

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

Itcha-Ilgachuz Subpopulation

Chilcotin Local Population Unit



BRITISH
COLUMBIA

Recommended Citation:

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EXECUTIVE SUMMARY

DRAFT

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1 BACKGROUND

1.1 INTRODUCTION TO THE PROGRAM

The Itcha-Ilgachuz woodland caribou population is grouped under *Northern Mountain Caribou* (Designatable Unit (DU) 7) 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 listed as Special Concern. Previously, and until the DU structure for caribou populations is formally adopted, the Itcha-Ilgachuz caribou were considered *Northern Caribou*, and there are management plans devoted to their conservation (Youds et al. 2002, The Northern Caribou Technical Advisory Committee 2004, McNay et al. 2008, Youds et al. 2011, Austin 2012, Dodd 2017).

Woodland Caribou are further divided into Local Population Units by Environment Canada. Within the Northern Mountain Caribou group there are seven Local Populations. The Itcha-Ilgachuz subpopulation is in the *Chilcotin Local Population* together with the Rainbows and Charlotte Alplands 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). While the current designation for the Itcha-Ilgachuz subpopulation is “Special Concern”, current monitoring indicates that they are in decline and in need of comprehensive recovery planning.

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 Itcha-Ilgachuz Northern Mountain caribou subpopulation within in the Chilcotin Local Population Unit.

2 POPULATION DESCRIPTION

The Itcha-Ilgachuz¹ caribou are a subpopulation of northern mountain caribou (Designatable Unit 7; COSEWIC 2011). This ecotype of woodland caribou is currently *Blue-listed* in British Columbia and federally designated as *Special Concern* under the *Species at Risk Act*.

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 (Armleder et al. 2000, Johnson et al. 2000).

2.1 DISTRIBUTION

The Itcha-Ilgachuz subpopulation is one of the most southerly distributed populations within the distribution of southern mountain caribou (Fig. 1). Their 9457 km² range lies in the northwestern Cariboo Region

¹ A note on spelling. This herd is variously spelled as Itcha-Ilgachuz and Itcha-Ilgatchuz. This plan uses the former spelling throughout but includes resources that refer to the latter spelling.

and encompasses the Chilcotin Plateau, the Itcha and Ilgachuz Mountains in the Fraser Plateau ecoregion (Goward 2000). Animals are separated from the Rainbow subpopulation to the west by the Dean River, and from the Charlotte Alplands subpopulation to the southwest by ****. Animals from the Itcha-Ilgachuz, Rainbow and Charlotte Alplands herds occasionally share common winter range. They are separated from the Tweedsmuir subpopulation to the north by Tetachuck Lake. The Itcha-Ilgachuz caribou spend winters both in montane forested habitat east of the Itcha Mountains, and in subalpine habitat in the Ilgachuz Mountains (Cichowski 2007)

2.2 HABITAT AND BEHAVIOUR

Caribou subpopulations across western Canada are distinguished by their distinct seasonal habitat selection and behaviours. Information on seasonal movements and habitat selection of the Itcha-Ilgachuz subpopulation comes from two radio-telemetry studies; Cichowski (1989), Young and Freeman (2001) and summarized by Youds et al. (2002). Itcha-Ilgachuz caribou have typically spend winters in low elevation (montane), mature Pine forests. They migrate to high elevation, alpine habitats in spring for calving and summer range. In August, they return to montane forested habitats. At the onset of the fall rut, they return to alpine habitats, moving down to forests as winter sets in and snow accumulates (Youds et al. 2002, Youds et al. 2011).

They spend winter largely in the Montane Spruce BEC zone between 1200 and 1600 m elevation (Youds et al. 2002). However, their winter distribution at landscape and stand scales is driven more by snow depth than selection for other habitat features available at those sites; they seek out areas with shallow snow (Youds et al. 2002). The snow crust that develops near the end of winter compels them to move from forests with terrestrial lichens to wetter area where arboreal lichens are available. (Youds et al. 2002).

Females move to high-elevation alpine or subalpine habitat in the Itcha and Ilgachuz Mountains for calving in June and July with the majority of animal locations occurring above 1,800 m (Cichowski 1989, Young and Freeman 2001, 2003b). Animals move between the Itcha and Ilgachuz Mountains throughout the summer and August, some disperse, shifting to forested habitats adjacent to the mountains (Youds et al. 2002).

