Do Bathurst Caribou Display Temporal Habitat Selection Strategies During Winter?

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Introduction

Species-distribution models are an effective tool for monitoring and mapping patterns of habitat use, and show promise for conservation of animals with variable life histories. Considering the recent decline of the Bathurst herd of barren-ground caribou, these models can help direct management strategies by revealing important resources that may affect the persistence of the population (Fig. 1). Knowledge of the short- and long-term effects of wild land fire on caribou distributions are vital for future policy and planning. We used environmental variables to predict the occurrence of Bathurst caribou across both early and late winter range (Fig. 2).

Methods

- We used a Resource Selection Function (RSF) to scale the observed distribution of caribou to the relative probability of selecting a habitat patch.
- First, we developed a set of candidate models to investigate factors that might influence caribou distribution during winter: snow depth, patch age and vegetation type, distance to small and large fires, and distance to water.
- We used an information-theoretic approach called Akaike Information Criterion (AIC) to select the best model from the set of candidates and applied this global model to both the early and late winter caribou locations.
- We used matched logistic regression to test for selection or avoidance of habitats, and *k*-fold cross validation to evaluate model performance.

Fig. 1. Winter range habitats used by caribou for foraging. These habitats were characterized by open conifer stands and a high biomass of terrestrial lichen.

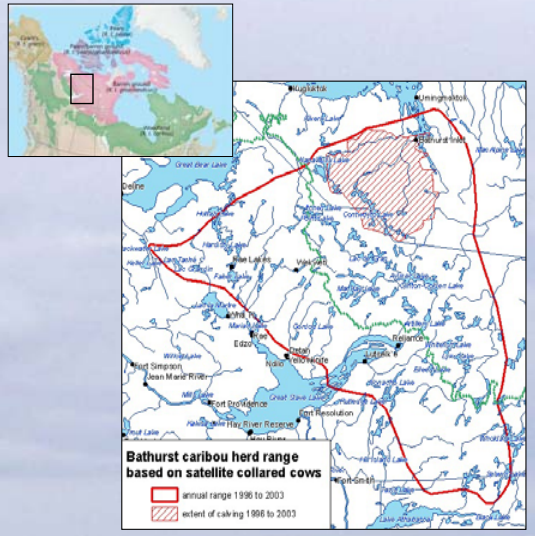

Fig. 2. Distribution of Bathurst caribou, 1996 - 2003. The winter range consists of the portions of the annual range that are below treeline (GNWT - ENR).

Results

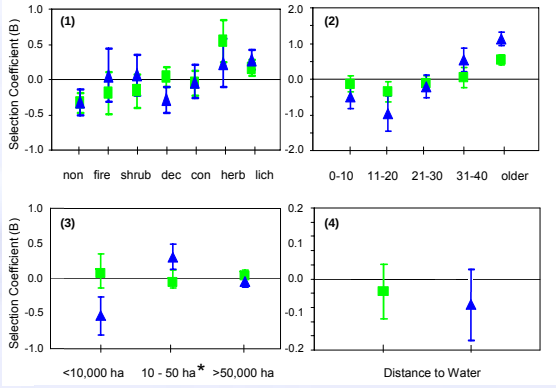

Fig. 3. Selection coefficients and 95% confidence intervals for covariates in RSF models during early (■) and late (▲) winter. Model 1 shows vegetation covariates for non-vegetated [non], recently burned [fire], shrubby [shrub], deciduous [dec], coniferous [con], herbaceous [herb], and lichen-dominant [lich] habitats. Models 2 - 4 show covariates for patch age, distance from fire class, and distance from water, respectively.

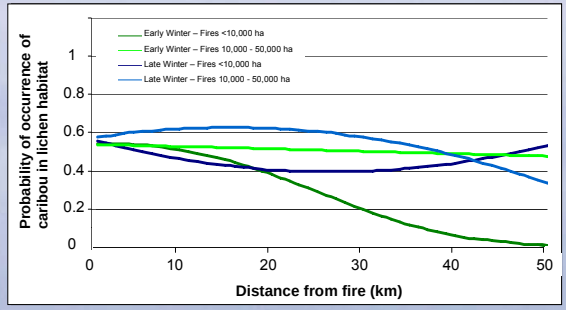

Fig. 4. The likelihood of occurrence of monitored caribou in a lichen patch relative to small (<10,000 hectares) and large (10,000 - 50,000 hectares) fires on the Bathurst winter range (1996 - 2007). Animal occurrence was allowed to vary with distance from fire while other covariates were held constant.

Conclusions

- The RSF yielding covariates for snow depth, patch age, vegetation type, distance to fire and water, and quadratic terms for distance variables best predicted the distribution of Bathurst caribou.
- *K*-fold analyses suggest that all models displayed good to excellent predictive capabilities of caribou occurrence.
- The models simulating seasonal distributions of caribou reveal some significant temporal differences in habitat use during winter (Fig. 3).
- Caribou appeared more selective during late winter, and favored older, lichen-rich patches farther from large fires* and closer to water (Fig. 3).
- Results suggested that caribou may be most sensitive to the short-term effects of wild fire during late winter.
- In late winter, caribou are more likely to occupy a lichen habitat at distances closer to small burns and farther from large burns (Fig. 4).
- The models were useful for exploring factors that may limit or influence the distribution of Bathurst caribou on the winter range.
- Future analyses will explore additional variables, such as predation risk and road disturbance.

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