

*He who can no longer pause to wonder and stand rapt in awe, is as good as dead;  
his eyes are closed*

*-- Albert Einstein*

PREVIEW

PREVIEW

**University of Alberta**

Aversive Conditioning on horseback: A management alternative for  
grassland systems threatened by sedentary elk populations.

by

Holger Ronald Spaedtke

A thesis submitted to the Faculty of Graduate Studies and Research  
in partial fulfillment of the requirements for the degree of

Master of Science

in

Ecology

Department of Biological Sciences

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*To Antje, Mia and Finn who always stand behind me – despite all.*

PREVIEW

## ABSTRACT

Loss of migratory behaviour in ungulates has been observed worldwide and invites new tools for managing the habitat degradation that results from these sedentary populations. We assessed use of aversive conditioning on horseback as a means of reducing grazing pressure and restoring migratory behaviour in elk (*Cervus elaphus*) at the Ya Ha Tinda Ranch, which is an important wintering range. We conditioned elk by herding them daily in the direction of their historic migratory route and monitored changes in elk distribution and grassland biomass each year. After three summers of aversive conditioning treatments, summer elk presence on the targeted grassland had declined substantially and grassland biomass had increased. Although elk use shifted in the desired direction, we did not detect any longer-distance migration in targeted elk. Our research suggests that aversive conditioning on horseback can temporarily reduce grazing pressure on threatened grasslands, but is unlikely to change migratory behaviour.

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## TABLE OF CONTENTS

<b>CHAPTER ONE - OVERVIEW AND RATIONALE FOR MANAGING SEDENTARY UNGULATE POPULATIONS WITH AVERSIVE CONDITIONING</b>	<b>1</b>
LITERATURE CITED	7
<b>CHAPTER TWO - USE OF HERDING TECHNIQUES TO ENCOURAGE MIGRATION IN SEDENTARY ELK</b>	<b>13</b>
INTRODUCTION	13
METHODS	17
Study area description	17
Radio-collaring	18
Aversive Conditioning treatments	19
Wolf presence and weather data	19
STATISTICAL ANALYSES	20
Aversive Conditioning trial distance	20
Daily changes in elk distribution	21
Within season changes in elk distribution	22
Among season changes in elk distribution	23
RESULTS	24
Aversive Conditioning trial distance	24
Daily changes in elk distribution	25
Within season changes in elk distribution	26
Among season changes in elk distribution	27
DISCUSSION	28
MANAGEMENT IMPLICATIONS	33
LITERATURE CITED	48
<b>CHAPTER THREE - MANIPULATING ELK DISTRIBUTION AFFECTS BIOMASS IN A MONTANE FESCUE GRASSLAND</b>	<b>59</b>
INTRODUCTION	59
METHODS	63
Study Area	63

Aversive Conditioning Treatments	63
Vegetation plot design	64
Elk pellet counts	65
Biomass estimation	66
Grazing percentage and biomass growth difference	67
Precipitation	67
STATISTICAL ANALYSES	68
Elk pellet counts	68
Grazed biomass and re-growth	69
Precipitation	70
RESULTS	71
Elk pellet counts	71
Grazed Biomass and re-growth	71
Precipitation	72
DISCUSSION	73
MANAGEMENT IMPLICATIONS	77
LITERATURE CITED	90
<b>CHAPTER FOUR - IMPLICATIONS OF AVERSIVE CONDITIONING ON HORSEBACK FOR MANAGING A SEDENTARY ELK POPULATION.</b>	101
LITERATURE CITED	106
<b>APPENDICES</b>	
APPENDIX I – ELK NIGHTTIME STEPLENGTH	111
APPENDIX II – YA HA TINDA ELK HERD POPULATION DATA	113
APPENDIX III – YA HA TINDA SUMMER ELK RANGE SURVEYS 27, 28, 29 July 2007	118

## LIST OF TABLES

Table 2-1. Conditioning trial distance model selection for the Ya Ha Tinda elk population, Alberta, Canada for 113 conditioning trials conducted in years 2005 – 2007. Models were ranked by Akaike’s Information Criterion ( $AIC_C$ ) values (Rank 1 = best) and normalized  $AIC_C$  weights ( $W$ ). We only report models with  $\Delta AIC \leq 3$ .\_\_\_\_\_36

Table 2-2. Parameter estimates, unconditional SEs and significance levels for the top model explaining variation in AC trial distance.\_\_\_\_\_36

Table 2-3: Parameter estimates from random effects maximum likelihood estimator (xtreg) for a three individual models conducted on subsets of diel movement datasets of elk collected at the Ya Ha Tinda Ranch in 2005 – 2007.\_\_\_\_\_37

