1.1 Woodland Caribou (*Rangifer tarandus caribou*)

SPECIES NAME: Woodland caribou
SCIENTIFIC NAME: *Rangifer tarandus caribou*
SPECIES CODE: M-RATA
STATUS: Northern ecotype is not-listed by MELP (1997); Vulnerable (COSEWIC, 1998)

DISTRIBUTION

Provincial Range

Woodland caribou (*Rangifer tarandus caribou*) are associated with the boreal forest region of Canada. They are distributed across the northern portion of British Columbia and extends as far south as Tweedsmuir Provincial Park and the southern Kootenays (Nagorsen, 1990). Mainland populations have been reduced since historical times and small relic herds exist at the southern periphery of its range in the province (Stevenson and Hatler, 1985)

Provincial Benchmark

Ecoprovince: Northern Boreal Mountains
Ecosection: Stikine Plateau (STP)
Biogeoclimatic zone: SWBun/AT in winter and AT in growing
Broad Ecosystem Units: LP/6 – Lodgepole Pine/AG – Alpine Grassland in winter and AM - Alpine Meadow in growing

Project Study Area

Ecoprovince: Northern Boreal Mountains
Ecoregion: Northern Mountains and Plateaus and Northern Canadian Rocky Mountains.
Ecosection: Cassiar Ranges (CAR), Western Muskwa Ranges (WMR), Eastern Muskwa Ranges (EMR), Missinchinka Ranges (MIR).
Biogeoclimatic zone: BWBSdk1, SWBmk1, SWBmks1, ESSFmv4, ESSFmvp4 and AT.
Elevational range: Valley bottom to alpine.

Within the Mackenzie TEM Study Area, there are three caribou management areas that encompass distinct caribou populations.

Akie/Ospika: This population is located in the Akie, Pesika and Ospika river drainages on the east side of the Rocky Mountain Trench. This area also includes the Finlay River valley bottom as far south as the Ingenika Arm. Wood (1994) found approximately 200 caribou in this area in winter 1994.

Upper Finlay: The western portion of the Study Area, primarily in the Russel Range, is contained in the Upper Finlay caribou management area. In a March 1993 winter survey, 26 caribou were found in the Russel Range (Wood, pers. comm.).

Chase/Sustut: The south-western portion of the Study Area, located in the Butler Range south of the Ingenika Arm, lies within the Chase/Sustut management area. Wood (1996) found 396 caribou in a winter 1993 survey of alpine winter areas giving a population estimate of 690 ± 202 individuals.

ECOLOGY AND HABITAT REQUIREMENTS

Caribou in British Columbia belong to the woodland subspecies (*Rangifer tarandus caribou*), but they can be further divided into two different ecotypes, mountain ecotype and northern ecotype (Stevenson and Hatler, 1985). Mountain caribou are found in southeastern BC and spend much of the year at high elevations in subalpine forest and alpine habitats. Deep snow prevents them from cratering for terrestrial forage in winter so they rely primarily on arboreal lichens for winter food. Northern Caribou are found in the northern and west-central areas of the province. They generally inhabit mountainous areas in summer, and use low elevation pine forests or windswept alpine areas during winter (Wood, 1996).

The low snow depths in those habitats allow them to crater for terrestrial lichens (Seip and Cichowski, 1996). In the Mackenzie TEM Study Area, all caribou are the northern ecotype although a portion of their winter diet may include arboreal lichens (Wood, 1996).

Caribou habitat selection is largely a function of (1) food availability in relation to snow depth and (2) predator avoidance (Bergerud *et al.*, 1984; Bergerud, 1992). Both of these factors generally result in seasonal elevational migratory patterns. Because of the seasonal and annual variability of climate (particularly snow depth) and regional patterns of predator density, multiple habitat types may be occupied and vary from year to year.

Northern caribou habitat use is described in four separate seasons: early-winter, late winter, spring and summer/fall. Their movements follow the general elevational pattern of low/mid-elevation in early-winter, high elevation in late-winter, low elevation in spring and high elevation in summer/fall.

Differences exist among the three known caribou populations present in the study area. Habitat requirement that are shared among all of the populations are described first followed by a population-specific description.

In early-winter, caribou diet is primarily terrestrial lichen, arboreal lichen and conifers (Wood, 1996). In late-winter, they generally move to wind-swept, high-elevation slopes. Wood (1994) reports that all caribou found during a winter ungulate survey of the Muskwa Range were on windswept south or west facing slopes. Diet during late-winter is composed of terrestrial and arboreal lichens, mosses, grasses, shrubs and forbs (Wood, 1996).

