Environment and Natural Resources Trust Fund

M.L. 2025 Approved Work Plan

General Information

ID Number: 2025-063

Staff Lead: Lisa Bigaouette

Date this document submitted to LCCMR: June 8, 2025

Project Title: Evaluating Anticoagulant Rodenticide Exposure in Minnesota's Carnivores

Project Budget: $247,000

Project Manager Information

Name: Michael Joyce

Organization: U of MN - Duluth - NRRI

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Project Reporting

Date Work Plan Approved by LCCMR: June 24, 2025

Reporting Schedule: March 1 / September 1 of each year.

Project Completion: June 30, 2028

Final Report Due Date: August 14, 2028

Legal Information

Legal Citation: M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 03d

Appropriation Language: $247,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to determine anticoagulant rodenticide exposure rates and concentrations in Minnesota bobcats and fishers, factors influencing exposure risk, and negative effects of rodenticide exposure on carnivore health.

Appropriation End Date: June 30, 2028

Narrative

Project Summary: We will determine anticoagulant rodenticide exposure rates and concentrations in bobcats and fishers, evaluate factors influencing exposure risk, and evaluate negative effects of rodenticide exposure on carnivore health.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Rodenticides are used to control rodent populations to protect crops, reduce disease and property risks in human dwellings, and prevent ecological damage. Anticoagulant rodenticides (hereafter, ARs) are a class of rodenticides that interfere with blood clotting factors. Importantly, the negative effects of rodenticides are the same whether ingested directly by rodents or indirectly by predators eating rodents that were poisoned.

Recent studies have found AR exposure and poisoning to be surprisingly widespread among wild carnivore populations:

1. Predators in Europe, New Zealand, and North American have high rates of AR exposure.
2. Over 78% of fishers and ~50% of bobcats sampled in the northeastern US were exposed to ARs.
3. AR exposure is highest near urban and agricultural areas but also present in remote areas.
4. Fishers have received lethal doses of ARs in the wild.
5. AR consumption can cause negative effects on carnivore health and behavior.

Exposure of predators to ARs is an emerging issue that is receiving a lot of global attention, but data from Minnesota are lacking. Research is needed to fill key knowledge gaps including identifying exposure pathways, evaluating negative effects of exposure on wildlife populations, and determining effective strategies for reducing AR exposure.

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 anticoagulant rodenticide (AR) exposure rates in bobcats and fishers to determine whether Minnesota's carnivores are being exposed to ARs and to fill key knowledge gaps related to exposure risk factors and effects of AR exposure. Given the widespread exposure of fishers and bobcats elsewhere in North America, we anticipate finding high exposure rates in Minnesota.

We will work with MN DNR researchers and managers to sample road-killed and trapper-harvested bobcats and fishers for exposure to 11 first- and second-generation ARs. We will combine AR exposure data with sample location, age, sex, and reproductive status of females to evaluate negative effects of AR exposure. We will use the data we collect to:

1. Determine current prevalence of AR exposure in Minnesota bobcats and fishers.
2. Evaluate factors influencing AR exposure risk.
3. Map AR exposure risk for bobcats and fishers in Minnesota.
4. Evaluate negative consequences of AR exposure to carnivore health and reproduction.

The results of this project will have high management value. Additionally, we expect our results to be of high interest and value to the public. We will conduct public outreach and disseminate project results to help raise awareness of AR exposure in Minnesota's carnivores.

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?

No studies have evaluated anticoagulant rodenticide (AR) exposure in Minnesota's carnivores. Prevalence, routes of exposure, and potential effects to populations are currently unknown. The results of this study will help fill those critical knowledge gaps and provide foundational data on AR exposure in bobcats and fishers. Specifically, understanding the

factors that influence AR exposure can help identify and map sources of exposure, which can be used to direct efforts to reduce AR exposure risk. High AR exposure rates for bobcats and fishers may also indicate risk to other predators. Results will guide efforts to protect carnivores and reduce AR exposure.

Project Location

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

Region(s): Central, Metro, NE, NW, SE,

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

Activities and Milestones

Activity 1: Evaluate anticoagulant rodenticide exposure rates, exposure risk factors, and negative effects on bobcats and fishers.

Activity Budget: $247,000

Activity Description:
We will use samples collected from road-killed and harvested bobcats and fishers to evaluate anticoagulant rodenticide (AR) exposure rates for both species. We will analyze 200-300 samples of each species distributed from across their range to evaluate spatial patterns in AR exposure. We will also evaluate intrinsic (species, sex, age, diet) and extrinsic (proximity to human dwellings, land cover) factors influencing rodenticide exposure risk and map exposure risk across Minnesota. AR exposure risk will be determined by analyzing tissues for exposure to 11 different first- and second-generation ARs. For adult females, we will evaluate past reproductive status and litter sizes to determine whether AR exposure has an adverse effect on reproductive output. Reproductive data will come from analyzing placental scars on the uterus of each sample. Animal age will be determined for each sample using cementum annuli from teeth. We will conduct public outreach to share results of the project with the public.

