Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-526

Proposal Title: Search for State Jewels: Agrilus Beetles in Minnesota

Project Manager Information

Name: Cristian Beza Beza

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

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Project Basic Information

Project Summary: A previous project used biosurveillance to canvass jewel beetles across Minnesota, some of which are important pests. This proposal targets beetles related to emerald ash borer, which remain largely unexplored.

ENRTF Funds Requested: $279,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Small Projects (G)

Secondary Category: Fish and Wildlife (D)

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.

Minnesota enjoys a rich diversity of species in our waters, fields and forests. Several initiatives have contributed to cataloguing the diversity of life among birds, plants, insects, and more in several ecosystems. In Minnesota, one understudied group has been the flat-headed woodborers, aka "jewel beetles." These insects serve as nature's recyclers of woody materials but can also become important pests after invasion events or during droughts. Notable examples include the invasive emerald ash borer that is decimating our ash forests, native two-lined chestnut borer contributing to oak decline, and native bronze birch borer that eliminates birch trees in field and urban forests during dry spells. These three problems are members of the Agrilus genus, one of the largest groupings of any animal or plant taxon in the world.

In project M.L. 2014, Chp. 226, Sec. 2, Subd. 04d (2014-2017), we used biosurveillance with smokey-winged beetle bandit wasps to collect woodboring beetles across the state. We also catalogued several unexpected new state records. This proposal seeks to use more targeted survey techniques to document the diversity of Agrilus in Minnesota – both natives that could be lost and those that could become more problematic as conditions change.

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.

This project aims to catalog the diversity of Agrilus beetles in Minnesota, addressing three key questions: 1) which species are present, 2) which ones are native, and 3) which species pose threats to Minnesota's trees and shrubs. Two primary techniques will be used. First, we will conduct a comprehensive review of museum specimens to verify identities, update records, produce high quality images and identify geographic and taxonomic gaps. Taxonomy is a dynamic field, especially for hyper-diverse taxa like Agrilus. We will begin with specimens from the University of Minnesota Insect Collection (approximately 2000 unexplored Agrilus!) and other state collections to delineate our understanding of Agrilus distribution and diversity in Minnesota. Second, informed by museum data, field collections will be conducted across Minnesota, with specimens reared in the lab. This step will uncover new records and improve representation of rare species. Molecular data generated from collected jewel beetles will provide a lasting, foundational resource for emerging biodiversity monitoring methods such as environmental DNA and metabarcoding.

We are seeking funding to:

Activity 1: Develop an updated species checklist of Agrilus in Minnesota
Activity 2: Enhance digital accessibility of Agrilus state records
Activity 3: Generate molecular data for emerging and future monitoring methods

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?

Development of a critical biodiversity checklist of jewel beetles expands on the foundational work of appropriation M.L. 2014, Chp. 226, Sec. 2, Subd. 04d (2014-2017). This list will provide the foundational knowledge needed to identify native species, detect invasive threats, and prioritize actions to protect ecosystems and mitigate risks. Although Agrilus is known as the largest genus of animals, we have no idea of the diversity that exists in Minnesota. A catalogue will provide a basis from which to identify culprits (often native) that kill trees during droughts and serve as an early warning system for other species related

Activities and Milestones

Activity 1: Develop an updated species checklist of Agrilus in Minnesota

Activity Budget: $81,986

Activity Description:
With close to 3,000 species, Agrilus is considered one of the most diverse genera in the world. A previous study led by Co-PI Dr. Brian Aukema found at least 40 species of Agrilus in Minnesota using a broad biosurveillance technique. That number is almost certainly an underestimate of true abundance and diversity: the project did not perform specifically-targeted collections. The University of Minnesota Insect Collection holds at least 2,000 specimens of Agrilus that are not fully catalogued, for example.

