“Pine-ing” for cover: Caribou & Grizzly Bear response to Mountain Pine Beetle infestation in West-Central Alberta

S. Darlington, T. Larsen, D. Wismer, G. Stenhouse, L. Finnegan
FRI Research, Hinton, AB

Background

Mountain Pine Beetle (MPB, *Dendroctonus ponderosae*) infestations are a pervasive management challenge in Alberta following expansion from BC in 2006.

Areas susceptible to MPB include contiguous stands of mature lodgepole pine (*Pinus contorta*) in the eastern slopes of the Rocky Mountains.

Landscape level infestations can impact forest values including habitat for nationally threatened caribou (*Rangifer tarandus*) and provincially threatened grizzly bear (*Ursus arctos*).

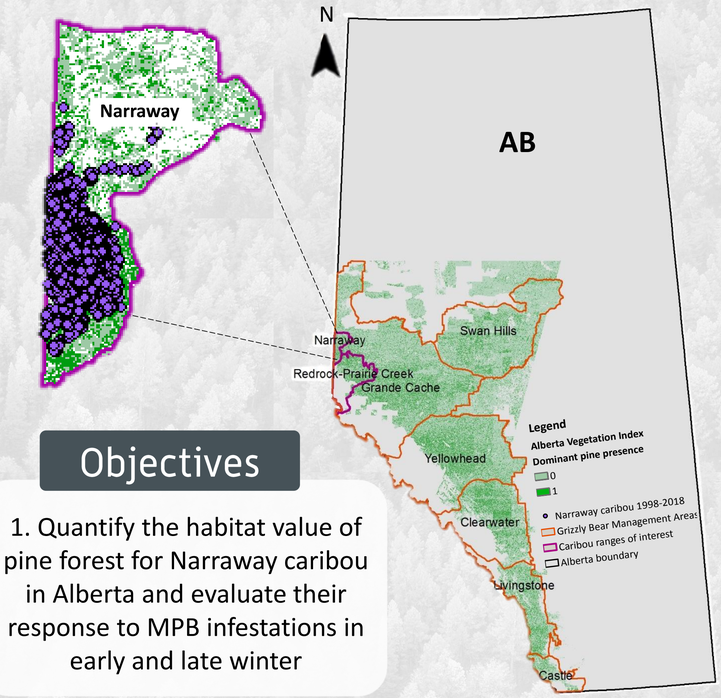


Figure 1. Study area extent of caribou ranges and grizzly bear management areas (BMAs) with the distribution of dominant pine forest (>= 50% pine cover). Inset: Late winter GPS data from Narraway herd (1998-2018,n = 37 caribou, n = 29,446 GPS locations).

Objectives

1. Quantify the habitat value of pine forest for Narraway caribou in Alberta and evaluate their response to MPB infestations in early and late winter

Hypotheses

1. Caribou will avoid MPB affected areas due to reduced lichen abundance and snow interception
2. Grizzly bears’ use of pine would increase due to an increase in food supply

Methods

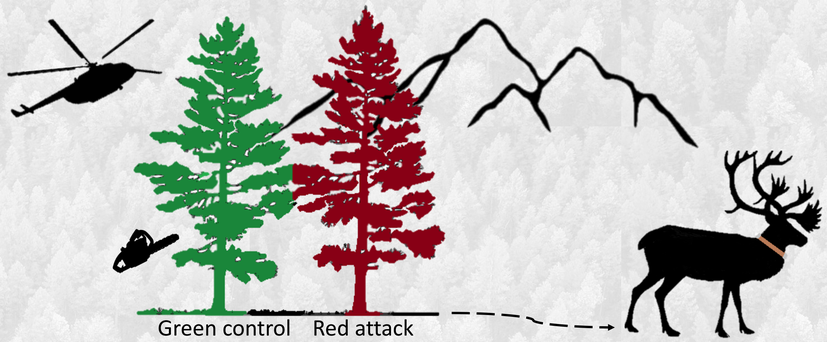
Resource Selection Functions

Data

- 20 years of caribou & 13 years of grizzly bear telemetry data
- GIS data: Forest composition (abundance of pine).
  MPB mortality from helicopter surveys (red attack, green control)
  Anthropogenic disturbance (well sites, cutblocks, roads, seismic)

Seasonal Population-level RSFs

- Multiple scales (2nd order and selection within pine stands)
- 1:10 availability ratios within annual individual home ranges
- Generalized Linear Mixed-effect Models (GLMMs)
- [1]Evaluated using lowest AIC score and validated using 10-fold cross validation



