

**Environment and Natural Resources Trust Fund
2019 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 019-A

Tagged Trout Explain if Beaver Dams Stop Fish

Category: A. Foundational Natural Resource Data and Information

Sub-Category:

Total Project Budget: \$ 389,874

Proposed Project Time Period for the Funding Requested: June 30, 2022 (3 yrs)

Summary:

We will determine when/how Beaver dams affect tagged Brook Trout movement. This will allow managers to make decisions based on knowledge, rather than opinion, of how Beaver and trout interact.

Name: Josh Dumke

Sponsoring Organization: U of MN - Duluth

Title: Senior Research Scientist

Department: Natural Resources Research Institute

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Location

Region: Northeast

County Name: Lake, St. Louis

City / Township:

Alternate Text for Visual:

Photos of Beaver dams under different conditions, suggesting not every dam represents an equal Brook Trout obstacle. Also, a mock-up stream showing Beaver dams, tag-detecting antenna, and tagged Brook Trout.

<input type="checkbox"/>	Funding Priorities	<input type="checkbox"/>	Multiple Benefits	<input type="checkbox"/>	Outcomes	<input type="checkbox"/>	Knowledge Base	
<input type="checkbox"/>	Extent of Impact	<input type="checkbox"/>	Innovation	<input type="checkbox"/>	Scientific/Tech Basis	<input type="checkbox"/>	Urgency	
<input type="checkbox"/>	Capacity Readiness	<input type="checkbox"/>	Leverage	<input type="checkbox"/>		TOTAL	<input type="checkbox"/>	%
<input type="checkbox"/> If under \$200,000, waive presentation?								



PROJECT TITLE: Tagged Trout Explain if Beaver Dams Stop Fish

I. PROJECT STATEMENT

Are Beaver dams affecting Brook Trout movement? Beaver dams are often perceived as impenetrable fish obstacles, but **our hypothesis is that not all beaver dams are complete fish barriers**. Many dams are small (suggesting fish may pass during higher flows) and not always maintained (suggesting fish may pass during intermittent breaches, or through inactive dams).

- **Goal:** Determine when Beaver dams become barriers to Brook Trout movement, with the specific outcomes of counting fish passage attempts, and identifying characteristics of individual fish, dams, and water conditions that explain when and how fish can get past Beaver dams.
- **Project Importance:** What we ‘know’ about how Brook Trout and Beaver interact is largely based on opinion rather than data, which creates controversy between land owners and avid trout anglers in Minnesota and makes it difficult for MNDNR to balance competing interests as they manage trout streams. **Our project will fill a considerable knowledge gap and offer unbiased data that could benefit Brook Trout populations through refined Beaver management.** For example, Beaver ponds with suitable temperature and oxygen year-round can be good habitat for trout and other species, so managers need science-based knowledge of how Brook Trout and Beaver interact to make informed decisions that not only affect one species, but an entire landscape.
- **Achieving our Goals:** We will place tiny electronic tags in Brook Trout and then install stationary tag-detecting antenna above and below beaver dams to record when individual trout pass up or downstream. Unsuccessful attempts to pass a dam would be apparent as repeated ‘hits’ of tagged fish on the downstream side of a dam, with no records of that fish reaching the upstream antenna. We will have treatment and control field sites, and two dams will be monitored in each. Half-way through our study, the Beaver and dams will be removed from the treatment site so we can record trout movement when no dams are present. By electronically-tracking the movements of Brook Trout and monitoring dams and water conditions, we can explain why some dams may be passable, while others remain barriers.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Record movement of Brook Trout in streams with and without Beaver dams

Description: In year 1, we will work with existing data from two prior-funded LCCMR projects, MNDNR, and USFS to select treatment and control field sites. In year 2 (dams present), we will capture trout, implant tiny electronic tags, and install tag-detecting antenna at 2 dams each in treatment and control sites. These antennas will detect each time a tagged fish passes its location. Remote cameras will capture time-lapse images of Beaver dams and water flows. Stream surveys and data loggers will capture important information around dams that could influence fish movement (e.g., temperature, oxygen, dam measurements). In year 3, Beaver dams will have been removed from the treatment site, and we will again track trout movement.

