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

LCCMR ID: 014-A1

Project Title: Moose Foraging, Calf Survival, and Thermal Refuges

Category: A1. Natural Resource Data and Information: Collection

Total Project Budget: $ $134,493

Proposed Project Time Period for the Funding Requested: 2 yrs, July 2011 - June 2013

Other Non-State Funds: $ 0

Summary:

Moose status in Minnesota remains uncertain. We'll use GPS collars to measure browse quantity and quality, monitor calf survival, and identify thermal refuges for use in management decisions.

Name: Ron Moen

Sponsoring Organization: U of MN - NRRI

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Duluth MN 55811

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Location

Region: NE

Ecological Section: Southern Superior Uplands (212J), Northern Superior Uplands (212L), No. Minnesota and Ontario Peatlands (212M)

County Name: Cook, Koochiching, Lake, St. Louis

City / Township: Duluth

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

PROJECT TITLE: Moose Foraging, Calf Survival, and Thermal Refuges

I. PROJECT STATEMENT

The point estimate from the DNR/Tribal aerial survey of 5,528 in 2010 was 2,065 less than the estimate of 7,593 moose in 2009. Calf survival is low, and even lower just to the north in Ontario. Aerial surveys show that about 70 out of every 100 calves born in May do not even survive 8 months.

In 2010 the LCCMR supported a moose habitat research project to develop Best Management Practices (BMPs) using GPS collars. Although the ENRTF project has not begun, we used federal funding to deploy these GPS collars on moose in Grand Portage (GP) and Voyageurs (VNP) in 2010. We understand that it is unusual to begin Phase II of a project before starting Phase I.

However, after just 2 months and an incredible 20,000 near real-time locations from moose in GP and VNP wearing these collars, we believed strongly enough in Phase II to develop this proposal. Never before could we pinpoint daily locations of free-ranging moose in real-time to guide field investigations. These GPS collars will be on moose until 2013 in the ENRTF project area and in GP and VNP into 2012 (see map). It is not likely we will have this kind of opportunity again in the foreseeable future.

With the VNP, GP, and ENRTF project areas, we cover the geographic extremes of moose range in NE MN, and the range of forests (old growth, recent cuts, low and high relief, Lake Superior effect, cover types) that NE moose experience. We include new and old partners in Phase II, building on a citizen-science partnership with the MN Zoo that began in Phase I. We could do the science without the zoo, but we think it is important to put research results supported by agencies in the public eye. Over 1,000,000 visitors a year help meet that objective. The moose website (www.nrri.umn.edu/moose) we described in our Phase I proposal is already very popular, even before the project begins!

Goals of Phase II Research:

1) Measure browse quantity and quality at moose foraging sites

The Moose Advisory Committee pointed out that biologists assume forage quantity and quality is not limiting moose in NE Minnesota, yet browse measurements are almost non-existent. GPS collars in all project areas will identify foraging paths to measure browse quantity. Chemical forage analyses will measure quality of browse moose are eating.

If we demonstrate forage quality and quantity are adequate at geographic extremes of moose range in NE MN, we can eliminate browse quantity and quality as a cause of moose decline.

2) Monitor calf birth and survival via cow movements with GPS collars.

The cause and timing of calf mortality remains largely unknown. Black bears prey only on young calves while wolf predation, disease, or malnutrition can kill calves all year. GPS collars on cows can provide clues to when and where calves are born, when calves may have died, and guide aerial searches for calves. We will test this calf survival protocol on cows already collared in 2010 at VNP and GP.

If successful, we will know exact birth sites and when calves die, a necessary step to correctly design calf survival studies and ultimately identify potential management actions to increase calf survival.

3) Thermal characteristics of moose foraging and resting areas in ENRTF study area

Thermal refuges in cedar bogs, mature conifers, and water are critical in hot weather. We will measure air and ground temperatures in the ENRTF thermal refugia moose used in almost real-time under Goal 3.

If we know site-level thermal characteristics of areas used during hot weather we can predict locations of other potential thermal refuges using GIS mapping and incorporate into the habitat BMPs.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Measure browse quantity and quality **Budget:** $ 61,278

GPS locations from radiocollared moose will guide us to foraging sites. We will measure use and availability in winter and summer, and collect and chemically analyze browse samples. Minnesota Zoo partners will develop a program and train teachers and zoo volunteers to assist in the field work.

Outcomes 1 – 3	Completion Date
1. Measure browse quantities in moose foraging areas	9/30/2012
2. Measure quality (chemistry) of browse used by moose	12/31/2012
3. Moose conservation education and field work training program at MN Zoo	12/31/2012

Activity 2: Monitor moose calf survival **Budget:** $ 48,248

GPS locations from radiocollared moose will guide us to cows with calves for aircraft searching, and we will monitor movement data to detect parturition sites and possibly when a cow loses a calf.

