

Provincial Caribou Recovery Program Herd Planning Disclaimer



The following herd plans are a result of Phase One planning and are an incomplete product. Additionally, the documents are 'living' reports and will be updated regularly as Phase Two progresses.

Phase Two planning is currently underway for some herds however still at its early stages of development; many plans reflect this as they are in different stages along their scheduled project continuum.

One of the cornerstone guiding principles to the Caribou Recovery Program (the Program) is to use consistent, fact-based approaches for all woodland caribou herds in the province. The Program has refined and adopted a new format to herd planning that will effectively:

- ❖ Provide a consistent approach to managing all woodland caribou herds in BC
- ❖ Recognize the unique circumstances of each herd
- ❖ Build from current (legacy) caribou management plans
- ❖ Consider First Nations' and stakeholder interests and ideas
- ❖ Be included in larger regional plans

Completed herd plans will describe the status of each herd, and the threats faced by that particular herd. The plans will take note of previous actions, and actions that are planned to take place in the future. As we implement the herd plans, the Program will carefully monitor to which extent and magnitude the caribou respond, and modify its actions as accordingly. Herd plans will help us document our decisions and discuss issues with First Nations and with stakeholders.

Phase One consisted of:

- ✓ Status of herd or sub-population
- ✓ Identified threats
- ✓ Literature
- ✓ Previous work completed

Phase Two will consist of input from:

- Engagement with Indigenous communities
- Provincial Caribou Science Team
- Stakeholders
- Decision-support tools

WOODLAND CARIBOU PLAN

Charlotte Alplands Subpopulation

Chilcotin
Local Population Unit



BRITISH
COLUMBIA

Recommended Citation:

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EXECUTIVE SUMMARY

DRAFT

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1 BACKGROUND

1.1 INTRODUCTION TO THE PROGRAM

The Charlotte Alplands subpopulation is the northern ecotype of woodland caribou (*Rangifer tarandus caribou*), designatable unit seven (DU 7), and is within the Southern Mountain National Ecological Area (SMNEA). These herds are listed as *Threatened* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2002) and appear on Schedule 1 of the Federal Species at Risk Act (SARA). They are blue-listed in British Columbia and are included in the Provincial Identified Wildlife Management Strategy (British Columbia Ministry of Water, Land and Air Protection 2004, Skeena Region 2017).

Woodland Caribou are further divided into Local Population Units by Environment Canada. The Charlotte Alplands subpopulation is in the Chilcotin Local Population Unit that it shares with the Itcha-Ilgachuz and the Rainbow subpopulations (Environment Canada 2014).

Range plans are required for all woodland caribou populations that are designated as threatened or endangered in Canada (Environment and Climate Change Canada 2016). The Charlotte Alplands subpopulation is blue-listed in BC, and current monitoring indicates that they are in decline.

This document spans the divide between these disparate designations in British Columbia and Canada, compiling past research, knowledge and management actions into guidance for the management and recovery of the Charlotte Alplands Northern Mountain caribou subpopulation.

2 POPULATION DESCRIPTION

Relative to other western mountain caribou (DU 8 and 9), members of this designatable unit are found in dry sub-boreal montane ecosystems and use pine-dominated habitats during winter. Most populations of Northern Mountain caribou are relatively small and sedentary, with individuals wintering in small groups. They generally use the calving strategy of moving to high elevations on open sub-alpine ridges, spacing away from conspecifics and predators (COSEWIC 2011).

2.1 DISTRIBUTION

The Charlotte Alplands subpopulation is located in the West Cariboo Region, north of the Klinaklini River, west of McClinchy River, south of the Hotnarko River, and east of Atnarko River.

Historically, the caribou distribution in the south Chilcotin was much larger than it is today, with reports of caribou throughout the area into the early 1900's (Spalding 2000). Reports by the Provincial Warden suggest that caribou inhabiting the Chilcotin were almost exterminated by 1916. Ritcey (1956) undertook a reconnaissance survey of Southern Tweedsmuir Park and summarized his discussions with locals by suggesting that caribou were abundant in the Caribou Mountain area in the 1920's but that the population crashed in the 1930's and eventually disappeared. He also reported that seven caribou were observed on Charlotte Lake during the winter of 1955–56 but there are no records of sightings in the area after that period prior to the transplant. This reconstructed historic caribou distribution is supported by the recovery of cast caribou antlers during the last half of the twentieth century. Throughout the western and central Chilcotin Ranges antlers have been found as far west as Caribou Mountain in southern Tweedsmuir Park (Hayhurst 1983) and as far east as Dash Creek (Darcy Peel personal communication). Exactly when and why these animals disappeared from this area remains unclear.

Woodland Caribou Plan for the Charlotte Alplands Subpopulation

In 1984 a Habitat Conservation Trust Foundation project was initiated to restore caribou to unoccupied habitat within the Chilcotin Ranges west and south of Charlotte Lake. Between 1984 and 1991, 52 caribou were transplanted to this area from capture locations on the north sides of the Itcha and the Ilgachuz Mountains; both capture locations were less than 100 kilometres to the north-east of the release area.

Historical radio-telemetry monitoring and population surveys suggest that this subpopulation has developed at least two habitat-use strategies: migratory and non-migratory. One group of caribou, identified as a non-migratory component of the Charlotte Alplands subpopulation, resides in alpine or parkland habitats year-round in the Trumpeter Mountain area. The migratory fraction of the herd appears to summer in alpine habitats south of Trumpeter Mountain and descends to forested habitats during winter. It is unclear where these animals spend the majority of the winter, but it is suspected that the Caribou Flats area is utilized. Since 2000, a south-easterly shift in distribution of caribou from Trumpeter Mountain to the McClinchy Lake and Caribou Flats area may have occurred. Mixing between the Charlotte Alplands subpopulation and the Itcha-Ilgachuz subpopulation likely occurs in the vicinity of Caribou Flats; mixing with the Rainbow Mountains subpopulation may also occur (Young et al. 2001). Calving that occurs in the Charlotte Alplands is done by animals that winter in the alpine or in pine forests between the Alplands and the Itcha-Ilgachuz Mountains (Youds et al. 2002).

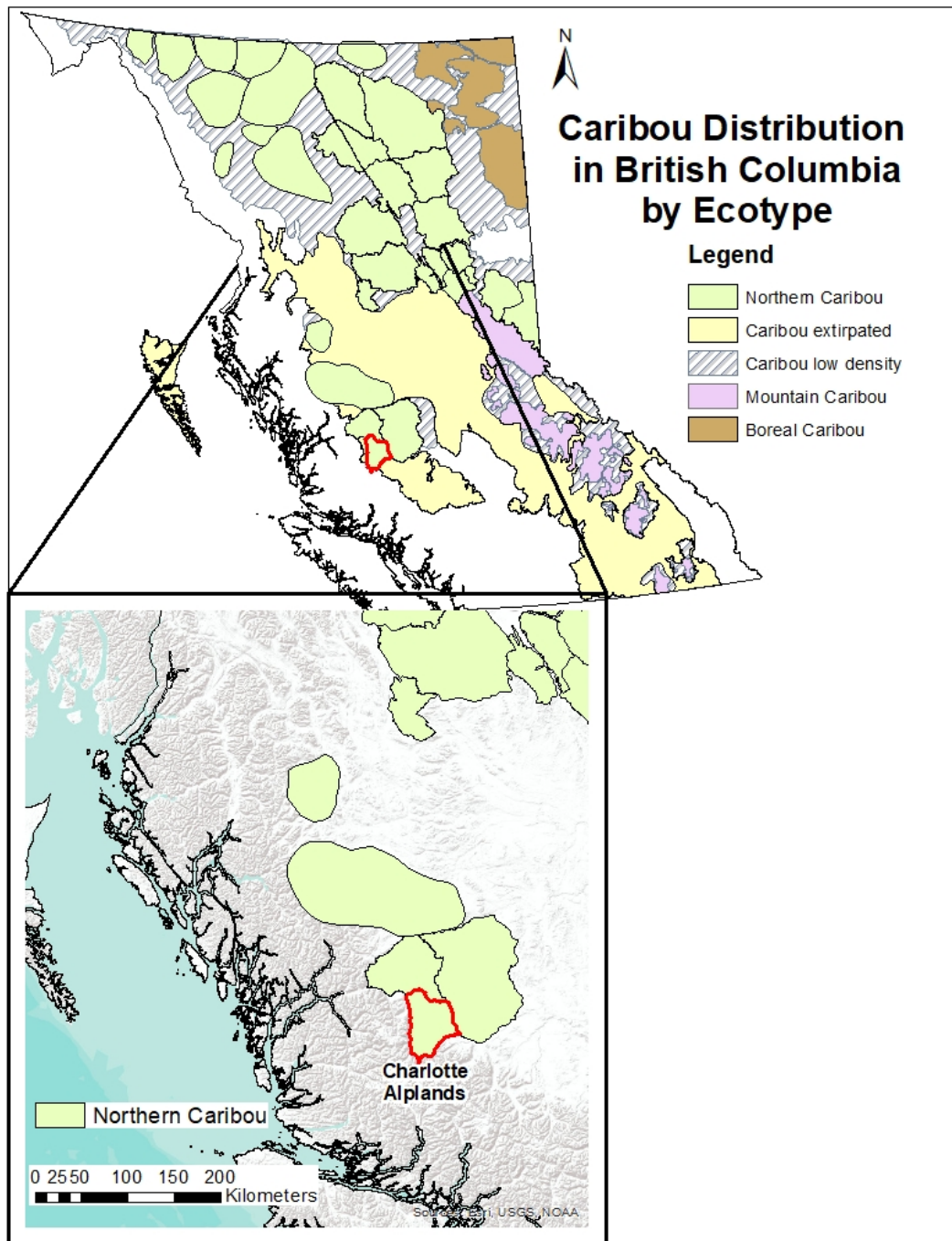


Figure 1: The location of the Charlotte Alplands subpopulation of woodland caribou. The approximately 2660 km² range (inset: red outline) is within the Cariboo Region.

