Environment and Natural Resources Trust Fund

2022 Request for Proposal

General Information

Proposal ID: 2022-215

Proposal Title: What's Causing Declines in Black Bear Reproduction

Project Manager Information

Name: Andrew Tri

Organization: MN DNR - Fish and Wildlife Division

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Project Basic Information

Project Summary: We will examine why bear reproduction has declined in central and northwestern Minnesota using citizen-science to collect samples from hunters to assess reproduction, health, and exposure to disease and pesticides.

Funds Requested: $553,000

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?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project

Narrative

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

Of all of Minnesota's mammals, bears take the longest to reach reproductive age (5 years, on average, before their first litter). Over the past 20 years, black bear reproduction on the edge of bear range (a 75-mile wide band of habitat that spans from Roseau to Forest Lake) has declined. Based on statewide estimates from hunter-submitted bear teeth, bears on the edge are delaying age of first reproduction for one full year, while reproduction in the core of bear range, the northeast 2/5ths of Minnesota has been stable since the 1970s. After bears have their first litter, they typically reproduce every two years; however, delaying first reproduction can greatly impact the population, including a 20% drop in lifetime female reproductive potential. The edge of bear range has more oak forest and agriculture (i.e., more crops for bears to eat) than the core, and until the last 2 decades, was the most productive bear population in the state (bears there used to reproduce at 4 years, on average). It is unclear why the delay in reproduction is not occurring systematically across the entire state, though food availability (and quality), disease, or pesticide exposure may play a role.

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.

Our previous research has documented that 40% of the bear management units in Minnesota are showing declines in reproduction and it is unclear why. To resolve this uncertainty, we will collect samples from hunter-harvested bears from across the state. Minnesota bear hunters have participated in citizen-science research with the DNR since the 1980s. We've had >80% tooth submission rates from hunters over the past 5 years. First, we will compare age-specific pregnancy rates, body condition, and body weights of adult bears between the core and the edge of their range to determine if the reproductive decline is caused by failure to reach sufficient body condition to enter estrus or failure in utero. Second, we will assess if bears have shifted their diets and estimate their exposure to zoonotic disease or pesticides. If bears have begun consuming more foods from anthropogenic sources, such as hunters' baits, trash, birdseed, or agriculture (crops), that would indicate (1) natural foods have declined, (2) bears had to consume other foods to make up the difference, and (3) by consuming more crops or baits, they may be exposed to more pesticides or have increased exposure with other animals at hunters' baits.

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?

Minnesota offers some of the best bear hunting in the nation (~60% success rate in 2020), and it is imperative that DNR manages for a resilient bear population. A healthy bear population will offer sustainable hunter opportunities, which brings in tourism dollars to outstate Minnesota. The work in this proposal will help us understand why reproduction is declining and how to mitigate those impacts. We can adjust management strategies to accommodate changing reproductive conditions (e.g., adjust forest management or set alternative harvest quotas and regulations), but to do so, we need a greater understanding of regional and statewide bear reproduction.

Activities and Milestones

Activity 1: Determine pregnancy rates and reproductive status of bears along the edge and in the core of bear range.

Activity Budget: $135,500

Activity Description:
Using citizen science, we will ask bear hunters and bear guides to provide reproductive tracts and fresh blood from harvested bears to determine pregnancy rates and reproductive history. We will use hunter check stations to collect additional samples. We will collect the reproductive tracts (uterus, ovaries, and fallopian tubes), which will provide average size of past litters and overall reproductive success. We will also assess body weight differences between bears in the core and at the edge of bear range, and compare this against historical bear weights taken from harvest data and prior check stations in the 1980s.

Activity Milestones:

Description	Completion Date
Obtain reproductive tracts from 2 years of hunter-harvested black bears	December 31 2023
Obtain weights of hunter harvested bears for 2 hunting seasons	December 31 2023
Read repro tracts to assess pregnancy rates, reproductive success, and litter size	September 30 2024
Analyze data	December 31 2024
Interpret results, write dissertation chapter, write final report	December 31 2025

Activity 2: Assess diets from bear hair and determine exposure to pesticides and zoonotic diseases from blood and tissue samples.

