

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

North Cariboo Subpopulation

Upper Fraser Local
Population Unit



BRITISH
COLUMBIA

Recommended Citation:

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EXECUTIVE SUMMARY

DRAFT

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1 BACKGROUND

1.1 INTRODUCTION TO THE PROGRAM

The North Cariboo woodland caribou subpopulation was designated as Southern Mountain Caribou (Designatable Unit (DU) 9 – Southern Group) by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; Environment Canada 2012a, 2014). As a group, the Southern Mountain group of woodland caribou is recommended as Endangered by Canada (Environment Canada 2014) and is Red-listed by the Province of British Columbia (British Columbia Conservation Data Centre 2017).

Woodland Caribou are further divided into Local Population Units by Environment Canada. Within the Southern Mountain Caribou group there are eleven Local Populations. The North Cariboo subpopulation is in the Upper Fraser Local Population together with the Narrow Lake and recently extirpated George Mountain subpopulations (Environment Canada 2014).

Range plans are required for all woodland caribou populations that are designated as threatened or endangered in Canada (Environment and Climate Change Canada 2016). The current designation for the North Cariboo subpopulation is “Endangered”, and current monitoring indicates that while the numbers have declined 40-50% over the last decade, the North Cariboo subpopulation appears stable since 2012 (Klaczek and Heard 2016).

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 North Cariboo Southern Mountain caribou subpopulation within in the Upper Fraser Local Population Unit.

2 POPULATION DESCRIPTION

Southern Mountain Caribou (formerly known as mountain caribou) live in the Interior Wet Belt that stretches from northern Idaho and Washington States to central British Columbia. In contrast to Central and Northern Mountain Caribou, they remain in mature subalpine forest habitat year-round. In winter, Southern Mountain Caribou walk on top of the deep snowpack and feed on lichens that grow on trees (Jones 2007).

2.1 DISTRIBUTION

The North Cariboo caribou subpopulation occurs on the west side of the Rocky Mountains, between Wells and McBride. Some of the southern part of their range is included in Bowron Lake Park, but the majority of the range is north of the park.

