



Environment and Natural Resources Trust Fund

2023 Request for Proposal

General Information

Proposal ID: 2023-090

Proposal Title: Changing Distribution of Flying Squirrel Species in Minnesota

Project Manager Information

Name: Michael Joyce

Organization: U of MN - Duluth - NRRRI

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Project Basic Information

Project Summary: We will determine the current distribution and habitat associations of northern and southern flying squirrels to fill key knowledge gaps in flying squirrel status in Minnesota.

Funds Requested: \$186,000

Proposed Project Completion: June 30, 2025

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.

There are two species of flying squirrels in Minnesota. Historically, southern flying squirrels lived in hardwood forests of the southern half of Minnesota while northern flying squirrels occupied hardwoods and transitional forests in northern Minnesota (see visual component). With changing climate, southern flying squirrels are rapidly expanding their range north and pushing northern flying squirrels further north in the process.

The rapid changes in flying squirrel distribution have led to northern flying squirrels being listed as a species of concern in Michigan, Wisconsin, and elsewhere in eastern North America. Neither species has conservation status in Minnesota, due in part to lack of adequate data to assess current distribution or interactions between the two species. Given the rapid change in flying squirrel populations in several eastern states, increasing understanding of the current distribution and abundance of flying squirrels in Minnesota is a critical step in evaluating the conservation status of both species.

Many people enjoy watching flying squirrels at bird feeders. They also have expressed strong interest in learning more about flying squirrels in Minnesota, including which flying squirrel species live near them.

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 the current distribution of both flying squirrel species across Minnesota to provide foundational data that will fill key knowledge gaps on flying squirrel distribution and ecology. Thus, project results will have high conservation and management value.

Recent research has shown that acoustic detectors, such as those used to monitor bats, can detect flying squirrel vocalizations and identify calls to species. Acoustic detectors are an efficient, cost-effective method for detecting flying squirrels where they occur.

We will re-analyze existing acoustic data from a previous ENRTF-funded bat project (M.L. 2015, Chp. 76, Sec. 2, Subd. 03i. Endangered bats, white-nose syndrome, and forest habitat), conduct additional acoustic surveys, and live-trap and radiocollar flying squirrels. We will use the data we collect to:

1. Describe the historic and current distribution of both flying squirrel species.
2. Examine habitat use overlap to determine potential for coexistence and evaluate spatial interactions.
3. Summarize fine-scale habitat used for nesting by both species.

We also expect that our results will be of high public interest and value. To inform the public about the project and disseminate project results, we will conduct public outreach as we have successfully done in past ENRTF projects.

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 both flying squirrel species in Minnesota that is of high value to the DNR. Northern flying squirrel populations may be declining as southern flying squirrels move north. The DNR will begin reviewing data on flying squirrels and other species for the next update of the State Wildlife Action plan in 2-3 years. The data we collect would fill important knowledge gaps and help the DNR evaluate the status of both species more effectively. The acoustic monitoring protocol we develop could also be used to monitor changes in population status in the future.

Activities and Milestones

Activity 1: Determine the current distribution and habitat associations of flying squirrels in Minnesota

Activity Budget: \$186,000

Activity Description:

We will evaluate the distribution of both flying squirrel species using two different sets of acoustic data. First, we will use existing data sampled broadly across the forested portion of Minnesota from 2015-2021. Over 400,000 calls were recorded at about 350 locations from an ENRTF-funded bat project and follow-up monitoring. Second, we will conduct acoustic surveys at sites where both flying squirrel species occur in 2023-2024 to collect detailed information on overlap in habitat use. Evaluating habitat associations of each species where they overlap can help determine how both species can coexist and would be useful to managers. We will analyze acoustic data using established methods developed by others and tested by us during a recent pilot study. We will also compile flying squirrel records from other data sources (Minnesota Biological survey, other projects). Finally, we will live-trap and deploy radiocollars on both species of flying squirrel and monitor collared squirrels to evaluate habitat use, to validate our acoustic survey results, and to examine spatial interactions between the two species. Part of the zone of overlap in species distributions is near Duluth, and UM-Duluth Biology students would gain valuable field experience on the telemetry part of the project.

