

**Environment and Natural Resources Trust Fund
2014 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 015-A

Improving Stream Trout Habitat by Beaver Management

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 219,755

Proposed Project Time Period for the Funding Requested: 3 Years, July 2014 - June 2017

Summary:

We will analyze aerial photographs and measure habitat in designated trout streams to improve stream management practices and meet objectives for trout while retaining broader ecological benefits provided by beaver

Name: Ron Moen

Sponsoring Organization: U of MN - NRRI

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Location

Region: Northeast

County Name: Cook, Itasca, Koochiching, 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: Improving Stream Trout Habitat by Beaver Management

I. PROJECT STATEMENT

NE MN contains more than 1,500 miles of Designated Trout Streams (Fig. 1) and trout fishing is an important recreational and economic activity in the state. Beaver removal is a common management technique used in trout streams. Beaver dams are frequently removed from streams to improve trout habitat. In some cases, removal of beaver dams is necessary to increase stream trout populations. However, beaver dam removal may actually improve cold water streams and trout habitat in certain situations.

Beaver removal is expensive, sometimes controversial, and can have unforeseen effects on ecological health of stream. Removing beaver from streams can also result in a loss of biodiversity and reduced functionality for important ecosystem services such as trapping sediment and storing water.

Removing beaver from trout streams can lead to increased trout populations.

Yet maintaining beaver as a component of stream ecosystems improves ecological health.

Balancing trout management with ecological health is the outcome of this proposed research.

Historically, beaver management has been a central pillar in stream trout management paradigms. As more is learned about the ecological importance of beaver in forested landscapes further investigation of the impacts of beaver removal is necessary. This issue highlights the difficulty of simultaneously managing for ecologically and economically important species such as beaver and stream trout. Management actions to improve populations or habitat for one species often negatively affect the other. Beaver management is an important tool used by fisheries managers to manage stream trout. Like every tool this one can be sharpened to optimize results. Fisheries managers and land managers require data to better understand how and when removal of beaver and beaver dams will improve stream trout habitat and trout populations.

ENRTF funded research studying the effects of climate change on deep lakes with cold water fish species in 2009. Trout streams in northeastern Minnesota are mostly fed by surface waters and are also sensitive to increasing summer temperatures projected for climate change scenarios in Minnesota. The effects of beaver dams on streams could magnify climate change impacts expected over the next 50-100 years. A comprehensive analysis of the ecological cost-benefit dynamics of beaver management for improvement of trout habitat would benefit fisheries managers and natural resource agencies.

Goal 1: Quantify importance of beaver in streams to ecosystems and to trout management

Beaver populations fluctuate over time and space and the need to manage beaver in individual trout streams will differ for different parts of the state or at different periods of time. Beaver activities, such as ponds and dams and tree cutting, are easily visible on aerial photos (Fig. 2). Aerial photos from different time periods show the distribution and changes in beaver populations. Understanding beaver population dynamics in areas with Designated Trout Streams will provide additional context to addressing issues surrounding beaver management. Historical beaver population levels will provide insight into landscape level effects and ecosystem services provided by beaver, which will be critical for biodiversity conservation in the face of projected climate change.

Goal 2: Determine the effects of beaver dams on cold water trout streams in NE MN

The most common reason for removing beaver from trout streams is that beaver activities degrade habitats by warming water temperatures beyond suitable ranges for trout. Beaver dams also alter other important habitat characteristics for stream trout such as water flow and dissolved oxygen concentrations. Management actions would be more effective if the relationship between the location, size, age, and number of beaver dams on trout habitat was better understood (Figs. 1 & 2). Data from this project will also help inform managers about the potential combined effects of beaver activities and climate change on cold water habitats.

Results for this project will be used to improve beaver management actions to meet management objectives for trout and while retaining the broader ecological benefits of beaver effects on the landscape.



Environment and Natural Resources Trust Fund (ENRTF)

2014 Main Proposal

Project Title: Improving Stream Trout Habitat by Beaver Management

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Determine ecological effect of distribution and abundance of beaver in NE MN Trout Streams beaver at the landscape scale **Budget: \$118,211**

We will compile existing data on beaver abundance and activity for northeastern Minnesota from approximately 1900-present. Source data include historical DNR trapping records and survey data from MNDNR and other sources. We will map beaver activity in selected areas in Koochiching, Itasca, St. Louis, Lake, and Cook counties using aerial photos from 1930s to the present to characterize changes in beaver populations over time in areas surrounding Designated Trout Streams in NE MN. We will then estimate ecological and economic costs and benefits of different management options to develop new management recommendations.

