

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

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**Project Title:**

**ENRTF ID: 036-AH**

Use Existing Data on Beaver Populations to Improve Management Outcomes in Minnesota

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**Category:** H. Proposals seeking \$200,000 or less in funding

**Sub-Category:** A. Foundational Natural Resource Data and Information

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**Total Project Budget: \$** 196,900

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

**Summary:**

We will conduct analyses from existing databases of beaver population dynamics in Voyageurs National Park to increase efficiency and improve management outcomes associated with beaver-human conflicts in Minnesota.

**Name:** Steve Windels

**Sponsoring Organization:** Voyageurs National Park

**Title:** Wildlife Biologist

**Department:** \_\_\_\_\_

**Address:** 3217 County Rd 24  
International Falls MN 56649

**Telephone Number:** (218) 283-6692

**Email** steve.windels@nps.gov

**Web Address**

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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**Alternate Text for Visual:**

Voyageurs National Park has collected data on beaver populations from 2000-2018. Information from EXISTING databases can be used to answer foundational questions about beaver ecology that can improve management outcomes in Minnesota.

<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: Use Existing Data on Beaver Populations to Improve Management Outcomes in Minnesota

I. PROJECT STATEMENT

Beavers are a "keystone species" that create habitat for wildlife, plants, and fish but the same beaver dam-building and tree-cutting activities that make them important ecological drivers also frequently put them in conflict with humans. Answering the following questions should increase efficiency and improve management outcomes associated with beaver-human conflicts in Minnesota.

Question 1: Why do beavers build dams and lodges where they do?

Question 2: How far can beavers disperse in different habitat types or landforms?

Question 3: How does death and dispersal of individual beavers affect abandonment of beaver colonies?

Ponded water behind beaver dams floods standing timber, or roads and other infrastructure. Tree cutting in riparian areas also results in timber losses or damage to vulnerable trees along lake front properties. Beaver dams in some streams can also degrade trout habitat or impair upstream fish movement. As a result, beavers are a common management problem for local, state, and federal agencies, and private property owners. Beavers can be trapped or dams removed but beavers often return to perpetuate the conflict, and thus require continuous management action at most local scales.

Tourism to Voyageurs National Park (VNP) generates more than 300 jobs and \$24 million dollars per year to Minnesota's economy. Voyageurs National Park also contains some of the highest densities of beavers in the United States, and long-term research on beavers conducted in the park has yielded invaluable insights into beaver ecology for the benefit of natural resource managers and scientists in Minnesota and all over the world. More than 60 peer-reviewed science publications have resulted from beaver-related research conducted at that park from the 1980s to the present. More importantly, park staff and collaborators have continued to collect a wealth of data from the beaver capital that is VNP, in the process establishing one of the largest and longest running studies of beaver populations in the world. Park staff, led by VNP Wildlife Biologist Dr. Steve Windels, have successfully live-trapped and marked more than 1,000 individual beavers, mapped nearly 4,000 beaver lodges in the park and surrounding landscape, and captured more than 150,000 photographs of beavers using game cameras since 2004.

By policy, beaver research and monitoring at VNP are conducted to aid management of VNP. HOWEVER, existing data from VNP can be analyzed to extract valuable additional information that can be used to improve science and management for the rest of Minnesota. Specifically, we believe that can we address the following three questions about beaver ecology that can have direct applications to many management problems throughout beaver range.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Determine factors affecting where beavers build dams and lodges

Where beavers decide to build dams and lodges has an obvious influence on the types of conflicts they create with humans. E.g., do they tend to build close to recent clearcuts or near roads? Using our existing database of 4,000 beaver lodges, we will build computer models to understand what factors are associated with lodge/dam building.

ENRTF BUDGET: \$44,300

Table with 2 columns: Outcome, Completion Date. Row 1: 1. Analyze factors affecting where beavers build dams and lodges, June 2020. Row 2: 2. Final report and peer-reviewed publication submitted, December 2020.

Activity 2: Estimate beaver dispersal distances and rates

Removal of dams and trapping of nuisance beavers are generally temporary solutions to beaver-human conflicts as new beavers, often dispersing juveniles, can quickly reoccupy sites and rebuild dams. We will use our existing database on movements of tagged beavers inside/outside of VNP to estimate dispersal distances and rates for



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2019 Main Proposal**

different aged beavers in several habitat types/landforms, including in lakes, rivers, and streams. This information can be incorporated in beaver management plans to improve efficiency of management actions undertaken.