2.2 HABITAT AND BEHAVIOUR

The Charlotte Alplands caribou subpopulation mostly inhabits the Western Chilcotin Uplands and Ranges “Ecosections”, west of Williams Lake, partially within the southern arm of Tweedsmuir Provincial Park (Young

et al. 2001). Habitat use information is limited for this subpopulation, and affected by the translocation of animals from the Itcha Ilgachuz range to repopulate the Charlotte Alplands range in the 1980's and early 1990's (Young et al. 2001). Charlotte Alplands caribou dominantly use Engelmann Spruce / Subalpine Fir and boreal Altai Fescue alpine habitats (mid and high elevation) followed by sub boreal Pine Spruce, and montane Spruce (low elevation) habitats (McNay 2011).

The translocated caribou have exhibited two distinct behaviours; migratory and non-migratory (Young et al. 2001, Cichowski and Maclean 2013, 2015). The non-migratory fraction live year-round at high elevations around the Trumpeter Mountain area near the northern edge of their range area (Young et al. 2001). The migratory group also occupy alpine habitats around Trumpeter Mountain area in summer, but then move to lower elevation forests in during the winter (Young et al. 2001).

2.3 POPULATION SIZE AND TREND

The Charlotte Alplands caribou subpopulation is small and declining. It is part of what likely used to be a broader regional Chilcotin population that included herds in the Itcha Ilgachuz and Rainbows mountains that have become fragmented over time (Figure 1). Since the early 1900s, few if any caribou have continuously occupied the Charlotte Alplands range area (Ritcey 1956, Spalding 2000). Population surveys conducted periodically since 52 animals were translocated from the Itcha Ilgachuz subpopulation in the 1980's and early 1990's. suggest that the Charlotte Alplands subpopulation has declined to approximately 23 animals (Figure 2). The cause of the decline is not entirely known, but thought to be due both to adult dispersal out of the range and predation driven mortality (Young et al. 2001).

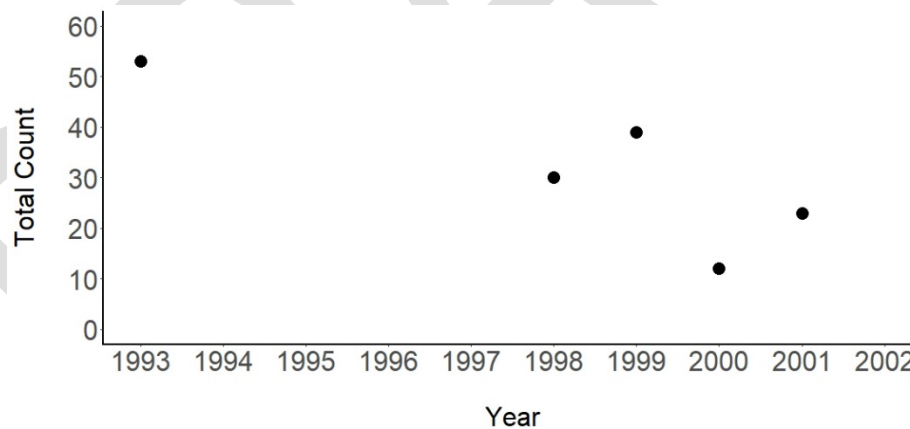


Figure 2: Caribou counts for the Charlotte Alplands sub-population. Counts made by Government of British Columbia staff in all years during mid-summer, post calving surveys (Young et al. 2001).

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Caribou recruitment is measured as percent of calves in the population observed during a spring census (Bergerud and Elliot 1986). Data for the Charlotte Alplands subpopulation is scant and inadequate to correctly understand or predict the population trend (Figure 3).

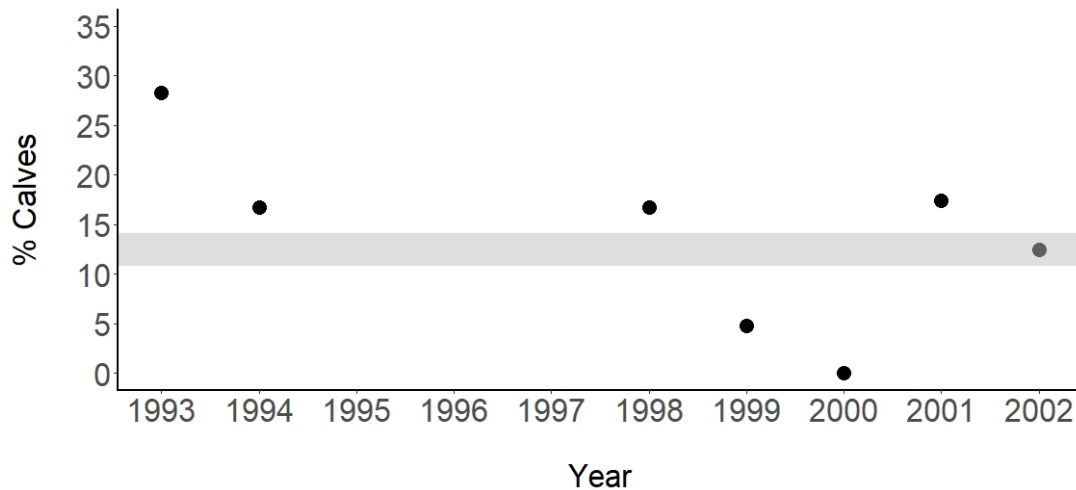


Figure 3: Caribou population recruitment measured in the Charlotte Alplands caribou subpopulation range. Recruitment is defined here as the percent of the total population that is in the calf cohort. Recruitment lower than approximately 10 to 12% is considered below a threshold that will balance natural mortality (grey band; Bergerud and Elliot 1986).

3 THREATS AND LIMITING FACTORS

Primary threats to caribou and their habitat have been summarized by McNay et al. (2008), COSEWIC (2015) and a variety of independent studies (e.g. James et al. 2004, Wittmer et al. 2005b, Courtois et al. 2007, Seip et al. 2007, Wittmer et al. 2007). In this review, threats are treated in isolation, but this does not discount the likelihood that they interact. Cumulative effects assessment (Sorensen et al. 2008, Johnson et al. 2015) is beyond the scope of this plan, but elements such as predation, human activities, and climate change are known to affect one another. Work on boreal caribou has demonstrated the value in developing comprehensive range planning for woodland caribou that considers interacting threats (Angelstam et al. 2004, Environment Canada 2012b).

Here, the following threats are considered:

1. Predation
2. Food limitation
3. Human activities
 - a. Industrial
 - b. Recreational
 - c. Other
4. Natural disturbance
5. Parasites and diseases
6. Climate change
7. Hunting and poaching

Small population size effects

3.1 PREDATION

GPS collar and radio telemetry studies indicate that the dominant, proximal cause of woodland caribou mortality is predation (Wittmer et al. 2013). Woodland caribou have evolved with their predators and have persisted despite millennia of predation (Bergerud 1988). While the predator species killing caribou vary regionally (wolf, black bear, grizzly bear, cougar), their impact on woodland caribou populations has increased as the result of three dominant processes: apparent competition mediated by alternative prey abundance (Hebblewhite et al. 2007), apparent competition mediated by expanding alternative prey distribution (Wittmer et al. 2007, DeCesare et al. 2010b, Latham et al. 2011a, Latham et al. 2011c), and enhanced predator access to woodland caribou habitat (Hayhurst 1983, Latham et al. 2011b). More generally, Bergerud (2007) has calculated that wolf densities greater than 6.5 wolves/1000 km² will result in woodland caribou declines. More recently, the federal recovery strategy identifies 3 wolves/1000 km² as a target (Environment Canada 2014).

The dominant cause of mortality in the Charlotte Alplands caribou subpopulation is predation (Young et al. 2001). The evidence comes from the fate of three caribou radio-collared on Trumpeter Mountain in 1999. All three died of wolf predation within 16 months of being collared.

