Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-402

Proposal Title: Investigating Social Interactions and Relationships of Urban Coyotes

Project Manager Information

Name: Geoffrey Miller

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

Office Telephone: (612) 624-5599

Email: mill8849@umn.edu

Project Basic Information

Project Summary: We will assess the habitat use, social associations and genetic relationships between coyotes in St. Paul to rigorously address the population structure of coyotes in Minnesota's urban landscapes.

ENRTF Funds Requested: $755,000

Proposed Project Completion: June 30, 2030

LCCMR Funding Category: Fish and Wildlife (D)

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?

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

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.

Coyotes are common throughout urban centers across Minnesota. In the ENRTF-funded Twin Cities Coyote and Fox Project, the most-commonly posed questions during public outreach relate to the social interactions of coyotes. Is the lone coyote I saw in my neighborhood related to the group of coyotes seen nearby? How many coyotes are typically in a social group within a territory? Despite the frequency of these questions, there is a lack of scientific evidence to provide rigorous answers. Coyotes lack individually identifiable features, and they often travel alone regardless of how many individuals they share a territory with. Without a systematic approach to mark and track many individuals within small study areas, the social status and number of coyotes in a territory is impossible to address. Because of this, questions about the associations between coyotes remain largely unanswered. Coyotes are also socially flexible; for example, one coyote tracked beginning in 2023 in Bloomington spent months within the territory of coyotes in Minneapolis before returning to its original territory. Addressing the social relationships between urban coyotes would not only provide answers to questions posed by Minnesotans, but may shed light on how social status predisposes individual coyotes to human–wildlife conflict.

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.

Investigating social relationships between coyotes requires intense focus on a small subset of the population. To do this, we will focus on three well-known packs of coyotes in St. Paul to address three broad research questions:

1) In what contexts do adult coyotes associate with each other within territories, and how do they interact with others in neighboring territories?

2) What are the genetic relationships between coyotes that share territories?

3) Do individuals sharing territories have similar diets, pathogen infection patterns, and select similar habitats, and does that differ from coyotes in neighboring territories?

In addition to tracking adult coyotes in the focal territories with GPS tracking collars, uncollared subadults will be marked with ear tags so that their activity can be tracked in a camera array established in collaboration with St. Paul Parks and Recreation (SPPR). In addition, a community science initiative to track human interactions and locations of marked and collared individuals. Partnership with SPPR will also include outreach and education efforts to engage the public. This focus on a subset of urban coyotes will provide vital behavioral information for wildlife managers and Minnesotans not only in St. Paul, but in urban centers across Minnesota.

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?

Sustainable coexistence with and management of wildlife populations requires intimate knowledge of their natural history, behaviors, and habitat preferences. An aspect of coyote behavior that remains mysterious is their social flexibility, and how that contributes to human–wildlife conflict. Focusing on the social relationships and genetic relatedness of coyotes in territories known from the Twin Cities Coyote and Fox Project in St. Paul will provide missing context that is applicable not only to managers working in urban landscapes across the Twin Cities, but also to other urban centers with coyote populations such as St. Cloud, Rochester, and Duluth.

Activities and Milestones

Activity 1: Assessing Social Relationships and Movements of Coyotes in Focal Packs in St. Paul

Activity Budget: $697,275

Activity Description:
Work on the ENRTF-funded Twin Cities Coyote and Fox Project has established the location of stable coyote territories across the Twin Cities through tracking individual residents within those territories. However, the broad spatial scope of that work left unanswered questions about the interactions of coyotes within and among those territories. In this work, we will address these social relationships by tracking adult individuals in three territories in St. Paul using GPS collars: the St. Paul Campus Pack, the Como Pack, and the East Bank Pack (up to 15 individuals). In addition to these focal territories, we will track single adult individuals in neighboring territories to establish territorial boundaries across St. Paul and surrounding municipalities (15 additional individuals). Alongside tracking with GPS collars, collared adult coyotes and uncollared subadults will be fitted with ear tags with unique numbers and color combinations so they can be tracked within a camera array of up to 60 cameras established across St. Paul in collaboration with St. Paul Parks and Recreation. A web interface will be established to crowdsource marked coyote observations and interactions with the public so that specific coyotes involved in human–coyote conflict can be tracked.

