

Winter foraging dynamics of woodland caribou in an artificial landscape

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Key words: Arboreal lichen, bite size, bite rate, intake rate

Rangifer, Special Issue No. 9, 235-236

Introduction

Woodland caribou (*Rangifer tarandus caribou*) subsist on a nearly monophagous diet of alectoroid arboreal lichens during winter in the high snowpack ecosystems of western North America. This phenomenon provided an opportunity to mimic an entire seasonal diet in a laboratory situation using bottle-raised woodland caribou. Arboreal lichen biomass is reported to vary significantly among tree species (i.e. more lichen on subalpine fir (*Abies lasiocarpa*), than Engelmann spruce (*Picea engelmannii*), among topographical sites (i.e. more lichen on valley bottom trees than on mid-slope trees) and along the vertical axis of trees (i.e. more lichen on branches between 4-5 m than between 2-3 m; Detrick, 1984). The objective of this experiment was to quantify arboreal lichen intake rates of woodland caribou foraging on natural branches collected from 2 land types, and 2 foraging heights within trees. We report the results of foraging trials using 8 woodland caribou (3, 2.5-year-old steers; 1, 1.5-year-old female; and 4 steer calves) conducted in an artificial forest during the autumn of 1992.

Methods

A 225 m² enclosure was constructed with 9 equally-spaced telephone poles. This "tree" density mimicked that measured in old-growth subalpine fir/Engelmann spruce forests in woodland caribou late-winter habitat (Rominger & Oldemeyer, 1991). Holes were drilled into poles to enable insertion of lichen bearing branches collected from historical woodland caribou habitat in northeastern Washington. Branches were collected from randomly sampled subalpine fir, Engelmann spruce, and snags of both species at a ratio of 5:2:2. Branches were collected from 2 topographical sites (valley bottom and mid-slope) and from 2 foraging

heights within trees (2-3 m and 4-5 m). These branches were then bundled by tree and reconstructed on randomly assigned telephone poles prior to foraging trials. Branches generally had both *Alectoria sarmentosa* and *Bryoria* spp. attached.

Trials were conducted by introducing caribou, paired on the basis of behavioral compatibility, into the enclosure to forage upon "trees" reconstructed with branches from a single topographic site and a single foraging height. Each caribou was followed by an experienced observer and bite sizes and bite rate, recorded into microcassettes during a 3 minute trial. The trial was then permuted with the alternate height within the same topographical site. A minimum of 10 bites during the 3 minutes was required for inclusion as a foraging trial.

Mean bite size (grams), bite rate (bites/minute), and intake rate (grams/minute) were analyzed with ANOVA (PROC GLM; SAS Inst., 1987) in a split plot design with caribou/topography as whole plot experimental units and caribou/topography/height as subplot experimental units. Bite size was estimable to 0.1 g and therefore bite sizes <0.05 g were recorded as traces but have been excluded from these analyses (see discussion regarding minimal effect of this protocol). Trials were conducted twice per week and caribou had access to an *ad-libitum* pelleted diet and therefore did not enter trials in a fasted state.

Results and discussion

Foraging data were collected from 194 trials. Mean intake rate varied significantly ($P < 0.001$) due to topography and foraging height without a significant interaction ($P > 0.4$) and therefore main effects may be assessed independently. Intake rate varied as a function of both topography and foraging height with the lowest biomass combination (mid-slope/2-3 m) having the lowest intake rate (0.85 g

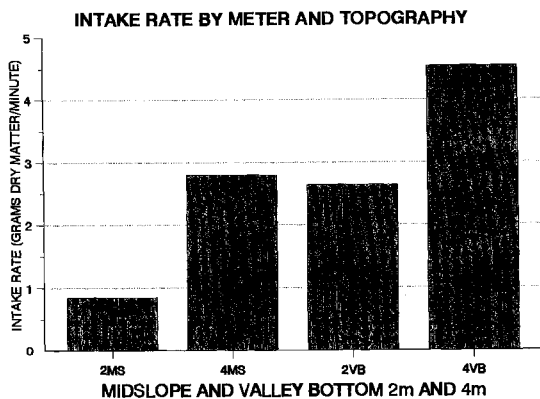


Fig. 1. Arboreal lichen intake rate of woodland caribou ($n = 8$) at 2 foraging heights within trees and 2 topographical sites.

DM/minute) and the highest biomass combination (valley bottom/4-5 m) having the highest intake rate (4.54 g DM/minute, Fig. 1). Bite size and bite rate also have similar relationships with topography and height therefore having a multiplier effect on intake rate (*sensu* White, 1983). A nearly 3-fold increase in bite size between the lowest and highest biomass becomes a 5-fold increase in intake rate (Fig. 1). Bite size, bite rate, and intake rate were similar between valley bottom/2-3 m and mid-slope/4-5 m. Biomass estimates for these locations are also similar (Detrick, 1984).

Substitution of the hypothetical values 0.01 g or 0.025 g for trace values increased total intake <1% and <2.2% respectively at topographical and foraging height groupings other than mid-slope 2-3 m. At mid-slope 2-3 m trace-size bites comprised

56.8% of all bites, however substitution of the above values only increased intake by 4.9% and 12.2% respectively.

These data suggest that arboreal lichen biomass and/or bite size are primary factors influencing intake rate. Caribou did not increase bite rate to compensate for smaller bite sizes or decreased biomass. Forest management should enhance lichen production to maximize intake rates for woodland caribou.

Acknowledgements

This research was funded by U. S. Fish and Wildlife Service-National Ecology Research Center. We also acknowledge the assistance of the U. S. Forest Service, Idaho Department of Fish and Game, British Columbia Wildlife Branch, Washington Department of Wildlife, Minnesota Zoo, Northwest Trek, Plum Creek Timber Company, and the Howard Hughes Undergraduate Research Fellowship. Personnel assistance included J. Gaulke, H. Miller, S. Miller, L. Paten, E. Reese, and A. Rominger.

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