Alberta Conservation Association

2022/23 Project Summary Report

Project Name: Pronghorn Movement Enhancement – Fence Trials

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Project Leader: Paul Jones

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Partnerships

Alberta Environment and Protected Areas
Alberta Fish & Game Association
Bushnell Corporation
Cabela's Canada
Canadian Forces Base Suffield
National Wildlife Federation
Safari Club International – Northern Alberta Chapter
TD Friends of the Environment Foundation
The Nature Conservancy

Key Findings

- This body of work has led to the publication of four peer-reviewed articles this year including: 1) the fence crossing behaviour of mule deer and white-tailed deer in *Frontiers in Conservation Science* (MacDonald et al. 2022); 2) the crossing behaviour of pronghorn in relation to fences and roads in *Movement Ecology* (Jones et al. 2022); 3) the effects of linear features on pronghorn survival in *Ecosphere* (Eacker et al. 2023); and 4) an editorial on fence ecology summarizing the papers accepted to the special issue published in *Frontiers in Conservation Science* (Wilkinson et al. 2023).

- We revised our book chapter on pronghorn in *Rangeland Wildlife Ecology & Conservation* (Jones et al. *in press*), which was accepted for publication. We expect the book to be published late 2023 or early 2024.
- Our published work has increased the awareness of the effects that fences and roads have on prairie wildlife to a global audience and has directed conservation benefits for pronghorn and many other species.

Abstract

The proliferation of fencing that followed cattle ranching since the 1880s throughout the Canadian prairies poses a serious barrier to ungulate movement. We have documented that pronghorn and deer show a propensity to cross under fences. For deer, this propensity to cross under may be an artifact of the top wire height being too high to allow passage over. Our results indicated that deer, even though we lowered the top wire, still displayed a propensity to cross under the bottom wire. In addition, we demonstrated that fences, roads, and fenced roads all influence the crossing success and spatial distribution of pronghorn. Lastly, we demonstrated that both road and fence density negatively impacted pronghorn survival. We published four papers in peer-reviewed journals and had a book chapter on pronghorn accepted for publication by Springer. We will disseminate our results and conclusions to stakeholders, wildlife managers, and conservation groups.

Introduction

The proliferation of fencing that followed cattle ranching into Alberta poses a serious barrier to pronghorn (*Antilocapra americana)* and deer (*Odocoileus* sp.) movement (Gates et al. 2012, Burkholder et al. 2018). Pronghorn may cross under fencelines in some locations, but it slows down their movement, making them susceptible to predators and in some cases strips hair off their back, causing lacerations and making them vulnerable to infection and frostbite (Jones 2014). Our previous results also documented that mule deer (*O. hemionus*) and, to a lesser degree, white-tailed deer (*O. virginianus*) also show a propensity to cross under the bottom wire of a fence as opposed to jumping over (Burkholder et al. 2018, Jones et al. 2020). However, the propensity for deer to cross under may be an artifact of the top wire being too high to allow easy passage over the fence.

Primary objectives for this work were to: 1) test whether lowering the top wire facilitates deer crossing over fences, or if deer continue to show a propensity to cross under; 2) assess which of roads, fences, or fenced roads are a greater impediment to pronghorn movement and distribution; 3) assess the effects of linear features on the survival of pronghorn; and 4) increase the profile of pronghorn and communicate the conservation challenges they face in Alberta through presentations, publications, and social media.

Methods

We used images captured on 30 trail cameras (n = 813,001 photos) at known wildlife crossing sites on Canadian Forces Base Suffield and 20 cameras (n = 630,160 photos) on the Matador Ranch in Montana to assess the fence crossing behaviour of mule deer and whiter-tailed deer. We used generalized linear models to determine the attributes that resulted in successful fence crossings by male and female deer of both species. We assessed how the spatial configuration of fences and roads affected the movement (crossing effect) and distribution (proximity effect) of 55 pronghorn in Alberta using global position system (GPS) collar data collected between 2003 and 2007. We analyzed the data within a step-selection function framework to assess the influence of four linear features (i.e., pasture fences, roads not fenced, roads fenced on one side, and roads fenced on both sides) on the selection pattern along a movement pathway (i.e., crossing effect) and whether these features affected the distribution of pronghorn (i.e., proximity effect) across the landscape. We were particularly interested in the impacts of roads and fences on the crossing effects because of the different behaviours employed by pronghorn while crossing a fence, a fenceless road, or a fenced road (Figure 1). Lastly, we used GPS collar data and know-fate records to assess the effects on linear features on pronghorn survival in Alberta, Saskatchewan, and Montana. We fit Bayesian proportional hazards models using a time-to-event approach to assess how snow water equivalent, forage production (measured using normalized difference vegetation index), and road and fence density affected pronghorn survival.

