Telkwa Caribou Population

Status and Background Information Summary

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1. Background

1.1 Status of Northern Caribou

All caribou and reindeer in the world belong to one genus and species, *Rangifer tarandus*. In British Columbia (BC), 3 ecotypes of caribou are recognized (mountain, northern, boreal) based on differences in habitat use, behaviour, and migration patterns (Stevenson and Hatler 1985, Heard and Vagt 1998, IWMS 2004). The Telkwa caribou population belongs to the northern ecotype.

Northern Caribou live in west-central and northern BC (Figure 1). During winter, they crater for terrestrial lichens on windswept alpine slopes and in low elevation forests. They also forage on arboreal lichens in low elevation forests, especially when foraging for terrestrial lichens is difficult, or in subalpine forests. Mountain Caribou live in the deep snowpack, interior wet belt of southeastern BC where they forage on arboreal lichens in subalpine forests during winter. Boreal Caribou live in the lowlands of northeastern BC, where they primarily use large peatlands throughout the year, and forage for terrestrial lichens during winter.

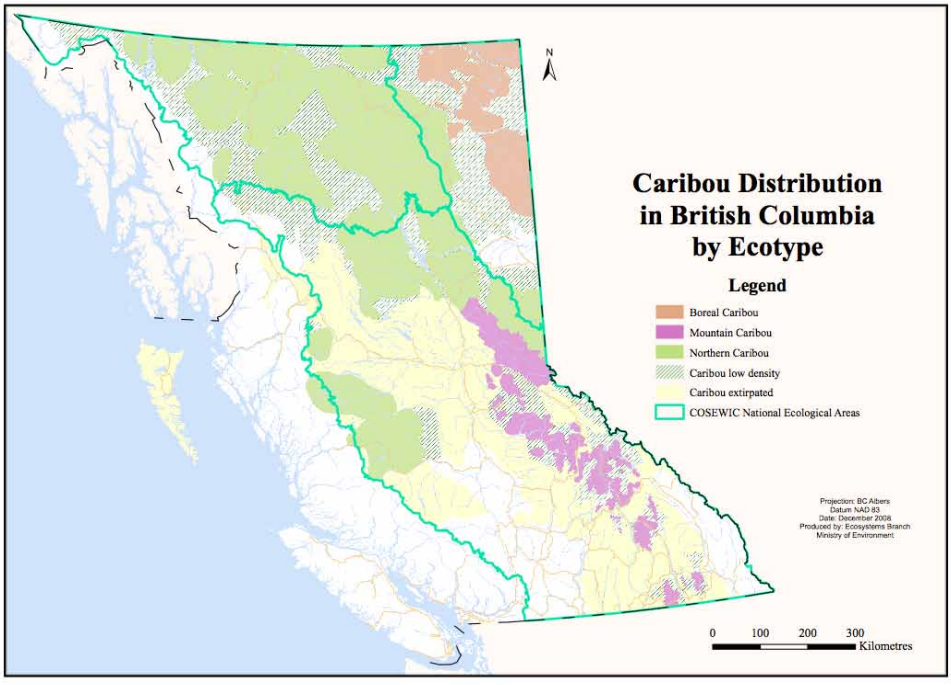


Figure 1. Three ecotypes of Woodland Caribou in British Columbia.

The Telkwa caribou population is located in the Committee on the Status of Endangered Wildlife in Canada's (COSEWIC) Southern Mountain National Ecological Area (SMNEA), which includes the southern two-thirds of BC, and the west-central portion of Alberta. All caribou in the SMNEA were listed as Threatened by COSEWIC in 2000 (and reaffirmed in 2002).

Table 1. Legal designations and conservation status of Northern Caribou in the Southern Mountains National Ecological Area.

Legal Designations	
Identified Wildlife Management Strategy	Yes (2004)
Federal *Species at Risk Act*	Schedule 1 (2003)
Conservation Status	
BC Conservation Data Centre (CDC)[1]	Blue list (2000)
COSEWIC	Threatened (2002)

[1] Referred to as "Northern Mountain Population" by the CDC

Caribou in the SMNEA were designated as Threatened in Schedule 1 of the federal *Species at Risk Act*, which was fully enacted in 2003, and are listed as an Identified Wildlife Management Species under the *Forest and Range Practices Act*.

The "Northern Mountain Population" of caribou, which refers to northern ecotype caribou found in both the SMNEA and Northern Mountains National Ecological Area were blue-listed by the BC Conservation Data Centre in 2000 (Table 1).

1.2 Species Information

1.2.1 Northern Caribou Populations and Distribution

In addition to west-central and northern BC, Northern Caribou are also found in southwestern Alberta, south and central Yukon, and the southwestern portion of the Northwest Territories. In BC, Northern Caribou populations are currently found only in areas where they have access to alpine and subalpine habitat (Heard and Vagt 1998). The distribution of the 25 populations of Northern Caribou in BC is mostly contiguous except for 5 populations in west-central BC, which are isolated from the other populations by the interior plateau.

Historically, Northern Caribou were also found throughout the interior plateau region of BC (Spalding 2000). The reduction of Northern Caribou from their historic range has coincided with increases in populations of other prey species. Moose (*Alces americanus*) were largely absent from or present at low densities in central BC until the late 1800s when they started becoming more common (Spalding 1990, Santamauro *et al*. 2012). Range contraction has also been observed for caribou in other parts of Canada and the United States with the southern distribution boundary in eastern Canada shifting north (Thomas and Gray 2002, Vors *et al*. 2007), the loss of caribou from the eastern United States, and a reduction in range in the northwestern contiguous United States..

The current number of Northern Caribou in BC is estimated at about 16,000 to 18,000 (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data). Of the 25 populations of Northern Caribou currently recognized in BC, 3 populations are currently stable, 7 populations are decreasing, and the population trend is unknown for 15 populations. All 5 populations in west-central BC are currently declining (Environment Canada 2014).

1.2.2 Caribou Biology

Caribou are the only members of the deer family in North America in which both male and female caribou typically have antlers. They are well adapted to winter conditions with crescent-shaped hooves and large, widely spaced dew claws set back on the foot, which reduce sinking depth and act like shovels when digging through the snow for winter forage (Thomas and Gray 2002).

Caribou have a low reproductive rate. Unlike other members of the deer family, caribou have only 1 young per year and females do not generally breed until they are 2 years old (Bergerud 1974). The rut typically occurs in October and females calve in late May/early June. Although pregnancy rates are generally high, calf mortality is also high (especially right after birth), resulting in overall low calf recruitment rates.

The primary anti-predator strategy of Woodland Caribou is to space away from predators and other prey (Bergerud 1996). Females that calve at high elevations or at low elevations on islands in lakes have higher calving success than females that calve in low elevation forested habitat (Seip and Cichowski 1996).

1.2.3 Northern Caribou Habitat and Range Requirements

Northern Caribou are characterized by feeding primarily on terrestrial lichens during winter; however, seasonal movement and habitat use strategies vary between populations. Some populations migrate long distances between summer and winter ranges while others do not, and use of high elevation versus low elevation winter ranges differs between populations, and within populations between winters. Variation in seasonal habitat use reflects differences in topography, snow accumulation, and availability of low elevation winter ranges between areas (Cichowski 2008).

Typically, Northern Caribou calve and summer in high elevation alpine and subalpine habitat, and winter in low elevation forests or on windswept alpine slopes where they forage on terrestrial lichens (see Appendix 1 for a more detailed description of habitat and range use). They also forage on arboreal lichens during winter in subalpine forests or at low elevations in habitats where arboreal lichens are available. Because lichens are slow growing, caribou tend to select older forests (80-250 years) where terrestrial and/or arboreal lichens are more abundant. For populations that move between winter and summer ranges, spring migration routes generally follow low elevation terrain where snow accumulation is lower. Most caribou calve at higher elevations in alpine or subalpine habitat, forgoing forage quality at lower elevations in order to reduce predation risk since predators focus on other prey that remain at lower elevations. During summer, caribou prefer high elevation habitats but can be found in a variety of habitats at all elevations since snow does not limit movement and herb and shrub forage is abundant. Consequently, Northern Caribou are highly dispersed during summer, more so than during any other season.

Habitat and range requirements for Northern Caribou include:

- access to a sufficiently large area of undisturbed high elevation calving and summer habitat for predator avoidance;
- access to an adequate supply of terrestrial and arboreal lichens during winter;
- snow interception by the forest canopy to allow movement within the winter range; and,
- unfragmented large tracts of range to provide caribou the ability to shift wintering areas in response to such factors as overgrazing, fires, changing snow conditions and/or predation pressure.

1.3 Northern Caribou Recovery in British Columbia

Caribou in the SMNEA, which include both Northern and Mountain ecotype populations, were listed as Threatened in 2002. The federal *Species at Risk Act* (SARA), which was fully enacted in 2003, directs that a recovery strategy for threatened species must be prepared within four years after listing. Because caribou in the SMNEA were already listed as Threatened at the time that the *Species at Risk Act* was enacted, a recovery strategy should have been completed by 2007.

Although the Northern Caribou Technical Advisory Committee completed a strategy for Northern Caribou in the SMNEA in BC in 2004 (Northern Caribou Technical Advisory Committee 2004), the strategy was never endorsed by the provincial government. One recovery approach from that strategy was to establish three Recovery Implementation Groups that would develop Recovery Action Plans. The West-Central Recovery Implementation Group, which was responsible for the Telkwa and Tweedsmuir-Entiako populations, met once in March 2005. That year, recovery planning for most species was suspended pending direction from the provincial Species at Risk Coordination Office.

In 2014, Environment Canada developed a recovery strategy for caribou in the SMNEA (Environment Canada 2014). The goal of the recovery strategy is:

- to achieve self-sustaining populations in all local population units within their current distribution.

Population targets include increasing the number of caribou in the SMNEA from about 5800 caribou to an overall target of 9100 caribou. The corresponding population and distribution objectives are, to the extent possible to:

- stop the decline in both size and distribution of all local population units;
- maintain the current distribution within each local population unit; and,
- increase the size of all local population units to self-sustaining levels and, where appropriate and attainable, to levels which can sustain a harvest with dedicated or priority access to aboriginal peoples.

The recovery strategy focuses on predator control in the short term to stop declines, and restoring habitat over the long term to address habitat alteration resulting from industrial activities (Environment Canada 2014).

For Northern Caribou in the SMNEA, critical habitat has been identified as:

- the habitat possessing those biophysical attributes required by southern mountain caribou to carry out life processes and which is found within:
    - the high elevation winter and/or summer (spring, calving, summer, fall/rut) range delimited by the local population unit boundaries;
    - the low elevation summer (spring, calving, summer, fall/rut) range delimited by the local population unit boundaries;
    - the local population unit boundaries, which provide for an overall ecological condition for low elevation winter range and Type 1 matrix range that will allow for an ongoing recruitment and retirement cycle of habitat, which maintains a perpetual state of a minimum of 65% of the area as undisturbed; and,
    - Type 2 matrix range that provides an overall ecological condition that will allow for low predation risk, defined as wolf population densities less than 3 wolves/1000 km^2.

Type 1 matrix range consists of areas within a local population unit's designated range that have not been mapped as summer (e.g. spring, calving, summer, fall/rut) or winter range, and may include seasonal migration areas (or portions of migration areas) and areas of relatively lower use compared to delineated seasonal ranges. Type 2 matrix range consists of areas surrounding ranges where predator/prey dynamics influence predator/prey dynamics in the population's range, and may also include areas of trace occurrences of caribou, dispersal zones between populations, and dispersal zones between local population units.

1.3.1 COSEWIC Designatable Units

In 2011, COSEWIC defined 12 Designatable Units (DUs) for caribou in Canada (COSEWIC 2011), which are discrete and evolutionarily significant units of caribou. Northern Caribou that were a part of the SMNEA for the 2002 assessment were reorganized into two DUs, and were separated from Mountain Caribou, which were given their own DU (Figure 2). All the populations in west-central and north-central BC were combined with Northern Caribou from the Northern Mountains National Ecological Area into the Northern Mountain DU (#7). In May 2002, the Northern

Mountains National Ecological Area population was assessed as Special Concern and a management plan was completed in 2012 (Environment Canada 2012). COSEWIC assessed all three western mountain caribou DUs (Northern Mountain [DU7], Central Mountain [DU8], Southern Mountain [DU9]) in May 2014. The Northern Mountain DU was assessed as Special Concern, while the Central Mountain and Southern Mountain DUs were assessed as Endangered (COSEWIC 2014). The updated listing will be submitted to the Federal Minister of the Environment in fall 2014 for listing consideration under SARA. Until SARA is amended with the updated listings, the Telkwa population remains listed as Threatened under SARA.

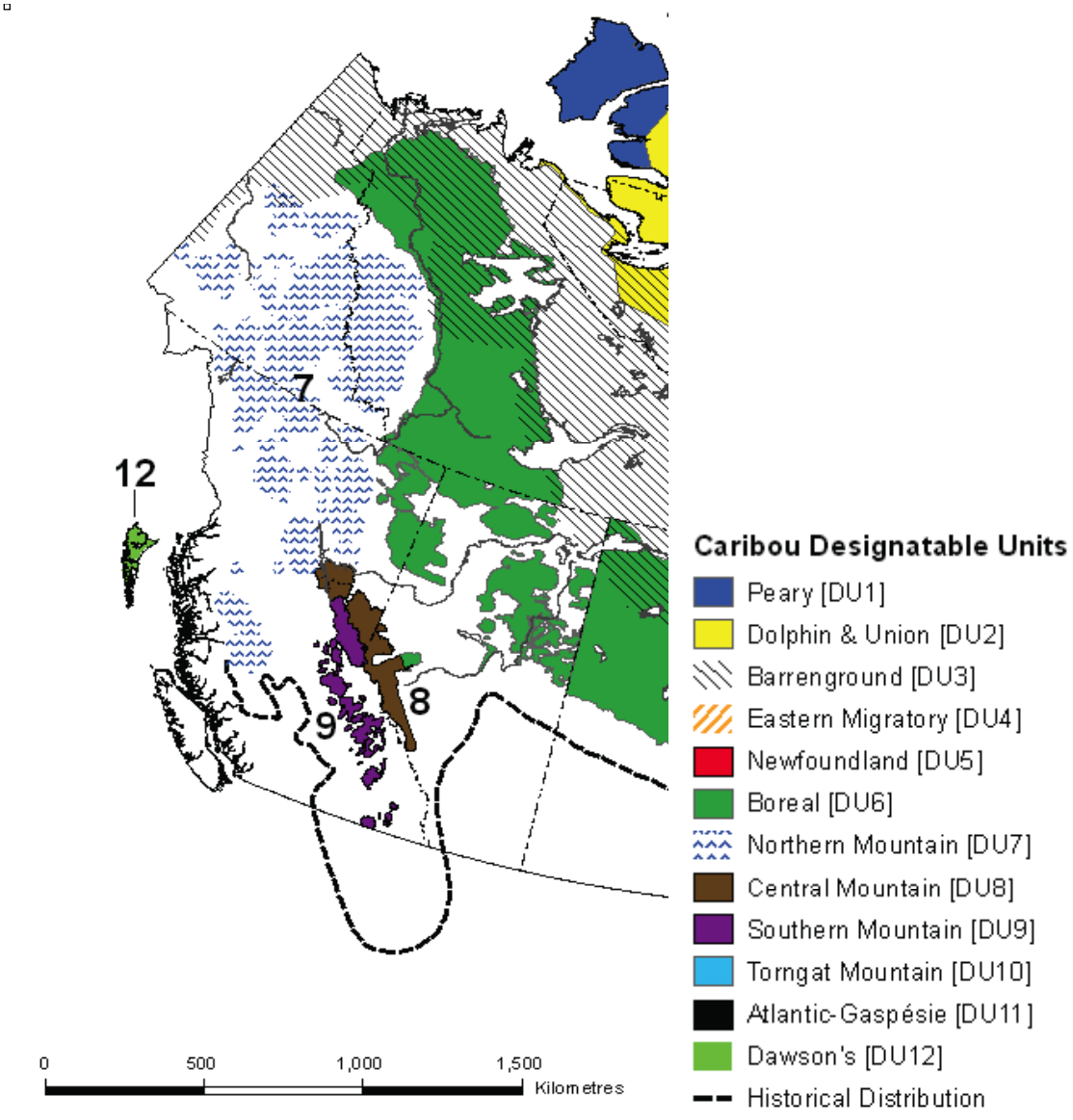


Figure 2. COSEWIC Designatable Units for caribou in western Canada (from COSEWIC 2011).

2. Telkwa Caribou Population

2.1 Description of Range

The Telkwa caribou range is located in west-central BC, approximately 15 km south of Smithers (Figure 3). The physical landscape ranges from low elevation valley bottom areas in the northeast, east and southeast portions of the range, to high elevation mountainous terrain that dominates most of the area.

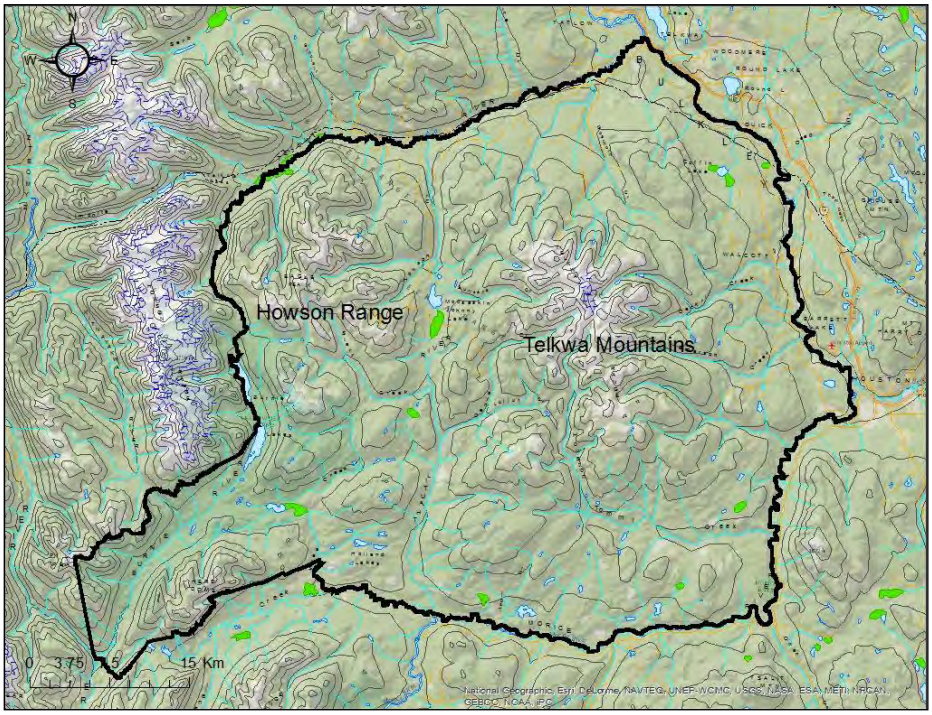


Figure 3. Telkwa caribou range (from Thiessen 2013).

The main large mammals that occur in the recovery area include caribou, mountain goats (*Oreamnos americanus*), moose, deer (*Odocoileus* sp.), elk (*Cervus elaphus*), wolves (*Canis lupus*), grizzly bears (*Ursus arctos*), black bears (*Ursus americanus*), wolverine (*Gulo gulo*), coyote (*Canis latrans*) and lynx (*Lynx canadensis*).

The Telkwa caribou range falls within 4 biogeoclimatic subzone/variants (Banner *et al*. 1993):

- Alpine Tundra (AT);
- Engelmann Spruce-Subalpine Fir (ESSF);
- Sub-Boreal Spruce (SBS); and,
- Coastal Western Hemlock (CWH).

The higher elevation ESSF is represented by 2 subzones: the moist cold ESSF (ESSFmc) subzone surrounds the Telkwa Mountains, and the wet very cold (ESSFwv) subzone is associated with higher elevations in the mountains in the western part of the area. Much of the lower elevation portion of the range lies within the Babine variant of the moist cold SBS subzone (SBSmc2), except for the area near the Bulkley River, which consists of the dry cool SBS (SBSdk), and lower elevations in the northwestern portion of the range, which lie within the montane variant of the wet submaritime subzone of the CWH (CWHws2). The Alpine Tundra zone is found above the ESSF throughout the study area.

The AT zone has a severe climate with low growing season temperatures and a very short frost-free period. Frost can occur at any time, and most of the annual precipitation falls as snow. The severe climate precludes the growth of trees; tree species are common at lower alpine elevations in stunted or krummholz form.

The ESSFmc has a continental climate with cold winters, relatively low annual precipitation and a light snowpack. Dominant tree species include subalpine fir (*Abies lasiocarpa*), hybrid white spruce (*Picea glauca* x *engelmanni*) and lodgepole pine (*Pinus contorta*). Whitebark pine (*Pinus albicaulis*) is occasionally present on the driest sites while amabilis fir (*Abies amabalis*) is absent and mountain hemlock (*Tsuga mertensiana*) is rare.

The SBSdk has relatively dry, warm summers and relatively dry, cold winters with a low snowpack. Major trees species include hybrid white spruce, lodgepole pine, trembling aspen (*Populus tremuloides*), and black cottonwood (*Populus balsamifera trichocarpa*).

The SBSmc2 has cooler and moister summers than the SBSdk and longer winters with a deeper snowpack. Hybrid white spruce, subalpine fir and lodgepole pine are dominant tree species.

The CWHws2 is a high elevation variant of the CWH and occurs between 600 and 1000 meters. The climate is submaritime with a short, cool and wet growing season, and cool snowy winters. Amabilis fir, subalpine fir,

mountain hemlock and Sitka alder (*Alnus viridis*) are common tree species; western redcedar (*Thuja plicata*) and red alder (*Alnus rubra*) (common in other CWH subzones) are absent or scarce.

Fire and forest insects are the two main large-scale disturbance factors at low elevations in the Telkwa caribou range. Although no recent large-scale fires have occurred within the range, the 1982 Swiss Fire burned a portion of the southeast corner of the range, including the Morice River Ecological Reserve. Both mountain pine beetles (*Dendroctonus ponderosae*) and spruce beetles (*Dendroctonus rufipennis*) have affected portions of the range.

2.2 First Nations

The Telkwa Caribou Recovery Plan Area lies entirely within Wet'suwet'en Territory. It overlaps portions of 10 House Territories, which represent all 5 clans.

2.3 Historic Distribution and Population Trend

Historically, caribou were more widely distributed throughout the Bulkley Valley than they are today (BC Ministry of Environment, Lands and Parks 1998, Spalding 2000). Elders from the Wet'suwet'en First Nation describe groups of up to 150 caribou moving across the Bulkley Valley, (including through the current site of the village of Telkwa), and caribou calving in the area now occupied by the town of Smithers (Munro 1947, BC Ministry of Environment, Lands and Parks 1998). Caribou were also described as "plentiful" in the mountains around Moricetown and Hazelton, and in the Howson Range (Spalding 2000, Stronen 2000). In 1913, 40-50 caribou were seen on Hudson Bay Mountain (Spalding 2000). Bill Holland from the Wet'suwet'en First Nation reported that caribou stopped using the valley bottoms after the railroad came in 1910 and that moose moved into the valley in the 1920s (Stronen 2000). By the mid 1940s, caribou were largely absent from the Babine Mountains (Theberge and Oosenbrug 1977).

There is very little information on the size of the Telkwa caribou population prior to the mid-1960s (Figure 4, Appendix 2). In 1943, the population was estimated at 250 caribou based on information "supplied by Mr. C. D. Muirhead who obtained it from various sources that are considered reliable" (Munro 1947). It was believed that caribou numbers

had been increasing for the 15 years prior to 1943 (Munro 1947). In 1947, 250 caribou were observed crossing a river (Stronen 2000). During a 2-week horseback trip in 1949 to assess caribou numbers, 18 caribou and the tracks of an additional 33 caribou were observed in the Telkwa Mountains, resulting in estimates of 60 caribou for the Telkwa Mountains, and 100 caribou for the area that includes the Telkwa Mountains and the area around Burnie Lakes and Herd Dome (Cox 1970). Caribou hunting in an area that included the Telkwa Mountains was closed from 1946 to 1955 (Stevenson and Hatler 1985).

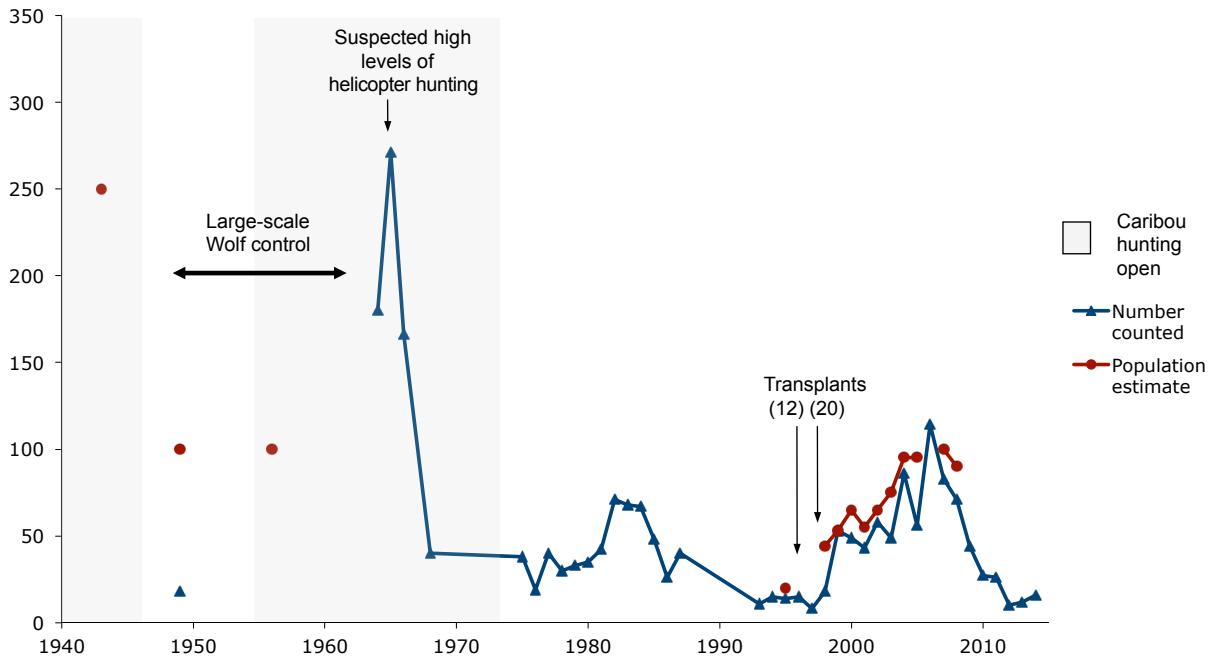


Figure 4. Highest number of caribou counted in a given year during flights conducted in the Telkwa caribou population range, and reported population estimates.

The first aerial survey of caribou in the Telkwa Mountains was conducted in 1955/56, which yielded a minimum estimate of 100 caribou (Cox 1970). Late winter surveys (March/April) were conducted annually starting in 1958, but results from those surveys are only available for 1964-68. From 1958 to 1965, the number of caribou counted during surveys increased and peaked at 271 caribou in 1965; calf recruitment during that time was high, ranging from 22% to 30% (Cox 1970). The number of caribou counted during late winter surveys declined from the

peak of 271 in 1965, to 166 in 1966, 2 in 1967 (due to a heavy snow year caribou remained below treeline), and 40 in 1968 (Cox 1970, Theberge and Oosenbrug 1977). Calf recruitment remained moderate (1965 - 18%; 1966 - 18%; 1968 - 26%) as the number of caribou counted declined (Theberge and Oosenbrug 1977), and the decline in numbers was attributed to suspected high levels of helicopter hunting (Cox 1970).

