Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-217

Proposal Title: Safeguarding Bees While Monitoring Pollinators and Nesting Habitats

Project Manager Information

Name: Colleen Satyshur

Organization: U of MN - College of Biological Sciences

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Project Basic Information

Project Summary: We will pioneer low-mortality methods for tracking bee populations and nesting materials, partnering with community science. Empowering Minnesotans to protect bees will help conserve these vital pollinators for future generations.

ENRTF Funds Requested: $667,000

Proposed Project Completion: June 30, 2028

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 and In the Future

Narrative

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

In the midst of bee declines, Minnesota has the opportunity to proactively develop new sustainable conservation strategies. Detailed information on the ranges and habitat needs of diverse pollinators is vital to maintaining our natural ecosystems and our agricultural food supply. Bees spend 80% of their lifetime inside their nests, yet comparatively little is known about where many of Minnesota's over 500 wild bee species nest and the resources they need to nest successfully. Studies of natural sites are especially lacking for mason and leafcutter bees, which have complex nesting needs requiring additional plant species to be locally available to house and construct nests. These bees are typically best sampled using nest traps, which are artificial tunnels where females build nests. Current methods often require destroying an entire nest of bees for identification. When populations are healthy, this survey practice has limited effect on populations. However, bee conservation would be better served by cultivating long-term sustainable monitoring methods, which would allow people to gather foundational data while maintaining biodiversity. Indeed, low-mortality methods become urgently needed if bee species are found to be imperiled, and would allow surveying at sensitive sites where residents want to avoid destructive sampling.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

Through four activities, we will develop low-mortality methods for monitoring bees while also discovering information on their nesting habitats. First, we will leverage the new nest-trap design and partner with dedicated active volunteers from the ENTRF project, “Improving Pollinator Conservation by Revealing Habitat Needs,” to test the removal of a single bee for DNA identification, reducing mortality by up to 80 percent. By placing traps around the state, we will simultaneously seek rare bees, thus informing conservation assessments. Second, we will test a new method to survey nest habitat by engaging volunteers to photograph bees foraging for nesting material, thus identifying plants needed by understudied ground nesting leafcutter bees. Third, we will take advantage of an exciting opportunity to collaborate with the Three Rivers Park district to examine natural nest sites in dead trees intentionally left by recent land management, filling a gap in foundational knowledge. Finally, we will investigate plant resins, a critical component of nest habitat for some bee species, and look at consequences for nest health. Because bee nesting occurs in spring and early summer and bees remain in nests until the following year, we are seeking a three-year grant to cover two full nesting cycles.

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?

We will document and test low-mortality protocols for community-science monitoring of leafcutter and mason bees. Volunteers will gain knowledge and take action to help bees, acting as ambassadors within their own communities. We will compile information on bee distribution into reports for agencies that work on bee conservation, including the MNDNR. We will list plants that bees harvest for nesting material and will contribute data on the function and importance of resin types in nest construction. We will report our findings from nest surveys in dead trees to help guide complete bee habitat creation.

Activities and Milestones

Activity 1: Develop low-mortality metrics for monitoring stem and wood nesting bees

Activity Budget: $238,000

Activity Description:
We will develop new low-mortality metrics for monitoring stem and wood nesting bees. We will use specially designed traps from the ENTRF project “Improving Pollinator Conservation by Revealing Habitat Needs” and will engage the active community science volunteer network built through that project and the ENTRF "Minnesota Native Bee Atlas." These special traps allow nests to be easily opened and closed again. Using this infrastructure, volunteers will put out nest traps statewide and monitor nesting activity. At the end of the nesting season, volunteers will open traps, take one larva from each nest, and send these samples to us for identification by DNA analysis. Representative samples will also be taken and sent for those species that overwinter as adults. Then volunteers will return the traps to their location outside so the remaining bees can emerge in their local environment. While developing this method, we plan to target areas for rare stem and wood nesting bees and produce a report for the MN DNR to support their conservation status assessments. In season 2 a sample of frass will be taken along with larvae, and DNA will be compared to see if frass can provide reliable bee identification and further reduce mortality.

Activity Milestones:

Description	Approximate Completion Date
Recruit volunteers for larvae sampling, send out nest traps, target areas for rare bees	May 31, 2026
Train and support volunteers to collect larvae from nest traps	October 31, 2026
Season 1: Extract DNA from larva. Identify adult bees.	March 31, 2027
Season 2: Extract DNA from larvae and test DNA from frass. Identify adult bees.	March 31, 2028
Summarize data, add to species maps, report on rare bees	June 30, 2028

Activity 2: Develop low-mortality methods for investigating bee nest habitat

Activity Budget: $129,000

Activity Description:
We will develop new low-mortality methods for discovering foundational data on leafcutter bee nest habitat. Leafcutter bees harvest circles of leaves to line the insides of their nests, leaving characteristic shapes cut in leaves. Volunteers will be trained to survey potential habitat for these cuts. After locating areas of leafcutting activity, volunteers will catch bees harvesting leaves, chill them for photographic identification, and then release them. Plants will also be photographed for identification. This method has the potential for multiple benefits as it is a way to collect data on the subset of leafcutter bee species that nest in the ground as well as those that can be studied using nest traps. Additionally, a test will be conducted on the potential for using eDNA left on cut leaves to identify the bee species harvesting them. The successful development of these methods will allow people to gauge bee activity in different habitats, collect habitat data on all leafcutter bee species and, for the first time, to associate groundnesting leafcutter bee species with plant species used for nesting material.