Outcome	Completion Date
1. Maps of aerial photos and report on beaver effect on trout streams	12/31/2015
2. Report summarizing historical patterns of beaver activity in northeast	6/30/2016
3. Management recommendations from landscape analysis of beaver populations in NE MN	6/30/2017

Activity 2: Effects of beaver ponds on trout habitat characteristics **Budget: \$111,730**

We will monitor habitat characteristics (e.g., water temperature, flow, dissolved oxygen, other variables) in pool and riffle habitats above and below beaver dams of different sizes and ages from a set of streams with and without beaver activity. MNDNR will conduct beaver dam removal in selected streams and we will measure response of habitat characteristics before and after dam removal.

Outcome	Completion Date
1. Habitat characteristics measured in trout streams for activity 2 in year 1	9/30/2015
2. Habitat characteristics measured after beaver dam removal from trout streams	9/30/2016
3. Best Management Practices recommendations for beaver effects on habitat in trout streams	6/30/2017

III. PROJECT STRATEGY

A. Project Team/Partners

Dr. Ron Moen, NRRI-University of Minnesota-Duluth, will be Project Manager and supervise UMD grad student.

Dr. Steve Windels is a beaver population expert with Minnesota Wildlife Consultants.

Dr. Andrew Hafs is a stream trout expert with Bemidji State University.

MNDNR staff from Area Fisheries Offices (Kevin Peterson, Dean Paron, Jeff Eibler, Jeff Tillma), Fisheries Research (Peter Jacobsen), Stream Habitat Program (Brian Nerbonne), and Wildlife Research (John Erb) and other offices will provide access to data, field support when possible, and input during all phases of the project, including study design, analysis, and report writing.

B. Timeline Requirements

This project will require 3 years to complete, starting on 7/1/2014 and ending on 6/30/2017. We will begin collecting data in 2014 and measure stream data above and below beaver dams in each year of the project. Two full summers are required to collect data on stream temperature and chemistry. We will collect data for 1-2 years after beaver dam removal, depending on when dams are scheduled to be removed by MNDNR.

C. Long-Term Strategy and Future Funding Needs

This project will develop Best Management Practices (BMPs) that will improve beaver management to optimize both stream trout and beaver populations and the associated ecological services they provide. Future funding would be needed to evaluate how BMPs affect individual movements, survival, and population growth of trout and beaver using radio tags and other techniques.

2014 Detailed Project Budget

Project Title: Managing Beaver to Improve Stream Trout Habitat

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel:	
Moen PI; analyze, write, manage, outreach; 5% fte; 75% salary/25% fringe, 36 mo (\$15,188)	\$ 88,617
AdvGRA; Data collect, analysis, writing; 5% fte-9 mo; 5% fte SUM 1-mo; 79% salary/21% fringe (\$8,175)	
GRA: Data collection, analysis, writing; 25% fte; 55% salary/45% fringe, 36 mo (\$37,649)	
Undergrad RA: 35% fte-18 mo, 75% fte/6 mo-SUM; 100% salary/0% fringe (\$18,736)	
Field lab tech; collect data, analyze; 10% fte; 92% salary/8% fringe, 36 mo (\$8,869)	
Contracts:	\$ 127,304
Northern Wildlife Consultants: S. Windels. Goal 1 lead, 10% effort/36 mo (\$23,500)	
Bemidji State University: (\$103,804)	
\$21,357 - A. Hafs, Goal 2 Lead, BSU, 10 fte; 81% S/ 19% F/36 mo	
\$50,321 - Grad RA 100% fte; 74% S/26% F/36 mo	
\$11,880 - 24 Depth/temperature loggers @ \$495 apiece	
\$8,856 - 72 Temperature loggers @ \$123 apiece	
\$11,390 field travel to/from study sites, 3 yrs, miles, food, lodging	
Equipment/Tools/Supplies:	
Field supplies; batteries for camera and GPS unit, flagging tape, sample bags, tarps	\$ 300
Travel:	
Duluth to Intl' Falls meet with Windels, \$0.565/mi @ 300 mi @ 4 trips/year @ 3 years	\$ 2,034
Additional Budget Items:	
Services - GIS lab fee (~366 hrs @ 4.10 per hour)	\$ 1,500
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 219,755