ENRTF BUDGET: \$337,881

Outcome	Completion Date
1. Year 1 start-up: Select study sites and methods with partners (MNDNR, USFS)	May 2020
2. Year 2: Tag at least 500 total trout, and collect movement data among 4 dams	November 2020
3. Year 2: Beaver and dams removed from treatment site	May 2021
4. Year 3: Repeat electrofishing, tag additional fish, and collect second season of fish movement data in control (with beaver) and treatment (without beaver) sites	November 2021



**Environment and Natural Resources Trust Fund (ENRTF)
2019 Main Proposal**

Activity 2: Determine effects of Beaver dams on trout movement and share the results

Description: Each winter, time-lapse imagery of dams, water flow, water temperature and oxygen content, and dam measurements will all be compared to Brook Trout movement. Project results will be presented to stakeholders (MNDNR, USFS, interested non-government organizations) in meetings and at the MN Chapter of the American Fisheries Society (AFS).

ENRTF BUDGET: \$51,993

Outcome	Completion Date
1. Enter and quality-check all field season data into a database by April (annually)	April 2022
2. Host 2 stakeholder meetings to share results (1 in Yr2, and 1 in Yr3 at project completion). Present project findings at MN AFS conference.	June 2022
3. Final report delivered to LCCMR	June 2022

III. PROJECT TEAM/PARTNERS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
Dr. Andrew Hafs	Associate Professor	Bemidji State University	Co-PI

B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Role
Deserae Hendrickson	Fisheries Supervisor	MNDNR	Site selection
Jason Butcher	Forest Aquatic Biologist	US-Forest Service	Site selection +winter fish tracking
Marty Rye	Hydrologist	US-Forest Service	Site selection +hydrology advisor
USFS Technicians	Hydrology/Fishery Techs	US-Forest Service	Assist with data collection

IV. LONG-TERM- IMPLEMENTATION AND FUNDING:

This project will fill a knowledge gap about whether some fish can move despite Beaver dams, and will also determine what characteristics about dams make them more or less likely to be barriers to up and downstream fish movement. This information is critical to help us understand what types of obstacles are truly barriers to Brook Trout. In addition, future work could use the purchased equipment to understand movement, timing, and return rates of steelhead (Rainbow Trout), another trout of great recreational interest and an economic driver in northeastern MN. Continuation of this or similar projects would be through additional requests to LCCMR or other funding sources.

V. TIME LINE REQUIREMENTS: Three years, from July 2019 through June 2022.

VI. SEE ADDITIONAL PROPOSAL COMPONENTS:

- A. Proposal Budget Spreadsheet**
- B. Visual Component or Map**
- C. Parcel List Spreadsheet** *(not applicable for this proposal)*
- D. Acquisition, Easements, and Restoration Requirements** *(not applicable for this proposal)*
- E. Research Addendum** *(not required at proposal stage)*
- F. Project Manager Qualifications and Organization Description**
- G. Letter or Resolution**
- H. Certified Audit or 990 Tax Information**

2019 Proposal Budget Spreadsheet

Project Title: Tagged Trout Explain if Beaver Dams Stop Fish

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel:	\$ 268,115
Josh Dumke, Principal Investigator: \$83,988 (fringe rate 33.5%); 33% FTE each year	
Bob Hell, Field Crew Leader: \$48,843 (fringe rate 27.2%); 25% FTE each year	
Holly Wellard Kelly, Fieldwork Technician: \$26,038 (fringe rate 27.2%); 20% FTE each year	
Kari Hansen, Field Technician: \$21,521 (fringe rate 27.2%); 15% FTE each year	
Bemidji State University Personnel (87,725):	
Dr. Andrew Hafs , Co-Investigator (analysis, writing, management, and outreach activities): \$17,820 (81% salary, 20% fringe); 12.5% FTE each year for 3 years. Graduate Research Assistant (data collection, analysis, writing): \$52,800 (90% salary, 10% fringe) and \$17,105 tuition and fees; 100% FTE each year for 3 years	
Professional/Technical/Service Contracts:	\$ -
Equipment/Tools/Supplies:	\$ 90,968
PIT tag antenna arrays (\$75,108): Stationary PIT tag reader antenna arrays (4 at \$18,777 ea)	
Temp / DO loggers (\$4,200): to determine beaver pond habitat suitability for trout (4 at \$1,050 ea)	
Toughbook Field Computer (\$3,500): rugged computer needed for field data collection	
Supplies (\$8,160 total): fish tags and tagging supplies (\$3,760), other field gear and supplies (\$4,400)	
Acquisition (Fee Title or Permanent Easements):	\$ -
Travel:	\$ 30,143
Bemidji State University (\$15,000): Field travel to/from sites for 3 years. Includes mileage, food per diem, and lodging. Expenses will be paid following University reimbursement policies.	
NRRI Fieldwork travel (\$15,143): Field travel to/from sites for 3 years. Includes mileage, food per diem, and lodging. Expenses will be paid following University reimbursement policies.	
Additional Budget Items:	\$ 648
Emergency GPS subscription services (\$648): \$36/mo for 6 mos each year.	
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 389,874

