Total** | **$2,300** |
| **Other Expenses** |  |  |  |  |  |  |  |  |
|  |  | University of Minnesota Genomic Center | cost of expert labor to prepare three specific necessary gene regions of vegetation samples |  |  |  |  | $53,820 |
|  |  | Plant metabolomics internal service organization | Analysis by Liquid Chromatography Mass Spectrometer for analysis of resin samples |  |  |  |  | $7,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$60,820** |
|  |  |  |  |  |  |  | **Grand Total** | **$614,000** |

### **Classified Staff or Generally Ineligible Expenses**

|  |  |  |  |
| --- | --- | --- | --- |
| **Category/Name** | **Subcategory or Type** | **Description** | **Justification Ineligible Expense or Classified Staff Request** |
| **Equipment, Tools, and Supplies** |  | 120 trap nesting blocks with signs and postage | In order to reach a statewide corps of citizen science volunteers in all parts of the state, and allow them to feasibly return nest-traps to the University of Minnesota, it is occasionally necessary to mail nest-traps, rather than arrange for in-person drop-off or pick-ups. In this case we want to pay for postage and not ask volunteers to take on this expense. Mailing can also provide budget savings over milage costs that would be accrued if project personnel drove to each volunteers site. |

### **Non ENRTF Funds**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Category** | **Specific Source** | **Use** | **Status** | **Amount** |
| **State** |  |  |  |  |
| In-Kind | INDIRECT - 55% MTDC | Indirect costs associated with this proposal at 55% MTDC | Pending | $336,000 |
| In-Kind | UMN Dr. Jerry Cohen - 1% FTE for 3 years ($6,900) | UMN Dr. Jerry Cohen - 1% FTE for 3 years ($6,900) From assistance on resin analysis. | Pending | $6,900 |
|  |  |  | **State Sub Total** | **$342,900** |
| **Non-State** |  |  |  |  |
|  |  |  | **Non State Sub Total** | **-** |
|  |  |  | **Funds Total** | **$342,900** |

## **Attachments**

### **Required Attachments**

#### **Visual Component**

File: [f4bc8283-c55.pdf](https://lccmrprojectmgmt.leg.mn/media/map/f4bc8283-c55.pdf)

#### **Alternate Text for Visual Component**

Graphic showing the 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

## **Administrative Use**

**Does your project include restoration or acquisition of land rights?**   
 No

**Does your project have patent, royalties, or revenue potential?**   
 No

**Does your project include research?**   
 Yes

**Does the organization have a fiscal agent for this project?**   
 Yes, Sponsored Projects Administration