



Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-063

Proposal Title: Monitoring Minnesota's Insects: Connecting Habitat to Insect Prey

Project Manager Information

Name: Matthew Petersen

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

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Project Basic Information

Project Summary: The protection of insect-feeding animals is reliant on sustained insect abundance. We will investigate the ecological roles and energy transfer by Minnesota insects and train future insect researchers

Funds Requested: \$199,000

Proposed Project Completion: May 31, 2027

LCCMR Funding Category: Small Projects (H)

Secondary 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?

Region(s): Central, NW,

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.

Declines in insect-feeding birds and bats have been documented, with their abundance fluctuating as insect abundance fluctuates. Insects that provision these animals are poorly studied and their biologies are not well understood. Protection of insect-feeding animal populations is dependent on improving our understanding of insect biology and how to best sustain their numbers.

A major knowledge gap exists surrounding the occurrence and timing of insect species in the environment and the habitat factors that influence their abundance and persistence in both their adult and immature life-stages. This is critical knowledge as insects transfer energy when they feed and grow as immatures in one habitat, then emerge as adults and transfer energy on to the animals that feed on them. Outside of pollinators and pests, knowledge of basic life-history information for Minnesota's insects is lacking.

There is a critical need to identify Minnesota's insects, particularly those groups that serve multiple roles throughout their life-cycles but are poorly studied. There is also a need to train future researchers in insect field techniques in order to address this impediment. Our study will focus on connecting identity, life-history, and ecological role of insects in Minnesota forests and on training a next generation of entomologists.

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 investigate the ecological roles and energy transfer by Minnesota insects and train future researchers on insect field techniques.

Our study will evaluate forest insect presence for both (i) total insect biomass and (ii) a single taxonomic group. Biomass is commonly used in determining how many insects are available, but a finer taxonomic investigation will allow us to determine which species are present, when each life-stage is active, and connect immature habitat to adult presence. We will connect adult insect presence to its larval ecology through surveys, molecular identification, and a detailed literature review. Combined, the two datasets will be used to inform on how forest structure, land use, and history impact insect presence and abundance. This data will be used to determine how forest structure impacts energy transfer and can guide forest management for practices that promote beneficial insects and safeguard animal abundance.

Training opportunities in the state on insect field techniques is also lacking. A full understanding of the importance of Minnesota's insects is hindered by these shortcomings. We will develop a summer course on Field Entomology at the Itasca Biological Station to train students in insect collecting techniques and life-stage association.

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 conservation of Minnesota animals relies on understanding which species are present and how they interact with each other and the environment. Specific data linking insects to their diverse habitats are needed to develop conservation plans. We will provide specific information on insect numbers that can inform both bird and bat food conservation, and allow conservation practitioners to create best management practices for sustaining insect populations. Training a next generation on proper insect field techniques will ensure that future research can continue to evaluate habitat requirements for different insect species and that can test for long-term trends.

Activities and Milestones

Activity 1: Assess Minnesota deciduous forest insect communities

Activity Budget: \$156,000

Activity Description:

We will establish replicated plots in the Eastern broadleaf forest zone with known land use histories. Insects in each plot will be sampled using blacklight, sweep net, and flight intercept traps in the Spring, Summer, and Fall for both (i) total insect biomass and (ii) a detailed study of a focal taxonomic group. Crane flies will be used as the focal group because they are decomposers, predators, and herbivores in terrestrial and aquatic environments as larvae, before emerging as adults. They are diverse in Midwestern forests, can account for ~30% of bird and bat diets, and are understudied in Minnesota. All individuals will be identified to species level and connected to their larval stage through surveys, molecular identification, and a detailed literature review to form a database of insect ecology. Insects will be deposited in the UMN Insect Collection, and data will be added to the MN Biodiversity Atlas. We will use high resolution imagery and local site habitat assessment to characterize forest structure and composition at multiple spatial scales around each plot location. Combined, the two datasets will be used to answer how forest structure, land use, and history impact insect biomass and energy transfer.

Activity Milestones:

Description	Approximate Completion Date
Identify Study Sites	June 30, 2024
Survey insect communities using structured sampling (yr 1)	September 30, 2025
Develop an online database of crane fly ecology	June 30, 2026
Survey insect communities using structured sampling (yr 2)	September 30, 2026
Evaluate factors associated with community structure and energy flow	December 31, 2026

Activity 2: Establish an Entomology Field Course at Itasca Biological Station

Activity Budget: \$26,000

Activity Description:

The public does not have a strong grasp on the complex life-histories and ecological importance of insects in Minnesota. This is due in part to the lack of available opportunities to learn insect field collection techniques, life-history associations, and taxonomy. Field courses that provide education on other animal groups are available but are currently lacking for the largest and most diverse animal group, insects. We will offer a 2.5 week summer insect field course at Lake Itasca Biological Station. The field course will provide education for enrolled students on insect collection techniques, identification, and insect ecology and natural history through field trips to aquatic and terrestrial habitats. Communication and outreach training will be provided on the importance of insects in the environment. This training will help build expertise that can then be relayed to the general public now, and in the future. Enrollment in entomology courses at the University of Minnesota has increased substantially over the last 4 years and will soon expand to all UMN campuses. This field course will be a cornerstone of the program. The faculty PI will lead this course across both years of this study.