Outcome 4	Completion Date
4. Estimates of parturition habitat and when cows lose calves	12/31/2012

Activity 3: Characteristics of refugia used by moose in hot weather **Budget:** $ 24,967

We will deploy dataloggers in locations used by moose in hot weather to identify temperatures that trigger a need for thermal cover, and to identify temperatures in adjacent habitats not used.

Outcome 5	Completion Date
5. Temperatures of habitats used by moose in hot weather	9/30/2012

Outcome 6: Activity 1, 2, and 3 results will be used in BMPs, habitat planning meetings, peer reviewed publications, zoo kiosk, and the moose project website (www.nrri.umn.edu/moose) 2011 to 2014.

III. PROJECT STRATEGY

A. Project Team/Partners

Ron Moen, University of Minnesota Duluth	Steve Windels, Voyageurs National Park
Seth Moore, Grand Portage Indian Reservation	Andy Edwards, 1854 Treaty Authority
Grant Spickelmier, Minnesota Zoo	Ron Tilson, Minnesota Zoo

B. Timeline Requirements

July 2011 to February 2013 when GPS collars are deployed for the GP, VNP, and ENRTF moose projects.

C. Long-Term Strategy and Future Funding Needs

After developing the habitat BMPs (Phase I) and answering Phase II questions we do not anticipate requesting future funding for habitat research from LCCMR. Research can lead to unexpected answers and raise new questions, but we believe that if Phases I and II are completed the next step for habitat work will be a move from research to management by the DNR, Superior National Forest, and Forestry Departments in Cook, Lake, and St. Louis Counties, all of which are interested in the ENRTF project.

The need for future Calf mortality research could be determined by Activity 2 in the proposed Phase II project, or results could immediately identify possible management actions to increase calf survival.

We have worked to keep over 50% support from federal sources for studying moose in Minnesota. Pending federal projects should help us maintain these proportions in the overall moose habitat project.

Investment in moose research is the best chance for maintaining moose in Minnesota.

2011-2012 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET 2 years

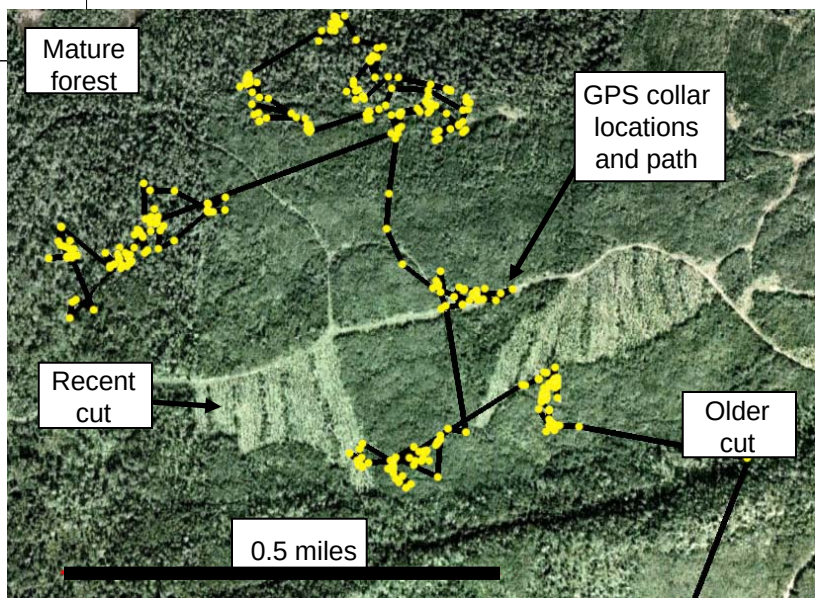
BUDGET ITEM	AMOUNT
Personnel:	
PI (Moen)-collect,analyze data. 24 mo,10% effort, FB 33%	$ 18,765
Grad Student-collect data. 24 mo, 50% summer only, FB 24.2%	$ 12,752
Undergrad Student-collect data. 24 mo, 15% AY, 50% Summer, FB 7.34%	$ 11,047
Lab Tech-analyze data. 24 mo, 20% effort, FB 40%	$ 22,929
Contracts:	
Flight (contractor TBD, estimated $200/hr Fixed, $500/hr helicopter)	$ 16,000
Forage analysis (~700 @ $24/sample)	$ 17,000
Argos (Additional Satellite transmission time for real-time locations)	$ 15,000
MN Zoo (Conservation Education and Field Work Training)	$ 6,000
Equipment/Tools/Supplies:	.
Dataloggers and black globe housings (120 @ $50/unit)	$ 6,000
Field supplies for browse (GPS, clippers, tapes, bags, batteries)	$ 4,000
Travel:	
Vehicle travel to browse collection sites (Est. $0.50/mile and 10k miles/yr)	$ 5,000
Additional Budget Items: N/A	
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND $ REQUEST	$ 134,493

