Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2017 LCCMR Work Plan

Date of Submission: May 31, 2017

Date of Next Status Update Report: January 1, 2018

Date of Work Plan Approval: 06/07/2017

Project Completion Date: June 30, 2020

Does this submission include an amendment request? _N_

PROJECT TITLE: Effects of Wolf Predation on Beaver, Moose, and Deer

Project Manager: Steve K. Windels

Organization: Voyageurs National Park

Mailing Address: 360 Hwy 11 E

City/State/Zip Code: International Falls, MN 56649

Telephone Number: (218) 283-6692

Email Address: steve_windels@nps.gov

Web Address: www.researchgate.net/profile/Steve_Windels

Location: Koochiching and St. Louis Counties

Total ENRTF Project Budget:	**ENRTF Appropriation:**	**$293,000**
	Amount Spent:	**$0**
	Balance:	**$293,000**

Legal Citation: M.L. 2017, Chp. 96, Sec. 2, Subd. 03l

Appropriation Language:
$293,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Voyageurs National Park to assess the effects of wolf predation on beaver, moose, and deer in the Border Lakes region. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Effects of Wolves on Beavers, Moose, and Deer in the Border Lakes Region

II. PROJECT STATEMENT:

We propose to examine gray wolf hunting behavior in an area with abundant beavers to better understand how the availability of vulnerable beaver prey may affect wolf predation on moose and deer. Gray wolves are widely known to prey on adults and fawns/calves of deer and moose. Beavers also make up a large portion of the diet in areas where beavers are plentiful. Recent studies in Voyageurs National Park (VNP) and surrounding area, where beaver densities are very high, demonstrated that up to 38% of the summer diet is beavers. In other areas of the state beavers are much less a part of wolf diet, generally <5-15%. Moose persist in VNP at low numbers, despite a healthy gray wolf population. Does the high abundance of beavers, a more easily killed prey item than moose, result in lower predation on moose? Likewise, how does the availability of beaver prey affect wolf predation on adult and fawn deer in summer and fall?

Beavers are 2-10x more abundant in VNP than elsewhere in the state because trapping has not been permitted within federally-owned lands in VNP since park establishment in 1975. High beaver densities are generally not tolerated elsewhere in Minnesota because of conflicts they cause from flooding of roads, cutting valuable timber or trees on waterfront property, or stream fisheries. However, a trade-off of lowered beaver densities may be increased predation on moose and deer by wolves.

Voyageurs National Park offers the perfect natural laboratory in Minnesota to learn about wolf hunting behavior in an area where beaver densities can be very high.

The proposed project would build on past and current monitoring and research in VNP related to wolf, beaver, moose, and deer interactions by focusing resources on estimating wolf diet from scats, stable isotopes, and examining kill sites of GPS-collared wolves in VNP for a 3-year study period. Specifically, our project goals are to:

1) Determine wolf predation rates on beavers, adult and calf moose, and adult and fawn deer for each of the 6-8 wolf packs that overlap VNP;
2) Census beaver populations within each wolf pack in VNP annually; and
3) Evaluate the relationship between beaver abundance and wolf predation rates on other prey species such as moose and deer.

Although the proposed research would occur within the boundaries of a U.S. National Park, the results will be applicable anywhere in MN where wolves, beavers, moose, and deer overlap. Project results will also add to the information generated by several other LCCMR-funded projects investigating the cause of moose declines in Minnesota.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of *January 1, 2018:*

Project Status as of *June 30, 2018***:**

Project Status as of *January 1, 2019***:**

Project Status as of *June 30, 2019***:**

Project Status as of *January 1, 2020***:**

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Determine predation rates on moose, deer, and beavers

Description: Within each of the 6-8 wolf packs (the number varies each year) whose territory overlaps VNP, we will capture and GPS-collar at least 2 wolves/pack. Potential wolf kill sites will be identified from GPS-collar locations (uploaded daily by satellite) and ground crews will examine sites for evidence of species (moose, deer, beaver, other), sex, and age (from teeth and other bones).

