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

Little Rancheria
Subpopulation

Northern Mountain Caribou

BRITISH COLUMBIA

Recommended Citation:

Photo credit: Doug Heard

EXECUTIVE SUMMARY

TABLE OF CONTENTS

1 BACKGROUND

1.1 INTRODUCTION TO THE PROGRAM

The Little Rancheria 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 *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).

Range plans are required for all woodland caribou populations that are designated as threatened or endangered in Canada (Environment and Climate Change Canada 2016b, a). The Little Rancheria subpopulation is blue-listed in BC, and current monitoring indicates that they are in decline. Comprehensive recovery planning is ongoing via the South Skeena Caribou Management Plan (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 Little Rancheria 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 Little Rancheria subpopulation range is predominantly south of the BC-Yukon border, but does extend a small distance into YT. In the west, the Little Rancheria territory is bounded by Alan Creek in the north, running linearly south to the Parallel River watershed. Running roughly east to just north of Boya Lake Park, the boundary line turns north again, following part of the Dease River valley.

The most recent (2015) population estimate for the Little Rancheria subpopulation is 189 individuals, down from an estimated 1000 in 1999, and the population trend is currently declining (Skeena Region Biologists 2017). Information on ecology and habitat use specific to Little Rancheria caribou is limited. Available information indicates that seasonal movements of Little Rancheria 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 2011). Winter forage consists primarily of terrestrial lichen (COSEWIC 2011).

They tend to migrate to higher elevations often over considerable distances, where they spend late spring and summer to calve and forage (Boonstra and Sinclair 1984, Cichowski 1989, Gullickson and Manseau 2000, Gustine et al. 2006a). Most populations of Northern Mountain caribou are relatively small and sedentary, with individuals wintering in small groups (see citations in COSEWIC 2011).

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

- 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).