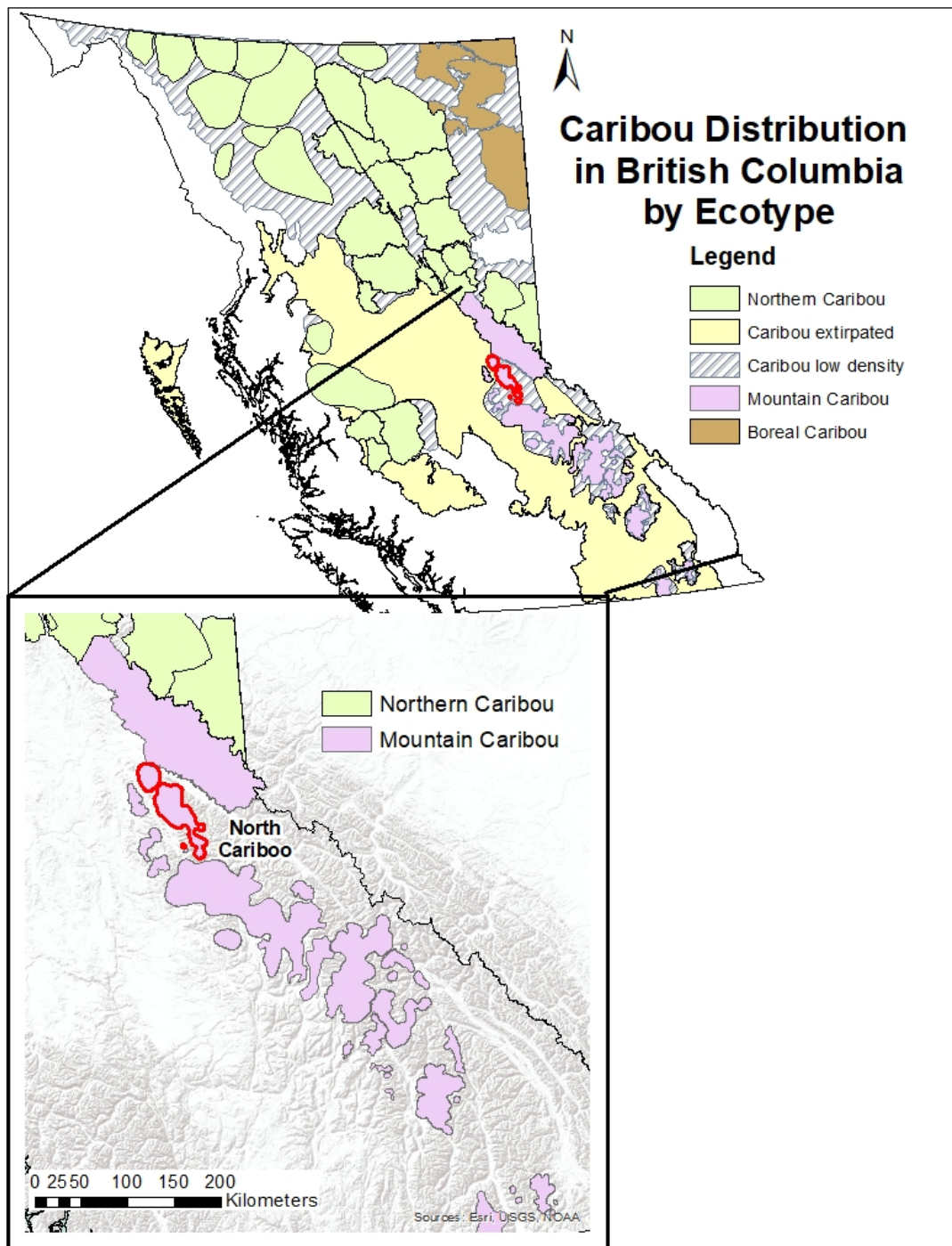


Figure 1: The geographical location of the North Cariboo subpopulation of woodland caribou. The 2327 km² range (inset: red outline) is situated within both the Omineca and Cariboo Regions of east-central British Columbia.

2.2 HABITAT AND BEHAVIOUR

North Cariboo woodland caribou range has gentle rolling mountains with treeline at or near the peak of most mountains. The caribou remain at mid-high elevations during most of the year (Seip 1990). In early winter, caribou selected subalpine fir forests on moderate angle slopes and low elevation cedar/hemlock forests (Seip 1990, Terry et al. 2000). During the winter, animals moved to higher to occupy open subalpine fir/ spruce forests (Seip 1990). Then in late-winter, caribou move into mature forest when consolidated snow allows them to feed on arboreal lichens (Terry et al. 2000).

North Cariboo animals are arboreal lichen feeders, selecting fruiticose lichen growing above the snowpack in tree branches (Terry et al. 2000, Jones 2007). In winter, they feed almost entirely on arboreal lichen and conifer tree needles (Seip 1992b, Terry et al. 1996). In the spring and summer they add shrubs, grasses and forbs to their diet.

This subpopulation is do not have a distinct seasonal migration like in some other regions (Seip 1992b). The fall rut is spent by most animals in this subpopulation in the high elevation, alpine tundra zone (Seip 1990). Animals move to lower elevations in the spring calving period, with animals tending to move downslope in May and June returning to high elevation habitats in summer (Seip 1990).

2.3 POPULATION SIZE AND TREND

There is a short history of population monitoring of the North Cariboo caribou subpopulation. (Seip et al. 2005, 2006, Heard et al. 2010, Seip et al. 2011, Courtier and Heard 2014, Klaczek and Heard 2016). Survey methods among years have remained relatively consistent. However, there are more years when only two census blocks (Sugar Bowl and Haggan) of the three that the population occupies (includes Bowron Lak Provincial Park). Figure 2 reports population estimates (count adjusted for sightability) for census' where all three blocks were included or where reasonable predictions of the Bowron block was possible (Klaczek and Heard 2016). These values indicate a recent population decline.

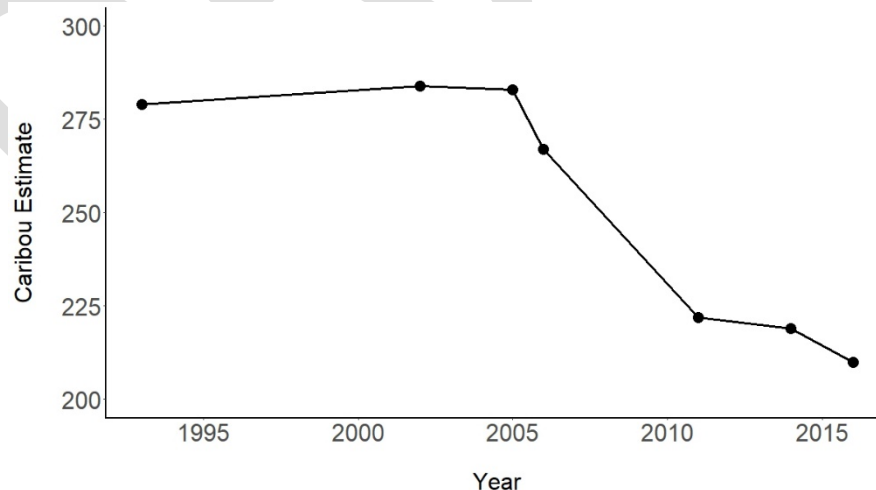


Figure 2: Caribou population estimates (counts adjusted for sightability) for the North Cariboo caribou subpopulation. Plotted points include either years where all three survey blocks (Sugar Bowl, Haggan and Bowron) or when two blocks were surveyed and a reasonable prediction of the population in the missing block was made (M. Klaczek pers. comm.).

Woodland Caribou Plan for the North Cariboo Subpopulation

Caribou recruitment, measured as percent of calves in the population observed during a spring census (Bergerud and Elliot 1986), varies considerably among years and appears to oscillate between approximately 16% and 9% from year to year (Figure 3).