The Itcha-Ilgachuz subpopulation seek out high-elevation habitat for the fall rut (Cichowski 1989). In September and October female caribou are found above 1,600 m (Youds et al. 2002). But by November, they have begun moving to low-elevation fescue-lichen meadows and pine forests east of the Itcha Mountains, again influenced by snow conditions (Youds et al. 2002).

As with other subpopulations, seasonal caribou movements among habitats and elevations not only varies snow conditions, but also affects predation risk for Itcha-Ilgachuz caribou. Landscape disturbance and habitat selection by other ungulate species (e.g. moose) and their predators (e.g. wolves) increases predation on caribou at low elevations. By using high elevation habitats during the vulnerable calving and rut periods, caribou increase their spatial separation from wolves (Bergerud et al. 1990, Apps et al. 2013).

2.3 POPULATION SIZE AND TREND

The Itcha-Ilgachuz population increased from a low of about 500 animals in 1977 to 2800 animals in 2003 (Young and Freeman 2001, 2003b, Freeman 2010, Youds et al. 2011). Since 2003 the population has experienced a steady decline. The most recent estimate is 1350 animals (Dodd 2017; Fig. 2). However, based on data spanning 20 years (from 1994–2014), the population trend is considered *stable*, as it has changed by only –11.1% over that time (Dodd 2017).

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In general, caribou populations increase when annual recruitment exceeds the 15-16% required to balance natural adult mortality and maintain population stability (Bergerud 1992). Between 1996 and 2003, neo-natal recruitment for the Itcha-Ilgachuz herd averaged 25.8% in June while late winter (annual) recruitment was 17.0%. During this period survey effectiveness was improved through more extensive search and having radio-collared animals. Both real population increases and more thorough surveys contributed to higher population estimates.

In 2007, a post-calving survey found only 1784 caribou. Poor survey conditions contributed to the low count (Roorda and Dielman 2007). Follow-up surveys under excellent conditions in 2009 and 2010 found minimum caribou counts of 2093 and 1367. The 2007 and 2009 survey results found stable female numbers but declining calf, bull and yearling numbers relative to 2002–03. While this suggests low recruitment contributing to a population decline, there is no clear explanation and uncertainty exists on the rate of population decline. However, during the 2014 survey, calf numbers were similar to those during the increasing population phase of the 1980's and 90's. Adult female mortality, based on radio-collar data, was 8.7% in 2012–13 and 33.3% in 2013–2014, which is high. This suggests that despite relatively high calf recruitment, it may not be high enough to offset female mortality, leading to recent declines (Dodd 2017).

The preferred measure of annual recruitment is percent calves from late winter surveys (compiling data for recruitment graph)