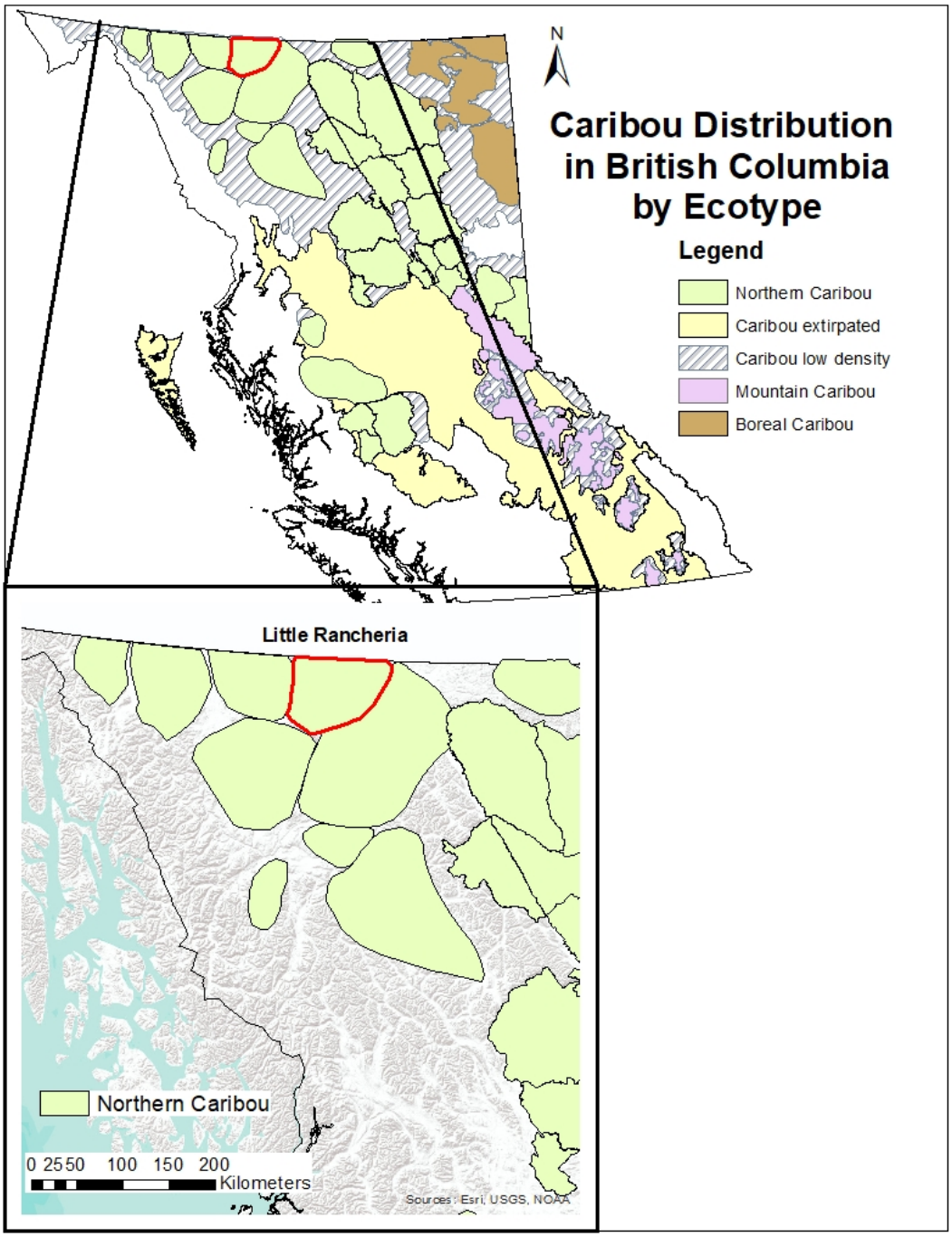

Figure 1: The location of the Little Rancheria subpopulation of woodland caribou. The 7000 km^2 range (inset: red outline) is within the Skeena Region.

2.2 Habitat and Behaviour

The Little Rancheria caribou subpopulation exhibits habitat selection typical of the northern caribou type by living in high elevation (alpine and sub-alpine) from the spring through to fall of each year (Farnell

and McDonald 1990, Florkiewicz et al. 2003). In fall, following the rut, they move to lower elevation forests. There are also reports of some caribou in this subpopulation spending summer in typical, low-elevation forest habitats (Kinley 2003). In this area, pine forests tend to have open canopies; a type of habitat for which caribou are known to select (Florkiewicz et al. 2003). Black spruce forests were common winter range habitats (Florkiewicz et al. 2003).

The Little Rancheria caribou subpopulation moves from the southern part of their range, in British Columbia during the fall to their northern winter range across the boundary to the Yukon (Florkiewicz et al. 2003). Radio telemetry data has found that there are low-elevation winter habitats in both the Yukon and British Columbia portions of their range (Florkiewicz et al. 2003).

2.3 Population Size and Trend

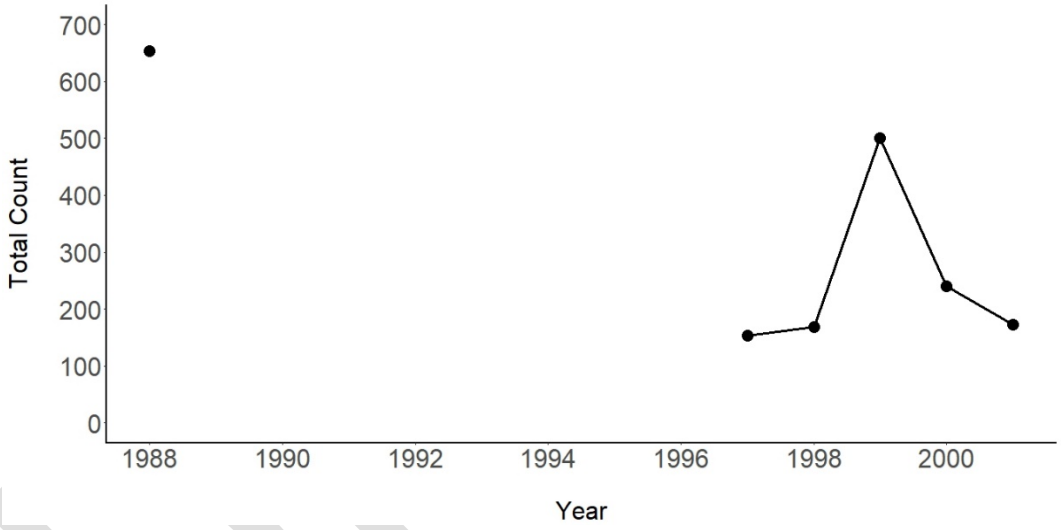

Figure 2: Caribou counts for the Little Rancheria sub-population. Counts conducted by both the British Columbia and Yukon governments and data from McLean et al. (2001) and Farnell and McDonald (1990).

