

**Environment and Natural Resources Trust Fund
2011-2012 Request for Proposals (RFP)**

LCCMR ID: 009-A1

Project Title: Determining Causes of Death in Declining Moose Populations

Category: A1. Natural Resource Data and Information: Collection

Total Project Budget: \$ \$717,250

Proposed Project Time Period for the Funding Requested: 3 yrs, July 2011 - June 2014

Other Non-State Funds: \$ 5,000

Summary:

Determining why Minnesota's moose are dying, and if nutritional stress is playing a fundamental role, will provide guidance for specific management actions to prevent further population decline.

Name: Erika Butler

Sponsoring Organization: DNR

Address: 5463C W Broadway
Forest Lake MN 55025

Telephone Number: 651-296-2662

Email erika.butler@state.mn.us

Web Address _____

Location

Region: NE

Ecological Section: Northern Superior Uplands (212L)

County Name: Cook, Lake, St. Louis

City / Township:

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ Employment	_____ TOTAL _____%

PROJECT TITLE: Determining Causes of Death in Declining Moose Population

I. PROJECT STATEMENT

Moose in Minnesota are dying at much higher rates than elsewhere in North America.

A research need identified in the Moose Advisory Committee's report to the Minnesota Department of Natural Resources (DNR) was to determine specific causes of adult moose mortality which would help explain their decline in northeastern MN.

To date, no study has determined specific causes of non-hunting mortality in northeastern MN, as this objective has never been assigned the required research priority.

Current proposed LCCMR research is focused on defining how moose use their habitat. While this research is needed to guide habitat management for moose, it is not designed to address the fundamental question of why moose are dying. The issues of habitat use and cause of mortality are so complex that it is *impossible* to design a project that encompasses both of these key research priorities.

With high mortality rates continuing for several years, identifying the causes of mortality is critical to identifying management actions that could increase survival.

A thorough investigation into moose mortality requires an unprecedented effort dedicated to investigating mortalities within a *critical* 24-hour period following death. Otherwise, decay of tissues will completely eliminate or markedly reduce the ability to make a conclusive diagnosis of causes of death. Recent study of northeastern moose reported adult non-hunting mortality as high as 35% per year, with most of the mortalities appearing health-related. Critically, to gain an understanding of what is killing moose, we need to capture and radiocollar a large number of animals to ensure investigation of a significant number of deaths can occur.

Further, nutritional condition of animals is centrally important to any thorough evaluation of cause of death, but thus far it has been afforded limited attention. The priority of this project is to *uniquely* focus on determining 1) specific causes of non-hunting mortality of moose, and 2) whether or not nutritional stress is implicated as a significant contributing factor.

Goals of the project

1) Determine specific causes of moose mortality

Identifying why moose are dying will allow recommendations of specific management efforts which may prevent further decline of the population.

2) Assess nutritional status and overall health of collared animals and the moose population at large as winters progress

If nutritional status is identified as a contributing factor to moose mortality and population decline, then management efforts can be focused on enhancing natural food sources.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Determine specific causes of mortality of moose in NE MN

Budget: \$ 647,250

Global positioning system (GPS) collars will initially be deployed on 75 adult female moose and 25 adult males. The collars will notify the research team when a moose has died by way of a motion-sensitive switch in the collar and a subsequent text message. A network of strategically stationed responders will reach moose within the critical 24-hours after death, ensuring the carcass is suitable for diagnostics. When possible, carcasses will be transported intact to the University of Minnesota's Veterinary Diagnostic Laboratory for a full diagnostic workup. Otherwise, a trained biologist or

veterinarian will perform a thorough field examination (necropsy). Diagnostic screening for more than 30 diseases, toxicities and deficiencies will occur by Board-certified veterinary pathologists at the Veterinary Diagnostic Laboratory and other cooperators throughout the country.

Outcome	Completion Date
1. Determine specific causes of death of moose that die during the study period.	6/30/2015
2. Quantifying rate of exposure to diseases and toxicity and deficiency levels	6/30/2015
3. Descriptive reports/articles in peer-reviewed publications addressing findings	6/30/2016

Activity 2: Determine the influence of nutritional stress as a contributing factor to the specific causes of deaths. Budget: \$ 70,000

Biological samples (blood, feces, and urine) will be collected from all moose at capture and fat measurements will be made by ultrasound. Baseline (early winter) data from blood and urine specimens and fat measurements will be used to assess body condition, nutritional status, and overall health of moose. Snow-urine samples will be collected each winter throughout the study area, and then chemically analyzed to determine the degree of winter nutritional stress experienced by the broader moose population. Value of this latter technique has been demonstrated with moose on Isle Royale and with elk and bison in Yellowstone National Park.

