Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-151

Proposal Title: Mapping Human-Carnivore Conflicts in Human-Dominated Landscapes

Project Manager Information

Name: Michael Joyce

Organization: U of MN - Duluth - NRRI

Office Telephone: (218) 788-2656

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Project Basic Information

Project Summary: We will evaluate bear, bobcat, and coyote habitat use, activity, and diet in Duluth and surrounding areas to map hotspots for human-carnivore conflicts and fill knowledge gaps to reduce conflicts.

ENRTF Funds Requested: $629,000

Proposed Project Completion: December 31, 2028

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?

Region(s): NE

What is the best scale to describe the area impacted by your work?

Region(s): NE, 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.

Carnivores are charismatic wildlife of public interest and value but can cause conflicts where they live close to humans. In many areas, human-carnivore conflicts are increasing due to simultaneous expansion of human and carnivore populations. Conflicts can result in property damage, which can be costly, and lead to fear of carnivores. In Duluth, several species of carnivore cause regular concern and conflicts with people:

1. Bears are attracted to birdseed and food items in garbage and can cause plant and property damage. Over the last 20 years, there have been ~2,500 bear-related conflict calls in the greater Duluth area.
2. Coyotes can get into trash cans, kill small livestock, and pose a risk to domestic cats and small dogs.
3. Bobcats can kill small livestock and hunt close to human dwellings, causing fear and concern over small livestock and pet safety.

Preventing and resolving human-carnivore conflicts requires detailed information on how carnivores are using human-dominated landscapes to identify where mitigation strategies are most likely to be effective. Additionally, such information can improve public awareness of conflict risk and effective mitigation strategies. Data on human-carnivore conflicts are needed to reduce conflicts and improve human-carnivore coexistence in Minnesota.

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 evaluate habitat use, activity patterns, and diets of bears, bobcats, and coyotes in the greater Duluth area to better understand causes of human-carnivore conflicts and identify where conflict mitigation strategies should be targeted to reduce conflicts. The results will have high management value for improving human-carnivore coexistence in Minnesota.

We will work with partners and the public to deploy GPS collars on all three carnivores and track their movements and habitat selection relative to humans. We will use the data we collect to:

1. Evaluate carnivore movements and map hotspots for human-carnivore conflicts
2. Evaluate carnivore attractants, diet, and foraging behavior of carnivores to determine factors promoting conflicts
3. Determine how frequently carnivores move into and out of urban and suburban areas to evaluate a range of lethal (harvest in current hunting areas) or non-lethal management strategies to prevent human-carnivore conflicts.
4. Provide the information needed to improve conflict management and raise public awareness of conflict mitigation needs and strategies

This project will be the first study on bears and bobcats in a human-dominated landscape in Minnesota and will address key knowledge gaps with respect to human-carnivore conflict, ensuring that the results will have high management value.

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 provide foundational data on human-carnivore conflicts to better understand the causes and identify opportunities for improved mitigation and human-carnivore coexistence. Additionally, it will provide the first formal evaluation of urban and suburban bear and bobcat ecology in Minnesota. Given the nature and frequency of conflicts between humans and carnivores in the Duluth area, the data we will collect will be used to help prioritize outreach and conflict prevention and mitigation efforts by wildlife managers. Specifically, this information will help managers work more effectively and efficiently with the public and municipalities to reduce and resolve human-carnivore conflicts.

Activities and Milestones

Activity 1: Determine habitat use, activity, and diet of bears, bobcats, and coyotes in the greater Duluth area

Activity Budget: $629,000

Activity Description:
We will evaluate habitat use, activity, and diet of carnivores living close to people by live-trapping and deploying GPS collars on 20 bears, 15 bobcats, and 15 coyotes living in Duluth and the surrounding areas. GPS location data will help us evaluate the extent of time spent between natural and human-altered landscapes and identify areas and resources attracting carnivores to human-dominated areas for food acquisition and reproduction. Specifically, identifying areas used by carnivores for reproductive denning and raising of young in human-dominated environments will add to our ecological knowledge base, and further inform human-carnivore coexistence strategies to improve human safety and carnivore persistence. We will combine GPS telemetry data with reported conflicts from the public to map hotspots for conflicts between people and each of the three focal carnivore species. We will quantify availability of natural foods to determine how natural food availability influences use of human food sources such as garbage, bird seed, domestic fruiting plants, and small livestock. We will use a combination of scat and stable isotope analyses to measure carnivore diets. Finally, we will perform targeted outreach to stakeholders and the public to ensure the results of this study inform efforts to reduce human-carnivore conflicts.