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:		
Ron Moen salary/fringe (Year 1)	\$ 4,000	Secured
Ron Moen salary/fringe (Year 2&3)	\$ 8,000	Pending
In-kind Services During Project Period:		
Dr. Andrew Hafs will provide access to backpack electrofishing equipment, additional YSI meters, temperature loggers, and flow meters. Dollar amount to be determined.	-	Pending
BSU offers a new faculty grant; when submitted with an external grant the faculty member can apply for up to \$8,000 annually.	\$ 16,000	Pending
MN DNR Fisheries offered use of available temperature loggers for monitoring in streams. Dollar amount to be determined.	-	Pending
Remaining \$ from Current ENRTF Appropriation (if applicable):		
Critical Habitat for Moose. M.L. 2010, Chapter 362, Sec 2, Subd 3k. This project will be finished 6/30/2013.	\$ -	
Moose Habitat Restoration to R. Moen. M.L. 2013, Chapter XX, Sec. XX, Subd XX	\$ 200,000	Secured
Funding History: Main personnel have done preliminary work on this project topic but it has not been previously funded	\$ -	

07/24/2013

Improving Stream Trout Habitat by Beaver Management

Figure 1. The history of beaver abundance will be studied in Koochiching, Itasca, St. Louis, Lake, and Cook counties. Effects of beaver on trout habitat in DNR Designated Trout Streams will be studied within the area bounded by the dashed line. Results would be applicable to trout streams across NE MN.

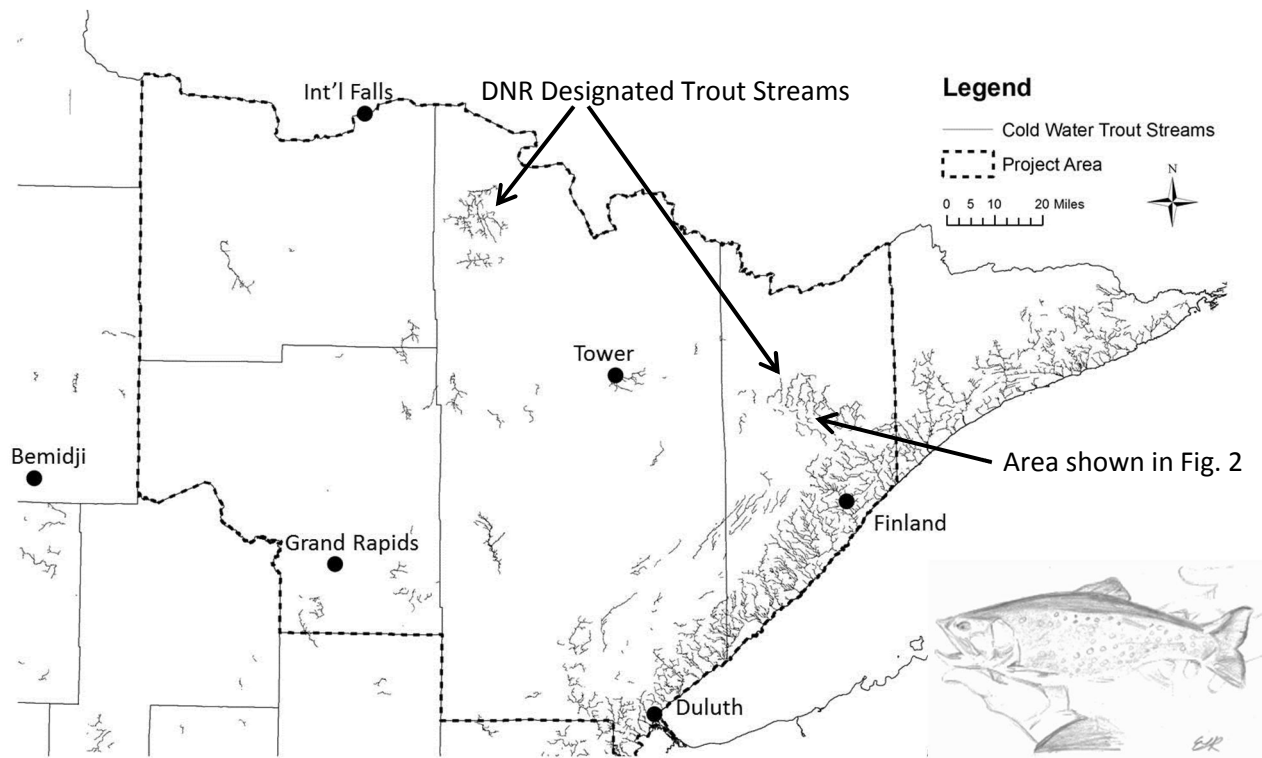
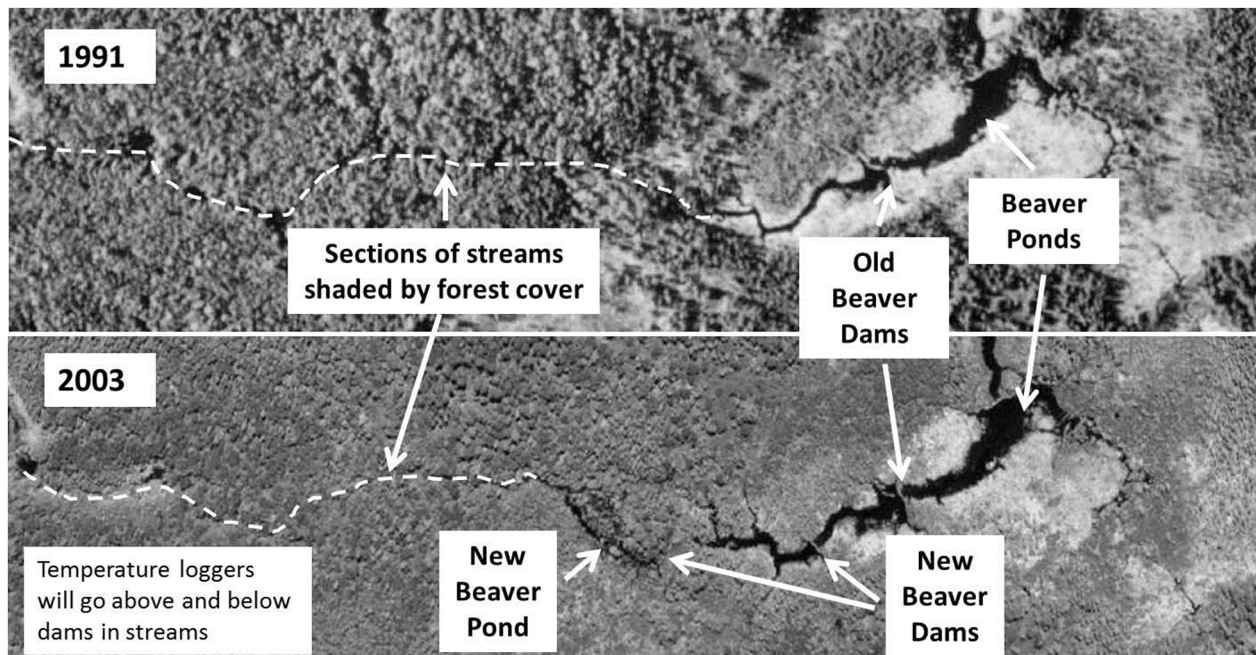