Activity Milestones:

Description	Approximate Completion Date
Recruit and train volunteers for leaf-cut surveys	May 31, 2026
Train and support volunteers to do leaf surveys, collect data, photos, collect plant samples	October 31, 2026
Modify methods based on previous summer, recruit volunteers, test leaf samples for eDNA from bees.	May 31, 2027
Train and support volunteers to do leaf surveys	October 31, 2027

Prepare methods protocols and recommendations, summarize findings	June 30, 2028

Activity 3: Evaluate natural nest substrates created by conservation management activities

Activity Budget: $163,000

Activity Description:
In partnership with the Three Rivers Park District, we will evaluate ongoing wood management techniques for the creation of bee nesting habitat. Park management uses tree girdling to create dead trees and more open habitats for herbaceous plants and animals like woodpeckers. We will categorize the characteristics of those same dead trees as well as fallen dead wood and quantify the nesting resource by surveying them for tunnels that could potentially be used by solitary bees and wasps for nesting. We will then find what bee and wasps species are using different types of dead wood by surveying the tunnels for completed nests and catching and identifying insects as the emerge from those nests. We will use this information to compile a report to inform the park district on management of dead wood during tree removal and prescribed burns.

Activity Milestones:

Description	Approximate Completion Date
Categorize dead wood in study area, choose sample snags for survey	November 30, 2025
Develop methods, survey and categorize potential bee nest tunnels and identify occupied nests.	December 31, 2026
Catch and identify insects emerging from previous season's occupied tunnels	October 31, 2027
Compile and summarize data	June 30, 2028

Activity 4: Investigate functional attributes of resins in bee nest habitat

Activity Budget: $137,000

Activity Description:
Without protection, the rich food stores the mother bees place in nests for their young would be eaten by things other than the bee offspring it was intended for. Some bees use plant resins to protect their nests. We will test the effect of different types of resin on the microorganisms growing on the food stored in nests for the young bees by looking for inhibitory effects of resins against microbes that colonize pollen in its absence. We will use information from the ENTRF project “Improving Pollinator Conservation by Revealing Habitat Needs,” to test resin plant species actually used by bees. We will use our easy-open nest trap design in an area with a healthy population of resin bees to obtain pollen stores from a few cells per nest.

Activity Milestones:

Description	Approximate Completion Date
Set up infrastructure for enhancing resin bee colonies and easy open nest traps	May 31, 2026
Test resin tree type used in nest on nest pollen	October 31, 2026
Perform microbial tests and analyze results	December 31, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Thea Evans	University of Minnesota	Thea Evans will act as project work coordinator. Organize workflow, coordinate with volunteers and staff, maintain equipment.	Yes
Angela Grill	Three Rivers Park District	Three Rivers Parks will provide access to their properties and facilities and assist in the monitoring and identification of bees and beetles found during the study.	No
Dr. Beatriz Baselga Cervera	University of Minnesota	Dr. Baselga-Cervera lab will provide facilities for the microbiome and resin antimicrobial properties studies. The laboratory is equipped for microbial isolation, growth and long- term storage, antimicrobial analyses, and microbiome DNA extraction and amplification. Dr. Baselga-Cervera will support the microbial aspect of the proposal and metagenomic analyses of microbial communities.	Yes
Dr. Emilie Snell-Rood	University of Minnesota	Dr. Snell-Rood will advise on experimental design, analysis and writing	No
Dr. Clarence Lehman	University of Minnesota	Dr. Lehman will provide lab space for bee and DNA work and will provide advice on scientific design, analysis and writing.	No

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 work be funded?

Results and methods will be shared through the Minnesota Bee Atlas website, plus Facebook pages and journal publications. Insect specimens will be donated to the UMN insect collection for long-term storage, and records will be available to the public through the Bell Museum Biodiversity Atlas. We will compile reports for the Three Rivers Park District and agencies such as the MNDNR, to inform their management activities and conservation assessments. DNA sequences will be uploaded to the Barcode of Life Data system (BOLD), making them available to researchers and the public.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Improving Pollinator Conservation By Revealing Habitat Needs	M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 03g	$500,000

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 nine years Colleen has been investigating stem- and wood-nesting bees as a Principal Investigator or Project Coordinator in the College of Biological Sciences, working closely with the UMN Bee Lab. She has designed, implemented, completed and published research on stem-nesting bees and grassland insect populations. Colleen has worked on three ENRTF projects -- Wildlife and Biofuels, Enhancing Pollinator Landscapes, and Minnesota Bee Atlas. More recently, she worked as Principal Investigator for one ENTRF project: Improving Pollinator Conservation by Revealing Habitat Needs, and as Principal Investigator for the UMN Minnesota Futures Pollinator Project. Her work spans project management, scientific design, logistical implementation, laboratory management, data collection, and dissemination of results. Colleen also has experience in organizing communications between bee projects for the benefit of all groups. In the present proposal she will act as

entomologist and principal investigator and, in coordination with the Co-PI, will hire one or more project personnel to coordinate with the public, as bee rearing specialists, lab technicians, and other necessary operations.

