Environment and Natural Resources Trust Fund
2022 Request for Proposal

General Information

Proposal ID: 2022-069

Proposal Title: Effects of Road Mortality on Minnesota Wildlife

Project Manager Information

Name: Ron Moen

Organization: U of MN - Duluth - NRRI

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Project Basic Information

Project Summary: Study road mortality of wildlife species in Minnesota and identify ways to reduce frequency of animal-vehicle collisions to conserve wildlife and improve safety on Minnesota roads

Funds Requested: $183,000

Proposed Project Completion: June 30 2024

LCCMR Funding Category: Small Projects (H)
      Secondary Category: Foundational Natural Resource Data and Information (A)

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.

Deer-Vehicle Collisions (DVCs) pose a significant risk to public safety on Minnesota roads. In 2019, 1,263 DVCs were reported to the MN Department of Public Safety (MnDPS).

DVCs with minor damage are not reported to MnDPS. State Farm estimated 42,207 DVCs in 2015 based on accident claims, about 20 times the number of DVCs reported to the MN DPS. An estimated 25,000 DVCs in 2019 had an economic cost of about $124 million (see Graphic). It is probably safe to assume that each of the 25,000 DVCs resulted in a dead deer.

Thus, the wildlife cost of DVCs in 2019 was about 13% of the 189,637 deer harvested in Minnesota.

Our current MnDOT project ("Identifying Deer-Vehicle Collision Concentrations in Minnesota", $165,450) focuses on the human cost of DVCs, uses machine-learning to identify locations to reduce DVCs, and develops a small-scale pilot project to obtain field estimates of the number of unreported DVCs.

With this proposal to the LCCMR, we hope to expand the MnDOT research project with a broader focus on the potential effect of road mortality on other wildlife.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

The proposed work builds on a funded MnDOT project to analyze safety implications of DVCs in Minnesota that also includes an analysis of DVCs near Duluth. Our proposed work applies this research methodology to study other wildlife species in Minnesota and expand the geographic scale of DVC surveys.

ENRTF funding would (1) expand the geographic scope of the MnDOT research project, and (2) collect roadkill data on other wildlife species. The ultimate goals of the road mortality research project are:

1. Use foundational data collected from road mortalities to estimate the potential effect of road mortality on wildlife species (including deer).

2. Identify ways to reduce the number of Wildlife-Vehicle Collisions (WVCs), which will benefit both humans and wildlife populations.

The MnDOT project is limited to DVCs and relies heavily on data collected in the area surrounding Duluth. With ENRTF funding we would expand the road survey for DVCs to include much of the area of reported DVCs (see graphic). We would also be able to record roadkill locations of other species to include in the DVC road mortality hotspot analysis framework. This would address both driver safety and wildlife conservation objectives for MnDOT and other highway departments.

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 project outcome is a greater understanding of the potential effect of road mortality on wildlife populations in Minnesota. Road mortality will always occur, and we believe a good approach is to understand the magnitude of road mortality in the context of populations of different wildlife species. Together, the MnDOT project and the proposed ENRTF roadkill project will help protect, conserve, preserve, and enhance the state's natural resources.

Activities and Milestones

Activity 1: Collect road mortality data for MN Wildlife to inform machine learning protocol and predict road mortality hotspots

Activity Budget: $183,000

Activity Description:
The activity has three parts:

Part 1: Collect and analyze road mortality data for Minnesota Wildlife species
Part 2: Use machine-learning to predict road mortality hotspots
Part 3: Disseminate results of Part 1 and Part 2 to resource management agencies and to the public

In Part 1, we use the road mortality protocol developed in the MnDOT DVC research project. Systematic surveys will be repeated on sections of roadways for an annual estimate of road mortalities for different species. Surveys will be stratified by road type and by Average Annual Daily Traffic data. We will also collect biotic and geographic features at each mortality site (e.g., vegetation, viewshed, road features).

In Part 2, we will apply the machine learning model developed in the MnDOT project to data collected in Part 1. Machine learning techniques are able to identify statistical patterns in data sets that may not be apparent otherwise. This allows the research team to construct a model for crash risk that goes beyond a simple map-based analysis.

In Part 3, we will disseminate results of Part 1 and Part 2 to agencies (MnDOT, MNDNR), to other scientists via peer-reviewed publications, and to the public via a roadkill website.

