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

Carcross
Subpopulation

Northern Mountain Caribou

BRITISH COLUMBIA

Recommended Citation:

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EXECUTIVE SUMMARY

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1 BACKGROUND

1.1 INTRODUCTION TO THE PROGRAM

The Carcross woodland caribou subpopulation is grouped under Northern Mountain Caribou (Designatable Unit (DU) 7 – Northern Group) by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; Environment Canada 2012a). As a group, the Northern Mountain population of woodland caribou is recommended as Special Concern (COSEWIC 2014). Previously, and until the DU structure for caribou populations is formally adopted, the Carcross caribou were considered Northern Caribou, and management plans devoted to their conservation will be prepared (The Northern Caribou Technical Advisory Committee 2004).

Range plans are required for all woodland caribou populations that are designated as threatened or endangered in Canada (Environment and Climate Change Canada 2016). While the current designation for the Carcross subpopulation is "Special Concern", current monitoring indicates that they are in decline and in need of comprehensive recovery planning. Note that this range plan covers management actions relevant to the British Columbia portion of the Carcross caribou subpopulation range. This herd spans the British Columbia – Yukon boundary with a reality of differing management issues and approaches between jurisdictions. This plan acknowledges these differences and makes best available recommendations to the British Columbia government.

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 Carcross Northern Mountain caribou subpopulation.

2 POPULATION DESCRIPTION

Northern mountain caribou are found in the northern mountains of Yukon Territory, the southern Northwest Territories, and central and northern British Columbia. Northern mountain caribou are distinct from other mountain-dwelling caribou for their feeding and movement habits. They spend winters in low-elevation, mature coniferous forests or on high elevation ridges with low snow loads (Boonstra and Sinclair 1984, Stevenson and Hatler 1985, Cichowski 1989, Heard and Vagt 1998). In winter, they feed on terrestrial lichens. Females move to high-elevation, sub-alpine calving grounds in spring (Johnson et al. 2000, Gustine et al. 2006).

2.1 DISTRIBUTION

The Carcross subpopulation is a British Columbia-Yukon transboundary herd that largely calves, summers, and ruts in northern BC in the Yukon-Stikine Highlands ecoregion of the Coast Mountains west of Tagish Lake and into the Southern Lakes area of the Yukon. Named after the shortened "Caribou Crossing" town in the Yukon, its winter range is primarily within the Yukon Southern Lakes ecoregion west of Little Atlin Lake and east of Bennett Lake up through the Southern Lakes area south of Whitehorse to Squanga Lake (Williams and Dixon 2016). The Yukon-Stikine Highlands is part of the Coast Mountains and receives high amounts of precipitation (300–500 mm annually) with very deep winter snow conditions (Francis and Nishi 2015).