Caribou recruitment, measured as percent of calves in the population observed during a spring census (Bergerud and Elliot 1986).

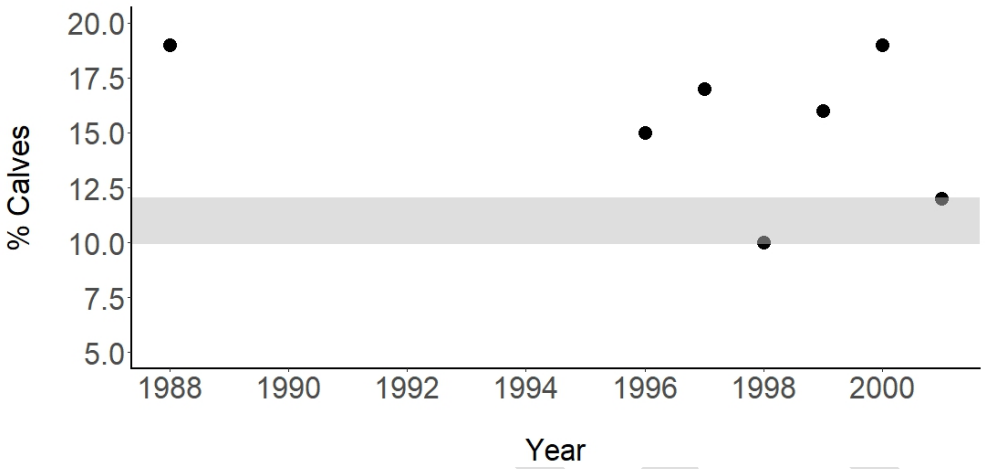

Figure 3: Caribou population recruitment measured in the Little Rancheria caribou subpopulation range. Recruitment is defined here as the percent of the estimated population that is in the calf cohort. Recruitment lower than approximately 10 to 12% is considered below a threshold that will balance natural mortality (grey band; Bergerud and Elliot 1986). Data from McLean et al. (2001) and Farnell and McDonald (1990).

3 THREATS AND LIMITING FACTORS

Primary threats to caribou and their habitat have been noted 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). Recent changes to their habitat that affects their ability to either avoid predators (Seip 1991) or avoid predation effects (Bergerud et al. 1984, Dzus 2001). 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).

Specific information on predator densities, distributions or predation rates is not available for the Little Rancheria caribou subpopulation.

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. 2006b). When it has been considered, estimates of caribou food abundance typically far exceeds population needs (Courtois et al. 2007).

A study of Little Rancheria subpopulation caribou habitat-use concluded that habitats dominated by lichen understory (Pine/Bearberry and Pine/Lichen) were highly selected by caribou (Florkiewicz et al. 2003). This suggests that caribou in this subpopulation actively seek food-rich habitats. As long as these habitats remain abundant and accessible, then food should not limit the Little Rancheria caribou subpopulation. But a recent, quantitative assessment of habitats is lacking.

Farnell and McDonald (1990) concluded that the Litter Rancheria caribou subpopulation is not winter food limited based on vegetation surveys, habitat use and fecal pellet analysis.

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.

There has been some logging in key winter range for the Little Rancheria caribou subpopulation, but not since the late 1990's (Environment Canada 2012a). There are only 2.67 km^2 (0.04% of the population range) of consolidated cutblocks in the range of the Little Rancheria caribou subpopulation.

The Kaska Forest Resources Stewardship Council developed a forestry plan for 2003–2007 including limits on forestry activities in winter ranges and in caribou migration corridors in the Yukon portion of the subpopulation range (Kaska Council et al. 2002, Environment Canada 2012a). The pine forests in the Liard Basin are considered to be of merchantable quality (Holmquist and Senger 1988).

