



# Environment and Natural Resources Trust Fund

## 2023 Request for Proposal

### General Information

**Proposal ID:** 2023-169

**Proposal Title:** Efficacy of Urban Archery Hunting to Manage Deer

### Project Manager Information

**Name:** Jacob Haus

**Organization:** Minnesota State Colleges and Universities - Bemidji State University

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### Project Basic Information

**Project Summary:** Several municipalities across Minnesota conduct special deer hunts within city-limits, but the efficacy is unknown. An analysis of deer survival and habitat use will improve management practices in these regions.

**Funds Requested:** \$393,000

**Proposed Project Completion:** December 31, 2025

**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): NW

**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 population within urbanized areas cause substantial socioeconomic burdens to municipalities. Overabundant deer populations result in greater rates of deer-vehicle collisions, landscape damage, and increased risk of disease transmission (e.g., Lyme Disease, CWD). Urban deer are difficult to manage as anthropogenic food sources can maintain artificially high population densities, and management practices such as a firearm hunting cannot be safely conducted. Many municipalities throughout Minnesota utilize 'special city archery hunts' that allow for more liberalized harvest regulations than during regular archery seasons. The Bemidji City Council formed the Deer Management Committee in 2005 to operate special archery hunts within 3 city districts to limit negative impacts from overabundant deer populations for city residents. The hunt has removed 478 deer from within city limits since implementation, with greater rates of harvest in more recent years. Annual spotlight surveys suggest deer populations are increasing within all 3 districts however. Deer may alter their behavior or movement in response to hunting pressure, or the number of deer harvested may simply be inadequate to prevent population growth. Special archery hunts may be able to manage urban deer populations, but more research is needed to evaluate the factors affecting their efficacy.

### **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.**

During the winter (January – March) of 2024 and 2025, we will live-capture a total of 40-50 adult female deer within city limits and affix individuals with GPS collars. Collars will provide information on both deer behavioral response to the city hunt as well as mortality data. Annual mortality rate of adult females is the most influential driver of deer population growth, and deer abundance is best managed by adjusting harvest rates of adult females. We will estimate overall rate of mortality as well as mortality due to harvest inside city limits, harvest outside city limits, wounding loss, vehicle collision, and natural causes. We will track the number of special hunt permits issued, hunter effort, and spatial distribution of hunting pressure using both mandatory logs submitted by hunters at the end of the season as well as small GPS units with participating hunters.

Collars on deer will be programmed to record a GPS location fix on individual deer every 30 minutes from 1 August to 31 January each year. We will examine changes in deer behavior in response to the city hunt using resource selection functions before, during, and after the hunting season.

### **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?**

Most research involving urban deer management evaluates human attitudes towards deer and options for non-lethal management. Minnesota is unique in that support of regulated lethal deer management is strong among suburban residents, but there is a paucity of guidelines for effective suburban archery hunting programs. This research will develop best management practices for special city archery hunts, including the spatial distribution of hunting pressure, harvest objectives, and the necessary number of issued permits to achieve management objectives. The guidelines established during this research can be implemented to improve harvest management the special archery hunts throughout the State.

## Activities and Milestones

### Activity 1: Capture, collar, and monitor adult female white-tailed deer within Bemidji city limits

**Activity Budget:** \$285,000

**Activity Description:**

We will capture deer using 25'x25' drop nets and netted Clover traps throughout Bemidji City limits between 1 January and 31 March in both 2024 and 2025. We will chemically immobilize deer before removing them from the trap and affixing GPS collars and uniquely identifiable ear tags. Capture locations will be representative of the available habitats within city limits, and we will select locations that prioritize animal safety during the capture process. Deer will be monitored for 2 years or until the conclusion of the study (12-31-2025), with collars recording a GPS location every 30 minutes. At the conclusion of the study, any remaining collars will be removed from the study animals via a remote break-off mechanism in the collar. We will inform participants of the special city hunt that all collared animals are available for harvest, and the presence of the collar should not influence their harvest decisions.

Outcome: Capture 40-50 study animals in total during 2 winter capture periods (2024 and 2025). Monitor deer through the 2025 hunting season to collect data for Activity 2.