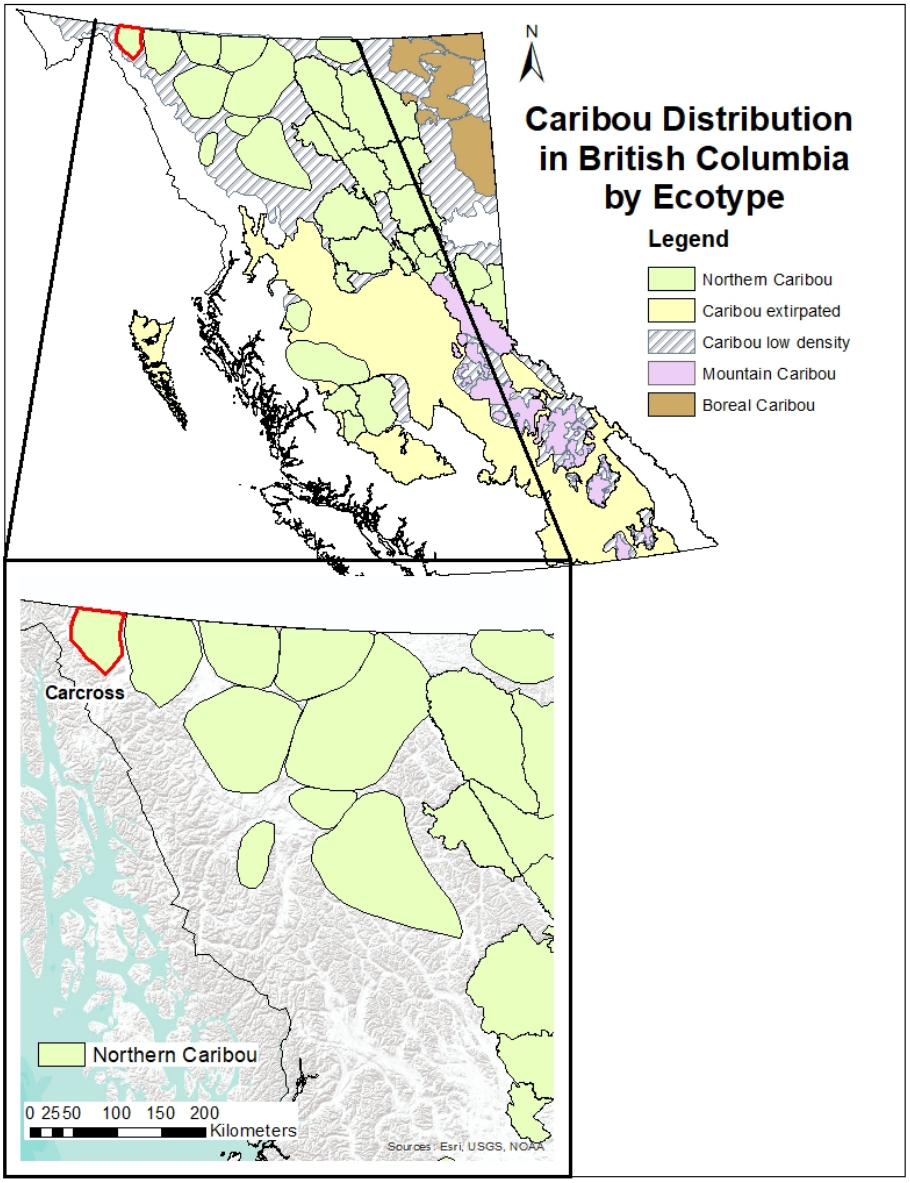

Figure 1: The geographical location of the Carcross subpopulation of woodland caribou. The 3274 km^2 range (inset: red outline) is situated within the Skeena Region of northwestern British Columbia.

2.2 HABITAT AND BEHAVIOUR

The Carcross caribou range transitions between the Coast Mountains and Interior Yukon Plateau. It is a diverse landscape with several mountains over 2000m and wide valleys. The area is interspersed with large lakes, alpine and subalpine plateaus, and a variety of glacial and fluvial landforms, including eskers, moraines, kettle lakes, glacial lake beds, and terraces.

In the BC portion of the Carcross range, the Yukon-Stikine Highlands is characterised by large areas of alpine and subalpine environments. It is part of the rugged Coast Mountains and receives high amounts of precipitation (300-500 mm annually) with very deep winter snow conditions that results in a long fire cycle of 1,081 years (Yukon Wildfire Management Branch, unpublished data).

Typical of most northern mountain caribou, the Carcross subpopulation is comprised of a number of sub-groups that have seasonal ranges during the summer and winter periods and move between them in the spring and late-fall.

There are large areas of potential summer range in both Yukon and British Columbia, comprised of the high elevation (greater than 1,200 m) subalpine and alpine areas. Areas with late lying snow patches are particularly important for summer insect relief. While on the summer range, cow caribou give birth to their calves and feed on grasses, sedges and dwarf shrubs during the post-calving period. The fall rut also occurs in these same high elevation areas. There are presently few immediate management concerns in the summer range. In the Yukon, with the exception of some mountain plateaus in the Whitehorse and Carcross (town) areas, the summer range has relatively low levels of human development footprint and activity (Francis and Nishi 2015).

Prime winter habitat is the mature pine and mixed pine/spruce-lichen forest communities located in the valley bottoms at less than 800 m elevation. In the Yukon, this is where the majority of development is found, but in BC the Carcross range is one of the most remote areas with little development (Conrad Thiessen, pers. comm., 2017).

2.3 Population Size and Trend

The Carcross caribou subpopulation is only infrequently monitored in British Columbia, but has a time series of systematic aerial survey from the Yukon government (Figure 2). These are not population estimates, but minimum counts and only from the northern resident population. The most recent British Columbia estimate is 120 caribou in the Carcross subpopulation (Bell 2015). Similarly, with recruitment, rather than use percent of calves in the spring population, Yukon use calves per 100 cows as a recruitment estimator (Bell 2015; Figure 3).