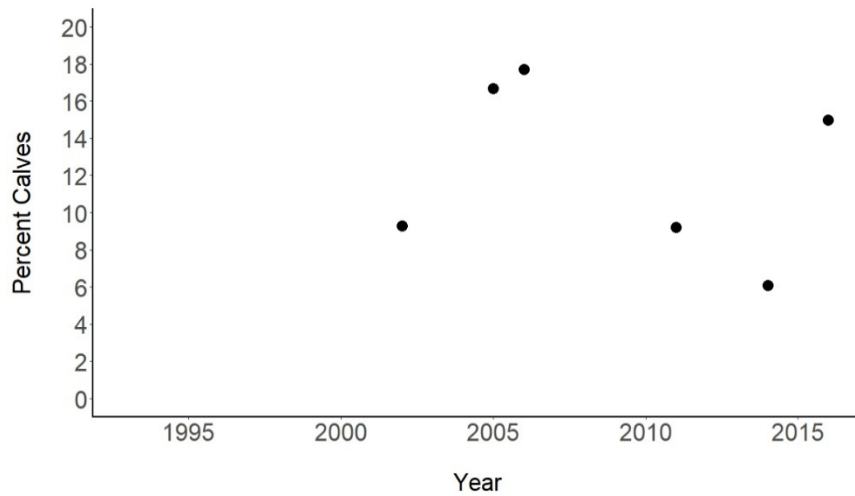


Figure 3: Caribou population recruitment measured in the North Cariboo caribou subpopulation range. Recruitment is defined here as the percent of the estimated population that is in the calf cohort. Recruitment below 10 to 12% is considered below a threshold that will balance natural mortality (Bergerud and Elliot 1986).

3 THREATS AND LIMITING FACTORS

Primary threats to caribou and their habitat have been noted by McNay et al. (2008), COSEWIC (2015) and a variety of independent studies focusing on individual threats (e.g. James et al. 2004, Wittmer et al. 2005b, Courtois et al. 2007, Seip et al. 2007, Wittmer et al. 2007). Threats are treated in isolation, but this does not discount the likelihood that they interact. Cumulate effects assessment (Sorensen et al. 2008, Johnson et al. 2015) is beyond the scope of this plan, but work on boreal caribou has demonstrated its value in developing comprehensive range planning for woodland caribou (Angelstam et al. 2004, Environment Canada 2012b).

Here we consider the following threats:

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 have indicated 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 hyperabundance (Hebblewhite et al. 2007), apparent competition mediated by expanding alternative prey distribution (Wittmer et al. 2007, DeCesare et al. 2009, Latham et al. 2011a, Latham et al. 2011c), and enhanced predator access to woodland caribou habitat (James and Stuart-Smith 2000a, Latham et al. 2011b). More generally, Bergerud (2007) has calculated that wolf densities greater than 6.5 wolves/1000 km² will result in woodland caribou declines. More recently, the federal recovery strategy identifies 3 wolves/1000 km² as a target (Environment Canada 2014).

In a 1980's study of caribou in the North Cariboo caribou subpopulation range, radio-collared caribou had a 29% mortality rate (Seip 1992b). When the cause of death could be identified, 70% was due to predation (55% wolf, 15% bear; Seip 1992b). A study between 1993 and 2001 that included part of the North Cariboo subpopulation range had 26 radio-collared caribou die. Although most mortalities were south of the North Cariboo subpopulation range, only 3 (~12%) were confirmed as predation. A 2016 caribou survey in the subpopulation range did not observe signs of wolf activity in high elevation caribou habitat, but found numerous wolverine tracks (Klaczek and Heard 2016).

3.2 FOOD LIMITATION

Woodland caribou are well known 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 small 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 the animals' nutritional needs (O'Brien et al. 2006, Brown et al. 2007). Trade-offs between these two fundamental demands as they select habitats (avoiding predators, finding food) raises the potential for woodland caribou to be food or energy limited (Poole et al. 2000, Gustine et al. 2006). When it has been considered, estimates of caribou food abundance typically far exceeds population needs (Courtois et al. 2007).

A 1980s study of caribou in the North Cariboo subpopulation range examined food habits and diet quality (Seip 1992b). Lichen is 80% of their winter diet with conifer needles, buds and twigs making up the other 20%. Nitrogen content of these food types, as indicated by fecal N levels, is low. In spring they add fresh grazing and browse but continue to eat lichen and conifer browse. 12% of mortality due to malnutrition, but two of these happened during the summer when food was abundant, suggesting that disease or age may have contributed (Seip 1992b). No caribou died of malnutrition in winter during the study.

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 development and clean energy. Caribou are affected by industrial activities both due to the infrastructure that is associated with it 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 populations. Although some populations live seasonally in treeless, alpine ecosystems, all spend some of the year in forests. For this reason, forestry 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 (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).