**Activity Milestones:**

Description	Completion Date
Identify suitable areas for deer capture within city limits.	November 30, 2023
Conduct capture efforts during winter 2024, with the goal of 25 deployed collars.	March 31, 2024
Conduct capture efforts during winter 2025, with the goal of 25 deployed collars.	March 31, 2025
Collect movement and survival data from collared deer for 1 year or until project termination.	December 31, 2025

### Activity 2: Estimate cause-specific mortality rates for monitored deer and determine shifts in habitat use in response to the city hunt

**Activity Budget:** \$82,000

**Activity Description:**

We will use survival data to determine the percentage of deer being removed from the population through harvest, wounding loss, vehicle collision, and disease, as well as the percentage of deer surviving to the next year. Deer will have tags with a phone number for hunters to call when they harvest a collared individual. We will analyze deer survival data using Kaplan-Meier survival curves and Cox proportional hazard modeling. To examine habitat use during the hunt, we will model resource selection using landscape variables (e.g., distance to road, distance to building, percent wetland cover, percent forest cover, ect.) for both day and night time locations before, during, and after the hunting season.

The distribution of hunting pressure through time and space will also be quantified using small GPS location loggers provided to participating hunters. GPS loggers will be activated by pressing a single on/off button before and after each hunt, and will internally store location data. Information on hunting pressure will be included in the analysis of deer movement and survival.

Outcome: Determine what percentage of adult females must be removed via harvest to control population growth, and how to most effectively achieve sufficient rates of harvest.

**Activity Milestones:**

Description	Completion Date
Analyze rates of deer harvest and mortality in relation to permits issued to hunters.	December 31, 2025

Quantify the habitat use of deer in response to hunting pressure.	December 31, 2025
Record hunter locations via GPS units to estimate the distribution of hunting pressure	December 31, 2025

### Activity 3: Identify management practices that effectively control deer population within urban areas using special archery hunts

**Activity Budget:** \$26,000

**Activity Description:**

Findings from Activity 2 will be integrated with results from hunter observation logs and harvest data. We will use the results of this research to develop recommendation for cities planning to implement or continue suburban archery hunting programs. Guidelines will include minimum hunter density and distribution, numbers of allotted tags per hunter, and priority habitats to target during management efforts.

Outcome: Develop guidelines for effective urban deer archery hunts in Minnesota.

**Activity Milestones:**

Description	Completion Date
Provide guidelines to regional and state wildlife managers.	December 31, 2025
Draft manuscripts of research results for submission to peer-reviewed scientific journals.	December 31, 2025

## Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Brian Hiller	Bemidji State University	Dr. Hiller has collected much of the preliminary data on deer density within Bemidji city limits and will continue to cooperate with Dr. Haus regarding the design and execution of the research project.	No
Deer Management Committee	Bemidji City Council	The Deer Management Committee has coordinated the special city archery hunt on behalf of the Bemidji City Council for 15 years. The committee will continue to issue permits, register harvested deer, and record information on hunter permits and hunting locations.	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?**

There are 28 cities and municipalities throughout Minnesota conducting special archery hunts, including several cities attempting to manage CWD outbreaks. Many additional cities experience negative impacts of overabundant deer populations but do not have the infrastructure to design an effective management program from the ground up. Based on the results of this research, we will develop recommendations for urban archery hunting best management practices. Cities across the state will be able to utilize the results of this research to improve the efficacy of their deer management efforts. The project will require no additional work or funding beyond the proposed timeline.

## Project Manager and Organization Qualifications

**Project Manager Name:** Jacob Haus

**Job Title:** Assistant Professor

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

Dr. Haus is a Certified Wildlife Biologist® and Assistant Professor in the wildlife biology program at Bemidji State University. He specializes in the management of white-tailed deer populations. He regularly coordinates field-based research projects in collaboration with state, federal, and tribal wildlife agencies, advises graduate students, and publishes research in peer-reviewed journals.

Selected publications:

Dion et al. 2021. Birth site selection by white-tailed deer in an area with low risk of predation. *Northeastern Naturalist* 28:94-105.

Dion et al. 2020. White-tailed deer neonate survival in the absence of predators. *Ecosphere* 11:e03122.

Haus et al. 2020. Interannual variability in survival rates for adult female white-tailed deer. *Journal of Wildlife Management* 84:675–684.

Haus et al. 2020. Individual heterogeneity in habitat use has implications for survival in adult white-tailed deer. *Ecosphere* 11:e03064.

Holland et al. 2020. Revisiting hunter perceptions toward chronic wasting disease; changes in behavior over time. *Animals* 10:187.

Dion et al. 2019. An initial performance review of vaginal implant transmitters paired with GPS collars. *Animal Biotelemetry* 7:22.

Haus et al. 2019. Land use and dispersal influence mortality in white-tailed deer. *Journal of Wildlife Management* 83:1185–1196.

Haus et al. 2019. A spatially and temporally concurrent comparison of popular density estimators for white-tailed deer. *Northeastern Naturalist* 26:305–324.