In 1963 and 1964, the rate of mining and forest harvesting development increased in the area, along with the use of helicopters for staking and accessing mineral claims (Cox 1970). In the fall of 1965, "there was a tremendous amount of helicopter traffic in the Telkwa Mountains" (Cox 1970). However, it is difficult to assess whether the reported hunting data from that time supports whether overhunting occurred because the Telkwa Mountains were part of a larger Game Management Area and it is unclear what portion of the kill came from the Telkwa Mountains (Stevenson and Hatler 1985). The increase in numbers counted from 1964 to 1965 could potentially be explained by immigration (Theberge and Oosenbrug 1977), or an "incomplete count" for the lower count in 1964 (Bergerud 1978), or a combination of both. A general increase in numbers was noted from 1958 to 1965 (Theberge and Oosenbrug 1977), which could also have been partially in response to wide-scale wolf control that was conducted in the 1950s and early 1960s in much of central and northern British Columbia (Hoffos 1987, Bergerud and Elliot 1998).

In 1971, the use of helicopters for hunting caribou was prohibited throughout BC (van Drimmelen 1985) and all caribou hunting in the Telkwa Mountains was closed in 1973. No survey information is available from 1969 to 1974. From 1975 to 1987, the most caribou counted during an individual survey in each year ranged from about 40 to 70, with the highest numbers occurring between 1982 and 1985 (Figure 4; see Appendix 2). No survey information is available from 1987 to 1992, but from 1993 to 1997, the most counted during any given survey did not exceed 15 caribou.

Caribou numbers increased following 2 transplants in 1997 and 1998/99 and reached a peak in 2006 when 114 caribou were counted. The population then decreased to less than 40 caribou by 2010. Although late winter (March) surveys were conducted during the decline, not enough funding was available to assess the cause of the decline.

In summary, although caribou were more abundant and more widely distributed in the Bulkley Valley in the late 1800s and early 1900s, the size and trend of the Telkwa caribou population was not well

documented prior to the mid 1960s and therefore difficult to assess. The highest count obtained in the Telkwa Mountains was 271 in 1965. The population decreased in the mid to late 1960s to a minimum of 40 caribou, increased in the early to mid 1980s to a minimum of 70 caribou, then decreased again to about 10-15 caribou in the mid 1990s. The population increased in the late 1990s to mid 2000s to at least 114 animals following two transplants in 1997 (12 caribou) and 1998-99 (20 caribou), then decreased to less than 40 caribou by the early 2010s.

2.4 Current Distribution and Population Status

Telkwa caribou are found throughout the Telkwa caribou recovery area that includes the Telkwa Mountains, Howson Range and Herd Dome (see Figure 3). Radio-collared caribou have also been found outside of the recovery area east of the Bulkley River and as far north as the headwaters of Porphyry Creek, and as far south as the Nanika River just south of Morice Lake (Roberts *et al*. 2003) and in the Sibola Mountains just north of Tahtsa Lake. Incidental observations of caribou on Tableland Mountain north of Kidprice Lake (Hodson 1977) also further support that caribou have been known to use areas beyond the recovery area boundary.

The Telkwa caribou population is currently estimated at about 25 animals based on 16 caribou counted during a survey conducted in October 2013 (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data). Population counts (see Figure 4) and the estimated population growth rate (Table 2) indicate an increasing population trend following the transplants in 1997 and 1998-99 until about 2007/08 when the population started to decline and continued to decline until 2011/12 when it appeared to stabilize.

Annual adult female mortality rate was variable between 1999/00 and 2008/09 (when sample size was ≥10) and ranged from 0 to 45%, based on both the proportion of adult female radio-collared caribou that were present in April each year that died within the next 12 months, and on the mortality rate calculated using the Kaplan-Meier method, which incorporates caribou that were newly collared any time during the year (Table 2). However, there appeared to be only a slight increasing trend in mortality rate as the population declined (Table 2). The adult female mortality rate in 2005/06 was very high (45%) and did not appear to reflect the mortality rate of the whole population since the number of caribou counted that year increased (Table 2, Figure 4).

Table 2. Calf recruitment, adult female mortality rates, and population growth rates for the Telkwa caribou population, 1992/93 to 2008/09.

	Adult Female Mortality				Calf Recruitment					Estimated population growth rate[6]		
	Proportion		Kaplan-Meier		Total caribou counted							
Year	N[1]	Mortality Rate	N[2]	Mortality Rate	N[3]	calves / 100 cows	N[4]	% calves	Estimated Trend[5]	λ	λ_{LCI}	λ_{UCI}
1992/93			2									
1993/94	2	0	2	0								
1994/95	2	0	5	0								
1995/96	5	40	5	40								
1996/97	3	33	3	33								
1997/98	2	50	13	55								
1998/99	8	0	28	0								
1999/00	24	0	25	0								
2000/01	24	17	24	17								
2001/02	20	25	22	25								
2002/03	16	6	17	6								
2003/04	11	0	20	0	34	62	74	28	+	1.309	1.309	1.309
2004/05	13	15	16	14	35	29	56	18	+/0	0.980	0.786	1.143
2005/06	11	45	24	45	42	52	76	29	0/-	0.688	0.480	0.897
2006/07	18	6	19	6	51	37	83	23	+	1.120	0.995	1.186
2007/08	16	13	22	12	48	15	71	10	0/-	0.947	0.804	1.073
2008/09	19	26	19	26	35	14	44	11	-	0.789	0.597	0.982
2009/10		Not yet compiled			15	27	22	18				
2010/11		Not yet compiled			14	57	26	31				
2011/12[7]		Not yet compiled			-	-	-	-				
2012/13		Not yet compiled			6	50	11	27				
2013/14		Not yet compiled			8	50	15	27				

[1] Mortality rate based on proportion of adult female radio-collared caribou that died during the year; N= radio-collared adult female caribou alive at the beginning of the year (April) minus caribou with unknown survival fates (e.g. collar failure)

[2] Kaplan-Meier mortality rate based on monthly survival; N=radio-collared adult female caribou alive at the beginning of the year (April) plus new collars put on that year

[3] N=number of female caribou counted during March calf survival surveys

[4] N=number of all caribou counted during March calf survival surveys

[5] Estimated population trend subjectively compares both adult female mortality rates to both calf recruitment rates

[6] Estimated population growth rate, λ = adult female survival rate/(1-R) where R = # female calves/(# female calves + # female adults); at λ=1, the population is stable; a λ>1 indicates an increasing population while a λ<1 indicates a decreasing population. Female survival was based on Kaplan-Meier adult female radio-collared caribou survival rates. The number of female calves was calculated using the number of calves counted during March calf survival surveys and assuming that females comprised 50% of calves counted. The lower confidence limit (LCL) and upper confidence limit (UCL) were calculated using the LCL and UCL for adult female radio-collared caribou survival generated by the Kaplan-Meier calculations.

[7] A flight was conducted in March 2012 and 10 caribou were counted, but only 3 were classified (2 cows, 1 calf) so no calf recruitment data is available

Calf recruitment was moderate to high until 2007/08 and 2008/09 when it fell below 15% calves, the rate recommended by Bergerud (1996) to achieve population stability. The start of the population decline coincided with the two years of poor calf recruitment. Poor calf recruitment in 2007/08 followed a deep snow winter in 2006/07 (Figure 5). It is not known if deep snow affects calf survival and recruitment, but it has been proposed that deeper snow during calving, such as measured in May 2007, could potentially force caribou to calve at lower elevations than normal, which could lead to higher predation risk for them and their calves (Bergerud 1996). Deeper snow in the winter prior to calving (e.g. November 2006 to April 2007) could also potentially result in reduced nutritional status of the adult female caribou, which could result in smaller calves that suffer higher mortality rates (Bergerud 1996). The deep snow year in 2006/2007 followed 4 years of relatively low snow levels as measured in May each year.

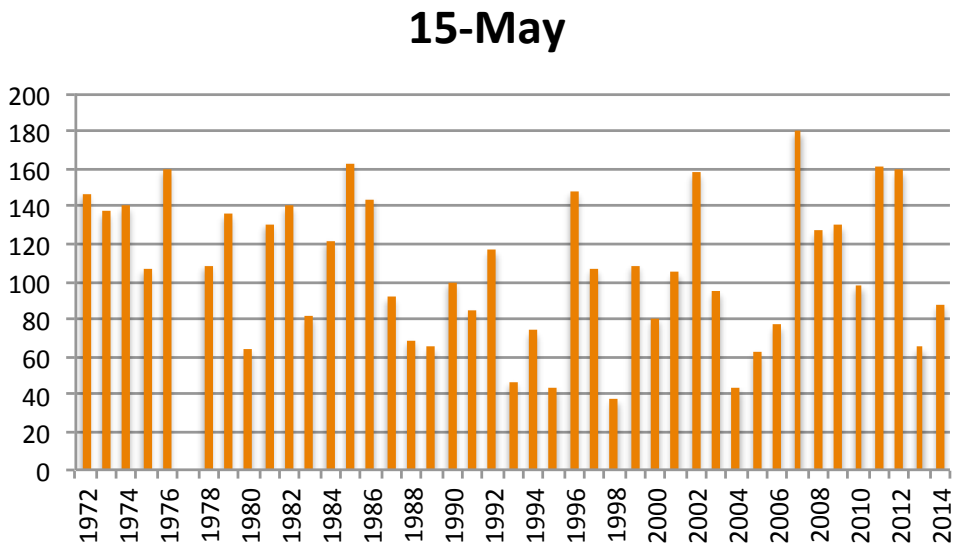


Figure 5. Snow depth at the Hudson Bay Mountain snow station on May 15th from 1972 to 2014.

Calf recruitment has been moderate to high since 2008/09, ranging between 18% and 31% (Table 2). The higher recruitment rate is consistent with a slight increase in the number of caribou counted in recent years (see Figure 4).

To assess how well the population growth rate data were able to predict the population trend, the number of adult female caribou counted during March calf survival surveys was plotted against the number of adult female caribou predicted in the population using the population growth rate, which is based on annual mortality and recruitment rates (Figure 6).

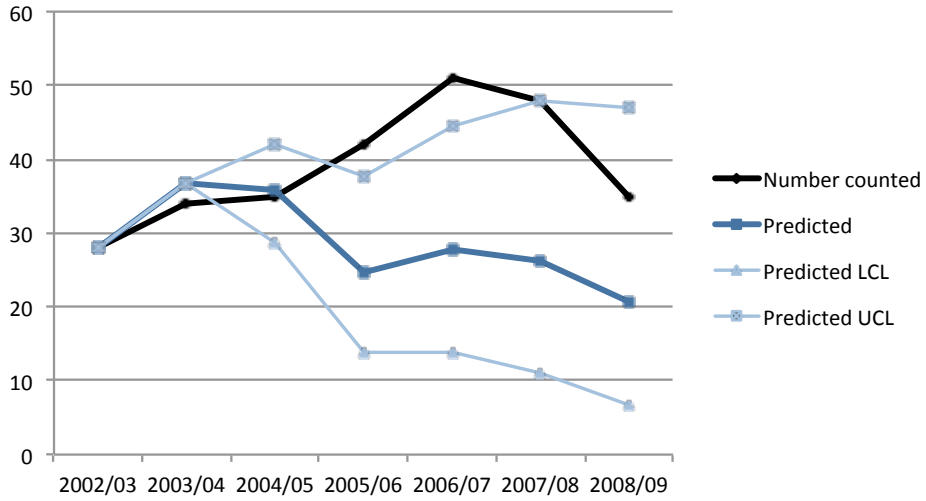


Figure 6. Number of adult female caribou counted during March calf survival surveys (number counted), and number of female caribou predicted in the population (predicted) based on annual population growth rates and associated lower (LCL) and upper confidence limits (UCL).

In general, the population trend (positive slope=increasing; negative slope=decreasing) based on the predicted number of caribou roughly matched that of the number counted, except that the lines diverged after 2004/05, and the slopes were different. This is likely due to a very high (45%) radio-collared female mortality rate recorded in 2005/06, which may not have reflected mortality rate of all females. If a mortality rate based on the average mortality rate from 2002/03 to 2008/09 is used for 2005/06, the predicted number of adult female caribou based on annual population growth rate data closely resembles the number of caribou counted (Figure 7).

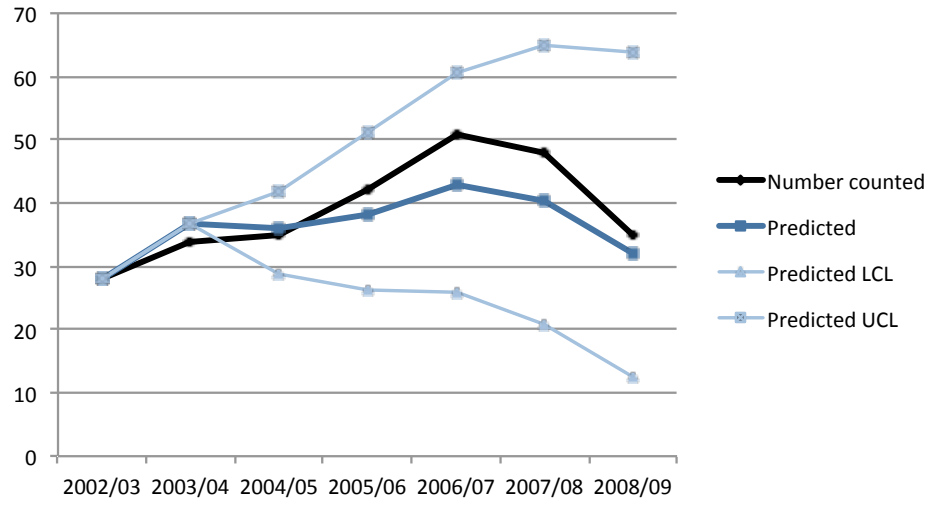


Figure 7. Number of adult female caribou counted during March calf survival surveys (number counted), and number of female caribou predicted in the population (predicted) based on annual population growth rates and associated lower (LCL) and upper confidence limits (UCL), using the average mortality rate from 2002/03 to 2008/09 as the mortality rate for 2005/06.

Wolf predation was found to be the primary known cause of adult mortality for radio-collared caribou tracked until 2008 (BC Ministry of Environment 2009). Other known causes of mortality included bear predation, wolverine predation, and injury/accident (BC Ministry of Environment 2009).

Mortality data is available from 2009/10 to the present, but has not yet been compiled. Table 2 and Figure 7 should be updated once those data are available.

2.5 Habitat and Range Use

In general, Telkwa caribou are found primarily in high elevation alpine and subalpine habitat throughout the year, but also use lower elevation forested habitats during some seasons (van Drimmelen 1986, Stronen 2000, Roberts *et al*. 2003, AECOM 2009).

Aboriginal traditional knowledge describes historical range and habitat use of Telkwa caribou (Stronen 2000):

> *Caribou were found throughout the Bulkley Valley, and migrated seasonally between Tweedsmuir and the Telkwa mountains. The caribou also travelled to the Microwave, Dennis Mountain, Nanika Mountain; to the Howson Range and through Telkwa Pass. When it was difficult to find food in the alpine during the winter, the caribou would normally be around the tree line feeding, and they would eat lichen off the trees.*

Important feeding and calving areas in the Telkwa and Howson mountains were also specified (Stronen 2000).

Habitat use of the Telkwa caribou population was also described by Munro (1947):

> *In winter the caribou travel in fairly large bands, feeding on 'caribou moss' in the alpine fir forests at timberline, and on lichens growing on the open mountain slopes, which are kept bare of snow by the prevailing winds. About the time of the first spring thaw in April the herds disperse and part of the population moves down the slopes, some animals going as far as the lower valleys. Here a few may remain as late as July. There follows a gradual movement upward and by September most of the population is again on the alplands.*

Since then, radio-collared caribou studies conducted in the late 1970s (Hodson 1977), mid 1980s (van Drimmelen 1986) and since 1992 (Stronen 2000, Roberts *et al*. 2003, AECOM 2009) provide more detailed descriptions of habitat use by Telkwa caribou.

In January 1977, one adult female caribou was radio-collared and monitored until the end of April (Hodson 1977). This caribou remained in alpine habitat until late March, when it moved into subalpine forest until the middle of April. Hodson (1977) suggested that caribou may have moved into subalpine habitat once crusting conditions allowed for travel on top of snow.

Four radio-collared female caribou were monitored from March 1985 to May 1986 (van Drimmelen 1986). Caribou were found primarily in alpine habitat throughout the year except in September, when they moved to subalpine forests, and December to February when they moved to lower elevation pine dominated forests. Van Drimmelen (1986) suggested that

caribou may have moved to lower elevations during mid winter due to heavy crusting of snow in alpine habitat. Incidental observations of uncollared caribou at low elevations in October and November, and in alpine habitat in January suggest that Telkwa caribou used a broader range of habitats/elevations than indicated by the radio-collared caribou sample.

From 1997 to 2002, following the translocation of caribou to the Telkwa Mountains, radio-collared female caribou selected alpine and subalpine parkland forested habitats in the ESSF biogeoclimatic zone in all seasons (winter, spring, calving, summer, fall) during most years (Roberts *et al*. 2003). They selected ESSF subalpine forests during winter 2000/01, calving 2001 and summer 2000 and 2001, and mostly selected slopes between 11 and 50% (Roberts *et al*. 2003). Some caribou were also found at low elevations during winter, spring and fall seasons. Almost half of all locations from 1998 to 2000 were on moderate slopes of 16-45%, and 66% of locations in forested habitats were in forests 101-250 years of age (Stronen 2000). During the winter of 1997/98, radio-collared caribou primarily used old subalpine forests, low elevation black spruce bogs or wetlands, and low elevation old pine stands (BC Ministry of Environment, Lands and Parks 1999). There was very little use of alpine areas that winter, likely because alpine areas were covered in snow and were not bared off by wind (BC Ministry of Environment, Lands and Parks 1999).

Although habitat selection was not analyzed for radio-collared caribou from 2002 to 2008, location maps show that caribou used primarily alpine habitat and subalpine (ESSF) forests during all years (AECOM 2009).

Monitoring of radio-collared caribou has continued since 2008 and habitat use based on the more recent data will be analyzed a part of a graduate student thesis currently being conducted.

In summary, although Telkwa caribou are found primarily in alpine and subalpine habitat throughout the year, caribou also use lower elevation habitats. Currently, caribou appear to use lower elevation areas less than they did historically.

3. Existing Land Use and Activities

3.1 Forest Harvesting

Forest harvesting has been conducted throughout the forested portion of the recovery area (Figure 8). The northern portion of the recovery area lies within the Bulkley Timber Supply Area and the southern portion within the Morice Timber Supply Area.

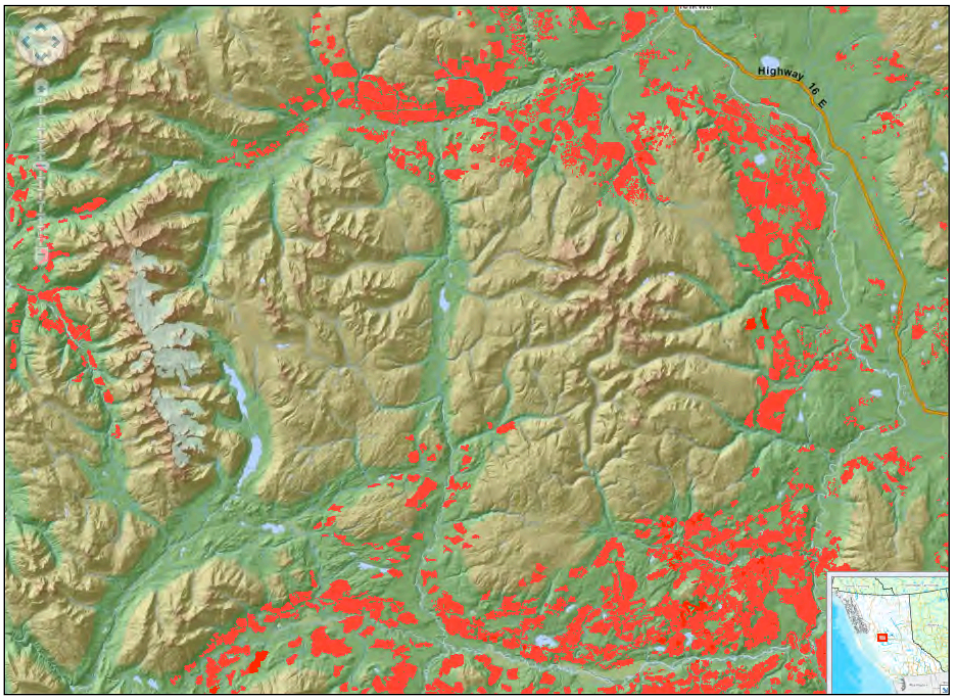


Figure 8. Forest harvest openings in and adjacent to the Telkwa Caribou Recovery Area.

3.2 Mining

Mineral claims overlap much of the central mountainous and northeastern portions of the recovery area (Figure 9). The most recent activity (i.e. since 2000) has been on claims near Mooseskin Johnny Lake, Chisholm Lake, Houston Tommy Creek and Gold Creek.

Currently, there are no active mines in the recovery area. Historically, 3 small mines came into production (Theberge and Oosenbrug 1977). In Hunter Basin, in 1914, 30 tons of ore high in copper and silver were produced at one site, and 42 tons of ore with copper and silver were produced at a second site (Theberge and Oosenbrug 1977). In 1967, a

small mine just west of Mooseskin Johnny Lake produced 239 tons of ore with silver, copper and traces of gold.

There is one coal tenure in the northeastern portion of the recovery area, but there has not been any recent activity on it.

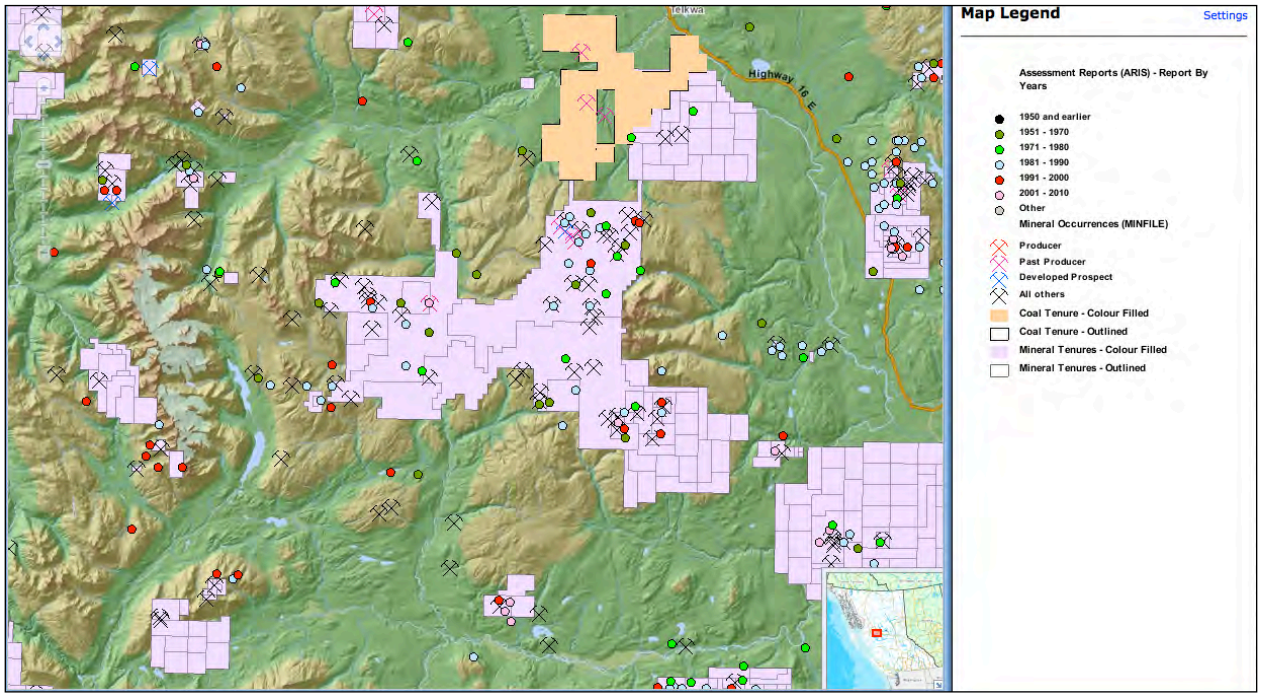


Figure 9. Mineral tenures, coal tenures, and mineral occurrences in and adjacent to the Telkwa Caribou Recovery Area.

3.3 Energy

Although there are no current energy projects in the Telkwa Caribou Recovery Area, there is potential for coal bed methane in the northern portion of the recovery area, which could become more viable if a liquefied natural gas (LNG) pipeline is constructed.

3.4 Transportation and Utility Corridors

Most of the transportation and utility corridors in the Bulkley Valley are located within or adjacent to the northeastern portion the Telkwa Caribou Recovery Area. Highway 16, the main highway linking Prince George and Prince Rupert, is located just outside the northeastern boundary of the recovery area between Houston and Telkwa. Lawson and Walcott roads connect Telkwa and Houston along the west side of the Bulkley River within the recovery area. This road also provides access for forest harvesting in the Morice and Bulkley Timber Supply Areas.

The Morice River Road is located just outside the southeastern boundary of the recovery area along the east and south sides of the Morice River. This road services forest harvesting in the Morice Timber Supply Area and provides access to Huckleberry Mine, which is located further south near Tahtsa Lake.

The Canadian National Railway is also located within the recovery area on the west side of the Bulkley River between Houston and Telkwa.

A 500 KV transmission line traverses the low elevation northeastern portion of the recovery area. Within the recovery area, a 138 KV transmission line branches off from the 500 KV line to the northwest to service Smithers and Hazelton.

The Pacific Northern Gas Ltd. (PNG) natural gas pipeline runs roughly parallel to the 500 KV transmission line, approximately 1 km away. This pipeline supplies natural gas to communities in the Bulkley Valley and on the coast. PNG is proposing to twin the existing pipeline with an LNG pipeline along most of its route including the portion traversing through the Telkwa Caribou Recovery Area.

The BC Environmental Assessment Office issued an Environmental Assessment Certificate in June 2008 for an LNG pipeline (Pacific Trail Pipeline – Apache-Chevron) through the southwestern portion of the recovery area. In June 2013, the Environmental Assessment Certificate was extended for an additional 5 years. No clearing has yet been conducted on the portion that traverses the recovery area.

Another proposed LNG pipeline (Coastal GasLink Pipeline – TransCanada) as well as the proposed Northern Gateway (Enbridge) oil pipeline, follow a similar route through the southwestern portion of the recovery area. The Coastal GasLink Pipeline proposal is currently under review by the

Environmental Assessment Office. In December 2013, the Joint Review Panel for the proposed Enbridge Northern Gateway pipeline recommended that the federal government approve the project, subject to 209 required conditions.

3.5 Agriculture and Settlements

The Village of Telkwa is located at the confluence of the Bulkley and Telkwa Rivers in the northern portion of the recovery area. The town of Houston is located just east of the confluence of the Bulkley and Morice Rivers, just outside of the recovery area.

The areas surrounding Telkwa and Houston and the areas adjacent to Highway 16 and the Bulkley River (both within and outside the northeastern portion of the recovery area) primarily consist of rural residences and agricultural lands, with two sawmills and log storage yards on land just west of Houston (Figure 10). Agricultural lands and rural residences also extend north along Highway 16 to the Town of Smithers.