The North Cariboo caribou subpopulation range overlaps with both the Prince George and Quesnel Timber Supply Areas (TSAs) within the Prince George Forest District. Prince George TSA’s current allowable annual cut (AAC) is 8,350,000 cubic metres as of October 11, 2017. The current AAC for the Quesnel TSA is 2,607,000 cubic metres, effective June 16, 2017 (British Columbia Ministry of Forests 2017). 282 km² has been harvested in the subspecies range since 1965 which is approximately 12% of the total area. Considering that much of the southern part of the range is protected from forestry by a provincial park, this concentrates forestry in approximately the northern ¾ of the range.

3.3.1.2 MINING

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

The North Cariboo caribou subpopulation range falls within Designated Placer Area 4 but there are no placer leases within their range (although there are leases close on the western boundary). The Giscome Limestone Quarry is being proposed for a location to the northwest of the North Cariboo caribou subpopulation range but outside of its home range.

3.3.1.3 OIL AND GAS

Oil and gas development threaten caribou populations through habitat destruction, human activity, access, habitat fragmentation that can lead to habitat abandonment and elevated predation (Dyer et al. 2001, Boutin et al. 2012, Hervieux et al. 2013). Given the spatial scope of developments and the range of activities that take place in caribou habitat to develop oil and gas resources (well sites, access roads, pipelines, seismic lines) 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 energy 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).

Oil and gas exploration or development is not an issue for the North Cariboo caribou subpopulation.

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 off migration routes. 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-park 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 wind or hydroelectric developments or proposals within the North Cariboo caribou subpopulation range, although there are run-of-the-river hydroelectric developments close to the southeast and northwest.

3.3.1.5 OTHER

There are currently no other major forms of industrial development within the North Cariboo caribou range.

3.3.2 RECREATION

Recreational use of caribou habitat refers largely to fall and winter activities, including snowmobiling, commercial heli-skiing, commercial cat-skiing and hunting. In some jurisdictions, winter tour skiing and mountaineering are also relevant recreational activities. Numerous studies have shown that woodland caribou to varying degrees avoid mechanized winter activities (Simpson 1987a, Simpson and Terry 2000, Mahoney et al. 2001, Kinley 2003, Wilson and Hamilton 2003, Seip et al. 2007). Despite numerous records of displacement, no study has been able to draw a link between winter recreational use and woodland caribou population decline.

3.3.2.1 SNOWMOBILE

Snowmobile use in caribou habitat can result in their displacement (Simpson 1987a, Apps et al. 2001, 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). The mechanisms of displacement include caribou avoiding or fleeing snowmobiles while they are in use, ease of access to caribou habitat by hunters and the facilitation of predator movement into caribou winter habitat from packed trails created by snowmobiles (Bergerud 1988, Polfus 2010)

Recreational snowmobile use is popular in the Quesnel Highlands, at the southern end of the North Cariboo caribou subpopulation range, (Price and Roorda 2006). Snowmobiles are used on 80% of winter weekends in most areas in the Quesnel Highlands and over a 4 year study, there were 21 times when snowmobile users came within 500 m of caribou (Price and Roorda 2006). Compliance for voluntary snowmobile closures to protect caribou winter range varied between 78.3 and 98.2% during that time (Price and Roorda 2006).

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 to monitor caribou and helicat ski operations in an attempt to minimize operational impacts.

Crescent Spur Heli-Ski operates on the eastern edge of range area of the North Cariboo caribou subpopulation. Bearpaw Heli-Skiing operates at the northern edge of their range. Both of these companies report caribou or

caribou track sightings during their winter operations, and take measures to avoid animals and educate staff and clients on caribou conservation (Government of British Columbia 2017b, Simmons 2017). Other heli-ski operators (Silvertip, Canadian Mountain Holidays) operate in the vicinity (south) of North Cariboo 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, motorized assist off-piste skiing) and mountaineering bring their participants into alpine areas that overlap with woodland 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).

Backcountry skiing and ski traction kiting occurs in and adjacent to the range of the North Cariboo caribou subpopulation, largely within Bowron Lake Provincial Park (exploreBC 2017). There are no backcountry ski lodges in the 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 2000b, 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 local snow depth. Growing hay and grain crops within or adjacent to caribou range has the potential to 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). Access to crops increases the population growth of these species that can increase the population of the predators that they share with caribou, putting downward pressure on caribou populations.

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

The southern extent of the North Cariboo caribou subpopulation range falls within the Cariboo Agriculture and Food Region (Charlton et al. 2014). It is also part of the Barlow/Barkerville Cariboo Electoral Area that governs the Agricultural Land Reserve (ALR). The ALR in this area is largely along Highway 16 to the east and north of subpopulation range (Connell and Eistetter 2015). There is little ALR land and little agricultural activity in this subpopulation range.