Activity Budget: $417,500

Activity Description:
We will use stable isotope chemistry to assess the diet composition of hunter-provided bear hair and compare against historical samples from our long-term bear monitoring study. We will ask hunters and bear guides to provide tissue samples and hair from harvested bears to assess potential exposure to pesticides and disease. We will also analyze a subset of historically collected hair and blood samples.

Activity Milestones:

Description	Completion Date
Obtain 2 years of harvested bear hair to assess differences in diet composition across Minnesota	December 31 2023
Obtain fresh blood and tissue samples for 2 years from hunter-harvested bears	December 31 2023
Send samples to lab for analysis of historically collected hair from radio-collared bears	April 30 2024
Send samples to lab for analysis of exposure to pesticides and disease	April 30 2024
Send samples to lab for analysis of pesticide exposure to neonicotinoids in blood and tissue	April 30 2024
Data analysis	December 31 2024
Interpret results, write dissertation chapter, write final report	December 31 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Andrew Tri	Minnesota Department of Natural Resources	Project Manager	Yes
Dr. Michelle Carstensen	Minnesota Department of Natural Resources	Co-investigator	No
Dr. David Anderson	University of Minnesota - Twin Cities, MN-USGS Cooperative Fish and Wildlife Research Unit	Co-investigator who will supervise graduate student on the study	Yes
Kelsie LaSharr	Minnesota Department of Natural Resources	Co-investigator	No
Dr. John Buchweitz	Michigan State University	Conduct mass spectrometry analysis on spleen samples to determine neonicotinoid prevalence and concentrations	Yes
Dr. Krysten Schuler	Cornell University Animal Health Diagnostic Center	Conduct serum analysis to determine disease exposure	Yes
Dr. Kim Sparks	Cornell Stable Isotope Laboratory	Analyze hair samples using stable isotope chemistry to assess bear diet	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?

This project will provide data and assessments for what may be causing reproduction declines in black bears, along with suggested management actions to reduce impacts on the population. Once we determine the causes of reproductive decline, we will be able to suggest management changes to help mitigate the effects and increase resiliency in the bear population. This work will enable us to answer a question we are unable to fund with internal funding and will be integrated into our long-term bear population dynamics and monitoring. Ongoing effort beyond this proposal will be supported by internal DNR funding sources.

Project Manager and Organization Qualifications

Project Manager Name: Andrew Tri

Job Title: Acting Bear Project Leader

Provide description of the project manager's qualifications to manage the proposed project.
Dr. Tri is the Acting Bear Project Leader for the DNR. He has a B.S. in Fisheries and Wildlife from the University of Minnesota-Twin Cities, an M.S. in Range and Wildlife Science from Texas A & M University-Kingsville, and a PhD Forest Resource Management (Wildlife Track) from West Virginia University. Dr. Tri has been working with black bears since 2010 and has been working with bears in Minnesota since 2015. He's responsible for leading research about the survival, reproduction, ecology, movement, human-bear conflicts, and bear harvest management to provide science-based recommendations for bear management in Minnesota.