Activity Milestones:

Description	Completion Date
Collect and analyze animal mortality data on Minnesota roads	December 31 2023
Machine learning model applied to animal mortality data	March 31 2024
Identify possible ways to reduce animal road mortality and increase human safety	June 30 2024
Disseminate results to resource management agencies and to the public	June 30 2024

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Raphael Stern	University of Minnesota - Twin Cities	Co-PI. Dr. Stern is an Assistant Professor in the Dept. of Civil, Environmental, and Geo- Engineering. He and his lab have expertise in traffic data analysis via machine learning. Dr. Stern is the PI on the related funded MnDOT project: Identifying Deer-Vehicle Collision Concentrations in Minnesota	Yes

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 be funded?

For wildlife, the systematic survey will provide an initial analysis of the effect of road mortality on wildlife populations. The effect may be larger than expected (DVC mortality equal to over 13% of the annual deer harvest), for other wildlife species the effect may be minimal at the population level.

For people, the benefit will be identifying ways to reduce wildlife-vehicle collisions (WVCs), and in conjunction with the MnDOT DVC project, making Minnesota roads safer.

This project could result in us, agency personnel, or a Citizen Science approach to continue monitoring AVCs using the protocol developed in the two projects.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Endangered Bats, White-Nose Syndrome, and Forest Habitat	M.L. 2015, Chp. 76, Sec. 2, Subd. 03i	$1,250,000
Genetic and Camera Techniques to Estimate Carnivore Populations	M.L. 2015, Chp. 76, Sec. 2, Subd. 03l	$200,000

Project Manager and Organization Qualifications

Project Manager Name: Ron Moen

Job Title: Associate Professor / Senior Research Associate

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

Key Qualifications: Ron is a Wildlife Ecologist and Research Lab Manager at the Natural Resources Research Institute, University of Minnesota Duluth. He has over 25 years of research experience focusing on mammals, telemetry, and wildlife ecology.

EDUCATION:

     Ph.D., 1995. University of Minnesota, Wildlife Conservation.
     M.S., 1988. University of Minnesota, Wildlife. Plant Physiology Minor.
     B.S., 1984. Cornell University, Division of Biological Sciences.

RELEVANT RESEARCH EXPERIENCE:

Dr. Moen has worked on and managed research projects on many different species while at NRRI, with over $4 million of research projects on Minnesota mammals funded. In addition, Dr. Moen has taught Mammalogy at the University of Minnesota Duluth since 2003, and guided over 20 graduate students doing research on mammals in Minnesota to M.S. and Ph.D. degrees.

PUBLICATIONS ON MAMMALS (Examples, > 50 peer-reviewed, > 60 Technical Reports):

Moen, R.A., C.L. Burdett, and G.J. Niemi. 2008. Movement and Habitat use of Canada Lynx during denning in Minnesota. Journal of Wildlife Management 72:1507-1513.

Moen, R., G.J. Niemi, and C. Burdett. 2008. Canada lynx in the Great Lakes. NRRI Technical Report No. NRRI/TR-2008/14.

McCann, N. and R.A. Moen. 2011. Mapping potential core areas for lynx (Lynx canadensis) using snowshoe hare (Lepus americanus) pellet counts and satellite imagery. Canadian Journal of Zoology 89:509-516.

Ditmer, M.A., J.R. Fieberg, R.A. Moen, S.K. Windels, S.P. Stapleton, and T.R. Harris. 2018. Moose movement rates are altered by wolf presence in two ecosystems. Ecology and Evolution 8(17):9017-9033.

Moen, R., and M. Swingen. (2018). Historical northern long-eared bat occurrence in Minnesota based on acoustic surveys. NRRI Technical Report No. NRRI/TR-2018-40.

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								
Project Manager		Manage project, Experimental design, Data analysis, Writing results, Field work			26.7%	0.16		$28,255
Co-Investigator		Help manage project, Experimental design, Data analysis, Writing results			26.7%	0.16		$28,960
Scientist		Experimental design, Data analysis, Writing results, Field work			26.7%	0.2		$17,343
Researcher 2 / Web Development		Field work, data entry, web site creation			24.1%	0.52		$41,246
Grad Student - Summer		Field work, Data entry and analysis, writing results			16.7%	0.14		$7,000
Grad Student - Academic Year		Field work, Data entry and analysis (machine learning), writing results			21.9%	0.36		$20,380
Undergraduate Research Assistant		Field work, Data entry, Literature searches			0%	0.38		$10,000
							Sub Total	**$153,184**
Contracts and Services								
University of Minnesota Duluth	Internal services or fees (uncommon)	NRRI GIS Lab fee @ $5.25 / hour. Standard user fee for access to NRRI GIS lab, estimated at 38 hours				0		$200
							Sub Total	**$200**
Equipment, Tools, and Supplies								
	Tools and Supplies	Dash cams (4), Cameras w/ GPS (4), Latex gloves (20 boxes), SD cards (8), Lithium AA batteries (2 boxes)	Dash cams record road mortalities while driving, cameras w/ GPS give site-specific data, SD cards for cameras/Dashcams, Latex gloves for touching dead animals, batteries for power cameras					$2,500

