# 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

# Horseranch
## Subpopulation

Northern Mountain Caribou

BRITISH COLUMBIA

**Recommended Citation:**

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# EXECUTIVE SUMMARY

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# 1 BACKGROUND

## 1.1 INTRODUCTION TO THE PROGRAM

The Horseranch subpopulation is the northern mountain ecotype of woodland caribou (*Rangifer tarandus caribou*), designatable unit seven (DU 7), and is within the Northern Mountain National Ecological Area (SMNEA). These herds are listed as *Special Concern* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2002). 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).

Range plans are required for all woodland caribou populations that are designated as threatened or endangered in Canada (Environment and Climate Change Canada 2016). British Columbia is taking the extra step of preparing these plans for the Northern Mountain population of special concern. The Horseranch subpopulation is blue-listed in BC, and current monitoring indicates that they are increasing (British Columbia Ministry of Water, Land and Air Protection 2004, Skeena Region 2017).

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 Horseranch Northern Mountain caribou subpopulation.

# 2 POPULATION DESCRIPTION

Relative to other western mountain caribou (DU 8 and 9), members of this DU 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 employ 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 Horseranch subpopulation range area is roughly 17,800 km$^2$. It touches the Yukon Territory in the north, runs south roughly along the Dease River, then east just north of the Tanzilla and Turnagain Rivers. It then runs northeast to the Kechika River north to the Dease River near the Yukon border.

The most recent population estimate for the Horseranch subpopulation is 600 individuals, last censused in 1999. The population trend is currently unknown (British Columbia Ministry of Water, Land and Air Protection 2004, Skeena Region 2017).

Information on ecology and habitat use specific to Horseranch caribou is limited. Available information indicates that seasonal movements of Horseranch caribou are dependent on snow conditions, though in general, they spend the summer in high elevation alpine and subalpine habitats and move to lower elevation coniferous forests during the winter (COSEWIC 2002). Winter forage consists primarily of terrestrial lichen (COSEWIC 2002).

Three biogeoclimatic (BEC) zones (Meidinger and Pojar 1991) occur in the range area. These BEC zones are generally described as:

- Boreal Altai Fescue Alpine (BAFA) is dominated mostly by rock, ice and snow with vegetation limited to shrubs, herbs, mosses, lichens and dwarf trees.
- Spruce Willow Birch (SWB) occurs at mid-elevations below the BAFA. The SWB supports open forests of predominantly white spruce, subalpine fir and deciduous shrubs.

Boreal White and Black Spruce (BWBS) zone is found in the lower elevations. Frequent fires have resulted in extensive successional forests of lodgepole pine and trembling aspen. On gentle terrain, stands of white spruce and trembling aspen are interspersed with black spruce bogs (Brumovsky and McNay 2015).

