Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2015 Work Plan

Date of Report: May 22, 2015

Date of Next Status Update Report: January 1, 2016

Date of Work Plan Approval:

Project Completion Date: June 30, 2018

Does this submission include an amendment request? No

PROJECT TITLE: Movement and Seasonal Habitat Use of Minnesota Elk

Project Manager: Gino J. D'Angelo

Organization: Minnesota Department of Natural Resources, Division of Fish and Wildlife, Section of Wildlife

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Location: The project will be conducted in the Minnesota counties of Beltrami, Kittson, Marshall, and Roseau.

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$200,000**
	Amount Spent:	**$0**
	Balance:	**$200,000**

Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 03k

Appropriation Language:
$200,000 the first year is from the trust fund to the commissioner of natural resources to collect biological information about Minnesota elk, including movements and habitat use to enable long-term, sustainable management. This appropriation is contingent on a $50,000 match from state or non-state sources. This appropriation is available until June 30, 2018, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Movement and Seasonal Habitat Use of Minnesota Elk

II. PROJECT STATEMENT: Elk (*Cervus elaphus*) were numerous across the Minnesota prairie and forest transition zone prior to settlement by Europeans. Due mainly to conversion of habitat to agriculture and over-exploitation, elk were extirpated from Minnesota by the early 1900s. Through restoration efforts and immigration, there are currently about 150 elk in northwest Minnesota (Figure 1). The primary objective of this study is to provide baseline information necessary to efficiently accelerate management of elk and their habitats for future enhancement of elk in the state. We will affix Global Positioning System (GPS) collars to 20 adult elk and study their movements and preferences for habitats. This study will provide the first information collected about movements, home ranges, and habitat use by elk in Minnesota. A two-pronged approach, including spatial analysis of elk movements and direct measurement of habitat characteristics, is necessary to classify fine-scale habitats preferred by elk in Minnesota. This information will enable MNDNR to improve management practices and to identify additional patches of habitat likely to be used by elk, which may be managed to aid in enhancing the population size and range extent of elk in the future. The goals of this project are to: 1) describe the home range sizes and movements of adult elk, and 2) characterize seasonal habitat use of elk at the landscape level and identify fine-scale habitat features preferred by elk. These data will inform future management of the population and will help design strategies to improve the habitats essential to elk. In subsequent research, MNDNR will use data generated in the proposed study to develop landscape level maps with Global Information Systems (GIS) to identify additional areas ideal for improving elk habitats to promote the enhancement of elk numbers and their range extent.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of January 1, 2016:

Project Status as of July 1, 2016:

Project Status as of January 1, 2017:

Project Status as of July 1, 2017:

Project Status as of January 1, 2018:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Describe home range sizes and movements of adult elk.

Description: Beginning in January 2016, we will capture 20 adult elk and fit them with GPS collars. We will set GPS collars to collect multiple daily locations of elk for one year. GPS collars will be programmed to obtain locations approximately every 2-4 hours. Locations will be automatically downloaded from Iridium satellites. We will segregate locations into discrete seasonal periods to determine home range sizes of elk and core areas of use during biologically critical time periods of the year, including pre-parturition, parturition, post-parturition, breeding, and post-breeding. We will calculate the size and spatial orientation of home ranges, and we will use a subset of clustered locations to develop core areas. Additionally, we will examine shifts in home ranges, changes in core areas of use among seasons, and spatial overlap among collared study animals.

Summary Budget Information for Activity 1:

ENRTF Budget:	**$151,089**
Amount Spent:	**$ 0**
Balance:	**$151,089**

Outcome	Completion Date
1. Capture 20 adult elk and fit with GPS collars	3/15/2016
2. Complete collection of location data from collared elk	3/15/2017
3. Analyze locations to determine annual home ranges, seasonal home ranges, and movement patterns	9/30/2017
4. Report findings	6/30/2018

Activity Status as of January 1, 2016:

Activity Status as of July 1, 2016:

Activity Status as of January 1, 2017:

Activity Status as of July 1, 2017:

Activity Status as of January 1, 2018:

Final Report Summary:

ACTIVITY 2: Evaluate seasonal habitat use of adult elk.

Description: Within each seasonal core area for individual elk, we will select randomly 5 location points recorded by GPS collars to sample habitat characteristics. At each sampling point, we will center a sampling array oriented to a randomly generated azimuth. Sampling arrays will be sampled once during the growing season. Procedures will generally follow previously established methods for elk habitat evaluations.

Within each sampling plot, the following variables will be recorded: 1) woody seedlings-species and height; 2) percent cover of bare ground, litter, forbs, grasses, woody vegetation or other conditions to be described; 3) biomass of herbaceous plants by species, 4) percent plant cover in vertical zones, 5) canopy coverage, and 6) a record all trees and shrubs by species and diameter at breast height.