Haus et al. 2018. Theileriosis identified in multiple neonatal white-tailed deer in Delaware, USA. *Journal of Wildlife Diseases* 54:885–888.

Haus et al. 2017. Hunter perception towards chronic wasting disease; implications for harvest and management. *Wildlife Society Bulletin* 41:294–300.

Dr. Hiller is a Professor in the biology program at BSU with 15 years of experience in the wildlife profession. The City of Bemidji Deer Management Committee is chaired by a city council representative and consists of several stakeholders, residents, and local wildlife experts.

**Organization:** Minnesota State Colleges and Universities - Bemidji State University

**Organization Description:**

Bemidji State University, located amid the lakes and forests of northern Minnesota, occupies a wooded campus along the shore of Lake Bemidji. Enrolling approximately 5,000 students, Bemidji State offers 70 undergraduate areas of study and eight graduate degrees encompassing arts, sciences, and pre-professional programs. BSU's Shared Fundamental Values include civic engagement and leadership, international and multicultural understanding, belief in the power of liberal arts, and environmental stewardship.

Embedded within the university's strategic priorities are commitments to themes of place and inspired diversity. These priorities allow students to engage in enriching educational experiences that involve the unique rural landscape of the greater Bemidji area. Students also gain knowledge and appreciation of the Indigenous culture deeply rooted within the region. The distinctive experiences and opportunities provided by the university promote a welcoming, safe, and inclusive learning environment for all those it serves.

Biology is one of the largest academic departments, with thirteen faculty supporting an average of 500 students annually. Academic majors include aquatic biology, wildlife biology, medical science, and life science. Students can also pursue a Master of Science degree in biology. The wildlife biology program is supported by four full-time faculty members and two dedicated research laboratories.

## Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
<b>Personnel</b>								
Graduate Research Assistant stipend		Data collection, analysis, writing			13%	2.5		\$63,563
Haus Principle Investigator		Manage, analyze data, write, outreach			20%	0.24		\$19,673
Technician support		Seasonal employees to assist graduate student with winter field work			13%	2		\$51,415
Undergraduate Research Assistant		Assist graduate student with equipment acquisition, maintenance, and field work			0%	1		\$22,600
Graduate Research Assistant: Tuition and fees		Tuition remission and student fees to support a graduate research assistant			0%	2.5		\$15,250
Hiller Co-Investigator		Manage, write, outreach			20%	0.1		\$9,600
							<b>Sub Total</b>	<b>\$182,101</b>
<b>Contracts and Services</b>								
GPS collar manufacturer	Professional or Technical Service Contract	Deployed GPS collars require a monthly service fee with manufacturer in order to receive data. We are budgeting 30/month/deployed collar.				-		\$18,000
							<b>Sub Total</b>	<b>\$18,000</b>
<b>Equipment, Tools, and Supplies</b>								
	Equipment	GPS collars (35x) at \$3250 per unit	Collars to collect data on deer movement and survival					\$113,750
	Equipment	Telemetry receivers (3) and antennas (4)	Equipment used to track and relocate GPS collars					\$2,100

	Equipment	Pharmaceuticals for deer capture (\$75/deer)	Drugs used to immobilize deer during capture and handling					\$4,125
	Equipment	Drop nets (4x) at \$4250 per	Nets used to capture multiple deer					\$17,000
	Equipment	Clover traps (5x) at \$1000 per	Traps used to capture single deer					\$5,000
	Tools and Supplies	Miscellaneous capture supplies (syringes, needles, ear tags, tag applicators, tool boxes, ect.)	Supplies to safely process captured deer					\$8,624
	Tools and Supplies	Bulk shelled corn (3000 lbs)	Corn used to bait traps for deer capture					\$1,500
	Equipment	GPS loggers to track hunters (80x) @ \$100 per	Small GPS units provided to hunters to carry on their person while hunting					\$8,000
							<b>Sub Total</b>	<b>\$160,099</b>
<b>Capital Expenditures</b>								
							<b>Sub Total</b>	-
<b>Acquisitions and Stewardship</b>								
							<b>Sub Total</b>	-
<b>Travel In Minnesota</b>								
	Miles/ Meals/ Lodging	Field travel to, from, and within study sites; miles (40,000 miles at 0.58/mile)	Travel during field research activities					\$23,200
	Conference Registration Miles/ Meals/ Lodging	Registration, travel, lodging, and food for 2 people to attend 2 professional conferences	Travel for graduate student and undergraduate researcher to attend 2 conferences in Minnesota and present results of research					\$6,000
							<b>Sub Total</b>	<b>\$29,200</b>
<b>Travel Outside Minnesota</b>								
							<b>Sub Total</b>	-
<b>Printing and Publication</b>								
	Publication	Publication charges for 2 research manuscripts at \$1800 per	To publish results in peer-reviewed journals available to the scientific community					\$3,600



