Effects of Partial Cutting on Arboreal Lichens Used by Mountain Caribou

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EXPANDED ABSTRACT

About 10 years ago, managers began to experiment with partial cutting rather than clearcutting in mountain caribou habitat. The rationale was to determine whether it was possible, through use of non-clearcutting silvicultural systems, to harvest timber and also maintain the habitat attributes that are critical to caribou (Stevenson et al. 1994). Much has been learned from those early trials about layout, harvesting practices, and short-term impacts on timber values and caribou habitat attributes (Jull et al. 1996, Cariboo Forest Region 1997, Jull and Stevenson 1999). A new generation of operational partial cutblocks is under way, building on the results of the earlier trials (Waters 1996, Armleder et al. 2000, Stevenson et al. 1999).

Recently, the move to improve biodiversity conservation by patterning forest management after the characteristic natural disturbance regime (Province of British Columbia 1995, Voller and Harrison 1998) has given added impetus to the use of partial cutting in the forests of the Interior Cedar–Hemlock and Engelmann Spruce–Subalpine Fir biogeoclimatic zones in southeastern British Columbia. Most mountain caribou range is characterized by a natural disturbance regime in which stand-destroying events are infrequent, and regeneration occurs largely through the death of individual trees or small groups of trees. Single-tree selection and group selection resemble the natural disturbance regime in these stands more than do even-aged silvicultural systems. However, no silvicultural system perfectly imitates nature. Partially cut stands typically differ from natural stands in several ways: more trees are usually removed in a harvest entry than would die naturally; few dead trees are left standing after a harvest entry; and, over time, more and more of the trees are in younger age classes.

Partial cutting can affect mountain caribou in a variety of ways. Here we discuss only the effects of partial cutting on the main winter foods of mountain caribou, the arboreal lichens *Bryoria* spp. and *Alectoria sarmentosa*.

The most immediate impact is the loss of the arboreal lichens on the trees that are felled for harvest. Sometimes caribou forage on the felled trees, but those lichens are available only briefly. The reduction in lichen biomass exceeds the level associated with merchantable timber removal, because of the additional loss of lichens on dead or dangerous trees that are felled to ensure a safe work environment.

The lichens on the remaining trees are exposed to more wind than they were exposed to before cutting. In extreme instances, due to topographic exposure, excessive timber removal, or both, much of the lichen in the residual stand may be blown off. More commonly, increased exposure may result in a pulse of litterfall after harvesting, followed by stabilization.

By opening up the canopy of a stand, partial cutting alters the canopy microclimate. We expect that at any given level in the canopy, the microclimate will be slightly windier, drier, and more extreme in temperature in a partially cut stand than in an unharvested stand. These microclimatic changes are likely to affect the physiological activity, growth rates, and fragmentation rates of the lichens in the canopy. So far, our studies of growth rates of lichens in the lower canopy of Engelmann spruce–subalpine fir stands indicate a decline in the growth rate of *A. sarmentosa*, but not necessarily of *Bryoria* spp., after partial cutting. These results suggest that a gradual shift in genus composition will occur, and are consistent with the stratification of epiphyte species in a forest canopy along a moisture gradient described by McCune (1993). As caribou select *Bryoria* spp. over *A. sarmentosa* in feeding trials (Rominger et al. 1996), such a shift in genus composition may not be unfavourable to them.

Distances between old trees and many of the young trees will be greater in a partially cut stand than in an unharvested stand. Studies of dispersal of lichen propagules (Stevenson 1988, Dettki 1998) have shown that *Bryoria* spp. disperse effectively over much greater distances than *A. sarmentosa*. *Bryoria* colonization is likely to exceed background levels throughout the openings in a partial cut, but not necessarily in a clearcut. *A. sarmentosa* may be uncommon on young trees in the interior of openings, especially if

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it is limited to the lower canopy in the adjacent mature trees.

Because of the altered age structure in a partially cut stand, a higher proportion of the substrate available for lichen growth will be young. Young branches support lower biomass of *A. sarmentosa* and *Bryoria* spp. than do old branches, even when the effect of branch size is controlled (Esseen et al. 1996). This may occur in part because *Bryoria* spp. grow more abundantly on the defoliated portions of branches than on the needle-bearing portions, and the defoliated parts constitute a higher proportion of old than young branches (Goward 1998).

It seems clear that caribou-forage lichens will still be present in Interior wet-belt stands after partial cutting, that the total amount of available forage will be lower in partially cut stands than in uncut stands, and that the relative proportion of *Bryoria* spp. to *A. sarmentosa* will increase. There are many unanswered questions about the dynamics, magnitude, and functional processes associated with these changes. To address these questions, we are currently investigating the effects of the size and pattern of selection harvest openings on distribution and abundance, physiological functioning, growth and fragmentation, and litterfall rates of arboreal caribou-forage lichens in wet-belt forests east of Prince George.

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