



PROJECT SUMMARY

The ecosystem management component of the Morice & Lakes IFPA has embarked on several projects that assess biodiversity, ecological attributes, and fish and wildlife habitat. These projects will provide important ecological data that will be used in learning scenario development for the IFPA's Sustainable Forest Management Plan.

Calving and Post-calving Habitat Use by the Tweedsmuir-Entiako Caribou Herd in the Morice Forest District

Ecosystem Management

Forest Productivity

Public Involvement

Adaptive Management

Introduction

The Tweedsmuir-Entiako caribou (TEC) herd has been identified as a resource that will require specific management strategies to minimize the effects of forest harvesting practices on their habitats. In 2001, a multi-year project was initiated to provide the Morice & Lakes Innovative Forest Practices Agreement with information on potential management strategies for the caribou calving areas found below treeline.

Consisting of approximately 250-300 individuals, the TEC herd has been identified as a high management priority. This designation is indicative of the need to conserve the species by promoting habitat management practices that prevent or mitigate impacts on existing populations.

Since 1983, the Ministry of Environment, Lands and Parks, now the Ministry of Water, Land and Air Protection (MWLAP), has monitored radio-collared individuals of the herd as part of the Tweedsmuir Caribou Monitoring Project (TCMP). This project's main focus is to understand population ecology (including productivity, mortality rates and causes), seasonal distribution (including migration routes), habitat use (including winter ranges, calving and

rutting areas), and feeding habits. Information gained in the early portions of this project found that the herd winters in low-elevation forested habitat east of Tweedsmuir Park near Entiako Lake and migrates to alpine and forested habitats in and adjacent to northern Tweedsmuir Park.

Telemetry locations from the TCMP along with incidental observations suggest portions of the Whitesail and surrounding landscape units of the Morice Forest District may provide high value habitat during the calving and post-calving seasons. However, the area is currently experiencing a mountain pine beetle and spruce bark beetle outbreak, resulting in a large increase in rate of harvest. Caribou in this area often calve below treeline in what is presumed to be an environment of relatively low predator levels and limited alternate prey availability in early spring. Current harvest rates are expected to alter a portion of calving and post-calving ranges.

As of spring of 2001, 24 individuals (19 females and 6 males) within the herd had been fitted with radio collars. This provided the opportunity to conduct a study of caribou habitat use in the Whitesail Landscape Unit. This summary reports on the first year's results and provides recommendations to improve

data collection and sampling regimes for future years. Using the information gained from the TCMP, a habitat suitability model will be developed for predicting caribou calving areas. This model will be used to help predict present and future calving areas and will be used in the M&L-IFPA's timber supply and management model to develop and test a variety of management strategies to maintain viable caribou calving habitat.

Objectives

The long-term objectives of this project are to:

1. identify caribou calving and post-calving sites occurring below treeline;
2. characterize movement and distribution across calving and post-calving range at a landscape level;
3. describe calving and post-calving habitats at the stand level (e.g. site series); and
4. develop recommendations for landscape and stand-level habitat management for input into bark beetle strategies and forest management plans.

Methods

Study Area

The study area was defined by the radio-collared cow caribou within landscape units (LUs) of the Morice Forest District: Whitesail, Tahtsa, Nadina, and Troitsa. In general, the landscape units rest along the eastern slopes of the Coast Mountains. The Whitesail LU is of particular interest because it is geographically isolated, surrounded to the north, south, and east by the Nechako Reservoir, and is centrally located within the bounds of our study area. It consists primarily of SBSmc2, ESSFmc and AT biogeoclimatic ecosystem classification (BEC) zones. Average winter snow depth is high and this likely limits mule deer and moose access and activity in the area. Caribou cross the Tahtsa Reach (Nechako Reservoir) into the Tahtsa and Nadina LUs where the first pass of forest harvesting has been partially completed. The Tahtsa and Nadina consist primarily of SBSmc2 BEC zones. Troitsa A and Troitsa B are currently unallocated LUs that consist primarily of SBSmc2, ESSFmk, CWHws, MHmm2 and AT BEC zones.