							<b>Sub Total</b>	<b>\$3,600</b>
<b>Other Expenses</b>								
							<b>Sub Total</b>	<b>-</b>
							<b>Grand Total</b>	<b>\$393,000</b>

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
<b>State</b>				
			<b>State Sub Total</b>	-
<b>Non-State</b>				
In-Kind	Bemidji State University	Bemidji State University will provide indirect cost (12%) as in-kind support.	Secured	\$47,160
In-Kind	Bemidji State University Wildlife Research Program	Dr. Haus will provide trail cameras (30), telemetry receivers (4), antennas (3), GPS units (2), and other miscellaneous field supplies as in-kind support.	Secured	\$20,000
			<b>Non State Sub Total</b>	<b>\$67,160</b>
			<b>Funds Total</b>	<b>\$67,160</b>

## Attachments

### Required Attachments

#### *Visual Component*

File: [46e0a881-8fa.pdf](#)

#### *Alternate Text for Visual Component*

Title reads "City of Bemidji Deer Spotlight Surveys". The image shows a graph of increasing estimated deer density over 5 years using spotlight surveys and distance sampling analysis. The x-axis includes a range of years from 2016 to 2019. The y-axis is deer density expressed in deer per square mile....

## 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?**

No

# City of Bemidji Deer Spotlight Surveys

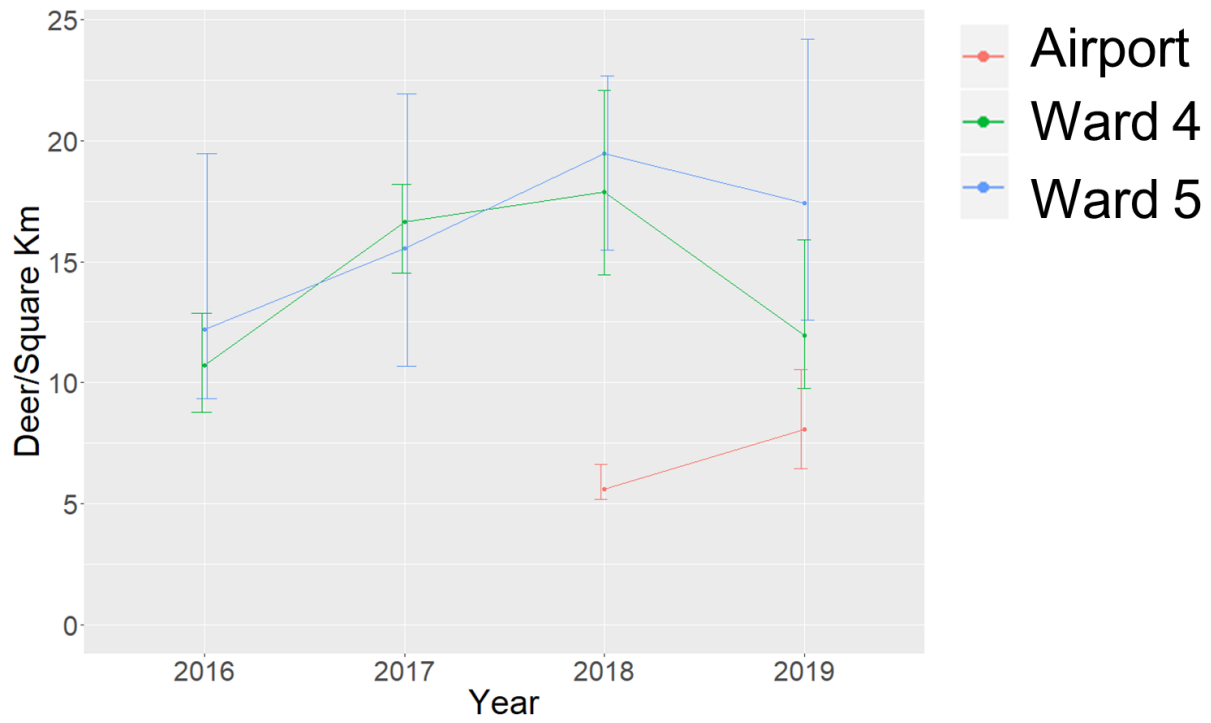


Figure 1. Deer density estimates from 3 city wards in Bemidji, MN. Estimates are generated from spotlight surveys performed annually by the Bemidji State University wildlife biology program

