

# Calf Survival of Woodland Caribou in a Multi-Predator Ecosystem

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## Abstract

The proximate role of predation in limiting caribou (*Rangifer tarandus*) populations is well documented, but the long-term effects of predation pressure on selection of calving areas and the subsequent impacts to calving success remain unclear. We examined the relationships among calf survival, predation risk, and vegetation characteristics among 3 calving areas and across spatial scales in the Besa-Prophet River drainage of northern British Columbia. Fifty woodland caribou (*R. t. caribou*) neonates were collared and monitored twice daily for the first month and once weekly during the next month of life in 2 summer field seasons (2002 and 2003). Predation risk was estimated using resource selection functions (RSFs) from Global Positioning System (GPS) locations of 15 grizzly bears (*Ursus arctos*) and 5 gray wolf (*Canis lupus*) packs. The Normalized Difference Vegetation Index (NDVI) derived from Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper (ETM) data were used to quantify large-scale characteristics of vegetation (indices of biomass and quality). We incorporated small- and large-scale characteristics (i.e., predation risk, vegetation, and movement of woodland caribou calves) of neonatal calving sites into logistic regression models to predict survival for the calving (25 May–14 Jun) and summer (15 Jun–31 Jul) seasons. Predation risk and vegetation characteristics were highly variable among calving areas and calving sites, and parturient woodland caribou responded to these characteristics at different scales. Minimizing gray wolf risk and selecting against areas of high vegetation biomass were important at large scales; areas with high biomass were likely associated with increased predation risk. Calving in areas high in vegetation quality was important across scales, as parturient woodland caribou took higher levels of predation risk to access areas of high vegetative change. Models using small-scale characteristics of calving sites to predict survival performed better in the calving season than in summer. Large-scale characteristics predicted survival of woodland caribou neonates better in summer than in the calving season, probably in part because of the unexpected role of wolverines (*Gulo gulo*) as the main predator of woodland caribou calves during calving. Gray wolves were the main cause of mortality during the summer. Movement away from calving sites corresponded to higher calf survival and appeared to be in response to increased access to forage during the peak demands of lactation and/or minimizing gray wolf risk in the summer. High variation in predation risk and vegetation attributes among calving areas and at calving sites within calving areas, with no differences in calf mortality related to that variation, illustrates the importance of behavioral plasticity as a life-history strategy for woodland caribou.

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