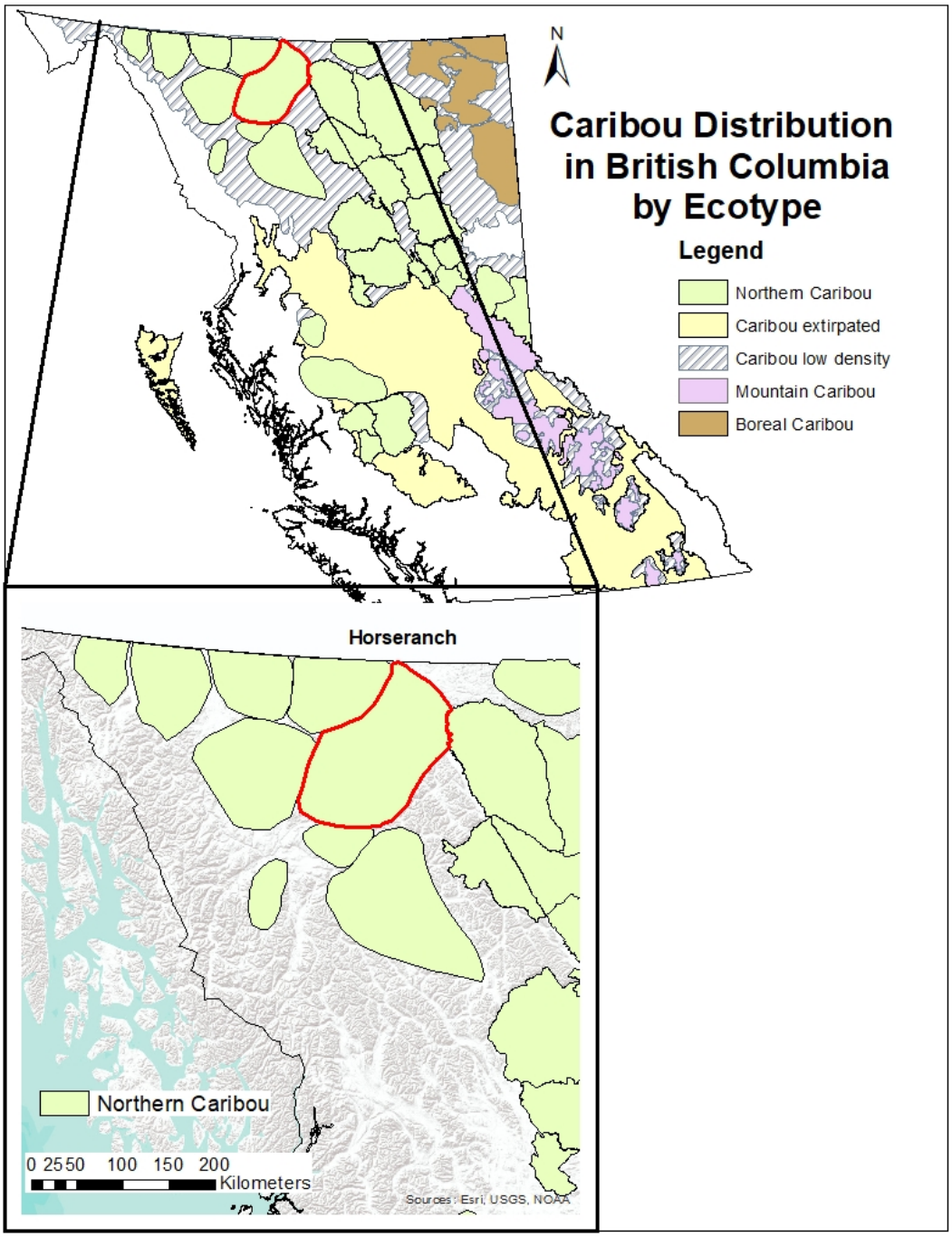


Figure 1: The location of the Horseranch subpopulation of woodland caribou. The 17,720 km$^2$ range (inset: red outline) is within both the Skeena and Peace (7b) Wildlife Regions.

## 2.2 Habitat and Behaviour

The Horseranch caribou subpopulation occupies habitats typical of northern mountain caribou in neighbouring herds. However, the Horseranch caribou range has relatively little alpine habitat, forcing them into

small differences in their rutting and calving behaviour (Fenger et al. 1986). To calve, Horseranch caribou seek out very rugged, fescue and heather sites not used at other times of year (Fenger et al. 1986). Post-calving, their summer, upland, moraine and sparsely forested range overlaps with their fall rutting distribution (Fenger et al. 1986). In the winter, they occupy forested lowlands where snow is typically shallow and access to terrestrial lichen is eased (Fenger et al. 1986).

## 2.3 Population Size and Trend

The Horseranch caribou subpopulation was censused in October 1977 from a fixed-wing aircraft and then annually from 1978 to 1983 during October from a helicopter (Bergerud and Elliot 1986). A 2015 classification survey was flown for the Horseranch caribou subpopulation, but no report has been prepared. The available population trend suggests that the population has been increasing (Figure 2).