Summary Budget Information for Activity 2:

ENRTF Budget: $48,911
Amount Spent: $ 0
Balance: $48,911

Outcome	Completion Date
1. Determine landscape-level habitats used by elk	9/30/2017
2. Characterize fine-scale habitat features preferred by elk	3/15/2018
3. Report findings and make recommendations	6/30/2018

Activity Status as of January 1, 2016:

Activity Status as of July 1, 2016:

Activity Status as of January 1, 2017:

Activity Status as of July 1, 2017:

Activity Status as of January 1, 2018:

Final Report Summary:

V. DISSEMINATION:

Description: The results of the study will be reported in the MNDNR Summaries of Wildlife Research Findings, in a Master's thesis, in a peer-reviewed scientific journal, and in professional presentations at conferences. Also, the results will be shared with MNDNR area wildlife managers via summary reports and direct consultation. Working with the MNDNR Office of Communications and Outreach, we will publicize widely to the public about the progress and findings of the research.

Status as of January 1, 2016:

Status as of July 1, 2016:

Status as of January 1, 2017:

Status as of July 1, 2017:

Status as of January 1, 2018:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Overview Explanation
Professional/Technical/Service Contracts:	$144,000	1 Graduate student ($91,000) – for 3 years (50% research assistantship) to lead fieldwork for analysis of home range and habitat data. Elk capture ($33,000) – wildlife helicopter capture company (to be determined) to capture and handle 20 adult elk. Iridium satellite data acquisition ($20,000) – transmission of locations and mortality messages.
Equipment/Tools/Supplies:	$52,548	GPS collars for adult elk ($50,000) – 20 collars @ $2,500 each to collect data, transmit temperature data and mortality signals. Vegetation sampling supplies ($2,548) – measurement devices and associated supplies.
Other: Direct & Necessary Costs	$3,452	DNR Direct & Necessary Costs ($3,452) – services to support this appropriation (*Please see footnote).
TOTAL ENRTF BUDGET:	**$200,000**	

* Direct support services. DNR's direct and necessary costs pay for activities that are directly related to and necessary for accomplishing appropriated programs/projects. In addition to itemized costs captured in our proposal budget, direct and necessary costs cover Financial Support (~$1,372), Communication Support (~$1,141), Planning Support (~$704), and Procurement Support (~$235) that are necessary to accomplishing funded programs/projects. Department Support Services are described in the agency Service Level Agreement, and billed internally to divisions based on rates that have been developed for each area of service. These services are directly related to and necessary for the appropriation. Department leadership services

(Commissioner's Office and Regional Directors) are not assessed. Those elements of individual projects that put little or no demand on support services such as large single-source contracts, large land acquisitions, and funds that are passed-thru to other entities are not assessed Direct and Necessary costs for those activities.

Explanation of Use of Classified Staff: Funds will not be used to pay for classified staff.

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

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: N/A.

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 1.5 FTE.

B. Other Funds: To meet and exceed the $50,000 funding match required in the appropriation law, MNDNR Section of Wildlife will provide a total of $69,250 in funding from the State Game and Fish Fund to directly support this research project including technology support ($20,000), student workers ($11,250), supplies ($13,000), travel ($20,000), and a spotter plane for elk capture ($5,000). Additionally, multiple employees from the MNDNR Section of Wildlife, Farmland Populations and Research Group will devote approximately 25% effort to the project throughout its 36-month duration (Total salary ~$63,656).

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
State Game and Fish Fund			
MNDNR Section of Wildlife	$20,000	$	Technology support for programming GPS collars, GPS and GIS work.
MNDNR Section of Wildlife	$11,250		Student workers ($11,250) – to assist graduate student with vegetation sampling (750 hours @ $15/hr).
MNDNR Section of Wildlife	$5,000	$	Project supplies – additional vegetation sampling supplies, GPS units, digital camera, capture supplies.
MNDNR Section of Wildlife	$8,000	$	Immobilization and reversal drugs for elk capture.
MNDNR Section of Wildlife	$20,000	$	Travel to study area and per diem by elk project management staff, graduate student, and student workers.
MNDNR Section of Wildlife	$5,000	$	Spotter plane to be used during elk capture efforts.
MNDNR Section of Wildlife, Farmland Populations and Research Group	$63,656	$	Multiple employees (36 months, 25% effort) – project management, field work, data analyses, reporting.
TOTAL OTHER FUNDS:	**$132,906**	**$**	

VII. PROJECT STRATEGY:

A. Project Partners:

Dr. Gino D'Angelo, MNDNR, project manager; Dr. Marrett Grund, MNDNR, co-investigator;
Dr. Lou Cornicelli, MNDNR, collaborator; Mr. John Williams, MNDNR, collaborator; Ms. Leslie McInenly, MNDNR, collaborator; Mr. Joel Huener, MNDNR, collaborator.

B. Project Impact and Long-term Strategy:
This study will provide the first scientifically collected information about movements, home ranges, and habitat use by elk since reestablishment of the species in Minnesota. Improving our understanding about seasonal movement patterns and habitat use of elk will facilitate population monitoring processes, help evaluate current habitat and depredation management actions, and will allow MNDNR to develop science-based options for managing elk and their habitats. This study will provide MNDNR with the data necessary to identify portions of northwest Minnesota that are most likely to support viable and sustainable elk populations.