Table 2-4. Concentric circle use model selection for the Ya Ha Tinda elk population, Alberta, Canada for years without (2002-2004) and with (2005 – 2008) AC. Models were ranked by Akaike’s Information Criterion ( $AIC_C$ ) values (Rank 1 = best) and normalized  $AIC_C$  weights ( $W$ ). We only report models with  $\Delta AIC \leq 3$ .\_\_\_\_\_38

Table 2-5. Parameter estimates, unconditional SEs and significance levels for the top model explaining variation in concentric circle use.\_\_\_\_\_38

Table 2-6. VI model selection for the Ya Ha Tinda elk population, Alberta, Canada for years without (2002-2004) and with (2005 – 2008) AC. Models were ranked by Akaike’s Information Criterion ( $AIC_c$ ) values (Rank 1 = best) and normalized  $AIC_c$  weights ( $AIC_w$ ). \_\_\_\_\_ 39

Table 2-7. Parameter estimates, unconditional SEs and significance levels for the top model explaining variation in VI. \_\_\_\_\_ 39

Table 3-1: Parameter estimates from random effects negative binomial regression estimator (xtnbreg) for a model explaining variation in elk pellet counts at the Ya Ha Tinda Ranch, using year of the censuses (year) as fixed effects and the pellet plot id as a random effect. \_\_\_\_\_ 79

Table 3-2: Bootstrap results for summer and winter pellet counts conducted in years without (2000 – 2002) and with (2005 – 2007) aversive conditioning at the Ya Ha Tinda Ranch, Alberta. \_\_\_\_\_ 80

Table 3-3: Parameter estimates from random effects maximum likelihood estimator (xtreg) for a model explaining variation in grazing percentage at the Ranch, using year of the project (year), number of revisit (visit) and their interaction (year\*visit) as fixed effects and the vegetation plot id as a random effect. \_\_\_\_\_ 81

Table 3-4: Parameter estimates from random effects maximum likelihood estimator (xtreg) for a model explaining variation in biomass re-growth between two vegetation plot revisits at the Ranch, using year of the project (year), number of revisit (visit) and their interaction (year\*visit) as fixed effects and the vegetation plot id as a random effect. \_\_\_\_\_ 82

Table 3-5: Parameter estimates for a generalized linear mixed effects model on two candidate models. Explanatory variables included ac (0 = no conditioning, 1 = conditioning) and precip (average annual summer precipitation), random effect was the vegetation plot ID. \_\_\_\_\_ 83

PREVIEW

## LIST OF FIGURES

Figure 2-1 a – b. Ya Ha Tinda Ranch grasslands and surroundings with GIS established measurement tools: 5 concentric circles dividing the grassland in 6 areas (1 = within inner circle - 6 = area outside last circle); Mason-Dixon line (in red) drawn through the middle of the target grassland, with the migration gradient indicated as black dotted line in 90 degree angle to Mason-Dixon line. Yellow dots indicate sample elk data of a 24 hour period with AC. In figure a) the elk returns immediately after the end of the AC trial, whereas in figure b) the elk moves on beyond the end location of the AC trial. In both Figures 1 indicates the elk location at the beginning of AC, 2 the location at the end of AC and subsequent numbers indicate clusters of elk locations after AC. \_\_\_\_\_40

Figure 2-2. Hourly mean elk distance (m) to a Mason-Dixon Line dividing Ya Ha Tinda Ranch target grasslands in eastern and western portions. Negative values indicate eastern, positive values indicate western elk distance to the Line in the hours before during and after a conditioning trial for 3 years of AC application. Error bars indicate Standard Errors. \_\_\_\_\_42

Figure 2-3. Annual mean elk distance (m) to a Mason-Dixon Line dividing Ya Ha Tinda Ranch target grasslands in eastern and western portions. Negative values indicate eastern, positive values indicate western elk distance to the Line in the hours before during and after a conditioning trial for 3 years of AC application. Error bars indicate Standard Errors. \_\_\_\_\_43

Figure 2-4: Mean percentage of elk use in areas defined by concentric circles (diameter increasing by 1km per circle) around the target grasslands at the Ya Ha Tinda Ranch for month April – August in pre (2002 – 2004) and post (2005 – 2007) years. Error bars indicate Standard Errors. \_\_\_\_\_ 44

Figure 2-5: Utilization Distributions of sample elk in April and June of 2 sample elk. A) without conditioning and B) with conditioning. \_\_\_\_\_ 46

Figure 2-6: Mean Volume of intersection (VI) index for elk locations compared to the April locations of the same individual. Note: VI in April must be 1 given that April locations are compared with themselves. \_\_\_\_\_ 47