In spring (April/May), caribou move from high elevation winter ranges to lower elevation habitat, primarily lodgepole pine and lodgepole pine-white spruce dominated stands (Wood, 1996). In early spring, caribou are seeking new green vegetation in bogs, riparian areas, and open meadows (Hatler 1986). Use of habitats such as south-facing deciduous hillsides, aspen stands and meadows that become snow-free earlier than heavily timbered areas is common (Wood, 1994).

Summer range is primarily upper elevation Engelman spruce/subalpine fir forests and sub-alpine/alpine areas. Females often ascend to summer ranges for calving before males. In Jasper, summer northern caribou diet is composed of forbs, shrubs and graminoids and continues to include terrestrial lichens. Rutting occurs in the fall and rutting areas are usually in or close to summer habitats (Wood, 1994; Sentar, 1994).

Akie/Ospika

- This population probably uses low elevation pine stand in the Finlay and Akie valley bottoms in **early-winter** (Wood, pers. comm.)**.**
- In **late-winter**, caribou in this area are using high-elevation windswept areas. However, during low snowfall years, they may also remain in low elevation pine forests.
- Wood (1994) found all caribou in high-elevation windswept areas in **late-winter** which was a high snowfall year.
- Terry (1998) found caribou remaining in low elevation pine forests throughout the **winter**.
- Both types of winter habitat are important, it just depends on snow depths.
- Anecdotal reports from Tsay Keh natives suggest that caribou use low elevation pine flats in the Finlay River valley in **winter** (Wood, pers. comm.).

Upper Finlay

- Wood (pers. comm.) reports caribou only in the north end of this management area, outside of the Mackenzie TEM Study Area.

Chase/Sustut

- In **early-winter** (November to January), the majority of radio-collared Chase/Sustut caribou were found in high elevation spruce/fir and low elevation pine/spruce forests.
- In **late-winter** (February to March), nearly all caribou were in alpine/subalpine habitat during a high snowfall year. In a low snowfall year, caribou were found to use both alpine/subalpine and low elevation forests.
- Recent data suggests that the Chase herd generally use mid-elevation and subalpine in **late-winter** (Wood, pers.comm.)
- Wood (1996) concludes that caribou in this area prefer forested areas in winter but are forced onto windswept alpine ridgetops by deep snow.

- 60% of collared caribou were found in low-elevation lodgepole pine and lodgepole pine/white spruce forests in **spring**. Use of habitats that become snow-free earlier is common.
- During calving in late May/early June, all collared females were in upper elevation spruce/fir forests or alpine/subalpine areas. All collared caribou spent the **summer** in these habitats as well**.**

Lichen availability is critical to evaluating mountain caribou habitat however, predicting lichen productivity is difficult. Highest densities are associated with mature forests as lichen is very slow growing. The most suitable growing sites tend to be drier, with low nutrient availability and where productivity of other plants is low (Coxson *et al.*, 1998; Sentar, 1994; Seip, 1996). Coxson *et al.* (1998) also reports higher terrestrial lichen cover on crest and upper slopes of the landscape. Other factors which influence the distribution and abundance of terrestrial lichen are the severity of initial perturbation (e.g. fire), and site conditions.

Wood (1996) reports average caribou density in the Omineca mountains at 0.056 caribou/km^2. Seasonal movements can be considerable; up to 100 km.

Caribou require extensive areas of mature coniferous forest for cover and lichen production. Fire and forest harvesting remove these essential forests. Caribou avoid recently burned areas which affect their movements and fragments their range (Nietfeld *et al.* 1985). They may continue to use burned areas, feeding on lichens in unburned patches, for about five years until fire-killed trees fall and obstruct movement.

Predation, primarily by wolves, can have a severe impact on caribou recruitment. Caribou possess the lowest productivity of the deer family and therefore are slow to recover from population declines (Nietfeld *et al.* 1985). Seip and Cichowski (1996) conclude that the density of caribou populations in BC appears to be related to their ability to become spatially separated from their predators. Further, the abundance of wolves is a function of the availability of its other prey, particularly moose. Therefore, by avoiding habitats that support alternate prey, caribou reduce their exposure to predators. Wood (1996) suspected that mortalities of radio-collared caribou in the Omineca Mountains were primarily from wolves. In the Mackenzie TEM Study Area, low moose densities (and thus low wolf densities) would be expected in continuos forest cover containing low shrub cover that provide poor moose food and in high elevation alpine and parkland habitats.