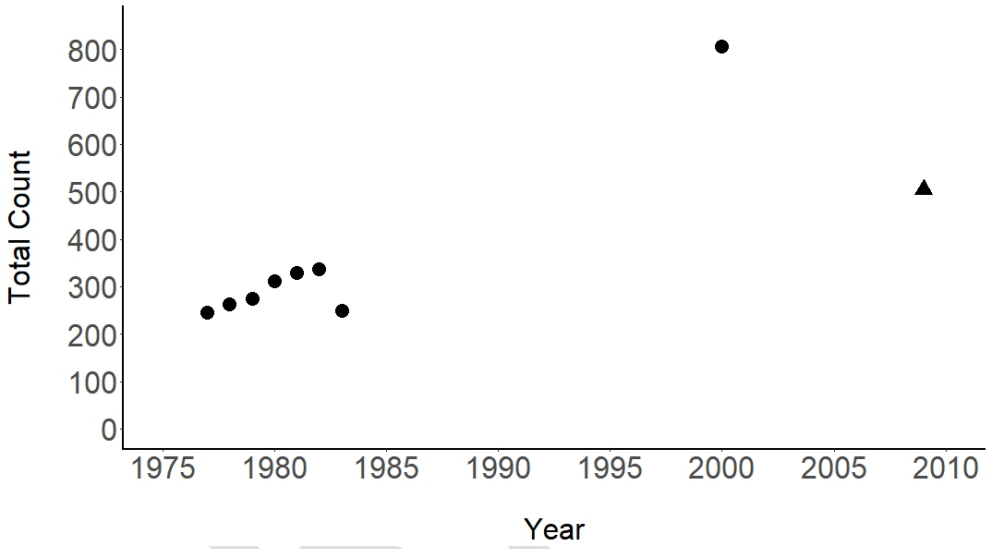


Figure 2: Caribou counts that included the complete range of the Horseranch caribou subpopulation area (filled dots; Bergerud and Elliot 1986, COSEWIC 2014) and a partial survey (filled triangle; COSEWIC 2014).

Caribou recruitment, measured as percent of calves in the population observed during a spring census (Bergerud and Elliot 1986), in the Horseranch caribou subpopulation has been at or above threshold four out of seven years (Figure 3) but has not been determined since 1983.


Figure 3: Caribou population recruitment measured in the Horseranch caribou subpopulation range (Bergerud and Elliot 1986). Recruitment is defined here as the percent of the estimated 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 noted by McNay et al. (2008), COSEWIC (2014) 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
8. 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 $km^2$ will result in woodland caribou declines. More recently, the federal recovery strategy identifies 3 wolves/1000 $km^2$ as a target (Environment Canada 2014).

During the 1980s Bergerud and Elliot (1986) conducted experimental wolf removal in the Horseranch caribou subpopulation range to test the effect of predation on calf survival. They found that calf survival increased significantly in the 3 years that wolves were reduced (Bergerud and Elliot 1986). It has also been found that while most calf mortality has occurred by the fall after birth, there is both a significant level of overwinter mortality and the timing and extent of calf mortality varies among years and among herds (BC Government unpublished data, Bergerud and Elliot 1986, Bergerud and Page 1987, COSEWIC 2014).

## 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).

The large range that is relatively devoid of disturbances and with diversity of habitats that typically carry high lichen abundance suggests that food should not be limiting for the Horseranch caribou population range. The best way to detect food stressed caribou is to measure pregnancy rates (Cameron et al. 1993). Nutritionally stressed female caribou either do not conceive or abort their fetus at early stages and thus nutritionally stressed herds show low pregnancy and birth rates (Gaillard et al. 2000). There are no indications of this from the limited surveys of the Horseranch caribou 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.

#### 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.

The Horseranch caribou subpopulation falls within the Cassiar and Fort Nelson Timber Supply Areas. Although these TSAs are very active, there is little forestry in the Horseranch caribou subpopulation range. There are only 113 hectares of cutblock in the area with the most recent cut having been made in 1992.

#### 3.3.1.2 MINING

Mine sites deter caribou both for the activities that occur there when they are active as well a 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 active mines, gravel pits, open pit mines and abandoned mines and pits in the area of the Horseranch caribou subpopulation range. But their overall area is small; 3.8 $km^2$ in total, largely concentrated along Highway 37 (Stewart Cassiar / Dease Lake Highway). There is a concentration of open pit mines not associated to the highway, but only about 3 $km^2$ in total area.

#### 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 are no oil and gas plays or developments in the Horseranch 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).

There are no major clean energy projects or hydroelectric dams in, or proposed for, the Horseranch caribou subpopulation range. There are, however, two dams immediately south of their range; the Hluey Lakes and the Tsenaglode Creek Dam, that are unlikely to affect the Horseranch caribou subpopulation.

#### *3.3.1.5 Other*

There are no other major developments proposed in the area of the Horseranch caribou subpopulation.

### 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, Wilson and Hamilton 2003, Borkowski et al. 2006, Seip et al. 2007, Kinley 2008, 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 often delayed in time.