Results

Narraway Landscape Model

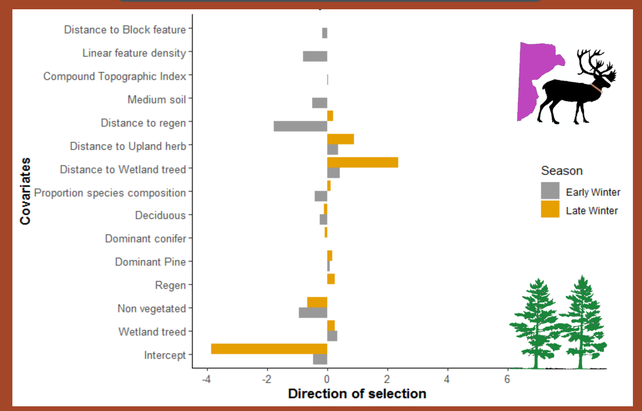


Figure 2. Selection coefficients of top landscape RSF models for Narraway herd Early Winter (n = 28 individuals & n = 13,829 GPS locations, AIC =90 645, k-fold = 0.97) and Late Winter (n= 37 individuals & n = 29,446 GPS locations, AIC=189 820, k-fold =0.94).

Narraway Within Pine

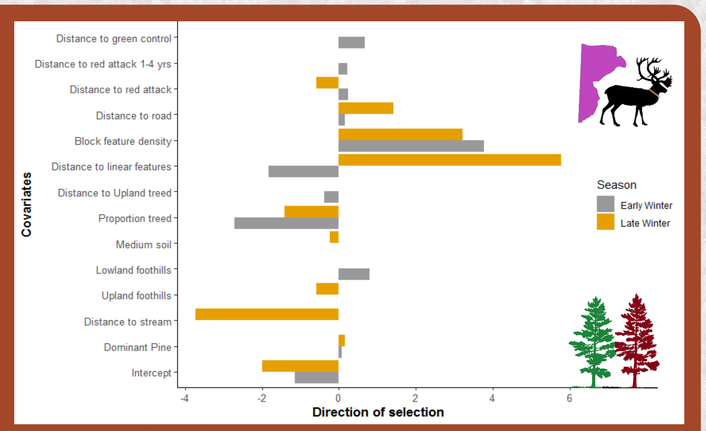


Figure 3. Selection coefficients of top RSF models within pine stands for Narraway herd Early Winter (n = 21 individuals & n = 8,150 GPS locations, AIC = 35 587, k-fold=0.92) and Late Winter (n= 25 individuals & n =15,893 GPS locations, AIC=99 766, k-fold= 0.97).

Stages of attack

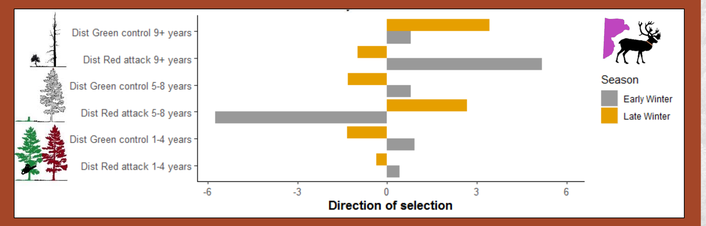


Figure 4. Direction of selection for main effects of Mountain Pine Beetle red attack and green control variables in Narraway herd between 2006-2018. Variables are binned in years since survey data collection.

Conclusions

Narraway caribou selected stands where pine was the dominant species (>= 50%), corroborating findings by [2]Chicowski & Williston (2005) with Tweedsmuir—Entiako caribou in BC.

Caribou avoided most MPB affected stands in early winter and selected them in late winter, which indicates a strong seasonal response to MPB infestations.

Next Steps

1. Complete caribou RSF analysis for Red-rock Prairie Creek
2. Develop seasonal RSF models for grizzly bear in response to pine and MPB-killed pine
3. Create a user-friendly GIS tool of MPB-killed pine response for forest managers

Acknowledgements: We would like to acknowledge Weyerhaeuser Ltd, Alberta Environment and Parks, and Alberta Agriculture and Forestry for contributing caribou, mountain pine beetle survey data, and AVIE GIS layers for this project. We thank our funding partners with the Foothills Research Institute Mountain Pine Beetle Ecology Program for monetary and in-kind contributions.

References

[1]Boyce, M., Vernier, P. R., Nielsen S., Schmiegelow, F.K.A. (2002). Evaluating Resource Selection Functions. Ecological Modelling, 157; 281-300.

[2]D. Cichowski1 & P. Williston. (2005). Mountain pine beetles and emerging issues in the management of woodland caribou in Westcentral British Columbia. Rangifer, 25(16): 97-103.