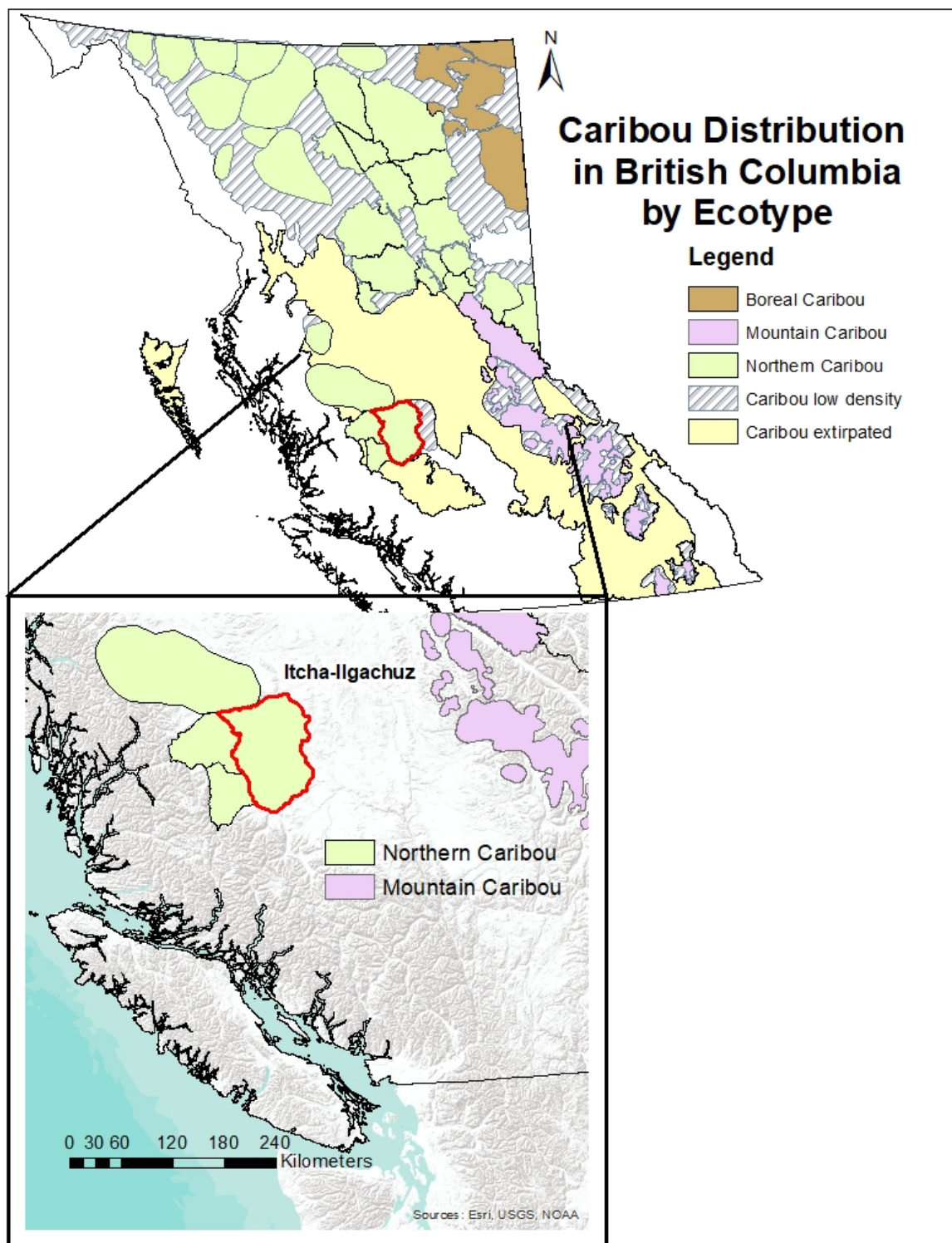


Figure 1: The geographical location of the Itcha-Ilgachuz subpopulation of woodland caribou. The 9457 km² range (inset: red outline) is situated within the Cariboo Region of west-central British Columbia.

Woodland Caribou Plan for the Itcha-Ilgachuz Subpopulation



Figure 2: Estimated population estimates of caribou in the Itcha-Ilgachuz subpopulation compiled from field data from multiple data sources (Smith and Hebert 1987, Heard and Vagt 1998, J. Young personal communication, Young and Freeman 2003a, Roorda and Dielman 2007, Freeman 2009, Wilson 2012, Dodd 2017, B. Cadsand, personal communication)

