

Natural regeneration on seismic lines influences movement behavior of caribou predators

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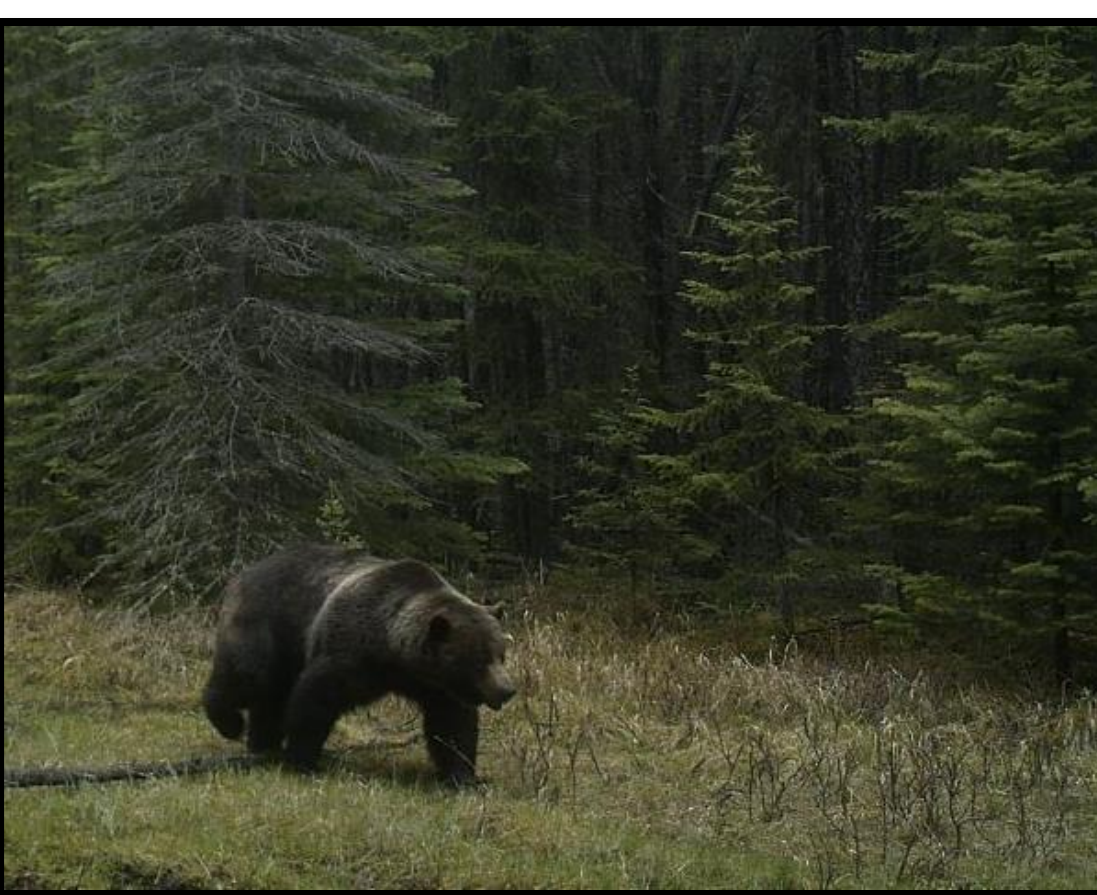
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Aerial view of seismic lines in Alberta



Woodland caribou



Grizzly bear traveling along seismic line



Wolf traveling along seismic line

Introduction

- Habitat loss and disturbance are the main causes of woodland caribou declines
- Seismic lines are one of the most pervasive disturbances throughout Canada's boreal forest
- Cleared seismic lines with seral vegetation attract ungulate prey and facilitate predator movement

Objectives

- Relate wolf and grizzly bear movements to vegetation regeneration on seismic lines using animal GPS data and LiDAR data on vegetation height
- Determine if predator movement patterns are explained by vegetation height on seismic lines or by predators moving towards seismic lines because they contain vegetation attractive to ungulate prey, and vegetation preferred by bears