3.3.3.2 MAJOR HIGHWAY CORRIDORS

Where they occur in caribou habitat, highways have a strong, negative effect on caribou populations (Johnson and Todd 1977, Curatolo and Murphy 1986, Apps and McLellan 2006). They have several effects. Vehicle activity on highways creates a movement barrier for caribou as they are either reluctant to approach or get killed crossing (Dyer et al. 2002, Rytwinski and Fahrig 2012). In the former case habitat and population

fragmentation results. In the latter case, populations numbers decline directly. Highways and roadways can also provide access to people 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 16 runs through the northern edge of the North Cariboo caribou subpopulation range, and close to its eastern boundary. Vehicle collisions are a concern due to the traffic volume and speed on this road (COSEWIC 2015, p. 55).

3.3.3.3 LINEAR FEATURES

Linear features are land disturbances that tend to be long, continuous and narrow, including things like seismic cut lines, pipelines and overhead power transmission rights-of-way. They are not cleared to a road standard, but enable both four-wheel-drive access and ease travel for predators and alternative prey (Hebblewhite et al. 2010a). One hypothesized effect is that linear features facilitate predator movement into and within prey habitat and increasing predator-prey overlap (DeMars and Boutin 2017).

There are no prominent linear features (non-highway) such as seismic lines or electrical transmission corridors in the North Cariboo caribou subpopulation range.

3.3.3.4 HUNTING

The North Cariboo caribou subpopulation range spans both the Omineca and Cariboo resource districts, and is covered by districts 7-5, 7-6, 7-7 (Omineca) and 5-16, 5-15 (Cariboo). There is no caribou hunt in any of these districts, but there are seasons for many other game species including mule deer, white-tailed deer, moose (limited entry), elk and mountain goat. While reduction in alternative prey through hunting pressure can be beneficial to woodland caribou, active hunting in their winter range may also contribute to accidental death by hunters who misidentify their prey.

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).

There are no records of caribou poaching of North Cariboo caribou from the Omineca or Cariboo regions from the Conservation Officer Service.

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 critical habitat and changes predator-prey dynamics by improving habitat for alternative prey and increasing wolf-caribou spatial overlap (Robinson et al. 2012). Fire suppression has increased the possibility of an intense fire that would alter habitat (Environment Canada 2012a).

Approximately 9 km² of wildfires burned in the North Cariboo caribou subpopulation range in 2017 and about 417 km² of area has burned historically (since 1927). In total this is 18% of the total area. Most of this occurred in

1961 and 1985 in two large lightning started fires along Haggan Creek. Influencing factors such as climate change may exacerbate the frequency, size and intensity of wildfires (Harding and McCullum 1997).

Mountain pine beetle (MPB) has been active in the TSA. Pine stands have been affected by a high level of infestation that occurred in British Columbia over the past decade. MPB peaked in the Prince George and Vanderhoof Districts in 2004 and in the Fort St. James District in 2006. Within the range of the North Cariboo caribou subpopulation there has been 275 km² of severely affected MPB forest (12%), 110 km² moderately affected (5%) and 226 km² of lightly affected pine forest (10%).

3.5 PARASITES AND DISEASES

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

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

There is no reported occurrence of brucellosis or tuberculosis in British Columbia in any species, severe symptoms of Besnoitiosis have not been found in caribou in British Columbia (Miller et al. 2014a). However, many of the other parasites can be found in woodland caribou in British Columbia with affects on individuals, but no reported population-effects on the North Cariboo 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 duration, may be directly affected by climate change (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). 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) and 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 (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 a snow adapted, arboreal lichen eating animal like caribou. This benefit could be negated by more frequent freeze-thaw cycles (Plummer et al. 2006) that will influence predation and access to food for caribou, and increased forest fires (Gillett et al. 2004, Dawson et al. 2008). Predictions of 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).

There are no studies that directly look at links between North Caribou caribou and climate change.

3.7 SMALL POPULATION SIZE EFFECTS

Small population effects include several threats to caribou populations that are unique to small (approximately less than 50 animals) and isolated subpopulations. These include reproductive and genetic isolation (McDevitt et al. 2009), predation, 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, fires or floods can kill an entire herd (Hebblewhite et al. 2010b). Movement barriers that prevent inter-population dispersal exacerbate small population effects creating situations where small or extirpated populations have no chance of rescue.

The breeding population of the North Caribou caribou subpopulation is small to moderate size but declining (Figure 2), so that they are under pressure of small population effects. Accidents account for a relatively large proportion of all annual mortalities (18%) in the Quesnel Highlands (Seip and Jones 2010). While this is not an issue with the overall population size as it is, accidental deaths could pose a real threat if the recent decline continues.

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 (Weckworth et al. 2012). Although not small enough to experience a bottleneck, further fragmentation or declines in the North Caribou caribou subpopulation could result in genetic anomalies that will be impossible to correct without translocation or other intervention (cf. McDevitt et al. 2009, Weckworth et al. 2012).

4 MANAGEMENT HISTORY

4.1 HABITAT

Caribou habitat in the range of the North Caribou caribou subpopulation is complex as not all animals follow the same seasonal patterns of habitat selection. While most spend fall and winter in high elevation subalpine fir, some selected mid elevation spruce/subalpine fir and others were at low elevations in the

cedar/hemlock forest (Seip 1992b). What is common among animals is selection for selection for stands >80 years old and avoidance of young stands (Seip 1992b, Terry et al. 2000).

