BEHAVIORAL RESPONSES OF FEMALE ELK TO HUNTING IN NORTHWESTERN MINNESOTA

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INTRODUCTION

Currently, Minnesota Department of Natural Resources (MNDNR) is undertaking research to study home range sizes, movements, and seasonal habitat use of adult female elk (*Cervus elaphus*) in an effort to improve habitats and management strategies for the species in Minnesota. Although we continue to grow our knowledge-base on elk in Minnesota, little is known about how elk respond to direct human disturbance in the agriculture-dominated landscape. The Minnesota elk hunting season presents an opportunity to study behavior of elk relative to their period of greatest vulnerability to harvest. Most licenses available during each year's elk hunt are for antlered bull elk only. However, disturbances during the hunting season would not be restricted to bulls due to the harem behavior exhibited during the rut. We compared GPS locations of collared adult cow elk with GPS locations of hunters to quantify elk behavior in response to hunter pressure. Information gleaned from this study will allow managers to identify habitat needs of elk during times of increased human disturbance while also balancing opportunities for elk harvest through management of publicly accessible property. Hunters will also benefit from this information by learning how their encounters with elk can influence elk behavior and movements during the hunting season.

OBJECTIVES

1. Quantify changes in elk movements during the hunting season compared to pre- and post-hunt time periods.

STUDY AREA

Minnesota's elk herd is found in 3 distinct herds (Kittson-Central, Caribou-Vita, & Grygla) which reside in Kittson, Roseau, and Marshall Counties, respectively. The landscape consists of >50% agricultural land but is interspersed with publicly accessible Wildlife Management Areas (WMAs), lands owned and managed by The Nature Conservancy, Conservation Reserve Program (CRP) grasslands, small woodlots, and wetlands. In recent years, the Caribou-Vita and Kittson-Central herds have had numbers sufficient to allow limited hunting whereas the Grygla herd has declined and has not been hunted since 2012.

METHODS

During 2016 and 2017, elk hunting was open for the Kittson-Central and Caribou-Vita herds. Hunting was closed for the Grygla herd during both years. The 2016 elk season was open from 10-18 September, and licensed hunters could legally harvest antlered bull elk only. Five licenses were available during the 2016 season in the Kittson County Central Elk Zone (hereafter, Zone 20; Figure 1) where 14 previously GPS-collared adult cow elk

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resided, and 2 licenses were available in the Kittson County Northeast Elk Zone (hereafter, Zone 30, Figure 1) where 3 previously GPS-collared adult cow elk resided. In 2017, the season was open from 9-17 September and 7-15 October. Six antlered bull elk-only licenses and 2 antlerless-only licenses were available in Zone 20, and 5 antlered bull-only licenses were available in Zone 30 during 2017. In 2016, all 20 elk (17 in hunted areas, 3 in non-hunted) collars were programmed to collect hourly locations beginning 9 d prior to the hunting season through 9 d following the close of the season. Once the 9-day hunting season began, locations were increased to 15 min from 2 hr prior to sunrise until 2 hr after sunset, while remaining at 1-hr locations during the night. The same pattern was followed for the 2017 hunting season; however, due to collar battery restrictions only 10 of the 20 collars collected increased locations as described above. In addition, hunters were asked to participate in data collection by carrying a small GPS-logger programmed to take locations every 15 min, simultaneous with locations recorded by the elk collars. Hunter-carried GPS-loggers were activated prior to the hunter's first day afield and hunters attached the unit to the outside of a backpack or related item so that it could record their movements during hunting hours. Upon completion of the hunter's time afield, units were returned to researchers so that movement data could be downloaded from the units. Hunters were also provided a daily hunt log datasheet to record any encounters with elk, with an emphasis on identifying any encounters with ear-tagged and/or GPS-collared animals (Figure 2).

As a preliminary analysis, we calculated daily kernel density utilization distributions using hourly locations for GPS-collared elk from data collected in 2016 to evaluate whether elk movements differed between pre-hunt, hunting season, and post-hunt time periods. Calculations were processed using the adehabitatHR package in Program R (ver. 3.4.0; R Development Core Team 2017).

RESULTS AND DISCUSSION

In 2016, all 7 hunters carried a GPS-logger during their time afield. Five of 7 completed and returned the daily hunt log sheet. In 2017, 10 of 13 carried a GPS-logger during their time afield and 7 hunters returned a daily hunt log sheet.