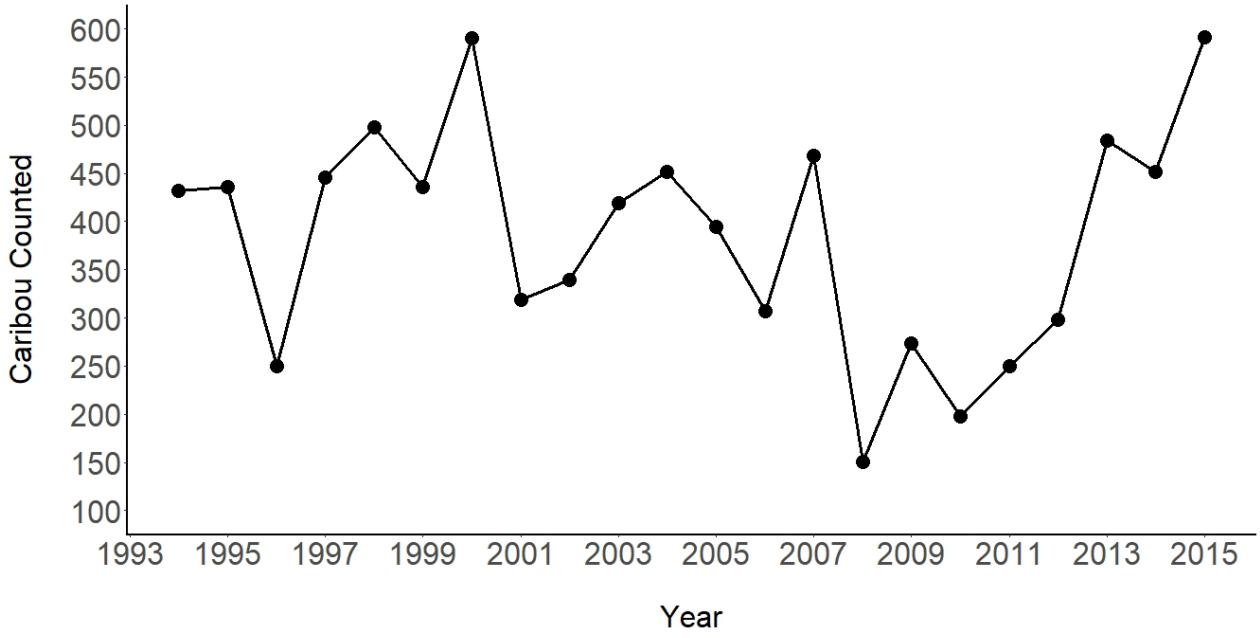

Figure 2: Total caribou counts from the Carcross caribou conducted by the Yukon government on the Yukon part of their range (Bell 2015). Note that they did not calculate a population estimate but reported total count.