Figure 3-1: Locations for vegetation/pellet plots (black triangles) adapted from a grid developed by McInenly (2003). Revisits were conducted monthly for pellet and vegetation surveys between May and September 2005-2007 and for pellet analyses in May and September 2000 – 2002 by McInenly (2003). The red frame indicates the Ya Ha Tinda boundary and black framed indicates three main grassland areas targeted by Aversive Conditioning at the Ya Ha Tinda Ranch, Alberta. \_\_\_\_\_ 84

Figure 3-2: Correlation of dry weight of biomass ( $\text{g/m}^2$ ) and drop disc height (cm). Data obtained for drop disc calibration at the Ya Ha Tinda Ranch, Alberta.

Figure 3-3: Means of winter and summer pellet group counts in years with (Post AC) and without (Pre AC) aversive conditioning conducted at the Ya ha Tinda Ranch , Alberta. Error bars indicate Standard Errors. \_\_\_\_\_ 86

Figure 3-4: Mean percentage of biomass grazed, detected during monthly revisits of vegetation plots at the Ya Ha Tinda Ranch, Alberta. Error bars indicate Standard Errors. \_\_\_\_\_ 87

Figure 3-5: Difference of biomass re-growth between caged and uncaged plots per revisit of vegetation plots at the Ya Ha Tinda Ranch, Alberta. Positive values indicate that caged plots had higher regrowth whereas negative values indicate that caged plots had lower regrowth values. Error bars indicate Standard Errors. \_\_\_\_\_ 88

Figure 3-6: Regression of biomass ( $\text{g/m}^2$ ) measured in grasslands and the sum of rain in the summer months (June – August; mm) in years without (Pre AC) and with (Post AC) aversive conditioning. \_\_\_\_\_ 89

## CHAPTER ONE: INTRODUCTION

### ***OVERVIEW AND RATIONALE FOR MANAGING SEDENTARY UNGULATE POPULATIONS WITH AVERSIVE CONDITIONING.***

Worldwide millions of animals migrate between habitats. Migration is a regular, periodic movement of populations away from and back to their place of origin (Baker 1978). A single round trip may take the entire lifetime of an individual, as with the Pacific salmon (*Oncorhynchus*), or an individual may make the same trip repeatedly, as with many of the migratory birds and mammals. The animals may travel in groups along well-defined routes, as with many bird and ungulate species, or individuals may travel separately, congregating for breeding and then spreading out over a wide feeding area, as for some seal species (Aidley 1981). Migration distances vary between a few hundred meters in several amphibian species (e.g., wood frogs (*Rana sylvatica*), or eastern newts (*Notophthalmus viridescens*; Regosin *et al.* 2005) and thousands of kilometers as in purple martins (*Progne subis*; Stutchbury *et al.* 2009). The record for long-distance flying is held by the Eskimo curlew (*Numenius borealis*), a shorebird that navigates from Alaska to Tierra del Fuego, a distance of 16,000 km (Jukowsky 1995). Not only costs migration an enormous amount of energy (Bohlin *et al.* 2001), a great number of animals suffer injury or death in an attempt to migrate, the most famous example for this being salmon (Cooke *et al.* 2004). For these reasons, migration must have a net positive effect. For ungulates, this benefit

mostly stems from the migration triggered “grazing succession” (Vesey-Fitzgerald 1960), basically triggering a foraging facilitation effect (Sinclair and Arcese 1995). Despite the ancient history of migration in many species, migratory behaviour has changed in recent decades in a host of species (reviewed by Berger 2004). Many of the massive and historically described overland treks by herd-dwelling mammals have been lost from Asian steppes, African savannas, and North American grasslands (Berger 2004). The ecological changes connected with the loss of migratory behaviour are sometimes drastic; the changes in population distributions caused by loss of migratory behaviour influences natural predator-prey relationships, leading to hyper abundant populations (Ripple and Beschta 2006), and triggers loss of diversity in wildlife and vegetation communities (Warren 1991, Soulé *et al.* 2003). When ungulates cease to migrate to summer ranges, which are, in Canada’s Rocky Mountains, typically at higher elevations (Hebblewhite *et al.* 2008), continued summer grazing on lower-elevation wintering ranges can threaten ecosystem health (Derner and Whitman 2009). When the viability of these important grasslands is compromised, the entire ecosystem that is built on it may be threatened as well (Derner and Whitman 2009). This is mainly because summer grazing has been shown to remove deep-rooted, and grazing-resistant grasses such as Parry oat grass (*Danthonia parryi*; Dormaar and Willms 1990) and rough fescue (*Festuca campestris*; McInenly 2003). On top of this, grazing may cause growth suppression and regeneration delays, as well as mortality among seedlings that are repeatedly browsed or pulled out of the ground (Crouch 1976, Tilghman 1989).