3.2 FOOD LIMITATION

Woodland caribou are herbivores and rare among large mammals as lichen eaters (Johnson et al. 2004). While lichen makes up the bulk of their winter diet (Johnson et al. 2000, Parker et al. 2005), it is a smaller proportion of their summer diet (Denryter et al. 2017). And although habitat selection is predominantly thought to be influenced by predator avoidance, selected habitats must also be able to satisfy an individual's nutritional needs (O'Brien et al. 2006, Brown et al. 2007). Trade-offs between these two fundamental demands (avoiding predators, finding food) raises the potential for woodland caribou to be food or energy limited as they seek predator refugia (Poole et al. 2000, Gustine et al. 2006). When it has been considered, estimates of caribou food abundance typically far exceeds population needs (Courtois et al. 2007).

A vegetation assessment of the Charlotte Alplands showed a proliferation of terrestrial and arboreal lichens, particularly in the sub boreal pine - spruce habitat (Clement and Dalziel 2000). With a population density less than one caribou per 125 km² it is unlikely that food is limiting the Charlotte Alplands subpopulation.

3.3 HUMAN ACTIVITIES

Human activities have consequences for woodland caribou conservation throughout British Columbia. This section focusses on the consequences of human industrial, recreational and other (agriculture, highway, linear feature clearing) activities (Wolfe et al. 2000).

3.3.1 INDUSTRIAL

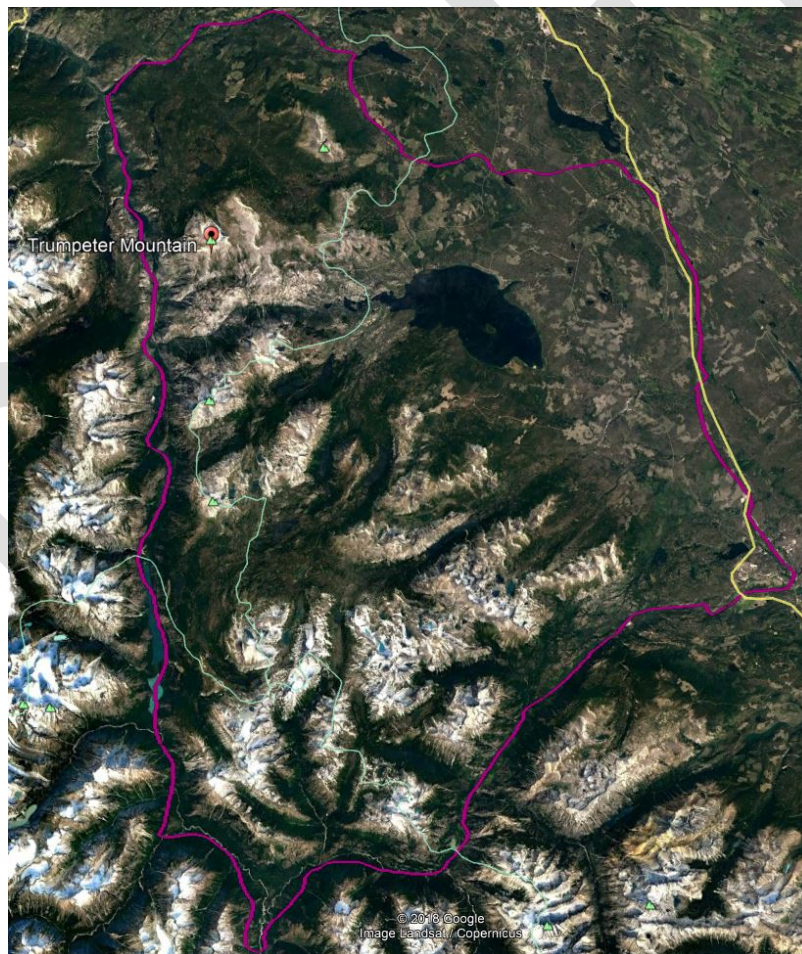
Industrial activities include forestry, mining, oil, gas and clean energy development. Caribou are affected by industrial activities both due to the presence of physical infrastructure as well as the resulting impacts on their habitat. A key concept to measure and understand industrial effects on caribou is the Zone of Influence (ZOI; Polfus et al. 2011). This is the area beyond the actual footprint of an industrial development or activity that affects caribou (Dyer et al. 2001). Zones of influence vary by activity and by the presence and absence of people.

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3.3.1.1 FORESTRY

Woodland caribou are an old-growth forest dependent species (Bergerud 2000). Hence, forest management affects their distribution and population dynamics. Although mountain caribou populations live seasonally in treeless, alpine ecosystems, all spend some of the year in forests. For this reason, forestry and natural disturbances will affect woodland caribou populations through habitat destruction and fragmentation (Smith et al. 2000). Forestry effects include very general habitat loss that reduces the amount of old-growth forest, to reduction in forest-based food resources to creating more, early seral forest habitat for apparent competitors (see below) such as deer and moose (Simpson and Woods 1987, Cichowski 1989, Seip 1990, Stevenson 1991, Cumming 1992). Factors, such as the type of forest regrowth (Cichowski 1989) and the size of cutblocks (Edmonds and Bloomfield 1984), play a role in the effect of forestry practices on woodland caribou populations. The ZOI of clearcuts for woodland caribou in Newfoundland was found to be 15 km beyond the actual cut block (Chubbs et al. 1993). Hence, even an array of small forest cutblocks can have a significant influence on caribou habitat availability.

There are about 145 km² of cutblocks in the range area of the Charlotte Alplands caribou subpopulation; approximately 18% of its total area. Forestry is concentrated in eastern and lowland portion of the range, east and



south of Charlotte Lake.

Figure 4: Google Earth image of the Charlotte Alplands range area (purple boundary; accessed January 26, 2018). Cutblocks are concentrated in the east and appear as pale polygons in the top right of the image.

3.3.1.2 MINING

Mine sites deter caribou both for the activities that occur there when they are active as well as for the habitat they destroy. Mines have a 2 km ZOI when they are active, but this shrinks to the physical footprint of the mine site when mines are dormant, inactive or abandoned (Polfus et al. 2011).

There are no mine developments or major mines in the Charlotte Alplands caribou subpopulation range.

3.3.1.3 OIL AND GAS

Oil and gas development threatens caribou populations through habitat destruction, human activity, access, habitat fragmentation and elevated predation (Dyer et al. 2001, Boutin et al. 2012, Hervieux et al. 2013). Given the spatial scope of oil and gas developments (well sites, access roads, pipelines, seismic lines) and the range of activities that take place in caribou habitat cumulative effects of this combined with other activities (e.g. forestry, hydroelectric) also play a large role in threatening resident caribou herds (Nitschke 2008). A study of the consequences to caribou of being disturbed by oil and gas exploration found that individuals in active plays can lose more than 15% of body mass over winter attributed to noise displacement (Bradshaw et al. 1998).

There is no oil and gas development in the Charlotte Alplands caribou subpopulation area.

3.3.1.4 CLEAN ENERGY

Clean energy refers to hydroelectric dams and wind farms. Hydroelectric reservoirs in caribou range can destroy or fragment habitat and cut movement corridors. Research in southern British Columbia correlated hydroelectric development with declines in caribou populations (Simpson 1987b). Hydroelectric dams, during their construction and operation, have a ZOI that exceeds their footprint (Nellemann et al. 2003). Wind farm development can destroy caribou habitat, reduce forage availability, displace caribou and increase early-seral habitat that promotes growth of alternative prey populations (British Columbia Ministry of Environment 2014).

The Upper Klinaklini Hydroelectric project remains in the permitting and pre-application stage as a major clean energy project that falls within the Charlotte Alplands caribou subpopulation range (www.gov.bc.ca/naturalresource/majorprojects). However, according to BC Hydro in 2010, this project was no longer being pursued, in part because its construction would impinge on the Great Bear Rainforest (Hunter 2010). This decision was overturned in 2012 (Gillis 2012) and the project continues to be active.

Mosley Watershed Hydroelectric project and wind electric project is located approximately 30 kilometers south and east of the Charlotte Alplands caribou subpopulation range. It is also in the permitting and pre-application stage (www.gov.bc.ca/naturalresource/majorprojects). Little information is available on this 96-Megawatt project.

3.3.1.5 OTHER

There are other major developments proposed, but on hold, in the vicinity of the Charlotte Alplands caribou subpopulation range, including aggregate mines and a wind farm, both to the northeast of the range.

3.3.2 RECREATION

Recreational use of caribou habitat refers largely to fall and winter activities, including snowmobiling, commercial heli-skiing, commercial cat-skiing and hunting. In some jurisdictions, winter tour skiing and mountaineering are also relevant recreational activities as is summer use with off highway vehicles (OHVs). Numerous studies have shown that wildlife generally and woodland caribou in particular, avoid mechanized winter activities to varying degrees (Simpson 1987a, Simpson and Terry 2000, Mahoney et al. 2001, Kinley 2003, Wilson and Hamilton 2003, Borkowski et al. 2006, Seip et al. 2007, Harris et al. 2014). Despite records of displacement, no study has been able to draw a direct link between winter recreational use and woodland caribou population decline, largely because effects are chronic and delayed.