Summary Budget Information for Activity 1:

ENRTF Budget: $ 233,000
Amount Spent: $ 0
Balance: $ 233,000

Outcome	Completion Date
1. *Capture and GPS-collar ≥12 wolves.*	November 30, 2018
2. *Estimate wolf predation rates on moose, deer, and beaver.*	November 30, 2019
3. *Final report and activity results submitted.*	June 30, 2020

Activity 1 Status as of *January 1, 2018***:**

Activity 1 Status as of *June 30, 2018***:**

Activity 1 Status as of *January 1, 2019***:**

Activity 1 Status as of *June 30, 2019***:**

Activity 1 Status as of *January 1, 2020***:**

Final Report Summary:

ACTIVITY 2: Census beaver populations within each wolf pack in VNP

Description: Annual fall beaver cache surveys will be completed using fixed-wing aircraft. Each active beaver lodge will be identified and mapped using real-time GIS software. Beaver abundance data gathered for this project can be related to other beaver population work done in VNP from the 1950s-present.

Summary Budget Information for Activity 2:

ENRTF Budget: $ 20,000
Amount Spent: $ 0
Balance: $ 20,000

Outcome	Completion Date
1. *Annual estimates of beaver abundance in each wolf pack.*	November 30, 2019
2. *Final report and activity results submitted.*	June 30, 2020

Activity 2 Status as of *January 1, 2018***:**

Activity 2 Status as of *June 30, 2018***:**

Activity 2 Status as of *January 1, 2019***:**

Activity 2 Status as of *June 30, 2019***:**

Activity 2 Status as of *January 1, 2020***:**

Final Report Summary:

ACTIVITY 3: Evaluate relationship between beaver abundance and wolf predation on moose and deer

Description: Beaver abundance varies across the VNP landscape and therefore varies between wolf packs. We will evaluate how differences in the abundance of beavers can affect wolf predation rates on moose and deer of different sex and age classes (fawn/calves, yearlings, prime adults, old adults).

Summary Budget Information for Activity 3:

ENRTF Budget: $ 40,000
Amount Spent: $ 0
Balance: $ 40,000

Outcome	Completion Date
1. *Modeling/analysis of predation rates and prey abundance.*	November 30, 2019
2. *Final report and management recommendations detailing linkages between beaver abundance and wolf predation rates on moose and deer.*	June 30, 2020

Activity 3 Status as of *January 1, 2018***:**

Activity 3 Status as of *June 30, 2018***:**

Activity 3 Status as of *January 1, 2019***:**

Activity 3 Status as of *June 30, 2019***:**

Activity 3 Status as of *January 1, 2020***:**

Final Report Summary:

V. DISSEMINATION:
Description: Project progress and results will be shared with the public in a number of ways. While field work is ongoing, outreach will include newsletter articles; articles in local, regional, and state newspapers; posts on Voyageurs National Park's Facebook page; presentations to interested stakeholder groups (e.g., Minnesota Deer Hunter's Association or Isaac Walton League of Duluth); presentations at scientific conferences; and peer-reviewed literature in quality journals.

Status as of *January 1, 2018***:**

Status as of *June 30, 2018***:**

Status as of *January 1, 2019***:**

Status as of *June 30, 2018***:**

Status as of *January 1, 2020***:**

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:
A. Preliminary ENRTF Budget Overview:
***This section represents an overview of the preliminary budget at the start of the project. It will be reconciled with actual expenditures at the time of the final report.**

Budget Category	$ Amount	Overview Explanation
Personnel:	$ 156,500	NATIONAL PARK SERVICE: 4 interns at 20% FTE for 2 years = $6,500. UNIVERSITY OF MINNESOTA-TWIN-CITIES: 1 graduate research assistant at 50% FTE for 2.75 years ($120,000); 2 undergraduate research assistants at 33% FTE for 2 years ($30,000). Allocation of effort among personnel categories are estimates that may be adjusted to best meet project objectives.
Professional/Technical/Service Contracts:	$72,000	NATIONAL PARK SERVICE: GPS collar data acquisition for 3 years. $2000/collar/yr for 3 years * 12 collars/yr.
Equipment/Tools/Supplies:	$41,500	NATIONAL PARK SERVICE: 24 GPS collars @$1,500 ea = $36,000; pharmaceuticals for wildlife capture = $3,000; GPS units and other field supplies = $2,500.
Travel Expenses in MN:	$8,000	NATIONAL PARK SERVICE: Vehicle mileage = $5000; boat gas for boat travel in park = $3,000
Other:	$15,000	NATIONAL PARK SERVICE: Flight time for beaver surveys; $100/hr * 50 hours/yr * 3 years.
TOTAL ENRTF BUDGET:	**$293,000**	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than $5,000: N/A

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 4.3 FTE

Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 0

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state			
Voyageurs National Park (in-kind)	$176,000	$	Project management; supplemental wolf monitoring and kill sites visits; misc field supplies and equipment; boat and vehicle use; housing for interns; pilot salary
TOTAL OTHER FUNDS:	**$176,000**	**$**	