Activity Milestones:

Description	Approximate Completion Date
Summarize all diet, habitat use, and activity data collected from the first year of study	June 30, 2026
Deploy GPS collars on 20 bears, 15 bobcats, and 15 coyotes over 2 capture seasons	March 31, 2027
Measure diets of carnivores to determine use of natural and anthropogenic food sources	June 30, 2027
Summarize all data collected from the second year of the study	June 30, 2027
Create conflict hotspot maps for each species and finish all analyses and reports	December 31, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Michael Joyce	UMD-NRRI	Project manager overseeing all aspects of this project including coordinating field work, data management, analysis, and reporting.	Yes
Dr. Andrew Tri	MN DNR	Providing input and in-kind support on the project, including design, field work, and data-analysis for the components of the project focusing on bears.	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 will use well-developed methods and collaboration with the MN DNR to generate foundational data on carnivores in human-dominated landscapes in Minnesota. Collaboration with the MN DNR will ensure that results will have high management value and address key knowledge gaps. Engagement with municipalities before, during, and after the project will ensure that local policy-makers have full access to our results, while targeted outreach activities will ensure that results will help raise public awareness of effective carnivore-conflict mitigation strategies.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Den Boxes for Fishers and other Nesting Wildlife	M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 03i	$190,000
Bobcat And Fisher Habitat Use And Interactions	M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 03i	$400,000
Distribution and Movements of Fishers in Southern Minnesota	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 03f	$340,000
Changing Distribution of Flying Squirrel Species in Minnesota	M.L. 2023, , Chp. 60, Art. 2, Sec. 2, Subd. 03e	$186,000

Project Manager and Organization Qualifications

Project Manager Name: Michael Joyce

Job Title: Wildlife Ecologist

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

Dr. Joyce is a Wildlife Ecologist at the Natural Resources Research Institute. He has over 13 years of wildlife research experience, including radiotelemetry, habitat analyses, and carnivore diet measurement. Michael is working on and managing three ENRTF-funded projects and is project manager for another project currently recommended for funding as part of the FY23 RFP. He has worked extensively on wildlife research projects in Minnesota over the last decade.

EDUCATION:
Ph.D., 2018. University of Minnesota, Integrated Biosciences.
M.S., 2013. University of Minnesota, Integrated Biosciences.
B.S., 2008. University of Wisconsin-Madison, Molecular Biology.

RECENT PUBLICATIONS:
Velander, T.B., M.J. Joyce, A.M. Kujawa, R.L. Sanders, P.W. Keenlance, and R. Moen. 2023. A dynamic thermal model for

predicting internal temperature of tree cavities and nest boxes. Ecological Modelling 478:110302.

Alston, J.M., M.J. Joyce, J.A. Merkle, R.A. Moen. 2020. Temperature shapes movement and habitat selection by a heat-sensitive ungulate. Landscape Ecology 35(9):1961-1973.

Joyce, M., J. Erb, B. Sampson, R. Moen. 2019. Detection of coarse woody debris using airborne light detection and ranging (LiDAR). Forest Ecology and Management 433 (pp 678-689).

Joyce, M. 2018. Evaluating American marten habitat quality using airborne light detection and ranging (LiDAR) data. PhD Dissertation, University of Minnesota.

Joyce, M., A. Zalewski, J. Erb, R. Moen. (2017). Use of resting microsites by members of the Martes Complex: the role of thermal stress across species and regions. The Martes complex in the 21st Century: Ecology and Conservation.

Green, R., M. Joyce, S. Matthews, K. Purcell, J. Higley, A. Zalewski. (2017). Guidelines and techniques for studying the reproductive ecology of wild fishers, American martens, and other members of the Martes complex. The Martes complex in the 21st Century: Ecology and Conservation.

Organization: U of MN - Duluth - NRRI

Organization Description:
The Natural Resources Research Institute (NRRI) is an applied research and economic development engine for the University of Minnesota research enterprise. NRRI employs over 130 scientists, engineers and technicians to deliver on its mission to deliver integrated research solutions that value our resources, environment and economy for a sustainable and resilient future. NRRI collaborates broadly across the University system, the state and the region to address the challenges of a natural resource based economy.