3.3.2.1 SNOWMOBILE

Snowmobile use in caribou habitat can result in their displacement (Simpson 1987a, Webster 1997, Apps et al. 2001b, Brade 2003, Kinley 2003). Studies in British Columbia and elsewhere have shown that caribou are far less likely to occupy winter habitats that are being used for recreational snowmobiling than equivalent habitats without snowmobile use (Horejsi 1981, Mahoney et al. 2001, Seip et al. 2007). Mechanisms of displacement include caribou avoiding or fleeing snowmobiles while they are in use, or avoidance of snowmobile packed trails that facilitate access to caribou winter habitat by human hunters and natural predators (Bergerud 1988, James and Stuart-Smith 2000, Oberg 2001, Powell 2004, Polfus 2010, Whittington et al. 2011).

Snowmobiling has been identified as a critical disturbance, particularly in alpine areas in the Charlotte Alplands caribou subpopulation range. The small numbers of animals and their concentration in the Trumpeter Mountain area makes snowmobile disturbance on their winter range a particular threat. A 2002 management plan recommended that snowmobile access to Trumpeter Mountain be closed (Youds et al. 2002, Youds et al. 2011). As of winter 2016, snowmobiling was still permitted on Trumpeter Mountain and being promoted as a tourist activity.

3.3.2.2 HELI-SKI / CAT-SKI

Helicopter skiing and cat skiing are backcountry recreational activities that enable off-piste skiers to access high mountain terrain using either a helicopter or a tracked snow-cat that shuttles them to the top of ski runs. This is a commercial activity with numerous operators in British Columbia represented under one umbrella organization, HeliCat Canada (HCC). In southern British Columbia, HCC partners with the British Columbia government and non-government organizations to monitor caribou and helicat ski operations and minimize operational impacts.

Bella Coola Helisports operates to the west and south of the range of the Charlotte Alplands caribou subpopulation. Although they are an accredited member of HeliCat Canada (Tomm 2017), they do not report wildlife observations as part of the Mountain Caribou Recovery Implementation Plan (MCRIP Progress Board 2007).

3.3.2.3 OTHER

Backcountry tour skiing and mountaineering are recreational activities that occur in caribou habitat and can have an impact on woodland caribou conservation (Lesmerises et al. 2018). Backcountry skiing (a term embracing backcountry ski touring, unsupported, off-piste skiing and snowmobile assisted off-piste skiing) and mountaineering bring their participants into alpine areas that overlap with mountain caribou populations at sensitive times of the year (rut, winter) (Simpson and Terry 2000). Unexpected encounters between individuals

and people who are not in a vehicle can be very stressful for caribou and they can show a very strong flight response (McKay 2007). Other activities in caribou habitat also includes summer OHV use.

Backcountry skiing is popular in Tweedsmuir Provincial Park and mountainous areas bordering the park, however there has been no specific threat assessment nor are their winter access restrictions associated with this activity.

The Trumpeter Mountain area is a popular destination in summer for OHV users and sees moderate use and no restrictions on access (Youds et al. 2011).

3.3.3 OTHER

Other human activities occur in caribou habitat and have the potential to harm caribou and / or affect caribou populations. agriculture, transportation corridors, electrical transmission rights-of-way, oil and gas exploration and pipelines and hunting all have known effects on caribou populations (James and Stuart-Smith 2000, Wolfe et al. 2000).

3.3.3.1 AGRICULTURE

The effects of agriculture on caribou conservation are largely the result of conversion of low-elevation habitat to crops and pasture (habitat destruction) and the food subsidy they provide for alternative prey (deer, elk, moose). Habitat conversion is functionally similar to clearcut logging in that it removes overstory vegetation and can alter landscape properties like vegetation composition and local snow depth. Growing hay and grain crops within or adjacent to caribou range has the potential to directly increase the regional population size of deer, elk and moose that eat crops (Bowden 1985, Côté et al. 2004, Butler et al. 2008, Hatter et al. 2017) and indirectly their predators like bears and wolves. These, in turn, predate caribou, putting downward pressure on caribou populations (apparent competition).

Spread of disease and parasites from and to cattle is also a threat to woodland caribou from agricultural operations (Neiland et al. 1968, Trainer 1973, Wobeser 1976, Sifton 2001), and is discussed in section 3.5 (Parasites and Disease).

Agriculture is not a common activity in the Charlotte Alplands caribou subpopulation range. There are two Agricultural Land Reserve areas in the far eastern portion of the range and a 2011 census of the area shows very few people engaged in farming or ranching in the region (80 to 105 in a vast area covering the central interior mountains).

3.3.3.2 MAJOR HIGHWAY CORRIDORS

Where they occur in caribou habitat, highways have strong, negative effects on caribou populations (Johnson and Todd 1977, Curatolo and Murphy 1986, Apps and McLellan 2006). Vehicle activity on highways poses a movement barrier for caribou as they are either reluctant to approach a roadway or get killed trying to cross (Dyer et al. 2002, Rytwinski and Fahrig 2012). Habitat and population fragmentation results as populations are unable to move between ranges. Highways and roadways can also give people access to caribou range that increases the potential for disturbance. Linear disturbances, such as roadways have a large ZOI (Wolfe et al. 2000, Oberg 2001, Polfus et al. 2011, Whittington et al. 2011).

Highway 20 runs along the eastern boundary of the Charlotte Alplands caribou subpopulation range for approximately 41 kilometers. Between 1998 and 2007 there were 747 recorded wildlife mortalities on Highway 20 (Sielecki 2010) but none of these were caribou (most are deer and moose).

3.3.3.3 LINEAR FEATURES

Linear features are narrow land disturbances that tend to traverse entire ranges. They include seismic cut lines, pipelines, forestry roads and overhead power transmission rights-of-way. Linear features are not necessarily cleared to a roadway standard, but enable both four-wheel-drive access and ease travel for predators and alternative prey (Oberg 2001, Hebblewhite et al. 2010a). One hypothesized effect is that linear features facilitate predator movement into and within prey habitat thereby increasing predator-prey overlap (DeMars and Boutin 2017).

There are 442 kilometers of forest roads in the Charlotte Alplands caribou subpopulation range, concentrated in the northeastern, lowland portion of the area. There are also 266 km of trails and secondary roads in the region. There are no other linear disturbances (railways, electrical transmission rights of way, pipelines, etc.) in this range.

3.3.3.4 HUNTING

No open seasons for caribou have been in force within the range of the Charlotte Alplands herd (WMU 5-6) since 1956 (Youds et al. 2002). While hunting may have played a role in their early 20th century decline, it is not inhibiting recovery.

3.3.3.5 POACHING

Caribou poaching is an unregulated, indiscriminate and largely unknown source of mortality across their range. Animals are taken in any season, of any age or sex and in any number. This kind of additive mortality can have a profound impact on caribou populations in British Columbia (Johnson 1985) and interacts with habitat management and human access (Stevenson 1990) resulting in population declines.

In the entire Cariboo region, there were 30 instances from 2012 to 2018 where tickets were issued for killing wildlife not within an open season (poaching; Government of British Columbia 2017a). There are not enough details available to know whether caribou were killed in any of these instances, but it is possible.

3.4 NATURAL DISTURBANCE

Fire as a natural disturbance can have large-scale and long-lasting impacts on woodland caribou (Environment Canada 2014). Fire kills individuals, destroys habitat and changes predator-prey dynamics by improving habitat for alternative prey and increasing wolf-caribou spatial overlap (Robinson et al. 2012). Fire suppression, on the other hand, has increased the possibility of very large and intense fires that could alter entire range areas (Environment Canada 2012a). Mountain pine beetle infestations are also natural disturbances with large-scale and long-term effects (Cichowski and Williston 2005).

There have been approximately 854 km² of wildfire burned forest in the Charlotte Alplands caribou subpopulation range; approximately 38% of the entire area. Unlike many areas of the province, the fire pattern is dominated by a few very large fires, including two that burned in 2017 (Figure 5).

Approximately 1050 km² of pine forest in the Charlotte Alplands caribou subpopulation range has been severely infested by Mountain pine beetle (39.5%). A model of caribou habitat use in the Charlotte Alplands range with respect to mountain pine beetle affected habitats using radio-collared animals suggested that they neither select

nor avoid most mountain pine beetle affected areas (Apps and Dodd 2017). They did appear to avoid forests that were mountain pine beetle infested 11–13 years prior to the study (Apps and Dodd 2017).