Methods

- GPS tracking dataset**
 - Sampling rate: 4 hours
 - Wolves:
 - n=24 during 2003–2007 & 2007–2009
 - Grizzly bears:
 - n=19 during 2005–2009
- LiDAR**
 - Attributed vegetation height to 15,588km of seismic lines from 2003–2008
 - classified vegetation height as low (0-1.5m), moderate (1.5-5m) or high (>5m)
- Land cover**
 - Vegetation cover data from MODIS and Landsat imagery
- Quantifying broad scale movements:**
 - Step selection functions (SSF) to assess the effect of seismic line regeneration, land cover, and wetness on predator movements
- Assessing fine scale movement rates**
 - Linear mixed models to assess movement predator movement rates in relation to vegetation height and topographic attributes of seismic lines

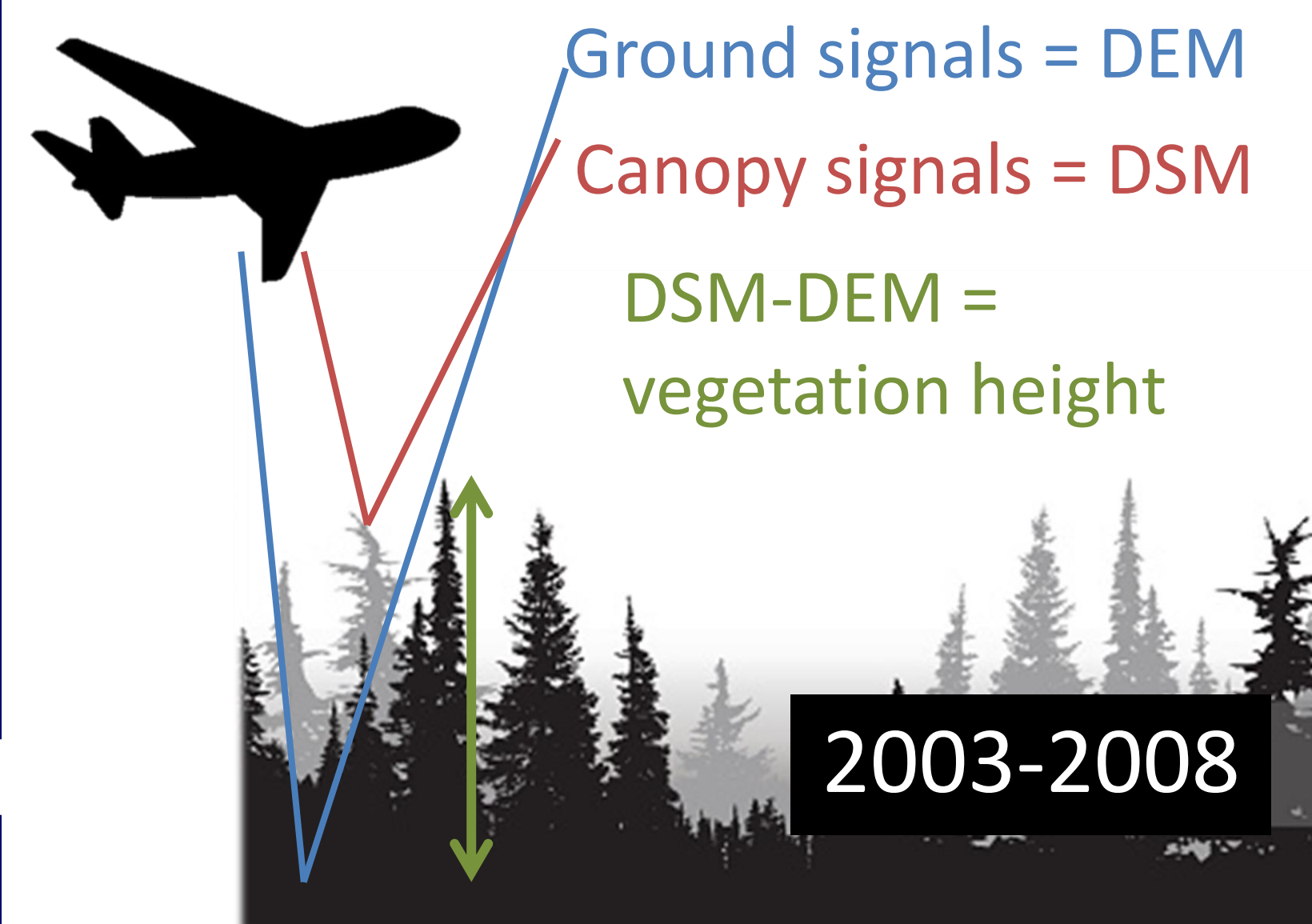


Figure 1: Schematic showing LiDAR data collection for vegetation height

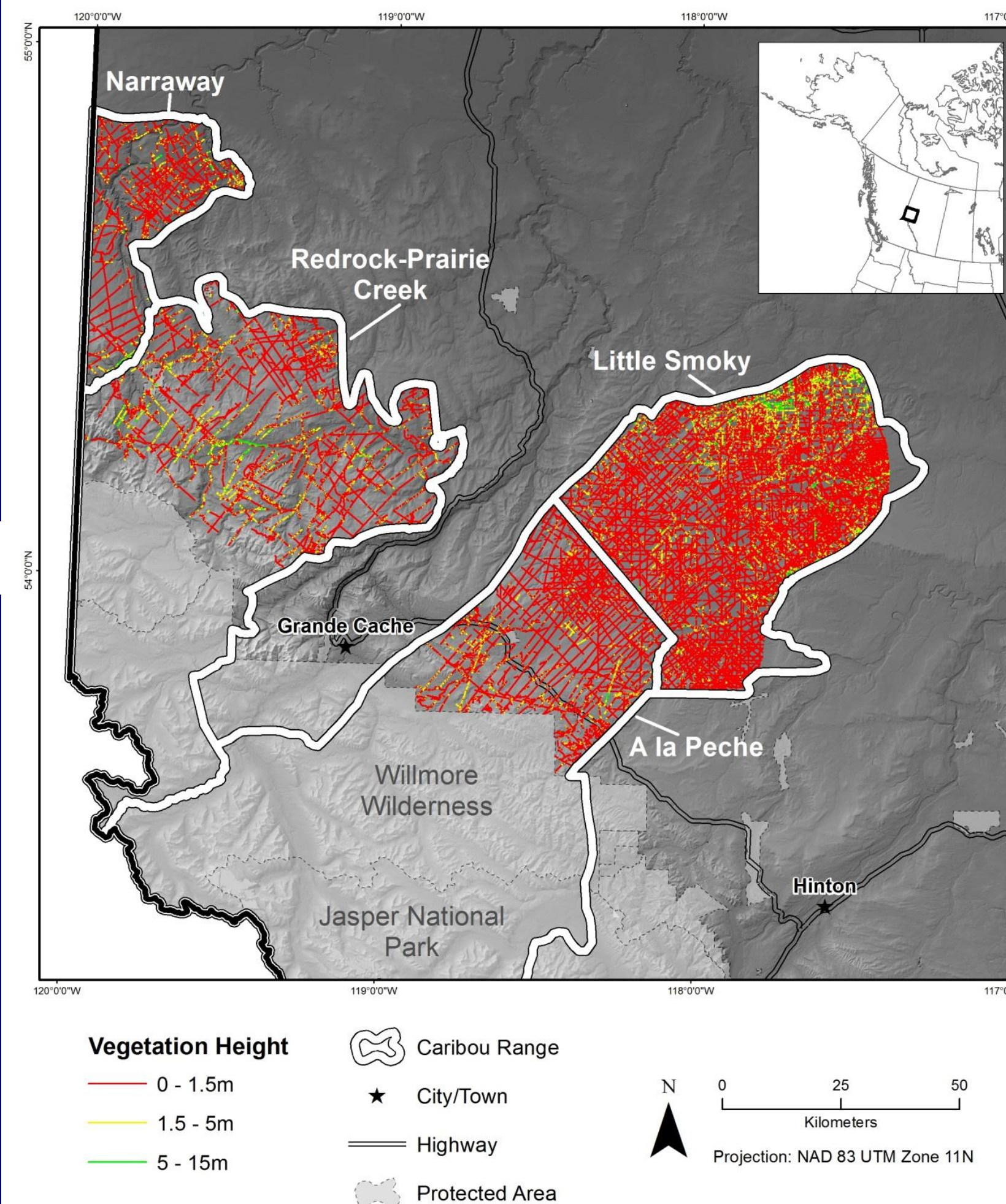


Figure 2: Legacy seismic line footprint (15,588km) within the range of west-central Alberta, Canada, caribou herds attributed with vegetation heights (33%, 66% and 100% quantiles) using LiDAR.

