Forestry and caribou in British Columbia

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Abstract: Forest harvesting in mountain caribou range has been an issue for many years. Radiotelemetry studies on mountain caribou in the last decade have helped identify the geographic areas of conflict, improved understanding of the mechanisms by which forestry activities affect caribou, and suggested new approaches to management. Forest harvesting has begun to impact population of northern caribou, and researchers have begun to examine those impacts. Interest in integrating forest management and caribou habitat management has increased and has manifested itself in two ways: experimentation with special stand management practices intended to maintain or create caribou habitat, and the creation of tools to help managers make decisions in a landscape context.

Keywords: *Rangifer,* caribou, British Columbia, habitat management, forestry, forest management, conflicting interests.

Rangifer, Special Issue No. 7: 124—129

Introduction

In the last decade researchers and managers concerned with caribou/forestry issues in British Columbia have seen major changes in the information base available to them and in the problems they confront. Mountain caribou in southeastern British Columbia have been the subject of a number of telemetry-based studies (Antifeau 1987; Simpson and Woods 1987; Rominger and Oldmeyer 1989; Servheen and Lyon 1989; Watts 1989; Seip 1990; Seip 1991). In west-central and northern British Columbia caribou/forestry issues have developed recently. There have been only two major caribou studies in that part of British Columbia (Hatler 1986; Cichowski 1989), and only the latter is directly related to forestry concerns.

The last decade has also seen a shift in how British Columbia biologists think about the natural regulation of caribou populations. Ten years ago, biologists were polarized into two camps - one that stressed the importance of predation in limiting caribou populations, and one that stressed the importance of habitat. Today, biologists are more likely to think of caribou as part of complex predator/prey/habitat systems. There is a general recognition that the major habitat variable affecting caribou numbers is space. The use of large home ranges allows caribou to select habitats offering acceptable combinations of snow conditions and food availability, select habitats that have given them an advantage over predators, and reduce their vulnerability to predators by dispersing themselves widely. There is also a reluctant, but increasing recognition on the part of managers that it may be counterproductive to try to maintain caribou and manage for high moose populations in the same area.

The objective of this paper is to discuss current efforts to maintain large areas of suitable habitat for caribou in British Columbia, in the face of an increasing demand for timber. I describe habitat use by caribou in British Columbia and identify some of the key habitat attributes that are important to maintain. Then I discuss experimental management practices that may help maintain or recreate those habitat attributes, and describe efforts to manage within a landscape context. This paper is based in part on results of recent research and new management ideas that were discussed at the British Columbia Caribou Conference held in Prince George in November 1990.

Habitat use by caribou in British Columbia

The distribution of the three ecotypes of woodland caribou that occur in British Columbia has been described by Edmonds (this publication). The «mountain/arboreal» animals of the southeastern and east-central portion of the province are generally known in British Columbia as «mountain caribou». The «mountain/terrestrial» type of west-central and northern British Columbia is often described as «northern». The «boreal» ecotype, which is not discussed here, is sparsely distributed in the northeastern corner of British Columbia, and is known largely from studies undertaken outside the province.

Mountain (mountain/arboreal) caribou

Most of the mountain caribou of high-snowpack ecosystems in the southeastern quadrant of British Columbia make altitudinal migrations, and some make horizontal seasonal movements as well. Their summer/fall ranges are located at high elevations, either above or below timberline. Many caribou migrate to summer ranges that are higher and more rugged than their winter ranges, while others use areas that are similar to winter ranges. Conflicts with forestry over summer/fall ranges are minimal.

Early winter ranges are mature timber stands that are lower in elevation than summer ranges and often located in areas of more subdued topography. During early winter, caribou feed on low evergreen shrubs and other vascular plants, and on arboreal lichens available on blowdown and as litterfall. The habitat attributes thought to be most important to caribou on early winter ranges are arboreal lichens, litterfall and blowdown, and, to a lesser extent, snow interception and vascular forage (Stevenson *et al.*, this publication). The absence of habitat attributes attractive to moose might also be considered a key habitat attribute for caribou, as range overlap with moose during early winter as likely to increase the vulnerability of caribou to predation. Nearly all early winter ranges are commersial forest stands.

As the snowpack becomes more supportive later in winter, caribou increasingly use opencanopied mature stands on high subalpine plateaus, where the snow is typically 2-3 meters deep. During this period, arboreal lichens, available on the lower branches of standing trees, are the major forage item and a key habitat attribute. Freedom form access development is also important, not only because heavy recreational use may cause caribou to abandon winter ranges (Simpson 1988), but also because of the risk that ploughed roads or packed trails may be used by wolves to gain access to high-elevation winter ranges. Some winter ranges are above the elevation of merchantable timber, but many are subject to forest harvesting.

In April and May, some caribou remain at high elevations, but many move to lower elevations, where green forage is available. There is more use of disturbed sites, such as avalanche tracks, road cuts, and clearcuts, during spring than during other seasons. Many spring ranges are in merchantable timber types. The impact of forest harvesting on spring range use is poorly understood. The presence of clearcuts in spring range does not seem to affect caribou adversely, but once the clearcuts have developed into closed-canopy seral stands, they are likely to be non-habitat, and may even constitute barriers to movement.

