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Brief communication

Winter forage selection by barren-ground caribou: Effects of fire and snow.

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Debate over the role of wildfire in the ecology of barren-ground caribou (*Rangifer tarandus*) has generated both questions and controversy. In summer 1988, a wildfire burned 84615 ha of the Selawik National Wildlife Refuge in northwestern Alaska. Portions of the burned area have been used historically as a migratory corridor by the Western Arctic Caribou Herd. The objective of this study was to address the effects of fire on caribou on a tundra range in late winter (March through April) by comparing vegetative cover, production, and snow characteristics at feeding and control sites in burned and unburned habitat. I also compared the protein content and digestibility of a sedge species collected in burned and unburned habitat.

Replicate plots (30 x 30 m), each containing feeding craters and undisturbed snow, were established in burned and adjacent unburned tussock tundra in late March through April 1990 (n=20 burned, 20 unburned) and 1991 (n=16 burned, 16 unburned). Craters were located from the air when possible or by following caribou trails. Plots were randomly oriented with respect to direction and distance from edges of craters. Within each plot, I measured snow depth and hardness at 10 points along the least disturbed edges of feeding craters and at 10 randomly located points in undisturbed snow. Randomization of undisturbed points was achieved by randomly selecting intersections of x,y coordinates spaced at 0.1 m intervals along two edges of the plot; coordinates intersecting in craters were discarded. I collected vegetation from craters in both burned and unburned plots in 1991 for analysis of crude protein content and *in vitro* digestibility. Caribou fecal pellets were collected and microhistologically analyzed to estimate winter diet in the general area.

In late July-August, I revisited plots and established up to 10 0.25 m^2 quadrats within former craters and centred quadrats on the 10 randomly located points sampled in late winter. Species lists were compiled for each quadrat and I calculated the relative frequency of occurrence for each plant species in a plot. Percent relative frequency was defined as follows:

$$\text{Relative frequency species A} = \left(\frac{\text{No. quadrats containing species A}}{\text{Sum of frequency values of all species}}\right) \times 100$$

I also clipped above-ground vegetation in 5 of the randomly located quadrats to estimate biomass. Years were analyzed separately, and stepwise discriminant function analysis (DFA) was used to select key variables prior to making statistical comparisons. Based on the results of DFA, snow depth and hardness and the relative frequencies of occurrence of lichens and bryophytes were selected as important variables in both 1990 and 1991. In addition, relative frequency of *Eriophorum vaginatum* was selected as a variable in 1991.

Multiple analysis of variance (MANOVA) indicated that there were significant differences in snow depth and hardness and in plant relative frequency data between burned and unburned plots and between craters and unused areas within plots in both years. I performed ANOVAs to determine which variables contributed to these differences.

Snow depth and hardness were the most influential factors determining selection of feeding areas by caribou in both burned and unburned plots. Snow was shallower and softer at edges of caribou feeding craters than at adjacent undisturbed points in both years. There was little difference in snow depth or hardness between burned and unburned plots.

Frequencies of particular plant taxa were only significant in influencing selection of crater sites in unburned plots in 1990, when caribou craters had higher relative frequencies of lichens and lower frequencies of bryophytes than unused areas. Lichens were primarily in the genera *Cladina, Cetraria*, and *Cladonia*.

Relative frequency and biomass of most vascular plants were reduced in burned plots, with the exception of post-disturbance species. Biomass and relative frequency of *Eriophorum vaginatum* were greater in burned plots than in unburned plots in 1991. Also, protein and *in vitro* digestibility levels were significantly enhanced in samples of this species collected from burned plots in 1991. Bryophytes had greater relative frequencies in burned plots than in unburned plots, but species composition differed between the two areas. Bryophytes in unburned plots consisted mostly of *Sphagnum* spp. and feather mosses; in burned plots, post-disturbance species in the genera *Ceratodon, Polytrichum,* and *Marchantia* dominated. Although lichen biomass was significantly reduced in burned plots in both years, lichens composed 74% and 59% of caribou diet in 1990 and 1991, respectively.

Both long- and short-term consequences should be considered when examining the effects of fire on the foraging behavior of caribou. Post-fire increases in protein content, digestibility, and availability of *E. vaginatum* make burned tussock tundra an attractive feeding area for caribou in late winter. These benefits are likely short-lived, however. Lowered availability of lichens and increased relative frequency of bryophytes will persist for a much longer period.