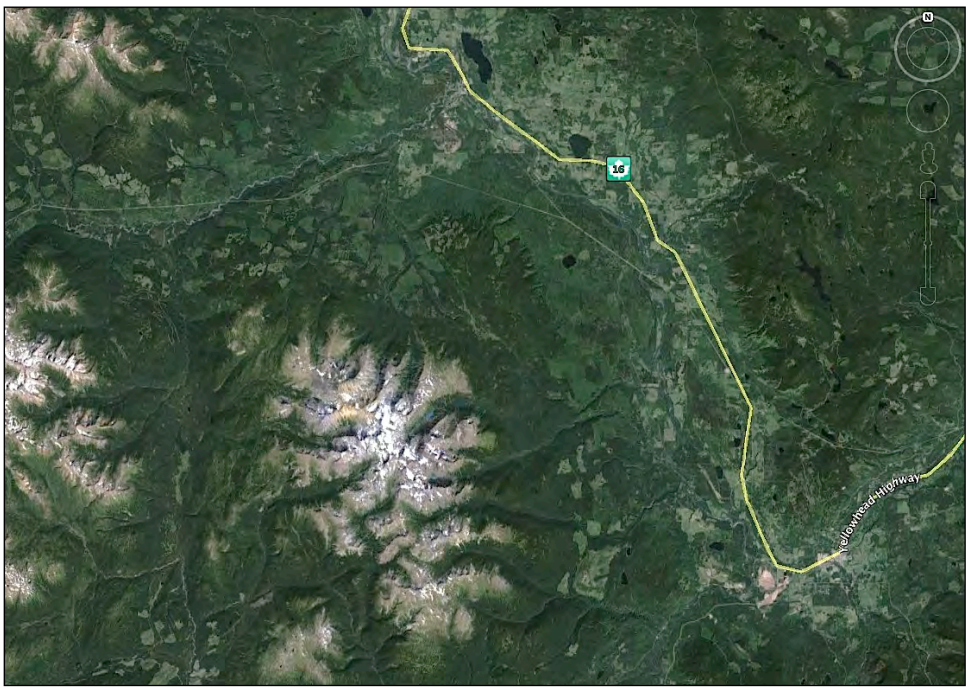


Figure 10. Location of settlement and agricultural lands in the Bulkley Valley, in and adjacent to the northeastern portion of the Telkwa Caribou Recovery Area. (Also note the transmission line right of way).

3.6 Recreational Activities

Recreational activities in the Telkwa Mountains include hiking, skiing, hunting, horseback riding, snowmobiling and ATVing. Although caribou hunting is closed in the Telkwa Mountains, there is a limited entry hunt for mountain goats.

The Telkwa Mountains Caribou Recovery Project Voluntary Recreation Access Restrictions (Voluntary Recreational Access Management Group 2011) provide non-legal guidance on where and when non-motorized and motorized recreational activities occur (see section 4.7 Recreation Access Management).

Recreational activity in the recovery area has been increasing.

4. Management to Date

Table 3 provides a chronological list of management and planning activities that have been conducted for the Telkwa caribou population. These are described in the following sections by type of activity or in other sections as noted. Some activities listed were not conducted specifically for the Telkwa caribou population but are included because of how they influence or could potentially influence caribou management.

Table 3. Management activities and planning conducted for the Telkwa caribou population.

Year	Activity Type	Activity	Sections
1946	Hunting	Caribou hunting closed	2.3, 4.4.1
1947	Research and monitoring	Ground survey	2.3
1950s-early 1960s	Population management	Predator control	2.3
1955	Hunting	Caribou hunting opened	2.3, 4.4.1
1955/56	Research and monitoring	Aerial survey	2.3, 4.5
1958-1968	Research and monitoring	Aerial surveys (winter)	2.3, 4.5
1971	Hunting	Helicopter use for caribou hunting prohibited	2.3, 4.4.1
1973	Hunting	Caribou hunting closed	2.3, 4.4.1
1970s (mid)	Proposed protected areas	Burnie Lakes Proposed Provincial Park	4.1
1977	Proposed protected areas	Proposed Ecological Reserve (Telkwa Mountains)	4.1
1977	Research and monitoring	Radio-collared caribou study (1 caribou)	2.5, 4.5
1977-1981	Research and monitoring	Periodic aerial surveys (at least 1/year)	2.3, 4.5
1981	Access management	Proposed motorized vehicle closure	4.7
1983-1987	Research and monitoring	Aerial surveys (about 1/year)	2.3, 4.5
1985-1986	Research and monitoring	Radio-collared caribou study (4 caribou)	2.5
1986	Habitat protection	Proposed Wildlife Management Area	4.6.1
1993-1997	Research and monitoring	Radio-collared caribou study (2-5 caribou)	4.5
1993-1997	Research and monitoring	Aerial surveys (at least 1/year)	2.3, 4.5
1996	Research and monitoring	Telkwa Range lichen abundance inventory	4.5
1997-1998	Planning	Telkwa Caribou Herd Recovery Plan	4.3
1997-1998	Recreational Access Management	Telkwa Caribou Voluntary Access Management Plan (part of the recovery plan)	4.3, 4.7
1997	Proposed protected areas	Protected Areas Strategy	4.1
1997	Population management	Population Augmentation (12 caribou)	4.4.2
1997-2008	Research and monitoring	Radio-collared caribou study (9-25 caribou)	2.4, 2.5
1997-2011	Research and monitoring	Aerial surveys (1-3/year)	2.4
1998-1999	Population management	Population Augmentation (20 caribou)	4.1

Year	Activity Type	Activity	Sections
1999	Habitat protection	Interim Harvesting Guidelines	4.6.2
1999	Research and monitoring	Early calf survival study	4.5
1999	Planning	Bulkley LRMP	4.2.1
1999	Research and monitoring	Lichen survey	4.5
1999	Research and monitoring	Calf mortality study	4.5
2000	Recreational Access Management	Voluntary Recreational Access Management Group (VRAMG) formed	4.7
2000	Status and Recovery	COSEWIC assessment - Threatened	1.1
2002	Status and Recovery	COSEWIC assessment – Threatened reaffirmed	1.1
2003	Status and Recovery	Federal *Species at Risk Act* fully enacted	1.1
2003	Recreational Access Management	Updated Voluntary Recreation Access Restrictions	4.7
2004	Status and Recovery	A Recovery Strategy for Northern Caribou in BC completed (not endorsed by government)	1.3
2005	Status and Recovery	Provincial recovery planning efforts suspended	1.3
2006	Planning	Bulkley Objectives set by Government	4.2.1
2007	Planning	Morice LRMP	4.2.2
2009-present	Habitat Protection	Proposed Wildlife Habitat Area (#633)	4.6.3
2011	Status and Recovery	COSEWIC - reorganization of caribou into Designatable Units (DUs)	1.3.1
2011	Recreational Access Management	Updated Voluntary Recreation Access Restrictions	4.7
2012-present	Research and monitoring	Aerial surveys (2/year)	2.5, 4.5
2012-present	Research and monitoring	Radio-collared caribou study (7-8 collars)	4.5
2014	Status and Recovery	COSEWIC status assessment for Southern, Central and Northern Mountain DUs completed	1.3.1
2014	Status and Recovery	Recovery Strategy for the Southern Mountain Caribou Population completed (Environment Canada)	1.3

4.1 Proposed Protected Areas

The Telkwa Range and Burnie Lakes area were first proposed for protection in the 1970s. Initially, the Burnie Lakes provincial park proposal included the area surrounding Burnie Lakes and a corridor linking the proposed park to the Telkwa Range (see Appendix 3). In 1977, an Ecological Reserve was proposed for caribou that included most of the higher elevation portions of the Telkwa Range and a connection to the proposed park (Theberge and Oosenbrug 1977; see Appendix 3).

Theberge and Oosenbrug (1977) also recommended that the boundaries for the proposed Burnie Lakes Provincial Park be extended north to include all of the high elevation area in the Eagle Peak area, and south to include all of Herd Dome to incorporate all known caribou range in the area.

In the 1990s, the Prince Rupert Regional Protected Areas Team identified the Telkwa Range and Burnie Lakes as Goal 1 Areas of Interest/Official Study Areas during the Protected Areas Strategy. Goal 1 areas were recommended to increase representation within the Bulkley Ranges Ecosection, which at the time did not contain any protected areas, and to include important caribou habitat. The Telkwa Range included most of the higher elevation portions of the Telkwa Range as well as Mooseskin Johnny Lake and the upper portion of Howson Creek (see Appendix 3). Burnie Lakes included the area surrounding Burnie Lakes and Tom George Lake (see Appendix 3).

The Protected Areas Strategy was then integrated into the land and resource management planning (LRMP) process. The two Goal 1 areas were located within the Bulkley and Morice LRMP areas. Most of the Bulkley LRMP portion of the Telkwa Range was incorporated into Special Management Zones (Bulkley Valley Community Resources Board and Interagency Planning Team 1998). In the Morice LRMP, the Telkwa Range was zoned as General Management within a Caribou Management Area (see 4 .2 Land Use Planning), and most of Burnie Lakes was incorporated into Burnie-Shea Provincial Park (BC Ministry of Agriculture and Lands 2007).

4.2 Land Use Planning

4.2.1 Bulkley LRMP, SRMP and Objectives Set by Government

The Bulkley LRMP, which includes the northern half of the Telkwa Mountains, was completed in 1998 (Bulkley Valley Community Resources Board and Interagency Planning Team 1998). The LRMP was based on Consensus Management Direction (CMD) reached by the 12-member Bulkley Valley Community Resources Board through a 5 ½ year process. The Consensus Management Direction was ratified by the Board in 1996 after public input and then endorsed by government in 1997 to be the basis of the LRMP document. The Bulkley LRMP provides management direction for the Bulkley portion of the Skeena Stikine Resource District,

and is a policy document so the management direction is not legally binding.

The Bulkley LRMP portion of the Telkwa Caribou Recovery Area includes 3 high elevation special management zone planning units (Hankin Plateau, Howson Range, Mooseskin Johnny Lake), 1 low elevation special management zone planning unit (Telkwa River) and one low elevation integrated resource management zone planning unit (Goathorn Creek). Appendix 4 contains detailed management direction from the Bulkley LRMP that affects caribou.

Management direction for forest harvesting includes no harvesting in the Hankin Plateau and Howson Range planning units. Forest harvesting in the Mooseskin Johnny Lake planning unit is to be conducted in a low impact manner that recognizes caribou habitat and the existing commercial backcountry tourism tenure. There are no restrictions on mineral exploration and development, except for controlling motorized access in the Hankin Plateau and Howson Range planning units. The Goathorn Creek planning unit was to be evaluated for range use expansion. With respect to access, the LRMP directed that a strategic Recreational Access Management Plan be developed.

Overall management direction for all five planning units was "to develop a comprehensive plan to sustain and enhance a viable caribou population". In 1998, the Telkwa Mountains Caribou Herd Recovery Plan was developed (BC Ministry of Environment, Lands and Parks 1998; see section 4.3) and in 1999, interim harvesting guidelines were developed (Telkwa Caribou Standing Committee 1999; see section 4.6.1).

In 2005, the Bulkley Valley Sustainable Resource Management Plan was finalized (BC Integrated Land Management Bureau 2005). This plan was developed under the Landscape Unit Planning Framework for the Bulkley Valley Landscape Unit, and incorporated caribou habitat objectives and strategies for the low elevation habitats in the area west of the Bulkley River, which were not included in direction for caribou in the Bulkley LRMP.

In 2006, the Bulkley LRMP Objectives set by Government were developed to streamline legal objectives already put in place following the completion of the LRMP, and to incorporate objectives that had not yet been set (BC Integrated Land Management Bureau 2006). These objectives include biodiversity objectives that provide seral stage targets for each biogeoclimatic zone in each landscape unit, and objectives for caribou.

In the Bulkley LRMP Objectives set by Government, the objective for wildlife in general is to:

- provide for wildlife habitat and populations by implementing and timing road location, development and maintenance activities in a manner that minimizes the effects on these values.

Objectives for caribou are to:

- provide forests with mature and old characteristics within the Telkwa Caribou Herd Recovery Area;
- provide forests with near natural disturbance patterns by biogeoclimatic zones within the Telkwa Caribou Herd Recovery Area;
- provide for forest types capable of supplying a long-term supply of terrestrial and arboreal lichen forage in the Telkwa Caribou Herd Recovery Area;
- provide security cover in the Telkwa Caribou Recovery Area;
- provide large areas of inactivity over a rotation in the Telkwa Caribou Recovery Area; and,
- avoid caribou displacement, by reducing human, caribou and predator interaction, in the Telkwa Caribou Herd Recovery Area.

4.2.2 Morice LRMP

The Morice LRMP was completed by the Morice LRMP planning table in 2004 and then was finalized in 2007 following government to government negotiations with First Nations (BC Ministry of Agriculture and Lands 2007).

The Morice LRMP provides specific direction on maintaining high value seasonal forage habitats and calving/post-calving habitats for caribou, and limiting disturbance from development activities adjacent to calving/post-calving habitats (see Appendix 5). Direction is also provided to comply with the existing and any future Telkwa Caribou Recovery Plan and to use best management practices (identified as the Interim Harvesting Guidelines for the Telkwa Recovery Plan Area) until they are replaced by species recovery strategies under the federal *Species at Risk Act*.

Recreational motorized access restrictions in the Telkwa Mountains were mostly adopted from the Telkwa Caribou Recovery Area Recreation Access Management Plan.

No legal objectives have been defined for the Morice LRMP area.

4.3 Telkwa Mountains Caribou Herd Recovery Plan

The Telkwa Mountains Caribou Herd Recovery Plan was finalized in 1998 (BC Ministry of Environment, Lands and Parks 1998). As part of the planning process, a series of open houses, public meetings and meetings with stakeholders were conducted starting in 1997 to invite public and stakeholder input into the plan (BC Ministry of Environment, Lands and Parks 1998).

The goal of the plan was:

- to meet public demands and BC Environment mandated responsibilities for wildlife management, by working towards enhancing and sustaining a genetically viable population of caribou in the Telkwa Mountains.

The objectives of the plan were:

- to reverse recent declines in size of the population;
- to increase understanding of factors influencing growth rates of the population; and,
- to protect caribou habitat.

The four key elements of the plan included:

- augmenting the population with caribou from other populations;
- frequently monitoring radio-collared caribou;
- recommending a recreational access management plan; and,
- protecting habitat by using existing land zonation and by modifying industrial activities to compliment caribou recovery.

A total of 32 caribou were transplanted into the Telkwa Mountains between November 1997 and February 1999 (see 4.4.1 Transplants). All transplanted animals were radio-collared and frequent fixed-wing telemetry flights were conducted to monitor range use and population demographics. The plan also included recommendations on zonation and voluntary restrictions to manage recreational access, which were developed with input from user groups.

To protect habitat, management and habitat protection zones were developed for the recovery area (Figure 11), and guidelines for forest

harvesting were developed with input from the BC Ministry of Forests and licensees (see 4.6.1 Interim Harvesting Guidelines).

Zone 1 (Integrated Use) consists of lower elevation habitat where industrial activities are expected to occur (BC Ministry of Environment, Lands and Parks 1998).

Zone 2 is the "Core" re-introduction area, where transplanted caribou were introduced. Voluntary restrictions on all access were recommended for this zone, especially during the first few years of recovery. Zone 3 (Caribou Movement Corridor) was zoned to maintain the potential for genetic exchange with the Tweedsmuir-Entiako caribou population and to allow access to habitat within their historic range. Zones 4-6 focused on varying provisions for motorized and non-motorized recreational use (see 4.7 Recreation Access Management).

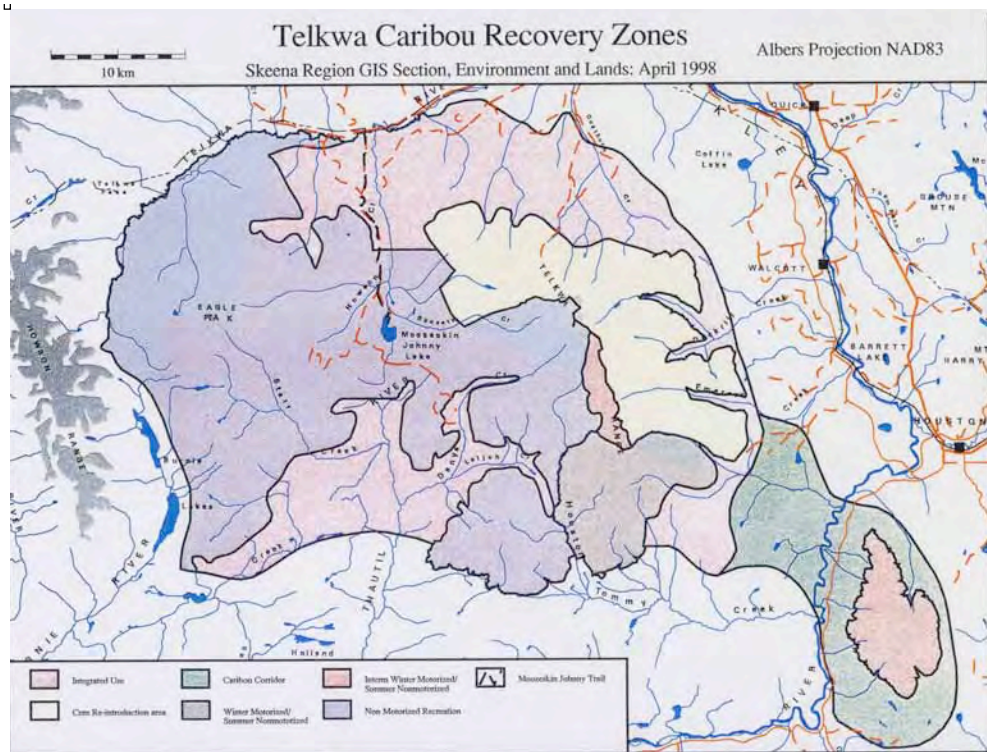


Figure 11. Habitat and protection zones in the Telkwa Caribou Recovery Area, 1998.

In 2004, the BC Ministry of Water, Lands and Air Protection revised the original recovery area boundary to the current boundary (see Figure 3) based on 5 years of radio-collared caribou locations and aerial survey

observations (Keim, no date). The new boundary included low elevation habitats and provided an easily definable boundary that used the Telkwa and Bulkley rivers in the north and east, and the Morice River in the south. The new boundary was incorporated into the Morice LRMP, the Bulkley SRMP, and the Bulkley LRMP Objectives Set by Government (Keim, no date).

4.4 Population Management

4.4.1 Hunting

Caribou hunting in the Telkwa Mountains was closed from 1946 to 1955 (Hatler and Stevenson 1985), and was closed again in 1973 and has been closed since.

Harvest information specific to the Telkwa Mountains for the periods when caribou hunting was open are almost impossible to determine. Prior to 1967, the Telkwa Mountains were part of a larger Management Area (20) that included a large part of central BC, which encompassed a number of Northern Caribou as well as Mountain Caribou ranges. From 1967 to 1975, the Telkwa Mountains were part of Management Area 25, which extended from Morice Lake to the southern boundary of Spatsizi Park, and which contained portions of several Northern Caribou ranges making it difficult to attribute which caribou range caribou were harvested from.

4.4.2 Population Augmentation

As part of the Telkwa Caribou Herd Recovery Plan, a proposal was prepared to transplant 40 caribou into the recovery area (BC Ministry of Environment, Lands and Parks 1997). A total of 32 caribou were transplanted into the population in the late 1990s. Twelve caribou (11 adult females, 1 adult male) were transplanted from the Chase caribou population in north-central BC to the Telkwa Range on November 24 and 25, 1997 (BC Ministry of Environment, Lands and Parks 1998). An additional 16 caribou (14 adult females, 2 adult males) from the Chase population were transplanted in October 1998 and 4 caribou (2 adult females, 1 calf female, 1 adult male) in February 1999 (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data).

Two of the adult females transplanted in October 1998 moved out of the Telkwa Mountains and into the Takla Lake area in November 1998, and did not return (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data). The adult male caribou transplanted in February 1999 died shortly after he was released, apparently due to transplant related causes. All other caribou remained in the Telkwa Mountains area.

4.5 Research and Monitoring

Monitoring of the Telkwa caribou population began in 1955/56 with an aerial survey of the area. Population surveys were then conducted annually until 1968. No monitoring was conducted between 1968 and 1975, but from 1975 to 1987, at least 1 survey was conducted each year (Appendix 2). In January 1977, one adult female was radio-collared and monitored approximately weekly until April 1977 (Hodson 1977), and monitored occasionally afterwards until the collar failed in October 1977 (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data). Four adult female caribou were collared in March 1985 and monitored weekly until April 1986 except in August 1985 and January 1986 when no telemetry flights were conducted (van Drimmelen 1986).

No surveys were conducted from 1988 to 1992. When monitoring restarted in 1993, the number of caribou counted had dropped from 40 in 1987 to less than 15 (see Appendix 2). From 1993 to 1997, 1-2 surveys were conducted each year and 5 caribou were radio-collared (2 in March 1993, 3 in March 1995).

Lichen abundance surveys were conducted in 1996, 1999 and 2000 (Houwers 1996, Roberts 2000a, 2000b). Arboreal lichens were predominantly *Bryoria* sp. (Houwers 1996, Roberts 2000a, 2000b). Arboreal lichen loads were higher in older forests (Roberts 2000a) but were patchy across the landscape (Houwers 1996). Preferred terrestrial forage lichens were most abundant on dry, low productivity sites (Roberts 2000a).

Due to the low number of caribou counted during surveys conducted between 1993 and 1997 (< 16 caribou), 32 caribou were translocated into the population between 1997 and 1999 (see 4.4.2 Population Augmentation). All 32 translocated caribou were radio-collared and monitored. Additional caribou were radio-collared in 2001 (4; 2 of which were recollared in 2003), 2004 (3), 2006 (13) and 2008 (5). Radio-

telemetry flights were conducted regularly until March 2008, when funding for the project was reduced. Radio-telemetry data were used to conduct habitat selection analyses (Stronen 2000, Roberts *et al*. 2003) and home range analyses (Roberts *et al*. 2003, AECOM 2009).

Calf survival surveys were conducted in June and October from 1998/99 to 2002/03. March calf survival surveys were added in 2002/03 and June calf survival surveys were dropped in 2003/04. From 2003/04 to 2010/11, calf survival surveys were conducted in October and March, except for October 2007 and 2009, when surveys were not conducted.

In addition to calf survival surveys, a calf mortality study was conducted in 1999 (Stronen 2000). Of 6 calves radio-collared (5 male, 1 female), 3 (2 male, 1 female) died within days of capture. Although one was killed by an avian predator (likely a golden eagle), all 3 mortalities were likely associated with the capture. The other 3 calves were still alive in April 2000 (Stronen 2000). Subsequently, one collar malfunctioned in August 2000, and the other two caribou died in 2001, one due to wolf predation and one due to bear predation (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data).

More intensive monitoring of caribou began again in 2012. In March 2012, 5 caribou (4 female, 1 male) were captured and fitted with GPS collars and an additional 4 caribou (2 female, 2 male) were captured and collared in March 2013 (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data). As of March 2013, calf survival surveys have been conducted in October and March each year.

A comprehensive summary of timing and causes of adult mortality is currently being prepared.

Monitoring of recreational activities in the Telkwa recovery area started in the summer of 2013 when trail monitors (infra-red, electromagnetic, cameras) were installed in high recreational use areas including Hunter Basin, Grizzly Plateau and the Mooseskin Johnny trail (C. Thiessen, pers. comm. 2014). During the winter of 2013/14, four fixed-wing flights were conducted to assess extent of recreational activities. Also in 2013/14, hand-help GPS units were provided to snowmobile and backcountry ski organizations to provide to their members for when they recreated in the recovery area. However, it appeared that none of the GPS units were used, potentially because of the newness of the program (C. Thiessen, pers. comm. 2014). In addition, a Facebook page was established in January 2014 to provide recreational users planning to use the recovery

area with up to date information on recreational access restrictions, and areas to avoid due to caribou presence.

4.6 Habitat Management

4.6.1 Proposed Wildlife Management Area (1986)

In 1985, a Wildlife Management Area was proposed for the Telkwa Mountains, which encompassed the Alpine Tundra biogeoclimatic zone as delineated by the 1350 m contour (BC Ministry of Environment 1986). The objectives for the Wildlife Management Area were to establish a "benchmark" wildlife population against which to measure the effectiveness of harvest management measures implemented elsewhere, to monitor "natural" population processes in an area with no hunting for caribou, mountain goats and grizzly bears, and to encourage non-hunting recreation involving wildlife with an emphasis on providing wildlife populations near urban centers for viewing and photography.

In 1987, BC Ministry of Forests and BC Ministry of Energy, Mines and Petroleum Resources supported BC Ministry of Environment's efforts to acquire management authority over the area (Keim, no date). The area was formally designated as a wildlife reserve under section 16 of the *Lands Act* (L. Vanderstar, pers. comm. 2014).

4.6.2 Interim Harvesting Guidelines

Interim Harvesting Guidelines were developed for the Telkwa caribou recovery plan area as part of the recovery plan by a committee consisting of representatives of BC Ministry of Environment, Lands and Parks, BC Ministry of Forests, and licensees (Telkwa Caribou Standing Committee 1999). The objectives of the Interim Harvesting Guidelines focus on maintaining sufficient arboreal and terrestrial lichen producing range and habitat quality for a viable population, minimizing caribou habitat fragmentation, managing human access to minimize disturbance to caribou and caribou displacement from the Telkwa Mountains, and maintaining habitat separation from predators.

As part of the guidelines, Key Caribou Habitats were identified based on areas of known previous and current high caribou use, areas of moderate/high arboreal lichen abundance, ungulate capability mapping, and areas that are likely movement corridors. Harvesting and access

strategies were developed for the Key Caribou Habitats as well as for the SBS and ESSF biogeoclimatic zones in general, and included seral stage objectives, opening size, and forest leave areas.

Access management strategies included limiting or controlling access coupled with screening, conducting forest harvesting in summer or early winter to avoid creating packed trails during winter, using access control points in the ESSF, establishing access restrictions, cooperatively managing access, and ensuring effective forested buffers adjacent to harvest blocks and to roads to restrict motorized access to non-motorized areas.

4.6.3 Proposed Wildlife Habitat Area (#6-333)

BC Ministry of Forests, Lands and Natural Resource Operations has been preparing a proposal to establish a Wildlife Habitat Area (#6-333) over the Telkwa Caribou Recovery Area. Four zones are included in the draft General Wildlife Measures: No Harvest; ESSF; SBSmc; and, SBSdk. The Key Caribou Habitats in the interim harvesting guidelines have mostly been incorporated into the No Harvest zone, which is made up of the upper portion of the ESSF and the Alpine Tundra biogoeclimatic zone.

General Wildlife Measures have been drafted for each biogeoclimatic zone that include minimum mature forest targets, maximum young seral targets, wildlife tree patch retention, establishing non-roaded forested buffers around wetlands, minimizing access through road planning, deactivating roads, treed reserves to prevent access to subalpine habitat, and large areas of inactivity in SBS subzones.

General Wildlife Measures have also been drafted for woodlots and for mineral exploration activities.

4.7 Recreational Access Management

All recreational access restrictions in the Telkwa Mountains have been and are currently voluntary, except for a legislated restriction under the *Wildlife Act* that prohibits the use of motor vehicles above 1100 meters for the purpose of hunting, excluding the main trail to the 'gas stop' location on Grizzly Plateau. However, other legislated recreational access restrictions have also been proposed on several occasions.

The need for access management for the Telkwa caribou population was recognized in the mid 1970s (Hodson 1980). Several incidents of displacement of caribou by snowmachines led to the recommendation that recreational snowmobile use be banned from an area in the Telkwa Mountains from November 1st to April 30th each year (BC Fish and Wildlife Branch 1980). Following discussions between the Wildlife Branch and the Smithers and Houston snowmobile organizations, an Order-In-Council to close motorized use was approved in May 1981 (Keim, no date). However, the area was not closed to motorized use because of ongoing opposition by the MLA for Omineca, and a lack of support from the Smithers and Houston snowmobile organizations (Keim, no date).

In 1997, a Recreation Access Management Plan (RAMP) was developed for the Bulkley portion of the Skeena Stikine Forest District as directed by the Bulkley LRMP (BC Ministry of Forests and Range 1997). However, planning for the Telkwa Mountains area was deferred to a future process to be led by BC Environment due to overriding environmental concerns, specifically caribou and mountain goats (BC Ministry of Forests and Range 1997, BC Ministry of Environment, Lands and Parks 1998). The Bulkley RAMP clarified that where recreational values are secondary to the resource values identified by the LRMP (e.g. caribou) and where management of recreation may be required to protect the resource, that management guidelines proposed by the agency override recreational considerations (BC Ministry of Forests and Range 1997, BC Ministry of Environment, Lands and Parks 1998). The Bulkley RAMP also clarified that in areas identified for motorized recreational use, objectives for fish, wildlife and habitat values must still be met (BC Ministry of Forests and Range 1997).