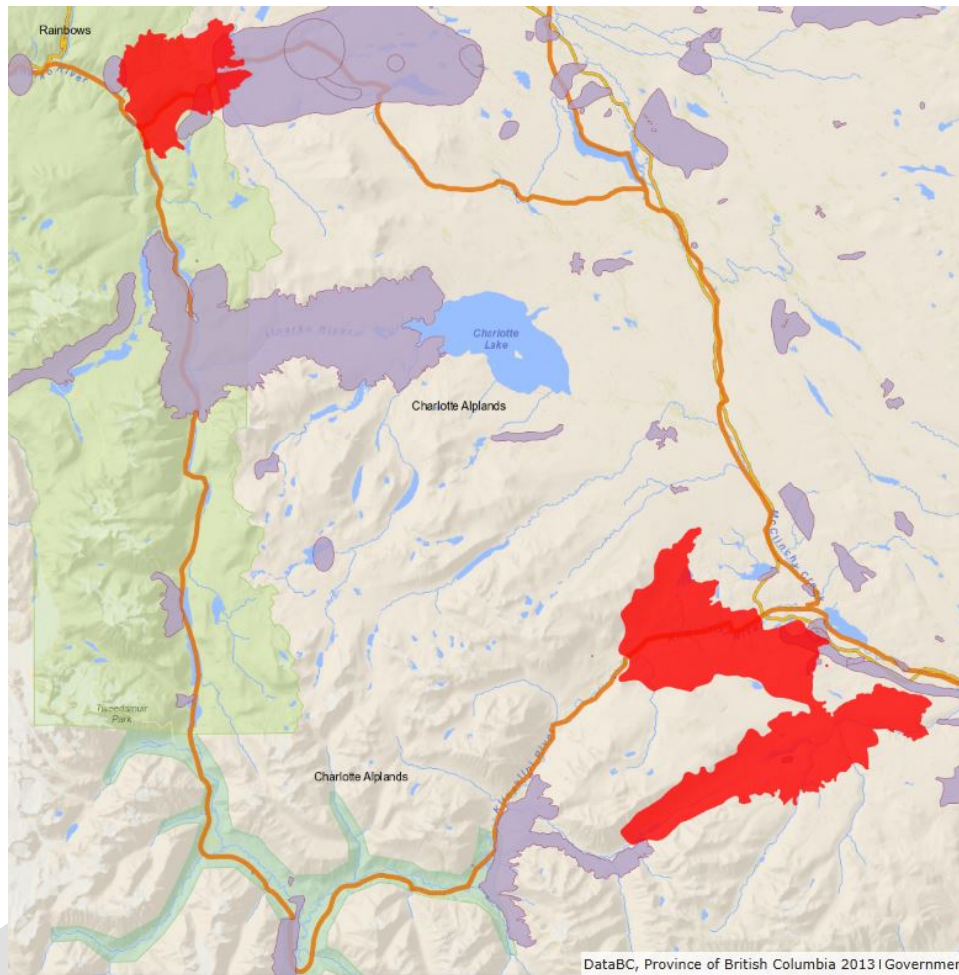


Figure 5: Outline of historical (red) and 2017 (violet) wildfires in and adjacent to the Charlotte Alplands caribou subpopulation range. The caribou range boundary is drawn in orange and the light green area is Tweedsmuir Provincial Park. Source iMapBC <http://maps.gov.bc.ca/ess/sv/imapbc/>.

3.5 PARASITES AND DISEASES

Caribou are generally susceptible to a range of native and introduced diseases and parasites found in other ungulate species. Brucellosis is a contagious disease of ruminants which can cause spontaneous abortions particularly among first time breeding females (Neiland et al. 1968). The bacteria causing brucellosis in caribou is primarily *Brucella suis* that also affects swine (Jones 2014). Caribou are highly susceptible to the meningeal worm (*Parelaphostrongylus tenuis*) that is fatal in some, but not all, deer species (Anderson 1972, Trainer 1973). Early reports of woodland caribou declines in eastern Canada attributed it to their overlap with white-tailed deer who are meant to be the primary host of *P. tenuis* (Cringan 1956). Besnoitiosis is a disease caused by infection with the protozoan parasite *Besnoitia besnoiti* and is known in wildlife and livestock around the world (Walden et al. 2014). It can cause spontaneous abortions in pregnant females and infertility in males, but it is primarily expressed as facial hair loss in infected animals. It has been found in free-ranging woodland caribou in northern Saskatchewan in 1976 (Wobeser 1976), captive caribou (Glover et al. 1990).

Caribou are also susceptible to tape worms (*Echinococcus granulosus*, *E. multilocularis*, *Taenia ovis krabbei*), bot flies (Oestrinae), warble flies (Hypodermatinae), liver flukes (*Fascioloides magna*), lumpy jaw (*Actinomyces bovis*), muscle worms (*Parelaphostrongylus andersoni*, *P. odocoilei*), and winter tick (*Dermacentor albipictus*) (Miller et al. 2014b).

There is no reported occurrence of brucellosis or tuberculosis in British Columbia in any species. Severe symptoms of Besnoitiosis have not been found in caribou in British Columbia (Miller et al. 2014a). However, many of the other parasites can be found in woodland caribou in British Columbia with affects on individuals, but no reported population-effects on the Charlotte Alplands subpopulation. Chronic wasting disease, which has the potential for strong negative effects on this subpopulation, has not been detected in British Columbia in any species (Schwantje 2015).

There is no herd specific research or reports on the Charlotte Alplands caribou subpopulation related to disease. Given that this herd is largely comprised of animals transplanted from the Itcha Ilgatchuz herd, an evaluation of their disease and parasite status is warranted (Ray et al. 2015).

3.6 CLIMATE CHANGE

For species such as woodland caribou that undergo seasonal migrations, have predators with seasonal cycles, respond to plant and insect phenology and are sensitive to snow depth and season length, climate change will have direct effects (Vors and Boyce 2009). With alpine tundra habitats predicted to shrink in a warming climate, the effects of climate change on caribou may be profound (Harding and McCullum 1997, Swift and Ran 2012). Natural resource industries, such as forestry and oil and gas are both vulnerable and have a role to play in climate change mitigation (Houghton et al. 2001). How they adapt may also have consequences for caribou (Racey 2005). Climate change adds much complexity to managing caribou for long-term recovery, including how it affects the distribution of alternative prey (Seip 2008, Dawe and Boutin 2016) and available food (Parker et al. 2009).

Climate change models for British Columbia suggest that areas in the Cariboo Mountains will experience increased winter snow loads (Kinley et al. 2007, Dawson et al. 2008, Griesbauer and Green 2010) that could affect food access and mobility for animals. Such a change could be positive for snow adapted, arboreal lichen eating caribou. This benefit could be negated by more frequent freeze-thaw cycles (Plummer et al. 2006) that will improve the ability to predators to move across frozen crusts as well as limit access to food for caribou (Gillett et al. 2004, Dawson et al. 2008) and nutrient content of summer forage (Lenart et al. 2002). Predictions of forest type shifts due to climate change mediated by fires suggest that black spruce may be replaced by white spruce and lodgepole pine, affecting caribou habitat (Hebda 1997, Wittmer et al. 2010).

There has been no subpopulation-specific climate change research conducted on the Charlotte Alplands caribou. Nevertheless, their mountainous habitat, location in a high-snow area and movement barriers in the low elevation portion of their range suggests that they will be vulnerable to climate change effects.

3.7 SMALL POPULATION SIZE EFFECTS

Small population effects include several threats to caribou that are unique to small (approximately less than 50 animals) and isolated subpopulations. These include reproductive and genetic isolation (McDevitt et al. 2009), predation (Sinclair et al. 1998, Abrams 2002), Allee effects where small groups are more vulnerable to predators

(McLellan et al. 2010), risk of demographic bottlenecks where single-sex or male-dominated cohorts lead to population decline and increased chance that localized natural events such as avalanches (McClung 2001), fires or floods that kill a disproportionate number or key members of a small herd (Hebblewhite et al. 2010b). Movement barriers that prevent inter-population dispersal exacerbate small population effects by preventing small or extirpated populations of rescue (Gilpin 1990). Small population effects can be a particular hazard for species with slow growth rates (Laikre et al. 1997).

The Charlotte Alplands caribou subpopulation has been extirpated in the past, re-established by translocation and is currently very small and declining (Young et al. 2001, Youds et al. 2002). It is extremely vulnerable to becoming extirpated again due to basic small population effects.

The genetic viability of caribou subpopulations is dependant upon their size and dispersal (inter-population migration) ability (Weckworth et al. 2012). Small populations are subject to genetic drift that is a simple function of their small and unique gene pool as well as reduced gene flow (Boulet et al. 2007). Populations that are small and declining are particularly susceptible to genetic isolation (Laikre et al. 1997, Weckworth et al. 2012).

The Charlotte Alplands caribou subpopulation have gone through several genetic bottlenecks; first in the early 20th century when its population was reduced to very few, or no, individuals, and then again when 50 animals were translocated from the Itcha Ilgatchuz herd in the 1980's and 90's. Although they are in close proximity to other subpopulations (Rainbows, Itcha Ilgachuz; Figure 1), there are highway, burned forest and cutblock barriers within connecting habitats (Figure 4, Figure 5). This makes the Charlotte Alplands also vulnerable to genetic isolation.

4 MANAGEMENT HISTORY

4.1 HABITAT

The Charlotte Alplands caribou live in a mountainous, forested landscape that is partly within areas protected from forestry but largely in unprotected lowland river valley (Figure 5). They select habitats most frequently within the high elevation, protected areas (Apps and Dodd 2017). Importantly, these areas do not have secure connecting habitats that both isolates individuals within the subpopulation and places dispersing / migrating animals at high predation risk (Apps et al. 2001a).

