Environment and Natural Resources Trust Fund

2023 Request for Proposal

General Information

Proposal ID: 2023-154

Proposal Title: Developing Conservation Priorities for Rare and Specialist Bees

Project Manager Information

Name: Ian Lane

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: We will collect data on occupancy and range of rare pollen specialized bees and their habitat preference to determine status and conservation strategies

Funds Requested: $668,000

Proposed Project Completion: June 30, 2026

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.

Despite concentrated efforts to characterize bees across the United States, the lack of historic data has made evaluating and prioritizing bee species for conservation elusive. The Minnesota DNR has conducted extensive bee surveys across the state and, together with the UMN bee lab, created a comprehensive dataset with over 118,000 observations, representing 492 species. As a result, we have identified rare species potentially in decline and in need of conservation prioritization. However, due to the idiosyncratic nature of bee species, it is unclear whether the rarity of some of these species is related to decline or if they have life histories that make them exceptionally difficult to find, and thus, new sampling strategies are needed.

Two aspects of bee biology make certain bee species difficult to detect: floral specialization and nesting habitat. Bees with specific pollen requirements (floral specialist) are difficult to detect if the specific flowers they use are not surveyed in a systematic way. Bees with specific soil nesting requirements will not be detected if those habitats are not targeted for sampling. Bees with these specializations are likely at elevated risk from habitat fragmentation as the flowers and soils they need become increasingly isolated across the landscape.

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.

We will determine the conservation status of at least 12 specialist bees that are predicted to be in decline or at risk of extinction. First, we will leverage existing data from the DNR and UMN bee lab to focus on rare bees that are pollen specialists across MN. We will use DNR MBS data to identify populations of flowers and perform intensive targeted sampling across the region to determine the presence of the bee species of focus. We will do this for four bee genera, providing high quality and reliable data as to the status of these bees.

Second, we will investigate how sandy habitats, specifically dune-like natural areas, interact with pollen specialization to make bee species exceptionally rare and at risk. We will target two species of prairie forbs, purple prairie clover (Dalea purpurea) and silky prairie clover (Dalea villosa), which host at least 7 rare and specialized bee species. We will target areas where these rare bees are known to occur, such as Weaver Dunes, and then sample nearby non-dune areas where prairie clover exists. This sampling will allow us to understand how important sandy habitats are to a subset of rare, pollen-specialized, bees.

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 generate new range and rarity information for a subset of potentially imperiled pollen-specialist bees identified in the Bees of Minnesota collaboration between the MN DNR and UMN bee lab. These data will be used in making assessments of conservation status and for potential listing as Species of Greatest Conservation Need (SGCN). Additionally, our work will identify the plants and soil conditions needed to support species of interest. We will disseminate this information through outreach and report documents so that restoration practitioners and conservation planners can prioritize the establishment of host plants needed in the areas of greatest impact.

Activities and Milestones

Activity 1: Determining Range and Conservation Status of Pollen Specialist Bees

Activity Budget: $255,770

Activity Description:
Utilizing data from MBS and UMN bee lab we will conduct targeted surveys of bee species recognized as potentially in decline. Specifically, we will focus on species who are floral pollen specialists as they are more likely to be in decline and their potential habitat is easy to identify. These bees include oil collecting bees (Macropis), cellophane bees (Colletes), mining bees (Andrena), and short-faced bees (Dufourea). Collectively, these groups of bees contain specialists that use pollen from plants such as willow, native loosestrifes, bellflowers, prairie alumroot, leadplant, goldenrod, and spring-beauties.

To determine the conservation status of pollen specialist bees, we will consult with the DNR MBS botanists to select host plant populations throughout the known range of the plant in MN. We will survey host plant populations across their range to infer the degree to which a pollen specialist bee's range overlaps with that of the host plant. From a subset of the identified bee populations, we will estimate local population sizes. Together this information will allow us to understand the range and abundance of a given pollen specialist bee species and infer its conservation status.