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period:		
Other State $ Being Applied to Project During Project Period:		
Minnesota Zoo (1 yr)	$ 3,500	Secured
Minnesota Zoo (1 yr)	$ 3,500	Pending
In-kind Services During Project Period:		
Voyageurs National Park Biologist/Technician	$ 8,700	Secured
1854 Treaty Authority Resource Management Division Biologist/Technician	$ 8,000	Secured
Remaining $ from Current ENRTF Appropriation (if applicable):		
ENRTF Moose project begins 7/1/2010 (HF 2624 Sec. 2 Subd. 3-k)	$507,000	New Project
Funding History:	$ -	
Amounts estimated conservatively. Updates would be available by Fall 2010. If project is funded additional commitments in FY2012 and FY2013 from 1 year cooperators likely.		
Notes on Match/Other Funds: Voyageurs National Park (~$300,000) and Grand Portage Study sites (~$200,000) are awarded federal funding but federal rules don't allow us to list dollar amounts in the columns to right even though funds have been awarded. Similarly, we have a pending project for moose habitat restoration with federal funds (GLRI 2010, $193,000). We also will have a project in Quetico Provincial Park pending sometime in summer 2010 (~ $20,000).		

Cow moose wearing a GPS collar that was deployed in 2010. These collars have given us over 20,000 locations on moose in Voyageurs National Park and on the Grand Portage Indian Reservation. Collars transmit locations daily to the Argos Satellite system. We can get up to 40 locations per day from a single moose.

Example locations from a 2010 GPS collar in Grand Portage Indian Reservation. The path of transmitted GPS locations shows how we can track each moose in near real-time. These locations can interpret moose behavior and guide us to field sites for browse collection and datalogger placement.



2011-2012 LCCMR Project Manager Qualifications and Organization Description

Ronald A. Moen, Natural Resources Research Institute, University of Minnesota Duluth

Key Qualifications

Dr. Moen is a research associate at the Natural Resources Research Institute, non-tenure track assistant professor in the Department of Biology at the University of Minnesota Duluth, and holds appointments in the graduate programs of Integrated Biological Science (Duluth campus) and Conservation Biology (Twin Cities campus).

Education

University of Minnesota, Wildlife Conservation, Ph.D. 1995
University of Minnesota, Wildlife, M.S. 1988
Cornell University, Biological Sciences, B.S. 1984

Selected Grants

2010. Legislative-Citizen Commission on Minnesota Resources. R. Moen, M. Lenarz, M. Johnson. Identifying Critical Habitats for Moose in Northeastern Minnesota. $507,000.
2009. U.S. Fish and Wildlife Service. S. Moore, A. Edwards, and R.A. Moen. Mooz (Moose) Habitat Use in a Changing Climate. $199,999.
2009. U.S. Geological Survey. S. Windels, M.E. Nelson, R.A. Moen. Investigate Effects of Climate Change and Other Factors on Population Viability of Moose in Voyageurs National Park. $307,700.
2008. National Park Service. R.A. Moen and S. Moore (Grand Portage Natural Resources and Grand Portage Indian Reservation). Beaver Populations in Grand Portage National Monument and the Grand Portage Indian Reservation $18,985.
2008. MN Department of Natural Resources. R.A. Moen. Pine Marten and prey in NE Minnesota. $20,000.
2004-2008. Over $800,000 in grant funding from federal, state, and private sources for research project on Canada lynx in Minnesota. For full list of funders see www.nrri.umn.edu/lynx.

Selected Publications

Moen, R.A., J.R. Rasmussen, C.L. Burdett, K.M. Pelican. 2010. Hematology, serum chemistry, and body mass of free-ranging and captive Canada lynx in Minnesota. Journal of Wildlife Diseases 46:13-22.
Moen, R.A., C.L. Burdett, and G.J. Niemi. 2008. Movement and habitat use of Canada lynx during denning in Minnesota Journal of Wildlife Management 72:1507-1513.
Moen, R. G.J. Niemi, and C. Burdett. 2008. Canada lynx in the Great Lakes region. Final report to USDA Forest Service and US Geological Survey and Minnesota Department of Natural Resources. NRRI Technical Report No. NRRI/TR-2008-14.
McCann, N.P., R.A. Moen, and G.J. Niemi. 2008. Using pellet counts to estimate snowshoe hare numbers in Minnesota. Journal of Wildlife Management 72:955-958.
Burdett, C.L., R.A. Moen, G.J. Niemi, and L.D. Mech. 2007. Defining Canada lynx space use and movements with GPS telemetry. Journal of Mammalogy 88:457-467.
Moen, R.A., J. Pastor, and Y. Cohen. 2001. Effect of animal movement on GPS telemetry locations. Alces 37:207-271.
Moen, R.A., J. Pastor, and Y. Cohen. 1997. Accuracy of GPS telemetry collar locations with differential correction. Journal of Wildlife Management 61:530-539.

Natural Resources Research Institute is a part of the University of Minnesota Duluth. NRRI's mission is to promote private sector employment based on natural resources in an environmentally sensitive manner. NRRI scientists have extensive experience in applied ecological research on terrestrial and aquatic systems.