Activity Milestones:

Description	Approximate Completion Date
Conduct a power analysis to evaluate sample size targets and modify targets if needed.	November 30, 2025
Summarize all data collected during the first year of sampling	June 30, 2026
Summarize all data collected during the second year of sampling	June 30, 2027
Determine AR exposure rates from 200-300 bobcat and fisher samples	September 30, 2027
Complete and summarize final analyses of factors influencing exposure risk and negative effects on carnivores	June 30, 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 sample collection, data management and analysis, and reporting.	Yes

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.
Our results will be of high value to wildlife researchers and managers tasked with monitoring and managing bobcats and fishers in Minnesota. We will engage with DNR wildlife researchers and managers at all stages of this project to communicate objectives, gain feedback on project design and methods, and share results. Additionally, wildlife researchers and managers will help with access to carcasses to sample for anticoagulant rodenticide exposure. We will provide formal and informal updates to stakeholders via state and local meetings, email communication, and other means. We will present project results to the larger scientific community at state, regional, and national scientific meetings. Travel to meetings outside of Minnesota will not be paid for by project funding. We will also prepare and submit manuscripts for publication in peer-reviewed scientific journals.

We will conduct outreach with tribal authorities to share our project objectives and invite tribal input and collaboration. We will also share data directly with tribal authorities.

We anticipate that this project will be of high interest and value to the public. We will engage with the public to share project background and updates as the project progresses. We will create a website to distribute information to the public. We will also disseminate results to the public via webinars and other outreach events. Public outreach will help raise awareness of issues with using anticoagulant rodenticides.

We will likely have periodic contact with print and broadcast media. These contacts will be documented as they occur.

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, and other communications per the ENRTF Acknowledgement 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?
This project will generate foundational data on anticoagulant rodenticide (AR) exposure risk and negative effects to bobcats and fishers, two charismatic game species in Minnesota. We have engaged with the MN DNR while developing this proposal to ensure results are of high management value. If results show high rates of AR exposure and the potential for negative effects to both populations, future work may be needed to evaluate exposure of other carnivores and develop effective strategies to reduce AR exposure while also effectively controlling rodent populations. Funding sources for future work would depend on the results of this project.

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

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Michael Joyce, Researcher 6		Project Manager			27.1%	0.15		$17,414
TBD, Researcher		Planning and coordination of sample collection and data management			25.1%	1.05		$75,941
Masters Graduate Student		Completes MS thesis on project			20.1%	0.51		$27,836
Seasonal Technician		Conducts sample preparation and data entry/QAQC work			7.1%	0.6		$28,946
Undergraduate Research Assistant		Sample preparation and data entry			0%	0.27		$9,206
							Sub Total	**$159,343**
Contracts and Services								
Michigan State University Vet Diagnostic Lab (or similar service lab)	Service Contract	Toxicological analysis of 200-300 carnivore samples per species to determine anticoagulant rodenticide exposure.				0		$75,000
							Sub Total	**$75,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	Supplies for sample processing and collection (nitrile gloves, scalpel blades, measurement tools, sample bags and vials, shipping supplies)	Supplies needed to process carnivore carcasses and store samples prior to submission to toxicology lab for analysis					$4,557
							Sub Total	**$4,557**
Capital Expenditures								
							Sub Total	-

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel to MN DNR wildlife management offices to pick up samples	Travel to obtain samples to test for toxicological analysis					$7,500
							Sub Total	**$7,500**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Shipping fees	Fees for shipping samples to the veterniary diagnostic lab for toxicological analysis					$600
							Sub Total	**$600**
							Grand Total	**$247,000**

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				
			State Sub Total	**-**
Non-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	$135,850
			Non State Sub Total	**$135,850**
			Funds Total	**$135,850**

Total Project Cost: $382,850

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: dd864e5c-7aa.pdf

Alternate Text for Visual Component

The graphic shows a diagram of rodenticide being eaten by rodents and then poisoned rodents being eaten by bobcats and fishers. Text describes past studies showing high rodenticide exposure rates in bobcats and fishers, project activities, research needs, and project impacts....

Supplemental Attachments

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

Title	File
UMD SPA Transmittal Letter	8730e01d-f5e.pdf
2025-063 Research Addendum revised_final	d234904a-71b.docx

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Very few changes were made. I added the Dissemination section text, updated the location of project activities to include southeastern Minnesota, and corrected one grammar issue I found in the text (data...is was changed to data...are since data is the plural form of datum).

I revised the text in the Narrative section about how results of this study will protect and enhance Minnesota's wildlife.

I added an additional milestone to activity 1 to conduct a power analysis to evaluate sample size adequacy for the number of factors we intend to include in our analyses.

I revised Milestone 4 of Activity 1 to indicate that it represents a completion of final analyses and summary of project outcomes.

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 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 project:

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

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