#### *3.3.2.1 Snowmobile*

Snowmobile use in caribou habitat can result in their displacement (Simpson 1987a, Webster 1997, Apps et al. 2001, Brade 2003, Kinley 2008). 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 (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). A study of stress using hormone profiles in free-ranging caribou demonstrated that elevated fecal glucocorticoids in animals as far as 10 km from snowmobile activity, suggesting that caribou perceive snowmobiles in their habitat as a stressor (Freeman 2008).

Snowmobiling is a popular activity in Dease Lake, a town that is within the Horseranch caribou subpopulation range. However, there is not a strong, tourism-based recreational industry in this area.

#### *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. Concentrations of glucocorticoid stress hormones are higher in caribou that live where commercial heli-skiing operates than in areas without heli-skiing (Freeman 2008).

There are no heliski or catski tenures in the Horseranch caribou subpopulation range, but Last Frontier Heliskiing and Skeena Heliski operate in the vicinity.

#### 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. Backcountry skiing (a term embracing of 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). 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).

There are backcountry ski routes through the Cassiar Mountains in the Horseranch caribou subpopulation range, but they are not often used.

### 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).

There is some ranching in the region, but agriculture is not a significant industry in the Horseranch caribou subpopulation range.

#### 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 37, the Stewart-Cassiar Highway, traverses the Horseranch caribou subpopulation range for approximately 160 kilometres in the southwest. The Alaska Highway travels just outside of the northeastern corner of their range. From 1988 to 2007, 19 caribou were killed on highways in BC Highway District 10

(Bulkley-Stikine). This is a vast area, and certainly not all of these animals were killed along Highway 37. Nevertheless, 560 animals were killed on this highway during this period, by far the most of any highway in the region. Moose are the most common animal struck on this districts' highways. This suggests that highway mortality is a potential threat to the Horseranch caribou subpopulation.

#### 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).

Except for the Stewart-Cassiar Highway and a parallel utility corridor, there are no linear features in the range of the Horseranch caribou subpopulation. The COSEWIC (2014) status report lists the current threat from utility and service lines to be negligible, but indicates that the Horseranch caribou subpopulation is likely to be affected by pipeline developments in the future.

#### 3.3.3.4 *Hunting*

The Horseranch caribou subpopulation straddles four Wildlife Management Units (WMUs) and two wildlife regions (Skeena (6) to the west and Peace (7b) to the east). Caribou hunting is permitted in the Skeena region and in the WMUs (19, 23 and 24) and in the Peace region (WMU 7-52) for five-point bulls only. From 1976 to 2015, 2133 caribou were reported killed by resident and non-resident hunters in the Skeena WMUs and 600 caribou reported killed in the Peace WMU. In total, 2733 caribou were killed (average of 70 per year). If all of these animals are taken from the Horseranch caribou subpopulation (the Little Rancheria, Level Kawdy, Tseneglode and Spatsizi all share these WMUs), this would be around 9% of a population of 800 estimated caribou in the subpopulation. However, this is unlikely to be the case.

#### 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.

There are no records of charges issued for hunting caribou out of season in the Skeena region from 2006 through 2018. Within the Peace region, there have been charges for "killing wildlife not within open season", but the species was not specified. In 2012 a hunter was charged with failing to leave evidence of sex and species of a hunted caribou. Although poaching likely does occur in this area, it is unlikely to be a limiting threat (Seip and Jones 2017).

## 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 almost 7000 km$^2$ of wildfires in or crossing into the Horseranch caribou subpopulation range from 1944 to 2016, or approximately 40% of the area (this area is artificially high as some areas have burned more than once and wildfire areas for fires crossing the boundary include area burned outside the Horseranch range). Wildfires are concentrated in the northeastern, lowland forest part of the range and around the town of Dease Lake in the southwest. About half of this area burned before 1968, or 50 years from the time of writing and within the age that would be recovering as effective caribou habitat (Robinson et al. 2012).

## 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 tenius*) 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 Horseranch 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).

## 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 (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). 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).