							Sub Total	**$2,500**
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Estimated 60 trips, 13,000 miles, 1 person / trip, some overnight	In state travel to search for wildlife mortalities on roads					$23,816
	Conference Registration Miles/ Meals/ Lodging	Conference attendance (e.g., The Wildlife Society meetings, DNR Roundtable). Estimated Costs include conference registration fee and GSA approved rates for mileage, hotel, per diem.	Presentations/Discussion on results of road mortality survey project					$1,000
							Sub Total	**$24,816**
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Publication	Page charges for manuscripts on Road Mortality Project results	Peer-reviewed publications increase acceptance of research results					$2,300
							Sub Total	**$2,300**
Other Expenses								
							Sub Total	-
							Grand Total	**$183,000**

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	MnDOT Project Number: 2020-063, Contract WO#: 1036342 WO#11 TITLE: Identifying Deer-Vehicle Collision Concentrations in Minnesota	The MnDOT project referenced in this proposal is funded from 7/1/2021 to 11/30/2023 with Raphael Stern as PI and Moen as CoPI. The focus of the MnDOT project is reducing Deer-Vehicle collisions. In this proposal to LCCMR we are expanding the work to other wildlife species (also of concern to MnDOT) and collecting data on deer from a broader area (the direct link between the two proposals). There will be 50% overlap in time in these projects if this proposal to LCCMR is funded. The MnDOT award is technically not matching funds for the LCCMR project, so the award amount is not specified here. However, the proposed LCCMR project will significantly benefit from the analyses and data developed under the MnDOT award, and the MnDOT project will significantly benefit from the geographic expansion of data collection.	Secured	-
-			**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	$99,934
			Non State Sub Total	**$99,934**
			Funds Total	**$99,934**

Attachments

Required Attachments
Visual Component
File: b333cd45-56f.pdf

Alternate Text for Visual Component
Figure showing the wildlife and human costs of deer-vehicle collisions (DVCs). The number of deer killed by cars equals about 13% of the number killed during the hunting season. Other wildlife species are rarely recorded in the MN DPS database, and our goal in this project is to increase understanding of the effect of road mortalities on wildlife populations....

Optional Attachments
Support Letter or Other

Title	File
UMD Sponsored Projects Transmittal Letter	944f58ba-7b0.pdf
MnDOT Letter of Support	5b429869-ac8.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?
No

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?
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

Effects of Road Mortality on Minnesota Wildlife Populations

Problem: Deer-Vehicle Collisions (DVCs) and Wildlife-Vehicle Collisions (WVCs) in Minnesota

Only 1 in 20 DVCs may be reported to MN DPS[2]

Our Calculations:

1,263 DVCs reported to MN DPS in 2019. With a 5% reporting rate[2] this is 25,000 DVCs in 2019

Economic Cost[3]:

Death:	$1,659,000
Serious Injury:	$96,200
Minor Injury	$22,300
PDO:	$ 4,500

The Wildlife Cost of 25,000 DVCs:

13% of 2019 deer harvest. Wow! What about other wildlife species?

The Human Cost of 25,000 DVCs:

Reported DVCs: $18 million
20 deaths in the last 5 years[1]
Unreported DVCs: $106 million

Next Steps:

Other wildlife species are not common in the MN DPS database. A collision with a raccoon, for example, would usually not even cause a PDO event. Data collected for each road mortality will include physical and biological characteristics of the collision site that are also collected for DVCs on the MnDOT project.

MnDOT project: > 8,000 historic DVCs are being used in a machine learning based approach to do a hotspot analysis of increased accident risk for deer. We will apply techniques developed in the MnDOT project to other wildlife species.
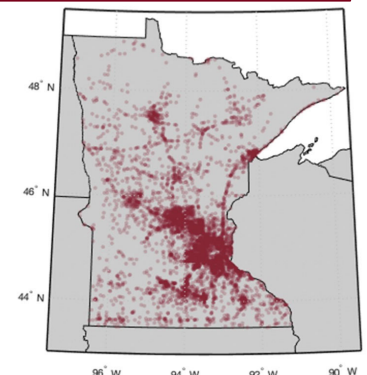
[1] MN DPS Dept. of Vehicle Safety | http://bit.ly/3vVM7XJ
[2] Conover, M.R. 2019. Human–Wildlife Interactions 13(2):264–276
[3] https://dps.mn.gov/divisions/ots/reports-statistics/Documents/2019-crash-facts.pdf