As part of the Telkwa Caribou Herd Recovery Plan, a series of open houses, public meetings and meetings with stakeholders were conducted starting in 1997 to invite public and stakeholder input into the plan, which included recommendations on zonation and restrictions to manage recreational access (BC Ministry of Environment, Lands and Parks 1998).

The draft Telkwa Caribou Herd Recovery Plan (Telkwa Caribou Recovery Team 1997) zoned the recovery plan area into 6 zones (Table 4, Figure 12; Appendix 6). Zone 1 included areas where industrial activity was expected to occur. Zone 2 included areas of highest use by caribou. Zone 3 consisted of 2 corridors, one to Morice Mountain in the southeastern portion of the area, and one in the southwestern portion of the area to link to the Tweedsmuir-Entiako caribou population. Zone 4 recognized the importance of the area to the Houston Snowmobile Club and that caribou mainly used this area in early spring and summer. Zone 5 was a

corridor along the trail to Mooseskin Johnny Lake, and Zone 6 included habitat in the Telkwa/Howson ranges and Morice Mountain above the forest harvest operability limit.

Table 4. Draft Telkwa Caribou Herd Recovery Plan Habitat Protection Zones and proposed access restrictions (from Telkwa Caribou Recovery Team 1997).

Zone #	Zone	Access restrictions
Zone 1	Caribou Management – Industrial Use	• No access restrictions
Zone 2	"Core" Re-introduction Area	• All access restricted
Zone 3	Caribou Movement Corridors	• No access restrictions specified
Zone 4	Winter Motorized Use	• Motorized use during winter only
Zone 5	Mooseskin Johnny Corridor	• No motorized access on the existing mining road to Mooseskin Johnny Lake
Zone 6	Non-Motorized Recreation	• No motorized access

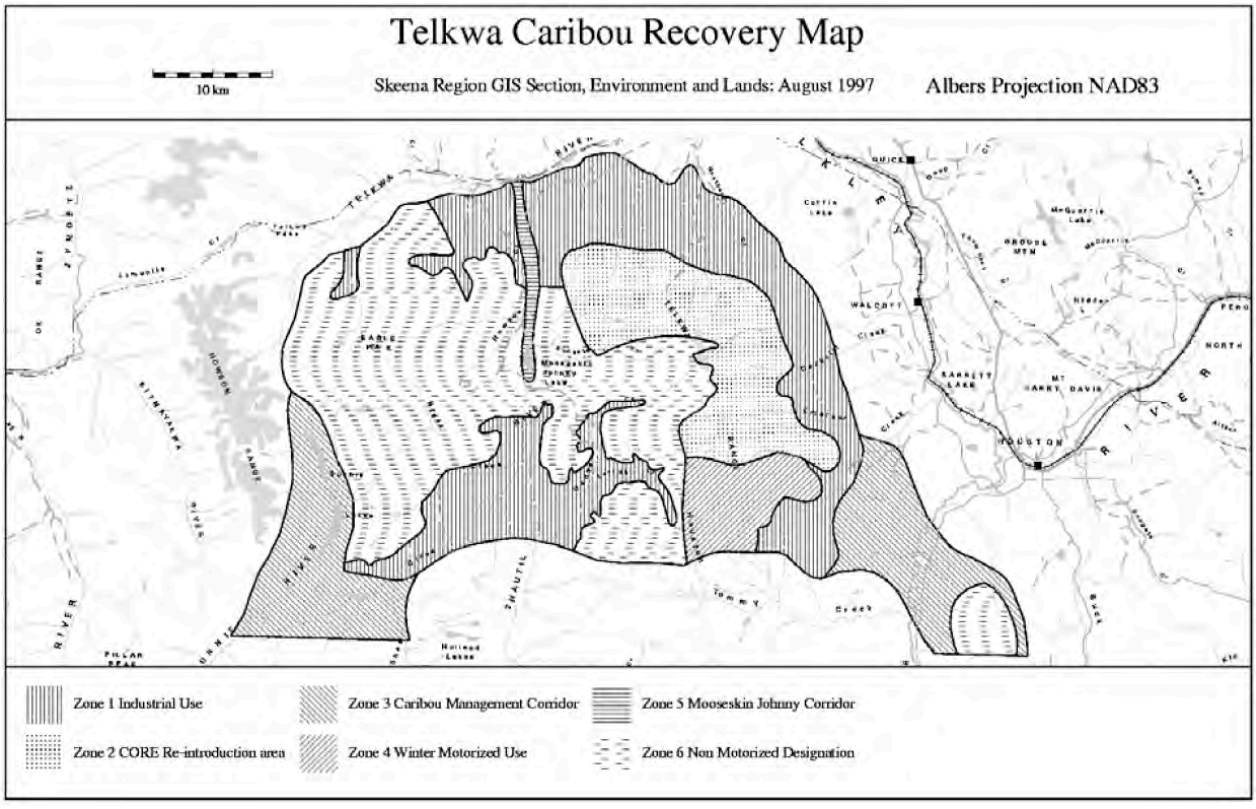


Figure 12. Draft habitat and protection zones in the Telkwa Caribou Recovery Area developed in 1997 (from BC Ministry of Environment, Lands and Parks 1998).

The proposed mechanism for enacting access restrictions was legislation, except for in Zone 5 where legislation was considered one option, along with restrictions on the use of motorized vehicles for hunting, and physical barriers. For Zone 4, non-motorized legislation was to be implemented for the summer period only.

Following public consultation, proposed legislated access restrictions were changed to voluntary access restrictions (BC Ministry of Environment, Lands and Parks 1998). Zone 5 (Mooseskin Johnny Corridor) was integrated into Zone 6 (upper portion) and Zone 1 (lower portion) and replaced with the "Interim Winter Motorized/Summer Non-motorized", which included "Meat Cache Trail" and Morice Mountain (Table 5, see Figure 11). The new Zone 5 was an interim designation to be evaluated following a trial snowmobile season. Also, in the final version of the plan, the Tweedsmuir corridor was removed from Zone 3 due to a lack of proposed forest harvest plans for that area. Appendix 7 contains the final version of the habitat protection zones and voluntary access restrictions portion of the Telkwa Caribou Herd Recovery Plan.

Table 5. Telkwa Caribou Herd Recovery Plan Habitat Protection Zones and voluntary access restrictions (from BC Ministry of Environment, Lands and Parks 1998).

Zone #	Zone	Access restrictions
Zone 1	Caribou Management – Industrial Use	• No access restrictions
Zone 2	"Core" Re-introduction Area	• All access restricted
Zone 3	Caribou Movement Corridor to Morice Mountain	• No access restrictions specified
Zone 4	Winter Motorized/ Summer Non-motorized	• Motorized use during winter only
Zone 5	Interim Winter Motorized/ Summer Non-motorized	• Motorized use during winter only; trial designation
Zone 6	Non-Motorized Recreation	• No motorized access

Representatives of recreational organizations (Bulkley Valley Naturalists, Bulkley Valley Cross Country Ski Club, Bulkley Valley Rod and Gun Club) supported the Recovery Plan and were willing to comply with proposed voluntary restrictions during the initial stages of caribou recovery (BC Ministry of Environment, Lands and Parks 1998). The Houston Snowmobile Club and Smithers Snowmobile Association expressed a

willingness to comply with winter motorized/summer non-motorized restrictions in zones 4 and 5, but neither club indicated that they supported restrictions on motorized access in the Starr Basin area (BC Ministry of Environment, Lands and Parks 1998).

Regular monitoring indicated that caribou were using the Meat Cache Trail area, and therefore after one trial winter, which extended into two winters (1997/98, 1998/99), the area was incorporated into Zone 6, the non-motorized recreation zone (BC Ministry of Environment, Lands and Parks 2000a). A compromise was agreed to with the Houston Snowmobile Club that there could potentially be an opportunity for their club to host a special event one weekend a year in the Meat Cache Trail area if there were no caribou present (BC Ministry of Water, Lands and Air Protection 2001). In addition, no caribou were found in the Mt. Morice area since monitoring began so Zone 5 in that area, as well as Zone 3 (the caribou movement corridor to Morice Mountain), were removed from the recreation access management plan area (BC Ministry of Environment, Lands and Parks 2000a).

Despite general support for the voluntary access restrictions, snowmobile and ATV use continued in areas that were designated as non-motorized or no access, and hiking, horseback riding and other non-motorized activities were continuing in the no access zone (BC Ministry of Environment, Lands and Parks 2000b). In addition, a newly-cut access trail into Hankin Plateau was detected during caribou monitoring flights prompting the BC Ministry of Environment, Lands and Parks to consider an emergency legislated access closure for the Core Re-introduction area in December 1999 (BC Ministry of Environment, Lands and Parks 2000b, BC Ministry of Water, Lands and Air Protection 2001).

In January 2000, many of the local user groups formed the Telkwa Mountains Consultation Group in response to the proposed legislated closures (BC Ministry of Water, Lands and Air Protection 2001) and requested that voluntary access restrictions continue.

In July 2000, voluntary access restrictions in the No Access area were amended to allow for non-motorized use from July 15 to September 15 (Schultze 2000). The amendment included a protocol for recreational users in the recovery area, and clarified that dogs were not allowed in the alpine.

In the fall of 2000, the consultation group requested that the BC Ministry of Water, Lands and Air Protection participate in a working group that would address recreational opportunities and conflicts with caribou (BC

Ministry of Water, Lands and Air Protection 2001). As a result, the Voluntary Recreational Access Management Group (VRAMG) was formed representing about 25 local interest groups. The purpose of the VRAMG was to proactively identify ways to comply with access restrictions that would meet the conservation needs of caribou, and to take responsibility for ensuring that voluntary compliance would work by increasing public awareness through increased signage, taking a more active role in informing recreational user groups about the recreational access restrictions, and identifying areas of concern and non-compliance that needed attention (BC Ministry of Water, Lands and Air Protection 2001).

The VRAMG met once in 2000, 11 times in 2001 (January, February, March, April, May, June, August, September, October, November, December), 5 times in 2002 (January, February, April, May, July), 5 times in 2003 (January, March, April, August, December) and then approximately annually until 2006 (August 2004, February 2006, September 2006). There was a 3 year gap before the group met again in April 2009. The group then met in January 2010 and December 2010 but has not met since. Since that time, the BC Ministry of Forests, Lands and Natural Resource Operations has met individually with user groups to discuss the voluntary recreational access restrictions.

In the late 1990s and early 2000s, non-compliance continued to be an issue in several areas (BC Ministry of Water, Lands and Air Protection 2001):

- hikers in the No Access Zone were complying with seasonal restrictions, but some people continued to take their dogs;
- some motorized use continued in Hunters Basin;
- both winter and summer motorized use continued and increased in the non-motorized area west of Mooseskin Johnny Lake;
- unsanctioned motorized use occurred in the Meat Cache Corridor at the end of 2001, despite good success by the snowmobile clubs in curbing use in the area during most of 2000 and 2001;
- summer motorized activity continued in the Winter Motorized/Summer Non-motorized zone; and,
- motorized access increased along the Mooseskin Johnny Trail because the access control gate was left open.

In 2003, the VRAMG updated the voluntary recreation access restrictions (Table 6, Figure 13, VRAMG 2003, Appendix 8). The zone boundaries were the same as the previous zones, but the wording for each zone was updated, and the protocol for recreational user encounters with caribou was included. The updated voluntary access restrictions included a

provision for potential limited access opportunities in the Core Recovery Area. The updated voluntary access restrictions also included an understanding into the non-motorized zone north of the Grizzly Plateau (available to the Houston Snowmobile Club), and the non-motorized zone west of Mooseskin Johnny Lake (available to the Smithers Snowmobile Association). Although both areas were located in the non-motorized zone, special additional access could be made available through the snowmobile organizations, provided that the needs of caribou were met. The understanding no longer restricted the special additional access to 1 weekend each year. Also, the understanding clarified that the snowmobile organizations acknowledged that legislated closure would be necessary as a final option if the voluntary restrictions could not be made to work.

Table 6. Telkwa Caribou Voluntary Recreation Access Restrictions, March 2003.

Zone #	Previous Zone	Zone	Access restrictions
Zone A	Zone 1	Integrated Use area	• Access restrictions controlled through deactivation of industrial roads
Zone B	Zone 6	Non-Motorized Areas	• No motorized recreational use • Some winter motorized opportunities potentially available through the Smithers and Houston snowmobile clubs • No dogs
Zone C	Zone 4	Grizzly Plateau Area	• No summer recreational motorized access past the “Gas Stop” (May 1-Sept 15) • Winter motorized allowed (Sept 16 – April 30) • No dogs
Zone D	Zone 2	Core Recovery Area	• No recreational access except non-motorized access from July 15 to Sept 15 • Additional limited access opportunities may be available through clubs after discussion with the VRAMG • No Dogs
Not zoned		Mooseskin Johnny Trail	• Motorized access is allowed along the old access trail from the Telkwa River bridge to Mooseskin Johnny Lake. Industrial access upgrades and development are not intended to improve or increase the recreation access to the area

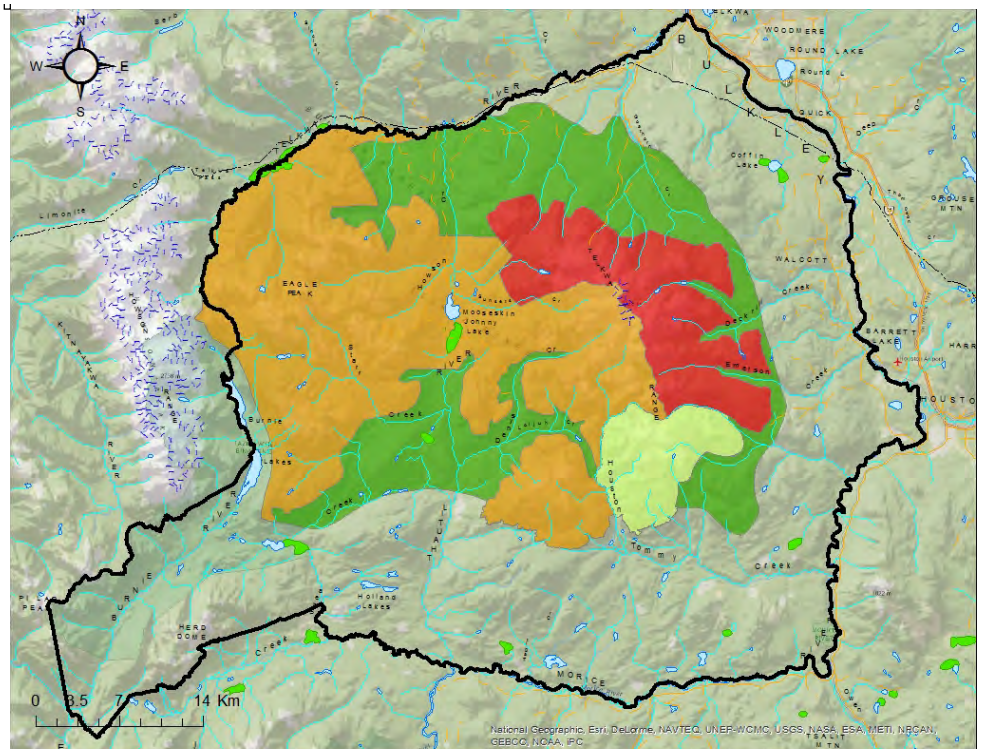


Figure 13. Current zones for voluntary access management restrictions in the Telkwa Recovery Area, Zone A (Green), Zone B (Orange), Zone C (yellow), Zone D (Red).

In 2006, due to continued summer motorized use in the recovery area, the VRAMG recommended that the province pursue legislation to control summer motorized access in the recovery area (VRAMG 2006). However, legislation has not yet been put into place because recovery efforts have focused on establishing the Wildlife Habitat Area (VRAMG 2010).

In 2011, wording was added to the Voluntary Recreation Access Restrictions that clarified that the bridge across the Telkwa River on the Howson Road (which branches off Coalmine Road at km 18) was not intended to facilitate recreational activities other than for the one weekend a year agreement to allow motorized access through the protected area (Appendix 9). Also in 2011, the understanding between the snowmobile organizations and the BC Ministry of Natural Resource Operations regarding special opportunities for recreational motorized activities in the non-motorized zone was revised (Appendix 9). Previously, the understanding for the Grizzly Plateau area was specifically with the Houston Snowmobile Club, and the understanding for the Mooseskin Johnny Lake area was specifically with the Smithers Snowmobile Association. In the 2011 revised understanding, the wording

for both areas was combined into one understanding between the BC Ministry of Natural Resource Operations and both snowmobile organizations, effectively allowing access into both areas by both snowmobile organizations.

In 2013, a summer recreational access management plan was developed for the Bulkley LRMP (Summer RAMP Table 2013). For the Telkwa Mountains Caribou Recovery Area, the RAMP table deferred to the Telkwa Mountain Access Understanding.

4.8 Current Management

Forest harvesting in the recovery area is guided by the Interim Harvest Guidelines and by management direction from the Bulkley and Morice LRMP until the Wildlife Habitat Area is established. Recreational access management is guided by the 2011 Voluntary Recreation Access Restrictions and Telkwa Mountain Access Understanding.

5. Threats

While predation is considered the main proximate limiting factor for caribou populations, large-scale habitat alterations that affect abundance, habitat use and movements of predators and alternate prey ultimately affect caribou populations (Festa-Bianchet *et al*. 2011).

The following sections are adapted from the discussions of threats in the Recovery Strategy for Woodland Caribou, Southern Mountain population in Canada (Environment Canada 2014) and the COSEWIC Status Report on Caribou in the Northern Mountain, Central Mountain and Southern Mountain Designatable Units (COSEWIC 2014 In Press). Each section describes an individual threat; however, because threats interact, some discussion crosses over between sections.

5.1 Predation

The most significant threat to Northern Caribou is increased predation resulting from habitat alteration due to industrial activities (Environment Canada 2014). Industrial activities such as forest harvesting, mining and mineral exploration, and oil and gas exploration and development remove or destroy caribou habitat (mature and old forests) and create early seral habitats favoured by other prey species such as moose and deer. In ranges with habitat alterations that provide favourable conditions for other prey species, predators such as wolves can increase in number, which can significantly reduce or even eliminate caribou populations (Seip 1991; Seip 1992a; Wittmer *et al*. 2005a).

Wolves are the primary predator of caribou in western Canada (Edmonds 1988, Farnell and McDonald 1988, Seip 1992a, Hayes *et al*. 2003, McNay 2009, Whittington *et al*. 2011), but bears, cougars, and wolverine can be important predators locally and/or seasonally (Kinley and Apps 2001, Cichowski and MacLean 2005, Wittmer *et al*. 2005a, Gustine *et al*. 2006a, McNay 2009, Milakovic and Parker 2013). For the Telkwa caribou population, wolf predation was the primary known cause of adult mortality, and other known causes of mortality included bear predation, wolverine predation, avian predation and injury/accident (BC Ministry of Environment 2009).

Historically, predator-prey dynamics on caribou ranges have fluctuated with environmental conditions and management practices. Moose were largely absent or present at extremely low densities in southern and

central BC until the late 1800s when they started to increase (Spalding 1990, Santomauro *et al*. 2012). In the Telkwa Mountains area, moose began colonizing the Bulkley Valley in the 1920s (Stronen 2000). In the 1950s and 1960s, wolves and coyotes were poisoned through widescale predator control programs (Bergerud 1978, Hoffos 1987, Bergerud and Elliott 1998). Legal harvests of caribou in the late 1960s and early 1970s (Cox 1970, Bergerud 1978) combined with recovering wolf populations and adverse weather may have contributed to caribou population decreases in BC, including the Telkwa Mountains, in the 1970s.

Although predation is the primary cause of caribou mortality (Edmonds and Smith 1991, Seip 1992a, Wittmer *et al*. 2005a), caribou are usually a secondary prey species in the diet of predators, especially wolves, whose populations are sustained by other prey species such as moose and deer (Seip 1992a, Stotyn 2008, Williamson-Ehlers 2012). While caribou and other prey do not compete directly for resources, other prey affect caribou populations through ”apparent competition”, which is the indirect interaction between species when they share a common predator (Holt 1977, Wittmer *et al*. 2007, DeCesare *et al*. 2009). For caribou, this interaction is usually negative with caribou declining when other prey species increase in numbers (Wittmer *et al*. 2007, DeCesare *et al*. 2009).

Caribou that coexist with predators and other prey on their ranges are generally spatially separated from predators and other prey through much of their annual cycle (Seip 1992a, Stotyn 2008, Hebblewhite *et al*. 2010a, Steenweg 2011, Robinson *et al*. 2012). For Mountain Caribou in southeastern BC, spatial separation is greatest during late winter when caribou are found in subalpine forests and wolves, cougars, moose and deer are found in valley bottoms; the lowest degree of spatial separation occurs during spring (Seip 1992b, Stotyn 2008, Steenweg 2011). Wolf predation on Mountain Caribou occurs primarily at low elevations (Apps *et al*. 2013). Northern Caribou in west-central Alberta and BC select higher elevations and forested habitats and avoid burns, while wolves select burns, areas close to burns, and open habitats and avoid high elevation/alpine areas (Gustine and Parker 2008, Hebblewhite *et al*. 2010a, Robinson *et al*. 2010). Wolves also frequent early seral habitats while caribou do not (Williamson-Ehlers 2012). In west-central Alberta, wolves use high elevations most in summer and fall (Whittington *et al*. 2011).

During calving, caribou spatially separate themselves from other prey and predators by dispersing into high elevation alpine and subalpine habitat (where forage is limited) or onto islands in lakes where predators are less

abundant (Bergerud *et al*. 1984, Bergerud 1985). In west-central BC, caribou that calve in mountains or on islands in lakes have higher early calf survival than caribou that calve in low elevation forests (Seip and Cichowski 1996, Cichowski and MacLean 2005).

Because spatial separation of caribou from predators and other prey is important for maintaining caribou populations, any human activities that result in reduced spatial separation, or increased access to caribou ranges, can result in increased predation risk and reduced calf and adult survival rates.

Predator reduction and sterilization are tools used for reversing caribou population declines (Bergerud and Elliot 1998, Hayes *et al*. 2003). Wolf removals of 60-90% have resulted in increased numbers of caribou, reduced caribou adult mortality, and increased calf recruitment (Farnell and McDonald 1988, Bergerud and Elliot 1998). In most cases, the effects of wolf removal are short lived and caribou populations decline once wolf removal has ended (Adamczewski *et al*. 2007). However, for the Aishihik caribou population in the Yukon, caribou continued to increase even after the wolf removal and sterilization program ended (Hegel and Russell 2010). On the Barkerville and Wells Gray (north) Mountain Caribou ranges where wolves were removed and sterilized, and wolf densities were reduced to 3.2-3.4 wolves/1000 km^2 on about 60% of the study area, the Barkerville population increased and the Wells Gray (north) population remained stable, but calf recruitment was variable (Roorda and Wright 2012).

Reduction of alternate prey is another potential tool for reversing caribou population declines. Reduction of moose through liberalized hunting resulted in a 71% reduction in moose numbers and about a 50% reduction in wolf numbers on three Mountain Caribou ranges in southern BC; the Columbia North population (the largest subpopulation in the study) experienced a modest increase while the two small populations (Columbia South, Frisby-Boulder) decreased (Serrouya 2013). In the Parsnip portion of the Hart Ranges Mountain Caribou range in central BC, moose numbers declined, possibly due to a severe winter affecting moose mortality, but over 6 years, neither wolf nor caribou numbers appeared to respond (Steenweg 2011, D. Heard, pers. comm. 2013).

5.2 Industrial Activities

Forest harvesting and mineral exploration are the primary industrial activities affecting the Telkwa caribou population. Salvage harvesting of

mountain pine beetle-killed stands and mid-term timber supply issues are also contributing to increased pressure to harvest within or directly adjacent to important caribou habitat. Although coal exploration and development, oil and gas exploration and development, and wind-farms are not a current threat to the Telkwa caribou population, the coal claims in the northeastern portion of the range, and the potential for coalbed methane in the Bulkley Valley could affect the caribou in the future.

Although the impacts of industrial activities do not generally result in direct mortality of Northern Caribou, indirect impacts include facilitated movement of predators through caribou ranges and altered predator/prey dynamics due to habitat alteration, which lead to increased predation rates on caribou. Where infrastructure is involved (e.g., open pit mines, roads) or habitat is converted to other uses (e.g., agriculture, pipelines, transmission lines), habitat alteration is essentially permanent. Fire-adapted forest habitat can take 60-80 years to recover following forest harvesting and more than 100 years may be required for high elevation subalpine habitat to once again become suitable caribou habitat.

Caribou select habitat in a hierarchical manner; at the landscape scale the priority of selection is to reduce predation risk (Johnson *et al*. 2002, Gustine *et al*. 2006b). Habitat alteration resulting from industrial activities on caribou ranges has been linked to: reduced spatial separation between caribou and other prey or predators (Peters 2010); reduced occupancy by caribou (Smith *et al*. 2000, Apps and McLellan 2006, Wittmer *et al*. 2007); reduced calf recruitment (McCarthy *et al*. 2011); displacement of caribou (Chubbs *et al*. 1993, Schaefer and Mahoney 2007, Weir *et al*. 2007); reduced adult caribou survival (Smith 2004, Wittmer *et al*. 2007); and caribou population declines (Wittmer *et al*. 2007). Industrial activities can also affect caribou directly through impacts on forage lichens (Kranrod 1996, Sulyma 2001, Miège *et al*. 2001, Stevenson and Coxson 2007).

The effects of habitat alteration due to industrial activities may reduce the viability of a caribou population through increased predation rates within caribou ranges or displacement of caribou to areas of higher predation risk. This could lead to a reduction in the size of the annual range and potentially result in the extirpation of a population. Habitat alteration due to industrial activities also reduces the suitability of adjacent habitat (Smith *et al*. 2000; Williamson-Ehlers 2012). In some cases caribou may use areas of inadequate or degraded habitat (e.g. habitat surrounding certain types of development), particularly in highly disturbed ranges where opportunities for movement to suitable

undisturbed habitat are limited or unavailable (Williamson-Ehlers *et al*. 2013). In these situations caribou are at a higher mortality risk. In addition, large-scale industrial disturbances to the landscape (e.g., widespread forest harvesting) can cause caribou to discontinue their use of portions of the range (Smith *et al*. 2000).

Caribou distance themselves away from habitat alteration if there is an opportunity to; however, where the density of habitat alteration is high, caribou may not have opportunities to use areas that are distant from the habitat alteration (Polfus *et al*. 2011, Williamson-Ehlers *et al*. 2013). For example, on very disturbed landscapes, during calving when fidelity to ranges is higher, caribou may need to choose between reducing range fidelity (potentially resulting in lower female and calf survival due to reduced familiarity with escape cover, predation risk and food distribution) or maintaining site fidelity in a landscape where predation risk has increased due to increased habitat alteration (Faille *et al*. 2011, Tracz *et al*. 2010).

Habitat alteration affects the distribution and configuration of high quality habitat on the landscape. In west-central Alberta, caribou selected winter habitat patches with high area to perimeter ratios (Saher 2005). In west-central Alberta, at the landscape level, caribou avoided and were less abundant in areas disturbed by forest harvesting (Smith *et al*. 2000, DeCesare *et al*. 2012). For Mountain Caribou, Apps *et al*. (2013) were unable to link localized habitat fragmentation due to forest harvesting within caribou ranges with predation on caribou, and suggest that habitat alteration functions at a broader scale and includes winter ranges of primary prey beyond caribou ranges. Schneider *et al*. (2010) suggest that large undisturbed patches may need to be protected to prevent infiltration by predators from surrounding areas.