Elk in the Kittson-Central and Caribou-Vita herds, which were subjected to hunting pressure, had smaller utilization distributions during the hunting period in 2016 compared to pre-and post-hunt time periods (Figure 3). The average daily area used decreased from 749.3 ha to 375.6 ha once the hunting season was in effect. Following the hunting season, utilization distributions of elk in hunted areas increased to 448.2 ha. Elk in the non-hunted Grygla herd had utilization distributions that increased during the hunting season, showing a pattern opposite to elk subjected to hunting pressure (Figure 3).

Results from our preliminary analysis show evidence that adult cow elk decreased their movements in response to hunting pressure. Additionally, we anecdotally noted instances where elk split into smaller groups away from other herd members in response to interactions with hunters. Following these disturbances, collared elk took at least 2 wk to regroup with their previous herd members.

We continue to analyze the data and plan to utilize the Movement Ecology Tools extension (ArcMET; Wall 2014) in ArcGIS (ver 10.4.1, Environmental Systems Research Institute 2017, Redlands, CA) to quantify movements of collared elk during 2016 and 2017 in relation to hunter pressure during the hunting season. In addition to quantifying overall movement metrics, we anticipate calculating movement metrics during day and night time periods, investigating path tortuosity, and linking hunter and elk movement locations to identify potential disturbance events.

ACKNOWLEDGMENTS

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LITERATURE CITED

Wall, J. 2014. Movement Ecology Tools for ArcGIS (ArcMET) v.10.2.2vX. Available at: www.movementecology.net. Accessed: November 20, 2017.