V. OTHER FUNDS

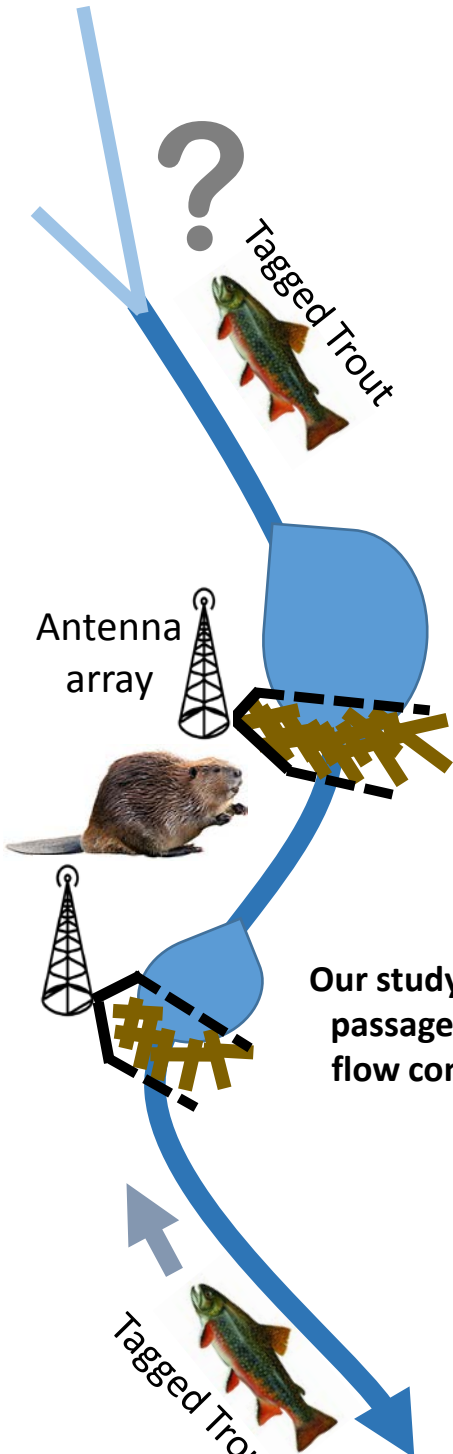
SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ To Be Applied To Project During Project Period:	\$ -	
Other State \$ To Be Applied To Project During Project Period:	\$ -	
In-kind Services To Be Applied To Project During Project Period:		
U of M NRRI: Unrecovered indirect costs (54% MTDC, base \$237,041) (MTDC charges indirect on only \$25,000 of the subaward to Bemidji State University, and equipment ≥\$5k each)	\$ 128,002	Secured
Bemidji State University: Unrecovered indirect costs (30.7% TDC, base \$102,725)	\$ 31,537	Secured
Bemidji State University: Funding to pay for two personnel to attend Minnesota Chapter of the American Fisheries Society each year of the project to share results of the project: lodging \$1,920, food \$200, registration \$480, and mileage \$450	\$ 3,050	Secured
Minnesota Department of Natural Resources: Duluth Area Fisheries Supervisor Deserae Hendrickson will provide up to 10 hours of in-kind support of this project for each of three years, for a total value of \$1,600. She will provide advice on study design, site selection, and information on Minnesota DNR beaver control efforts so that important information relevant to Minnesota DNR fisheries management needs are considered.	\$ 1,600	Secured
USDA Forest Service: Assistance from the water resources staff of the Superior National Forest as in-kind contributions for project development, logistical support, and field assistance. Hydrologist 10hrs @ \$64/hr = \$640 each year (\$1,920 total) Fish Biologist 40hrs @ \$50.50/hr = \$2,020 each year (\$6,060 total) Biological Technician 80hrs @ \$21.75/hr = \$1,740 each year (\$5,220 total)	\$ 13,200	Secured
Past and Current ENRTF Appropriation: The proposed project will use Beaver dam locations mapped using the following two LCCMR-funded projects: Bemidji State University (Dr. Andrew Hafs): M.L. 2016, Chp. 186, Sec. 2, Subd. 03 - "Improving Brook Trout Stream Habitat Through Beaver Management." \$106,636 remains unspent/not legally obligated. Natural Resources Research Institute, UMD (Dr. Lucinda Johnson): M.L. 2015, Chp. 76, Sec. 2, Subd. 08a - "Prioritizing Future Management of North Shore Trout Streams." \$106,876 remains unspent/not legally obligated.	\$ 213,512	Unspent
Other Funding History:	N/A	N/A

