



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-477

Proposal Title: Climate Resilient Pollinator Corridors

Project Manager Information

Name: Jeremy Hemberger

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

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Project Basic Information

Project Summary: The iBUG Lab will monitor urban pollinator habitats using bio-thermal sensors and camera traps to identify seed mixes creating climate refuges that protect Minnesota's pollinator investments from extreme heat.

ENRTF Funds Requested: \$300,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Small Projects (G)

Secondary Category: Resiliency (A)

Project Location

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

Region(s): Metro

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.

Minnesota has invested millions in urban pollinator habitats through initiatives such as municipal bee lawns and pollinator plantings. However, a major emerging threat remains largely unaddressed: the Urban Heat Island (UHI) effect. As cities warm and urban density increases, microclimates are shifting faster than many native pollinators can adapt. While programs like Lawns to Legumes have expanded floral resources, the climatic performance of these restorations remains unknown. Without understanding how habitats function during extreme heat, the state risks creating ecological traps—sites that attract pollinators with food but expose them to temperatures exceeding their physiological limits.

Three key risks arise from this knowledge gap. First, habitats may provide forage without the thermal refuge needed to prevent overheating during peak summer heat. Second, there is little empirical data on which native plant species or architectures maintain cooling microclimates when surrounding pavement temperatures exceed 100°F. Third, Species of Greatest Conservation Need (SGCN), particularly specialized native bees, may face heightened risk if habitats fail to provide “thermal Goldilocks” conditions that are neither too hot nor too exposed.

Urban landscapes contain diverse microhabitats that remain poorly studied in their capacity to support pollinator biodiversity under extreme heat. Without data on how plant structure

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 use the iBUG Lab’s Bio-Thermal Monitoring Protocol to quantify the microclimate benefits of urban pollinator habitats. High-resolution sensor networks will measure temperature and environmental conditions across habitat types at 30+ established sites. In partnership with parks, gardens, zoos, private landowners, and pollinator experts across Minnesota, we will deploy sensors that capture fine-scale thermal variation within urban landscapes.

Non-lethal camera traps paired with AI-assisted pollinator identification will link insect activity with real-time temperature data, allowing us to identify which species are thriving and which may experience thermal stress. These data will help identify “Thermal Goldilocks” plants—native species whose architecture and transpiration maintain cooler microclimates despite rising urban temperatures.

The project will also improve pollinator garden programs by providing evidence-based recommendations for designing thermally resilient habitats. By correlating more than 100,000 observations of pollinator activity with localized temperature data, we will generate foundational evidence to ensure Minnesota’s pollinator restorations remain effective through 2030 and beyond while engaging community science partners in a publicly accessible monitoring network.

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?

This project will create the first "Climate-Proofed" landscaping guide for Minnesota, featuring a standardized Thermal Performance Index for 20+ native MN plants and a live Resilient Habitat Dashboard. This data will help the MN DNR and local managers prioritize seed mixes for future climate resilience, protecting Species of Greatest Conservation Need (SGCN) and ensuring long-term ecological stability. The data will be publicly available for urban insect mapping and pollinator corridor planning. Collaboration with environmental educators will convert this data into teaching tools to promote climate-resilient landscaping.

Activities and Milestones

Activity 1: Monitoring of Thermal Habitats and Pollinator Activity

Activity Budget: \$159,000

Activity Description:

The goal of this activity is to establish a continuous monitoring network for pollinator activity and local thermal conditions (i.e., microclimate) across a gradient of sites in the Metro urban heat island. At approximately 30 sites, we will install non-lethal pollinator camera traps to continuously monitor, photograph, and census pollinator activity and temperature conditions in habitat installations (including Lawns to Legumes, Pocket Prairies, and other Metro Blooms habitat enhancements). The camera traps are designed to mimic highly attractive floral resources using a multi-colored UV reflective plastic imaging base monitored by a Raspberry-Pi based camera. This design allows us to continuously gather data on pollinator activity in habitat installations along with temperature, humidity, and other local microclimatic conditions. We will pair this camera-trapping with standardized floral resource sampling protocols to estimate plant/flower abundance at the local (habitat) and landscape (1000m) scale. The data collected from these camera traps will enable the construction of species-specific thermal performance models (Activity 2) and provide critical data to assess the benefit of urban pollinator habitat enhancements on pollinator activity rates -- data that thus far is absent from many Metro area habitat enhancement initiatives.

