Environment and Natural Resources Trust Fund

M.L. 2025 Approved Work Plan

General Information

ID Number: 2025-217

Staff Lead: Tom Dietrich

Date this document submitted to LCCMR: June 10, 2025

Project Title: Safeguarding Bees While Monitoring Pollinators and Nesting Habitats

Project Budget: $590,000

Project Manager Information

Name: Colleen Satyshur

Organization: U of MN - College of Biological Sciences

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Project Reporting

Date Work Plan Approved by LCCMR: June 24, 2025

Reporting Schedule: April 1 / October 1 of each year.

Project Completion: June 30, 2029

Final Report Due Date: August 14, 2029

Legal Information

Legal Citation: M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 03u

Appropriation Language: $590,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to pioneer low-mortality methods for monitoring bee populations and to investigate nest habitat materials and antimicrobial properties in cooperation with community scientists and management agencies. This appropriation is available until June 30, 2029, by which time the project must be completed and final products delivered.

Appropriation End Date: June 30, 2029

Narrative

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.

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 produce methods protocols for community-science monitoring of leafcutter and mason bees (on website, and subsequent publication). At least 60 volunteers will gain knowledge and contribute directly to development of methods to help Minnesota bees. We will compile rare bee locations into a report for the MNDNR. We will list plants that bees harvest for nesting material on the website, and will produce a dataset of resin types and microbial communities in bee nests suitable for publication. We will report to Three Rivers on our findings from nest surveys in dead trees to help guide complete bee habitat creation.

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

Activities and Milestones

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

Activity Budget: $147,000

Activity Description:
We will gather 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 statewide 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 existing 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. We will sequence the larva DNA producing data that can be used to analyze effectiveness and identify species for a future publication. 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 seek volunteers in areas for rare stem and wood nesting bees and produce a report for the MN DNR to support their conservation status assessments. Volunteer feedback will be critical to developing this low mortality field method which will be shared for use by others.

Activity Milestones:

Description	Approximate Completion Date
Recruit 60+ volunteers for larvae sampling, send out nest traps, seek areas for rare bees	May 31, 2026
Train and support volunteers to collect larvae from nest traps	November 30, 2026
Season 1: Extract DNA from larva. Identify any adult bees	May 31, 2027
Volunteer input received for methods development	March 31, 2028
Summarize methods on website, data prepared for publication, rare bee report sent to DNR	June 30, 2028

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

Activity Budget: $133,000

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. 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
Develop preliminary methods for leaf-cut surveys	May 31, 2026
Pilot survey methods with staff and up to 3 volunteers in first field season	October 31, 2026
Modify methods based on previous summer, recruit volunteers.	May 31, 2027
Train and support volunteers to do leaf surveys	October 31, 2027
Receive and incorporate volunteer feedback into methods	March 31, 2028

Summarize methods protocols and plants used by nesting bees on website.	June 30, 2028

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

Activity Budget: $168,000

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, focusing on tree species and diameter, and quantify potential nesting habitat. We will conduct initial broad surveys in year one to assess tunnel numbers and initial occupancy rates in order to determine appropriate numbers of trees to survey in the more intensive occupancy and emergence survey the following season, which will document bee and wasp species by catching insects as they emerge from nest tunnels. In the event that tree snags have very few natural insect tunnels, we will modify our methods by drilling holes into selected snags. We will also characterize the potential wood-nesting bee species that could use tunnels by using nest traps made from non-conifer wood. 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. We will place a summary on the project webpage.

Activity Milestones:

Description	Approximate Completion Date
Initial survey of tree species and tunnel numbers to use in choosing quantity and locations	November 30, 2025
Choose dead trees for intensive survey. Develop methods. Conduct intensive survey.	December 31, 2026
Catch and identify insects emerging from a subset of the previous season's occupied tunnels	October 31, 2027
Submit report to Three Rivers Park Park district and summarize on webpage	June 30, 2028

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

Activity Budget: $142,000

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 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. Pollen will tested with two methods. First, a Direct Contact Test (DCT), a common technique to assess the antimicrobial properties of materials, will be used to compare microbial communities by DNA sequencing pollen masses that have been placed on different resins. The Resin Diffusion Test (RDT) which is an adaptation of Agar Diffusion tests for susceptibility, will be used to test microbial colonies grown from pollen samples on Petri dishes for inhibition by different resins.