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 programs that accelerate seedling establishment (Cichowski 1989, Cichowski 1996). Forestry regulation promote and enforce practices that balance resource use with habitat protection (Seip 1998). Because caribou in this subpopulation range use a wide range of habitats, understanding the impact of habitat management in this area requires a comprehensive analysis using landscape tools such as remote sensing (Sachs et al. 1998, Herzog et al. 2001).

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.

Within and adjacent to the range of the North Cariboo caribou subpopulation there are several provincial parks and protected areas. Bowron Lake, Sugarbowl Grizzly Den, Chun T'Oh Whudujut Provincial Parks and the Sugarbowl Grizzly Den Protected Area are all within the subpopulation range. Purden Lake, Erg Mountain Ptarmigan Creek Provincial Parks and the Ptarmigan Creek Protected Area are all adjacent to the subpopulation range. In addition, a no-hunting Wildlife Management Area falls along the subpopulation's eastern boundary. And, Since 2007 Ungulate Winter Range protection designations have been established over much of the high elevation habitat to minimize forestry-related activities (Klaczek and Heard 2016). Only about 658 km² of this subpopulation's range (28%) is not under some form of protection.

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). 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.

There is no large-scale habitat restoration being conducted in the North Cariboo caribou subpopulation range.

4.2 RECREATION AND ACCESS MANAGEMENT

Road access to woodland caribou habitat elevates conservation threats including conflicts with snowmobiles, 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 how they 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).

The large number of forestry cutblocks in the North Cariboo caribou subpopulation range has left a legacy of road access in the region. There are about 518 km of forestry roads in or adjacent to the subpopulation range; only 41 of which have been retired (by 2017). This is 0.22 km/km² of roads in the subpopulation range, which is high (Dyer et al. 2002, Smith 2004, Apps and McLellan 2006, Beauchesne et al. 2014, COSEWIC 2015, Bennett 2017). Managing user access to this road network is paramount to caribou persistence and recovery here, and access restrictions for motorized vehicles are in place in most areas (Klaczek and Heard 2016, Government of British Columbia 2017a).

4.2.1 SNOWMOBILE

A recognition of the impact of snowmobile encounters on caribou habitat use (Kinley 2003, Price and Roorda 2006, Seip et al. 2007) has prompted a closure of much of the range of the North Cariboo caribou subpopulation to snowmobile use (Klaczek and Heard 2016).

4.2.2 HELI-SKI / CAT-SKI

Management of the North Cariboo caribou subpopulation is included under the umbrella of the Mountain Caribou Recovery Implementation Plan, approved in 2007. As a result of this, restrictions and increased scrutiny of commercial heli-skiing operations is in place (see above; Klaczek and Heard 2016). This means that HeliCat Canada, an organization that represents most helicopter and cat-ski operators in British Columbia and all of those that operate in the subpopulation range, comply with guidelines to avoid caribou and their habitat during their activities. They record and report all wildlife observations, have adopted best management practices to avoid caribou encounters and undertake an annual review of their practices with respect to wildlife, particularly caribou, interactions.

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 (non-hunting) OHV use.

4.3 PREDATORS

Unsustainable predation is acknowledged as a key, proximal mechanism of woodland caribou decline across Canada (Bergerud and Elliot 1986, Bergerud 1988). Woodland caribou populations have persisted despite ongoing predation from wolves, bears (black and grizzly) and cougars for millennia, but the profound impact of predators is a recent phenomenon. What has changed is habitats due to resource extraction, access to critical caribou ranges and the dynamics among caribou, their ungulate kin (moose, deer, elk) and predators.

Shrinking old-growth forest caribou habitat has forced caribou into increasingly smaller ranges, making their locations more predictable to predators, seasonal migratory routes track through predator rich areas, and bringing them into closer proximity to alternative prey species that can sustain higher predator populations (Seip 1992a, Apps et al. 2013). Road and seismic line clearing and winter trail packing makes travel for predators into caribou critical habitats more efficient, elevating wolf predation in particular (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).

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

4.3.1 WOLF MANAGEMENT

Wolves are an important, year-round caribou predator. Caribou populations in northern British Columbia were shown to decline when wolf densities were 9–10/1000 km² but increased at wolf densities from 1–4/1000 km² (Bergerud and Elliot 1986). For this reason, target wolf densities that would enable caribou recovery are set to 6.5/1000 km². In the absence of effective habitat or alternative prey management to achieve these densities, direct wolf management must be undertaken to achieve caribou conservation goals.

Wolf control was conducted in the Quesnel Highlands for two years as part of a study between 1984 and 1989 (Seip 1992b). Prior to wolf management only 2.5% of female caribou had calves that survived from spring calving to the fall rut survey (Seip 1992b). When wolf management was taking place, or in places where wolves were not seen, 39% of females had calves that survived this period (Seip 1992b).