LIFE REQUISITES/SEASONAL USE PATTERNS

Caribou life requisites are divided into food, security and reproduction (Table 29).

Table 1. Mountain caribou seasonal life requisites

Rank	Life Requisite	Season	Months
1.	Food	Early-winter	October-December
2.	Food	Late-winter	January-May
3.	Food	Spring	June
4.	Food	Summer/Fall	July-September
5.	Security	All	All
6.	Reproduction	Summer/Fall	July-September

Food

Suitable feeding habitat is an important determinant of caribou distribution and underlies much of their seasonal movements. In early-winter, low elevation sites with an abundance of terrestrial lichen are optimal. Sites with the greatest densities of lichen are dry, mature forests, with low nutrient availability and where productivity of other plants is low. In late-winter, wind-swept south and west facing slopes provide the greatest access to terrestrial lichen in addition to arboreal lichens, grasses, forbs and mosses. In spring, low elevation moist sites, such as bogs, riparian areas, and open meadows, have the earliest green vegetation. Use of south-facing deciduous slopes, aspen stands and meadows that become snow-free earlier than heavily timbered areas is also common. In summer, caribou feed on terrestrial lichen, forbs, shrubs and graminoids in sub-alpine and alpine habitats.

Security

Security from predators is provided primarily by avoidance– habitats that have low wolf density have optimal security. These are areas that have low alternate prey densities, specifically moose, especially in early summer during calving. These areas are at high elevations and at low elevations in forest stands with continuous forest cover. Habitat for security is not rated in this model and is included here only for completeness.

Reproduction

Calving takes place in early summer usually at high elevation in subalpine or parkland habitats. Rutting occurs in the fall within normal summer/fall ranges. Habitat for reproduction is not rated in this model and is included here only for completeness.

HABITAT USE AND ECOSYSTEM ATTRIBUTES

The relationship between caribou habitat use and TEM ecosystem and terrain attributes are described in Table 30.

Table 2. Caribou habitat use related to TEM ecosystem and terrain attributes.

TEM Attribute	Habitat Use
Ecosection	Caribou in the CAR belong to the Upper Finlay and Chase/Sustut populations described above. Caribou in the EMR belong to the Akie/Pesika herd. Habitat use and caribou density is therefore different between these two Ecosections and this will be differentiated in the following sections. Based on overview capability mapping for the NE region of BC (Habitat Inventory Section, 1994) and BC Environment (1998), the WMR, EMR and MIR provide up to moderately high caribou habitat (corresponding to a rating of 2).The CAR provides up to moderate caribou habitat (corresponding to a rating of 3).
Biogeoclimatic Zone	Northern caribou movements follow the general elevational pattern of low to mid-elevation in early-winter, high elevation in late-winter, low elevation in spring and high elevation in summer/fall. This pattern is dependent on both snow depth and herd. In general, caribou in the CAR caribou utilise mid-elevation forests for than those in the WMR during winter. Spring and summer habitat is assumed to be the same. CAR: • In early-winter, use low elevation pine/spruce (BWBSmw2) and mid-elevation spruce-fir (ESSFmv4 and SWBmk1). • In late-winter, use mid elevation forests (ESSFmv4, SWBmk1) and subalpine/alpine (SWBmks1, ESSFmvp4 and AT), especially when snow is deep. • In spring, found in low elevation forests (BWBSmw2). • Spend summers in upper elevation ESSFmv4, ESSFmvp4 and AT. WMR/EMR/MIR: • In early-winter, primarily use low elevation pine stands (BWBSmw2). • In late-winter, use low elevation pine stands (BWBSmw2) if snow depth is low, otherwise use windswept areas of ESSFmvp4 SWBmks1 and AT. • In spring, found in low elevation forests (BWBSmw2). • Spend summers in upper elevation ESSFmv4, ESSFmvp4 and AT.
Site Series	Moister site series (sub-mesic to sub-hygric) provide better spring and summer/fall forage than drier sites and drier, less-productive sites have a greater probability of high terrestrial lichen densities which provide better winter habitat (Sentar, 1994; Seip, 1996).
Structural Stage	In winter, northern ecotype caribou are found in habitats with high terrestrial lichen. Since lichen is very slow growing, mature forests will have the greatest cumulative lichen densities. The primary structural stages used in early-winter are young forest (5) to old forest (07). In late-winter, herbaceous (2) and sparse/bryoid (1) stages will also be use on wind-blown slopes. In spring, northern caribou seek out early-greening plants and will utilise herb and low shrub stages in addition to mature and old forest. In summer, caribou may be found in herbaceous and shrub stages and in mature and old-forest. Tall shrub (3b), pole/sapling (04) and young forest provide low-level feeding habitat dusting all seasons.
Site Modifier	Wood (1994) found higher use of south aspects in late-winter. Therefore, warm aspects will be rated higher than cool aspects in this season.
Exposure	Northern caribou that use high elevation habitat require exposed, wind-swept areas to access forage. Non-vegetated/sparse and herb structural stages in the SWBmk, SWBmkp and AT would have the greatest likelihood of having windblown, snow-free surfaces.