Organization: MN DNR - Fish and Wildlife Division

Organization Description:
The mission of the Minnesota Department of Natural Resources (DNR) is to work with Minnesotans to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life. The role of the DNR Forest Wildlife Populations and Research Group is to provide inventory information on wildlife populations, project how populations will respond to management, and develop a better understanding of how populations are impacted by changes in their environment. The forests of northern Minnesota create their own special blend of problems for wildlife managers and it is the responsibility of this group to help solve these problems. Important wildlife species such as white-tailed deer, moose, black bear, grouse and furbearers are particularly difficult to inventory because of the enormous area they inhabit and the difficulty in observing these species in a forested environment. For these reasons, most species are monitored with a combination of surveys and computer simulation models. The group is responsible for designing and coordinating surveys and analyzing results. They have developed population models for most species that allow wildlife managers to project the outcome of specific management practices.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
2 Lab Technicians (4 months/year, 2 years)		Technicians to process hair, blood, and tissue samples			0%	1.34		$56,000
							Sub Total	**$56,000**
Contracts and Services								
Michigan State University	Professional or Technical Service Contract	Neonicitinoid sampling, mass spectroscopy (500 samples/year @ $100/sample for 2 years)				-		$100,000
Cornell University Veterinary Diagnostic Lab	Professional or Technical Service Contract	disease and hormone testing (toxoplasmosis, canine adenoviruses, Brucella, and progesterone [250 samples/year + 150 historical samples/year for 2 years @$145/sample)				-		$116,000
Cornell University Stable Isotope Laboratory	Professional or Technical Service Contract	Hair analysis for bear diets. ($10/sample x 2000 samples/year x 2 years + 1000 historical samples)				-		$50,000
University of Minnesota	Sub award	Advising of the graduate student (3 years)				-		$141,000
							Sub Total	**$407,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	Laboratory supplies (reagents and slides; $750/year for 2 years)	Supplies to conduct genotoxicity screening					$1,500
	Equipment	1 Laboratory Microscope with camera	To conduct genotoxicity screening					$3,000

	Tools and Supplies	Supplies for 4 check stations (scales, block and tackle, gambrel hoists, signs, blood and tissue sample equipment)	Items are used to operate hunter check stations to collect weight, tissue samples, and hunter information					$6,000
	Tools and Supplies	Supplies for hunter sampling kits and return shipping ($25,000/year)	Prepackaged kits for hunters to collect organs, hair, and blood from harvested bears to participate in the citizen science project					$50,000
							Sub Total	**$60,500**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Trips to collect samples, travel to check stations each year (fleet @$0.55/mi, estimated 5,000 miles/year), meals and lodging ($6000/year * 2 years)	Travel to check stations and sample collections by check station staff and volunteers					$18,152
							Sub Total	**$18,152**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
		Direct and Necessary costs	Direct and necessary costs cover HR Support ($2,230),Safety Support ($345), Financial Support ($1,708), Communication Support ($1,311), IT					$11,348

			Support ($4,745), and Planning Support ($1,008)					
							Sub Total	**$11,348**
							Grand Total	**$553,000**

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	Salary and fringe for Andrew Tri, supplied by MNDNR	MNDNR Forest Wildlife Populations & Research Group: Andrew N. Tri, project management, fieldwork, data analysis, writing, outreach; 36 mos, 15% effort	Secured	$39,083
In-Kind	Salary and fringe for Michelle Carstensen, supplied by MNDNR	MNDNR Wildlife Health Program: Michelle Carstensen, project management, field necropsies, analyze, write, outreach; 36 mos, 5% effort	Secured	$19,500
In-Kind	Salary and fringe for Kelsie LaSharr, supplied by MNDNR	MNDNR Wildlife Health Program: NR Spec-Intermediate Kelsie LaSharr, sample kit preperation, distribution, biological sample coordination; 36 months 30% effort	Secured	$62,011
			State Sub Total	**$120,594**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$120,594**

Attachments

Required Attachments

Visual Component

File: 231d9494-601.pdf

Alternate Text for Visual Component

Figure shows a map of Minnesota, in which bear populations in the northeastern one-third of the state have had stable age of first reproduction, but bear populations in the middle third of the state and the northwest part of the state have delayed reproduction between 0.5-1.1 years. There is a photo of a yearling bear laying on a tree limb and a picture of a female collared bear with a cub next to her....