Activity Milestones:

Description	Completion Date
Visit potential sample sites, confer with MBS staff, and finalize sampling locations	December 31, 2023
Initial field data collection investigating species ranges	October 31, 2024
Follow up field collection targeting species for abundance estimation	October 31, 2025
Summarize results for stakeholders and information disseminated	June 30, 2026

Activity 2: Determining soil conditions needed for the conservation of rare pollen specialist bees

Activity Budget: $409,730

Activity Description:
To better understand how sandy habitats play a role in bee species biology, we will focus broadly on the bee visitors to purple prairie clover (Dalea purpurea) and silky prairie clover (Dalea villosa) in a variety of habitat types. Prairie clover is a cosmopolitan genus, living in both mesic and xeric sites. This habitat range, combined with the rare bees that specialize on its pollen, make prairie clover an excellent focal species to better understand how habitat may limit the populations of some bee species.

We will target both sandy/dune type habitats and nearby mesic sites with prairie clover populations. We will utilize current data to identify sites where prairie clover's specialist bees were observed previously. With the assistance of the DNR we will identify nearby mesic sites with populations of prairie clover which we will sample simultaneously. We will compare differences in species present between paired sites to determine if sandy habitats indeed harbor unique species present only in these locations. This will expand our knowledge of species that specialize on prairie clover, specifically cellophane bees (Colletes aberrans, Colletes albescans, Colletes susannae, Colletes wilmattae), the white-clothed longhorn bee (Eucera albata), and the pale-yellow fairy bee (Perdita perpallida).

Activity Milestones:

Description	Completion Date
Visit potential sample sites, confer with MBS staff, and finalize sampling locations	December 31, 2023
Initial intensive field data collection	October 31, 2024

Second year data collection honing in on specific species or habitats	October 31, 2025
Summarize results for stakeholders and information disseminated	June 30, 2026

Activity 3: Disseminating Information to Conservation Stakeholders

Activity Budget: $2,500

Activity Description:

As a result of this work, we will generate important new data about an important group of bee pollinators and their conservation status. To disseminate this knowledge to interested stake holders, we will create outreach materials and hold workshops to inform Minnesotans of the results of this project. We will specifically target restoration practitioners, summarizing the soil conditions that would be especially impactful for restoration planning and the flower species that would be of high impact to the species we investigated. We will build off existing ENTRF funded resources such as the Pollinator Resource Guide information currently in development by the MNDNR to supplement those tools with information about bee specialists. We will make our data publicly available through the MN DNR. Finally, we will collaborate with UMN Extension to disseminate this information through events and digital platforms.

Activity Milestones:

Description	Completion Date
Create outreach materials - online and in print	June 30, 2026
Hold collaborative workshop to disseminate results to land managers	June 30, 2026
Collaborate with UMN Extension on potential workshops and disseminating media	June 30, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Jessica Petersen	Minnesota Biological Survey	Contract manager responsible for project design, oversight, coordination with UMN Bee lab, and data analysis.	Yes
Nicole Gerjets	Minnesota Biological Survey	Responsible for actively managing the project, planning, conducting fieldwork, and managing specimen preparation and identification.	Yes
Dustin Graham	Minnesota Biological Survey	Dustin is a plant ecologist and will assist in identifying populations of host plants.	No
Christina Locke	Minnesota Department of Natural Resources	Christina is the pollinator coordinator for the DNR and will assist with disseminating information of project outcomes.	No
Dr. Elaine Evans	University of Minnesota Extension	Elaine is the native bee extension specialist and we will collaborate on best ways to disseminate results through the extension network.	No
Dr. Dan Cariveau	University of Minnesota	Dr. Cariveau will be the Co-PI and advise on research and study design.	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 will be disseminated through digital and physical outreach materials developed as a part of activity three, through professional conference presentations, peer reviewed papers, and stake holder meetings. We will work with partners to host informational workshops for restoration practitioners to help disseminate information on plant species and habitats to target. The UMN bee lab has a strong history of collaboration with the DNR, Fish and Wildlife Service, and the Board of Water and Soil Resources in organizing and presenting informational workshops related to habitat restoration and pollinators in greater Minnesota which will allow us to disseminate results.