Outcome	Completion Date
1. Formulate conclusions about the nutritional condition, health, and overall well-being of moose at the start of winter.	3/31/2015
2. Formulate conclusions about how progressive winter nutritional stress and poor condition of moose contributed to specific causes of death.	6/30/2015

III. PROJECT STRATEGY

A. Project Team/Partners

Dr. Erika Butler¹, MN DNR, project leader; Dr. Michelle Carstensen¹, MN DNR, co-investigator
 Dr. Glenn DelGiudice¹, MN DNR, co-investigator;
 Dr. Ulrike Munderloh², University of MN Dept. of Entomology, collaborator;
 Dr. Ron Moen¹, NRRI-UMD, collaborator; Mark Johnson¹, MDHA, collaborator;
 Mike Schrage¹, Fond du Lac Resource Management Division, collaborator
 Dr. Arno Wuenschmann^{1,2}, Veterinary Diagnostic Laboratory, collaborator;
 Dr. Anibal Armien^{1,2}, Veterinary Diagnostic Laboratory, collaborator
¹In-kind contributor; ²Receiving LCCMR trust funds

B. Timeline Requirements

This project is designed as a 3-year study, although we anticipate investigating specific causes of moose mortality for at least 2-3 years beyond this period (throughout the life time of the collars).

C. Long-Term Strategy and Future Funding Needs

Our results will enhance understanding of specific causes of mortality of MN's moose and key factors (e.g., nutritional stress) that contributed to their vulnerability. Once the specific causes of mortality and major influential factors are identified, appropriate management actions may be taken to address population decline. For example, if parasites such as liver flukes and brainworm are responsible for the moose decline, then steps could be taken to mitigate the life cycle of these parasites. Or, if inadequate nutrition is negatively impacting survival, management efforts could focus on improving forage quantity and quality. Long-term investment in additional applied research will be necessary to evaluate the effects of management efforts and to determine whether it is feasible to apply them throughout moose range in the northeast to prevent the disappearance of moose.

Determining Causes of Death in Declining Moose Populations Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET (3 years)

BUDGET ITEM	AMOUNT
Personnel:	
Wildlife Technician, 1 FTE, field data collection, analyze, field necropsies, outreach; 36 mos; 100% effort (\$42,200/yr @ 75% salary & 25% fringe)	\$ 126,600
2 seasonal interns, field data collections (work for room & board only)	\$ 12,000
Contracts:	
Wildlife Helicopter Capture Company (yet undetermined): Year 1: Initial moose capture and handling (100 moose @ \$1,000 ea); Year 2: Additional moose capture to maintain sample (20 moose @ \$1000 ea); Year 3: Additional moose capture to maintain sample (20 moose @ \$1000 ea)	\$ 140,000
University of Minnesota, Veterinary Diagnostic Laboratory: disease and health screening for dead moose (screening for over 30 diseases, various toxicities and nutritional deficiencies) (est. 60 moose @ \$450 ea)	\$ 27,000
University of Minnesota, Department of Entomology, diagnostic services (screening for 4 tick borne diseases)	\$ 5,000
Equipment/Tools/Supplies:	
GPS collars (Year 1: 100@\$2,500, new) (Year 2: 20@\$1,000, refurbished; Year 3: 20@1,000 refurbished)	\$ 290,000
Capture drugs (\$228/moose for immobilization and reversal)	\$ 31,900
Portable visible ultrasound	\$ 30,000
Medical & laboratory supplies and field necropsy kits (syringes, needles, sawzall, blood tubes, whirlpaks, etc)	\$ 4,000
Field equipment (handheld GPS, camera, antennae, reciever, etc)	\$ 2,000
Acquisition:	N/A
Travel:	
Travel to study area by project management staff (fleet@\$0.55/mi, 20,000 miles)	\$ 11,000
Travel to study area by technician and interns (fleet@\$0.55/mi, 25,000)	\$ 13,750
Additional Budget Items:	
Spotter plane during capture/recapture efforts (120 hrs @\$200/hr)	\$ 24,000
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND \$ REQUEST	\$ 717,250