Tagged Trout Explain if Beaver Dams Stop Fish

The most common mental image of beaver dams are large, impermeable fish barriers:



Example of study design below:



Our study will investigate Brook Trout passage at different dam types and flow conditions using tagged trout.

However, not all dams are equal. Brook Trout passage may be possible over small dams, during high flow, or when dams are unmaintained:



Our Goal: To measure how Brook Trout interact with Beaver dams so that managers can use data, rather than opinion, as a guide for Beaver management strategies within trout streams.

PROJECT TITLE: Tagged Trout Explain if Beaver Dams Stop Fish

2019 LCCMR Project Manager Qualifications and Organization Description

Mr. Dumke is a Senior Research Scientist in fisheries and aquatic studies at the Natural Resources Research Institute. Dumke's expertise lies in project design, performing fisheries surveys, statistical analysis, and making habitat assessments of stream and wetland environments as they pertain to fish.

Dr. Hafs is an Associate Professor of Biology at Bemidji State University specializing in fisheries research. The Aquatic Biology Program at Bemidji State University has a strong reputation and offers MS degrees, making it an excellent location to conduct research focused on stream ecology. Dumke and Hafs will co-lead this project.

Dumke Education (highest degree earned)

2009 – M.S. (Integrated Biosciences), University of Minnesota Duluth

Hafs Education (highest degree earned)

2012 – Postdoctoral Research, University of California - Santa Barbara

2011 – Ph.D. Fisheries and Wildlife Resources, West Virginia University

Dumke Selected Grants as Principal Investigator

Lake Superior Steelhead Association, \$29,934, 2017-2018, Knife River Stream Assessments.

St. Louis County, \$61,541, 2015-2017, St. Louis County AIS Introduction Risk Assessment.

Hafs Selected Grants as Principal Investigator

LCCMR, \$225,000, 2016-2019, Improving Brook Trout Stream Habitat through Beaver Management

MNDNR, \$79,979, 2013-2016, Influence of American Pelican on Red Lake Walleye Natural Mortality

Dumke and Hafs Selected Publications

Dumke, J.D., H.A. Wellard-Kelly. 2017. Pre-treatment Assessment of Habitat and Biota in the Knife River Mainstem, MN. NRRI/TR-2017/09. Prepared for the Lake Superior Steelhead Association.

Dumke, J.D., T.R. Hrabik, V.J. Brady, K.B. Gran, R.R. Regal, M.J. Seider. 2010. Channel morphology response to selective wood removals in a sand-laden Wisconsin trout stream. *North American Journal of Fisheries Management* 30:776-790.

Studinski, J.M., **A.W. Hafs**, J.M. Niles, K.J. Hartman. 2017. The effects of riparian disturbance on the condition and summer diets of age-0 brook trout (*Salvelinus fontinalis*) in three central Appalachian streams. *Canadian Journal of Fisheries and Aquatic Sciences* 74:980-986.

Hafs, A.W., K.J. Hartman. 2017. Seasonal changes in condition of Appalachian brook trout. *North American Journal of Fisheries Management* 37:196-206.

The Natural Resources Research Institute is a University of Minnesota Duluth applied research organization. NRRI's mission is to deliver research solutions to balance Minnesota's economy, resources and environment for resilient communities.

Bemidji State University is an accredited higher learning institution that serves over 5,300 graduate and undergraduate students. BSU's mission is to create an innovative, interdisciplinary and highly accessible learning environment committed to student success and a sustainable future for our communities, state and planet.