In this activity, we will develop a comprehensive and accurate species checklist as a critical first step for effective conservation and pest management. For building this checklist we will: 1) morphologically examine all the individual Agrilus specimens held at the UMN insect collection and other state collections, to review their taxonomic identity, and extract relevant ecological data from specimen labels; 2) with the distribution data obatained form the museum specimens, we will identify undersurvey areas and rarely collected species; Finally 3) we will travel around the state each summer to collect infested material before rearing specimens for identification in the laboratory. Collection areas will be prioritized based on museum representation and earlier results from Project 2014-04d.

Activity Milestones:

Description	Approximate Completion Date
Review Agrilus in UMN Insect Collection, UMN Duluth and Science Museum of Minnesota	January 31, 2028
Canvasing trips across the state	December 31, 2028
Publication of Agrilus species checklist	June 30, 2029

Activity 2: Enhance digital accessibility of Agrilus state records

Activity Budget: $72,066

Activity Description:
Biodiversity collections play a pivotal role as repositories of data supporting identification, classification, and discovery. Efforts are being made by scientific collections to transition their records into Digital Extended Specimens (DES). This emerging concept combines the actual physical specimen, high-resolution images, genetic information, ecological data, and other multimedia content into a single digital package. This kind of data integration enables an effective synthesis of biodiversity.

Currently, the UMN Insect Collection holds around 2,000 Agrilus specimens with a digital record that includes a unique digital identifier, scientific name, and collecting metadata associated with the specimen. Aproximately 1,425 of those digital records are not georeferenced, and none of them have research quality images. We will transition all Agrilus specimens to Digital Extended Specimens by georeferencing existing records and produce high quality photographs of 1000 specimens, including at least one for each species. These data will be aggregated to the existing digital records published in the Global Biodiversity Information Facility, increasing institutional presence and democratizating biodiversity data to Minnesotans. The produced images will be used to create a photographic reference guide. Funds will be used to purchase supplies and equipment for data acquisition and hire undergraduate students to assist.

Activity Milestones:

Description	Approximate Completion Date
Georeferencing digitally available collection records	June 30, 2027
Imaging Agrilus specimens in the UMN Insect Collection	June 30, 2028
Publication of digital resources in publicly available repositories	June 30, 2029

Activity 3: Generate molecular data for emerging and future monitoring methods

Activity Budget: $124,948

Activity Description:
Recent advancements in DNA sequencing technologies have transformed the way biodiversity is monitored. These innovations, including non-invasive methods (e.g., eDNA, metabarcoding), improve detection capabilities while providing cost-efficient monitoring solutions (e.g., imagine being able to swab a piece of wood to identify what insect killed the tree, instead of needing to catch or rear the culprit out in the laboratory!). These methods are undoubtedly the direction for biomonitoring in the future but their precision relies on having meticulously curated and comprehensive databases derived from molecular data of previously identified samples. International efforts, like Barcode of Life (BOLD), pioneered DNA barcoding and served as international repositories of data. But with so many species in the world, the production of "barcodes" for different species is a community effort needing local scientists and their native fauna.

We will create a molecular database for native Agrilus species of Minnesota. In addition to the traditional (COI) barcode region, we will generate "Mitogenomes" for each species. These new molecular markers will increase the accuracy and capabilities of biodiversity monitoring using DNA. This initiative will enhance the inclusion of data from MN Agrilus species populations in public databases and increase the identification capabilities for local use.

Activity Milestones:

Description	Approximate Completion Date
Mining of public repositories and data curation	June 30, 2027
DNA extraction, marker amplification and sequencing	June 30, 2028
Data analyses, database construction	December 31, 2028
Publication of database	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Brian Aukeman	University of Minnesota Department of Entomology	Help mentor personnel on biodiversity of woodboring beetles. He was a university lead on an earlier project using biosurveillance of smokey-winged beetle bandit wasps to sample jewel beetles in Minnesota. The team successfully published a guide that provides a baseline for more focused work on one important family now	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?

This project builds from an earlier investment focused primarily on emerald ash borer and biosurveillance (2014-04d). We learned that we are drastically underestimating native Agrilus diversity, and have found surprising instances since of unexpected tree mortality. This three-year project would complete our efforts in this area. Results will be shared with forest managers and resource professionals through relevant workshops (e.g., Cloquet Research Review, Northern Silviculture Workshop, etc), social media, and scientific publications.