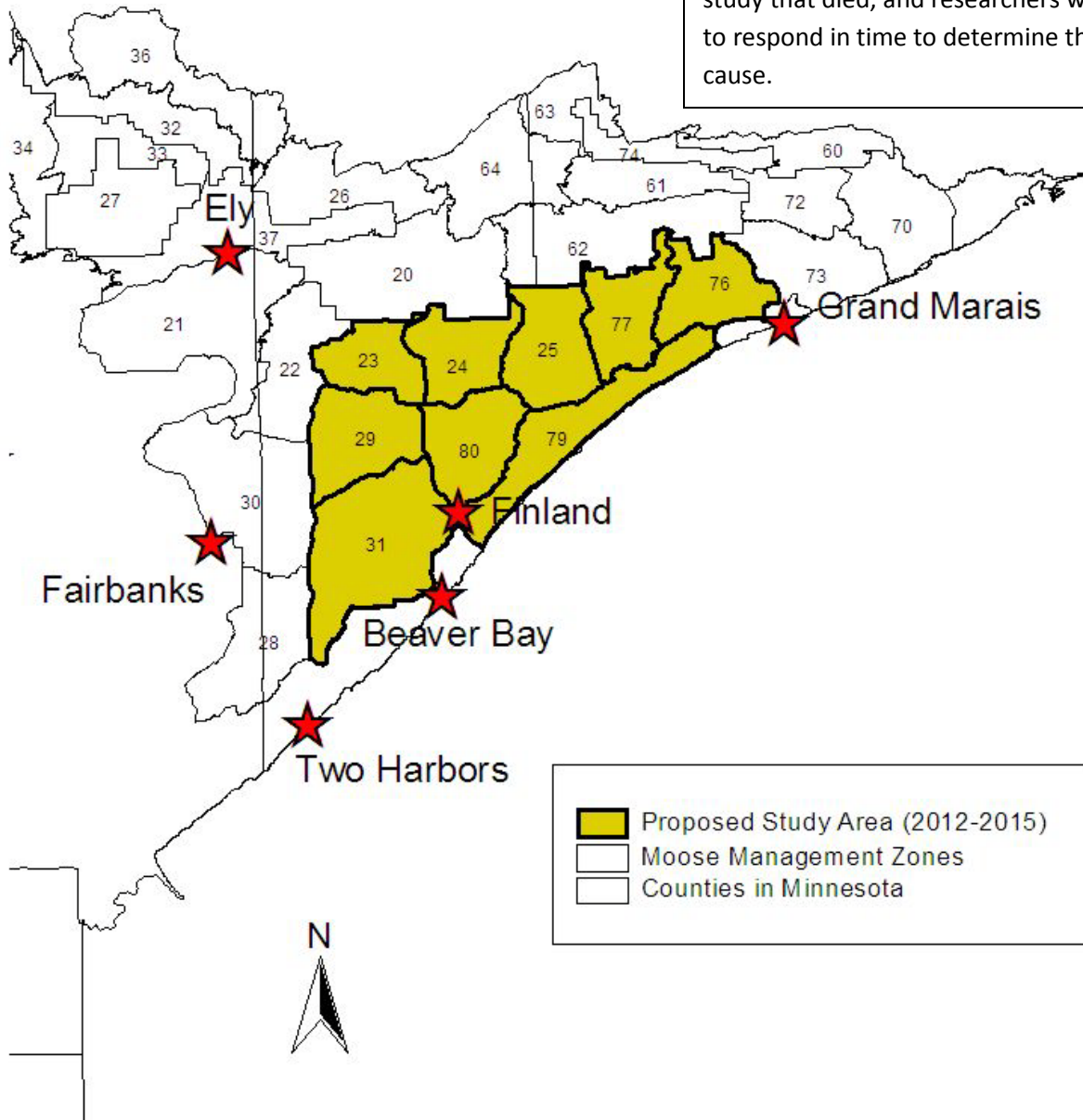
V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period:		
Minnesota Deer Hunter's Association	\$ 5,000	Secured
Other State \$ Being Applied to Project During Project Period:		
DNR Shared Services	\$ 19,430	Secured
FAW Division Support	\$ 25,820	Secured
In-kind Services During Project Period:		
MNDNR Wildlife Health Program: Erika Butler, project management, field necropsies, analyze, write, outreach; 36 mos, 25% effort	\$ 52,500	Secured
MNDNR Wildlife Health Program: Michelle Carstensen, project management, field necropsies, analyze, write, outreach; 36 mos, 25% effort	\$ 45,000	Secured
MNDNR Wildlife Research: Glenn DelGiudice, project management, analyze, write, outreach; 36 mos, 10% effort	\$ 21,000	Secured
MNDNR Wildlife Health Program: Erik Hildebrand, field data collection, field necropsies, outreach; 36 mos, 15% effort	\$ 15,750	Secured
MNDNR Wildlife Research: Carolin Humpal, snow urine analysis	\$ 5,000	Secured
MNDNR Wildlife Research GIS: Robert Wright, habitat anlysis and mapping	\$ 5,000	Secured
MNDNR Wildlife Health Program: University of Minnesota, Veterinary Diagnostic Laboratory, disease and health screening for live moose at capture (screening for over 30 diseases, various toxicities and nutritional deficiencies)	\$ 32,000	Secured
University of Minnesota, Veterinary Diagnostic Laboratory, disease and health screening for dead moose (pathologist time, operational costs, bacteriology, molecular diagnostics, histopathology) (\$1,340/moose)	\$ 120,600	Secured
Fond du Lac Resource Management Division, field support	\$ 80,000	Secured
Remaining \$ From Current ENRTF Appropriation	N/A	N/A
Funding History	N/A	N/A
TOTAL OTHER FUNDS	\$ 427,100	