Habitat management in this area is overseen by the provincial government and implemented by the forestry industry through application of their annual allowable cut. Active restoration takes place in the form of cutblock replanting that accelerates seedling establishment (Cichowski 1989, Cichowski 1996). For their part, forestry regulations prescribe practices to manage resource use and protect forests that are caribou habitat (Seip 1998). Despite recommendations for habitat management in this area, no habitat targets for the Charlotte Alplands subpopulation have been established (Youds et al. 2002).

4.1.1 PROTECTION

Provincial park legislation does not automatically protect caribou habitat from forestry, mining and petroleum resource activities. When land is acquired for a provincial park, with it comes the mineral and coal leases as well as timber and related licences (with compensation) (Government of British Columbia 1996a). Hunting is also prohibited (Government of British Columbia 1996b). Petroleum and natural gas tenures are

permitted by the British Columbia Park Act (Section 33 Government of British Columbia 1996a) but are not relevant in this subpopulation range.

Approximately 350 km² of Tweedsmuir Provincial Park overlaps with the range of the Charlotte Alplands caribou subpopulation (13%). Wildlife Habitat Area 5-087, established to protect largely the Rainbows caribou subpopulation also overlaps marginally with the Charlotte Alplands caribou range along its northern boundary. It covers only about 25 km² of its range (1%). There is no designated Ungulate Winter Range in the range of the Charlotte Alplands caribou subpopulation.

4.1.2 ENHANCEMENT AND RESTORATION

Large-scale habitat restoration and enhancement for caribou protection and recovery generally refers to oil and gas activities (well sites, seismic lines) rather than forestry. Although there is research on best management practices for restoring caribou habitat following logging (Newsome et al. 2016) their recommendations (avoiding pine in high elevation caribou habitat for instance) has yet to be widely adopted in practice (B.C. Ministry of Forests 2002). Habitat restoration is very expensive and rarely undertaken at a scale that is beneficial to caribou (Schneider et al. 2010, Dickie et al. 2017). Small-scale habitat restoration actions, like decommissioning roads, replanting seismic lines or installing movement and visual barriers along pipelines can be effective (MacNearney et al. 2016, Pigeon et al. 2016, DeMars and Boutin 2017). Nevertheless, it is considered an essential step for caribou recovery in the absence of protection required for natural habitat regrowth that can take tens of decades.

Habitat restoration specifically for caribou recovery has not been conducted at any large scale in the range area of the Charlotte Alplands caribou subpopulation.

4.2 RECREATION AND ACCESS MANAGEMENT

Road access to woodland caribou habitat elevates conservation threats including conflicts with motor vehicles, hunting pressure, habitat fragmentation and in some cases predation (James et al. 2004, Apps and McLellan 2006, Seip et al. 2007, Apps and Dodd 2017). A key element of caribou life history is to seek separation from competitors (moose, deer, elk) and their predators (Bergerud and Elliot 1986, Wittmer et al. 2007). Constructed access roads into woodland caribou habitat connects them to their threats and contributes to population declines (Dussault et al. 2012).

There are 442 km of forestry roads (active and retired) in the Charlotte Alplands caribou subpopulation range. Because of the provincial park and inaccessible mountainous terrain in their range, forestry roads are unevenly distributed, and make for 0.17 km road / km² range area largely in summer habitat. This is low (Dyer et al. 2002, Smith 2004, Apps and McLellan 2006, Beauchesne et al. 2014, COSEWIC 2015, Bennett 2017). At this density, roads should not threaten caribou recovery. However, their concentration in low-elevation habitat, suggests that management as part of a plan to regulate seasonal access will be a part of caribou persistence and recovery. An area encompassing parts of the Dean River Road, Kappan Main Road and secondary roads north of Charlotte Lake have access restrictions for 4 × 4 vehicles. These occur on the northern edge of the Charlotte Alplands caribou subpopulation range (map 12 in Youds et al. 2002). The Cariboo-Chilcotin Land Use Plan acknowledges that road development in this area will have detrimental effects on this and neighbouring herds (Youds et al. 2002).

4.2.1 SNOWMOBILE

There are no special recreational snowmobile access zones in the range of the Charlotte Alplands caribou subpopulation range.

4.2.2 HELI-SKI / CAT-SKI

The only HeliSki operation in the area of the Charlotte Alplands caribou subpopulation is Bella Coola Helisports. Their ski tenure is along the western and southern boundaries of Tweedsmuir Provincial Park and abut Charlotte Alplands caribou habitat. Although this company is a member of HeliCat Canada, they do not participate in annual wildlife reporting as part of the Mountain Caribou Recovery Implementation Plan (Tomm 2017).

See section 3.3.2.2 for general threat information.

4.2.3 OTHER

Recreational access to the Charlotte Alplands range area, based out of Anahim Lake, is promoted as and has become a winter destination for backcountry ski-touring, snowshoeing and cross-country skiing. There are ski clubs in the region that map routes, groomed trails and winter facilities for residents and tourists. Snow conditions in this region are best in late winter and spring (Travel British Columbia 2011).

4.3 PREDATORS

Unsustainable predation is acknowledged as a key, proximal mechanism of woodland caribou declines across Canada (Bergerud and Elliot 1986, Bergerud 1988, Environment Canada 2012b, 2014). Woodland caribou metapopulations have persisted despite ongoing predation from wolves, bears (black and grizzly) and cougars for millennia, but the existential impact of predators on caribou is a recent phenomenon. Human changes to habitats, fragmentation, movement barriers, dynamics of alternative prey and predator access to caribou habitat have led to conditions where caribou subpopulations are permanently extirpated.

Shrinking old-growth forest caribou habitat has forced caribou into increasingly smaller ranges, making their home range potentially more predictable to predators. Seasonal migratory routes track through predator rich areas and bring them into closer proximity to alternative prey species that can sustain higher predator populations (Seip 1992, Apps et al. 2013). Road and seismic line clearing and winter trail packing makes travel for predators into caribou critical habitats more efficient, elevating predation (Dickie et al. 2016). And, finally, a shift in forest structure towards younger age classes has favoured moose, deer and elk at densities that can support greater predator densities. Not only does this shift bring woodland caribou into closer proximity to predators, but it also promotes greater predator abundance (Hebblewhite et al. 2007).

While habitat changes facilitate unsustainable predation, habitat regrowth and restoration occurs too slowly to recover woodland caribou in the short-term. As a result, direct predator management is a caribou recovery tool to ensure that populations persist long enough to benefit from habitat restoration efforts (Wilson 2009, Brook et al. 2014, Hervieux et al. 2014).

4.3.1 WOLF MANAGEMENT

Wolves are an important, year-round caribou predator. Caribou populations in northern British Columbia were shown to decline when wolf densities were 9–10/1000 km² but increased at wolf densities from 1–4/1000 km² (Bergerud and Elliot 1986). For this reason, target wolf densities that would enable caribou recovery are set

to 6.5/1000 km². In the absence of effective habitat or alternative prey management to achieve these densities, direct wolf management must be undertaken to achieve caribou conservation goals.

In 2009–10 a wolf inventory was undertaken in the west Chilcotin region that included the eastern, unprotected area of the Charlotte Alplands caribou subpopulation range (Davis 2009). The Charlotte survey as part of this inventory found 0.054 wolf tracks/day/km surveyed, which was average for the area. This is not translated into an absolute wolf density but positively related to habitat and prey track density (Davis 2009).

Wolf predation has a large effect on the caribou population in the Charlotte Alplands (Young et al. 2001). No direct wolf management accompanied the caribou translocation that was conducted in the late 1980's and early 1990's (Hayek et al. 2016b), although 8 wolves were killed by hunters in 1990. Between 1980 and 2013, 30 wolves were killed by resident hunters (all in 1990, 2002 and 2011) and 4 killed by non-residents. A bag limit of 3 wolves per hunter in WMU 5-06 remains in force (Government of British Columbia 2017b). In the absence of a wolf census, it is difficult to know if this level of removal can affect wolf densities enough to benefit caribou.

4.3.2 COUGAR MANAGEMENT

Cougars are not common in the Charlotte Alplands caribou subpopulation range, but they are present (Spalding 1994). In British Columbia, particularly in the south (Wittmer et al. 2005a), cougars are a significant caribou predator. Cougar densities respond positively to deer density, and as deer densities climb, so will cougar densities. However, in west-central and northern British Columbia, there are only rare reports of cougar predation on caribou. There is a cougar hunting season in the wildlife management units that overlap with the Charlotte Alplands subpopulation range, but from 1985 through 2013 only 5 cougars were killed by resident and non-resident hunters. The objective of this hunt is not explicitly to manage this predator to benefit caribou, and there is no estimate of the number of cougars in this area. This level of management does not likely affect caribou population dynamics.

4.3.3 OTHER

Grizzly bears, black bears and wolverines are also woodland caribou predators (Seip 1992, Wittmer et al. 2005a). However, their protection status, seasonality and / or low predation rate and dependence on caribou as food does not warrant management to benefit caribou populations. In rare cases associated with intensive caribou management programs (captive breeding, maternity penning) bear or wolverine removal may be conducted.