Forest succession after forest harvesting differs from that after natural disturbance. In particular, succession of terrestrial lichens after forest harvesting depends on initial ecological conditions, degree of disturbance, surface treatment, and restocking methods. On extremely dry sites dominated by terrestrial lichens, lichen cover may decrease after clearcut harvesting (Miège *et al*. 2001), while on more moist sites, harvesting may promote an increase in terrestrial lichen cover where other vegetation has outcompeted the lichens (Sulyma 2001). Partial cutting can result in increased arboreal lichen abundance in the lower canopy of the residual forest until new regeneration begins to shelter the lower canopy of remaining trees, while heavier cuts can result in reduced arboreal lichen abundance (Stevenson and Coxson 2007).

Disturbance due to noise, traffic and/or other factors caused by human activities and associated access could result in displacement of caribou from preferred or low predation risk habitats, increased stress, changes in movement patterns, increased energy expenditures and/or physical injury or death. Female caribou with calves during the calving season are the most prone to disturbance, while bulls throughout the year and all caribou during the insect harassment season are less likely to avoid disturbances (Wolfe *et al*. 2000). Physical disturbance from roads, drilling sites and seismic lines have resulted in avoidance of habitats well beyond actual development footprints (Polfus *et al*. 2011, Williamson-Ehlers *et al*. 2013).

Studies from other areas provide further insight into effects of industrial activities on caribou. In Alaska, oil and gas facilities appeared to displace calving caribou to other areas, which could potentially lead to increased predation on calves (Nellemann and Cameron 1998). Logging activities, including hauling logs through winter habitat, have resulted in displacement of caribou (Darby and Duquette 1986, Darby *et al*. 1989, Cumming and Hyer 1998). In Newfoundland, female caribou showed reduced use of areas within 9.2 km of timber harvest cutblocks (Schaefer and Mahoney 2007), and construction of a hydroelectric development in Newfoundland displaced some caribou and disrupted the timing of migration (Mahoney and Schaefer 2002). Cameron *et al*. (1995) found significantly lower abundance and reduced movements of female caribou within a developed oil field compared with more remote areas. In Alberta, simulated petroleum exploration noise resulted in higher mean movement rates and displacement of Boreal Caribou, but feeding patterns were not affected (Bradshaw *et al*. 1997, Bradshaw *et al*. 1998). Avoidance of well sites by Boreal Caribou in Alberta was greatest during late winter and calving (Dyer *et al*. 2001).

5.3 Roads and other anthropogenic linear features

Roads impact caribou directly through vehicle collisions and increased access for regulated and unregulated hunting (Brown and Ross 1994, ASRD & ACA 2010). Roads and linear features such as pipelines, seismic lines, and hydro transmission lines also affect caribou indirectly through habitat fragmentation and improving the efficiency of movement for some predators. Linear features can also support permanent early seral habitat favoured by other prey species. For example, grass seeding on road and transmission line right-of-ways provides forage for other prey species.

In general, caribou avoid disturbance associated with roads and other anthropogenic linear features (Oberg 2001, Hebblewhite *et al*. 2010a, Polfus *et al*. 2011, DeCesare *et al*. 2012, Williamson-Ehlers 2012), often despite the availability of preferred habitat (e.g. lichen producing winter habitat) near those features (Florkiewicz *et al*. 2007). Caribou avoid areas in close proximity to roads (Hebblewhite *et al*. 2010a, Williamson-Ehlers 2012), while response of wolves to roads is variable (Hebblewhite *et al*. 2010a).

Roads and anthropogenic linear features associated with industrial and recreational activities affect predation risk. For Northern Caribou in west-central Alberta, encounter rates between wolves and caribou increased with proximity to anthropogenic linear features (Whittington *et al*. 2011). For Mountain Caribou, wolf predation on caribou occurred in association with roads at the fine scale (Apps *et al*. 2013). Roads and other anthropogenic linear features were associated with increased predation risk for Boreal Caribou in Alberta and with facilitating wolf movements (James 1999, James and Stuart-Smith 2000, Latham *et al*. 2011).

Improved access to the summer calving range may increase risk of disturbance by humans during calving; calving areas are the most sensitive of all habitats for caribou (Seip and Cichowski 1996) and require protection. In Alaska, Nellemann and Cameron (1998) found that the greatest incremental impacts of roads were attributed to initial construction and related facilities and that females and calves were far more sensitive to surface development than adult males and yearlings. Displacement could lead to increased predation risk if caribou are forced into habitats where predation risk is higher. During winter, displacement could also lead to poorer body condition if caribou have to increase energy expenditure to avoid disturbances, or use lower quality habitats where food quantity and/or quality are lower.

5.4 Recreational Activities

Snowmobiling, ATV use, hiking, backcountry skiing and horseback riding are the primary recreational activities that affect the Telkwa caribou population.

Snowmobiling has been found to result in displacement for Northern Caribou in the Yukon (Powell 2004) and Mountain Caribou in BC (Seip *et al*. 2007), increased stress for Mountain Caribou (Freeman 2008), reduced feeding due to increased vigilance and movement after

disturbance for Northern Caribou (Powell 2004), and increased access for wolves along packed trails in winter for Northern Caribou (Powell 2004). Mountain Caribou in southeastern BC were absent from an area that had extensive snowmobile use, even though it contained high quality habitat (Seip *et al*. 2007). Displacement could force caribou into areas where mortality risk is higher. Increased concentrations of the fecal stress hormones (glucocorticoids) were detected in Mountain Caribou located up to 10 km away from winter recreational activities (Freeman 2008). Chronic disturbance and stress could potentially lead to reduced body condition and consequent population level effects if reproductive rates, survival or recruitment are affected (Simpson and Terry 2000).

Backcountry skiing/snowshoeing has resulted in displacement of reindeer in mountainous terrain in Norway (Reimers *et al*. 2003, 2006), increased vigilance following encounters for caribou in the Laurentian Highlands in Quebec (Duchesne *et al*. 2000), and increased access for wolves on packed trails (Bergerud 1996). During summer, reindeer in mountainous areas in Norway avoided areas with tourist trails, resorts, and cabins (Vistnes and Nellemann 2001, Vistnes *et al*. 2008).

Caribou reactions to recreational disturbance may also be influenced by environmental conditions. In Newfoundland, Mahoney *et al*. (2001) found that caribou in Newfoundland fled from shorter distances and responded more slowly to snowmobiles during a high snowfall winter, presumably as an attempt to decrease energy expenditure when cost of locomotion was higher and forage was less available. In Scandinavia, reindeer selected insect relief areas distant from human activity during the insect harassment season if available, but did use insect relief areas where hiking activity was high if they did not have access to insect relief areas that were far from human activity (Skarin *et al*. 2004, Vistnes *et al*. 2008).

5.5 Natural disturbances

Fire and forest insects are the primary natural disturbances in the low elevation portion of the Telkwa caribou range. Habitat alteration by natural disturbances can affect caribou through direct impacts on forage (Cichowski *et al*. 2009, Seip and Jones 2010, Waterhouse *et al*. 2011, Cichowski and Haeussler 2013) or through indirect impacts associated with habitat change favouring other prey species (Festa-Bianchet *et al*. 2011). Successional changes after disturbance on caribou ranges can vary depending on ecological conditions (e.g. cover type, soil conditions, disturbance characteristics, slope, aspect, elevation, climate change), and

succession after fire to adequate cover of terrestrial lichens preferred by caribou takes decades (Thomas and Armbruster 1996).

The recent mountain pine beetle epidemic initially resulted in increased abundance of dwarf shrubs and a corresponding decrease in terrestrial lichens (Cichowski *et al*. 2009, Seip and Jones 2010, Waterhouse 2011, Cichowski and Haeussler 2013). However, by 10 years following mountain pine beetle attack, dwarf shrub abundance decreased and terrestrial lichen abundance increased on drier, less productive sites (Cichowski and Haeussler 2013). Despite habitat alteration due to mountain pine beetles in west-central and east-central BC, caribou continued to crater for terrestrial lichens in beetle-killed mature pine forests even after needle loss (Cichowski 2010, Seip and Jones 2010). Continued research is needed to follow the changes in ecosystem components as trees fall.

Pine rusts are also a concern on some low elevation winter ranges. The treatment for pine rusts is drag scarification, which impacts terrestrial lichens.

Historically, when natural disturbance occurred, caribou could shift their use of habitat from affected areas to areas that were more suitable. However, with the increase of industrial activities, resulting in habitat loss and fragmentation, caribou will have fewer suitable areas into which they can move either within or between ranges.

5.6 Other Threats

5.6.1 Hunting

Licenced hunting has been closed for the Telkwa caribou population since 1973. The extent of unlicensed hunting is not known but suspected to be low. Historically, overhunting of caribou in BC was primarily a result of road access associated with human industrial and recreational development (Bergerud 1978, Stevenson and Hatler 1985).

5.6.2 Severe Weather/Climate Change

Large-scale climate patterns can affect calf recruitment. In the Yukon, the Pacific Decadal Oscillation (PDO) during the winter prior to birth and weather conditions during the May calving period was positively related

to calf recruitment (Hegel *et al*. 2010a). Higher PDO values during winter represent decreased precipitation during May and increased temperature, both leading to a reduced snowpack at calving and an earlier onset of the first snowfree day of the year. This affords pregnant females easier movement to higher elevation areas. In Alaska, birth weight of calves born in mountainous terrain is related to reproductive history the previous year and availability of food in winter (e.g., Adams and Dale 1998) and particularly in the last trimester of pregnancy.

Deep snow conditions could also affect predation by delaying spring migration (Edmonds and Smith 1991) and could potentially affect winter energy requirements. Caribou can forage through up to a metre of snow or more (Johnson *et al*. 2000) but at a cost to energy reserves.

Detrimental effects of climate change could include altered frequency and severity of natural disturbances (fire and forest insects), changes in vegetation composition, shifts in distribution of other ungulates, and increased incidence of diseases and parasites (Vors and Boyce 2009). Increased summer temperatures and extended fire seasons could result in increased area disturbed by fire. Increased winter temperatures and fewer cold weather extremes could lead to increased forest insect activity, such as mountain pine beetles. Increased temperatures could also potentially result in increased severity of biting insects.

Climate change can result in changes to vegetation composition even without changes to natural disturbance patterns. Predicted warmer temperatures could lead to ecological conditions that favour vegetation species that can outcompete terrestrial lichens and/or that are preferred by other prey species (Hamann and Wang 2006), leading to northward expansion of ranges of other ungulate species, further altering predator/prey relationships. Hoefs (2001), for example, reports both mule and white-tailed deer have colonized the southern Yukon, with white-tailed deer first observed north of the BC border in 1975.

Climate change could also result in more favourable conditions for diseases and parasites that affect caribou. Disease has played a major role in caribou declines in eastern North America where altered landscapes and mild winters allowed white-tailed deer carrying the meningeal worm to expand north and infect caribou (Bergerud and Mercer 1989). Longer summer seasons could also speed up life cycles for some parasites.

Although climate change is not expected to result in major habitat shifts in the short term, climate-related changes in habitat in the long term are

expected to favour deer and other prey species, thereby increasing predator populations and predation on caribou, and facilitating the spread of diseases and parasites. However, impacts of climate change on caribou in the short term are expected to be low compared to other immediate threats that they face.

5.6.3 Parasites and Diseases

Although parasites and infectious diseases have not been found to be a significant direct cause of mortality in caribou in BC, they may be under-diagnosed (H. Schwantje, pers. comm. 2013). Some have the potential to affect reproductive output, and/or as chronic diseases, can lead to reduced vigour, potentially resulting in greater susceptibility to predation. Climate change can lead to: increased prevalence, intensity and geographic distribution of some parasites; reduced parasite survival of others; facilitated invasion of new parasites; and, the invasion of new hosts, resulting in introduction of new parasites and changes in abundance and distribution of endemic parasite species (Kutz *et al*. 2009).

5.6.4 Avalanches

At least three avalanche related mortalities have been documented for the Telkwa caribou population (BC Ministry of Forests, Lands and Natural Resource Operations, unpublished data). Avalanches are a known cause of caribou mortality in other areas, especially for Mountain Caribou. In west-central Alberta, the last five caribou in the Banff population were killed in an avalanche in 2009 (Hebblewhite *et al*. 2010b).

5.6.5 Settlements and Agriculture

Human settlements and agriculture result in permanent alteration of caribou habitat. Agriculture also converts forested habitat into early seral habitat favoured by other prey species. Within the Telkwa Caribou Recovery Area, agricultural activity, rural residences and settlements are concentrated at low elevations adjacent to the Bulkley and Telkwa rivers. However, more extensive agricultural activity adjacent to the recovery area in the Bulkley Valley has converted mature forested areas into early seral habitat. Rural residences, the Towns of Houston and Smithers, the Village of Telkwa, and industrial developments (e.g. sawmills, railway

sorting yards) adjacent to the recovery area have also contributed to permanent conversion of caribou habitat at lower elevations.

Historic burning in the Bulkley Valley (Stronen 2000) also played a role in habitat alteration.

5.7 Cumulative Effects

Although individual natural disturbances or human activities may not have significant impacts on the Telkwa caribou population, the impacts of all the activities combined need to be considered when assessing the overall effects on the population. Also, because predator/prey dynamics function at a scale that extends beyond the recovery area boundaries, habitat and predator/prey dynamics adjacent to the recovery area must also be considered.

For the Telkwa caribou population, habitat alteration/conversion within historic low elevation ranges outside of the recovery area include human settlements, rural residences, industrial developments, transportation and utilities corridors, agriculture, forest harvesting and historic burning. Within the recovery area, the primary anthropogenic activities include forest harvesting, mineral exploration and development, utility corridors, and recreational activities.

6. References

Adamczewski, J., R. Florkiewicz, R. Farnell, C. Domes and K. Egli. 2007. Summary – Late-winter population survey of Finlayson Caribou 2007. Yukon Fish and Wildlife Branch, Whitehorse, Yukon. 21p.

Adams, L.G. and B.W. Dale. 1998. Reproductive performance of female Alaskan caribou. Journal of Wildlife Management 62 (4):1184-1195.

AECOM Canada Ltd. 2009. Telkwa Caribou Home Range Analysis. Prepared for BC Ministry of Environment, Smithers, B.C. 11p.

ASRD&ACA (Alberta Sustainable Resource Development and Alberta Conservation Association). 2010. Status of the Woodland Caribou (*Rangifer tarandus caribou*) in Alberta: Update 2010. Alberta Sustainable Resource Development. Wildlife Status Report No. 30 (Update 2010). Edmonton, AB. 88p.

Apps, C., and B. McLellan. 2006. Factors influencing the dispersion and fragmentation of endangered mountain caribou populations. Biological Conservation 130:84-97.

Apps, C., B. McLellan, T.Kinley, R. Serrouya, D. Seip and H. Wittmer. 2013. Spatial factors related to mortality and population decline of endangered mountain caribou. Journal of Wildlife Management 77: 1409-1419.

Banfield, A.W.F. 1974. Mammals of Canada. National Museum of Canada. The University of Toronto Press. 438 pages.

Banner, A., W. Mackenzie, S. Haeussler, S. Thomson, J. Pojar and R. Trowbridge. 1993. A field guide to site identification and interpretation for the Prince Rupert Forest Regional. BC Ministry of Forests, Reserch Branch, Victoria, B.C., Land Management Handbook No. 26.

BC Integrated Land Management Bureau. 2005. Bulkley Valley Sustainable Resource Management Plan. BC Ministry of Agriculture and Lands, Integrated Land Management Bureau, Smithers, B.C.

BC Integrated Land Management Branch. 2006. Bulkley LRMP Objectives Set by Government. BC Ministry of Agriculture and Lands, Integreated Land Management Bureau, Smithers, B.C.

BC Ministry of Agriculture and Lands. 2007. Morice Land and Resource Management Plan. BC Ministry of Agriculture and Lands, Integrated Land Management Bureau, Smithers, B.C.

BC Ministry of Environment. 1986 Proposed Telkwa Wildlife Management Area. BC Ministry of Environment, Wildlife Branch, Northern Region, Smithers, B.C.

BC Ministry of Environment. 2009. Telkwa Caribou Activities Summary 2003-2008. Prepared for April 20, 2009 VRAMG meeting. BC Ministry of Environment, Smithers, B.C. Unpublished report.

BC Ministry of Environment, Lands and Parks. 1997. Telkwa Caribou Herd: A transplant proposal. BC Ministry of Environment, Lands and Parks, Skeena Wildlife Program, Smithers, B.C.

BC Ministry of Environment, Lands and Parks. 1998. Telkwa Mountains Caribou Herd Recovery Plan. BC Ministry of Environment, Lands and Parks, Wildlife Branch, Smithers, B.C.

BC Ministry of Environment, Lands and Parks. 1999. Telkwa Caribou Project Update to December 1999. BC Ministry of Environment, Lands, and Parks, Smithers, B.C. Unpublished report.

BC Ministry of Environment, Lands and Parks. 2000a. Telkwa Caribou Recovery Project – Progress report to the public. BC Ministry of Environment, Lands and Parks, Smithers, B.C. 1p.

BC Ministry of Environment, Lands and Parks. 2000b. Telkwa Mountain Caribou Herd Recovery – The Need for a Legislated Recreational Access Plan. BC Ministry of Environment, Lands and Parks, Smithers, B.C. Unpblished report.

BC Ministry of Forests and Range. 1997. Recreational Access Management Plan for the Bulkley portion of the Skeena Stikine Forest District. BC Ministry of Forests and Range, Smithers, B.C.

BC Ministry of Water, Land and Air Protection. 2001. Telkwa Caribou Recovery Progress Report – October 2001. BC Ministry of Water, Land and Air Protection, Smithers, B.C. Unpublished report.

Bergerud, A.T. 1974. The decline of caribou in North America following settlement. Journal Wildlife Management 38:757-770..

Bergerud, A.T. 1978. The status and management of woodland caribou in British Columbia. Report to Fish and Wildlife Branch, Victoria. 138 pages.

Bergerud, A.T. 1985. Antipredator strategies of caribou: dispersion along shorelines. Can. J. Zool. 63(6):1324-1329.

Bergerud, A.T. 1996. Evolving perspectives on caribou population dynamics, have we got it right yet? Rangifer Special Issue No. 9: 95-116.

Bergerud, A.T. and J.P. Elliott. 1998. Wolf predation in a multiple-ungulate system in Northern British Columbia. Canadian Journal of Zoology 76:1551-1569.

Bergerud, A.T. and W.E. Mercer. 1989. Caribou introductions in eastern North America. Wildlife Society Bulletin 17:111-120.

Bergerud, A.T., H.E. Butler, and D.R. Miller. 1984. Antipredator tactics of calving caribou: dispersion in mountains. Can. J. Zool 62(8):1566-1575.

Bradshaw, C.J.A., S. Boutin, and D.M. Hebert. 1997. Effects of petroleum exploration on woodland Caribou in northeastern Alberta. Journal of Wildlife Management 61:1127-1133.

Bradshaw, C.J.A., S. Boutin, and D.M. Hebert. 1998. Energetic implications of disturbance caused by petroleum exploration on woodland caribou. Canadian Journal of Zoology 73:1319-1324.

Brown, W.K., and I. Ross. 1994. Caribou-Vehicle Collisions: A review of methods to reduce caribou mortality on Highway 40, west-central Alberta. Prepared for Alberta Environmental Protection, Fish and Wildlife Service and Alberta Transportation and Utilities, Research and Development Branch.

Bulkley Valley Community Resources Board and Interagency Planning Team. 1998. Bulkley Land and Resource Management Plan. Bulkley Valley Community Resources Board and Prince Rupert Interagency Planning Team, Smithers, B.C.

Cameron, R., E. Lenart, D. Reed, K. Whitten and W. Smith. 1995. Abundance and movements of caribou in the oilfield complex near Prudhoe Bay, Alaska. Rangifer 15:3-7.

Chubbs, T.E., L.B. Keith, S.P. Mahoney, and M.J. McGrath. 1993. Responses of Woodland caribou (*Rangifer tarandus caribou*) to clear-cutting in east-central Newfoundland. Canadian Journal of Zoology 71:487-493.

Cichowski, D. 2008. Compendium of northern woodland caribou forestry guidelines in British Columbia. Prepared for Ministry of Environment, Victoria, B.C. 54 p (Volume 1) + appendices (Volume 2).

Cichowski, D. 2010. Tweedsmuir-Entiako Caribou Project: Effects of a Mountain Pine Beetle Epidemic on Northern Caribou Habitat Use – Final Report. Prepared for the Bulkley Valley Centre for Natural Resources Research and Management, Smithers, B.C. 66p.

Cichowski, D., and S. Haeussler. 2013. The response of caribou terrestrial forage lichens to mountain pine beetles and forest harvesting in the East Ootsa and Entiako areas – Annual Report – 2012/13 – Year 11. Prepared for Bulkley Valley Centre for Natural Resources Research and Management, Habitat Conservation Trust Foundation and BC Ministry of Forests, Lands and Natural Resource Operations, Smithers, B.C. 49p.

Cichowski, D., and N. MacLean. 2005. Tweedsmuir-Entiako Caribou Population – Technical Background Information Summary (1983-2003). Prepared for Ministry of Environment, Smithers, B.C. 199 p.

Cichowski, D., A. Macadam, and S. Haeussler. 2009. Mountain Pine Beetle/Lichen Project – Quesnel TSA – Year 4 – 2008/09. Prepared for Ministry of Environment, Williams Lake, B.C. 79p.

COSEWIC. 2011. Designatable Units for Caribou (*Rangifer tarandus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 88pp.

COSEWIC. 2014. COSEWIC Wildlife Species Assessments (detailed version), May 2014. www.cosewic.gc.ca (accessed May 20, 2014).

COSEWIC. 2014. In Press. COSEWIC assessment and status report on the Caribou *Rangifer tarandus caribou* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxii+113pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Cox, L. 1970. An isolated caribou herd in the midst of a developing area. BC Fish and Wildlife Branch, Smithers, B.C. Unpublished report.

Cumming, H., and B. Hyer. 1998. Experimental log hauling through a traditional caribou wintering area. Rangifer Special Issue No. 10:241-258.

Darby, W.R. and L.S. Duquette. 1986. Woodland caribou and forestry in Northern Ontario, Canada. Rangifer Special Issue No. 1:87-93.

Darby, W.R., H.R. Timmermann, J.B. Snider, K.F. Abraham, R.A. Stefanski, and C.A. Johnson. 1989. Woodland Caribou in Ontario - Background to a policy. Ministry of Natural Resources. Toronto. 38 pages.

DeCesare, N., M. Hebblewhite, H. Robinson, and M. Musiani. 2009. Endangered apparently: the role of apparent competition in endangered species conservation. Animal Conservation 13: 353-362.

DeCesare, N., M. Hebblewhite, M. Bradley, K. Smith, D. Hervieux, and L. Neufeld. 2012. Estimating ungulate recruitment and growth rates using age ratios. J. Wildl. Manage. 76(1):144-153.

Duchesne, M., S. Côté and C. Barrette. 2000. Responses of woodland caribou to winter ecotourism in the Charlevoix Biosphere Reserve, Canada. Biological Conservation 96(3):311-317.

Dyer, S., J. O'Neill, S. Wasel and S. Boutin. 2001. Avoidance of industrial development by woodland caribou. Journal of Wildlife Management 65:531-542.

Edmonds, E. J. 1988. Population status, distribution, and movements of woodland caribou in west central Alberta. Canadian Journal of Zoology 66:817-826.

Environment Canada. 2012. Management Plan for the Northern Mountain Population of Woodland Caribou (*Rangifer tarandus caribou*) in Canada. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. vii + 79pp.

Environment Canada. 2014. Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. viii + 103 pp.

Faille, G., C. Dussault, J. Oullet, D. Fortin, R. Courtois, M. St-Laurent and C. Dussault. 2010. Range fidelity: the missing link between caribou decline and habitat alteration? Biological Conservation 143(11):2840-2850.

Farnell, R., and J. McDonald. 1988. The demography of Yukon's Finlayson caribou herd 1982-1987. Yukon Fish and Wildlife Branch Report TR-872. Whitehorse, Yukon. 54p.

Festa-Bianchet, M., J. Ray, S. Boutin, S. Cote, and A. Gunn. 2011. Conservation of caribou (*Rangifer tarandus*) in Canada: an uncertain future. Can. J. Zool. 89:419-434.

Florkiewicz, R., R. Maraj, T. Hegel and M. Waterreus. 2007. The effects of human land use on the winter habitat of the recovering Carcross woodland caribou herd in suburban Yukon Territory, Canada. Rangifer Special Issue No. 17:181-197.

Freeman, N. 2008. Motorized backcountry recreation and stress response in mountain caribou (*Rangifer tarandus caribou*). MSc. Thesis. University of British Columbia, Vancouver, B.C. 75p.Gadd, B. 1986. Handbook of the Canadian Rockies. Corax Press, Box 1557, Jasper, Alberta. T0E 1E0.

Gustine, D., and K. Parker. 2008. Variation in the seasonal selection of resources by woodland caribou in northern British Columbia. Can. J. Zool. 86: 812-825.

Gustine, D., K. Parker, R. Lay, M. Gillingham, and D. Heard. 2006a. Calf survival of woodland caribou in a multi-predator ecosystem. Wildlife Monographs 165:1-32.

Gustine, D., K. Parker, R. Lay, M. Gillingham and D. Heard. 2006b. Interpreting resource selection at different scales for woodland caribou in winter. J. Wildl. Manage. 70:1601-1614. Doi:10.2193/0022-541X(2006)70[1601:IRSADS]2.0.CO;2.

Hamann, A., and T. Wang. 2006. Potential effects of climate change on ecosystems and tree species distribution in British Columbia. Ecology 87(11):2773-2786.

Hayes, R., R. Farnell, R. Ward, J. Carey, M. Dehn, G. Kuzyk, A. Baer, C. Gardner and M. O'Donoghue. 2003. Experimental reduction of wolves in the Yukon: ungulate responses and management implications. Wildlife Monograph No. 152. 35p.

Heard, D. and K. Vagt. 1998. Caribou in British Columbia: A 1996 status report. Rangifer, Special Issue No. 10: 117-123.

Hebblewhite, M., M. Musiani, N. DeCesare, S. Hazenberg, W. Peters, H. Robinson and B. Weckworth. 2010a. Linear features, forestry and wolf predation of caribou and other prey in west central Alberta. Final report to the Petroleum Technology Alliance of Canada (PTAC). 84p.

Hebblewhite, M., C. White, and M. Musiani. 2010b. Revisiting extinction in National Parks: mountain caribou in Banff. Conservation Biology 24:341-344.

Hegel, T., and K. Russell. 2010. Aishihik and Kluane northern mountain caribou herds census, 2009. Fish and Wildlife Branch, Yukon Environment. 14p.

Hegel, T., A. Mysterud, T. Ergon, L. Loe, F. Huettmann, and N. Stenseth. 2010a. Seasonal effects of Pacific-based climate on recruitment in a predator-limited large herbivore. Journal of Animal Ecology 79:471-482.

Hodson, K. 1977. A winter population and habitat survey in the Telkwa Mountains of mountain caribou (*Rangifer tarandus montanus*) Jan-April/1977. BC Fish and Wildlife Branch, Smithers, B.C. 9p.

Hodson, K. 1980. Snowmobile conflict with the Telkwa Caribou herd. Fish and Wildlife Branch, Skeena Region. 11p.

Hoefs, M. 2001. Mule, *Odocoileus hemionus*, and White-tailed, O*. virginianus*, deer in the Yukon. Canadian Field-Naturalist 115(2):296-300.

Hoffos, R. 1987. Wolf management in British Columbia: the Public Controversy. BC Ministry of Environment and Parks, Wildlife Branch, Wildlife Bulletin No. B-52. Victoria, B.C.

Holt, R. 1977. Predation, apparent competition, and the structure of prey communities. Theoretical Population Biology 12:197-229.

Houwers, C. 1996. Lichen Abundance Inventory of the Telkwa Range. Unpublished report prepared for Ministry of Environment, Lands and parks, Smithers, B.C. 32p.

Identified Wildlife Management Strategy. 2004. Woodland Caribou Account. BC Ministry of Water, Land and Air Protection – Biodiversity Branch, Victoria, B.C.