Results

- Wolves**
 - Moved preferentially towards seismic lines in all seasons regardless of vegetation height, particularly towards seismic lines with wet, low height vegetation.
 - Moved faster near low-vegetation height seismic lines (<0.7m) during summer
- Grizzly bears**
 - Although SSF models showed grizzly bears used areas near seismic lines, there was no relationship between grizzly bear movement rate and vegetation height of nearest seismic line except in females with cubs of the year
- Cross validation**
 - Strong selection of seismic lines by wolves
 - Poor predictive power for grizzly bear models



Seral vegetation along seismic line



Regenerating seismic line

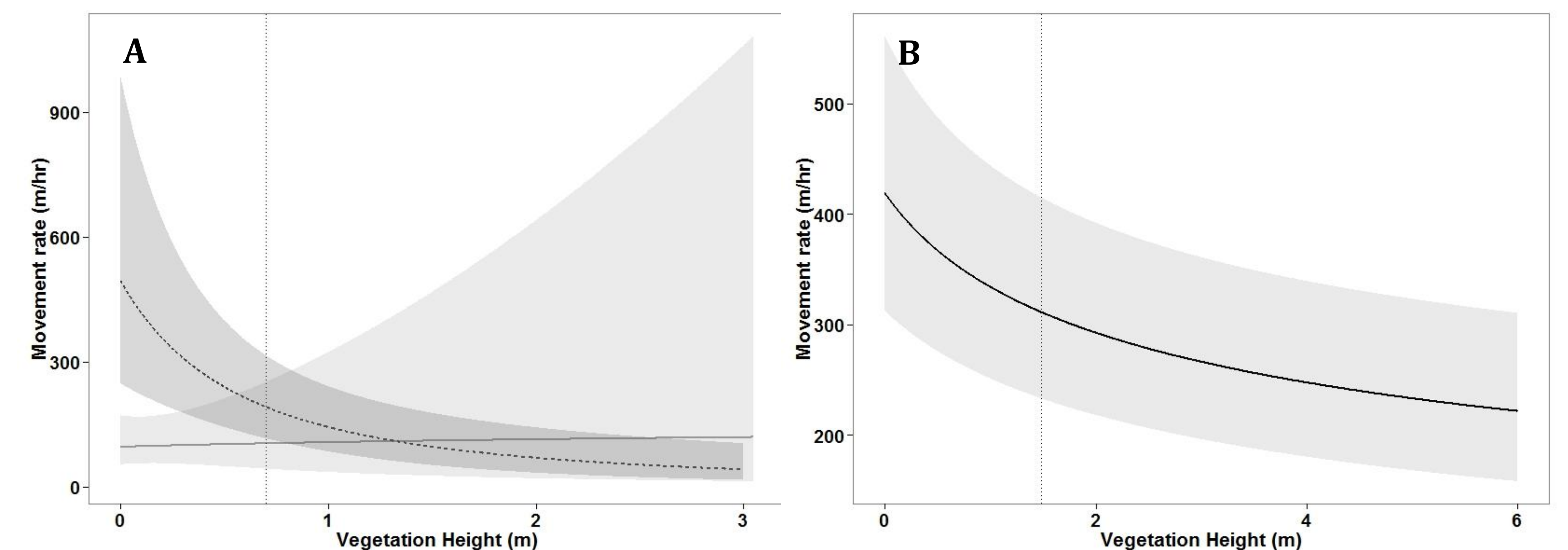


Figure 3: Movement rates of (A) wolves and (B) female grizzly bears with cubs of the year in west-central Alberta, Canada, between 2003 and 2009 within 100m of seismic lines in relation to vegetation height of seismic lines (A) within forest (dashed black line), and non-forest (solid grey line) land cover, and (B) in relation to vegetation height of seismic lines regardless of habitat type. The vertical dotted line is the change in slopes identified from piecewise regression. Shaded areas are 95% confidence intervals.

Conclusions

- Seismic lines primarily benefit wolves, facilitating movement and likely increasing food availability
- Seismic lines are a relatively less important disturbance habitat type for grizzly bears than larger habitats such as clear cuts and burned areas
- Restoration efforts focused on seismic lines with regeneration heights of less than 1m might reduce predator movement and benefit caribou populations
- Because wolves are influenced by seismic lines in all states of regeneration, line blocking may be required to reduce wolf response to seismic lines