Activity Milestones:

Description	Approximate Completion Date
Equipment acquisition, personnel training, camera array deployment, and trapping preparation.	August 31, 2027
First capture season in focal territories.	September 30, 2027
First capture season in neighboring territories.	February 28, 2028
Second capture season in focal territories.	September 30, 2028
Second capture season in neighboring territories.	September 30, 2028
Conclusion of camera array.	December 31, 2029
Final report and activity results submitted.	June 30, 2030

Activity 2: Kinship Analysis, Diet, and Disease in Urban Coyotes

Activity Budget: $57,725

Activity Description:
A critical component of social interactions in many wildlife species is the genetic relatedness of individuals. To map the relatedness of collared and ear-tagged coyotes, we will extract DNA obtained from skin biopsy and blood samples (collected during processing and ear tag application). Kinship analyses will be used in combination with tracking data to assess how genetic relatedness affects the social interactions among individuals. Alongside genetic mapping, stable isotope analysis of hair samples collected from individuals will test whether there are differences in dietary preferences in coyotes both within the same territory and among different territories, and serological testing for pathogen antigens will show whether there are differences in infection for eight pathogens across territories. These latter two investigations will provide continuity to disease and diet data collected over the course of the Twin Cities Coyote and Fox Project between 2019–2026.

Activity Milestones:

Description	Approximate Completion Date
Completion of sample collection during first capture season.	February 28, 2028
DNA extraction and shipping of all samples from first capture season.	April 30, 2028
Conduct kinship analysis for genetic samples from the first season.	June 30, 2028

Completion of sample collection during second capture season.	February 28, 2029
DNA extraction and shipping of all samples from second capture season.	April 30, 2029
Conclude kinship analysis.	June 30, 2029
Final report and activity results submitted.	June 30, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
James Forester	UMN Department of Fisheries, Wildlife, and Conservation Biology	Co-PI / Lead ecological and behavioral analysis of movement data collected from coyotes.	Yes
Adam Robbins	St. Paul Parks and Recreation	Assistance in selection of sites for coyote capture and monitoring through camera grids in St. Paul Parks.	No
Emily Dunlap	St. Paul Parks and Recreation	Assistance in selection of sites for coyote capture and monitoring through camera grids in St. Paul Parks.	No
Mary Henke-Haney	St. Paul Parks and Recreation	As Education Coordinator at St. Paul Parks and Recreation, Mary will have input on the development and publicity campaign of a web interface where the public can share information on encounters with coyotes.	No

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.
The nature of an urban project studying a charismatic wildlife species makes it inherently conducive to public engagement. Coyotes are both a mysterious species and one that can be found in back yards in the most populous areas of Minnesota. Not only will we engage residents of St. Paul involved in reporting sightings of coyotes through a web interface developed for the project, but we will also work with St. Paul Parks and Recreation to ensure that we maximize the impact of the project through summer programming in K–12 education and other outreach events. Residents will also be able to track project updates on social media, such as a project Facebook page. Furthermore, as with previous mortalities on the ENRTF-funded Twin Cities Coyote and Fox Project, coyotes that die over the course of this study will be contributed to the Bell Museum of Natural History's mammalogy collection. There, these specimens can contribute to a growing collection of urban coyotes and foxes collected over the course of that project that may be used in answering study questions posed by future generations of researchers. Beyond local dissemination and engagement, we will publish research findings in journals such as Animal Behaviour for behavioral findings regarding coyote social interactions, and the Journal of Animal Ecology for findings related to the ecological impacts of those behaviors. These findings will also be shared locally in the Minnesota Chapter of the Wildlife Society, as well as a relevant national conference (the specific conference depends on research findings).

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 expand upon ongoing research, with the long-term goal of establishing a dataset spanning over a decade describing coyote movement, habitat preferences, and behaviors in the Twin Cities Metropolitan Area. In addition to publishing and disseminating these results through presentations at national and regional conferences, the project manager will apply for funding from the National Science Foundation (NSF) as the project concludes in 2029, possibly leveraging funds associated with the NSF urban Long-Term Ecological Research (LTER) site established in the Twin Cities.

Project Manager and Organization Qualifications

Project Manager Name: Geoffrey Miller

Job Title: Postdoctoral Associate

Provide description of the project manager's qualifications to manage the proposed project.
Dr. Geoffrey D. Miller completed a PhD in Ecology, Evolution, and Behavior at the University of Minnesota (2025), and has continued his work on the ENRTF-funded Twin Cities Coyote and Fox Project (TCCFP) as a postdoctoral associate in the Fisheries, Wildlife and Conservation Biology department since then. He has led field work for this project spanning two grant cycles from 2019 to 2026, during which he captured and handled 49 coyotes, 39 red foxes, and five gray foxes. Through this work, he has gained the necessary experience to efficiently capture and deploy GPS collars on urban coyotes and has established working relationships with an extensive network of private, state, federal, and municipal partners throughout the proposed study area. This combination of expertise, social connections, and intimate knowledge of the species within the study area uniquely qualifies him to manage the logistics of a project of this scale in an urban landscape. Dr. Miller also has relevant experience in DNA extraction laboratory methods and analysis of spatiotemporal data from GPS collars and trail cameras. Previous analyses of GPS data from coyotes focused on how humans in the urban and rural landscapes in Minnesota affect the movement ecology and interspecies interactions of coyotes and foxes across the Twin Cities Metropolitan Area and Greater Minnesota.