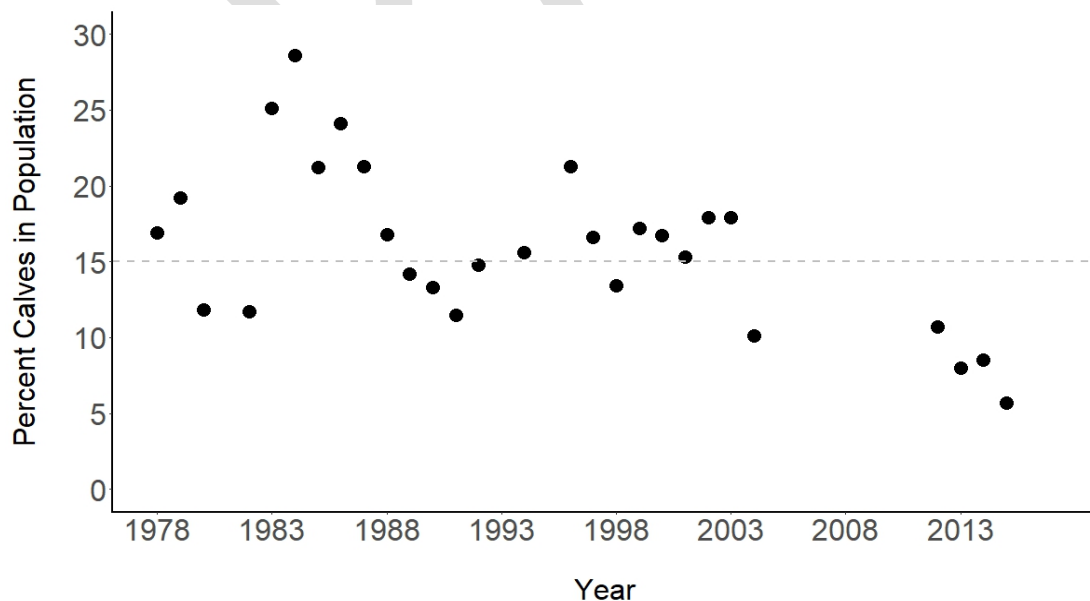


Figure 3: Calf recruitment, or percent of the total population that are young of the year calves in March of each year. The dashed line is the threshold for population stability (Bergerud and Elliot 1986, Bergerud 1988). Data from Dodd (2017) and sources within.

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). All of these 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

Multiple GPS 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. While the predators 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 km² will result in woodland caribou declines but the federal recovery strategy identifies 3 wolves/1000 km² as a target (Environment Canada 2014).

Information collected from radio collared caribou to establish Wildlife Habitat Areas in the Cariboo region indicated that wolf predation was the dominant cause of caribou mortality in the Rainbow Mountains and Charlotte Alplands herds (Young and Freeman 2001, Young et al. 2001) that neighbour the Itcha-Ilgachuz herd. However, by deduction, wolf predation was not considered important for the Itcha-Ilgachuz caribou as that subpopulation was stable or increasing. Since 2003 this woodland caribou population has been declining, yet no new information on wolf densities or distribution has been collected.

Grizzly bears are also present in the Itcha-Ilgachuz subpopulation range. Where they have been studied, grizzly bears have been shown to reduce caribou calf recruitment and contribute to adult caribou mortality (Adams et al. 1995, Wittmer et al. 2005a). Although predation rates for grizzly bears have not been determined, their density in

the Itcha-Ilgachuz range was estimated to be 9/1000 km² in 2004 and 2008 (Halmilton et al. 2004). However the 2012 estimate fell to 2.6/1000 km², falling to threatened status provincially (Newsome et al. 2017).

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) Indeed, suitable winter habitat limits this subpopulation with the key habitat features being either wind-swept or densely covered areas where snow depths are sufficiently shallow to allow access to their lichen food (Apps and Dodd 2017).

There is no comprehensive survey of caribou forage in the Itcha-Ilgachuz subpopulation range. However, the Itcha-Ilgachuz Provincial Park Management Plan (Environmental Stewardship Division 2002) notes that fire suppression on the Chilcotin Plateau has resulted in more areas of old forest in the park than would otherwise be expected. This would suggest that, at least in this protected area of the Range, foraging habitat and forage should be abundant.

A study of vegetation change in mountain pine beetle affected forests in the Itcha-Ilgachuz range suggests that terrestrial lichens may decline due to the increasing dominance of vascular plants in canopy gaps (Cichowski 2007). A related study in an adjacent area noted that terrestrial lichens recovered in 1 to 2 years from the effects of needle-fall from beetle killed trees (Willison and Cichowski 2006). While terrestrial lichens in this study had decline marginally as a result of kinnikinnick (*Arctostaphylos uva-ursi*) growth, they had not declined in direct response to pine needle fall (Willison and Cichowski 2006).

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).

Northern Mountain Caribou will continue to use mountain pine beetle attacked forests in caribou habitat (Seip and Jones 2008). They will also use 10–15 year old clearcuts have an abundance of terrestrial lichens that attract caribou, but they will abandon these sites in winter if snow depth exceeds approximately 40 cm (Johnson et al. 2000, Seip and Jones 2008). Even in beetle attacked landscapes, retaining some standing trees within a mosaic of clearcuts and salvage logging sites is critical for woodland caribou.