**ENRTF BUDGET: \$44,300**

<b>Outcome</b>	<b>Completion Date</b>
1. <i>Analyze beaver dispersal distances and rates</i>	<i>December 2020</i>
2. <i>Final report and peer-reviewed publication submitted</i>	<i>June 2021</i>

**Activity 3: Determine factors affecting abandonment and establishment of beaver colonies**

Directed trapping removes individuals from within beaver colonies (lodges), but trapping all beavers in a colony is not necessarily feasible or desirable. What intensity of trapping effort is required to cause beavers to abandon a lodge or dam site? How does natural dispersal of juveniles from these lodges factor into abandonment rates? We will genotype up to 400 individuals to determine colony composition and relatedness, and combined with information from our existing databases of live captures and lodges, will determine factors associated with abandonment and establishment of colony sites. This information can inform land-use planning or be incorporated into beaver management plans.

**ENRTF BUDGET: \$108,300**

<b>Outcome</b>	<b>Completion Date</b>
1. <i>Analyze factors affecting abandonment and establishment of beaver colonies</i>	<i>June 2021</i>
2. <i>Final report and peer-reviewed publication submitted</i>	<i>December 2021</i>

**III. PROJECT PARTNERS:**

Project lead Dr. Steve Windels has received funding from Voyageurs National Park and the National Park Service to continue this long-term research and monitoring program since 2003. External funding is needed to extract other information from this project that could be applied to other parts of Minnesota and beyond. Dr. Windels has developed an international reputation as an expert in beaver and wetland ecology, resulting in 12 publications in peer-reviewed journals, 1 book chapter, 3 completed MS theses, and dozens of presentations at local and national conferences from beaver-related data collected at VNP.

**A. Partners receiving ENRTF funding**

- Dr. Steve Windels, Wildlife Biologist, Voyageurs National Park. Project Lead. Oversight of analysis and writing.

**B. Partners NOT receiving ENRTF funding**

- Thomas (Tom) Gable, PhD Student, University of Minnesota. Assistance with study design and writing.
- Dr. Joseph (Joe) Bump, Assoc. Professor, University of Minnesota. Assistance with study design and writing.
- Sean Johnson-Bice, Research Assoc., University of Minnesota-Duluth. Assistance with study design and writing.
- Dr. Joanne Crawford, Research Assoc., Michigan State University. Assistance with study design and writing.

**IV. LONG-TERM- IMPLEMENTATION AND FUNDING:**

This project builds on an existing long-term database of beaver data virtually unparalleled in North America. Using this existing database, we believe that can we address important questions about beaver ecology that can have direct applications to many management problems throughout Minnesota and beyond. This project also builds on the 2017 LCCMR project “Effects of Wolves on Beavers, Moose, and Deer in the Border Lakes Region.” We will disseminate our information through peer-reviewed publications, technical reports, print/social media, and presentations to local and state audiences to ensure knowledge transfer.

**V. TIME LINE REQUIREMENTS:**

This project utilizes an existing database of information about beaver populations. No field work for new data collection is planned after July 1, 2019. Once funding is transferred to the NPS and staff are hired by the end of 2019, we believe the project will progress rapidly and can be completed in the proposed 2.5-year time window.

## 2019 Proposal Budget Spreadsheet

**Project Title: Use Existing Data on Beaver Populations to Improve Management Outcomes in Minnesota**

### IV. TOTAL ENRTF REQUEST BUDGET: 2.5 years

BUDGET ITEM	AMOUNT
<b>Personnel:</b>	
Term Wildlife Biologist (66% salary, 33% benefits); 100% for 2 years; will implement analysis and serve as lead author for publications and reports.	\$ 140,000
<b>Professional/Technical/Contract Services:</b>	
DNA analysis (genotyping) to identify individual beavers and familial relationships (400 samples *\$125/ea)	\$ 50,000
<b>Equipment/Tools/Supplies:</b>	
Computer software, licensing, office supplies	\$ 1,500
<b>Travel:</b>	
In-state travel for 2 meetings/yr with project partners and 1 presentation/yr at in-state science conference to present results (mileage, food, lodging)	\$ 3,000
<b>Additional Budget Items:</b>	
Page charges for peer-reviewed publications (3@ \$800/ea)	\$ 2,400
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 196,900</b>