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

Organization Description:
Within the University of Minnesota College of Food, Agricultural, and Natural Resource Sciences, the Department of Fisheries, Wildlife, and Conservation Biology is nationally recognized as a leader in research and training undergraduates in the field of natural resources. In addition to training the next generation of professionals, the department's mission is to conduct rigorous research that is applicable to real-world problems in the management and conservation of natural resources faced by resource managers, community members, and organizations within Minnesota and across the world.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Geoffrey Miller / R5 Researcher / PI		Project management: leading field effort, data analysis and project logistics.			36.6%	3		$282,592
James Forester / Associate Professor / Co-PI		Lead ecological and behavioral analysis of movement data collected from coyotes			36.6%	0.25		$55,085
1 R1 Researcher		Hired for first 2.5 years of project operation to manage camera grid operation and assist in capture			36.6%	2.5		$176,959
1 Field Technician		Technicians will be hired each year in three 4-month capture seasons			32.3%	1		$52,285
							Sub Total	**$566,921**
Contracts and Services								
TBD	Service Contract	Serological testing of blood samples for antigens to pathogens				-		$15,000
TBD	Service Contract	Stable isotope testing of hair samples to determine dietary niches of captured coyotes				-		$1,200
TBD	Service Contract	Genetic sequencing of captured coyotes to determine genetic relationships between individuals.				-		$12,000
TBD	Service Contract	Collar service ($650/collar, 30 collars)				-		$19,500
							Sub Total	**$47,700**
Equipment, Tools, and Supplies								
	Equipment	GPS collars (30 collars @ $2,500/collar)	To track movements of individual study animals.					$75,000
	Tools and Supplies	Equipment and supplies for animal capture and managing biological samples, including pharmaceuticals and traps. Also includes items	This category of items are necessary for effective animal capture, handling and monitoring.					$12,854

		necessary for monitoring animals, such as spotting scopes.						
	Tools and Supplies	Qiagen DNeasy extraction kits (2 kits at $700/kit)	Supplies necessary for DNA extraction prior to sending samples for sequencing.					$1,400
	Equipment	Trail cameras to monitor study animal movement (60 @ $300/unit including lock box and cable)	This equipment is necessary for monitoring coyotes across the grid comprising the study area.					$18,000
	Tools and Supplies	Trail camera operating supplies (lithium batteries, SD cards, etc.)	Necessary for maintenance of camera grid.					$5,000
							Sub Total	**$112,254**
Capital Equipment								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	35,000 miles @ $0.725 for checking traps, tending cameras, and monitoring study animals between 3 personnel	Completion of field work including the capture and monitoring of study animals and management of camera arrays					$25,375
	Conference Registration Miles/ Meals/ Lodging	PI will make a formal presentation at The Wildlife Society local chapter	This will serve as both local dissemination and outreach to communicate study results. $165 for lodging (1 night), $102 meal per diem ($51/day first and last), $309 conference registration, and $174 mileage (240 miles @ $0.725).					$750
							Sub Total	**$26,125**
Travel Outside Minnesota								
	Conference Registration	PI will make a formal presentation at a national professional society	PI will submit a formal presentation in order to disseminate results of the study. $825 for lodging (5 nights), $500	X				$2,000

	Miles/ Meals/ Lodging		for airfare, $374 per diem ($51 first/last, 4 days $68), and $301 for conference registration.					
							Sub Total	**$2,000**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$755,000**

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	PI will make a formal presentation at a national professional society	It is crucial to disseminate our results to a national audience. Extending the reach of this work will not only share what was learned in the course of this study, but will potentially aid in acquiring future funding.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
Cash	54% MTDC foregone indirect costs	Projects generally have associated overhead/indirect costs. These charges are real expenses incurred in the conduct of projects and need to be recovered from the sponsor. If this award is reduced from the requested amount, the proposed cost sharing will be reduced proportionate	Secured	$407,700
			State Sub Total	**$407,700**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$407,700**

Total Project Cost: $1,162,700

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: f24b08eb-dfe.pdf

Alternate Text for Visual Component

This graphic displays a map of coyote territories to be targeted for collaring, as well a trail camera image indicating plans for a camera grid to monitor movement of marked individuals. It indicates plans for genetic testing and public engagement through a website to report human interactions with marked coyotes....

Supplemental Attachments

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

Title	File
Saint Paul Parks and Recreation Support Letter	a840544b-6c0.pdf
UMN SPA Approval	4c319a8b-3f1.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:

James Forester (University of Minnesota); Adam Robbins (St. Paul Parks and Recreation); Emily Dunlap (St. Paul Parks and Recreation); Mary Henke-Haney (St. Paul Parks and Recreation)

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