Activity Milestones:

Description	Approximate Completion Date
Submit course proposal for approval at UMN	July 31, 2024
Deliver field course yr 1	June 30, 2025
Deliver field course yr 2	June 30, 2026

Activity 3: Assessing change to the Minnesota crane fly community over a 50 year period

Activity Budget: \$17,000

Activity Description:

Declines in several insect groups have been documented in Minnesota. However, very few groups have long-term data that allows for an evaluation of how insect abundance may have changed over long time periods. A survey of crane flies was previously conducted in Minnesota at Itasca State Park in 1970. This survey serves as an important checkpoint that can be used to examine how species compositions have changed over a 50 year time-period during which time forest habitats, management practices, and climates have changed. We will establish one of our research plots during Activity 1 at Itasca State Park. We will then replicate collection protocols used during this historic study as a way to evaluate (i) the potential for faunal loss or change over the 50 years, and (ii) if this change is associated with habitat or climate factors. We will evaluate how similar the two crane fly faunas are, before using detailed information on species development, feeding ecology, and distribution to address questions on how and why particular species may be absent from the current sampling. Understanding which species may have been lost, or added, can help inform trends may occur in the future.

Activity Milestones:

Description	Approximate Completion Date
Evaluate factors influencing crane fly community change	June 30, 2026
Sample to crane fly community of Itasca State Park	August 31, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Lake Itasca Biological Station and Laboratories	University of Minnesota	Collaborators will assist in offering the insect field biology course	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?

All study results will be shared with the MN DNR, the US Forest Service, and Minnesota tribes as a way of highlighting the importance of insect species identity in promoting conservation and management of forests and associated animals. We will share a project summary in a written form at the conclusion of the study, publish 2 peer-reviewed publications, and will upload our data to the Minnesota Biodiversity. Our results will have a long-lasting impact through the development of the insect field course. We will seek external funding in the future to expand our investigations into other habitats, such as prairies.

Project Manager and Organization Qualifications

Project Manager Name: Matthew Petersen

Job Title: Teaching Associate Professor

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

Dr. Matt Petersen is an insect researcher focused on determining the underlying mechanisms responsible for insect presence and abundance. As an ecologist and taxonomist, he has been involved in large-scale initiatives to survey and document insect diversity in forest environments, focusing on how insect species ecology - including development and life-history - and environment interact. The goal of his program is to highlight how understanding the ecology of individual insect species can lead to better informed habitat management practices, sustained populations of beneficial insects, and stable insect-feeding animal populations. As a taxonomic expert in crane flies, he brings the necessary skills needed to better understand the roles of the species in this hyperdiverse group. Dr. Petersen also directs the undergraduate entomology program at the University of Minnesota where he has helped to substantially increase the prominence of insect education for the state.

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

Organization Description:

College of Food, Agricultural and Natural Resources Sciences (CFANS) is comprised of Twelve academic departments and 10 research and outreach centers, along with the Minnesota Landscape Arboretum, the Bell Museum, and dozens of interdisciplinary centers. As part of a major urban university located in the heart of the Twin Cities, we also provide immersive study opportunities across the state. Our living laboratories allow students, faculty, and staff to study throughout Minnesota’s diverse ecosystems.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Graduate Student		Conduct insect surveys and habitat assessment			24.1%	2		\$105,943
Faculty Member		Oversee project (partial time in summer) and lead field course			36.8%	0.6		\$49,133
Undergraduate student		Help in insect collections, database construction, and lab work			0%	0.5		\$24,000
							Sub Total	\$179,076
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Tools and Supplies	Insect pins, alcohol, insect storage cabinet and vials, DNA extraction kits; general insect field collecting supplies;	Supplies are needed for preparation and storage of collected insect specimens					\$4,500
							Sub Total	\$4,500
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Mileage/Meals/Lodging for field work over 2 years and 3 periods (spring, summer, fall; est. 400 miles for each collection period; collection periods last 7 days)	Travel for fieldwork, including mileage, lodging, and per diem for researchers. Travel is largely associated with insect collection and					\$13,924

			lodging during the 2024 and 2025 field seasons.					
							Sub Total	\$13,924
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
		eDNA Processing at UMN Genomics Center. (estimate ~100 samples @ \$15/ sample)	Identify insects consumed by birds and insects available in the environment					\$1,500
							Sub Total	\$1,500
							Grand Total	\$199,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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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: [fa51e14d-e50.pdf](#)

Alternate Text for Visual Component

Title: Monitoring Minnesota's Insects: Connecting Habitat to Insect Prey. Insect food sources and forest factors structure forest insect diversity. Bird shown eating an adult insect, the immature stage of the same insect is feeding on decaying wood. How do available food sources impact insects presence and abundance?...

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
UMN Letter of Support	6c5ec651-161.pdf
Itasca Biological Station	1049f13c-154.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?

No

Does your project include the design, construction, or renovation of a building, trail, campground, or other capital asset costing \$10,000 or more?

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?

No