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 significant mineral (coal and gold) deposits concentrated in the northern part of the British Columbia extent of the Little Rancheria caribou subpopulation range. There are two small gravel pits in the range and six mines, all clustered in the northwest in the Tootsee River basin including the large Silvertip mine (silver, lead and zinc; under construction). There is some small-scale Jade mining in the southern part of the 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 are no oil and gas plays in the range of the Little Rancheria caribou subpopulation area, but such development is possible, and perhaps likely through their range (Environment Canada 2012a). In the 1980's there was a proposal to lay a pipeline through the Liard Basin and the Liard basin has 219 trillion cubic feet of shale natural gas that remains undeveloped (National Energy Board 2016).

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 three major clean energy projects proposed in the range of the Little Rancheria caribou subpopulation. These are hydro electric proposals on the Tootsee River, Rancheria River and Watson Lake/Creek proposed in 2014 with an intent to provide electrical energy to the town of Watson Lake (Midgard Consulting Incorporated 2016).

3.3.1.5 OTHER

There are no other major developments proposed in the area of the Little Rancheria 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, 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 be time-lagged. Recreation is listed as a concern in management plans for this subpopulation (Environment Canada 2012a)

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 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 (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 is a popular activity in the Cassiar Mountains, although activity is low in the range of the Little Rancheria caribou subpopulation.

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.

Last Frontier Heliskiing operates in the vicinity. They are accredited HCC members but do not report wildlife sightings. Atlin Heli Sports and Yukon Alpine Heliski also operate in northern British Columbia, but their runs are to the west of the Little Rancheria caribou subpopulation range.

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 is a downhill ski operation (Mount Maichen Ski Hill), north of Watson Lake within the Yukon portion of the Little Rancheria caribou subpopulation range.

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 an important industry in the range of the Little Rancheria caribou subpopulation and there are no Agriculture Land Reserves in their range and few, if any, farms or ranches.

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) cuts through the eastern portion of the Little Rancheria caribou subpopulation range and in the Yukon, the Alaska Highway (#1) cuts through the north of the 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. During the 1990's, approximately 15 individuals from the Little Rancheria caribou subpopulation were killed on the Alaska Highway in the Yukon (Environment Canada 2012a, Winter 2013). These statistics suggest that highway mortality is a real threat to the Little Rancheria 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).

Excluding Highway 37, there are no visible linear features (seismic lines, pipelines, transmission rights of way, railways) in the Little Rancheria caribou subpopulation range. There is an outstanding proposal for a gas pipeline to extend north of Watson Lake in the Yukon (Midgard Consulting Incorporated 2016).

3.3.3.4 Hunting

There is an open season (August 15 to October 10) on bulls in the Little Rancheria caribou subpopulation within British Columbia (2017). Between 1976 and 2015, 1599 bulls were killed by resident hunters and 1383 bulls were killed by guided, non-resident hunters (total = 2982) in the management units overlapping this subpopulation. Not all of these animals are from the Little Rancheria group. In the Yukon, on average 5.6 and 3.4 caribou were killed each year (1978–1986) from the Little Rancheria subpopulation by resident and non-resident hunters respectively. The Yukon government also estimates that 10 caribou are killed annually by Indigenous hunters, accounting for approximately 20 caribou per year or 3% of the subpopulation and recommends that the hunt not exceed this amount (Farnell and McDonald 1990).

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.

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 has been 884 km^2 of forest burned in the range of the Little Rancheria caribou subpopulation from 1944 to 2017. This is approximately 12.5% of the British Columbia population area. The largest occurred in 2010 and was 352 km^2 that burned along the Stewart-Cassiar highway and burned over older burns (1963) and has burned since (2011, 2016).

The spruce dominated forest types of the Little Rancheria caribou subpopulation range has not been affected by mountain pine beetle infestation experienced elsewhere in the province (the closest infested forest is approximately 130 km to the south).

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 Little Rancheria caribou 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 Cassiar 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 Little Rancheria subpopulation. Frequent freeze-thaw cycles could also negatively affect caribou (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).

While there is no herd-specific information on climate change effects on the Little Rancheria 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).

The Little Rancheria caribou subpopulation numbers well over 200 animals, and probably much larger based on recent estimates (Conrad Thiessen, 2018 personal communication). Given the relative intactness of its habitat it is unlikely to be suffering from small population effects resulting from habitat fragmentation.