Activity Milestones:

Description	Completion Date
Disseminate preliminary results to the public via outreach and media	June 30, 2024
Analyze acoustic data to determine current distribution of both species across Minnesota	December 31, 2024
Conduct new acoustic surveys to determine habitat associations of both species of flying squirrel	June 30, 2025
Deploy radiocollars on 28 flying squirrels (14 per species) and monitor habitat use and movements.	June 30, 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Michael Joyce	UMD-NRRI	Project manager overseeing all aspects of this project including study design, coordination of field work, data management and analysis, and reporting.	Yes
Dr. Ron Moen	UMD-NRRI	Co-investigator. Will provide input and support on all aspects of this project and will work with project manager to oversee all aspects of this project.	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 work be funded?

This project will leverage existing acoustic data collected by a previous ENRTF-funded project (2015. Endangered bats, white-nose syndrome, and forest habitat) to generate foundational data on flying squirrel distribution. We have discussed this project with MN DNR non-game mammologist Gerda Nordquist to ensure that the data we collect are of high value to the MN DNR. Specifically, we have designed this project to address key knowledge gaps and provide information that will help inform the status of both species when the DNR begins reviewing species statuses as part of the next Wildlife Action Plan update.

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
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

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, University of Minnesota Duluth. He has over 10 years of wildlife research experience, including telemetry, habitat analyses, and use of acoustic monitoring devices to detect and identify flying squirrel calls. Michael is working on and managing two ENRTF-funded projects and is project manager for another currently being considered for funding as part of the FY22 RFP. He has worked extensively on wildlife research projects in northern Minnesota over the last decade.

EDUCATION:

Ph.D., 2018. University of Minnesota, Integrated Biological Sciences.

M.S., 2013. University of Minnesota, Integrated Biological Sciences.

B.S., 2008. University of Wisconsin-Madison, Molecular Biology.

RECENT PUBLICATIONS:

Joyce, M., J. Erb, P. Coy, B. Sampson, R. Moen. (in revision). Age- and sex-specific dispersal in a harvested population of

American martens. Submitted to Journal of Mammalogy.

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* (pp. 181-220).

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*

Organization: U of MN - Duluth - NRRRI

Organization Description:

The Natural Resources Research Institute (NRRRI) is a part of the University of Minnesota research enterprise and employs over 130 scientists, engineers and technicians. Its mission is to deliver integrated research solutions that value our resources, environment and economy for a sustainable and resilient future.

NRRRI collaborates broadly across the University system, the state and the region to address the challenges of a natural resource-based economy.

By partnering with industry, business leaders, agency decision-makers and many others, NRRRI researchers frame and deliver on real-world solutions. NRRRI scientists have extensive experience in managing large, interdisciplinary projects. Major objectives include the development of tools for environmental assessment and resource management. NRRRI's role is as an impartial, science-based resource that develops and translates knowledge by characterizing and defining value-resource opportunities, minimizing waste and environmental impact, maximizing value from natural resource utilization and maintaining/restoring ecosystem function.

Major outcomes from NRRRI projects include informing environmental management and policy and assisting industry and communities in defining and maintaining the social license to operate in natural systems. NRRRI has established mechanisms for sharing outcomes through press releases, publication in peer-reviewed journals, technical reports, annual reports, periodicals, and through social media channels.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Michael Joyce, Research Scientist		Project Manager			25.1%	0.2		\$17,216
Ron Moen, Research Scientist/Professor		co-Investigator			25.1%	0.16		\$27,568
Wildlife Technician		Field and office work			22.3%	0.6		\$28,017
M.S. Graduate Student		Complete MS thesis on project			19.1%	0.26		\$14,255
Seasonal Wildlife Technician		Conducts field and office work			7%	0.8		\$26,965
Undergraduate research assistant		Conducts field and office work			0%	0.7		\$17,472
							Sub Total	\$131,493
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Equipment	New acoustic detectors with microphones (15 @ \$1,400 ea) and 10 replacement microphones for existing acoustic detectors (@ \$200 ea).	To conduct acoustic surveys for flying squirrels					\$23,000
	Tools and Supplies	Supplies for acoustic surveys (batteries, bait, locks/straps, etc.)	To conduct acoustic surveys for flying squirrels					\$3,000
	Equipment	Radiocollars for flying squirrels (14 collars x 2 species = 28 collars @ \$150 ea)	For tracking habitat use of flying squirrels					\$4,200
	Tools and Supplies	Flying squirrel live trapping supplies (cage traps, wood for trapping platforms, bait, pharmaceuticals, etc.)	For live-trapping flying squirrels to fit radiocollars					\$4,307
							Sub Total	\$34,507
Capital Expenditures								