### V. OTHER FUNDS

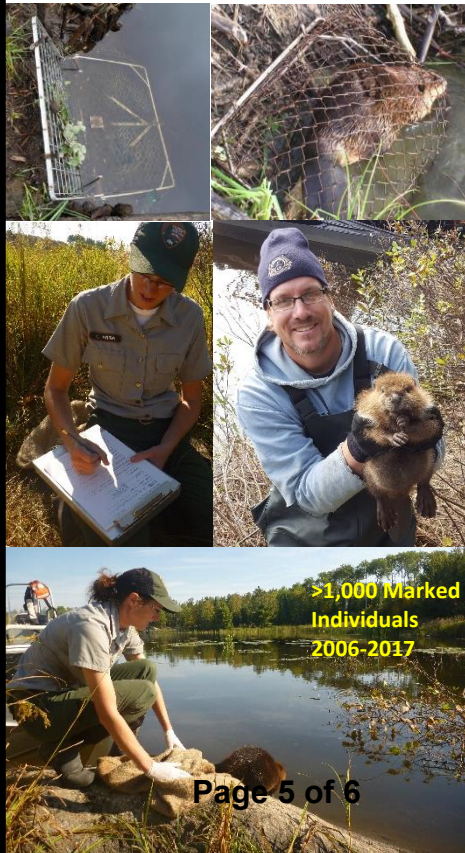
SOURCE OF FUNDS	AMOUNT	Status
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b> L'Oreal Women in Science Fellowship Program	\$ 100,000	<i>Pending</i>
<b>Other State \$ To Be Applied To Project During Project Period:</b>	None	
<b>In-kind Services To Be Applied To Project During Project Period:</b> Voyageurs National Park: 20% FTE salary/benefits for 2.5 yrs (\$61,000); 5% FTE salary/benefits for 2.5 yrs GIS support by VNP biologist (\$14,000); use of office space, computers, software, etc.	\$ 75,000	<i>Secured</i>
<b>Past and Current ENRTF Appropriation:</b> M.L. 2017, Chp. 96, Sec. 2, Subd. 03l; Effects of Wolf Predation on Beaver, Moose, and Deer; \$293,000. The majority of funds for this project are for study of wolf predation behavior. Most remaining unspent funds are for purchase of wolf telemetry collars and data acquisition. Up to \$10,000 of the remaining unspent funds from this project could go towards aerial beaver lodge surveys in 2018 and 2019, and this data could be used in Activities 1 and 3 if appropriate.	\$ 126,600	Unspent
<b>Other Funding History:</b> Voyageurs National Park/National Park Service contribute about \$19,000/yr in personnel, supplies, and transportation to collect data from live-trapped beavers in the fall from 2006-2018. They also contributed about \$10,000/yr to collect data from live-trapped beavers in the spring from 2007-2010. Estimated investment in trapping equipment (@\$400/trap) used for live-trapping is \$25,000. They also contribute about \$9,400/yr in personnel and flight time for fall aerial beaver lodge surveys from 2000-2018. Additional contributions towards data management tasks associated with this compiling and maintaining these dataset are about \$4,400/yr. Total estimated VNP/NPS contribution for data collection and mgmt is \$496,000.  University partners (Northern Michigan University, Lakehead University) have contributed significantly towards these 2 databases. Specifically, 3 MS students have worked on beaver-related projects at VNP during the period 2000-2018, estimated at a contribution of \$150,000.  Total estimated investment in generating the existing data for the period 2000-2018 is \$646,000.	\$ 646,000	<i>Secured/ Spent</i>

# Use Existing Data on Beaver Populations to Improve Management Outcomes in Minnesota

Voyageurs National Park has collected data on beaver populations from 2000-2018, perhaps the longest and largest continuous beaver research program in North America.

Information from EXISTING databases can be used to answer foundational questions about beaver ecology that can improve management outcomes in Minnesota.

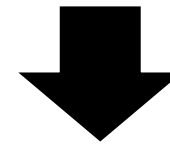
## Live-Trapping



## Aerial Lodge Surveys



- Question 1: Why do beavers build dams and lodges where they do?
- Question 2: How far can beavers disperse?
- Question 3: How does death and dispersal of individual beavers affect turnover of beaver colonies?



## Project Outcomes

- Increased efficiency in application of nuisance trapping and dam removal
- Incorporation into land-use planning to minimize future human-beaver conflicts

ENRTF ID: 036-AH



## Project Title: Use Existing Data on Beaver Populations to Improve Management Outcomes in Minnesota

### 2019 LCCMR Project Manager Qualifications and Organization Description

#### I. QUALIFICATIONS

Dr. Steve K. Windels has been a Research Wildlife Biologist at Voyageurs National Park, MN from 2003-present. He currently oversees research and monitoring projects on beavers, wolves, moose, and other wildlife species. Most relevant to the proposed project, he and his staff have successfully live-trapped and marked more than 1,000 individual beavers, mapped nearly 4,000 beaver lodges in the park and surrounding landscape, and captured more than 150,000 photographs of beavers using game cameras since 2004. He recently won the prestigious National Park Service Director's Award for Natural Resource Research in 2014.