Two Timber Supply Areas (TSAs) overlap the Itcha-Ilgachuz Range. The Williams Lake TSA (in the Cariboo-Chilcotin Natural Resource District) covers approximately the southern 2/3 of the Range and the Quesnel TSA (in the Quesnel Natural Resource District) overlaps with approximately the northern 1/3. Five harvest schedules are zoned in this area: *no-harvest* (Wildlife Habitat Area), *modified harvest* (Montane Spruce BEC), *natural disturbance seral distribution* (Sub-boreal Pine Spruce BEC), *caribou enhanced conditional harvest* (Wildlife Habitat Area) and *conventional harvest* (Youds et al. 2002).

Commercial logging in the Quesnel TSA occurred primarily in the decade 1985–95 (Youds et al. 2002). Youds et al. (2011; Table 7) report that prior to 2002, 72,811 Ha of forest was harvested using largely conventional harvest (clearcut with reserves) (Youds et al. 2002) and between 2002 and 2011 an additional 15,007 Ha was harvested within the Itcha-Ilgachuz Caribou Habitat Area (an area 1.5× larger than the mapped herd range). In the Williams Lake TSA is a modified harvest zone that was logged in the east beginning at a small scale in 1980, peaking between 1985 and 1999 and tapering off in 2001–2001 (Youds et al. 2002). In the eastern part of the modified harvest zone was logged between the mid 1980s and the early 1990s (Youds et al. 2002).

A multi-year study of Alternative Silvicultural Systems was conducted in the Itcha-Ilgachuz range to test forestry techniques that would protect woodland caribou habitat (Waterhouse and Armleder 2005). Elements such as natural regeneration (Steen et al. 2007), microclimate effects (Sagar et al. 2005), thinning prescriptions (Wei et al. 2000), lichen (Miège et al. 2001, Waterhouse et al. 2011) and replanting (Waterhouse et al. 2001) were studied. Results show that these practices modify the growing environment for lichens and trees, potentially benefitting caribou populations while permitting tree harvest (Sagar et al. 2005).

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).

At the northern edge of the Itcha-Ilgachuz herd range is the proposed Blackwater mine. This will be an open pit gold and silver mine and ore processing facilities with a milling rate capacity of 60,000 t/d (22 Mt/y). Project components include mine site, mine access road and a new 133 km transmission line (Government of British Columbia 2017b). There is also a 3Ts gold and silver exploration project just south of the Blackwater mine, also

on the northern boundary of the Itcha-Ilgachuz range. Group selection and irregular group shelterwood techniques were tested.

Metallic mineral potential of this herd range is ranked low to moderate by the British Columbia government (Rank 0 to 576 on a scale from 0 to 794). There are 132 mineral claims and 138 mineral titles (or claims) in the subpopulation range that cover 58,000 Ha or 6% of the herd area. There is no mapped mineral production in the range area.

There are 8 mineral reserves in the Itcha-Ilgachuz range (Long Lake, Chilanko Marsh, Anahim Lake, Tsacha Lake, Chilcotin Lake, Narcosli Park, Redbrush Park and Patterson Lake) all protected from mineral extraction due to park or sensitive area status. This area is 8540 Ha or 1% of the herd area, but does not include the Itcha-Ilgachuz Provincial Park where there are no mineral tenures.

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 exploration, tenures or plays in this area.

3.3.1.4 CLEAN ENERGY

Clean energy refers to hydroelectric dams and wind farms. Hydroelectric reservoirs in caribou range can destroy or fragment habitat and cut 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).

The range of the Itcha-Ilgachuz caribou subpopulation falls within the Fraser Plateau Hydrologic Zone. While there are no hydroelectric dams in the area, there are 18 Run-of-River developments in the range. Although there are no flooded areas that could affect caribou populations, they are accompanied by infrastructure such as transmission lines and access roads that all have ZOIs and provide authorized or unauthorized human access to caribou habitat. The current impact of this is minor, but it does add to cumulative effects of multiple developments in the range (Bonnell 1997).

There are no wind energy proposals or installations in the Itcha-Ilgachuz range.

3.3.1.5 OTHER

[place holder]

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)

According to Youds et al. (2011), there are no motor vehicle restrictions across the winter range of the Itcha-Ilgachuz herd. The Wildlife Act limits snowmobile and other motorized vehicle use for hunting (September 1st – October 15th) throughout the modified harvest area.