Caribou Monitoring

Collared caribou were located from a fixed-wing aircraft using traditional radio-telemetry techniques using techniques outlined in the *Resource Inventory Committee Wildlife Telemetry Version 2.0* manual. Based on previous data, a proportion of collared individuals were already known to range within the general study area during the calving and post-calving seasons.

Monitoring flights were spaced a minimum of 10 days apart to improve sample independence, and minimize autocorrelation among individuals. Each animal's location was recorded using a Global Positioning System; however, in most instances a visual record could not be obtained, so a series of points was used to

triangulate the most likely location. The broad vegetation cover type and the number of animals associated with the collared caribou were recorded from the air.

Vegetation Variables

We sampled vegetation characteristics at each female caribou location following techniques outlined in the *Resource Inventory Field Manual for Describing Terrestrial Ecosystems (Land Management Handbook Number 25)* and the *Guide to Evaluating Forest Stands as Terrestrial Forage Lichen Habitat for Caribou*. Caribou locations were accessed using trucks, helicopters, and small powered boats. Because most locations were only approximate (± 100 m), we surveyed a 300 m radius around each GPS position to determine habitat use. The area was then stratified by ecosystem type (e.g., meadow, open pine, etc). A nested vegetation plot was placed in an area deemed of high use. Additional plots (up to a maximum of three) were placed in adjacent site series where use was also noted to be high. The type of use (e.g. beds, trails, security cover) was noted for each plot. Additional information included stand-level tree density, arboreal and terrestrial lichen abundance, and use intensity. Use intensity was determined by placing two 50 m transects from the plot center at north and east cardinal locations. In instances where placing a transect in any of the two cardinal directions was not possible (e.g. water barrier), the next cardinal direction was chosen for that transect.

Model Development

The development of the caribou calving habitat suitability model follows the methodology described by Brooks (1997), which includes development, calibration, verification and validation. The model is being developed using Habitat Suitability Index (HSI) techniques developed by the U.S. Fish and Wildlife Service. Belief Network software (Netica©) is used in the model development to evaluate various attributes important to caribou calving habitat and determine a habitat suitability rating. Calibration will be carried out using available information from digital sources. Verification and validation of the model will be completed through additional fieldwork and testing of the model against existing data.

Results

Monitoring

A total of 19 fixed-wing flights conducted between May 25 and Oct. 18, 2001 collected 155 (92 female and 63 male) locations. Female caribou were located in the study area during the first flight. An independent cow/calf census flight was conducted by helicopter on June 18 by the MWLAP, during which caribou calves were observed ranging in age from three days to two weeks. Cow caribou were observed in groups ranging from one to three. As the cow caribou could not be observed at the exact time of calving, the exact biogeoclimatic zone variants used for calving could not be determined, but zones used during the calving and post-calving period included SBSmc2, ESSFmk, ESSFmc, and Mhmm2. Islands were used almost exclusively by one collared female and extensively by two other females. These islands appeared to have been used extensively in previous years. Dense networks of trails covered the whole island and signs of browsing was evident throughout.

Stand-level habitat characteristics

A sufficient number of locations was collected to determine stand-level habitat attributes for eight of the 10 females using areas in or near the Whitesail LU. In total, 98 site descriptions were completed.

Generally, females were located within 300 m of an opening. Openings were largely sedge meadow complexes and shore-forest ecotones adjacent to mature forests. However, there was large variability in female habitat use during the calving and post-calving periods. When habitat attributes were compared among females, some variables exhibited significant differences.

Average elevational locations varied greatly between females ($F=12.17$; $df=7,87$; $p<0.0001$). Elevations ranged between 884 m and 1290 m, although most observations were made below treeline. Biogeoclimatic zones used by the females included AT, ESSF, SBS, and MHmm. The degree of canopy closure did not vary between sites used by females ($F=0.095$; $df=7,86$; $p=0.47$), and canopy closures ranged from 10 to 22%. Shrub cover, herb cover, lichen and moss cover, and primary and secondary stem densities were not significantly different between or among locations of individual females (all $p>0.07$).