There are between 8 and 15 grizzly bears / km² over parts of the Charlotte Alplands and Rainbows caribou subpopulation range (Youds et al. 2011). There are 11 traplines that are within or bounding on the Rainbows range. Operators have the potential to remove caribou predators, including bears as part of their licences, but numbers have not been consistently reported. But from 1976 to 2013, 152 hunter killed black bears and 25 grizzly bears were reported in wildlife management units 5-06 and 5-11. This is unlikely to have had a depressive effect on bear populations.

Caribou predation by bears has not been documented in this area.

4.4 PRIMARY PREY

Moose, elk, white-tailed deer and mule deer (including black-tailed deer) share large, mammalian predators such as wolves, bears and cougars. In a process known as apparent competition (Holt 1977), an increase in one

prey population will lead to a decrease in a second prey population. It appears as if these two, prey species are competing with each other, but the decline of the second prey species is due to the boost that their shared predator population experiences because of the high density of the first prey species. Woodland caribou have avoided apparent competition by occupying habitats distant from other deer species. However, changes to their habitats, movement barriers and facilitated predator access have limited their access to continued isolation. Across their range, woodland caribou populations have been subject to apparent competition (DeCesare et al. 2010b, Wittmer et al. 2013). For this reason, managing primary prey, either directly through hunting quotas, or indirectly through habitat management, has become a caribou management action.

4.4.1 MOOSE MANAGEMENT

Throughout British Columbia, moose are a common and sustaining prey of wolves (Messier 1994). But their expanding range (Bergerud and Elliot 1986), a wolf numerical response to moose densities (Messier and Joly 2000) and apparent competition with woodland caribou mean that even moderate moose densities in or adjacent to caribou range poses a threat to caribou persistence (Seip and Cichowski 1996, Lessard et al. 2005, Serrouya et al. 2017). Moose densities respond positively to early seral forest habitat and negatively to human hunting, and moose numbers have been falling around the province in response to harvest pressure (Moose Management Technical Team 2015). Lessard et al. (2005) found that a 10% increase in the moose harvest could stabilize caribou populations.

Directed moose management has not been undertaken in the range area of the Charlotte Alplands caribou subpopulation. Moose population trends were re-evaluated by McNay et al. (2013). In Game Management Zone 5D, where the bulk of moose habitat in the Charlotte Alplands caribou subpopulation range lies, 8 surveys were conducted from 1985 to 2012. They found that moose densities had declined from 2005 to 2012 over a reasonably large area (24,543 km²) and in 2012 were approximately 0.2 moose / km². Target moose density for this region is 0.4 moose / km². Calves / 100 cows, an estimate of population growth potential, was below the 40 threshold suggested for population stability (McNay et al. 2013). Serrouya et al. (2017) found that caribou adult survival increased in southern British Columbia at moose densities were experimentally reduced to 0.2 moose / km².

4.4.2 DEER MANAGEMENT

Managing deer populations in support of caribou conservation is a challenge. Both mule and white-tailed deer can support predator populations that have negative effects on caribou (Latham et al. 2011c). Both can transmit diseases that could be catastrophic were they to spread to caribou populations (see above; Habib et al. 2011). Where mule deer and white-tail deer ranges overlap, mule deer tend to decline, perhaps also due to apparent competition (Robinson et al. 2002). In British Columbia, there is active management to increase mule deer populations through habitat protection (British Columbia Ministry of Environment 2017) and manage white-tailed deer populations through hunting regulations (British Columbia Ministry of Forests, Lands and Natural Resource Operations 2015). Neither are strictly regulated by either predators or food. White-tailed deer populations respond strongly to food availability as well as hunting or predation (Fryxell et al. 1991, Messier 1991, Dumont et al. 2000). Mule deer are similar, but tend to be more vulnerable to predation, food availability, severe weather and loss of native winter habitat (Pierce et al. 2012, Forrester and Wittmer 2013, Bergman et al. 2015). Indeed, regulating deer density using hunter tags must counter some difficult trends (declining number of hunters, increase prey refugia from hunters and increased use of residential areas by deer) to be successful (Brown et al. 2000). Managing deer populations to a lower density will require managing artificial food sources (hay, grain), and access to high quality habitats as well as increased hunting pressure.

White-tailed deer are rare in the range area of the Charlotte Alplands caribou. Hunting records show that despite 349 hunter days between 1987 and 2013, no white-tailed deer were killed in WMU 5-06. This contrasts with mule deer of which 556 were hunter killed during that time in both WMUs overlapping in the Charlotte Alplands caribou range. Because white-tailed deer are rare, and efforts to protect and recover mule deer are being undertaken across the province (British Columbia Ministry of Environment 2017), it is unlikely that deer management will occur in this area.

4.4.3 OTHER

Elk, like moose and deer, are wolf prey and could potentially facilitate apparent competition with caribou (DeCesare et al. 2010b).

Elk are not known to occur in the Charlotte Alplands caribou subpopulation range, although from time to time translocations from the Quesnel area have been proposed.

4.5 POPULATION REINFORCEMENT

The International Union of Conserving Nations (IUCN) has established guidelines for reintroductions and related conservation translocations (IUCN Species Survival Commission 2012), of which population reinforcement is one tool. In this document, reinforcement is defined as an intentional movement and release of an organism into an existing population of conspecifics within its indigenous range. It differs from reintroduction in that the species has not been extirpated from that range (DeCesare et al. 2010a), but existing populations are being added to. The management tools described in this section are based on the assumption that caribou populations are being reinforced and not reintroduced.

4.5.1 MATERNITY PENNING

Maternity penning (sometimes called maternal penning) is a technique to increase calf recruitment by capturing and temporarily penning pregnant females to protect them from predators. These females are held through parturition and for up to six weeks after calves are born. By this time calves are large and strong enough to better avoid predators, improving their survival probability and population recruitment. Thus, if young-of-the-year predation is a contributing factor to unsustainable population decline, maternity penning can be an effective mitigation (Hayek et al. 2016a). Maternity penning is an *in situ* method where the pen is constructed within their home range and animals are never moved outside of their home range.

There is no maternity penning operating or planned for the Charlotte Alplands caribou subpopulation range.

4.5.2 CAPTIVE BREEDING

Captive breeding is a conservation method that captures both male and female animals and moves them permanently to a facility where they are bred under controlled conditions (IUCN Species Survival Commission 2012). The objective is to create a surplus of female calves in the breeding facility that can then be translocated to ranges to reinforce small populations. To be effective, recipient populations should have low adult female survival that this action can reverse. This is a *ex situ* approach that takes animals away from their home range and returns animals to ranges that may not be where they originate (Harding and McCullum 1997). A number of factors, such as source animals, animal husbandry, genetic bottlenecks, gene mixing with destination herds, status of destination herds, disease transmission, fate of male calves among others must be considered in such an effort (Dolman et al. 2015, Hayek et al. 2016a).

Because the Charlotte Alplands is very small, they could be a candidate *recipient* population for a captive breeding effort. They would be a poor candidate to provide individuals as a source for captive breeding due to their small size.

4.5.3 TRANSLOCATION

Translocation is the reinforcement of small populations by moving animals directly from a sustainable population (Ray et al. 2015, Hayek et al. 2016a). The goal is to rapidly increase the numbers of animals of all ages and sexes in the target population (Miller et al. 2007, Decesare et al. 2010c). Animals are captured in their home range, transported to the target range and either soft released in a temporary pen that offers an opportunity for individuals to adjust to their new surroundings, or hard released directly into the destination habitat.

Compared with other reinforcement methods, translocation is a relatively cost-effective approach to add animals to small populations. It has been tried successfully and unsuccessfully with caribou populations in Canada and British Columbia (Compton et al. 1995, Stronen et al. 2007, Hayek et al. 2016a).

During five capture events between 1984 and 1991, 52 caribou were translocated from the Itcha Ilgachuz herd to the Charlotte Alplands range area where there were few or no extant caribou (Young et al. 2001). The subsequent lack of threat management has meant that this subpopulation has declined (Figure 2). Much was learned in this effort including likely fates of individuals, return migration of adults, and how animals distributed in a novel area (Young et al. 2001).

No future translocations are being planned, and would require threat management to be considered (Hayek et al. 2016b).

4.5.4 OTHER

The proximate cause of caribou population declines is predation. While predator management is a direct way to manage this threat, an alternative solution is predator exclusion fencing (Hayek et al. 2016a). In part, this approach is linked to direct predator management as any predators within an exclusion fence would be lethally removed, and it is linked to maternity penning as this is a form of small-scale, temporary predatory exclusion fencing. However, there are recent, and very large scale (thousands of hectares), proposals to erect predator exclusion fencing as a mitigation for caribou populations where habitat restoration is an unrealistic goal but the caribou population is critically low (Boutin and Merrill 2016, Cornwall 2016, Hebblewhite 2017, Proulx and Brook 2017).

To date, this conservation method has not been attempted anywhere, including in the range of the Rainbows caribou subpopulation (Antoniuk et al. 2016).