There are several widely used management tools to limit the changes in animal distributions caused by loss of migration. Nonlethal methods such as repellents and animal-activated frightening devices are often employed to reduce damage to areas of interest (VerCauteren *et al.* 2005, 2006). The Kenya Wildlife Service, for example, has been recognized as a world leader in wildlife power fencing by being among the first in the world to use modern high powered electric fencing for the exclusion of problem wildlife (Kassilly, 2002). Largely because of the high rate of habitat destruction, relocation has become an increasingly prominent conservation tool over the last couple of decades (e.g. Conant 1988, Fisher and Lindenmayer 2000, Kleinmann 1989). Destruction of problem wildlife is often called for as a management tool in ranching communities; e.g. farmers called for destruction of problem wildlife more so than non farmers in location (McIvor and Conover 1994). Especially in urban settings destruction of wildlife threatening humans is accepted (Hansen and Beringer 1997).

Each of the management tools mentioned above has limitations. Repellents and frightening devices are largely ineffective for elk and other cervids due to rapid habituation (VerCauteren *et al.* 2005). Moreover, fencing and frightening devices usually cannot distinguish between target and non target animals and thus can have undesired effects on ecosystems. More invasive methods such as relocation can cause mortality rates as high as of 50% (Wright 1977; Rosatte and Macinnes 1989). Although live capture and relocation is accepted by the general public, this impression assumes that the animals will live “happily ever after” in their new location (Craven *et al.* 1998). This reaction

seems to stem from the appreciation people have for urban wildlife, and the empathy they have for individuals as opposed to populations (Runde and Milsap 1994). For the same reason, the public is generally strongly opposed to lethal management of problem animals (Braband and Clark 1992).

Aversive Conditioning (AC) is widely used for predator control (reviewed by Smith *et al.* 2000) but it has rarely been used to change animal distributions (but see Kloppers *et al.* 2005). The advantages of AC are that it is inexpensive (relative to many alternatives) and its effects are, given that the contact to the target species is maintained directly, usually limited to the species of concern (Jelinski *et al.* 1983). AC can generate short-term changes in both distribution and wariness of elk (Kloppers 2005), but AC can produce rapid habituation in both deer (*Odocoileus*; Craven and Hygnstrom 1994, Curtis 1995) and black bears (*Ursus Americanus*; Leigh and Chamberlain 2008). AC seems to be most effective if it is implemented either before or at the initial stages of a conflict situation as behavioural patterns are difficult to modify once they have been established (DeNicola *et al.* 2000).

The underlying theory for AC is based on the assumption that the target species is responsive to negative associative learning. Learning can be defined as a relatively permanent change in behaviour that results from experience (Klein 2008). However, learning reflects a change in the potential for a behaviour, it does not automatically lead to a change in behaviour, also, the changes in behaviour are not always permanent (Klein 2008). Avoidance learning is an AC procedure in which a response terminates a primary aversive event. Through

negative reinforcement, a target species will learn to avoid conditions that are painful or unpleasant. Through avoidance learning, the necessary coping responses can be acquired without undue physical suffering. Avoidance training involves using a signal or cue to alert the animal or person to impending danger (Klein 2008). With punishment, in contrast to avoidance learning, the animal is presented with an aversive stimulus in response for a given behaviour of its own. This does not simply suppress ongoing behaviour, it also strengthens behaviour directly associated with its termination (Lindsay 2000). Additionally as a result of implementing punishment, cues occurring prior to the onset of punishment become emotionally conditioned with fear (Lindsay 2000). As a direct contrast of terms, avoidance is sometime termed active avoidance and punishment is termed passive avoidance. In this thesis, I test the efficacy of AC on horseback as a means of changing the distribution and habitat use of elk conducted a research project at the Ya Ha Tinda Ranch, just east of Banff National Park, in Alberta, Canada, during the summers of 2005 – 2007. This elk population has partially lost its migratory behaviour which appears to be threatening the grassland ecosystem that provides its winter range (Hebblewhite *et al.* 2005). The main objectives of this research project were to (1) determine whether it is possible to use horseback riders to aversively condition elk to change their distribution (Chapter 2) and (2) determine whether it is possible to detect changes in elk use in the response of a rough fescue grassland at the Ya Ha Tinda Ranch (Chapter 3). If it is possible to manipulate elk distribution in this way with concomitant

changes to grassland health, the work has implications for a variety of grasslands threatened by altered migratory patterns and overgrazing elsewhere.

PREVIEW