Calving generally takes place near snowline. No impacts of forestry activities on calving habitat have been identified.

Thus, the major conflicts between forestry and mountain caribou habitat are in winter ranges. Concerns that apply to all seasonal ranges are the potential effects of access and habitat fragmentation, especially where ranges are separated by immature stands.

Northern (mountain/terrestrial) caribou

Northern caribou inhabit the mountains and high plateaus of west-central and northern British Columbia. Snowfall is lower than in southeastern British Columbia, allowing the animals to crater for terrestrial forage under most winter conditions. The following comments on seasonal habitat use are based largely on the work of Cichowski (1989).

Summer ranges for northern caribou are typically alpine or subalpine, although some animals in some populations use low elevations. Forestry conflicts with summer ranges have not been identified.

Northern caribou exhibit two major patterns of winter habitat use. For most northern caribou, the primary winter habitats are mature lodgepole pine or pine/spruce forests with abundant terrestrial lichens. Caribou select feeding sites with high terrestrial lichen abundan-

ce. The lichens are most abundant on sites with well-drained soils, either in dry meadows or in open-canopied forests older than about 80 years. Younger forests are avoided. Dry meadows are used when snow depths are low or moderate, but not when snow is deep.

Arboreal lichens are also used by northern caribou, but the degree of use is unclear. The fecal fragment data of Cichowski (1989) suggest about equal use of arboreal and terrestrial lichens during winter, whereas the feeding site data suggest more use of terrestrial lichens. It seems likely that the importance of arboreal lichens varies among populations and among years. Arboreal lichens are used more in stands where spruce is present than in pure pine stands. The major conflicts with forestry are centred on low-elevation winter ranges.

Northern caribou also use alpine slopes with low snow accumulation during winter. One population regularly winters in alpine habitats. More commonly, the alpine is used by a small proportion of caribou throughout the winter, or by many caribou for short time. Sometimes caribou move to the alpine when snow conditions below treeline restrict their ability to move around or to forage (Hatler 1986).

During spring migration, northern caribou tend to use low-elevation movement routes and to feed on green vegetation in openings. Some use of clearcuts in spring has been reported. In some populations, nearly all the calving is at high elevations, but in other populations some cows calve at high elevations while others disperse throughout forested habitats.

Thus, for northern caribou the major overlaps with forestry activities occur on low elevation winter range, and on spring range. Habitat fragmentation and access are concerns for managers of northern caribou, as they are for managers of mountain caribou.

Management responses to accelerated logging in caribou range

Mountain caribou

Forest harvesting has been under way in mountain caribou habitat for many years, and has been perceived as a problem for many years. Until recently, many managers expected that large areas of low-value timber would remain unlogged for some time, providing a stable core of caribou habitat. Today, managers have observed changes in the rate of cut, the elevation of the cut, and merchantability standards that have caused them to alter their expectations. More than fifty percent of the timber volume that has been harvested in interior British Columbia since 1911 has been harvested in the last thirteen years (data compiled by R. Traves from Ministry of Forests Annual Reports, 1911-1990). In some drainages, first-pass logging has been completed at lower elevations and much of the planned logging is in high-elevation caribou ranges. Harvesting is now in progress in stands that were considered unmerhantable a few years ago, such as decadent cedar *(Thuja plicata)*-hemlock *(Tsuga heterophylla)* types and high-elevation subalpine fir *(Abies lasiocarpa)* types. Most managers concerned with habitat protection for mountain caribou no longer feel confident that there will be enough marginal or remote timber to support caribou.

Where logging has been proposed in important winter ranges, some managers have tried to institute reserves. Until recently, reserves have generally been either small or short-lived. In 1990, a landmark event occurred when a Ministry of Environment team succeeded in getting a consensus agreement for the Ministry of Forests at the regional level to the removal of a sizable area from the commercial forest land base for a 20-year period. The terms of the agreement are being observed locally, pending approval by the Chief Forester.

Another response to accelerated logging has been to try the develop management practices and strategies that allow timber harvesting and also maintain habitat values for caribou. A variety of partial cutting techniques are being used experimentally in mountain caribou habitat. The residual stand of lichen-bearing trees continues to provide forage for caribou, though at a reduced level, and also provides lichen fragments to colonize the regenerating trees. Other special management techniques are being used to recreate caribou habitat in second growth.

These efforts to integrate forestry and caribou habitat management are described by Stevenson *et al.* (this volume).

Northern caribou

Forestry is a relatively new concern for managers responsible for northern caribou in British Columbia. Until a few years ago, nearly all the logging activity was remote from the core ranges of northern caribou. In 1990, government

biologists identified five northern caribou ranges in which major logging developments were in progress or imminent, and several others in which moderate impacts were anticipated.