NRRI researchers have extensive experience in managing large, interdisciplinary projects. NRRI's role is as an impartial, science-based resource that develops and translates knowledge. Projects include characterizing and defining resource opportunities, minimizing waste and environmental impact, maximizing value from natural resources and maintaining/restoring ecosystem function.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Michael Joyce, Researcher 6		Project Manager			26.9%	0.45		$61,489
TBD Researcher 3		Field and lab work			24.2%	2.25		$191,499
Wildlife Technician		Field and lab data collection			7.1%	2.58		$125,735
Undergraduate research assistant		Field and lab work			0%	0.39		$15,648
Masters Graduate Student		Complete MS on project			46%	0.75		$34,396
							Sub Total	**$428,767**
Contracts and Services								
TBD	Professional or Technical Service Contract	Analysis of diet composition at stable isotope laboratory ($11/sample x 50 carnivore samples + 200 food samples)				0.09		$2,750
TBD	Professional or Technical Service Contract	GPS data downloads for carnivore collars ($40 activation fee + $15/month for estimated life of collar).				0.09		$16,400
MN DNR	Professional or Technical Service Contract	Telemetry flights to search for missing study animals				0.03		$8,640
							Sub Total	**$27,790**
Equipment, Tools, and Supplies								
	Equipment	GPS collars for bears ($2,600 x 20 collars), bobcats ($2,250 x 15 collars), and coyotes ($2,250 x 15 collars)	To collect movement, habitat selection, and activity data from carnivores					$119,500

	Tools and Supplies	Trail cameras and supplies (SD cards, locks) to aid in carnivore trapping and monitor use sites	40 cell cameras will be used to find bobcats and coyotes to target, help monitor traps to captured carnivores are processed promptly, and monitor reproductive sites of study animals.					$4,600
	Tools and Supplies	Live-capture, handling, and field monitoring supplies (e.g., pharmaceuticals, sample collection gear, trapping bait/lure, traps, etc.)	Critical for live-trapping and anesthetizing carnivores to deploy GPS collars					$7,843
	Tools and Supplies	Laboratory supplies for processing diet samples	Help process scats and hair samples for diet analysis					$2,800
							Sub Total	**$134,743**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Field work for trapping and tracking study animals	To deploy collars and intensive field-monitoring of study animals					$37,500
							Sub Total	**$37,500**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Shipping fees	Fees for shipping samples to the stable isotope lab for diet analysis					$200
							Sub Total	**$200**

							Grand Total	**$629,000**

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				
In-Kind	UMN unrecovered indirect costs are calculated at the UMN negotiated rate for research of 55% modified total direct costs.	Indirect costs are those costs incurred for common or joint objectives that cannot be readily identified with a specific sponsored program or institutional activity. Examples include utilities, building maintenance, clerical salaries, and general supplies. (https://research.umn.edu/units/oca/fa-costs/direct-indirect-costs)	Secured	$345,950
In-Kind	The Minnesota Department of Natural Resources (MN DNR)	Minnesota DNR Bear Project Leader Andrew Tri will provide 200 hours of in-kind support of this project for each of three years, for a value of $26,106. Dr. Tri will provide advice on trap site selection, assist with fieldwork (bear trapping, anesthesia, collar fitting), assist with communications with DNR and other partners, and serve as the subject matter expert on the urban bear aspect of the project. Minnesota DNR Wildlife Research Specialist Hannah Leeper will provide 160 hours of in-kind support of this project for each of three years, for a value of $12,936. Ms. Leeper will provide fieldwork support (both trapping and den work).	Secured	$39,042
			State Sub Total	**$384,992**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$384,992**

Total Project Cost: $1,013,992

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 9c1c991e-ebe.pdf

Alternate Text for Visual Component

The graphic shows a bobcat with a kitten taken in rural Duluth, a coyote in rural Duluth, a map of bear conflicts across Duluth, and a picture of a radio-collared black bear taken in Minnesota. Text described project activities and impacts....

Supplemental Attachments

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

Title	File
MN DNR In-Kind Letter	8dc3dbf1-4e9.pdf
UMD SPA Transmittal Letter	e7aa1e4f-229.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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:

Taylor Velander (NRRI), Michael McMahon (NRRI), Anna Mangan (NRRI), Megan Gorder (NRRI), Julie Christopherson (NRRI), UMD Sponsored Project Administration, Andrew Tri (MN DNR)