Another wolf study in the Quesnel Highlands, at the southern end of the North Cariboo caribou range ran from 2001 to 2010 (with a lapse in 2004; Roorda and Wright 2004, 2010). From 2001 to 2004, 30 wolves were killed in the study area and 16 were sterilized. Between 2007 and 2010, 40 wolves were collared to track movements and mortality rates, 34 were killed and 31 were sterilized. In 2010 wolf density was 5.5 wolves/1000 km² in the active control area which is below the recommended threshold of 6.5 wolves/1000 km² (Bergerud 2007, Roorda and Wright 2010).

A wolf management program began in 2008 in the Narrow Lake area adjacent to the North Cariboo subpopulation range, but only 2 wolves were removed in the first year. The wolf population is occasionally censused in the area (Young and Freeman 2003).

4.3.2 COUGAR MANAGEMENT

Cougars are rare in the North Cariboo caribou subpopulation range (Spalding 1994) but their population is likely increasing. Cougar hunting in the Omineca region is gaining popularity and the number of successful hunts is increasing. In 1980 there was one cougar killed by both resident and non-resident hunters, while in 2013 there were 19 cougars killed by resident and non-resident hunters. 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. Nevertheless, 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 1992a, 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 and Black Bears are relatively abundant in the North Cariboo caribou subpopulation range, and are predators particularly of calves in the spring (Wittmer et al. 2005a). To date, bear management to reduce their densities to favour caribou population numbers is not being conducted.

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 ability to continued isolation. Across their range, woodland caribou populations have been subject to apparent competition (DeCesare et al. 2009, Wittmer et al. 2013). For this reason, managing primary prey, either directly through hunting quotas, or indirectly through habitat management has become a needed 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). 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.

No purposeful management reduction of moose, elk or deer populations have taken place in the range of the North Cariboo caribou subpopulation. However, since 2007 an alternate prey reduction experiment has taken place in the neighbouring Parsnip subpopulation range aimed at reducing wolf densities through a reduction in moose densities to ultimately reduce predation pressure on caribou (Heard et al. 2013, Klaczek and Heard 2016).

4.4.2 DEER MANAGEMENT

Managing deer populations in support of caribou conservation is a challenge. Where mule deer and white-tail deer ranges overlap, mule deer tend to decline, perhaps also due to apparent competition (Robinson et al. 2002). Neither are strictly regulated by either predators or food, but white-tailed deer populations respond as strongly to food availability than 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 and loss of native winter habitat (Pierce et al. 2012, 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), increased hunter take and likely a government cull.

Deer (white-tailed and mule) are present in the North Cariboo caribou subpopulation range and relatively abundant (Government of British Columbia 2010) but are not being purposely managed.

4.4.3 OTHER

Elk, like moose and deer, are wolf prey and could potentially facilitate apparent competition with caribou (see above). Elk are present in the North Cariboo caribou subpopulation range but are not being purposely managed.

4.5 POPULATION REINFORCEMENT

The International Union of Conserving Nations has established guidelines for reintroductions and other 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).

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 penning pregnant females protected from predators. The females are held through parturition and for up to six weeks after birth. By this time calves are large and strong enough to better avoid predators, improving their survival 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 known as an *in situ* method as 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 North Caribou caribou subpopulation 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. 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 approach 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. A number of factors, such as source animals, animal husbandry, avoiding genetic bottlenecks, gene mixing with destination herds, status of destination herds, disease transmission, fate of male calves and many more must be considered in such an effort (Dolman et al. 2015, Hayek et al. 2016).

Captive breeding to reinforce the North Caribou caribou subpopulation is not being planned. This subpopulation is declining and thus may not 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 age and sex groups in the target population (Miller et al. 2007, Decesare et al. 2010b). 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 North Caribou 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 North Cariboo 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 regulations where none were before (Hayek et al. 2016). Gaining the social licence to undertake management actions like predator management, translocations, 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 running reinforcement activities such as maternity pens.

Prince George is an important hub for caribou research and conservation in central British Columbia. There are a number of caribou populations in the region, government offices focussed on caribou monitoring, Indigenous communities with cultural links to caribou and a university campus (University of Northern British Columbia) that conducts a lot of fundamental research on caribou and their habitat.

There is already a Community Working Groups for species at risk in Prince George; specifically for White Sturgeon recovery. These are composed of First Nations, ENGO, Industry, Provincial and Federal Government representatives. A similar group could be established for caribou conservation. As well, the Spruce City Wildlife Association is a membership group of hunters, naturalists, anglers, trappers, guides and environmentalists conducting projects for wildland protection (SCWA 2017). Outreach to groups such as this to promote programs and education in caribou themes.

4.7 RESEARCH

Every caribou subpopulation in British Columbia requires some degree of management action; habitat protection or restoration, population reinforcement, alternative prey management, 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 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 these factors are well understood in a broad sense, ongoing research is necessary to fine tune caribou responses to ecological stimuli and human disturbance.