							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel for field work on acoustic surveys, trapping and collaring flying squirrels, and tracking radio-collared study animals. Includes mileage (75%) and lodging for entire research team. Mileage will be reimbursed at \$0.585/mile (MN state rate)	Collect field data for project					\$20,000
							Sub Total	\$20,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$186,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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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	\$102,300
			Non State Sub Total	\$102,300
			Funds Total	\$102,300

Attachments

Required Attachments

Visual Component

File: [48083d0e-82f.pdf](#)

Alternate Text for Visual Component

The visual component shows a map of historic distribution of northern and southern flying squirrels, a picture of a flying squirrel from Itasca State Park, a map of >350 sites where >400,000 acoustic files have been collected that we would analyze, and example sonograms of flying squirrel calls....

Optional Attachments

Support Letter or Other

Title	File
UMD Sponsored Projects Transmittal Letter	a595dd03-c65.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?

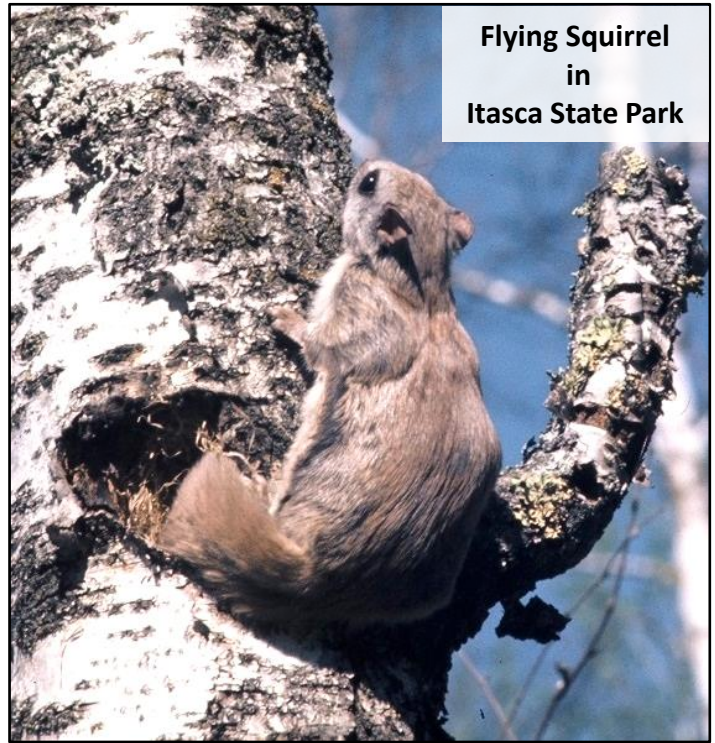
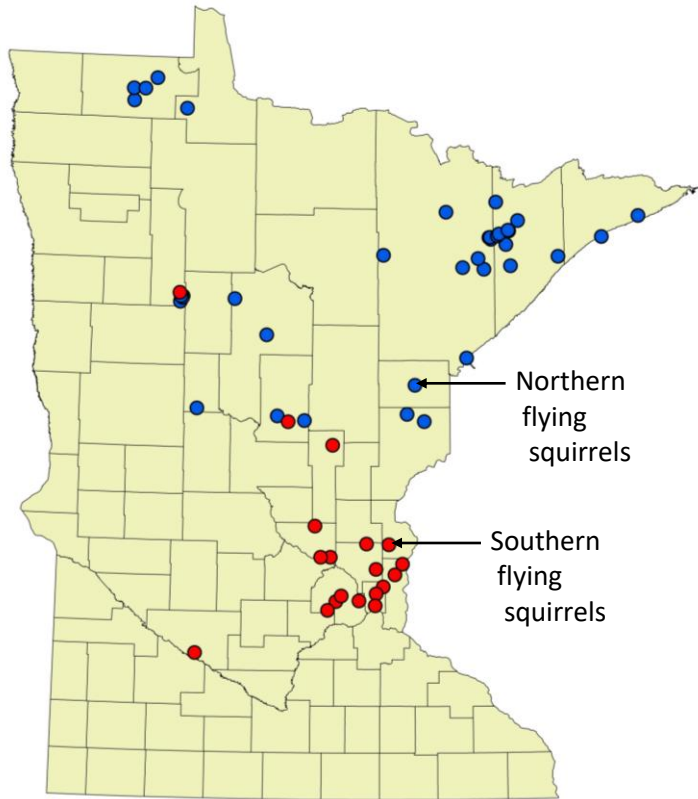
Yes