Project Manager and Organization Qualifications

Project Manager Name: Ian Lane

Job Title: Postdoctoral Scholar

Provide description of the project manager's qualifications to manage the proposed project.

Ian Lane, PhD is a postdoctoral researcher working with Dr. Dan Cariveau in the Department of Entomology Bee Lab at the University of Minnesota Twin Cities campus. Dr. Lane's research is focused on the factors that drive rarity and decline in native bees and the habitat restoration methods needed to conserve them. Dr. Lane achieved both his Masters and PhD degree working on ENRTF projects and has extensive experience managing grants and reporting to LCCMR. As a masters student, Dr. Lane investigated bee lawns with Dr. Marla Spivak (Bee Pollinator Habitat Enhancement M.L. 2013, Chp. 52, Sec. 2, Subd. 04h) and PhD working under Dr. Dan Cariveau studying prairie restoration impacts on bee communities (Data-Driven Pollinator Conservation Strategies M.L. 2016, Chp. 186, Sec. 2, Subd. 03a). While working on these projects Dr. Lane has published or co-authored nine different peer reviewed papers (with four in preparation), three outreach documents, and given over 40 different outreach talks. In addition he collaborates with conservationists across institutions such as the DNR, BWSR, USGS, and USFWS to further bee conservation initiatives, improve restoration practice, and increase the impact of research projects.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:
The College of Food, Agriculture and Natural Resources Sciences (CFANS) is housed at the University of Minnesota's Twin Cities campus. The vision of CFANS is to "To advance Minnesota as a global leader in food, agriculture, and natural resources through extraordinary education, science-based solutions, and dynamic public engagement that nourishes people and enhances the environment in which we live." It is comprised of 13 academic departments and 10 research and outreach center. The Bell Museum and Minnesota Landscape Arboretum are also part of CFANS.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Postdoctoral Scholar		Dr. Ian Lane will be co-PI and manage the implementation of the grant over its three year span			20.9%	3		$194,038
Bee Biologist/taxonomist		Dr. Zach Portman will be providing critical support for study design, bee identification, and manuscript writing.			28.7%	1.5		$99,393
Research Technicians		Research technicians assist with field activities that begin before the end of classes and extend into fall after classes have begun			7.5%	0.36		$36,877
Undergraduate Research Technicians		We will hire and mentor two undergraduate researchers for sampling support in summer and data and specimen processing during the semester			0%	0.66		$40,261
							Sub Total	**$370,569**
Contracts and Services								
Minnesota Department of Natural Resources	Professional or Technical Service Contract	Conduct targeted surveys of bee species recognized as potentially in decline as outlined in Activity 1. Budget includes funds for two unclassified DNR staff members ($230,570), one at 0.2 FTE and the other at 0.75 FTE for each year, and travel to field sites ($25,200).				2.85		$255,770
							Sub Total	**$255,770**
Equipment, Tools, and Supplies								
	Tools and Supplies	Pins	Needed for the curation of collected specimens					$350
	Tools and Supplies	Specimens Drawers	Needed for long term storage and curation at the UMN insect collection					$560
	Tools and Supplies	Unit Trays	Unit trays go in specimen drawers and hold the physical specimens. These are needed for long term					$96

			storage and curation of specimens at the UMN insect collection					
	Equipment	collecting materials (nets, vials, tractor flags)	These are used for the field collection and preservation of insect specimens					$600
							Sub Total	**$1,606**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Budgeting for 50,000 miles over three year at $0.60 a mile	Car Rental for travel to field sites					$30,000
	Miles/ Meals/ Lodging	We will use a combination of camping and hotel stays during extended field collecting events. We estimate an average $85 dollars/night with 43 nights over 3 years.	Lodging					$3,655
	Miles/ Meals/ Lodging	Per diem for researchers on overnight stays. We estimate $50 per person for a combined 78 stays over three years.	Per Diem					$3,900
							Sub Total	**$37,555**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Planning for the publication of two to three papers based on research	Publishing Peer Reviewed Papers					$2,000
	Printing	High quality printing of handouts/reports, planning for at least 100 copies.	Handouts/Reports					$500
							Sub Total	**$2,500**
Other Expenses								