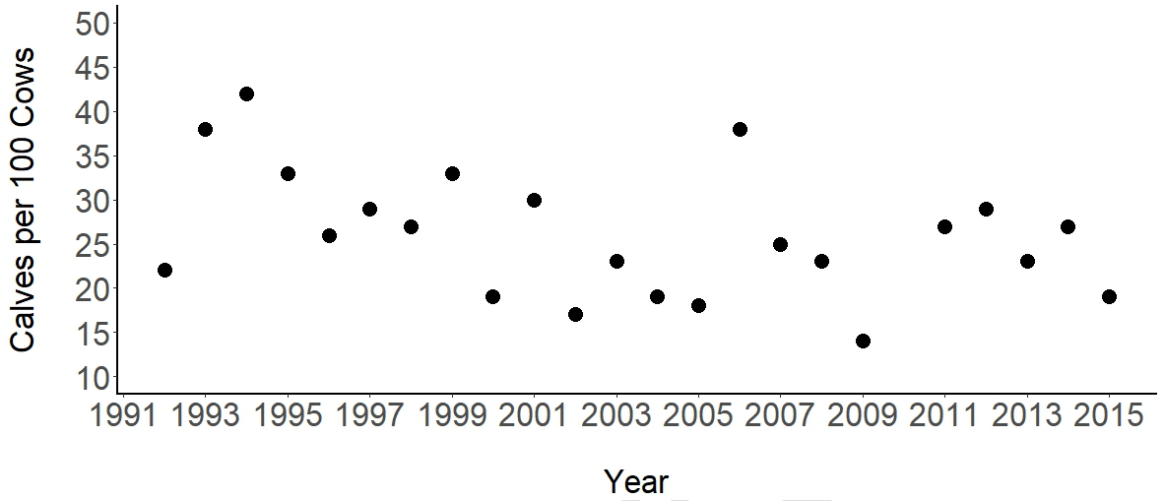

Figure 3: Calves per 100 cows counted on the Yukon part of the Carcross caribou herd (Bell 2015). This is one way to estimate recruitment but differs from that reported in other subpopulation plans that use percent of the spring population that is calves. Nevertheless, the general pattern of this measure provides a useful impression of overall conditions. No time series of recruitment estimates for BC caribou are reported, however when measured, however it is reported to be up to 2× that on the Yukon part (Bell 2015).

3 THREATS AND LIMITING FACTORS

Primary threats to caribou and their habitat have been noted by McNay et al. (2008), COSEWIC (2014) and a variety of independent studies 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. 2010b, Latham et al. 2011b), and enhanced predator access to woodland caribou habitat (Hayhurst 1983, Latham et al. 2011a). 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).

Predation rates on the Carcross caribou subpopulation is unknown as are grizzly and black bear densities in their range. Wolf densities in the Yukon portion of the subpopulation range is reported as 4.9/1000 km^2. This is between the Bergerud (2007) and Environment Canada (2014) targets for woodland caribou recovery.

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 (Newsome et al. 2000, 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).

Habitat types in the Carcross caribou subpopulation range include Boreal White and Black Spruce, Sub-Boreal Spruce, Spruce-Willow-Birch, Engelmann Spruce-Subalpine Fir and Boreal Altai Fescue alpine zones. These habitat types have abundant terrestrial lichen that comprise the majority of their winter and part of their summer diet (Kuzyk et al. 1999). Sedges in sedge meadow communities are the bulk of their summer and early fall diets Where the forest remains largely undisturbed and snow depths remain shallow in these forests (Johnson et al. 2001), food should not be limiting for Carcross caribou (Thomas and Gray 2002).

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).

There are few cutblocks in the range of the Carcross caribou subpopulation. There are three consolidated cutblocks totaling 63 ha between Tutshi Lake and Taku Arm that were cut in 1981. Forestry is not currently a significant threat to this subpopulation.

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).

On the British Columbia side of the subpopulation's range, active mining is not a concern, but there is active exploration and some areas have high potential. There is one gravel pit by Tutshi Lake, and there are 79 mineral and placer subsurface crown grants clustered near the south reach of Taku Arm.

On the Yukon side of the range there is sporadic mineral exploration including the Skukum Gold property had underground exploration and was shut down in 2008 (Environment Canada 2012a).

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).

There are no oil and gas fields mapped in the Carcross caribou subpopulation range, but there is a possibility of natural gas pipeline development through this range (Environment Canada 2012a).

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 hydroelectric or wind energy installations in the Carcross caribou subpopulation range. There have been 30 reports on the potential for run-of-the-river hydroelectric development throughout the range.

3.3.1.5 OTHER

There are currently no other major forms of industrial development within the Carcross 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)

Snowmobiling is not considered a large threat to the Carcross caribou subpopulation, but no monitoring has been conducted and this popular activity has potential for growth. See section 4.2.1 for management actions.

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.

There is a tenure for helicopter skiing in the Carcoss caribou range operated by Atlin Heli Sports located in the southwestern part of their range (White Moose Mountain, Hale Mountain, Mount Lawson). Yukon Alpine Heliski operates in the area, but not directly within the Carcross caribou range.

See section 4.2.2 for management actions.

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). There are several backcountry touring routes in the Carcross caribou range (Fraser Peak, Mount Log Cabin, Summit Creek Hill)(Steele 2014). There is also an Atlin, BC to Juneau, AK ski traverse route that skirts the southern edge of the Carcross population range.

Commercial downhill ski resorts also operate in woodland caribou habitat and have impacts on individuals and habitats (Czetwertynski and Schmiegelow 2014). There are no downhill ski resorts or known development proposals in the Carcross caribou range.