James, A.R.C. 1999. Effects of industrial development on the predator-prey relationship between wolves and caribou in northeastern Alberta. Ph.D. thesis, University of Alberta, Edmonton. 70 pages.

James, A. and K. Stuart-Smith. 2000. Distribution of caribou and wolves in relation to linear corridors. J. Wildl. Manage. 64(1):154-159.

Johnson, C., K. Parker, and D. Heard. 2000. Feeding site selection by woodland caribou in north-central British Columbia. Rangifer Special Issue No. 12:159-172.

Johnson, C., K. Parker, D. Heard, and M. Gillingham. 2002. A multiscale behavioural approach to understanding the movements of woodland caribou. Ecological Applications 12:1840-1860.

Keim, R. No Date. Telkwa Caribou Herd Proposed Wildlife Habitat Area #6-153. Background Document. Ministry of Environment, Smithers, B.C. 61p.

Kinley, T.A. and C.D. Apps. 2001. Mortality patterns in a subpopulation of endangered mountain caribou. Wildlife Society Bulletin 29(1):158-164.

Kranrod, K.A. 1996. Studies on lichen-dominated systems. XX.. An examination of some aspects of the northern boreal lichen woodlands in Canada. Can. J. Bot. 55:393-410.

Kutz, S., E. Jenkins, A. Veitch, J. Ducrocq, L. Polley, B. Elkin, And S. Lair. 2009. The Artic as a model for anticipating, preventing, and

mitigating climate change impacts on host-parasite interactions. Veterinary Parasitology 163:217-228.

Latham, A.D., M.C. Latham, M. Boyce and S. Boutin. 2011. Movement responses by wolves to industrial linear features and their effect on woodland caribou in northeastern Alberta. Ecological Applications 21:2854-2865.

Mahoney, S.P. and J. Schaefer. 2002. Hydroelectric development and the disruption of migration in caribou. Biological Conservation 1007:147-153.

Mahoney, S., K. Mawhinney, C. McCarthy, D. Anions, and S. Taylor. 2001. Caribou reactions to provocation by snowmachines in Newfoundland. Rangifer 21(1):35-43.

McCarthy, S., R. Weladji, C. Doucet and P. Saunders. 2011. Woodland caribou calf recruitment in relation to calving/post-calving landscape composition. Rangifer 31(1):35-47.

McNay, R.S. 2009. Spatial and temporal patterns of predation risk on woodland caribou in the Wolverine and Chase herds, north-central British Columbia, 1991-2006. Peace/Williston Fish and Wildlife Compensation Program Report No. 323. 28pp. plus appendices.

Miège, D.J., Armleder, H.M., Waterhouse, M.J., and T. Goward. 2001. A pilot study of silvicultural systems for northern caribou winter range: lichen response. Res. Br., B.C. Min. For., Victoria, B.C. Work. Pap. 56/2001. 22p.

Milakovic, B., and K. Parker. 2013. Quantifying carnivory by grizzly bears in a multi-ungulate system. Journal of Wildlife Management 77:39-47.

Munro, J.A. 1947. Observation of birds and mammals in central British Columbia. British Columbia Provincial Museum Occasional Paper No. 6. Victoria, B.C.

Nellemann, C. and R. Cameron. 1998. Cumulative impacts of an evolving oil-field complex on the distribution of calving caribou. Can. J. Zool. 76(8):1425-1430.

Northern Caribou Technical Advisory Committee. 2004. A Strategy for the Recovery of Northern Caribou in the Southern Mountains

National Ecological Area in British Columbia. Version 1.0. Ministry of Water, Land and Air Protection, Victoria, B.C. 108p.

Oberg, P. 2001. Responses of mountain caribou to linear features in a west-central Alberta landscape. M.Sc. Thesis, University of Alberta, Edmonton, AB.

Peters, W. 2010. Resource selection and abundance estimation of moose: implications for caribou recovery in a human altered landscape. M.Sc. Thesis. University of Montana, Missoula, Montana, USA. 104p.

Polfus, J., M. Hebblewhite and K. Henemeyer. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. Biological Conservation 144:2637-2646.

Powell, T. 2004. Behavioural response of woodland caribou (*Rangifer tarandus caribou*) to snowmobile disturbance in an alpine environment. MSc. Thesis, Universite de Sherbrooke, Quebec. 55p.

Reimers, E., S. Eftestol, and J. Colman. 2003. Behavior responses of wild reindeer to direct provocation by a snowmobile or skier. J. Wildl. Manage. 67(4):747-754.

Reimers, E., F. Miller, S. Eftestol, J. Colman and B. Dahle. 2006. Flight by feral reindeer *Rangifer tarandus tarandus* in response to a directly approaching human on foot or on skis. Wildl. Biol. 12:403-143.

Roberts, A. 2000a. Telkwa Caribou Herd lichen and forage survey. Prepared for Canfor, Houston, B.C., and BC Environment, Smithers, B.C. 20 p. + appendices.

Roberts, A. 2000b. Summary of lichen traverses in Starr Creek and Tom George Lakes areas. Prepared for BC Ministry of Environment, Smithers, B.C. 5p.

Roberts, A., M. Leung, L. Turney and N. MacLean. 2003. Home Range and Habitat Selection of Female Caribou in the Telkwa Mountain Range, British Columbia. Prepared for Ministry of Water, Land and Air Protection, Smithers, B.C. 41p. + appendices.

Robinson, H., M. Hebblewhite, M. Musiani, N. DeCesare, W. Peters, B. Weckworth and A. McDevitt. 2010. Modeling relationships between fire, caribou, wolves, elk and moose to aid recovery of Southern Mountain Woodland Caribou in the Canadian Rocky Mountain National Parks. Final Report submitted to Parks Canada, Banff and Jasper National Parks, Revised version, Sept 27, 2010. 175p.

Roorda, L., and R. Wright. 2012. Caribou recovery in the Quesnel Highlands: predator management progress report – March 31, 2012. Prepared for the Ministry of Forests, Lands and natural Resource Operation, Cariboo Region, Williams Lake, B.C. 23p.

Saher, D. J. 2005. Woodland caribou habitat selection during winter and along migratory routes in West-Central Alberta, M.Sc. Thesis, University of Alberta, Edmonton, AB.

Santomauro, D., C. Johnson, and G. Fondahl. 2012. Historical-ecological evaluation of the long-term distribution of woodland caribou and moose in central British Columbia. Ecosphere 3(5):37. http://dx.doi.org/10.1890/ES11-00371.1.

Schaefer, J.A., and S.P. Mahoney. 2007. Effects of progressive clearcut logging on Newfoundland caribou. J. Wildl. Manage. 71:1753-1757.

Schneider, R., G. Hauer, W. Adamowicz and S. Boutin. 2010. Triage for conserving populations of threatened species: the case of woodland caribou in Alberta. Biological Conservation 143(7):1603-1611.

Schultze, G. 2000. Telkwa Caribou Recovery Area – Access Restriction Amendment. BC Ministry of Environment, Lands and Parks, Smithers, B.C. Letter on file.

Seip, D.R. 1991. Predation and caribou populations. Rangifer Special Issue No.11: 46-52.

Seip, D. 1992a. Factors limiting woodland caribou populations and their interrelationships with wolves and moose in southeastern British Columbia. Canadian Journal of Zoology 70:1492-1503.

Seip, D. 1992b. Habitat use and population status of woodland caribou in the Quesnel Highlands, British Columbia. BC Ministry of Environment, Lands and Parks, Wildlife Bulletin No. B-71, Williams Lake, B.C. 50p.

Seip, D., and D.B. Cichowski. 1996. Population ecology of caribou in British Columbia. Rangifer, Special Issue No. 9:73-80.

Seip, D., and E. Jones. 2010. Response of woodland caribou to partial retention logging of winter ranges attacked by mountain pine beetle. Annual Report. FSP Project #Y102010. B.C. Ministry of Forests, Prince George, B.C., 27p.

Seip, D., C. Johnson and G. Watts. 2007. Displacement of mountain caribou from winter habitat by snowmobiles. J. Wildl. Manage. 71(5):1539-1544.

Serrouya, R. 2013. An adaptive approach to endangered species recovery based on a management experiment: reducing moose to reduce apparent competition with woodland caribou. PhD. Thesis, University of Alberta, Edmonton, Alberta. 220p.

Simpson, K. and E. Terry. 2000. Impacts of backcountry recreation activities on mountain caribou - management concerns, interim management guidelines and research needs. B.C. Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria, B.C. Wildl. Working Rep. No. WR-99. 11p.

Skarin, A., O. Danell, R. Bergstrom and J. Moen. 2004. Insect avoidance may override human disturbances in reindeer habitat selection. Rangifer 24(2):95-103.

Smith, K. 2004. Woodland caribou demography and persistence relative to landscape change in west-central Alberta. MSc. thesis, University of Alberta. 112p.

Smith, K.G. E.J. Ficht, D. Hobson, T. Sorenson, and D. Hervieux. 2000. Winter distribution of woodland caribou in relation to clear-cut logging in west-central Alberta. Canadian Journal of Zoology 78:1433-1440.

Spalding, D.J. 1990. The early history of moose (*Alces alces*); distribution and relative abundance in British Columbia. Contr. to Nat. Sci. #11, Royal B.C. Mus., Victoria, B.C. 12p.

Spalding, D.J. 2000. The early history of woodland caribou (*Rangifer tarandus caribou*) in British Columbia. B.C. Ministry of the

Environment, Lands and Parks, Wildlife Branch, Victoria. Wildlife Bulletin No. 100. 61 pages.

Steenweg, R. 2011. Interactions of wolves, mountain caribou and an increased moose-hunting quota - primary-prey management as an approach to caribou recovery. MSc. Thesis. University of Northern British Columbia, Prince George, British Columbia, Canada. 144p.

Stevenson, S., and D. Coxson. 2007. Arboreal forage lichens in partial cuts – a synthesis of research results from British Columbia, Canada. Rangifer, Special Issue No. 17: 155-165.

Stevenson, S. and D, Hatler. 1985. Woodland caribou and their habitat in southern and central British Columbia. Vol. 1. B.C. Min. For., Victoria, B.C. Land Manage. Rep. No. 23. 354p.

Stotyn, S. 2008. Ecological interactions of mountain caribou, wolves and moose in the North Columbia Mountains, British Columbia. MSc thesis. University of Alberta, Edmonton, Alberta, Canada. 126p.

Stronen, A. 2000. Habitat selection and calf survival in the Telkwa caribou herd, British Columbia 1997-2000. MSc. Thesis, University of Calgary, Calgary, AB. 125p.

Sulyma, R.G. 2001. Towards an understanding of the management of pine-lichen woodlands in the Omineca Region of British Columbia. MSc. Thesis. University of Northern British Columbia, Prince George, B.C. 99p.

Summer RAMP Table. 2013. Summer Recreational Access Management Plan for the Bulkley LRMP. Prepared for the Bulkley Valley Community Resources Board, Smithers, B.C.

Telkwa Caribou Recovery Team. 1997. Draft Telkwa Mountains Caribou Herd Recovery Plan. BC Environment, Smithers, B.C. 19p.

Telkwa Caribou Standing Committee. 1999. Interim Harvesting Guidelines for the Telkwa Caribou Herd Recovery Program Area. Telkwa Caribou Standing Committee. 12p.

Theberge, J. and S. Oosenbrug. 1977. Analysis of potential for an Ecological Reserve in the Telkwa Mountains, British Columbia, to protect mountain caribou. Prepared for BC Department of

Environment and BC Department of Recreation and Travel Industry. 62 p. plus appendices.

Thomas, D. C., and D.R. Gray. 2002. Update COSEWIC status report on the woodland caribou *Rangifer tarandus caribou* in Canada, in COSEWIC assessment and update status report on the Woodland Caribou *Rangifer tarandus caribou* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-98 pp.

Thomas, D.C. and H.J. Armbruster. 1996. Jasper National Park caribou habitat study: a management report containing conclusions and recommendations. Unpublished report, Canadian Wildlife Service, Environment Canada, Edmonton, AB T6B 2X3. 57 pages.

Tracz, B., J. LaMontagne, E. Bayne and S. Boutin. 2010. Annual and monthly range fidelity of female boreal woodland caribou in response to petroleum development. Rangifer 30(1):31-44.

van Drimmelen, B. 1985. Telkwa Mountains Caribou Telemetry Project. Progress Report #1. BC Environment, Smithers, BC. March 1986 13pp. + appendix.

van Drimmelen, B. 1986. Telkwa Mountains Caribou Study: Progress Report #2. Ministry of Environment. 13p.

Vistnes, I. and C. Nellemann. 2001. Avoidance of cabins, roads and power lines by reindeer during calving. J. Wildl. Manage. 65(4):915-925.

Vistnes, I., C. Nellemann, P. Jordhoy and O. Stoen. 2008. Summer distribution of wild reindeer in relation to human activity and insect stress. Polar Biology 31(11):1307-1317.

Vors, L., and M. Boyce. 2009. Global declines of caribou and reindeer. Global Change Biology 15:2626-2633.

Vors, L., J. Schaefer, B. Pond, A. Rodgers, and B. Patterson. 2007. Woodland caribou extirpation and anthropogenic landscape disturbance in Ontario. The Journal of Wildlife Management 71(4):1249-1256.

VRAMG (Voluntary Recreational Access Management Group). 2003. Telkwa Mountains Caribou Recovery Project voluntary recreation

Access Restrictions. Voluntary Recreational Access Management Group, Smithers, B.C.

VRAMG (Voluntary Recreational Access Management Group). 2006. Voluntary Recreational Access Management Group – September 20, 2006 Meeting Minutes (Draft). Voluntary Recreational Access Management Group, Smithers, B.C.

VRAMG (Voluntary Recreational Access Management Group). 2010. Voluntary Recreational Access Management Group – January 14, 2010 Meeting Minutes (Draft). Voluntary Recreational Access Management Group, Smithers, B.C.

Waterhouse, M. 2011. Lichen and vegetation response to mountain pine beetle damage in partial cuts and mature forests in the West Chilcotin in 2008. EP1208 File Report. Unpublished draft on file at Ministry of Forests, Lands and Natural Resource Operations, Williams Lake, B.C. 23p.

Weir, J., S. Mahoney, B. McLaren and S. Ferguson. 2007. Effects of mine development on woodland caribou *Rangifer tarandus* distribution. Wildl. Biol. 13:66-74.

Whittington, J., M. Hebblewhite, N. DeCesare, L. Neufeld, M. Bradley, J. Wilmshurst and M. Musiani. 2011. Caribou encounters with wolves increase near roads and trails: a time-to-event approach. Journal of Applied Ecology 48:1535-1542.

Williamson-Ehlers, E. 2012. Impacts of industrial developments on the distribution and movement ecology of wolves (*Canis lupus*) and woodland caribou (*Rangifer tarandus caribou*) in the south Peace Region of British Columbia. MSc. thesis, University of Northern British Columbia. 163p.

Williamson-Ehlers, L., C. Johnson, and D. Seip. 2013 . Behavioural responses, landscape change and habitat loss for woodland caribou (*Rangifer tarandus caribou*) across the Peace region of northeastern British Columbia. Prepared for the Habitat Conservation Trust Foundation, Victoria, B.C. 58p.

Wittmer, H., A.R.E. Sinclair, and B. McLellan. 2005. The role of predation in the decline and extirpation of woodland caribou. Oecologia 144:257-267.

Wittmer, H., B. McLellan, R. Serrouya and C. Apps. 2007. Changes in landscape composition influence the decline of a threatened woodland caribou population. Journal of Applied Ecology 76:568-579.

Wolfe, S., B. Griffith and C. Wolfe. 2000. Response of reindeer and caribou to human activities. Polar Research 19(1):63-73.

Appendix 1. Summary of Northern Caribou seasonal habitat and range use (from Cichowski 2008)

In general, Northern Caribou habitat use in B.C. can be described using 4 seasonal time periods. Exact dates for the seasonal time periods vary for each population and depend on local conditions. The following seasons, their approximate dates, and factors that influence caribou movements in each season are summarized below.

Fall Migration and Early-winter *(November to mid-January*)

Snow accumulation in November or the approach of weather systems may trigger caribou movement out of high elevation summer and rutting ranges to lower elevation early winter ranges although some local populations may remain in alpine/subalpine habitat on windswept slopes. Low elevation early winter ranges may be adjacent to the summer range or some distance away. At this time, caribou continue to seek out terrestrial forage and avoid deeper snow accumulations where terrestrial forages are difficult to access. Fall migration between summer and winter ranges tends to be diffuse as caribou migrate in response to changing weather patterns and/or snow accumulation.

During early winter, snow depth at low elevations may be highly variable between years. In general, snow depth on low elevation winter ranges is lowest during early winter and gradually increases as the winter progresses. Shallower snow depths in early winter allow caribou to use the higher and more open portions of their forested plateau winter ranges (Itcha-Ilgachuz), or low elevation forested habitat (Wolverine) that are abandoned if sufficient amounts of snow accumulates during mid- to late-winter.

Late-winter (mid-January to mid-April)

By mid- and late-winter, caribou have moved to low elevation forested winter ranges, or high elevation alpine/subalpine winter ranges to feed primarily on terrestrial lichens. Preferred terrestrial lichens include *Cladina* sp., *Cladonia* sp., *Cetraria* sp. and *Stereocaulon* sp.

In low elevation forested habitat, caribou prefer older pine forests on drier sites where terrestrial lichens are abundant. Caribou also feed on arboreal lichens opportunistically as they travel between terrestrial lichen sites or seek arboreal lichens in forested wetlands and along wetland fringes where arboreal lichens are abundant. Arboreal lichen use increases as snow hardness increases later in winter with melt/freeze conditions. During milder winters, frequent melt/freeze episodes could make cratering for terrestrial lichens difficult earlier in the winter, especially when ice crusts form close to the ground, forcing caribou to increase their reliance on arboreal lichens. *Bryoria* spp. are the most abundant arboreal lichens on most Northern Caribou winter ranges.

At higher elevations, caribou prefer windswept alpine slopes for cratering for terrestrial lichens. Subalpine forests are also used for arboreal lichen feeding, and to a lesser extent, for terrestrial lichen feeding.

Caribou that winter in low elevation forested areas and share winter ranges with moose would be expected to be more susceptible to wolf predation than caribou wintering at higher elevations. However, adult mortality during winter is relatively low for caribou that have extensive, large, low elevation winter ranges (Itcha-Ilgachuz, Tweedsmuir-Entiako, Spatsizi). Northern Caribou that winter at higher elevations distance themselves from moose, and presumably wolves. Other high elevation ungulates present on or near caribou winter ranges (mountain sheep, mountain goats) may also influence the distribution of wolves on the winter range, but to a lesser extent than moose.

Spring (mid-April to May)

By late April, caribou that migrate between winter and summer ranges begin moving back to calving and summering areas. Spring migration is more concentrated than fall migration both geographically and temporally. During spring, caribou may migrate along relatively snow-free low elevation routes to reach summer ranges.

Caribou that winter at higher elevations may move to lower elevations in spring to take advantage of an earlier green-up. Spring ranges may be adjacent to late-winter ranges or may be a function of migration patterns.

As caribou move to and through low elevations during spring, they are highly susceptible to predation by wolves and bears. Significant adult and calf mortality occurs during spring. Where bear predation is a major mortality factor for caribou, most of it occurs during spring and early summer (May-June).

Summer (June-October)

Female caribou reach calving areas by late May and calve in early June. Many caribou calve at higher elevations in alpine or subalpine habitat where food availability and quality is poor, to avoid other prey and predators that remain at lower elevations where more nutritious and abundant forage is available. Caribou that calve at higher elevations have higher calf survival rates than caribou that calve at lower elevations (Seip and Cichowski 1996). Caribou that calve below treeline may use islands in lakes, where they are available, as an anti-predator strategy (Bergerud and Page 1987, Shoesmith and Storey 1977).

During summer, caribou prefer high elevation habitats but can be found in a variety of habitats at all elevations since snow does not limit movement and herb and shrub forage are abundant. Consequently, Northern Caribou are highly dispersed during summer, more so than during any other season.

During the rut in October, some caribou move to rutting areas at higher elevations while others rut within their summer ranges. Portions of some local populations concentrate on rutting ranges, usually in open alpine or subalpine habitat.

Regional Differences in Habitat Use

Although foraging for terrestrial lichens during winter is a common feature of Northern Caribou, seasonal habitat use, especially use of higher elevation winter ranges, is variable. Variation in seasonal behaviour between local populations in the Southern Mountains National Ecological Area reflects differences in topography, snow accumulation, availability of low elevation winter ranges, and distribution of predators and human activities.

In general, caribou in the Southern Mountains National Ecological Area with access to low elevation winter ranges appear to prefer those winter ranges unless snow conditions preclude their use. In the Tweedsmuir-Entiako and Itcha-Ilgachuz areas, most caribou winter at

low elevations throughout the winter with a smaller component of the population using alpine and subalpine habitat during all or part of the winter. In the Wolverine area, caribou use lower elevation habitat throughout the winter during low snow years but move up to windswept alpine slopes in late winter during heavy or normal snow years.

Geographic differences in calving habitat use also occur. In west-central BC, caribou are found in alpine habitat during calving. In north-central BC, caribou often calve at or near treeline, presumably because of excessive snow loads in the alpine, and then move higher up as the summer progresses.

Less information is available on habitat use patterns of Northern Caribou in the Northern Mountains National Ecological Area. Habitat use patterns appear similar to those in the Southern Mountains National Ecological Area; however, more information will be available from studies currently being conducted.

References

Bergerud, A.T. and R.E. Page. 1987. Displacement and dispersion of parturient caribou at calving as antipredator tactics. Can. J. Zool. 65:1597-1606.

Seip, D., and D.B. Cichowski. 1996. Population ecology of caribou in British Columbia. Rangifer, Special Issue No. 9:73-80.

Shoesmith, M.W. and D.R. Storey. 1977. Movements and associated behaviour of woodland caribou in central Manitoba. Proc. Int. Congr. Game Biol. 13:51-64.

Appendix 2. Survey data for the Telkwa caribou population.

Date	Adult males	Adult females	Unclass. Adults	Total adults	Total Calves	Yrlgs	Unclass.	Total	% calves	Calves/ 100 cows	Calves/ 100 adults	Population estimate	Survey type	Source
1943												250[a]		Munro 1947
1949 July								18				<100	2 week horseback trip[1]	Cox 1970
1956[2]												100 (minimum)	Total Count (Fixed-wing)	Cox 1970
1964 April								180					Total Count (Fixed-wing)	Theberge and Oosenbrug 1977
1965 March					49			271	18				Total Count (Fixed-wing)[3]	Theberge and Oosenbrug 1977
1966 March					27			166	16				Total Count (Fixed-wing)[4]	Theberge and Oosenbrug 1977
1967 April								2					Total Count (Fixed-wing)[5]	Theberge and Oosenbrug 1977
1968 Jan 5-Feb 8								10					Unknown (CLI)	Stevenson and Hatler 1985
1968 February								40					Total Count (Fixed-wing)	Theberge and Oosenbrug 1977
1968 May					9			38	24				Total Count (Fixed-wing)	Theberge and Oosenbrug 1977
1975 April 2								29					Partial Count (Fixed-wing)	Flight Form – April 2, 1975
1975 June 30		2	6		5			13					Partial Count (Fixed-wing)	Flight Form – June 30, 1975
1975 November					2		36	38					Incidental Obs (Aircraft)	Remington Memo 17 Nov 1975
1976 January 15							12	12					Partial Count (Helicopter)	Flight Form - January 15, 1976
1976 August 5	3	3			2		11	19					Partial Count (Helicopter)	Flight Form – August 5, 1976
1976/77 (no date)	6	15			7		10	38					Compilation of obsrvations	Fish and Wildlife Branch 1980
1977 January 21					2		32	34					Total Count (Fixed-wing)	Hodson 1977
1977 January 31								14					Total Count (Fixed-wing)	Hodson 1977
1977 February 8	2	6			3			11	27				Partial Count (Ground)	Hodson 1977
1977 February 15								27					Total Count (Fixed-wing)	Hodson 1977
1977 March 8								27					Total Count (Fixed-wing)	Hodson 1977
1977 March 14	3	5			2			10					Partial Count (Ground)	Hodson 1977
1977 March 16	3	4			2		2	11					Partial Count (Ground)	Hodson 1977
1977 March 17		5			1			6					Partial Count (Ground)	Hodson 1977
1977 March 17								6					Partial Count (Fixed-wing)	Hodson 1977
1977 March 21							16	16					Partial Count (Ground)	Hodson 1977
1977 March 21								6					Total Count (Fixed-wing)	Hodson 1977
1977 March 29								17					Total Count (Fixed-wing)	Hodson 1977
1977 April 4								16					Total Count (Fixed-wing)	Hodson 1977
1977 April 9								4					Partial Count (Fixed-wing)	Hodson 1977
1977 April 20								19					Total Count (Fixed-wing)	Hodson 1977
1977 May 4								15					Total Count (Fixed-wing)	Hodson 1977

Date	Adult males	Adult females	Unclass. Adults	Total adults	Total Calves	Yrlgs	Unclass.	Total	% calves	Calves/ 100 cows	Calves/ 100 adults	Population estimate	Survey type	Source
1977 May 11		6						6					Partial Count (Fixed-wing)	Flight Form – May 11, 1977
1977 May 18								18					Partial Count (Fixed-wing)	Flight Form – May 18, 1977
1977 June 2								15					Partial Count (Fixed-wing)	Flight Form – June 2, 1977
1977 June 14		1	2		1			6					Partial Count (Fixed-wing)	Flight Form – June 14, 1977
1977 June 20-21		11			4	4		19					Partial Count (Ground)	Hodson Memo – June 22, 1977
1977 June 27		6			6		4	16					Partial Count (Fixed-wing)	Flight Form – June 27, 1977
1977 July 13					5		18	23					Partial Count (Fixed-wing)	Flight Form – July 13, 1977
1977 July 25					3		11	14					Partial Count (Fixed-wing)	Flight Form – July 25, 1977
1977 August 5					3		8	11					Partial Count (Fixed-wing)	Flight Form – August 5, 1977
1977 Aug 14							4	4					Incidental Obs (Aircraft)	Hatler Memo - Sept 22, 1977
1977 September 30	1	8			3		3	15					Partial Count (Fixed-wing)	Flight Form – Sept 30, 1977
1977 Oct 3								15					Incidental Obs (Aircraft)	Hodson Memo – Oct 3, 1977
1977 Oct 15	2	8			2			12					Partial Count (Fixed-wing)	Flight Form – Oct 15, 1977
1977 November 4	1	2					29	32					Partial Count (Fixed-wing)	Flight Form – Nov 4, 1977
1977 November 18	2	4			3		24	33					Partial Count (Fixed-wing)	Flight Form – Nov 18, 1977
1977 December 19	4	26			10			40					Partial Count (Fixed-wing)	Flight Form – Dec 19, 1977
1978 January 27							27	27					Partial Count (Fixed-wing)	Flight Form – Jan 27, 1978
1978 February 24							30	30					Partial Count (Fixed-wing)	Flight Summary – Feb 24, 1978
1978 April 14		1			1		28	30					Partial Count (Fixed-wing)	Flight Form – April 14, 1978
1978 April 24	1	3			1			5					Partial Count (Fixed-wing)	Flight Form – April 24, 1978
1978 May 5	1	3			1			5					Partial Count (Fixed-wing)	Flight Form – May 5, 1978
1977/78 (no date)	4	28			10			42					Compilation of obsrvations	Fish and Wildlife Branch 1980
1979 January 5	1	14			6		1	22					Partial Count (Fixed-wing)	Flight Form – January 5, 1979
1979 January 15	1	12			4		6	23					Partial Count (Fixed-wing)	Flight Form – January 15, 1979
1979 April 20							24	24					Partial Count (Fixed-wing)	Flight Form – April 20, 1979
1979 December	5	11	10		7			33					Partial Count (Ground)	Hodson Memo – Dec 13, 1979
1978/79 (no date)	6	17			10		10	43					Compilation of obsrvations	Fish and Wildlife Branch 1980
1979/80 (no date)	3	8			8		22	41					Compilation of obsrvations	Fish and Wildlife Branch 1980
1980 January 18	3	8			8			19					Partial Count (Helicopter)	Flight Form – Jan 18, 1980
1980 March 31					6		29	35					Partial Count (Fixed-wing)	Flight Form – March 31, 1980
1980/81 (no date)	3	2			9		37	51					Compilation of obsrvations	Fish and Wildlife Branch 1980
1981 February 11-12							14	14					Partial Count (Helicopter)	MOE 93L Map
1981 April 9	8	13	1		4			26					Partial Count (Ground)	MOE Memo – April 9, 1981
1981 November 25								42					Partial Count (Fixed-wing)	Caribou Sightings–Nov 25, 1981
1981/82 (no date)					10		55	65					Compilation of obsrvations	Fish and Wildlife Branch 1980
1982 February 22								71					Total Count (Helicopter)	Flight Transcript Feb 22-Mar 1
1983 January 14			15		2			17					Partial Count (Fixed-wing)	Marshall note and map
1983 March	23	36			9			68					Unknown (Aerial Survey)	Stevenson and Hatler 1985