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).

Although genetic screening of the northern mountain type of caribou has been sparse (Weckworth et al. 2012), it is clear that there is genetic differentiation of northern caribou in this area (Kuhn et al. 2010). While there are increasing pressures on the herds that comprise the Southern Lakes and Fortymile clusters, there are no current or recent bottlenecks that would result in small population effects for the Little Rancheria caribou subpopulation.

4 MANAGEMENT HISTORY

4.1 HABITAT

Most of the research and monitoring of the Little Rancheria caribou subpopulation habitat has occurred in the Yukon. Despite differing jurisdictions and management across the provincial / territorial divide, the habitat is comparable. Their winter range is lowland, spruce-dominated forest and the rest of the year they are common at higher elevation alpine and subalpine habitats that are sparsely forested. There is little merchantable timber in either of these ranges.

Habitat management in this area 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).

There is no active habitat management in the range of the Little Rancheria caribou subpopulation, but plans have been proposed, largely in the Yukon, to ensure long term habitat supply for these caribou (Adamczewski et al. 2003, Florkiewicz et al. 2003).

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.

There is one, small (9.7 km^2) ecological reserve in the Little Rancheria caribou subpopulation range and no provincial parks (although Boya Lake and Tuya Mountains parks are just south of its range edge). Blue/Dease Rivers Ecological Reserve was established to research ecological communities in the Boreal White and Black Spruce Zone (http://www.env.gov.bc.ca).

A proposed block of ungulate winter range (UWR; u-6-041) protection that restricts forest harvest covers 23,960 km^2 in total in the region, and about half of the area within the Little Rancheria caribou subpopulation range, largely high-elevation habitat. While u-6-041 will be established to protects Dall's sheep (*Ovis dalli*), it simultaneously protects caribou habitat.

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.

With few large-scale or linear habitat impacts in the Little Rancheria caribou subpopulation range, there has been no enhancement or restoration efforts.

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 only 25 kilometers of forestry roads providing access into caribou habitat in the Little Rancheria caribou subpopulation range. This means that authorized and unauthorized motorized vehicle access in this area is not a threat to caribou.

4.2.1 Snowmobile

The only snowmobile management areas or formal trail restrictions in the area of Little Rancheria caribou subpopulation occur in the Blue/Dease Rivers Ecological Reserve. The 2003 management direction lists all off-road snowmobile access as an unacceptable activity (Government of British Columbia 2003).

4.2.2 Heli-ski / Cat-ski

There are no heli- or cat-ski tenures in the Little Rancheria 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 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 change facilitates 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, Weclaw and Hudson 2004). 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.

Focussed wolf management on the British Columbia range of the Little Rancheria caribou subpopulation has not occurred. Between 1976 and 2015, 766 wolves were killed by resident and non-resident hunters and 259 wolves killed by trappers in the wildlife management units overlapping with the Little Rancheria caribou subpopulation.

Intensive wolf management has occurred in the Yukon in the vicinity of the Little Rancheria caribou subpopulation. In the Finlayson Lake area wolves were reduced during the 1980s and 90s, but rebounded to pre-control densities shortly after control ended (Hayes and Harestad 2000).

4.3.2 Cougar Management

Cougars are very rare in the Little Rancheria 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.

Grizzly bears, black bears and wolverines are all present in the area. Black and grizzly bears are both hunted in the wildlife management units overlapping with the Little Rancheria caribou subpopulation. 182 black bears were shot between 1976 and 2015 and 230 grizzly bears were killed during this same period. Wolverines are not hunted.

There are ten traplines that are either entirely or partially within or bounding on the Little Rancheria caribou subpopulation range, Operators have the potential to remove caribou predators as part of their licences, including wolverines, black bears and wolves (see above). Between 1983 and 2015, 323 wolverines and 39 black bears were reported trapped in the three management units that overlap the Little Rancheria caribou range.

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 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.

Moose population trends in British Columbia are controversial, but research suggests that in the Skeena region they are stable (Kuzyk 2016). The population estimate in 2016 was approximately 35,000 animals with an annual hunting allocation of 4216 bulls.