Figure 2. Aerial photographs of a section of trout stream in NE MN in 1991 and 2003. The locations of dams and ponds and new beaver activity can be seen from air photos. We will record dams, ponds, and other beaver-related activities on air photos going as far back as the 1930s.



Managing Beaver to Improve Stream Trout Habitat

2014 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, adjunct assistant professor in the Dept. of Biology at the University of Minnesota Duluth, with 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

2013. National Park Service / CESU. Climate change adaptation planning for northern forest ecosystems in the Great Lakes national parks. R. Moen, L. Frelich., S. Windels. \$400,000.

2013. Environment and Natural Resources Trust Fund. Moose habitat restoration in northeastern Minnesota. R. Moen. \$200,000.

2010. Environmental Protection Agency Great Lakes Restoration Initiative. Restoring moose foraging habitat in Lake Superior Uplands. R. Moen. \$198,000.

2010. Environment and Natural Resources Trust Fund. Identifying critical habitats for moose in northeastern Minnesota. R. Moen, M. Lenarz, M. Schrage, A. Edwards, and M. Johnson. \$510,000.

2009. U.S. Fish and Wildlife Service. Seth Moore, Andrew Edwards, and R.A. Moen. Mooz (Moose) habitat use in a changing climate. \$199,999.

2009. U.S. Geological Survey. Steve Windels, Michael E. Nelson, and R.A. Moen. Investigate effects of climate change and other factors on population viability of moose in Voyageurs National Park. \$307,700.

Selected Publications

McGraw, A.M., R.A. Moen, and L. Overland. 2012. Effective temperature of cover types found in moose home ranges in northeast Minnesota. *Alces* 48:45-52.

Moen, R.A., S.K. Windels, and B. Hansen. 2012. Suitability of Voyageurs National Park as Canada lynx habitat. *Natural Areas Journal* 32:348-355.

Moen, R.A., M.E. Nelson, and A. Edwards. 2011. Radiotelemetry locations, home ranges, and aerial surveys in Minnesota. *Alces* 47:101-112.

McGraw, A.M., R.A. Moen, and M. Schrage. 2011. Characteristics of post-parturition areas of moose in northeast Minnesota. *Alces* 47:113-124.

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. 1997. Accuracy of GPS telemetry collar locations with differential correction. *Journal of Wildlife Management* 61:530-539.

The **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.