Summer recreation can also affect the Carcross caribou subpopulation. Activities such as off-highway-vehicle (OHV) use and mountain biking allow deep access into caribou with only minimal road infrastructure required. ATV use for recreation (or hunting) is not prohibited in the Carcross caribou range, but there are no advertised trails for recreational OHV use. Nevertheless, a 1999 survey of the area east of the Carcross caribou subpopulation range noted widespread OHV activity and impacts in fall and winter caribou range (Marshall 1999).

In the Yukon, this herd ranges in areas of human habitation with frequent human contact and habitat fragmentation by residential, recreational and industrial developments and associated access. (Environment Canada 2012a, Francis and Nishi 2015).

See section 4.2.3 for management actions.

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 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).

Neither farming nor ranching occur in the range of the Carcross caribou subpopulation.

3.3.3.2 MAJOR HIGHWAY CORRIDORS

Where they occur in caribou habitat, highways have a strong, negative effect on caribou populations (Curatolo and Murphy 1986, Apps and McLellan 2006, McFarlane et al. 2009). 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 2 (the Klondike Highway) from Whitehorse to the US border at Skagway, Alaska runs through the western edge of the Carcross caribou subpopulation range. Vehicle collisions are a concern due to the traffic volume and speed on this road (COSEWIC 2014, 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 2018).

There are no prominent linear features (non-highway) occur in the Carcross caribou subpopulation range.

3.3.3.4 HUNTING

There is an open season for 5-point caribou bulls from the Carcross caribou subpopulation range from August 15 to October 15 each year. There is also guided caribou hunting in the region. In the Yukon part of their range, there has been a licenced harvest ban since 1994 and a voluntary harvest ban since 1992 (Environment Canada 2012a).

From 1976 to 2015, 71 caribou (an average of 1.7 (±1.4 SD) annually) were harvested by resident hunters. From 1978 to 2015, non-resident hunters killed 204 caribou (average 5.3 caribou (±2.7 SD) annually). From 2017 to 2021, 27 bull caribou have been allocated in resident and guided hunts (in total) from the Skeena region (British Columbia Ministry of Forests, Lands and Natural Resource Operations 2016). The specific impact to the Carcross subpopulation is unknown.

Thinhorn mountain sheep and mountain goats can be hunted in the western part of the caribou range during a limited entry season and there is an open season for moose (Government of British Columbia 2017). While reduction in alternative prey 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 is no information on caribou poaching in the Carcross region.

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). However, fire is not a common disturbance in the Carcross caribou subpopulation range. From 1921 to 2015

fires totalling 13.5 km^2 burned in the Carcross subpopulation range (22%). In northern and boreal habitats, it takes 80 years for a forest to recover from a fire to become caribou habitat again (Robinson et al. 2010). Fires since 1936 total 679 km^2 within the subpopulation range (0.4%). Influencing factors such as climate change may exacerbate the frequency, size and intensity of wildfires (Harding and McCullum 1997). There is no mountain pine beetle activity in the range.

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 Carcross 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).

There is no herd-specific information on climate change effects on the Carcross caribou subpopulation, however trends for western North America predict declining snow packs (Mote et al. 2005) and 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). 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 populations that are unique to small (approximately less that 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 Carcross caribou subpopulation was estimated to be 775 animals and stable in 2008 and 720 and stable in 2015 (Grant 2017). This is higher than commonly accepted thresholds for small populations and has relatively high genetic diversity (Kuhn et al. 2010). Nevertheless, this population is threatened geographically isolated from its neighbours by natural and anthropogenic barriers (highways, residential development).

4 Management History

4.1 Habitat

Habitat assessment for the Carcross caribou subpopulation has been conducted in the Yukon side of their range and extends to British Columbia. Summer range is subalpine and alpine plateaus over 1200m where spring calving and the fall rut also occurs (Francis and Nishi 2015). Their winter range is low elevation forested valleys that, for the Carcross subpopulation, occurs almost entirely in the Yukon (Francis and Nishi 2015). There has been little management of Carcross caribou subpopulation summer range in British Columbia.

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).

The only formal protection in the Carcross caribou subpopulation range are within the Atlin/Téix'gi Aan Tlein Provincial Park and the Chilkoot Trail National Historic Site (Environment Canada 2012a). While hunting is prohibited in the National Historic Site, it is permitted in the Provincial Park, controlled by provincial hunting regulations. Habitat is broadly protected in both sites.