Activity Milestones:

Description	Approximate Completion Date
Finalize partnership agreements and site selection	December 31, 2027
Deploy first-season sensor arrays and complete initial baseline data collection	June 30, 2028
Complete collection of two full seasons of high-resolution thermal and pollinator camera trapping data	October 31, 2029

Activity 2: AI-Assisted Analysis and Physiologically-Guided Modeling

Activity Budget: \$65,000

Activity Description:

This activity will identify the thermal thresholds of native specialist bees and model habitat resilience from camera trap and sensor data collected in Activity 1. We will utilize an existing analytical framework created by the iBUG lab to model the thermal performance curve of each pollinator species with sufficient data coverage captured in camera traps. These models allow us to predict pollinator activity rates in response to temperature conditions, and compare model functional forms, optima, and other parameters across different local habitat characteristics (i.e., pollinator habitat, landscape-scale heat island effect). From these data, we can identify plants, local habitat, and urban landscape characteristics that create a thermal "Goldilocks" zone for urban pollinators.

Activity Milestones:

Description	Approximate Completion Date
Complete AI-assisted identification of 100+ pollinator species from field samples	March 31, 2028
Develop and validate the Thermal Performance Index for common MN native plant species	December 31, 2029
Publish predictive models of bee activity under future heat-island scenarios	May 31, 2030

Activity 3: Build and Disseminate Climate Resilient Habitat Restoration Practices

Activity Budget: \$76,000

Activity Description:

The objective of this activity is to generate and share specific guidelines to enhance the climate resilience of pollinator habitat enhancements in both the Metro region and beyond. We have three distinct sub-activities : (1) Develop the MN Resilient Pollinator Habitat Dashboard, an open-access digital tool to assist land managers and local community organizations/individuals to appropriately site and establish climate-resilient pollinator habitats. The tool will include top plant recommendations as well as local/landscape characteristics that promote cooler microclimates in which to establish habitat; (2) Host regional workshops (Central, SE, NW) in coordination with UMN Extension to train DNR and municipal planners in the use of the Resilient Habitat Dashboard; (3) Create an “Urban Gardening Toolkit” for use by science and environment teachers in formal and outdoor classrooms to teach the importance of considering climate resilience and educate about the impacts of heat waves and urban heat islands on both people and insects.

Activity Milestones:

Description	Approximate Completion Date
Launch the public "MN Resilient Pollinator Habitat" digital dashboard	February 28, 2030
Distribute MN Resilient Pollinator Habitat guides to local government units	June 30, 2030

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.

Results will be disseminated via project reports, academic publications, and conference presentations. All data, code, and resultant products from this work will be made openly and freely available upon request and in-keeping with Open Science Framework practices.

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 data and tools generated by this project could be integrated directly into future pollinator planting cost-share requirements and MN DNR restoration contracts. By defining the "Climate ROI" of habitat today, we prevent the long-term waste of state funds on non-resilient reconstructions. Ongoing maintenance of the Resilient Habitat Dashboard will be supported by the iBUG Lab's core institutional funding and future federal climate-adaptation grants (e.g., USFWS or NSF).

Project Manager and Organization Qualifications

Project Manager Name: Jeremy Hemberger

Job Title: Assistant Professor

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

Jeremy Hemberger is an Assistant Professor at the University of Minnesota and the PI of the iBUG Lab (Insects, Biodiversity, and Urban Global change). He specializes in the responses of insect biodiversity to human-driven environmental changes, including land-use shifts and extreme weather. Professor Hemberger has a documented history of managing multi-agency conservation datasets and high-resolution monitoring projects. His expertise in ecoinformatics provides the technical oversight necessary to process 100,000+ data points and translate them into the models required by this project.

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

Organization Description:

The iBUG Lab at the University of Minnesota (CFANS) is a leader in ecoinformatics and global change insect ecology. The lab provides the necessary infrastructure for large-scale data processing and is uniquely equipped with the camera trapping and bio-thermal sensor technology required for this project.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Graduate Student Researcher		Coordinate project work and conduct research on how local (restoration composition) and landscape-level thermal characteristics impact wild bee activity and species composition, report and publication writing			24.2%	1.5		\$183,021
Research Technician		Build, maintain, and service camera trap and sensor devices for the wild bee and microclimatic monitoring			32.3%	0.8		\$51,323
Undergraduate Research Technicians (two)		Assist with data collection, processing, and other miscellaneous project tasks			0%	0.92		\$32,155
							Sub Total	\$266,499
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Tools and Supplies	Camera trap and sensor components, trap bodies, hardware, data storage, power management, and miscellaneous accessories	For camera trap and microclimate sensor arrays					\$21,501
							Sub Total	\$21,501
Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-

Travel In Minnesota								
	Miles/ Meals/ Lodging	UMN Fleet long-term rental vehicle for 4 months in each year, with approximately 7200 miles plus gas and insurance costs	Travel to field sites in metro area					\$12,000
							Sub Total	\$12,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$300,000

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	-

Total Project Cost: \$300,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [01ddba75-199.pdf](#)

Alternate Text for Visual Component

Conceptual figure of site selection across urban heat island of the metro area, data collection, data analysis, and project outputs associated with the three proposed activities...

Supplemental Attachments

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

Title	File
Letter file - UMN	b368205c-02a.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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?

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

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

Jake Wiebe (Three Rivers Parks district)

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

N/A