Date	Adult males	Adult females	Unclass. Adults	Total adults	Total Calves	Yrlgs	Unclass.	Total	% calves	Calves/ 100 cows	Calves/ 100 adults	Population estimate	Survey type	Source
1983 June 22		10			7			17					Unknown	F&W Memo
1984 February 3	17	32			15		3	67					Total Count (Aerial Survey)	Marshall Memo – Feb 3, 1984
1985 March 17								46					Telemetry (Fixed-wing)	van Drimmelen 1986
1985 March 25								4					Telemetry (Fixed-wing)	van Drimmelen 1986
1985 April 6								8					Telemetry (Fixed-wing)	van Drimmelen 1986
1985 May 14								14					Telemetry (Fixed-wing)	van Drimmelen 1986
1985 June 16		16			7			23	30	44			Calf survival (helicopter)	Cichowski 1985 – Field Notes
1985 July 16								17					Telemetry (Fixed-wing)	van Drimmelen 1986
1985 September 9								30					Telemetry (Fixed-wing)	van Drimmelen 1986
1985 October 6								48					Telemetry (Fixed-wing)	van Drimmelen 1986
1985 November 11								41					Telemetry (Fixed-wing)	van Drimmelen 1986
1985 December 23								-					Telemetry (Fixed-wing)	van Drimmelen 1986
1986 February 6								11					Telemetry (Fixed-wing)	van Drimmelen 1986
1986 March 12								24					Telemetry (Fixed-wing)	van Drimmelen 1986
1986 April 14								26					Telemetry (Fixed-wing)	van Drimmelen 1986
1986 April 29								20					Telemetry (Fixed-wing)	van Drimmelen 1986
1987 March 9	19	14			6		1	40					Total Count (Helicopter)	Caribou Survey Form – March 9
1993 March								11					Unknown (Fixed-wing)	Telkwa Caribou Recovery Team 1997
1994 July 5	1	6	2	9	1			10					Total Count (Fixed-wing)	Fish and Wildlife Files – Note to File (Smith 1994a)
1994 October 21	1	11			1		1	15					Total Count (Helicopter)	Fish and Wildlife Files – Note to File (Smith 1994b)
1995												20		Smith 1995a
1995 June 29		8			6			14					Calf survival (Helicopter)	Fish and Wildlife Files – Note to File (Smith 1995b)
1996 March 14		1	1		1	1	9	13					Total Count (Helicopter)	Fish and Wildlife Files – Note to File (Smith 1996)
1996 June 19		8			4	3		15					Partial Count (Helicopter)	Fish and Wildlife Files – Email correspondence (Cichowski 1996)
1997 June					0			6					Unknown (Aerial Survey)	Telkwa Caribou Recovery Team 1997
1997 November 20	2	4			1		1	8					Partial Count (Helicopter)	Fish and Wildlife Files – Note to File (Smith 1997)
1998 June	1	12		13	5			18		42			Calf survival (helicopter)	Schultze 2011
1998 October	3	10		13	1	1		15		10		44	Calf survival (helicopter)	Schultze 2010
1999 June	3	33		36	15	2		53		45			Calf survival (helicopter)	Schultze 2011
1999 October	6	23		29	8	3		40		35		50	Calf survival (helicopter)	Schultze 2010

Date	Adult males	Adult females	Unclass. Adults	Total adults	Total Calves	Yrlgs	Unclass.	Total	% calves	Calves/ 100 cows	Calves/ 100 adults	Population estimate	Survey type	Source
2000 June	10	24		34	15			49		62			Calf survival (helicopter)	Schultze 2011
2000 October	7	31		38	8	1		47		26		65	Calf survival (helicopter)	Schultze 2010
2001 June	3	19		22	9	3		34		47			Calf survival (helicopter)	Schultze 2011
2001 October	9	28		37	6			43		21		55	Calf survival (helicopter)	Schultze 2010
2002 June	2	28		30	21	3		54		75			Calf survival (helicopter)	Schultze 2011
2002 October	12	28		40	17		1	58		60		65	Calf survival (helicopter)	Schultze 2010
2003 June	1	22		23	18	2		43		82			Calf survival (helicopter)	Schultze 2011
2003 October	11	22		33	16			49		73		75	Calf survival (helicopter)	Schultze 2010
2004 March	19	34		53	21			74		62			Calf survival (helicopter)	Schultze 2011b
2004 October	25	38		62	23			86		60		95	Calf survival (helicopter)	Schultze 2010
2005 March	9	35		44	10		2	56		29			Calf survival (helicopter)	Schultze 2011b
2005 October	12	26		38	10			48		39		95	Calf survival (helicopter)	Schultze 2010
2006 March	12	42		54	22			76		52		100+	Calf survival (helicopter)	Schultze 2011b
2006 July 19								114					Telemetry (fixed-wing)	MFLNRO, unpublished data
2006 October	20	46		66	24			90		52		100[8]	Calf survival (helicopter)	Schultze 2010
2007 March	13	51		64	19			83		37		100+	Calf survival (helicopter)	Schultze 2011b
2007												90[9]		Schultze 2010
2008 March	16	48		64	7			71		15		90-100[10]	Calf survival (helicopter)	Schultze 2011b
2008 October	11	24		35	2		9+	46+		8		73	Calf survival (helicopter)	Schultze 2010
2009 March 25	4	35		39	5			44		14			Calf survival (helicopter)	Schultze 2011b
2010 March 9	3	15		18	4			22		27			Calf survival (helicopter)	Schultze 2011b
2010 October 28	3	9		12	8		7	27		89		-	Calf survival (helicopter)	Schultze 2010
2011 March 18	4	14		18	8			26		57			Calf survival (helicopter)	MFLNRO, unpublished data
2012 March 13		2		2	1		7	10					Calf survival (helicopter)	MFLNRO, unpublished data
2013 February 13	3	6		9	3			12	25	50	33		Capture (helicopter)	Thiessen 2013
2013 March 28	2	6		8	3			11	27	50	38		Capture (helicopter)	Thiessen 2013
2013 October 28	4	6		10	4			14	29	67	40		Calf survival (helicopter)	MFLNRO, unpublished data
2014 March 25	3	8		11	4			15	27	50	36		Calf survival (helicopter)	MFLNRO, unpublished data

[a] "The information submitted was supplied by C.D. Muirhead who obtained it from various sources that are considered reliable."

[1] Covered most of the range area except for a small area near Burnie Lake and Herd Dome; saw 18 caribou and tracks of 33 more; estimated 60 animals in the area covered and not more than 100 animals for the whole area.

[2] About 1956; season unknown; no data available on number counted but "A count was made from aircraft which established a minimum of 100 animals."; aircraft assumed to be fixed-wing

[3] perfect survey conditions – little snow

[4] heavy snow, bare patches

[5] heavy snow, animals still in trees

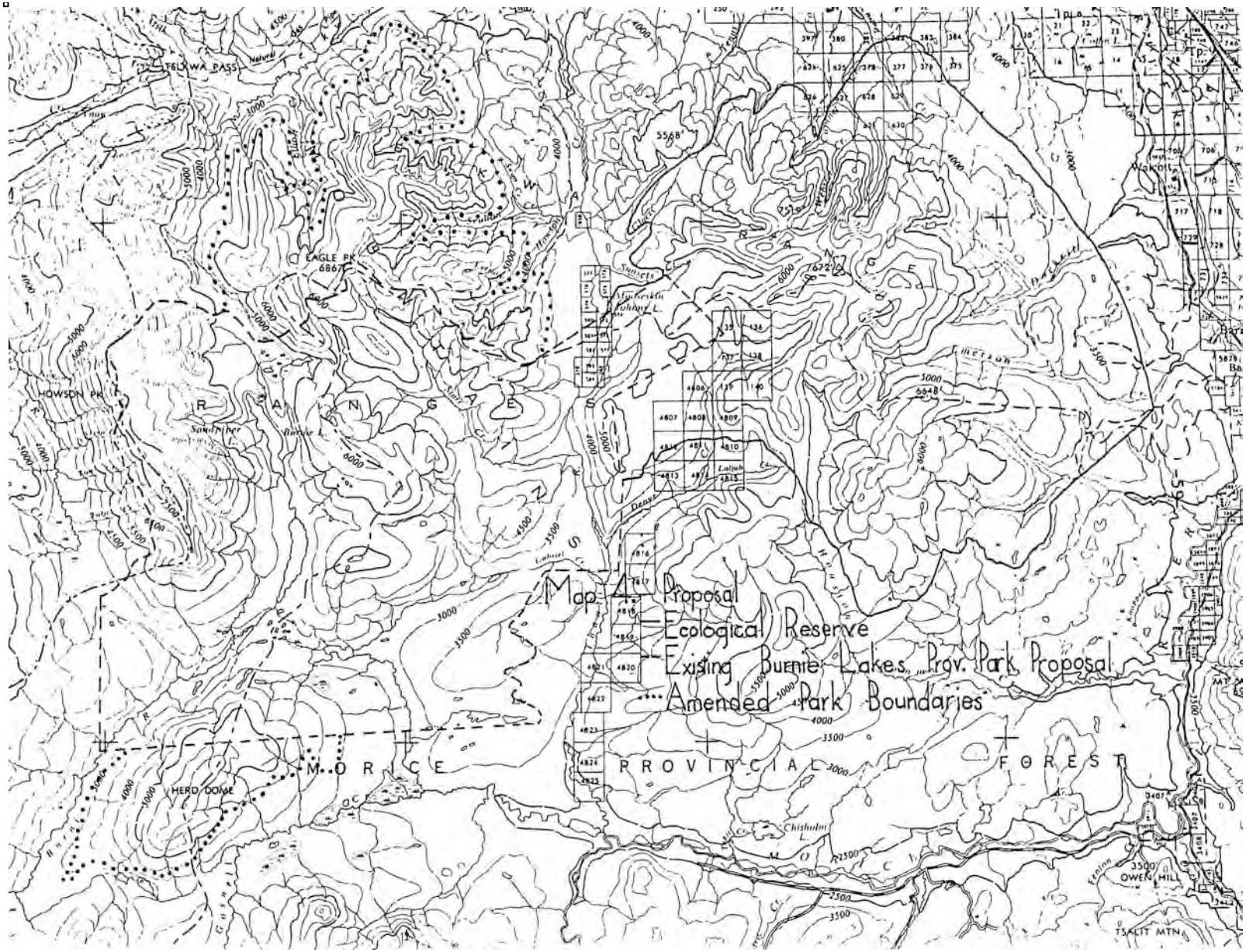
[6] survey data handwritten onto a copy of Fish and Wildlife Branch 1980

[8] population estimate using conservative 10% correction factor (Schultze 2010)

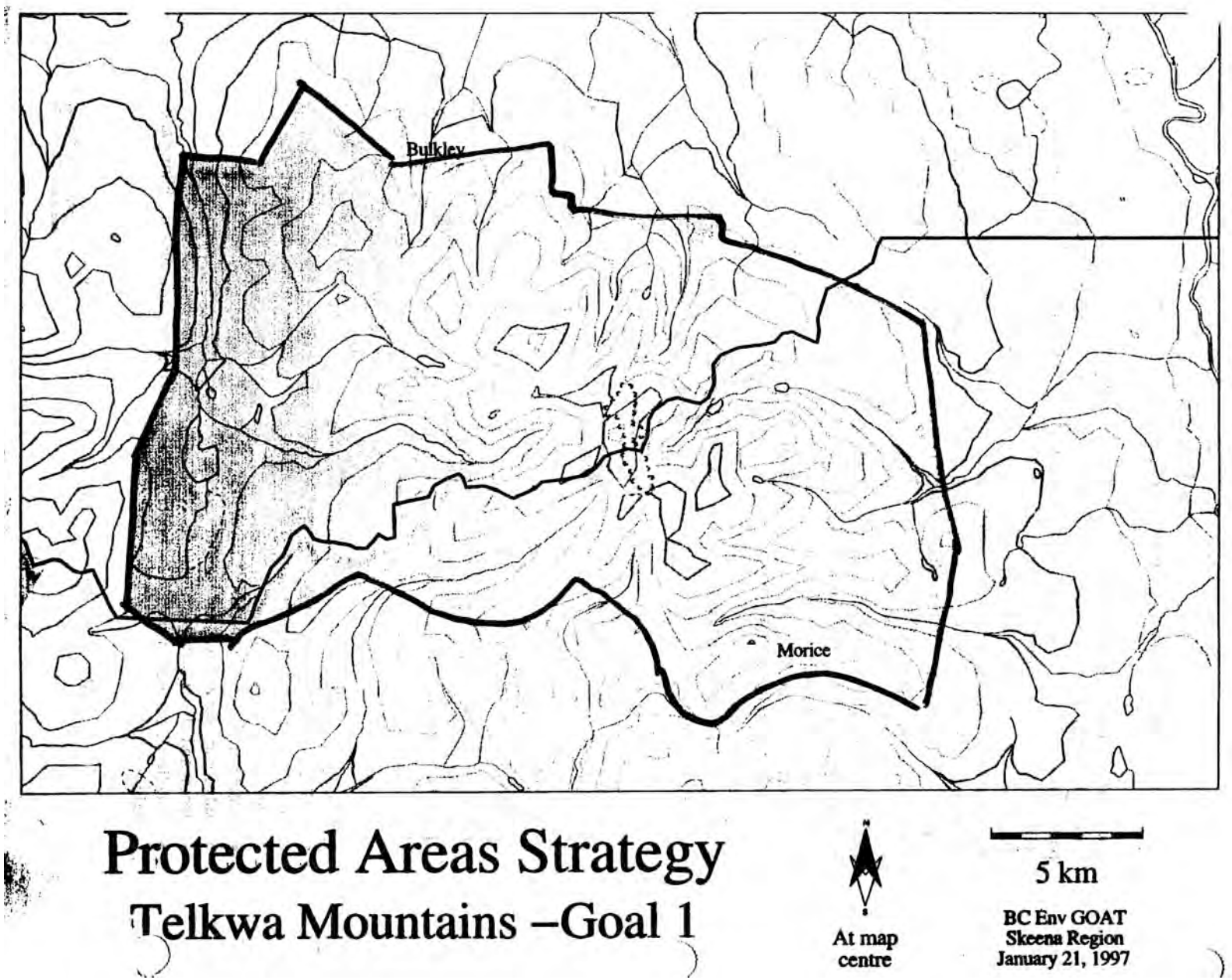
[9] subjective estimate based on anecdotal information of poor recruitment supported by low March 2008 yearling/cow ratio (Schultze 2010)

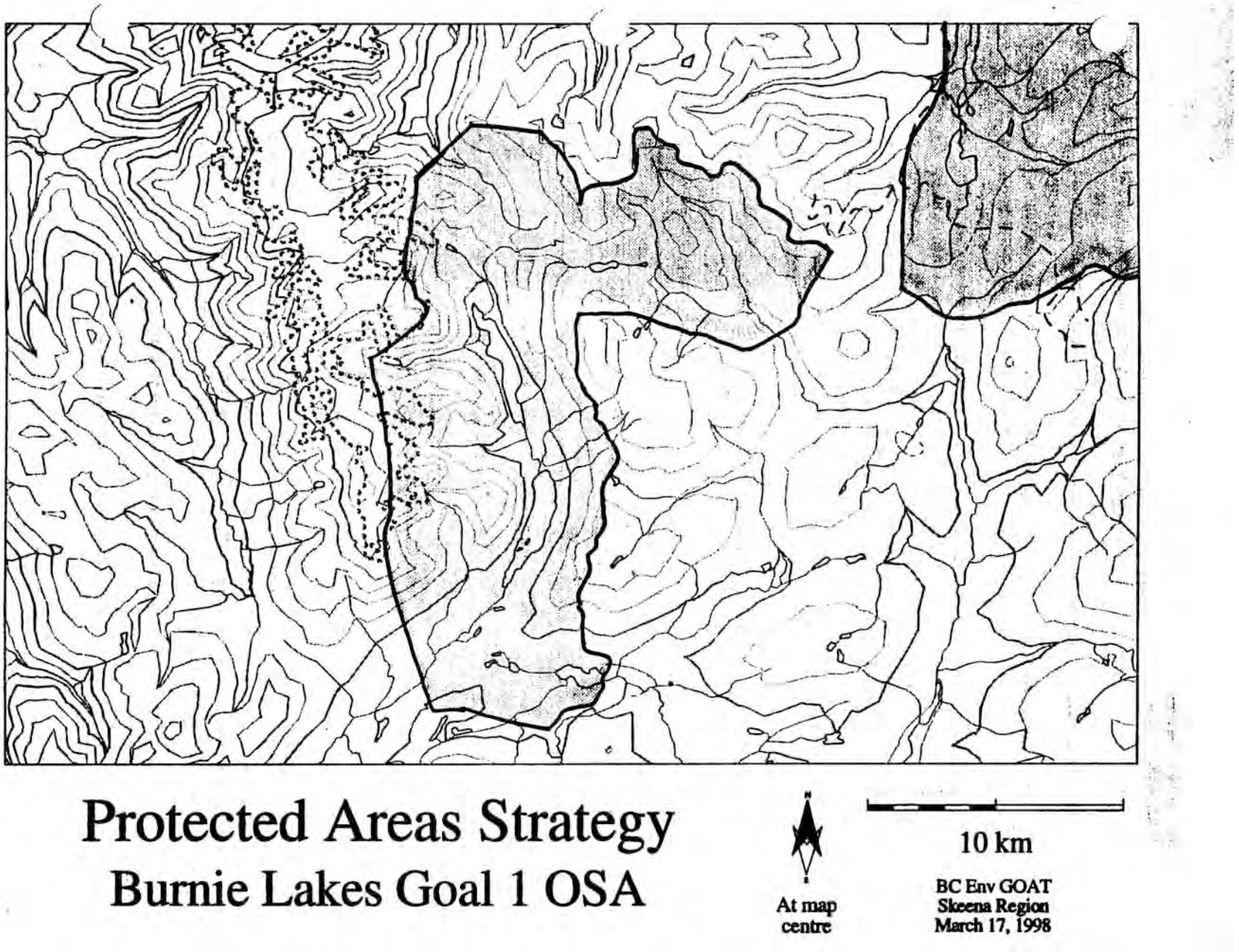
[10] population estimate based on collared adult mortality from 2007 of 12% (Schultze 2010)

Appendix 3. Protected area proposals in the Telkwa and Howson mountains area.



Burnie Lakes proposed provincial park and Telkwa Mountains proposed ecological reserve (from Theberge and Oosenbrug 1977).


Bulkley
Morice
Protected Areas Strategy
Telkwa Mountains –Goal 1
At map centre
5 km
BC Env GOAT
Skeena Region
January 21, 1997


Protected Areas Strategy
Burnie Lakes Goal 1 OSA
At map centre
10 km
BC Env GOAT
Skeena Region
March 17, 1998

Appendix 4. Management Direction for caribou in the Bulkley LRMP (adapted from Cichowski 2008).

Bulkley Land and Resource Management Plan

Reference: Bulkley Valley Community Resources Board. 1998. Bulkley Land and Resource Management Plan. Prepared by the Bulkley Valley Community Resources Board for the Skeena Inter-agency Management Committee, Smithers, B.C.

Landscape level guidelines/strategies/recommendations:

- biodiversity will be managed at the landscape level over the entire district, and will provide management objectives and strategies for the following:
  - ecosystem representation within the Ecosystem network and Protected Areas;
  - retention of old growth;
  - seral stage distribution;
  - landscape connectivity;
  - stand structure;
  - species composition;
  - temporal and spatial distribution of cutblocks;
  - endangered plant and animal life;
  - designation of sensitive areas;
  - special management or protection status of specific areas; and,
  - varied stocking densities and patterns
- the general management objective for timber resources is to maintain a sustainable supply of timber for the communities within the Bulkley Plan Area and to adhere to timber harvesting guidelines of the Forest Practices Code and use of the Forest Land Reserve to retain timber land in production
- critical wildlife habitats will be managed to maintain habitat values including habitats currently identified through this LRMP process, and areas yet to be identified under the Forest Practices Code as wildlife habitat areas

Stand level guidelines/strategies/recommendations:

-

Other guidelines/strategies/recommendations (if available):

- a strategic Recreational Access Management Plan (RAMP) is required for the Bulkley Plan Area, which will address motorized and non-motorized access for both on-road and off-road vehicles, especially in terrain sensitive to site degradation by off-road vehicles; it will consider regulated motorized access in areas containing resource values that will be negatively impacted in the absence of regulation, and identify enforcement provisions that may be required; in addition, conflicts such as those between snowmobiling and back-country skiing will be resolved for example, by designating some areas for exclusive use
- circular routes within the Bulkley Plan Area and connecting to adjacent districts can be potentially detrimental and should be discouraged wherever possible; this applies particularly when other values are paramount
- snowmobiles are permitted except where otherwise specified in the RAMP
- ATV will be permitted on identified hard surface roads and trails only (in sensitive terrain)
- road deactivation to minimize off-road vehicle damage to fragile ecosystems may be necessary in some circumstances

- provide opportunity for the safe, efficient and environmentally sound development and use of the energy and mineral resources for the economic benefit of the Bulkley Plan Area and the province
- identify and provide opportunities for future backcountry tourism
- development on Crown Land according to provincial regulations and guided by the government's commercial backcountry recreation policy in all areas except as identified in Specific Management Directions

Resource Management Zone specific recommendations:

- see attached table

Other findings/discussion:

-

Bulkley LRMP Planning Unit Recommendations which affect caribou						
Telkwa						Northern Caribou Local Population
HR 11-1	**HP 11-2**	**MJL 11-3**	**GC 11-4**	**TR 11-5**	**SC 11-6**	Telkwa Planning Unit (#11) Sub-units: GC=Goathorn Creek; HP=Hankin Plateau; HR=Howson Range; MJL=Mooseskin Johnny Lake; SC=Sinclair Creek; TR=Telkwa River
SM1	SM1	SM2	IRM	SM2	IRM	Resource management category: IRM=Integrated Resource Management; SM1=Special Management 1; SM2=Special Management 2
Wildlife/Biodiversity						
X	X	X	X	X	X	• agencies will develop a comprehensive plan to sustain and enhance a viable caribou population
X	X					• identify and conserve caribou habitat
X	X					• management emphasis is on caribou, as the caribou population is at risk
X						• maintain caribou and goat habitat, particularly winter habitat
		X				• maintain forest connectivity between Sub-units 11-1 and 11-2
		X	X			• identify and manage caribou habitat
				X		• maintain a wildlife corridor (for grizzly, deer, and wetlands)
				X		• maintain structural diversity of the riparian area and landscape corridor associated with the Telkwa River
				X		• restore the area over time to a more natural state (i.e. through forest structure)
				X		• assess potential for watershed restoration/rehabilitation
Timber						
X	X					• timber harvesting is not allowed; removal of trees is permitted only where required for approved mining exploration and development purposes, including access, and for other activities consistent with objectives and other specific direction for management stated in this planning unit and sub unit
		X				• conduct low impact management that recognizes the existing commercial backcountry tourism tenure and caribou habitat
Access						
X						• minimize impacts on critical winter habitat and populations of caribou and goat; restrict motorized access as required.
X	X	X				• agencies will identify specific areas for restrictions
X	X	X	X			• discourage circle route to Morice District
	X	X				• restrict motorized access (as it relates to caribou habitat)
		X				• allow the current motorized access to commercial operation at Mooseskin Johnny Lake to continue
				X		• agencies will address concerns about the impact of the main road on the river corridor, specifically regarding the effects on recreational, fish, water quality and ecological values
				X		• assess the options of altering main road access
					X	• evaluate the need for new access to Pine Creek from McDonell Road

Bulkley LRMP Planning Unit Recommendations which affect caribou						
Telkwa						Northern Caribou Local Population
HR 11-1	**HP 11-2**	**MJL 11-3**	**GC 11-4**	**TR 11-5**	**SC 11-6**	Telkwa Planning Unit (#11) Sub-units: GC=Goathorn Creek; HP=Hankin Plateau; HR=Howson Range; MJL=Mooseskin Johnny Lake; SC=Sinclair Creek; TR=Telkwa River
SM1	SM1	SM2	IRM	SM2	IRM	Resource management category: IRM=Integrated Resource Management; SM1=Special Management 1; SM2=Special Management 2
Minerals and Oil and Gas						
X						• recognize the current high interest in mineral exploration
X	X					• motorized access is permitted for mineral exploration/development, but will be controlled to protect caribou and goat habitat
	X					• manage access for exploration and development so that wildlife populations are conserved
			X			• maintain opportunities for coal exploration and extraction
Recreation/Range/Agriculture						
X	X					• permit wilderness recreation and backcountry tourism, subject to caribou habitat requirements
			X			• agencies will evaluate this unit for range potential, and potential range use expansion
				X		• range use will not be expanded into this area
						• maintain opportunities for high recreation use by bikers, hikers, skiers and snowmobilers, especially with access from the Microwave Road

Appendix 5. Management Direction for caribou in the Morice LRMP (adapted from Cichowski 2008 and updated).

Morice Land and Resource Management Plan

Reference: BC Ministry of Agriculture and Lands. 2007. Morice Land and Resource Management Plan. Ministry of Agriculture and Lands, Integrated Land Management Bureau, Victoria, B.C.