Climate change models for British Columbia suggest that areas in the Interior Mountains will experience increased winter snow loads (Dawson et al. 2008, Griesbauer and Green 2010) that could affect food access and mobility for animals. Such a change could be detrimental for snow adapted, terrestrial lichen eating caribou like the Horseranch caribou subpopulation. Frequent freeze-thaw cycles could also negatively affect caribou (Plummer et al. 2006) by improving the ability of predators to move across frozen crusts as well as limit access to terrestrial food for caribou (Gillett et al. 2004, Dawson et al. 2008). 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).

While there is no herd-specific information on climate change effects on the Horseranch caribou subpopulation, there is research into general climate change effects on the southern Yukon area (Ogden and Innes 2008). Predictions on forest type shifts due to climate change suggest that black spruce may be replaced by white spruce and lodgepole pine, affecting caribou habitat (Hebda 1997).

## 3.7 Small Population Size Effects

Small population effects include several threats to caribou that are unique to small (approximately less that 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).

There was limited winter range overlap found between the Horseranch and Little Rancheria caribou subpopulations in the late 1990's (N. MacLean and R. Marshall, BCELP, unpublished data cited in Adamczewski et al. 2003). However, since then surveys have found that caribou from the Little Rancheria, Horseranch, Swan Lake and Level-Kawdy subpopulations share overlapping winter ranges (M. Williams, pers. comm. 2013 cited in COSEWIC 2014). This overlap may foster genetic connectedness among these geographically close subpopulations.

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, Serrouya et al. 2012, Weckworth et al. 2012).

Although there is uncertainty in the current size of the Horseranch caribou subpopulation (Figure 2), it seems likely that they have remained above a threshold density that could trigger a genetic bottleneck. This observation, plus their current connectedness to neighbouring subpopulations, suggests that small population effects are unlikely to be threatening the Horseranch caribou subpopulation.

# 4 MANAGEMENT HISTORY

## 4.1 HABITAT

Habitat management in British Columbia is overseen by the provincial government and implemented by the forestry industry through application of their AAC (see above). 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). However, given the almost complete absence of forestry in this area, this scale of habitat management is not being undertaken.

### 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) (1996a). Hunting is also not automatically prohibited (Government of British Columbia 1996b). Petroleum and natural gas tenures are permitted by the British Columbia Park Act (Section 33 1996a) but are not relevant in this subpopulation range.

Boya Lake Provincial Park and Chicken's Neck Mountain Ecological Reserve both fall within the Horseranch caribou subpopulation range. These cover slightly more than 50 $km^2$ in the area or about 0.3% of the total range. Hunting is permitted in Boya Lake, but not snowmobiling (Government of British Columbia 2003a). All recreational and commercial activities are prohibited in Chicken's Neck Mountain Ecological Reserve (Government of British Columbia 2003b).

There is a large amount of high-elevation ungulate winter range (u-6-041) also overlapping the Horseranch caribou subpopulation range. This area has been set aside with constraints on forest harvest to protect thinhorn sheep, but also protects caribou calving, summer and rutting ranges.

### 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. 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.

The primary opportunities for restoration in the Horseranch caribou subpopulation area are in the gravel pits and small open mines along Highway 37. However, it is unlikely that this small area will have little impact on the caribou in this region.

## 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 approximately 240 km of resource and unregulated access roads in the Horseranch caribou subpopulation range. At 0.013 km/km$^2$, this is a very low density and is a minor threat to the caribou (Bennett 2017).

### 4.2.1 Snowmobile

There are no snowmobile management areas or managed snowmobile trails in the Horseranch caribou subpopulation area.

### 4.2.2 Heli-ski / Cat-ski

There are no heli- or cat-ski tenures in the Horseranch caribou subpopulation range. See section 3.3.2.2 for general threat information.

### 4.2.3 Other

There are no specific management actions to regulate or limit other recreational activities such as backcountry skiing or summer OHV use. Within the Yukon range of northern caribou subpopulations, use of off-road vehicles, trail designations and seasonal restrictions on trail use have been recommended (Francis and Nishi 2015).

## 4.3 Predators

Unsustainable predation is acknowledged as a key, proximal mechanism of woodland caribou decline 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 $km^2$ but increased at wolf densities from 1–4/1000 $km^2$ (Bergerud and Elliot 1986). For this reason, target wolf densities that would enable caribou recovery are set to 6.5/1000 $km^2$. 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.