Organization: U of MN - College of Biological Sciences

Organization Description:
This project is a collaboration of entities in the University of Minnesota with strengths in bee sampling and surveys, citizen science (MN Bee Atlas) and outreach. This project will be managed by University of Minnesota Ecology, Evolution and Behavior Department in the College of Biological Sciences and linked to 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.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Principal Investigator		overall project coordination, bee ID, basic laboratory work, dead tree surveys, results analysis, development of dissemination materials			37.1%	2.25		$212,000
Project Coordinator		Coordinate workers in lab and field, coordinate with volunteers, leaf cut surveys, order supplies, lab safety, manage data, compile results			33.5%	2.25		$171,000
Post Doc		high level technical bioinformatics analysis of DNA barcoding			37.1%	1		$83,000
Field/lab Leader		lead fieldwork, organize lab workflow, oversee other field/lab techs as needed, organize equipment.			33.5%	1.5		$77,000
Research Technician		assist in fieldwork, lab work, volunteer communications, data entry, curation, labeling			7.7%	0.9		$31,000
Undergraduates		assist with lab and field work, survey leaves and dead trees, bee nests, enter data, curation			0%	1		$31,000
Resin Microbiology		Investigate resin habitat use on bee nests through microbial techniques, including bioinformatics			37.1%	0.02		$4,000
							Sub Total	**$609,000**
Contracts and Services								
Witty Web Design	Professional or Technical Service Contract	Witty Web Design was picked competitively for building the original Minnesota Bee Atlas web site which volunteers use to enter their data. It is more cost effective to keep using this database. We anticipate minor maintenance or adjustments through the project. Fee is $80/hour.				0		$4,000
Seqcenter	Professional or Technical Service Contract	A laboratory that does reliable microbial sequencing with good results for the type of work proposed in this project and for competitive cost effective price. Current rates: $120/sample for mixed community samples, and $10/sample for single source samples. We anticipate ~30 mixed and ~80 single samples				0		$5,000

U of M Genomics Center	Internal services or fees (uncommon)	The Genomic Center sequences DNA, would be used for barcoding. approx 200 samples in 2 years at about $20/sample, plus labor fees				0		$11,000
							Sub Total	**$20,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab and field tools and supplies such as DBH tape, emergence cages, coolers, Icepacks, bee containers, wood for nest traps, DNA extraction kits, microbial plates, and curation supplies. This includes postage for mailing nest trap to volunteers	These supplies are needed to provide volunteers with nest traps and supplies for low mortality bee and leaf surveys, for DNA extraction and lab work, for any specimen curation, for surveying dead trees for nests. Mailing nest traps to volunteers is more cost effective than delivery by personnel	X				$18,000
							Sub Total	**$18,000**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Milage reimbursement for a subset of fieldwork at .67/mile. Fleet vehicle rental for sandy roads for dead tree surveys, eg small SUV for $340/week. For overnight trips will cover hotels and meals at approved rates.	For surveying leaf cutting activity and dead trees for bee nests and emerging bees. For placing a few nest traps in strategic locations for rare bees and checking for adults.					$15,000
							Sub Total	**$15,000**
Travel Outside Minnesota								
							Sub Total	**-**

Printing and Publication								
	Printing	Volunteer manuals, reports of results	Manuals with instructions and information on volunteer protocols, reports of results that can be distributed to agencies.					$1,000
	Publication	Publication fees for open source journals	Open source journals are available to anyone, including volunteers, and are a good way to get results out					$4,000
							Sub Total	**$5,000**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$667,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Equipment, Tools, and Supplies		Lab and field tools and supplies such as DBH tape, emergence cages, coolers, Icepacks, bee containers, wood for nest traps, DNA extraction kits, microbial plates, and curation supplies. This includes postage for mailing nest trap to volunteers	Postage to mail nest traps around the state: mailing traps is a less expensive and more efficient than hand delivery by project staff

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	INDIRECT - 55% MTDC	Indirect costs associated with this proposal at 55% MTDC	Potential	$366,000
			Non State Sub Total	**$366,000**
			Funds Total	**$366,000**

Total Project Cost: $1,033,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 53f0ab12-d35.pdf

Alternate Text for Visual Component

The visual shows the 4 project activities. 1) statewide network of volunteer sampling a single larva for ID, 2) photographic surveys of bees cutting leaves for nests, 3) a nest in natural dead wood substrate. 4) a bee collecting resin for a nest and two types of resin plant sources...

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Letter of Support- Three Rivers Park district	665d5d75-7cf.docx
LCCMR Proposal Approval Letter Satyshur	50854504-b78.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing $10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

Thea Evans, University of Minnesota