HABITAT RATINGS

Rating Scheme/Modelling Theme

A 6-class rating scheme is used rate habitat suitability for food (FD) in four seasons: early-winter (EW), late-winter (LW), spring (P) and summer/fall (S). Food ratings were assigned to polygons using the ratings table. As described above, caribou habitat use varies depending on winter snow depths. This model shows habitat for both normal and high snowfall years.

Food (FD) Habitat Use Assumptions

The ratings table assigns a suitability rating for FD to each ecosystem unit. An ecosystem unit is a combination of site series and structural stage. The relationship between caribou life requisites and the ecosystem attributes are defined by a degrading score relative to the optimal value for the attribute (Table 3.8.2). For example, an optimal structural stage for food has a degrading score of "0"– no degrading effect. However, a sub-optimal structural stage (such as pole-sapling) has a degrading score of 4, which would result in a maximum rating of 5 on a scale of 1 to 6. By summing the degrading scores over all of the ecosystem attributes, a final rating is calculated. See Section 2.5 for a full description of the methodology used to generate the ratings table.

Food (FD) Habitat Adjustments

Adjustments are used to modify the ratings in order to account for caribou habitat requirements that are not inherent features of the ecosystem unit.

- Cool aspects (285-135^{o}) are rated down one for FD in late-winter.

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Table 3. Caribou food habitat use assumptions. Each number represents a degradation score. A rating for an ecosystem unit is generated by summing the degradation scores over all attributes.

Attribute		Value	Degrading Score			
			FD-WE	FD-WL	FD-P	FD-S
1. BEC Unit	CAR	BWBSdk1	2	3	2	4
		ESSFmv4	2	2	3	3
		SWBmk1	2	2	3	3
		ESSFmvp4	4	2	4	2
		SWBmks1	4	2	4	2
		AT	5	2	5	2
	MIR	ESSFmv4	1	3	2	3
		ESSFmvp4	4	1	1	4

Attribute	Value	Degrading Score			
		FD-WE	FD-WL	FD-P	FD-S
EMR	AT	5	1	1	5
	SWBmk	1	3	2	3
	SWBmks	4	1	1	4
WMR	AT	5	1	1	5
	BWBSdk1	1	1	1	4
	ESSFmv4	1	3	3	2
	SWBmk1	1	3	3	2
	ESSFmvp4	4	1	4	1
	SWBmks1	4	1	4	1
	AT	5	1	5	1
2a. Site Series (SMR)	Xeric	0	0	1	1
	Subxeric	0	0	0	0
	Submesic	0	0	0	0
	Mesic	0	0	0	0
	Subhygric	0	0	0	0
	Hygric	0	0	0	1
	Subhydric	1	1	1	2
	Hydric	2	2	2	3
2b. Site Series (SNR)	Very poor- poor	0	0	1	1
	Medium-very rich	0	0	0	0
3. Structural Stage	Sparse (1a)	5	0	5	5
	Bryoid (1b)	5	0	5	5
	Herb (2)	5	0	0	0
	Low shrub (3a)	5	5	0	0
	Tall shrub (3b)	5	5	5	5
	Pole/sapling (4)	5	5	5	5
	Young forest (5)	0	0	0	0
	Mature forest (6)	0	0	0	0
	Old forest (7)	0	0	0	0
4. Stand Composition	Broadleaf	2	2	0	0
	Mixed	1	1	0	0

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