Results

We successfully published four papers: 1) the fence crossing behaviour of mule deer and white-tailed deer in *Frontiers in Conservation Science* (MacDonald et al. 2022); 2) the crossing behaviour of pronghorn in relation to fences and roads in *Movement Ecology* (Jones et al. 2022);

3) the effects of linear features on pronghorn survival in *Ecosphere* (Eacker et al. 2023); and 4) an editorial on fence ecology summarizing the papers accepted to the special issue published in *Frontiers in Conservation Science* (Wilkinson et al. 2023). To summarize, our results

Figure 1. Example of the two different crossing behaviours exhibited by pronghorn when crossing a fence (A) and a road (B). When crossing under a fence, a pronghorn must crawl on its elbows to get under the bottom wire of the fence (A). When crossing a road, a pronghorn can walk or run across depending on the presence of a vehicle (B). Panel C depicts a dead pronghorn as the result of a vehicle collision. The pronghorn was attempting to cross a road fenced on one side. Panel D depicts a group of pronghorn crossing a road with two fences where both the fence and road crossing behaviours are employed. (Photos: A—Alberta Conservation Association [ACA]; B—P. F. Jones, ACA, C— P. F. Jones, ACA, D—A. MacDonald, ACA)

indicated deer, even though we lowered the top wire, still displayed a propensity to cross under the bottom wire. In addition, we demonstrated that fences, roads, and fenced roads all influenced the crossing success and spatial distribution of pronghorn. In addition, we were able to demonstrate that both road and fence density negatively impacted pronghorn survival. Lastly, after a review by external reviewers and the editors, we revised our chapter on pronghorn for the book *Rangeland Wildlife Ecology & Conservation* (Jones et al. *in press*), which was accepted for publication. We expect the book to be published late 2023 or early 2024.

Conclusions

Our work has increased awareness of the effects that fences and roads have on prairie wildlife, particularly pronghorn and deer species. Our studies are the first scientific evaluation of the effectiveness of proposed fence modifications to increase fence permeability for pronghorn and deer. During this project, we have demonstrated that carabiners and smooth wire, used to raise the bottom wire, facilitate passage by pronghorn and deer under the fence. We have also determined that increasing fence visibility by placing sage-grouse reflectors and white PVC pipe on the top wire does not impede the movement of pronghorn or deer. We have determined that even when the top wire is lowered using clips or PVC pipe, deer prefer to cross under the bottom wire when not alarmed. We were first to demonstrate the negative effects of roads and fences on pronghorn survival, crossing rates, and distribution. Lastly, we continue to create awareness of the need for a fence ecology discipline by spearheading a special topic on the subject in *Frontiers in Conservation Science*. We continue to disseminate information and results to stakeholders, wildlife managers, and conservation groups to support efforts to restore movement patterns that have been relied on for thousands of years by pronghorn and deer.

Communications

Publications

Eacker, D.R., A.F. Jakes, and P.F. Jones. 2023. Spatiotemporal risk factors predict landscape-scale survivorship for a northern ungulate. *Ecosphere* 14:e4341. doi:10.1002/ecs2.4341.

Jones, P.F., S.E. Vegter, M.S. Verhage, and A.F. Jakes. 2022. Effects of linear anthropogenic features on the movement and distribution of an endemic ungulate. *Movement Ecology* 10:37. doi: 10.1186/s40462-022-00336-3.

Jones, P.F., A.K. Reinking, A.F. Jakes, M.M. Miller, T. Creekmore, and R. Guenzel. *In press*. Chapter 19 Pronghorn. *In*: McNew, L.B., D.K. Dahlgren, and J.L. Beck (Eds.). *Rangeland Wildlife Ecology and Conservation*. Springer. (to be published in 2023).

MacDonald, A.M., P.F. Jones, J.A. Hanlon, B.H. Martin, and A.F. Jakes. 2022. How did the deer cross the fence: An evaluation of wildlife-friendlier fence modifications to facilitate deer movement. *Frontiers in Conservation Science* 3:991765. doi:10.3389/fcosc.2022.991765.

Wilkinson, C.E., P.F. Jones, and A.F. Jakes. 2023. Editorial: Disentangling the complexity of fence effects on wildlife and ecosystems. *Frontiers in Conservation Science* 4:1147486. doi: 10.3389/fcosc.2023.1147486.

Presentations

Spatiotemporal interactions of a grassland community in southern Alberta. (P. Jones) – Prairie Conservation and Endangered Species Conference, February 22, 2023 (30 people).

Key Contacts

- Dr. Andrew Jakes – Smithsonian Conservation Biology Institute
- Dr. Carl Schwarz – Simon Fraser University

Literature Cited

Burkholder, E.N., A.F. Jakes, P.F. Jones, M. Hebblewhite, and C.J. Bishop. 2018. To jump or not to jump: Mule deer and white-tailed deer fence crossing decisions. *Wildlife Society Bulletin* 42(3): 420–429.

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Gates, C.C., P. Jones, M. Suitor, A. Jakes, M.S. Boyce, K. Kunkel, and K. Wilson. 2012. "The influence of land use and fences on habitat effectiveness, movements and distribution of pronghorn in the grasslands of North America." Pages 277–294. *In:* Somers, M.J., and M. Hayward (Eds.). 2011. *Fencing for Conservation: Restriction of Evolutionary Potential or a Riposte to Threatening Processes?* Springer-US, New York, New York USA.

Jones, P.F. 2014. Scarred for life: the other side of the fence debate. *Human-Wildlife Interactions* 8(1): 150–154.

Jones, P.F., A.F. Jakes, A.M. MacDonald, J.A. Hanlon, D.R. Eacker, B.H. Martin, and M. Hebblewhite. 2020. Evaluating Responses by Sympatric Ungulates to Fence Modifications Across the Northern Great Plains. *Wildlife Society Bulletin* 44(1): 130–141.

Jones, P.F., S.E. Vegter, M.S. Verhage, and A.F. Jakes. 2022. Effects of linear anthropogenic features on the movement and distribution of an endemic ungulate. *Movement Ecology* 10:37. doi: 10.1186/s40462-022-00336-3.

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Photos

Photo 1. Pronghorn and elk utilizing the same space at the same time. Photo: ACA

Photo 2. Coyote travelling down the fence line in search of a meal. Photo: ACA

Photo 3. Paul Jones (ACA) measuring the height of the fence wires. Photo: ACA