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 Carcross 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.

There is variable access to the Carcross caribou subpopulation range. With the Klondike Highway running along its western boundary, access is easier to the northwest of the range, and this is the most heavily used part of the range for recreation. But the steep terrain in the area is a natural barrier to access in all seasons.

4.2.1 Snowmobile

Snowmobiling is permitted over most of the Carcross caribou subpopulation range, although prohibited in Atlin/Téix'gi Aan Tlein Provincial Park. Although the lakes are primary access for winter recreation, there are trails in the southern part of the range (Atlin Mail Run, Engineer Trail, Challenge Lakes Trail) lakes that traverse the range from north to south as well as connector lakes east to west, access for snowmobile recreation is limited. Where access is possible, particularly surrounding Taku Arm and Tagish Lake, snowmobiling is popular with and extensively used by local BC and Yukon residents (Taku River Tlingit First Nation and British Columbia 2009).

The Thtshi Lake and River area, ease of access means that it has the heaviest front- and backcountry use in the area. The Teesee Mountain trail affords winter snowmobile access and the Tutshi River has extensive use with camping sites (Taku River Tlingit First Nation and British Columbia 2009). A trail along the north side of Fantail Lake connecting Tagish to Tutshi Lakes is of recreational importance (Taku River Tlingit First Nation and British Columbia 2009).

Access management for winter and summer use has not occurred. See section 3.3.2.1 for general threat information.

4.2.2 Heli-ski / Cat-ski

In the Skeena region there is 24,000 km^2 of Ungulate Winter Range designed to protect mountain goat habitat that also protects caribou winter range from heli-ski / cat-ski operations. Commercial helicopter skiing occurs outside of these areas.

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 the Carcross subpopulation, use of off-road vehicles, trail designations and seasonal restrictions on trail use have been recommended (Francis and Nishi 2015).

The Teesee Mountain trail in the western part of the Carcross subpopulation range affords access for backcountry skiing and mountaineering (Taku River Tlingit First Nation and British Columbia 2009).

See section 3.3.2.3 for general threat information.

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 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 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 km^2 but increased at wolf densities from 1–4/1000 km^2 (Bergerud and Elliot 1986). For this reason, target wolf densities that would enable caribou recovery are set to 6.5/1000 km^2. In the absence of effective habitat or alternative prey management to achieve these densities, direct wolf management must be undertaken to achieve caribou conservation goals.

There is no information on wolf numbers or population trends for the Carcross caribou subpopulation range. There is no targeted wolf management in the British Columbia Carcross caribou subpopulation area, however there is wolf hunting and trapping. There are six traplines that overlap with the Carcross caribou subpopulation and from 1976 to 2013 there were 93 wolves killed by resident hunters and 37 hunters killed by non-resident hunters. From 1986 to 2015, 61 wolves were reported by trappers as removed from management unit 6-27.

4.3.2 COUGAR MANAGEMENT

If they occur at all, cougars are very rare in the Carcross 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). 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 bears and grizzly bears are both hunted, with 194 black bears shot between 1976 and 2015 and 82 grizzly bears killed during this same period (5.1 and 2.1 black bears and grizzly bears respectively per year on average). Wolverines are not hunted.

There are six traplines that are either entirely or partially within or bounding on the Carcross 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 1985 and 2015, 94 wolverines and 6 black bears were reported trapped in management unit 6-27 that overlaps the Carcross caribou range.

4.4 PRIMARY PREY

Moose, elk, white-tailed deer and mule deer are ungulate species along with woodland caribou that are in the diet of large, mammalian predators such as wolves, bears and cougars. In a process known as apparent competition (Holt 1977) where an increase in one prey population will lead to a decrease in a second prey population because the first prey increase boosts the shared predator numbers that kill the second prey at a higher rate. Across their range, woodland caribou populations have been suffering from apparent competition due to expanding ranges of "primary prey" into their habitat (DeCesare et al. 2010b, Wittmer et al. 2013). For this reason, managing primary prey, either directly through hunting quotas, or indirectly through habitat management.

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.

There is very good moose habitat in the Carcross caribou subpopulation range. A 2015 moose survey in the Atlin region (east of the Carcross caribou range) estimated a regional population of 1579 animals in an 8000 km^2 regional Atlin survey area (Marshall 2015, Kuzyk 2016). This is a decrease from 1995 and 2000 estimates, but an increase from the 2007 estimate (Armleder and Stevenson 1996). Beyond moose hunter harvest, there is no systematic moose management to benefit caribou in this region.