Activity Milestones:

Description	Approximate Completion Date
Set up infrastructure for enhancing resin bee colonies and easy open nest traps	May 31, 2026
Collect pollen masses from resin bee nests	October 31, 2026
Perform microbial tests (DCT, RDT)	December 31, 2027

Summarize microbial communities, produce datasets on resin types and microbial communities in bee nests.	June 30, 2028

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

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
We will be conducting several types of volunteer training sessions and will provide volunteers with outcomes based on their contributions and feedback. Results and methods will be shared through the Minnesota Bee Atlas website (https://minnesotabeeatlas.umn.edu/), plus Facebook pages, talks and open access journal publications. We will produce a report for the MN DNR on bee distributions and any rare bees to support their conservation status assessments. We will write up the best methods we find for leaf cut monitoring protocols and along with recommendations. This will be made available to others seeking low morality monitoring methods. We will compile information on nest surveys in dead trees to inform the park district on management of dead wood during tree removal and prescribed burns We will acknowledge the Environment and Natural Resources Trust Fund by using the trust fund logo and/or, as appropriate, attribution language on the project website, volunteer guide, bee nest traps, reports/BMPs, presentations and any other electronic media, publications, signage, social media posts, and other communications per the ENRTF Acknowledgment Guidelines at
https://www.lccmr.mn.gov/pm_info/enrtf_acknowledgement_requirements_and_guidelines.pdf

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

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%	1.86		$232,000
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		$249,500
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		$30,000
Resin Microbiology		Investigate resin habitat use on bee nests through microbial techniques, including bioinformatics			37.1%	0.02		$4,000
							Sub Total	**$546,500**
Contracts and Services								
Witty Web Design	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		$3,000
Seqcenter	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		$7,000
							Sub Total	**$15,000**

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				$16,000
							Sub Total	**$16,000**
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.					$10,000
							Sub Total	**$10,000**
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.					$500

	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					$2,000
							Sub Total	**$2,500**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$590,000**

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 - 54% MTDC	Indirect costs associated with this proposal at 55% MTDC	Potential	$318,000
			Non State Sub Total	**$318,000**
			Funds Total	**$318,000**

Total Project Cost: $908,000

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	c291041f-f63.pdf
LCCMR proposal approval letter Satyshur second revision	dcf9d19e-d56.pdf
2025-217 Research Addendum revised_Final	fc11c0e8-26a.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

To adjust for the ~$80,000 reduction in budget in the recommended funding level paired with high inflation and changes to University salaries made to align with competitors, we can no longer support the bioinformatics postdoc position and the field supervisor position. We are able to retain all activities including the critical statewide volunteer network, but have adjusted work volume, and some outcomes, so as to be accomplished by fewer people. In Activity 1 we continue to provide methods for low mortality volunteer field monitoring based on one field season and will collect and produce larval DNA sequencing data sufficient for publication. Lacking the sophisticated analysis of a bioinformatics position, we will explore partnerships with UMGC and apply for potential funding to complete the analysis. To this end we extended the project end date to allow time to pursue this bioinformatics work. The field intensive portions of Activities 2 and 3 we are streamlining and stagger activities over the two field seasons, focusing on developing methods by staff the first summer and more intensive monitoring and recruiting volunteers to test the methods the second summer. We will choose the total number of trees and area surveyed in Activity 3 to fit available labor. Activity 4 remains primarily unchanged but is affected somewhat by the reduction in field help such that it is possible fewer types of resin or fewer replicates may be done based on available help.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the UMN Policy on travel applies.

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 project:

Thea Evans, University of Minnesota

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Yes, I understand