Habitat use

During stand-level investigations, information was also obtained on habitat use. Because site investigations happened as long as four months after the location was recorded, it was not possible to determine whether the use was by the collared caribou. Although this information has limitations, the observations provide general insight into habitat use by caribou. Caribou beds (and a large proportion of the locations) were found almost exclusively in forested areas adjacent to meadows and wetlands. Extensive networks of trails leading to these wetlands occurred frequently in mature, open pine stands. These stands were

characterized by sparse understories dominated by black huckleberry (*Vaccinium membranaceum*). Important forage species for caribou during the calving and post-calving period included black huckleberry, arctic lupine (*Lupinus arcticus*), sedges (*Carex spp*), Sitka valerian (*Valeriana sitchensis*), birch-leaved spirea (*Spirea, betulifolia*), Sitka alder (*Alnus sitchensis*), Copperbush (*Cladothamnus pyroliflorus*), and Lady fern (*Athyrium filix-femina*).

Habitat Suitability Model

A draft caribou calving habitat suitability model has been developed and is undergoing calibration using information gathered from the habitat use fieldwork and other sources. Preliminary results suggest that the model requires further adjustment and review by biologists familiar with the TEC herd to ensure that it adequately describes the calving habitat. The calibration phase will continue this spring, with model verification starting this field season.

Discussion

The first year of this pilot project provided preliminary information that will be used to improve and guide future sampling designs. Nevertheless, it provides an opportunity to comment on the study objectives.

Fifty percent of all radio-collared individuals were detected at our study area. Assuming radio-collared caribou in this study are a random subpopulation of the larger herd, then it can be speculated that the study area provides calving and post-calving habitat for approximately 50% of the animals. Females were well spaced during the calving and post-calving periods and used all biogeoclimatic zones available. A large proportion of locations were associated with meadow complexes and lakeshores. Islands were used extensively by females (and males) during the calving and post-calving periods, presumably because they provide additional security from predators. These findings are consistent with other studies. Bergerud (1992) and Bergerud *et al* (1990) noted that sedentary caribou in forest habitat space out among themselves and other ungulates as an anti-predator strategy. In addition, they found that habitats used by caribou during the calving and calf-rearing periods included islands, small openings in wetlands and lakeshores.

Increasingly, ecologists agree that increased predation by wolves is a key factor in caribou population declines (Seip and Cichowski 1994, Heard and Vagt 1996). Apparently moose (*Alces alces*) populations rise with increased forest development or harvesting. As a result, these areas can support higher densities of natural predators such as wolf, which results in greater predation pressures on caribou. In our study area sympatric species included both moose and wolves (*Canis lupus*). During this study we assumed that one such mortality occurred. However, mortality rates for the collared caribou were relatively low, and therefore inferences about that effect cannot be made with such limited information.

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Radio-telemetry techniques are very useful; however, there are inherent biases with this method, mostly of a temporal nature. Most flights have to be carried out during good weather and during the day, and therefore provide only snapshots in time when weather is appropriate for flying. Similarly, the cost can be high and yields (i.e. locations) few. During the winter of 2001/02, 10 GPS collars were purchased and fitted on caribou. GPS collars will allow for the following improvements:

- larger sample sizes;
- more evenly distributed locations over time (day/night, independent of weather);
- more efficient transfer of locations into GIS platforms; and
- decreased observer bias.

The GPS collars have been programmed to release from the animals during spring 2003 at which time the data can be retrieved. In the meantime, the collars will be monitored monthly to follow general caribou movements. In addition, radio-collared individuals will continue to be monitored for at least one more year. The addition of new information to the current data set will allow meaningful statistical analyses.

The caribou calving habitat suitability model is dependent on both the ability of the data to accurately reflect the attributes on the ground and the ability to predict the caribou's use of those attributes (our assumptions). Further work is required to ensure that both the data and the assumptions are reasonably correct before this model can be used to develop management strategies.

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