There is a history of wolf management in the area of the Horseranch caribou subpopulation. Wolves were actively reduced from 1977–1980 and again in 1985 (COSEWIC 2014). Removal of 60–90% of wolves over three winters increased recruitment of the Horseranch caribou subpopulation from 5.5% to 16.7% (Bergerud and Elliot 1986). During this period, wolves were reduced near the Horseranch caribou subpopulation from 10 to 1–4 /1000 $km^2$ resulting in a caribou increase from 1977 to 1982 at an average exponential rate of 6% per year (Bergerud and Elliot 1986).

Wolves were counted on the winter range of the Horseranch caribou subpopulation from 1978 to 1982 and the counts verified by the removal programs from 1978 to 1980 (Bergerud and Elliot 1986). There is no good current estimate of wolf density in this region, nor is there any ongoing wolf management outside of hunting and trapping.

### 4.3.2 Cougar Management

Cougars are very rare in the Horseranch caribou subpopulation range, but they may be 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 northern British Columbia, there are only rare reports of cougar predation on caribou.

### 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.

Bears are only managed in the Horseranch caribou subpopulation in response to human conflict and through hunting. Although black bears and grizzly bears both predate caribou in northern British Columbia, caribou are not a big part of bear diets (Merkle et al. 2017). Given the ban on 2017 grizzly bear hunting throughout BC and the low importance of bear predation on caribou population size, there is no active bear management in this region. Between 1976 and 2015, 500 black and grizzly bears were hunted by resident and non-resident hunters in the Skeena WMUs overlapping the Horseranch caribou range (13/year) and 646 black and grizzly bears were killed in WMU 7-52 in the Peace region (16/year).

In 2012, the British Columbia government estimated that there were 840 grizzly bears in the Muskwa region that overlaps with the Horseranch caribou subpopulation range (20–30/1000 km$^2$) (Ministry of Forests, Lands and Natural Resource Operations 2012). The predation rate of grizzly bears on caribou in this region is unknown.

## 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 what is 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 benefit 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 tool.

### 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.

A region-wide survey reports that the moose population in the Skeena region is lower than it was in 1987, but has been essentially stable since 1997 (Kuzyk 2016). In the Peace region (7b), the moose population has increased slightly since 1987 (Kuzyk 2016). There are no recent and targeted moose population estimates for the Horseranch caribou subpopulation range, but there are plans for surveys in the game management zones that overlap with that range (7pd and 6e; Moose Management Technical Team 2015).

### 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.

Deer occur at very low density (white tailed deer are absent and black tailed deer are rare) in the range of the Horseranch caribou subpopulation, and there is no current need for their management.

### 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 rare the Horseranch caribou subpopulation range, but in the 1970's and 80's there were enough elk to hold a hunt in the Skeena WMUs, and from 1976 to 2013 in the Peace WMU (7-52). They are nevertheless uncommon enough to not pose a significant management issue for caribou protection and recovery.

## 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. 2016). 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 Horseranch region.

### 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. 2016).

Captive breeding to reinforce the Horseranch caribou subpopulation is not being planned, nor is it likely needed. Given that this subpopulation is relatively large and apparently stable (Figure 2), it may be considered as a source population for captive breeding programs.

#### 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. 2016). 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. 2016).

The Horseranch caribou subpopulation meets the basic requirements as a source herd to reinforce other subpopulations, although the removal of more than approximately 20 from Horseranch may not be sustainable (Kinley 2009).

#### 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. 2016). 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 Horseranch 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. 2016). 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.

The Horseranch caribou range overlaps during part of the year with other herds in British Columbia and possibly the Yukon. The Stewart-Cassiar highway passes through its range. These create expanded opportunities for outreach that would be otherwise limited for remote caribou subpopulations such as the Horseranch. That this herd interacts with Yukon caribou provides opportunities to connect with stakeholders in Whitehorse, the largest urban area in the region.

There are significant opportunities for stewardship for the Horseranch caribou subpopulation. There is a thousands year long relationship between the people that inhabit this region that includes subsistence hunting for caribou (King and Carlick 1997). Thousands of tourist vehicles pass through this region along the Alaska and Stewart-Cassiar Highways creating opportunities for broad outreach as well as local stewardship for personal interpretation (e.g. caribou ambassadors http://ecologynorth.ca/caribou-ambassador-2/). As one of the few woodland caribou herds that is relatively large and stable (COSEWIC 2014), this subpopulation is a candidate to provide source animals for reinforcement activities (see above). Dease Lake is within this subpopulation's range. Effective outreach and stewardship is a necessary step in this process so that local people understand the process and their contribution to broader conservation.