							Sub Total	**-**
							Grand Total	**$668,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**-**

Attachments

Required Attachments

Visual Component

File: dea7cd8d-bae.pdf

Alternate Text for Visual Component

The graphic visually depicts activities one and two of our proposal. One image is a range map of the spring beauty miner bee in MN of the range of the flower. The second depicts a bee that may be specialized to live in dune habitats but we are uncertain....

Optional Attachments

Support Letter or Other

Title	File
Approval from UMN Sponsored Projects Administration	6827ce9f-df0.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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

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?

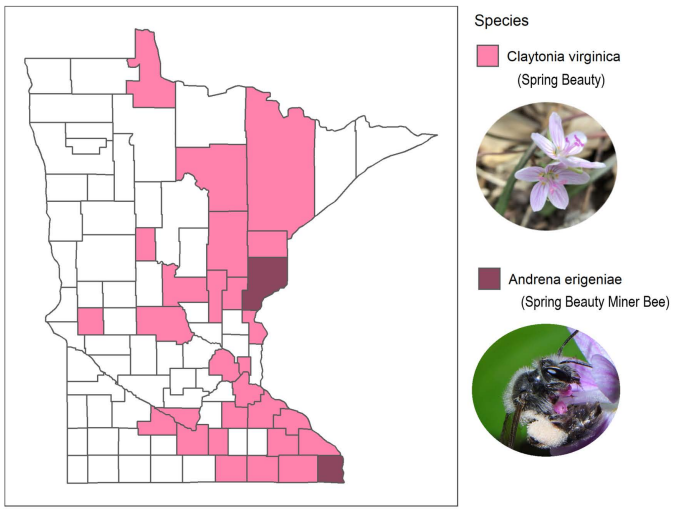
Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

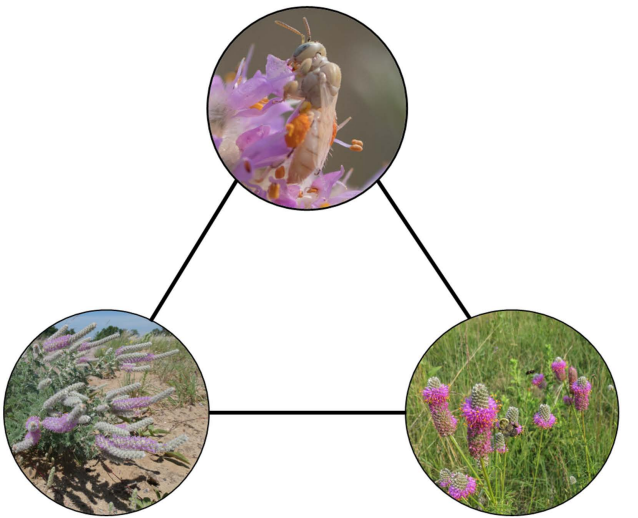
Need: Understand range and habitat associations of rare pollen specialist bees

Activity 1:
Determining Range and Conservation Status of Pollen Specialist Bees



Spring beauty flowers are found throughout Eastern Minnesota, but the spring beauty miner bee (a pollen specialist of spring beauty) is only known from two locations.

Activity 2:
Determining soil conditions needed for the conservation of rare floral specialist bees



The pale fairy bee (top) specializes on the pollen of prairie clovers. It is seemingly limited to dune habitats (left) but may be present in more traditional prairies (right).

Outcomes:

- Improved understanding of rare bees for future state listing updates
- Detailed habitat information for conservation practitioners