The North Cariboo caribou subpopulation, their habitat and predator-prey dynamics in the region, have been long studied by both university-based and government biologists. An understanding of caribou population variability, density of primary prey (moose and deer) and predator (wolf) dynamics has been studied (Seip 1998, Terry et al. 2000, Apps et al. 2001, Seip 2003, Wittmer et al. 2005a, Jones et al. 2007). An understanding of the cause and effect of caribou population declines remains incompletely understood, however manipulations of predator populations in the 1990s and early 2000s have provided important insights (Roorda and Wright 2004, 2010).

4.8 MONITORING

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

The Government of British Columbia has committed resources to monitoring caribou and game species population density in the North Cariboo caribou subpopulation range. Population size and trend of caribou in this area has not been regularly surveyed, although there have been recent surveys. Given the decline recorded in this subpopulation since 2005, regular and frequent population and recruitment surveys are recommended (see below).

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. 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 predation. None of these management actions can or will imperil other wildlife species but will necessitate changes to their population density and/or distribution.

Actions taken to protect and manage the North Cariboo caribou subpopulation 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 held low 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. However, changes to operations, seasonal restrictions and area closures will be required, locally affecting some recreational and commercial activities.

Already recreational snowmobile use has been restricted in this area since 2007, and the coverage of Ungulate Winter Range protections prevents forestry over much of the subpopulation range. The last caribou hunt was in 1997 and the last caribou killed by a resident hunter was in 1991 (non-resident, guided hunters killed the last hunted caribou in the region in 1997).

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. Neighbours 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 North Cariboo 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:** Lheidli-T'enneh First Nation, ?Esdilagh First Nation (Alexandria Indian Band), Carrier Chilcotin Tribal Council (Red Bluff Indian Band (Lhtako Dene), Lhoosk'uz Dene' Government Administration)

Local: Quesnel, McBride, Penny, Hixon, Dunkley

Regional: Prince George (and outlying communities)

Organizations: **Recreation:** British Columbia Snowmobile Federation (Wells Snowmobile Club, Prince George Snowmobile Club, McBride Big Country Snowmobile Association, Quesnel Snowmobile Club), Land Conservancy of British Columbia, Outdoor Recreation Council of British Columbia, Quad Riders Association of British Columbia, Prince George ATV Club, Quesnel Cross Country Motorcycle Association, Caledonia Ramblers Hiking Club, Prince George Horse Society, Prince George Off-Road Motorcycle Association, Prince George Snowmobile Club, Northwest Brigade Canoe Club, Tabor Mountain Recreation Society, Hickory Wing Ski Touring Club, Crescent Spur Heli-ski, Bearpaw Heli-ski, Canadian Mountain Holidays

Protection: Western Canada Wilderness Committee, BC Spaces for Nature, Yellowstone to Yukon Initiative

Commercial: **Hunting and Trapping:** British Columbia Trappers Association, Guide Outfitters Association of British Columbia, BC Wildlife Federation, Bear Lake Guides & Outfitters, Claw Mountain Outfitters

Accommodation and Guiding: Tabor Mountain Ski Resort, BC Safaris Hunting Guides, Inzana Outfitters, McGregor River Outfitters, Opatcho Lake Guide Outfitters, Sentinel Mountain Safaris, Bowron River Guiding, Touchwood Tours, Triple J Ranch, United Guide & Outfitter

Forestry (*Active licences to cut*): Prince George Activator Society, College of New Caledonia,

Forestry (*Woodlots*): Lee Foster, Point Creek Contracting

Agriculture: Prince George Agriculture and Historical Association

8 RECOMMENDED ACTIONS

8.1 SHORT TERM (WITHIN 6–12 MONTHS)

- Manage the predator-prey relationship with a goal of controlling wolf populations to a density of less than 6.5 wolves/1000 km² verified by periodic wolf population counts.

8.2 MEDIUM TERM (WITHIN 12–24 MONTHS)

- Resume caribou population monitoring through annual or bi-annual aerial census or through non-invasive techniques such as scat mark-recapture (Ball et al. 2007).
- Investigate resumption of predator management in the North Cariboo caribou subpopulation range.

8.3 LONG TERM (WITHIN 24–48 MONTHS)

- Achieve an increasing population for the North Cariboo caribou subpopulation over the next 7 years. The objective is to reverse the current population decline and recover the population to 300 animals. This will be monitored by measuring population size and growth rate.
- Maintain and enforce current population (no caribou hunt) and habitat (UWR and Provincial Park) protection
- Ensure a supply of habitat that supports a sustainable caribou population by leaving core habitat undisturbed or allowing it to recover. This will be measured using remote sensing tools of aerial extent of undisturbed or recovering vegetation classes.
- Expand habitat protection such that all high elevation habitat is protected as provided by the Recovery Strategy (Environment Canada 2014). This will be measured using legislative tools that track protected areas management through the Forest and Range Protection Act in British Columbia.
- Coordinate management actions with other initiatives including federal and provincial jurisdictions.

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