Landscape level guidelines/strategies/recommendations:

- maintain a distribution of representative seral stages across the plan area that is reflective of the range of natural variation
  - manage 10-20% of the plan area in HBEA
  - distribute High Biodiversity Emphasis Areas (HBEA) throughout plan area, independent of Landscape Unit (LU) boundaries; BEC variant and LU will be considered as units of measure for assessing distribution of HBEA

BEC	% representation across each HBEA		
	Early Seral Maximum (<40 years)	Mature + Old Seral Minimum (>100 years)	Old Seral Minimum (>140 years)
ATp	NA	NA	NA
CWHws2, MHmm2	16	71	70
ESSFmc, ESSFmv3	28	48	42
ESSFmk	7	86	84
SBSdk	50	21	16
SBSmc2, SBSwk2	37	33	26

BEC	% representation across the general forested area		
	Early Seral Maximum (<40 years)	Mature + Old Seral Minimum (>100 years)	Old Seral Minimum (>140 years)
ATp	NA	NA	NA
CWHws2, MHmm2	27	64	62
ESSFmc	38	37	34
ESSFmk	9	83	82
ESSFmv3	34	48	47
SBSdk	64	10	8
SBSmc2, SBSwk2	48	20	17

- Old Growth Areas (OGAs) will be delineated by 2008 to achieve old seral targets, in combination with existing reserves and management
  - OGAs will meet the following criteria: representative of ecosystem diversity at the scale of measure; maintain structural and functional forested connections between OGAs; in an unmanaged or natural condition; represent a range of sizes; spatial distribution is representative across the HBEA

Stand level guidelines/strategies/recommendations:

- maintain effective high value seasonal forage habitats for woodland caribou
  - 70% of area of known high value seasonal foraging habitats not impacted
  - use predictive modeling and existing field knowledge to outline potential high value seasonal foraging habitats
  - high value seasonal habitats are productive ecosystems as suggested by predictive modeling or local or First Nations knowledge and/or evidence of caribou tracks and/or feeding
  - high value habitats during spring, summer and fall are: those that produce large amounts of green forage used during spring, summer and fall seasons, and may include open habitats in riparian areas, or other forests with rich soils and open canopies; terrestrial lichen habitats (e.g. dry forest types)
  - high value winter habitats include: alpine or subalpine ridges with terrestrial lichen; dry forests with terrestrial lichen; forests, mostly but not entirely high elevation, with arboreal lichen
  - comply with the existing and any future Telkwa Caribou Recovery Plan and use Best Management Practices (see below) regarding woodland caribou until these practices are replaced by enactment of a species recovery strategy under the Species At Risk Act of Canada
  - current Best Management Practices for the Telkwa Caribou herd are found in Appendix 9 - Interim Harvesting Guidelines for the Telkwa Recovery Plan Area (see Map 12: Caribou Management Areas for locations of Key Forested Habitats)
  - current Best Management Practices for the Takla herd are based on the Ungulate Winter Range guidelines for the Takla herd and are found in Appendix 10
- maintain effective calving/postcalving habitats for woodland caribou
  - 100% of known calving/postcalving sites not impacted
  - use predictive modeling and existing field knowledge to outline potential calving/post-calving habitats
  - calving and post-calving habitats include: high elevation (>1200m) alpine and sub-alpine habitats, wetland complexes, and known calving islands (Map 12, *Caribou Management Areas*)
  - presence of multiple (>3) caribou cows with calves indicates calving/post-calving habitats
  - comply with the existing and any future Telkwa Caribou Recovery Plan and use Best Management Practices regarding woodland caribou until these practices are replaced by enactment of species recovery strategies under the Species At Risk Act of Canada
- maintain effective security cover adjacent to high value seasonal forage or calving/postcalving habitats
  - maintain no less than 70% of the area of functional screening coverage associated with each known high value seasonal foraging or calving/post calving habitat
  - screening cover is located adjacent to high value seasonal forage or calving/post-calving habitats
  - screening cover – provides visual screening especially from roads; and exists when vegetation obscures a person 20m away from the observer
- achieve structurally complex forested ecosystems, through all successional stages, distributed across the plan area
  - large patches can be created through the aggregation of several smaller cutblocks over time; manage aggregation of cutblocks to achieve a range of age complexities within early seral patches
  - guidance for implementation of ecologically sound wildlife tree retention will be as per Provincial Wildlife Tree Policy and Management Recommendations (MOF 2000); these recommendations will be replaced by the Best Management Practices once they are developed
  -

BEC	% land in patches <40 ha		% land in patches >250 ha	
All SBS	20	30	50	60
All CWH, ESSF, MH	15	25	50	60
AT, ATp	NA	NA	NA	NA

Percentage of harvested area required in wildlife tree retention					
% of area available for harvest that has already been harvested without recommend wildlife tree retention	% of biogeoclimatic subzone within the Landscape Unit available for harvest				
	90	70	50	30	10
10	10	8	6	4	3

30	12	10	8	6	4
50	14	12	10	8	6
70	16	14	12	10	8
90	18	16	14	12	10

Other guidelines/strategies/recommendations:

- limit disturbance from development activities adjacent to calving/postcalving habitats
  - no human, industrial or commercial activity on known calving islands (Map 12, *Caribou Management Areas*)
  - no industrial activities within 500 meters of known calving/post-calving habitats from May 15 to June 30
- limit disturbance from motorized activities in identified caribou management subareas
  - no motorized access within identified caribou management sub-areas
  - identified caribou management sub-areas are from the Telkwa Caribou Recovery Plan and the proposed Ungulate Winter Range map for the Takla Caribou herd (Map 12, *Caribou Management Areas*)
  - the sub-areas map identifies areas where winter motorized access is restricted and where summer motorized access is restricted
  - where practicable, avoid repeated flights in or near no-fly zones identified through the Telkwa Caribou Recovery Plan on Map 12, *Caribou Management Areas* (no fly zone map) during the period May 15 to June 30; in other Caribou Management areas, use best management practices when operating aircraft in the vicinity of caribou habitat; inform local pilots of known high value areas and season of use; provide information on flying and landing practices that minimize caribou disturbance
- limit risk of disease transfer between caribou and cattle
  - no new grazing tenures issued above 1000m within the Telkwa and Takla Caribou Management Areas or south of Tahtsa Reach and Tahtsa Lake in the Tweedsmuir Caribou Management Area
  - where possible, investigate all known caribou deaths to determine if a disease communicable between livestock and caribou was the cause
  - encourage development of best management practices for management of herd health of livestock in the vicinity of caribou
  - existing grazing tenures will be renewed subject to compliance with best management practices
- minimize and where necessary mitigate both immediate and cumulative access-related impacts, to environmental values as described in Table 9
- encourage access development to support social and economic values and address associated issues as described in Table 10
- develop a strategic access management plan for the plan area
- complete spatial access management plans, with public involvement, for areas of significant concern to determine: designated access routes; specific spatial and temporal access restrictions; access to present and future Crown land lot development (lakeshore, residential, recreation etc.); and, deactivation schedule and/or plan
- designated motorized and non-motorized recreational access (Map 7):
  - summer non-motorized - Tstsutl Mountain (3)
  - non-motorized (all seasons) – Telkwa Mountains Area (9B)
    - some winter motorized recreation access opportunities are available through the Smithers and Houston snowmobile clubs. Refer to the "Letter of Understanding, March 2003" as agreed to by the Voluntary Access Management Group which details the conditions of recreational use
  - non-motorized – Telkwa Mountains Area (9D)
    - non-motorized access is acceptable between July 15 and September 15.
  - summer non-motorized – Telkwa Mountains Area (9)
    - this area is generally designated summer non-motorized . Sub unit areas within have higher levels of access restrictions (Refer to 9B, 9C and 9D)
  - summer non-motorized – Telkwa Mountains Area (9C)
    - no summer motorized access is allowed pas the "Gas Stop" (May 1-September 15)

- non-motorized – Burnie North (11)
- summer non-motorized – Burnie South/Morice Range (12)
- summer non-motorized – Whitesail South (17), Kasalka (20)
  - Kasalka (20) – summer non-motorized above 1000 m elevation.
- winter non-motorized – Little Whitesail (18)

- where practicable, retain all existing access routes to guide territories and methods of transportation on these routes whether in protected areas, special management areas or general management areas
- changes to access routes (e.g. deactivation, motorized access restrictions, new development) should be carried out in consultation with tenure holders or through a TSA Access Management Plan
- promote mineral, aggregate and energy projects that provide a variety of economic opportunities for their full life cycles
- maintain the legal right to access for mineral exploration
- allow for access for aggregate and energy exploration and development outside of protected areas
- minimize environmental impacts, over the full lifecycle of mineral, aggregate and energy projects
- encourage opportunities to develop mineral and energy resources
- maintain or increase timber production and harvesting across the available landbase
  - apply adaptive management principles to meet timber objectives
- maintain the health of the timber resource
  - maintain forest health through integrated pest management
  - use best management practices for beetle management within the context of other resource values
- maintain or enhance moose summer and winter forage habitats
- maintain or enhance deer winter range

Resource Management Zone specific recommendations:

Herd Dome – Telkwa

- conserve the function and integrity of large contiguous forested ecosystems by managing as a non-timber harvesting area
  - no timber harvesting or salvage
  - no impacts to alpine ecosystems
- maintain the quality of the wilderness recreation experience
  - no motorized summer recreation use

Starr Creek - Telkwa

- conserve the function and integrity of large contiguous forested ecosystems by managing as a non-timber harvesting area
  - no timber harvesting or salvage
- maintain the quality of the wilderness recreation experience
  - develop a recreation plan with caribou recovery to take precedence, and to reduce conflicts between users and between users and wildlife

Tahtsa-Troitsa – Tweedsmuir-Entiako

- conserve the function and integrity of large contiguous forested ecosystems by managing as a non-timber harvesting area
  - no timber harvesting or salvage
  - single tree management for forest health is acceptable; biomass must be retained on site
- maintain or improve opportunities for a range of wilderness recreation experiences across the landscape
  - provide a range of recreational opportunities at Coles Lake
  - designated summer non-motorized areas
  - designated winter non-motorized areas

Other findings/discussion:

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Appendix 6. Draft habitat and protection zones in the Telkwa Caribou Recovery Area developed in 1997.

From: Appendix 2. Telkwa Caribou Recovery Management and Habitat Protection Zones (Telkwa Caribou Recovery Team 1997).

ZONE 1. CARIBOU MANAGEMENT - INDUSTRIAL USE.

Areas within Zone 1 consist of caribou habitat in which industrial activity is expected to occur. Caribou habitat areas were mapped using information from Biophysical Classification for Wildlife (ungulate) Capability Maps, 1996 lichen transect surveys, radio-telemetry locations of TCH caribou, and locations of confirmed caribou sightings. Primary industrial activity is expected to be modified forest harvesting and silviculture activities. Mineral exploration and extraction activities are expected to play a lesser role.

Higher elevation boundaries for Zone 1 were determined from the best approximation of forest harvest operability lines. Habitat capability, caribou distribution data and natural physical barriers formed lower zone boundaries. The upper Mooseskin Johnny Lake area was not included in zone 1 as forest harvesting is not slated for that area during the next five year time period. Future forest harvesting strategies for this area will depend on success of the caribou recovery program and information on annual movements, distribution and habitat use by TCH caribou.

Management within Zone 1 areas will involve adoption of forest harvesting strategies that integrate caribou values with management of public access through forest road and block deactivation planning. Area or specific road closures will be legislated through the Forest Practices Code of British Columbia Act or the Wildlife Act where necessary.

ZONE 2. "CORE" RE-INTRODUCTION AREA

Translocated caribou will be placed within this management zone. Area designation was based on historic and current use by TCH caribou and delineation of the area rated to have the highest capability rating for caribou.

All access will be restricted within this zone, especially during the first critical years of caribou recovery**,** when it is important that the potential for disturbance to cause recently introduced caribou to leave the recovery area be minimized. Legislation will be enacted under the Wildlife Act restricting all motorized use for this area in 1998.

ZONE 3. CARIBOU MOVEMENT CORRIDORS.

Caribou were once widely distributed throughout most mountainous areas surrounding Smithers and may have formed part of a larger herd whose range extended south into Tweedsmuir Park. To maintain the potential for genetic interchange between TCH animals and caribou in Tweedsmuir Park, the Recovery Team felt it was important to identify movement corridors that would not preclude caribou movement between the Telkwa Mountains and areas to the south, including Morice Mountain and Tweedsmuir Park. Morice Mountain was identified because there were confirmed sighting of caribou on Morice Mountain in both 1996 and 1997.

While harvest or access strategies are not currently planned for the Morice corridor, future harvest plans will be reviewed to ensure that cutting plans are designed to maintain habitat connectivity, permitting movement and security cover between harvest blocks and lowland valley development. No management changes are deemed necessary for the Tweedsmuir corridor at this time due to lack of proposed forest harvest plans for that area.

ZONE 4. WINTER MOTORIZED USE.

Zone 4 was identified to permit continued recreational snowmobile use, recognizing the importance of that area to the Houston snowmobile club, and consistent with the intent of the Recovery Plan to provide habitat protection measures that will ensure sufficient habitat exists to sustain a viable caribou herd while also providing recreational opportunity to the public.

The Recovery Team felt that winter snowmobile use could continue on a trial basis given available information and caribou distribution that shows TCH caribou mainly use this area in early spring and over the summer. Therefore non-motorized legislation will be implemented for summer periods.

Management actions in the Recovery Plan call for frequent monitoring of translocated caribou to determine annual movements, distribution and habitat use. That data will be used in future considerations of the importance of this zone to TCH caribou and whether winter motorized use is compatible with caribou winter range requirements.

ZONE 5. MOOSESKIN JOHNNY CORRIDOR.

The TCH Recovery Team identified the upper Mooseskin Johnny Lake area as critically important in regards to providing security for caribou movement between summer and winter ranges.

Further consultation with Pacific Inland Resources Ltd., the local guide/outfitter and the Wet'suwet'en First Nation as well as other affected interest groups is required to finalize management strategies for the lower Mooseskin Johnny corridor. The intent is to restrict use of motorized vehicles, consistent with direction provided by the Bulkley District LRMP and RAMP processes. Several options exist in this regard, including legislated year-round

restrictions on the use of motorized vehicles, restrictions of the use of motorized vehicles for hunting, and physical closure barriers. However, a strategy regarding use of ATV's has not been finalized.

A temporary Telkwa bridge access restriction agreement is currently in place for 1997, which restricts vehicle use of the existing mining road to Mooseskin Johnny Lake.

ZONE 6. NON-MOTORIZED DESIGNATION

Zone 6 consists of caribou habitat located above forest harvest operability lines. The intent is to restrict all motorized use within those areas to minimize potential direct and indirect impacts on TCH caribou. To that end, legislation will be implemented under the Wildlife Act to restrict the use of motorized vehicles for 1998. Alternate temporary access strategies are required for 1997. Management and access strategies in regards to possible mineral exploration or extraction have not been finalized.

Reference

Telkwa Caribou Recovery Team. 1997. Draft Telkwa Mountains Caribou Herd Recovery Plan. BC Environment, Smithers, B.C. 19p.

Appendix 7. Habitat protection zones and voluntary access restrictions in the Telkwa Caribou Recovery Area, 1998.

From: Appendix 2. Telkwa Caribou Recovery Management and Habitat Protection Zones (BC Ministry of Environment, Lands and Parks 1998).

ZONE 1. INTEGRATED USE.

Areas within Zone 1 consist of caribou habitat in which industrial activity is expected to occur, consistent with direction provided by the Bulkley LRMP. Caribou habitat areas were mapped using information from Biophysical Classification for Wildlife (ungulate) Capability Maps, 1996 lichen transect surveys, radio-telemetry locations of TCH caribou, and locations of confirmed caribou sightings. Primary industrial activity is expected to be modified forest harvesting and silviculture activities. Mineral exploration and extraction activities are expected to play a lesser role.

Higher elevation boundaries for Zone 1 were determined from the best approximation of forest harvest operability lines. Habitat capability, caribou distribution data and natural physical barriers formed lower zone boundaries. The upper Mooseskin Johnny Lake area was not included in zone 1 as forest harvesting is not slated for that area during the next five year time period. Future forest harvesting strategies for this area will depend on values incorporated in the Landscape Unit Planning process (maintaining visual quality, habitat connectivity, protection of wetlands around Mooseskin Johnny Lake).

Management within Zone 1 areas will involve adoption of forest harvesting strategies that integrate caribou values with management of public access through forest road and block deactivation planning. Area or specific road closures will be legislated through the Forest Practices Code of British Columbia Act or the Wildlife Act where necessary.

ZONE 2. "CORE" RE-INTRODUCTION AREA

Transplanted caribou were placed within this zone in November 1997 and additional caribou may be released in this zone over the winter of 1998/99. Area designation was based on historic and current use by TCH caribou and delineation of the area rated to have the highest capability for caribou.

All access will be restricted within this zone on a voluntary basis, especially during the first critical years of caribou recovery**,** when it is important to minimize the potential for disturbance to cause recently introduced caribou to leave the recovery area.

ZONE 3. CARIBOU MOVEMENT CORRIDOR TO MORICE MOUNTAIN.

To maintain the potential for genetic interchange between TCH animals and caribou in Tweedsmuir Park, and to allow caribou to access habitat within their historic range, caribou must be allowed to move between the Telkwa Mountains and areas to the south, including Morice Mountain and Tweedsmuir Park. In the Morice Mountain corridor, current and future harvest plans will be reviewed to ensure that cutting plans are designed to maintain habitat connectivity, permitting movement and security cover between harvest blocks and lowland valley development.

A corridor to Morice Mountain was identified because there were confirmed sightings of caribou on Morice Mountain in both 1996 and 1997. The Tweedsmuir corridor was removed from the initial draft of the Telkwa Caribou Recovery Zone map because of a lack of proposed forest harvest plans for that area.

ZONE 4. WINTER MOTORIZED/SUMMER NON-MOTORIZED.

Zone 4 was identified to permit continued recreational snowmobile use, recognizing the importance of that area to the Houston snowmobile club, and consistent with the intent of the Recovery Plan to provide public recreational opportunities so long as they are consistent with habitat protection measures that will ensure sufficient habitat exists to sustain a viable caribou herd. The boundaries of this area were determined through discussion and negotiation with representatives of the Smithers Snowmobile Club and Houston Snowmobile Association.

BCE staff felt that winter snowmobile use could continue on a trial basis given available information and caribou distribution that shows TCH caribou mainly use this area in early spring and over the summer. Therefore this area is designated non-motorized for summer periods.

Management actions in the Recovery Plan call for frequent monitoring of translocated caribou to determine annual movements, distribution and habitat use. That data will be used in future considerations of the importance of this zone to TCH caribou and whether winter motorized use is compatible with caribou winter range requirements.

ZONE 5. INTERIM WINTER MOTORIZED/SUMMER NON-MOTORIZED.

This zone (Meat Cache Trail) was designated, and the boundaries determined after discussion and negotiation with representatives of the Smithers Snowmobile Club and Houston Snowmobile Associations. This designation is in place for one year, to be evaluated at the end of the 1997/98 snowmobiling season. BCE was willing to consider continued motorized access to this area on a trial basis because most motorized use of the area occurs over a relatively

short period of time in the spring (March - May) before caribou move up into higher elevation area to calve, and because there exists natural physical barriers to motorized access to the areas (Emerson Ridge) currently used as late-winter range by the TCH.

This zone extends to the height of land on the east at which there is a natural, physical barrier to snowmachines onto Emerson Ridge. The north-western boundary has been extended up into a corridor through the "Meat Cache" area. The area to the west of the corridor is non-motorized and snowmobile access is prohibited. The area to the east is the "Core" introduction area and snowmobile access is also prohibited in that area. This corridor ends at the height of land prior to "the small lake". The small lake is in the "Core" area, and motorized access is not permitted.

These restrictions will be communicated to the public through signs placed at the trail head by the parking lot, and at the natural topographic funnel at "the top of the meat cache, before the hole". Additional signs will be located as necessary along the boundaries of the corridor area.

This zone also includes Morice Mountain. Members of the Houston Snowmobile Association will monitor caribou activity on Morice Mountain, and have agreed to refrain from using Morice Mountain if caribou are present.

BCE and the Smithers and Houston Snowmobile Associations will monitor voluntary compliance with the motorized restrictions in this zone over the winter of 1997/98 and will discuss the effectiveness of the restrictions at the end of the 1997/98 snowmobile season.

ZONE 6. NON-MOTORIZED RECREATION

Zone 6 consists of caribou habitat located above forest harvest operability lines. The intent is to restrict all motorized use within those areas to minimize potential direct and indirect impacts on TCH caribou, and to maintain the opportunity for caribou to use all areas of potential winter range.

Reference

BC Ministry of Environment, Lands and Parks. 1998. Telkwa Mountains Caribou Herd Recovery Plan. BC Ministry of Environment, Lands and Parks, Wildlife Branch, Smithers, B.C.

Appendix 8. Voluntary recreation access restrictions and Telkwa Caribou Recovery Area Access Understanding, 2003.

From: VRAMG (2003).

Reference

VRAMG (Voluntary Recreational Access Management Group). 2003. Telkwa Mountains Caribou Recovery Project voluntary recreation Access Restrictions. Voluntary Recreational Access Management Group, Smithers, B.C.

March 2003

Telkwa Mountains Caribou Recovery Project
Voluntary Recreation Access Restrictions

As agreed to by the Voluntary Recreational Access Management Group (VRAMG)

Zone A - Integrated Use Areas

- No restrictions.
- Access will be controlled through the deactivation (gates, barricades, ditching and bridge removal) of industrial roads.

Zone B - Non- Motorized Areas

- Generally no motorized recreational access is allowed (winter or summer).
- Some winter motorized recreation opportunities are potentially available through the Smithers and Houston snowmobile clubs.
- No dogs allowed

Zone C – Grizzly Plateau Area

- No summer recreational motorized access is allowed past the "Gas Stop" (May 1 – September 15)
- There are no non-motorized restrictions
- There are no winter motorized restrictions (Sept 16-April 30).
- No dogs allowed.

Zone D – Core Recovery Area (includes Hankin Plateau, Webster Lake and Hunters Basin)

- Generally, no recreational access is allowed in this zone except for non-motorized access between July 15 and September 30.
- Additional limited access opportunities may be available through clubs after discussion with the VRAMG.
- No dogs allowed

Mooseskin Johnny Trail

- Motorized access is allowed along the old access trail from the Telkwa River bridge to Mooseskin Johnny lake. Industrial access upgrades and development (roads and Bridges) are not intended to improve or increase the recreational access to the area.

Behavior Protocol

1. Dogs are not permitted in the alpine
2. If caribou tracks are observed do not follow the tracks.
3. If you see caribou do not approach. Do not attempt to get closer for photographs. Stay downwind if possible.
4. If caribou are encountered while you are operating a motorized vehicle, turn off your machine and allow the animals to calmly move away. After the caribou have departed, leave the area. Make every effort to minimize disturbance.
5. If caribou are encountered while you are engaged in non-motorized activities such as skiing, hiking, cycling or riding keep voices quiet and movement limited until the caribou have left the area. If the animals do not appear to see you, leave the area immediately.
6. Remember you are in their home.

March 2003

Houston Snowmobile Association Telkwa Mountain Access Understanding into the "Non motorized Zone North of the Grizzly Plateau

- The non motorized area north of the Houston snowmobile area (Grizzly Plateau) would remain designated as non motorized. Special additional access would be available through the club, provided that the needs of the caribou are met.
- The club is responsible for managing winter motorized access into the non motorized area (including the Meat cache corridor)
- The club will develop an effective means of signage and notification so that users will be clearly aware of when the area is off limits
- Snowmobile activity would be in the southern portion of the Meat Cache area to access the steep topography found there. The flatter terrain (ridge tops) would be avoided
- If caribou are determined to be present in the area either through telemetry, observation or sign, the club will take steps to keep snowmobilers out of the area until it is determined co-operatively by the ministry and club reps the caribou have left the area or on how to proceed.
- Winter motorized activity would go no later than April 30
- The CORE recovery area would remain off limits
- The club is committed to addressing the access/caribou concerns and is willing to make reasonable effort to ensure that the caribou receive the protection they require. The club further acknowledges that legislated closure will be necessary as a final option if the voluntary restrictions can not be made to work.

Smithers Snowmobile Association Telkwa Caribou Recovery Area Access Understanding into the "Non motorized Zone West of Mooseskin Johnny Lake

- The non motorized designation of the area would remain. Special additional access would be available through the club, provided that the needs of the caribou are met.
- The club is responsible for managing winter motorized access including into the area west of Mooseskin Johnny Lake off of the Mooseskin Johnny Trail.
- The club will develop an effective means of signage and notification so that users will be clearly aware of when the area is off limits
- If caribou are determined to be present in the area either through telemetry, observation or sign, the club will take steps to keep snowmobilers out of the area until it is determined co-operatively by the ministry and club reps the caribou have left the area or on how to proceed.
- Winter motorized activity would go no later than April 30
- The CORE recovery area would remain off limits
- The club is committed to addressing the access/caribou concerns and is willing to make reasonable effort to ensure that the caribou receive the protection they require. The club further acknowledges that legislated closure will be necessary as a final option if the voluntary restrictions can not be made to work.

Appendix 9. Voluntary recreation access restrictions and Telkwa Mountain Access Understanding, 2011.

From: VRAMG (2011).

Reference

VRAMG (Voluntary Recreational Access Management Group). 2011. Telkwa Mountains Caribou Recovery Project voluntary recreation Access Restrictions. Voluntary Recreational Access Management Group, Smithers, B.C.

January 2011

Telkwa Mountain Access Understanding

Agreement between the Houston Snowmobile Club, Smithers Snowmobile Association and Ministry of Natural Resource Operations (MNRO) regarding winter motorized access into the voluntary non-motorized designated zones in the Telkwa Caribou Recovery Area

- Recognizing that caribou recovery is the overriding priority in the area, through the Snowmobile Organizations (here after referred to as Clubs) additional special (limited) access may be available, provided that the needs of the caribou are met through conformance to the below provisions. These provisions are in addition to those outlined in the related document "*Telkwa Mountains Caribou Recovery Project Voluntary Recreation Access Restrictions*" [March, 2003 – attached as a supplement to this Agreement]:

- Clubs will co-manage (i.e. limiting use, promote awareness and compliance) the "special" winter motorized access into the non-motorized area (Zone B: including the 'Meat Cache' corridor and the Starr Creek Area);

- Clubs will develop, implement, and maintain an effective notification program, including options such as signage, phone calls, emails or other means of communication, so users will be clearly aware of when the special winter motorized access privileges are in effect or when the non-motorized designation applies;

- The CORE Recovery Area (Zone D) remains off limits;

- East of Thautil R, snowmobile activity would be in the southern portion of the 'Meat Cache' area to access the steep topography found there *[warning: avalanche hazard].* The flatter terrain (ridge tops) is to be avoided;

- If caribou are present in the area, determined either through telemetry or the observation of animals or sign, special winter motorized access privileges are suspended and the Clubs will initiate notification program to ensure user compliance. Special snowmobile privileges will not resume until it is determined co-operatively between government (MNRO) and the Clubs that the caribou have left the area;

- Winter motorized activity is to cease as of April 30;

- Clubs are committed to addressing the access/caribou concerns and are willing to make reasonable and responsible efforts to ensure that the caribou receive the protection they require. Clubs further acknowledge that legislated closure will be necessary as a final option if the voluntary restrictions can not be made to work;

March 2003

Telkwa Mountains Caribou Recovery Project
Voluntary Recreation Access Restrictions

As agreed to by the Voluntary Recreational Access Management Group (VRAMG)

Zone A - Integrated Use Areas

- No restrictions.
- Access will be controlled through the deactivation (gates, barricades, ditching and bridge removal) of industrial roads.

Zone B - Non- Motorized Areas

- Generally no motorized recreational access is allowed (winter or summer).
- Some winter motorized recreation opportunities are potentially available through the Smithers and Houston snowmobile clubs.
- No dogs allowed

Zone C – Grizzly Plateau Area

- No summer recreational motorized access is allowed past the "Gas Stop" (May 1 – September 15)
- There are no non-motorized restrictions
- There are no winter motorized restrictions (Sept 16-April 30).
- No dogs allowed.

Zone D – Core Recovery Area (includes Hankin Plateau, Webster Lake and Hunters Basin)

- Generally, no recreational access is allowed in this zone except for non-motorized access between July 15 and September 30.
- Additional limited access opportunities may be available through clubs after discussion with the VRAMG.
- No dogs allowed

Mooseskin Johnny Trail

- Motorized access is allowed along the old access trail from the Telkwa River bridge to Mooseskin Johnny lake. Industrial access upgrades and development (roads and Bridges) are not intended to improve or increase the recreational access to the area.
  Note*: The 18 Km bridge across the Telkwa R. Is not intended to facilitate recreational activities except for, due to the Morice LRMP, the one weekend a year agreement to allow motorized access through the Protected Area*

Behavior Protocol

7. Dogs are not permitted in the alpine
8. If caribou tracks are observed do not follow the tracks.
9. If you see caribou do not approach. Do not attempt to get closer for photographs. Stay downwind if possible.
10. If caribou are encountered while you are operating a motorized vehicle, turn off your machine and allow the animals to calmly move away. After the caribou have departed, leave the area. Make every effort to minimize disturbance.
11. If caribou are encountered while you are engaged in non-motorized activities such as skiing, hiking, cycling or riding keep voices quiet and movement limited until the caribou have left the area. If the animals do not appear to see you, leave the area immediately.
12. Remember you are in their home.