## 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 have been decades of studies on 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.

There has been little research conducted on the Horseranch caribou subpopulation since Bergerud and Elliot (1986). Links among predators, alternative prey (moose) and caribou to determine dominant sources of caribou mortality, predator densities and alternative prey distributions would refine management actions for protection and reinforcement.

## 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.

There has been relatively little ecological and population monitoring in this area, with only periodic surveys since the 1980's. The Horseranch caribou subpopulation was surveyed in 2015, but the results have yet to be analyzed.

Additional monitoring of predator and alternative prey populations to determine density and distribution is needed. Much of this could be achieved using non-invasive techniques such as scat DNA mark-recapture (Ball et al. 2010).

# 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 Horseranch caribou and their habitat may benefit or inhibit the protection of other species and their habitats (British Columbia Ministry of Environment 2013). The potential need for predator management will directly affect wolves, whose populations would be intentionally reduced, and other ungulate species like moose, whose densities may also have to be lowered to facilitate caribou conservation. Ungulate winter range protections in the Horseranch caribou range have been designed to protect high elevation thinhorn sheep populations. If UWR was extended to protect caribou, they would reciprocally protect sheep and goats.

# 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).

In the range of the Horseranch caribou subpopulation, there are limited commercial activities. Currently commercial logging operations in the area are compelled to avoid UWR that has been established over much of the high elevation terrain to protect thinhorn sheep. However, there are no commercial logging operations in the area. Expansion of UWR to new areas, if proposed, would further impede future operators.

Recreational snowmobiling also occurs in this area, at times combined with moose hunting. Again, careful management of recreational snowmobiling that considers elements of caribou recovery will be required to enable coexistence (Grant 2017).

# 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.

Below is a list of communities in and adjacent to Horseranch subpopulation range, organizations that have a clear interest in how this area is managed and businesses that have a commercial interest in the area. This may not be a complete list, particularly of distant organization with an inherent interest.

Communities: **First Nations**: Kaska Dena Council (Dease River First Nation), Tahltan Central Government, Liard First Nation, Iskut First Nation, Daylu Dene Nation

**Local**: Dease Lake, Dease River, Lower Post, Good Hope Lake

**Regional**: Watson Lake, Iskut, Eddontenajon

Organizations: **Recreation**: Atlin Helicopters, Tundra Helicopters, Osprey Air, Discovery Helicopters, British Columbia Snowmobile Federation, Klondike Heliskiing, Klondike Snowmobile Association, Land Conservancy of British Columbia, Outdoor Recreation Council of British Columbia, Quad Riders Association of British Columbia, Last Frontier Heliskiing, Alpine Lakes Air, BC Yukon Air, Tundra Helicopters, Pacific Western Helicopters, Northern Thunderbird Air

**Protection:** Canadian Parks and Wilderness Society, Yellowstone to Yukon Conservation Initiative

Commercial: **Hunting and Trapping**: **Accommodation and Guiding**: Tahltan Outfitters, Little Dease Ventures. Bluestone Guiding and Adventures, BC Safaris, Moosehorn Lodge, Worldwide Trophy Adventures

**Forestry** *(Active licences to cut)*: BC Hydro and Power Authority, District Manager, Skeena Stikine (DSS), Renald Bergeron, Ernest Hatzl, Jedway Enterprises Ltd.

**Forestry** *(Woodlots)*: none

**Agriculture**: none

# 8 Recommended Actions

## 8.1 Short Term (Within 6–12 Months)

- Publish the results of the 2015 caribou population survey.

## 8.2 Medium Term (Within 12–24 Months)

- Design and implement a long-term monitoring program for caribou, wolves and moose based on DNA scat mark-recapture analysis.
- Using harvest data, assess the effects of harvest rates on population trends (Environment Canada 2012a).
- Identify the timing and location if important road crossing areas for caribou and possible road crossing deterrents or alternatives to the application of road salt (Environment Canada 2012a).

### 8.3 LONG TERM (WITHIN 24–48 MONTHS)

- Quantify seasonal habitat relationships for caribou, moose and their predators.

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