4.6 STEWARDSHIP/OUTREACH

Local communities and stewards are an essential part of caribou recovery. Management actions to recover very small populations are at times expensive, controversial and require the imposition of new and restrictive regulations (Hayek et al. 2016a). Gaining the social licence to conduct management actions like predator management, translocation, captive breeding and access restrictions requires outreach. Effective outreach programs to local communities and regional populations must accompany planning for management actions (Antoniuk et al. 2015). This includes information to municipal and regional administrations, business

stakeholders, recreational groups, conservation organizations, farming organizations, hunting clubs among others (see below). Outreach must be timely, targeted and inclusive to be effective (Wilkinson 2010).

Stewardship is the active participation by citizens or citizen groups in conservation and recovery programs. For caribou this can take a number of forms ranging from ambassador programs where citizen volunteers promote caribou conservation at community events, habitat protection through conservation offsets (Robichaud and Knopff 2015) to fund-raising and operating reinforcement activities such as maternity pens.

Stewardship for the Charlotte Alplands caribou subpopulation is challenged by the remote location of this herd. Although Highway 20 runs along its eastern boundary, it is difficult to access this area and it is distant from its closest, major centres of Williams Lake (225 km to the east) and Bella Coola (100 km to the west). While its relative inaccessibility has benefits for recovery, it challenges the ability for people to connect to these animals. They would be best served as part of an outreach strategy that links the greater population of Itcha Ilgachuz, Rainbows, Tweedsmuir and Telkwa subpopulations (Youds et al. 2002).

4.7 RESEARCH

Every caribou subpopulation in British Columbia requires some degree of management action; habitat protection or restoration, population reinforcement, alternative prey management or predator control. Yet few caribou subpopulations in British Columbia have sufficient, herd-specific information to enable confident management decisions. To fill these gaps, scientific research and traditional ecological knowledge must be gathered to fill critical gaps.

There has been decades of research into caribou biology and conservation. This body of work has informed scientists and policy makers of the key factors that contribute to caribou population dynamics, important threats and potential solutions. Key findings have been the proximate role of predation and apparent competition in caribou population fluctuations and the ultimate role of habitat destruction in caribou population declines. While their interactions are broadly understood, ongoing research to fine tune caribou responses to ecological stimuli and human disturbance including habitat fragmentation and primary prey density can improve our management.

Most research conducted on the Charlotte Alplands caribou subpopulation has focussed on the translocation that occurred in the 1980's and 90's. This work established predation as the dominant cause for the decline that has occurred since then (Young et al. 2001). Research to determine a modified forest harvest prescription to allow logging while maintaining caribou habitat was called for in 1995 (Province of British Columbia 1995) and this also identified the Charlotte Lake area as needing special management. Further studies linking Charlotte Alplands caribou specific population dynamics to habitat disturbance (forestry), connectivity to neighbouring subpopulations, predation and human use are needed.

4.8 MONITORING

Ecological, population and industrial footprint monitoring is an essential activity for the conservation and recovery of woodland caribou. This work provides the information to enable the detection of conservation threats, the effectiveness of management activities and the status of target populations. Although it cannot replace conservation action, it is an essential piece of the caribou recovery program.

The current lack of monitoring is impairing the ability to manage the Charlotte Alplands caribou subpopulation as actions to manage habitats, predators and alternative prey are contingent upon high quality and recent herd

information (Youds et al. 2011). Generally, little effort has been made to monitor this population since the 2002 Caribou-Chilcotin Land Use Plan update (Kruse et al. 1998, Youds et al. 2002) .

5 IMPLICATIONS TO OTHER WILDLIFE

Changing population trends of woodland caribou will require manipulating the environment in ways that favour caribou ecology and life history at the expense of other wildlife. More old growth forest will benefit caribou but not moose or deer. Reducing adult female and calf mortality may require lethal wolf control. Maternity penning makes calves, common spring prey for black and grizzly bears, less vulnerable to these predators. None of these management actions can or will imperil other wildlife species, but will precipitate changes to their population density and/or distribution.

Actions taken to protect and manage the Charlotte Alplands caribou subpopulation and their habitat may benefit or inhibit the protection of other species and their habitats (British Columbia Ministry of Environment 2013). Predator management directly and intentionally reduces wolf populations and other ungulate species like moose, may also have to be held low to facilitate caribou conservation (Youds et al. 2011, Serrouya et al. 2017).

6 IMPLICATIONS TO OTHER VALUES

The recovery and protection of woodland caribou populations will affect a range of human values and activities across caribou range (Scarfe 2006). These include recreational / commercial activities such as camping, snowmobiling and backcountry skiing, commercial resource extraction activities such as forestry, mining and oil and gas development as well as non-commercial resource uses such as hunting. Research shows that none of these activities will have to be halted to protect woodland caribou (Kruse et al. 1998, Hebblewhite et al. 2006, Hebblewhite 2017). However, changes to operations, seasonal restrictions and area closures will be required, locally affecting some recreational and commercial activities (Government of Alberta 2016).

Recreational snowmobile and OHV use has been restricted within the protected areas (provincial parks) overlapping the Charlotte Alplands caribou subpopulation range using legal area and trail closures. It has been recommended that snowmobile and OHV use be prohibited on Trumpeter Mountain (Youds et al. 2002) As well Provincial Park protections restricts or prevents forestry over much of the subpopulation range. There has been no open season for caribou in WMU 5-06 since 1956, and no hunting in 5-11 as it is within Tweedsmuir Provincial Park where it overlaps with the Charlotte Alplands range area (Youds et al. 2002). Helicopter and cat skiing must abide by restrictive best management practices when operating in caribou winter habitat.

7 PARTNERS / NEIGHBOURS

Partners are existing or potential groups that can contribute to woodland caribou management with expertise, funding, in-kind or moral support. Neighbours are groups within in the caribou subpopulation area that are currently not participating in caribou management but that could be affected by caribou management. They include local governments, industry tenure holders, and recreation groups. Neighbours could potentially become future partners.

Woodland Caribou Plan for the Charlotte Alplands Subpopulation

Below is a list of communities in and adjacent to Charlotte Alplands subpopulation range, organizations that have a potential interest in how this area is managed and businesses that have a commercial interest in the area (McCrory et al. 2014). This may not be a complete list, particularly of distant organization with an inherent interest.

Communities: **First Nations:** Ulkatcho First Nation, Nuxalk Nation (Bella Coola Band), Alexis Creek First Nation (Tsi Del Del), Xeni Gwet'in First Nation, Yunesit'in First Nation

Local: Charlotte Lake, Anahim Lake, Alexis Creek, Bella Coola, Hanceville, Hagensborg

Regional: Williams Lake, Prince George, Quesnel

Organizations: **Recreation:** West Chilcotin Tourism Association, Tweedsmuir Ski Club, Horse Council of British Columbia, Back Country Horsemen of British Columbia, British Columbia Snowmobile Federation (Prince George Snowmobile Club, Quesnel Snowmobile Club, Williams Lake Powder Kings), Land Conservancy of British Columbia, Prince George Rod and Gun Club, Alpine Club of Canada, Outdoor Recreation Council of British Columbia, Quad Riders Association of British Columbia

Protection: Western Canada Wilderness Committee, BC Spaces for Nature

Commercial: **Hunting and Trapping:** Blackwater River Outfitting, British Columbia Trappers Association, Guide Outfitters Association of British Columbia, BC Wildlife Federation

Accommodation and Guiding: Atnarko Retreat, Rainbow Mountain Outfitting, Bella Coola Helisports, BC Adventure Network, Nuk Tessli Wilderness Experience

Forestry (*Active licences to cut*): BC Ministry of Transportation and Infrastructure, Patrick Morton, Telus Communications Inc., Cariboo Regional District

Forestry (*Woodlots*): none

Agriculture: BC Cattlemen's Association, Cariboo Cattlemen's Association, North Cariboo Agricultural Marketing Association

8 RECOMMENDED ACTIONS

Note that these recommendations follow the Cariboo Chilcotin Land Use Plan Northern Caribou strategy review (Youds et al. 2011).

8.1 SHORT TERM (WITHIN 6–12 MONTHS)

- Plan an immediate caribou population resurvey to recur on a 3-year cycle. Consider non-invasive techniques such as scat mark-recapture (Ball et al. 2007).
- Initiate predator management program with a goal of maintaining wolf populations at a density of less than 6.5 wolves/1000 km² verified by periodic wolf population counts.
- Initiate a regional outreach program to foster support for management that will promote ongoing growth of the Rainbows caribou program.

8.2 MEDIUM TERM (WITHIN 12–24 MONTHS)

- Expand access management in the forested and lowland regions of the Charlotte Alplands caribou subpopulation including logging road rehabilitation including decommissioning of current forest resource roads.
- Implement research that integrates modified forest harvest prescriptions with caribou habitat.

8.3 LONG TERM (WITHIN 24–48 MONTHS)

- Maintain and enforce current population and habitat (Wildlife Habitat Areas and Provincial Park) protection.
- Create an ungulate winter range designation for Trumpeter Mountain with restrictions for recreational access.
- Renew habitat survey for the range area of the Charlotte Alplands caribou subpopulation including harvest and mountain pine beetle effects.
- Ensure a supply of habitat that supports a sustainable caribou population by allowing it to recover. This will be measured using remote sensing tools of aerial extent of undisturbed or recovering vegetation classes.

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