Studies of the impact of forestry on northern caribou also have a short history in the province. Cichowski's (1989) investigation of habitat selection and winter feeding ecology of caribou in west central British Columbia helped identify potential impacts. In 1989, biologists began to examine the effects of forestry practices on terrestrial forage lichens, and to investigate whether special management practices can maintain winter habitat. Permanent plots have been established in scarified and non-scarified clearcuts to determine how clearcutting and site preparation affect terrestrial forage lichens. Manual and aerial techniques for transplanting terrestrial lichens are being investigated. Small patches have been logged in lodgepole pine stands where vascular plants were overgrowing lichens to determine whether lichen production could be enhanced. Finally, the potential of leave patches to maintain terrestrial lichen forage and provide for lichen dispersal is being studied (Enns 1990).

Geographic aspects of caribou management

For both mountain and northern caribou, researchers and managers have begun to examine opportunities to use special management practices to maintain or recreate caribou habitat. These practices are experimental and it will be many years before their effectiveness in maintaining acceptable caribou habitat and surviving caribou populations is known. The success of special management practices may depend, in part, on how they are applied at the landscape level. Managers need tools that will help them decide not only what to do, but also where and when to do it.

In the Revelstoke area of southeastern British Columbia, the Ministry of Environment built on previous radiotelemetry studies to develop habitat maps and associated guidelines to meet management objectives for mountain caribou and moose. Simpson *et al.* (1988) defined seasonal habitats for both species, using criteria such as elevation, aspect and forest cover type that could be identified on available maps. The map units were polygons that were labelled with season of use and habitat type. For each map unit, detailed management recommendations included cut/leave ratios, guidelines for timber harvesting, and guidelines for silvicultural practices.

In west central British Columbia, a hierarchical mapping system has been developed for northern caribou (Cichowski and Banner 1990) based on biophysical mapping and radiotelemetry data (Cichowski 1989). The radiotelemetry data allowed the authors to evaluate the importance of the biophysical map units to caribou, and then to develop interpretive maps using a GIS system. The interpretive maps were used to derive Caribou Management Zones. This hierarchical approach allows managers to make decisions on a landscape level (for example, to identify a Management Zone which is to remain undisturbed) and also to make site-specific decisions by overlaying a map of caribou habitat types on a forest cover map.

Managers face several issues having to do with the geographic context of habitat management for caribou. Forest harvesting results in a mosaic of stands of different ages. There is uncertainty about whether the mosaic should be fine-grained or coarse-grained. Edmonds and Bloomfield (1984) reported that caribou in Alberta used clearcuts that were less than two hectares, but did not use larger ones. Eighty-seven percent of all feeding and bedding sites in openings were within 50 m of cover. They developed guidelines calling for small clearcuts, intended to mimic the kind of openings that caribou naturally use.

An alternative approach, used in Ontario, is based on the observation that caribou tend to abandon areas where forest harvesting occurs, and on the concern that forest harvesting alters predator-prey relationships to the disadvantage of caribou (Racey *et al.*, this publication). Accordingly, timber management guidelines for caribou under development in Ontario call for large areas - 100 km^2 or more - of continuous habitat to be maintained as winter range. Logging is consolidated into very large clearcuts, rather than dispersed over the landscape. This approach is intended to minimize roads, edge, and moose. Managers in British Columbia are considering how these ideas apply to local landscapes.

A second issue that concerns managers is uncertainty about the relationship between area of suitable habitat and numbers of caribou that can be maintained. Habitat managers have difficulty defending their requests for timber deferrals of special management over large areas

to benefit caribou. Although it is not difficult to imagine the kinds of studies that would test hypotheses about habitat size and population size, the extensive manipulations that would be required have so far presented insurmountable obstacles.

A third problem faced by managers is the absence of a provincial policy identifying geographic areas in which caribou management is a high priority. Because the costs of conservative management for caribou are high, managers cannot expect to maintain caribou as a high priority species wherever it occurs. Managers need the mandate to make costly tradeoffs in some areas, and not to attempt them in others, and they need a rational basis for making those hard decisions. The issue is currently being addressed by a provincial Ministry of Environment committee.

Conclusion

Decisions about habitat management for caribou may involve significant departures from usual forestry management practices over large areas. These decisions will impact not only the forest industry, but also other wildlife species. Species which thrive on early seral stages and on edge, such as most game species, are likely to be displaced. Another recent development has begun to affect the context in which decisions about caribou research and management are made. As biodiversity becomes a greater public concern, biologists will be expected to create management strategies for caribou that also meet the needs of other «old-growth» species. The biodiveristy issue will add another dimension of complexity to decisions about the management of forested habitats to maintain caribou.

Acknowledgements

I am indebted to the participant at the 1990 British Columbia Caribou Conference, whose ideas formed the basis for this paper: D. Cichowski, A. Banner, K. Enns, H. Armleder, D. Seip, B. Compton, G. Watts, G. Woods, M. Beets, J. Edmonds, K. Brown, W. Darby, D. Eastman, and B. Nyberg.

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Printed from manuscript after editorial review.