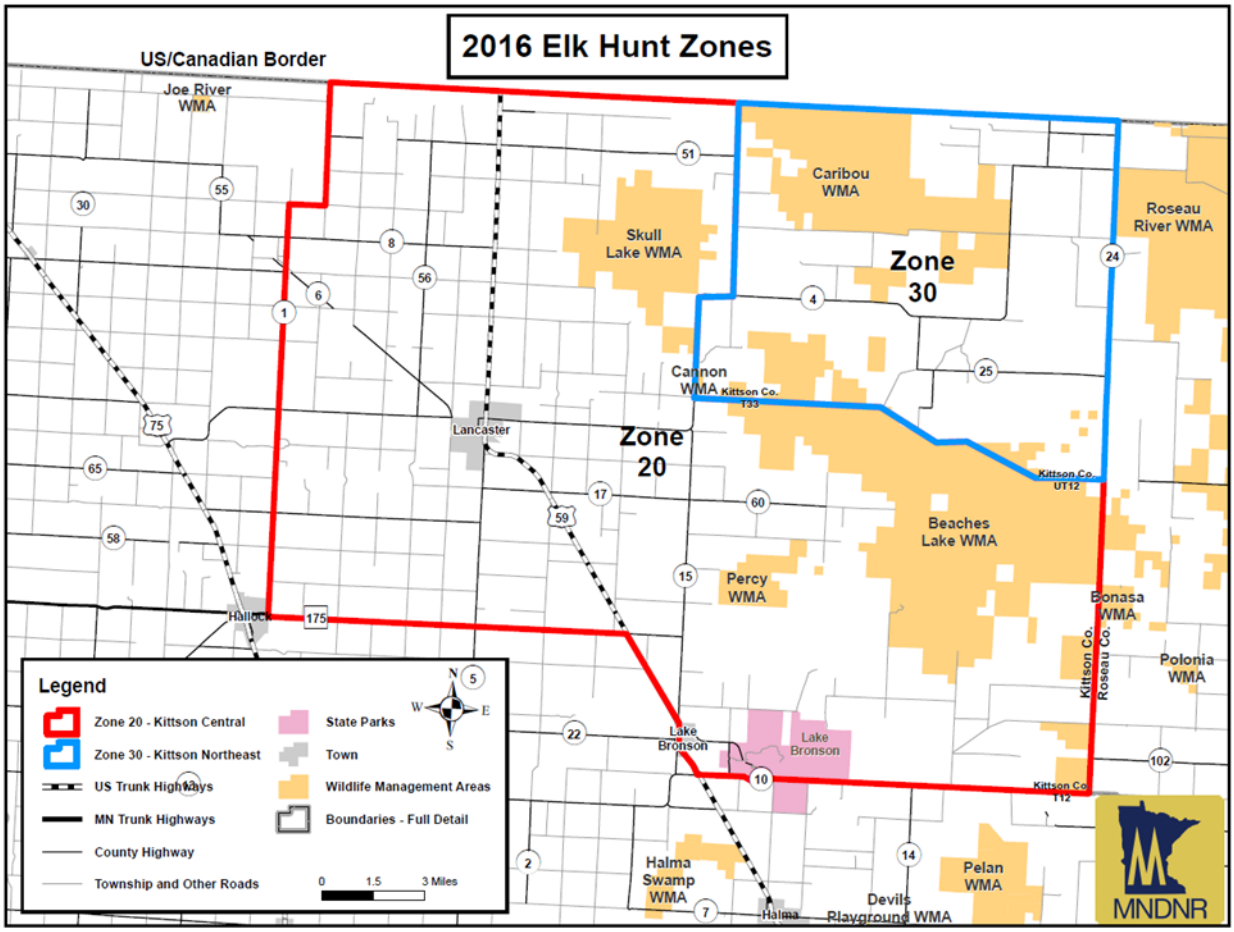

Figure 1. 2016 and 2017 Minnesota elk hunting zones found in Kittson and Roseau counties, Minnesota. Zone 20 included the Kittson-Central herd and Zone 30 included the Caribou-Vita herd.

2016 Minnesota Elk Hunt – Daily Hunter Log **Hunter Name:** _____ **GPS Unit ID:** 037607

Please complete a brief summary of your daily hunting activities during the elk season to help us evaluate elk behaviors in response to hunting.

Saturday, September 10, 2016		Sunday, September 11, 2016		Monday, September 12, 2016	
I hunted today:	☒ Yes ☐ No	I hunted today:	☒ Yes ☐ No	I hunted today:	☒ Yes ☐ No
Time I started hunting for the day (entered the field):	6 (AM) / PM	Time I started hunting for the day (entered the field):	6 (AM) / PM	Time I started hunting for the day (entered the field):	6 (AM) / PM
Time I stopped hunting for the day (left the field):	8:15 AM / (PM)	Time I stopped hunting for the day (left the field):	8:15 AM / (PM)	Time I stopped hunting for the day (left the field):	8 AM / (PM)
Total hours hunted:	14:15	Total hours hunted:		Total hours hunted:	
Number of elk observed:	0	Number of elk observed:	0	Number of elk observed:	2 cow + calf
Number of collared elk observed:		Number of collared elk observed:		Number of collared elk observed:	
I shot at an elk today:	☐ Yes ☒ No	I shot at an elk today:	☐ Yes ☐ No	I shot at an elk today:	☐ Yes ☒ No
Time shots fired:	AM / PM	Time shots fired:	AM / PM	Time shots fired:	AM / PM
Was elk harvested?	☐ Yes ☐ No	Was elk harvested?	☐ Yes ☐ No	Was elk harvested?	☐ Yes ☐ No
Comments:		Comments:		Comments:	

Tuesday, September 13, 2016		Wednesday, September 14, 2016		Thursday, September 15, 2016	
I hunted today:	☒ Yes ☐ No	I hunted today:	☒ Yes ☐ No	I hunted today: 6	☒ Yes ☐ No
Time I started hunting for the day (entered the field):	6 (AM) / PM	Time I started hunting for the day (entered the field):	6 (AM) / PM	Time I started hunting for the day (entered the field):	AM / PM
Time I stopped hunting for the day (left the field):	7:30 AM / (PM)	Time I stopped hunting for the day (left the field):	8 AM / (PM)	Time I stopped hunting for the day (left the field):	8 AM / (PM)
Total hours hunted:		Total hours hunted:		Total hours hunted:	
Number of elk observed:	1 Bull	Number of elk observed:	0	Number of elk observed:	0
Number of collared elk observed:		Number of collared elk observed:		Number of collared elk observed:	
I shot at an elk today:	☒ Yes ☐ No	I shot at an elk today:	☐ Yes ☐ No	I shot at an elk today:	☐ Yes ☐ No
Time shots fired: 2	AM / (PM)	Time shots fired:	AM / PM	Time shots fired:	AM / PM
Was elk harvested?	☐ Yes ☒ No	Was elk harvested?	☐ Yes ☐ No	Was elk harvested?	☐ Yes ☐ No
Comments: I walked a woods and chased elk out to 2 hunters.		Comments:		Comments:	

Figure 2. Example hunter log sheet filled out by a hunter during the 2016 Minnesota elk hunting season.