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

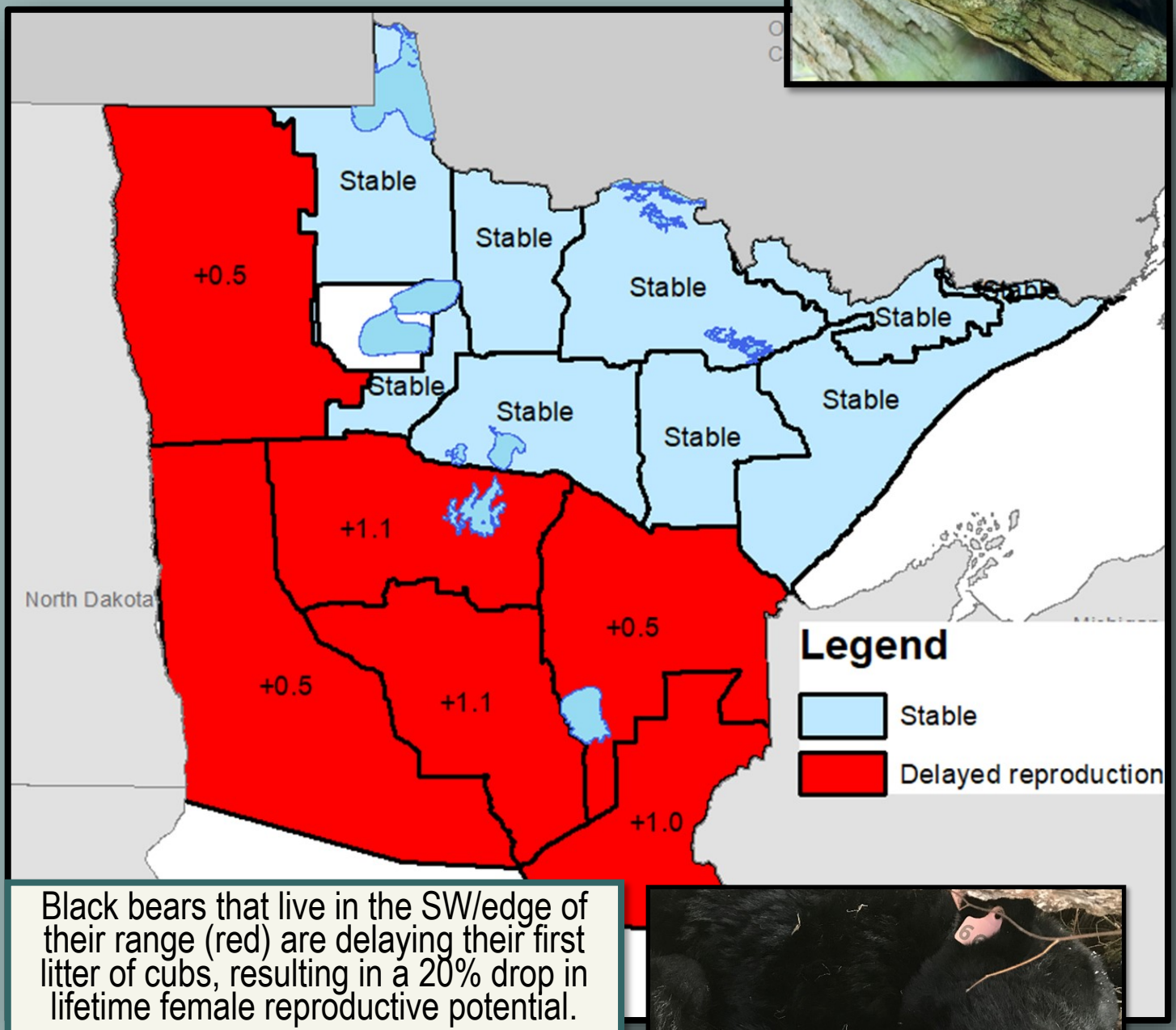
Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

No

What's happening with black bear reproduction?



Black bears that live in the SW/edge of their range (red) are delaying their first litter of cubs, resulting in a 20% drop in lifetime female reproductive potential.

However, in the core of bear range (blue), age of first reproduction has remained stable.

We aim to find out why this delay is occurring in over 40% of bear management units in Minnesota.