The Itcha-Ilgachuz Park management plan (2002; Map 10) limits snowmobile use to authorized routes. Monitoring suggests that there is some recreational snowmobile use by members of the local Itcha Cabin Society and Quesnel and Prince George residents with high compliance (Youds et al. 2011). The current and potential effects of snowmobiling on the Itcha-Ilgachuz caribou subpopulation are small.

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 are no commercial leases or tenures for helicopter or cat skiing in the Itcha-Ilgachuz caribou 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). There are known ski and mountaineering routes in the Itcha-Ilgachuz range, but commercial operations nor is the number of users known.

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.

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).

Only four of 27 census subdivisions that overlap with the Itcha-Ilgachuz caribou range have agricultural activity. While the habitat occupied by these farming activities do not interfere with caribou summer or winter range, their activities including cattle (horse, beef) ranching could pose a threat to caribou populations through disease transmission (see below).

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).

While there are no major highways going through the Itcha-Ilgachuz range, Highway 20 (the Chilcotin-Bella Coola Highway) skirts the southern and southwestern boundary of the range and there are over one thousand kilometers of gravel roads and trails within their range. There is approximately 0.1 km/km² of roads and trails in the area. Such low-speed roads do not present a threat through road mortality for caribou. This is low and currently not a threat to caribou recovery (Dyer et al. 2002).

3.3.3.3 LINEAR FEATURES

Includes seismic cut lines, pipelines and overhead power transmission lines. There are no seismic line cuts, pipelines or overhead power transmission line routes in the Itcha-Ilgachuz range.

3.3.3.4 HUNTING

There remains a hunting season for northern caribou in the Itcha-Ilgachuz subpopulation (Region 5), but no open season. Permits are available for both resident and non-resident (guided) hunts with a one animal bag limit (Fish and Wildlife Branch 2016). From 1966 to 2000, mean annual caribou harvest from the Itcha-Ilgachuz herd was 33.3 (± 17.0 Std. Dev.) with much year to year variation (Youds et al. 2002). Guided hunts occurred up until and including 2016. But due likely to small numbers, guides have voluntarily suspended a caribou hunt in 2017. At current rates, legal hunting does not pose a threat to the Itcha-Ilgachuz caribou subpopulation.

Moose, mule deer and goat hunting continue within the Itcha-Ilgachuz subpopulation range (Youds et al. 2011). 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. The specific impact to the Itcha-Ilgachuz subpopulation is unknown.

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). From 1921 to 2016 fires totalling 1694.5 km² burned in and adjacent to (crossing the existing boundary) of the Itcha-Ilgachuz subpopulation range (18%). In northern and boreal habitats, it takes 80 years for a forest to recover from a fire to become caribou habitat again. Fires since 1936 total 1530 km² within the subpopulation range (16%). Influencing factors such as climate change and mountain pine beetle infestation may exacerbate the frequency, size and intensity of wildfires (Harding and McCullum 1997). Indeed, a plot of cumulative area burned in the Itcha-Ilgachuz range shows a break-point at 2006-07. From 1921 to 2004, the cumulative area burned increased by approximately 13.5 ha per year ($r^2 = 0.93$, $P < 0.001$). From 2006 to 2016 the cumulative area burned increased by approximately 85 ha per year ($r^2 = 0.94$, $P < 0.001$).

Forests killed by mountain pine beetle alter wildfire risk and spread, reduce long-term lichen availability and create habitat scale movement barriers (Armleder and Waterhouse 2008), similar to burned areas once trees fall (10-15 years; Youds et al. 2011). In the range of the Itcha-Ilgachuz herd, peak mountain pine beetle attack was estimated to be in 2006 by which time almost three-quarters (72%) of their habitat area had been affected by beetles (Youds et al. 2011). Cichowski and Maclean (2015) reported Over most of this area (60%) more than half of the trees had been killed and by 2009 over some of the area approximately two-thirds of the dead trees had fallen (Youds et al. 2011).

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 Itcha-Ilgachuz herd. 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.

There is no herd-specific information on climate change effects on the Itcha-Ilgachuz subpopulation.

3.7 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).

Although poaching can be a locally important source of caribou mortality, research using radio collared animals among northern caribou has not uncovered illegal harvest (Seip and Cichowski 1996). While this may be biased by focussing on animals in protected and remote areas, it suggests that poaching is not of strong conservation concern.

