Environment and Natural Resources Trust Fund

M.L. 2024 Approved Work Plan

General Information

ID Number: 2024-063

Staff Lead: Lisa Bigaouette

Date this document submitted to LCCMR: June 12, 2024

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

Project Budget: $199,000

Project Manager Information

Name: Matthew Petersen

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Project Reporting

Date Work Plan Approved by LCCMR: June 20, 2024

Reporting Schedule: June 1 / December 1 of each year.

Project Completion: July 31, 2026

Final Report Due Date: September 14, 2026

Legal Information

Legal Citation: M.L. 2024, Chp. 83, Sec. 2, Subd. 03f

Appropriation Language: $199,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to investigate the ecological roles of and energy transfer by certain Minnesota insects throughout their life cycles and to train future insect researchers on field techniques.

Appropriation End Date: June 30, 2027

Narrative

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

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.

Project Location

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

Region(s): Central

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

Activities and Milestones

Activity 1: Assess Minnesota deciduous forest insect communities

Activity Budget: $156,000

Activity Description:
We will establish replicated plots in the Minnesota 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. We will use collections to determine (i) insect identity and create a detailed food web for the collected species and (ii) establish a detailed study of a focal taxonomic group. The total insect composition at each plot will be assessed in terms of species richness, abundance, and food web composition. 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. For objectives (ii) and (iii), 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. This survey will be used to create the first detained insect food web in MN,

Activity Milestones:

Description	Approximate Completion Date
Identify Study Sites at Chippawa National Forest	November 30, 2024
Present current findings at National Entomology Conference	November 30, 2025
Submit graduate thesis chapter detailing work and findings	June 30, 2026
Submit peer-reviewed publication relating insect composition to habitat factors (project completion)	July 31, 2026
Submit list of species collected to MN DNR to document findings	July 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	November 30, 2024
Deliver field course yr 1	May 31, 2025
Deliver field course yr 2	May 31, 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
Submit application to collect insects at Itasca State Park	July 31, 2024
Complete ecological assessment for collected species	June 30, 2026
Complete 2 years of sampling for crane flies at Itasca State Park	July 31, 2026
Submit report to MN State Parks and DNR	July 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

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.
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. The Environment and Natural Resources Trust Fund will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the ENTRF Acknowledgment Guidelines.

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?
The entomology field course developed through this work will be offered annually at the Itasca Biological Station. This project will also establish a baseline dataset of insect species detected in the state and provide an associated DNA designation for each species collected in this work. This will greatly improve the capacity of future researchers to document and monitor insect species in the state.

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								
eDNA Processing at UMN Genomics Center. (estimate ~100 samples @ $15/ sample)	Internal services or fees (uncommon)	DNA processing and sequencing for identification of insects associated with this project				0		$5,000
							Sub Total	**$5,000**
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					$3,600
							Sub Total	**$3,600**
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 associated with insect collection and lodging during the 2024 and 2025 field seasons.					$10,324
							Sub Total	**$10,324**
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	one trip to present project findings for the Graduate Student	Presentation of research findings at the Entomological Society of America Annual Conference	X				$1,000
							Sub Total	**$1,000**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$199,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	one trip to present project findings for the Graduate Student	Funds requested to allow for dissemination of project findings to a broader audience at a national conference. A presentation will be given that will detail the scientific findings found during this project

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?...

Supplemental Attachments

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

Title	File
Itasca Biological Station	1049f13c-154.pdf
UMN Letter of Support	6c5ec651-161.pdf
Research Addendum revised 2024-064_final	2db0b0c8-ea2.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

No major changes were made for this work plan. The description for Activity 1 was slightly modified for clarification, but not major changes were made to the objectives; modification to the original budget was made to account for changes in work flow and sampling periods

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 agree travel expenses must 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 agree to the UMN Policy.

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?

No

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