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 are very rare (white tailed deer are absent and black tailed deer are rare) in the range of the Carcross 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 (see above). Elk are absent from the Carcross caribou subpopulation range, but there is a small, introduced elk herd in Yukon that is hunted.

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 Carcross 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 Carcross caribou subpopulation is not being planned. Given that this subpopulation is 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 age and sex groups 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 Carcross 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 Carcross 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.

The Carcross 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, and inhabits lands close to Whitehorse, the largest urban area in the region creates outreach and stewardship opportunities. The border area occupied by the Carcross subpopulation is known as the Southern Lakes by people in the Yukon, and a Southern Lakes Caribou Steering Committee was begun in 1992 in response to declining caribou numbers (Southern Lakes Wildlife Coordinating Committee 2010). Stewardship in British Columbia and Yukon for this herd is already occurring.

Past, ongoing and opportunities for future stewardship is nevertheless great for the Carcross caribou subpopulation. There is a thousands year long relationship between the people that inhabit this region that was named for the migratory caribou that crossed the lakes here (Carcross is a contraction of caribou crossing (Spotswood 1998)). In 2009, the Taku River Tlingit First Nation partnered with the British Columbia government to create a landuse plan for this region, including caribou and habitat protection proposals. As well, they partnered with the University of Montana to link local and traditional knowledge with a scientific understanding cumulative impacts of resource use on caribou population dynamics and distribution (Polfus 2010, Polfus et al. 2014).

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.

A recent 3-year management plan identified two research priorities for the Northern Mountain caribou herds: increasing an understanding of predator-prey dynamics and identifying critical habitat quality and quantity (Grant 2017).

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.

A recent three-year management plan identified two key monitoring needs for Northern Mountain caribou: herd status (population trend over time) and health risks (disease and nutritional condition) (Grant 2017).

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 Carcross 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, who's populations would be intentionally reduced, and other ungulate species like moose, who's 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.

One of the key management actions identified in the three-year management plan is to manage harvest for sustainable use (Grant 2017). This will affect both First Nations' harvest as well as the number of limited entry tags issued, affective values in both of these communities.

In the range of the Carcross caribou subpopulation, there are limited commercial activities. Currently Heli-ski operators in the area are compelled to avoid Ungulate Winter Range (UWR) that has been established over much of the high elevation terrain to protect mountain goats. Expansion of UWR to new areas, if proposed, would further impede these operators.

Recreational snowmobiling is also a 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. 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 Carcross 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**: Taku River Tlingit First Nation, Tahltan First Nation, Kaska First Nation, Carcross Tagish First Nation, Teslin Tingit Council

Local: Atlin, Carcross, Taku, Conrad, Fraser, Teslin

Regional: Whitehorse, Skagway (USA)

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, Atlin Ski Club,

Protection: Western Canada Wilderness Committee, BC Spaces for Nature, The Skeena Watershed Conservation Coalition, Yellowstone to Yukon Initiative

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

Accommodation and Guiding: Atlin Heli Sports, Yukon Alpine Heliski, Little Atlin Lodge, Atlin Lake Wilderness Retreat, Sidka Tours / Glacier View Cabin, Tagish Wilderness Lodge, Glacier View Cabins, Atlin Visitors Association

Forestry *(Active licences to cut)*: none

Forestry *(Woodlots)*: none

Agriculture: none

8 Recommended Actions

Actions are adapted from Grant (2017).

8.1 Short Term (Within 6–12 Months)

- Fund and install GPS collars on British Columbia Carcross caribou (2018)

8.2 Medium Term (Within 12–24 Months)

- Conduct a systematic aerial survey of the British Columbia Carcross caribou (2019)

8.3 Long Term (Within 24–48 Months)

- Monitor herd status and trends over time
- Manage harvest for sustainable use
- Assess health risks and maintain caribou health
- Identify and assess the quality, quantity, and distribution of critical habitat for these populations

- Maintain or increase and protect the supply of habitat that supports sustainable caribou populations including implementing Ungulate Winter Range protection for woodland caribou in the Carcross caribou subpopulation range.
- Support research into predator-prey dynamics to enable effective predator and alternate prey management.

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