Procurement and manipulation of habitats to benefit elk in Minnesota is essential to the long-term management, enhancement, and viability of the species. Empirical evidence of the most effective habitat management strategies or the habitats most suited to manipulation to meet elk management goals is lacking. Identifying the habitat conditions critical to elk at key seasonal periods will improve application of specific management strategies where they are most needed. This will be an immediate benefit of the proposed research. Using data about elk movements, we will inform managers about the preferences of elk for landscape level habitat features. Results of fine-scale habitat evaluations will identify microhabitat characteristics important to elk, which may be achieved throughout the landscape by habitat management. Also, knowledge of elk locations in winter will improve the efficiency, accuracy, and precision of population surveys.

Data collected from this study will establish foundational information for more advanced analysis of the spatial relationships of habitat types and configurations. In subsequent research, we plan to use data collected from the currently proposed study to develop resource selection functions for elk in northwestern Minnesota. We will test variables important to predicting elk habitat use relative to available habitats in the region including landcover, distance to roads, distance to agriculture, distance to public land, and others habitat features elucidated as potentially important during our analyses of home ranges and local level habitat evaluations. This information will allow us to create predictive maps of habitats most suitable to elk, which will assist MNDNR in making informed predictions about the potential for natural expansion of elk across the landscape and other areas suitable to expansion of elk.

As an added benefit, the proposed research will stimulate the public's interest and understanding of elk and their habitats. By enhancing elk numbers and management, economic growth associated with elk-related recreation is quite likely.

C. Funding History: No portions of this project or any other elk research by MNDNR were funded previously by the Environment and Natural Resources Trust Fund. Although MNDNR has not previously conducted scientific research on Minnesota elk, management of the elk herds and associated habitats has increased in recent years. Since the 1990s, MNDNR has conducted habitat management on public and private land to benefit elk and to minimize elk-human conflicts. From 2010-2014, MNDNR spent approximately $100,000 to survey elk and estimate their population size to aid in setting harvest quotas. In 2014, MNDNR utilized a total of $166,830 in funding from a variety of sources to improve elk management, including $73,890 in DNR funding, and grants from the Conservation Partners Legacy of the Outdoor Heritage Fund ($52,500), Minnesota Deer Hunters Association ($2,250), and the Rocky Mountain Elk Foundation ($38,190).

VIII. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS:

A. Parcel List: N/A

B. Acquisition/Restoration Information: N/A

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

X. RESEARCH ADDENDUM: Please see attached research addendum.

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than January 1, 2016; July 1, 2016; January 1, 2017; July 1, 2017; and January 1, 2018. A final report and associated products will be submitted between June 30 and August 15, 2018.

Environment and Natural Resources Trust Fund
M.L. 2015 Project Budget

Project Title: Movement and Seasonal Habitat Use of Minnesota Elk
Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 03k
Project Manager: Gino J. D'Angelo
Organization: Minnesota Department of Natural Resources, Division of Fish and Wildlife, Section of Wildlife
M.L. 2015 ENRTF Appropriation: $200,000
Project Length and Completion Date: 3 *Years, June 30, 2018*
Date of Report: May 15, 2015

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	Describe home range sizes and movements of adult elk.			Evaluate seasonal habitat use of adult elk.				
Professional/Technical/Service Contracts								
Graduate student ($91,000) - 1 person, 0.5 FTE, 3 years, 75% salary, 25% benefits	$45,500	$0	$45,500	$45,500	$0	$45,500	$91,000	$91,000
Wildlife helicopter capture company to capture and handle 20 adult elk, competitive bid	$33,000	$0	$33,000				$33,000	$33,000
Data acquisition fees for transmission of locations and mortality messages from iridium satellites	$20,000	$0	$20,000				$20,000	$20,000
Equipment/Tools/Supplies								
GPS collars for adult elk, 20@$2,500 each	$50,000	$0	$50,000				$50,000	$50,000
Miscellaneous sampling equipment and supplies (i.e., tape measures, densitometers, cover boards, rangefinders, miscellaneous field supplies, etc.)				$2,548	$0	$2,548	$2,548	$2,548
Direct support services. DNR's direct and necessary costs pay for activities that are directly related to and necessary for accomplishing appropriated programs/projects. In addition to itemized costs captured in our proposal budget, direct and necessary costs cover Financial Support (~$1,372), Communication Support (~$1,141), Planning Support (~$704), and Procurement Support (~$235) that are necessary to accomplishing funded programs/projects.	$2,589	$0	$2,589	$863	$0	$863	$3,452	$3,452
COLUMN TOTAL	**$151,089**	**$0**	**$151,089**	**$48,911**	**$0**	**$48,911**	**$200,000**	**$200,000**

Figure 1. Current elk range in Minnesota