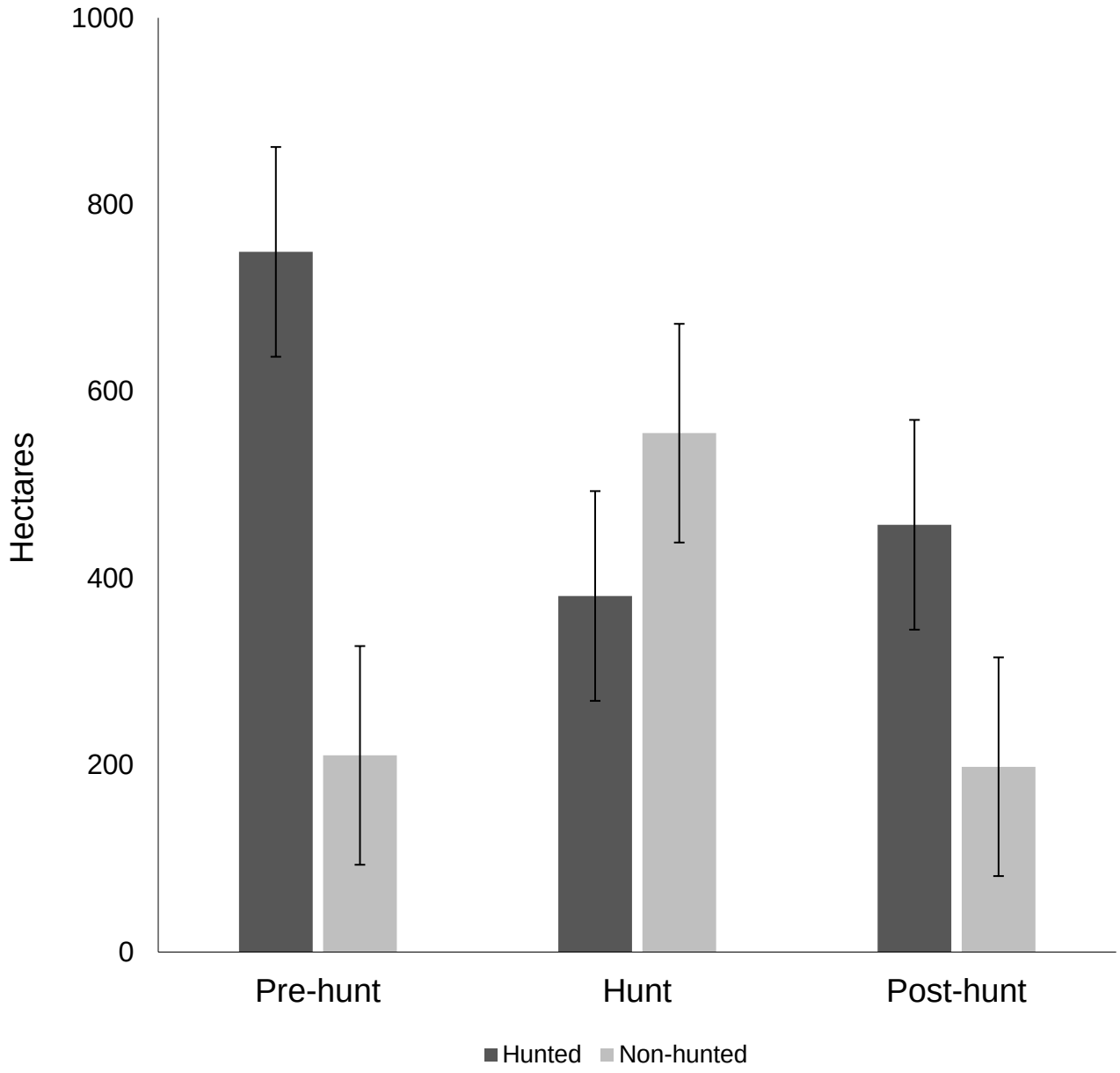

Figure 3. Daily utilization distributions (in hectares) of GPS-collared cow elk in hunted (dark gray) and non-hunted (light gray) zones during pre-hunt, hunting season, and post-hunt time periods in northwest Minnesota during fall 2016.