Florkiewicz (2008) found relatively clear habitat separation between moose and caribou in the Little Rancheria subpopulation range. While this may help insulate some caribou from predators hunting moose, the large range sizes of predators like wolves and bears can overlap both caribou and moose even if they occupy different habitats (Kittle et al. 2017, Serrouya et al. 2017).

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 Little Rancheria 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 absent from the Little Rancheria caribou subpopulation range, but there is a small, introduced elk herd in Yukon, close to its northern range, that is hunted.

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 Little Rancheria 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 Little Rancheria caribou subpopulation is not being planned. Given that this subpopulation is relatively large and considered stable, 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).

There have been no translocations to or from the Little Rancheria caribou subpopulation range.

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 Little Rancheria 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 Little Rancheria caribou range crosses the British Columbia - Yukon boundary. Interjurisdictional differences in human population distribution, wildlife management methods, stakeholder relations and management approaches create challenges for creating consistent outreach and building successful partners and stewards for this herd. That this herd crosses the frontier between British Columbia and Yukon, inhabits lands close to Whitehorse, the largest urban area in the region creates outreach and stewardship opportunities.

There are significant opportunities for stewardship for the Little Rancheria 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 2015), this subpopulation is a candidate to provide source animals for reinforcement activities. 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 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.

Much of the research conducted on the Little Rancheria caribou subpopulation occurred in the 1980s and 90s. This work, focussed on basic demographic information (Farnell and McDonald 1990), and habitat characteristics (Adamczewski et al. 2003, Florkiewicz et al. 2003) and focussed on the Yukon half of this caribou subpopulation's range. This work has clarified habitat use, movement timing and corridors and food resources for

this subpopulation. Given the potential for oil, gas and forestry development in the area, research on understanding potential threats to such developments is 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.

Basic population monitoring is being conducted in the Little Rancheria caribou subpopulation range with infrequent, but regular surveys for population size and growth rate. Enhanced monitoring of predator populations and habitat change would contribute to a more thorough understanding of this subpopulation's status and trend.

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 Little Rancheria caribou and their habitat may benefit or inhibit the protection of other species and their habitats (British Columbia Ministry of Environment 2013). The anticipated 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.

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. 2007, 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 Little Rancheria 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 Dall's sheep. Expansion of UWR to new areas, if proposed, would further impede these operators.

Recreational snowmobiling is also a reasonably popular activity, overlapping to some extent 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 Little Rancheria 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**: Liard First Nations, Kaska Dena, Teslin Tlingit Council, Treaty 8 First Nations

Local: Lower Post, Good Hope Lake, Jade City, Watson Lake, Dease Lake, Two and One-Half Mile Village,

Regional: Whitehorse, Smithers, Atlin

Organizations: **Recreation**: British Columbia Snowmobile Federation, Klondike Snowmobile Association, Land Conservancy of British Columbia, Outdoor Recreation Council of British Columbia, Quad Riders Association of British Columbia

Protection: Teslin Renewable Resources Council, Kaska Tribal Council, Kaska Dena Council, Yukon Fish and Wildlife Management Board

Commercial: **Hunting and Trapping**: Yukon Outfitters Association, Ceaser Lake Outfitters, Yukon Big Game Outfitters, Cosco Outfitting

Accommodation and Guiding: Mt. Maichen Ski Hill

Forestry *(Active licences to cut)*: Coeur Silvertip Holdings Ltd.

Forestry *(Woodlots)*: none

8 RECOMMENDED ACTIONS

8.1 SHORT TERM (WITHIN 6–12 MONTHS)

- Complete reporting of most recent population surveys of the Little Rancheria caribou subpopulation.

8.2 MEDIUM TERM (WITHIN 12–24 MONTHS)

- Plan habitat survey with an objective of measuring current state and detecting change.
- Initiate stewardship and interpretative programs along Stewart-Cassiar and Alaska Highways.

8.3 Long Term (Within 24–48 Months)

- Given that the Liard Basin has large gas exploration and exploitation potential, initiate and establish appropriate habitat protections for caribou against future development.
- Plan and execute a wolf study, including collaring and distribution / population density survey.
- Foster high and ground level caribou management with the Yukon government.
- Engage university researchers to study potential climate change effects

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