Proposed study area for determining specific causes of non-hunting mortality in northeastern moose. This area intentionally overlaps with previous and current moose research projects that focused primarily on how moose use their habitats, yet these studies were unable to determine causes of mortality. By building this mortality study on the foundation of previous research, we hope this sheds more light as to why the moose population is in decline. Further, this area is also larger than previous study sites, as recommended by the MAC committee, to encompass potential geographic variations in moose mortality.



A radio-collared moose from a past study that died, and researchers were unable to respond in time to determine the specific cause.



2011-2012 LCCMR Project Manager Qualifications and Organization Description

Erika A. Butler, Wildlife Veterinarian, Wildlife Health Program, MN Depart. of Natural Resources

Key Qualifications:

Dr. Butler is the wildlife veterinarian for the state of Minnesota where she investigates and manages diseases in the state's wildlife populations. Her professional interests include the mysterious decline in MN's moose population, transmission of disease between wildlife, livestock, and human populations, and the role of wildlife as a disease reservoir. She is an active member in the Wildlife Diseases Association, a voting member of the Wildlife Disease Committee for the United States Animal Health Association, and an organizer of the upcoming North American Moose Conference.

Education:

University of Minnesota, Veterinary Medicine, D.V.M. 2006

University of North Dakota, Wildlife and Fisheries Management, B.S. 2002

Selected Publications:

Butler, E., M. Carstensen, M. Schrage, D. Pauly, M. Lenarz, and L. Cornicelli. 2008.

Preliminary results from the 2007-2008 moose herd health assessment project. Summaries of wildlife research findings 2008, Division of Fish and Wildlife, MN DNR, St. Paul, MN
www.dnr.state.mn.us/publications/wildlife/research2008.html

Butler, E.A., W.F. Jensen, R.E. Johnson, and J.M. Scott. 2008. Grain overload and secondary effects as potential mortality factors of moose in North Dakota. *Alces* 44:74-79.

Carstensen, M., E. Butler, M. DonCarlos, and L. Cornicelli. 2008. Managing bovine tuberculosis in northwestern Minnesota; a 2008 progress report. Summaries of wildlife research findings 2008, Division of Fish and Wildlife, MN DNR, St. Paul, MN
www.dnr.state.mn.us/publications/wildlife.html

Carstensen, M., E. Butler, D. Pauly, M. Schrage, and L. Cornicelli. 2007. Preliminary results from the 2007 moose herd health assessment project. Summaries of wildlife research findings 2007, Division of Fish and Wildlife, MN DNR, St. Paul, MN
www.dnr.state.mn.us/publications/wildlife/research2007.html

Carstensen, M., L. Cornicelli, M. DonCarlos, and E. Butler. 2006. Minnesota Department of Natural Resources Chronic Wasting Disease Surveillance Program 2006. Summaries of wildlife research findings 2007, Division of Fish and Wildlife, MN DNR, St. Paul, MN
www.dnr.state.mn.us/publications/wildlife/research2006.html

The Minnesota Department of Natural Resources' mission is to work with citizens 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 Wildlife Health Program** is a research arm of the Wildlife Division. Created in 2006, the Program's mission is to maintain, protect, and enhance the health of Minnesota's wildlife populations. The program has been actively engaged in surveillance of chronic wasting disease and highly pathogenic avian influenza, management of bovine tuberculosis, waterfowl die-off investigations, and investigation of moose mortalities.