Does the organization have a fiscal agent for this project?

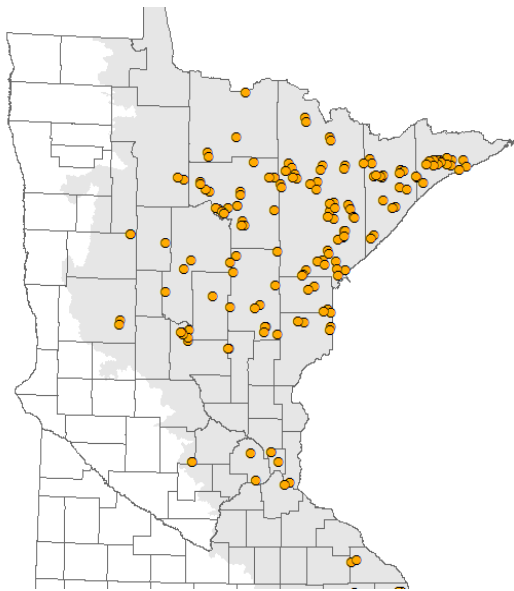
Yes, Sponsored Projects Administration (UMD)

Changing Distribution of Flying Squirrel Species in Minnesota

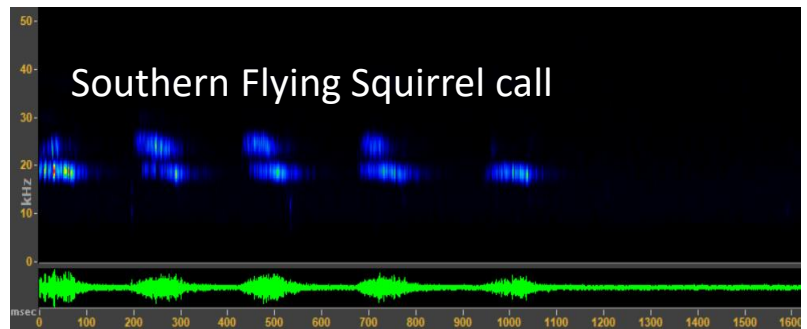
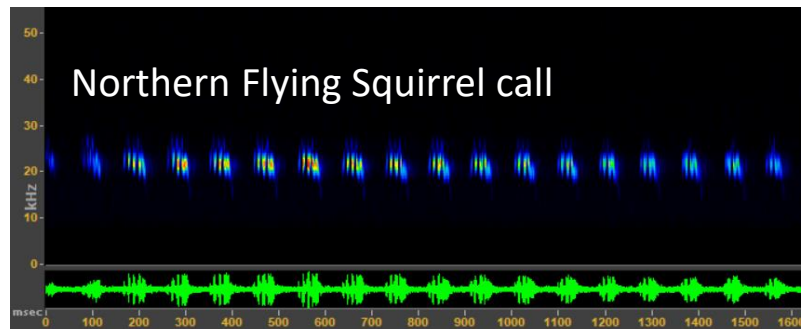
Historical distribution of flying squirrels: the current distribution of both species is unknown



Acoustic Detectors: We will analyze bat acoustic data for flying squirrel calls



> 350 Acoustic survey sites 2015 - 2020
with over 400,000 call files to check



We will determine the current distribution and habitat associations of northern and southern flying squirrels to fill key knowledge gaps in flying squirrel status in Minnesota.