Project Manager and Organization Qualifications

Project Manager Name: Cristian Beza Beza

Job Title: President's Postdoctoral Fellow

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

Dr. Cristian Beza-Beza is the current President's Postdoctoral Fellow in the Department of Entomology at the University of Minnesota and will soon transition to a faculty role. His research focuses on how species isolated in space and time result in long term geographical patterns of biodiversity, with implications to conservation, recovery, and management. He has worked with a variety of insects in several regions globally, and has shown how changes in temperatures, rainfall, and elevation alter insect assemblages. By combining phylogenetic and distribution data, his work informs ecological and species conservation efforts both in Minnesota and around the world.

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

Organization Description:

The University of Minnesota-Twin Cities, founded in 1851, is the largest campus within the University of Minnesota system with an enrolment of just over 50,000 students. As a historic land-grant university, the University of Minnesota's mission is to engage students and faculty to address Minnesota's most pressing issues. The project will be done within the Department of Entomology where the department is part of the College of Food Agriculture and Natural Sciences. UMN houses the University of Minnesota Insect Collection, one of the largest insect collections in North America.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Faculty		Project Mannager			36.6%	0.24		$41,805
PhD Graduate Student		Person in charge of data gathering analyses and publication			23.2%	3		$108,520
2 Undergraduate Assistants		Part time undergraduate research associate, to assist in georeferencing and specimen imaging			0%	1		$12,000
							Sub Total	**$162,325**
Contracts and Services								
TBD	Service Contract	Funds are requested to cover the cost of DNA sequencing for the Barcoding of Minnesota buprestid species specimens.				-		$20,000
							Sub Total	**$20,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab & Medical Supplies	Funds are requested for the following materials to process samples for barcoding; these materials include general lab consumables, Eppendorf tubes, DNA extraction kits, and PCR kits. Funds are budgeted for DNA extraction and template preparation. Funds are requested to purchase materials necessary to assist in field collection, and rearing equipment.					$17,500
							Sub Total	**$17,500**
Capital Expenditures								
							Sub Total	**-**

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	We budgeted fleet vehicle rental for 4 months for the first two years and for 2 months for the last two years. We planed to do 6 trips on year 1, 6 on year 2, and 3 on year 3. budget is for 2 person per trip	Funds are required for covering expenses associated with transportation, lodging and per diem for travel within Minnesota to collect buprestid beetles.					$21,000
	Conference Registration Miles/ Meals/ Lodging	travel to three domestic conferences.	Funds are requested to cover the cost associated with travel to Minnesota-based conferences and workshops (e.g., North Central Forest Pest Workshop, Cloquet Research Review, Northern Silviculture Workshop).					$1,500
							Sub Total	**$22,500**
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	1 trip to National Conference of Entomology	Funds are requested to cover the cost associated with travel to the annual meeting of the Entomological Society of America to present findings to the national scientific audience.	X				$1,750
							Sub Total	**$1,750**
Printing and Publication								
	Publication	Peer-reviewed journal	Funds are requested to cover the cost associated with publication in open-source peer-reviewed scientific journals.					$919
							Sub Total	**$919**
Other Expenses								
		Tuition cost PhD - Student	Funds are requested to cover the tuition cost of PhD student while the					$54,006

			person is enroll in the UMN entomology program					
							Sub Total	**$54,006**
							Grand Total	**$279,000**

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	1 trip to National Conference of Entomology	Products produced with this projects will be shared to a national scientific audience

Non ENRTF Funds

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

Total Project Cost: $279,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 4b50ccdd-8be.pdf

Alternate Text for Visual Component

Graphical abstract of "Search for State Jewels: Agrilus Beetles in Minnesota" including a brief summary of the project, and graphical example of activities...

Supplemental Attachments

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

Title	File
UMN Authorization letter	45219efe-501.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?

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 proposal:

Brian Aukema

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