VII. PROJECT STRATEGY:

A. Project Partners:

Partners receiving ENRTF funding

- *Steve K. Windels; Wildlife Biologist; Voyageurs National Park; will supervise field component of the project; will co-advise PhD student at UMN and assist with aspects of study design, data analysis, and preparation of peer-reviewed manuscripts. Windels has 14 years of experience at Voyageurs National Park conducting applied research on wolves, beavers, moose, deer, and other wildlife.*
- *Joseph K. Bump; Associate Professor; Gullion Chair; University of Minnesota-Twin Cities; will co-advise PhD student at UMN and assist with aspects of study design, data analysis, and preparation of peer-reviewed manuscripts. Bump has 14-years of experience working on wildlife projects related to wolves and is in a position to support this project as a featured part of a newly established research lab at University of Minnesota-Twin Cities. This will increase the profile of this project, increase dissemination potential, and create new opportunities for funding, collaboration, synergetic research with other faculty in the Department of Fisheries, Wildlife, and Conservation Science.*

Partners NOT receiving ENRTF funding

- *Ron Moen; Assoc Prof; University of Minnesota-Duluth; will assist with aspects of study design, data analysis, and preparation of peer-reviewed manuscripts.*

B. Project Impact and Long-term Strategy: If clear linkages can be found between beaver abundance and wolf predation rates on moose and deer, *potential management options exist where beaver populations could be manipulated to alleviate predation on moose and deer*. Options include reduced beaver harvest or incentives to encourage beavers in low density areas. This project would also contribute to continued understanding of the ecology of wolves and their prey in a natural setting in northern Minnesota.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	$ Amount
Voyageurs National Park (in-kind): funding provided to conduct annual wolf monitoring, annual beaver monitoring, and diet analysis for several wolf packs.	October 2012-June 2017	>$200,000

VIII. REPORTING REQUIREMENTS:

- **The project is for 3 years, will begin on 06/30/17, and end on 06/30/2020.**
- **Periodic project status update reports will be submitted** *[January 1]* **and** *[June 30]* **of each year.**
- **A final report and associated products will be submitted between June 30 and August 15, 2020**.

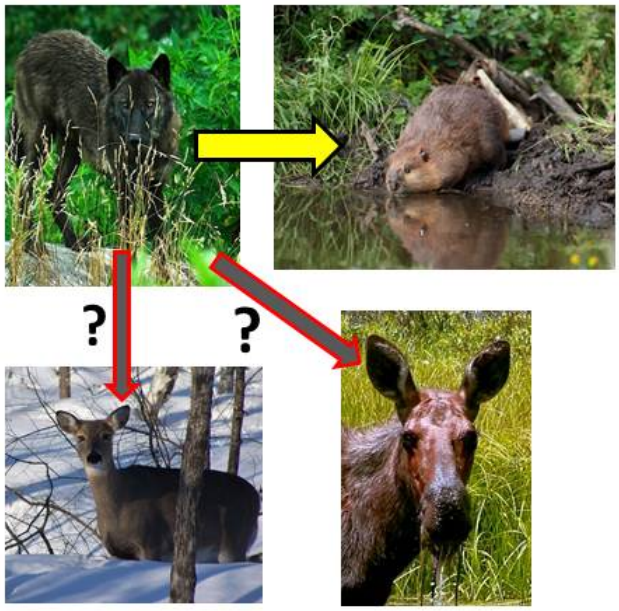
IX. VISUAL COMPONENT or MAP(S): see attached figures.

A. Parcel List: N/A

B. Acquisition/Restoration Information: N/A

Effects of Wolves on Beavers, Moose and Deer in Border Lakes Region

Wolves prey on moose, deer, and beavers. Does the availability of beavers, an easy food source, reduce predation pressure on moose and deer?



GPS collars on wolves can point to locations where wolves have killed prey. Species, sex, and age of prey items can be identified to understand wolf predation under high and low beaver densities.