#### Education/Certification

Ph.D. in Wildlife Ecology, Michigan Technological University  
M.S. in Range and Wildlife Management, Texas A&M University – Kingsville  
B.S. in Fisheries and Wildlife Management, University of Minnesota  
Certified Wildlife Biologist® by The Wildlife Society.

#### Relevant Publications

Johnson-Bice, S., K. Renik, **S.K. Windels**, and A. Hafis. *In Review*. A review of beaver-salmonid relationships and history of management actions in the Western Great Lakes (U.S.) Region. *North American Journal of Fisheries Management*.

Gable, T.D., T. Stanger, J.K. Bump, and **S.K. Windels**. 2018. Do wolves ambush beavers? Video evidence for higher-order hunting strategies. *Ecosphere* 9(3):e02159. doi 10.1002/ecs2.2159

Gable, T.D., **S.K. Windels**, F. Rosell, and M. Romanski. 2018. The forgotten prey of an iconic predator: a review of gray wolf-beaver dynamics. *Mammal Review* 48:123-138.

**Windels, S.K.** 2017. Beavers as Engineers of Wildlife Habitat. *In Beavers: Boreal Ecosystem Engineers*. Carol Johnston, ed. Springer-Verlag Press.

Gable, T.D., and **S.K. Windels**. 2017. Kill rates and predation rates of wolves on beavers. *Journal of Wildlife Management*. DOI 10.1002/jwmg.21387.

Gable, T.D., **S.K. Windels**, J.G. Bruggink, and A.T. Homkes. 2016. Where and how wolves kill beavers. *PLoS One* 11(12).

Smith, J.B., **S.K. Windels**, T. Wolf, R. Klaver, and J.L. Belant. 2016. Do transmitters affect fitness indices of American beavers (*Castor canadensis*)? *Wildlife Biology* 22:117-123.

**Windels, S.K.**, and J.L. Belant. 2016. Performance of tail-mounted transmitters on American beavers *Castor canadensis* in a northern climate. *Wildlife Biology* 22:124-129.

Johnston, C.L., and **S.K. Windels**. 2015. Using beaver works to estimate colony activity in boreal landscapes. *Journal of Wildlife Management* 79:1072-1080.

Severud, W.J., J.L. Belant, **S.K. Windels**, and J.G. Bruggink. 2013. Seasonal variation in assimilated diets of American beavers. *American Midland Naturalist* 169:30-42.

Severud, W.J., **S.K. Windels**, J.L. Belant, and J.G. Bruggink. 2013. The role of forage availability on diet choice and body condition in American beavers (*Castor canadensis*). *Mammalian Biology* 78: 87-93.

**Windels, S.K.** 2013. Ear tag loss rates in American beavers. *Wildlife Society Bulletin* 38:122-126.

Severud, W.J., J.L. Belant, J.G. Bruggink, and **S.K. Windels**. 2011. Predator cues reduce American beaver use of foraging trails. *Human Wildlife Interactions* 5:296-305.

#### II. RESPONSIBILITIES

Dr. Windels will coordinate and manage the overall project, and directly supervise the term NPS biologist, who will implement the data analysis plan and be the primary author of peer-reviewed publications. Dr. Windels will also oversee all aspects of study design, analysis, and final reporting.

#### III. ORGANIZATION DESCRIPTION

The mission of the National Park Service, celebrating its 100<sup>th</sup> Anniversary in 2016, is “to preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations.” Voyageurs National Park, Minnesota’s only National Park, was established in 1975 to preserve the history and natural resources of the Border Lakes Region. In many ways, American beavers are to Voyageurs National Park as wolves are to Yellowstone National Park, or wildebeest are to the Serengeti. They are an iconic wildlife species whose presence and activity shapes both the ecological foundations of the park but also the experience of we humans who visit it. Voyageurs National Park presents a unique window into the past about the dramatic importance of beavers to shaping their environment, perhaps only on a scale equaled by humans. The National Park Service has a strong mission to promote the use of National Parks as natural laboratories to better understand the natural world.