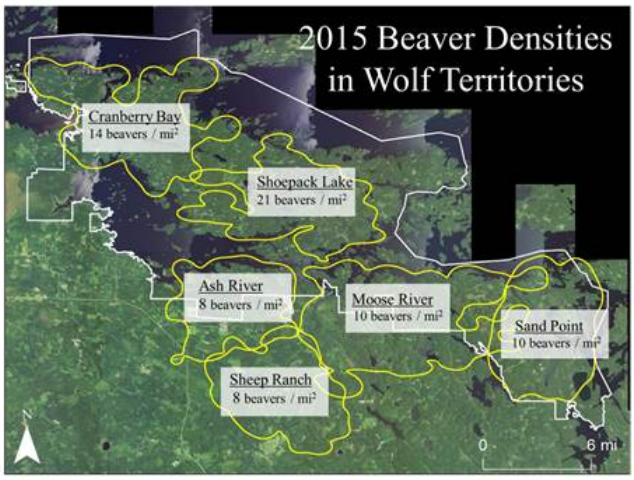
Examples of wolf kill sites

Wolf-Killed Beaver

Wolf-Killed Moose

Fig. 1. Voyageurs National Park, Minnesota's only National Park, has prohibited trapping since establishment in 1975. This has resulted in a beaver-rich environment where beaver abundance is 2-10x higher than other parts of the state.

Fig. 2. Beaver abundance varies spatially in the Voyageurs National Park landscape due to differences in topography. This variability will allow us to test wolf hunting behavior in 6-8 packs that have varying abundances of beavers.



Project Synergy

This proposal builds on other current research and monitoring in Voyageurs National Park, allowing us to cost-effectively study the relationship between wolves, beavers, moose, and deer in a relatively natural system:

- 1959-present: Long-term beaver population monitoring
- 2006-present: Beaver research
- 2009-present: Moose and deer population monitoring and research
- 2012-present: Wolf population monitoring and research

Potential Outcomes of Proposed Project

- Potential management recommendations to manipulate beaver populations to alleviate predation on moose and deer. Options include reduced beaver harvest or incentives to encourage beavers in low density areas
- Inform recommendations of Moose Management Options Committee and/or Moose Advisory Committee
- Improve understanding of ecology of wolves and their prey in northern Minnesota

Environment and Natural Resources Trust Fund

M.L. 2017 Project Budget

Project Title: Effects of Wolf Predation on Beaver, Moose, and Deer

Legal Citation: M.L. 2017, Chp. 96, Sec. 2, Subd. 03l

Project Manager: *Steve K. Windels*

Organization: *Voyageurs National Park*

M.L. 2017 ENRTF Appropriation: $293,000

Project Length and Completion Date: *3 Years, June 30, 2020*

Date of Report: November 1, 2016

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	***Determine Predation Rates…***			***Census Beaver Populations…***			***Evaluate Relationship….***				
Personnel (Wages and Benefits) - Overall											
Thomas Gable, Graduate Research Asst (56% salary, 44% benefits), UMN; 50% FTE for 2.75 yrs; will lead/coordinate all field work, data collection, analysis, writing, and public outreach.										$120,000	$120,000
2 Undergraduate Research Technicians (100% salary, 0% benefits), UMN; 33% FTE for 2 yrs; for wolf capture and kill site visitation.										$30,000	$30,000
4 Wildlife Interns (100% stipend @ $200/mo), NPS; 20% FTE for 2 yrs; to assist with wolf capture and kill site visitation.										$6,500	$6,500
Professional/Technical/Service Contracts											
GPS-satellite collar data acquisition contract; 12 collars/yr for 3 years; $2000/yr/collar. To be selected through competitive bid.	$72,000	$0	$72,000							$72,000	$72,000
Equipment/Tools/Supplies											
GPS-satellite wolf collars; $1500/collar for 24 collars to maintain 2 collars/pack for 3 years. Includes replacements for lost/damaged collars. To be selected through competitive bid.	$36,000	$0	$36,000							$36,000	$36,000
Pharmaceuticals for wolf capture @ $83/capture * 36 captures	$3,000	$0	$3,000							$3,000	$3,000
Misc field supplies for scat collection, stable isotopes, kill site visitation. E.g,. GPS units, sample bags, field notebooks, etc.	$2,500	$0	$2,500							$2,500	$2,500
Travel expenses in Minnesota											
Mileage paid to GSA per Federal guidelines. Boat gas for NPS-owned boats.	$8,000	$0	$8,000							$8,000	$8,000
Other											
Flight time for annual beaver census ($100/hr) 50 hours/yr for Year 1-3. Rate for NPS-owned aircraft per Federal govt. guidelines.				$15,000	$0	$15,000				$15,000	$15,000
COLUMN TOTAL	**$233,000**	**$0**	**$233,000**	**$20,000**	**$0**	**$20,000**	**$40,000**	**$0**	**$40,000**	**$293,000**	**$293,000**