3.8 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. 2010). 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 Itcha-Ilgachuz subpopulation has changed over time (Dodd 2017). Initial surveys in the 1980's showed a sex ratio that peaked at around 9 adult females for every adult male but declined to a 2:1 male to female ratio by 1993 (Young and Freeman 2001, 2003b). There has been some variation since the mid 1990's, but around a mean value of 3 females for every breeding male. In 2014 the ratio was 3.5 females:males. This appears to be a sustainable ratio for woodland caribou (Stuart-Smith et al. 1997, Mahoney and Virgl 2003).

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). However, there has been no analysis to specifically identify the genetic consequences of the small and declining Itcha-Ilgachuz caribou subpopulation.

4 MANAGEMENT HISTORY

4.1 HABITAT

As part of the Northern Caribou Strategy (Youds et al. 2002) integrated caribou habitat management approach was developed (Youds et al. 2011). Direction in that plan was intentionally high-level, providing broad regional goals that were to be developed locally while adapting to provincial implementation of wildlife habitat areas and ungulate ranges (Youds et al. 2011).

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).

There are two, Schedule D provincial parks wholly or partially within the Itcha-Ilgachuz subpopulation range. Itcha-Ilgachuz Provincial Park protects 109,063 Ha. About 93,350 Ha that is in the mapped range of the Itcha-Ilgachuz herd. Within the Provincial Park is the Ilgachuz Range Ecological Reserve (2746.5 Ha). Redbrush Provincial Park completely within the Itcha-Ilgachuz herd range (1165 Ha). As well Narcosli Lake Ecological Reserve completely within the Itcha-Ilgachuz herd range (1090 Ha).

No Ungulate Winter Range UWR either approved or proposed for caribou conservation within the Itcha-Ilgachuz herd range. There are two small areas of UWR to protect mule deer (*Odocoileus hemionus*). There are 321,452 Ha of Wildlife Habitat Area (WHA) within the Itcha-Ilgachuz herd range designated for caribou conservation (34% of land area). 223,021 Ha is designated as conditional harvest and 98,429 is a no-harvest zone.

4.1.1.1 NON-STAKING RESERVES

A reserve is established by a BC Regulation of the Chief Gold Commissioner under Section 22 of the Mineral Tenure Act and Section 21 of the Coal Act is the legal instrument to protect land from mineral, placer and coal exploitation (Government of British Columbia 2017a).

There are four non-park or wildlife area non-staking reserves in the Itcha-Ilgachuz caribou subpopulation range totaling 46.7 km². All have indicted for placer and one for coal. In addition, there are nine no-registration reserves that fall within parks or wildlife management areas. These total 85 km² and include Patterson Lake Park, Tsacha Lake and Anahim Lake (all on the range boundary), Tatla Lake, Chilanko Marsh, Long Lake, Narcosli, Redbrush Park and Chilcotin Lake. All of these non-staking reserves comprise 1.4% of the subpopulation area.

4.1.2 HABITAT ENHANCEMENT AND RESTORATION

Caribou habitat enhancement and restoration relates both to recreating or improving habitats for caribou seasonal range as well as managing linear disturbances (seismic lines, pipelines, transmission rights of way) to prevent facilitated predator access (Alberta Woodland Caribou Recovery Team 2005, Dickie et al. 2016, Dickie et al. 2017). As well, habitat enhancement and restoration must be accompanied by protection to be effective (Schneider et al. 2010). In Europe, reindeer migration routes are restored by removing recreational cabins and ski resorts that have a 15 km ZOI (Nellemann et al. 2010). Large scale restoration of seasonal caribou habitat (old growth forest) is only undertaken where protected areas (see above) extinguish forestry licences permitting forests to recover without the threat of second cut logging.

4.1.3 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.

The Vanderhoof Access Management Plan (Integrated Land Management Bureau 2008) has several (non-legal) Access Management Areas just north of the Itcha-Ilgachuz subpopulation range (within the Tweedsmuir range). These areas manage conflict among users (commercial and recreational), environmental and economic impacts. The Cariboo-Chilcotin Land Use Plan (Youds et al. 2011 Appendix 7) has included access management in its planning and consultation, but no actions have yet resulted. Two major forest service roads (3900 and 4000) access the Itcha-Ilgachuz subpopulation range and the Cariboo-Chilcotin Land Use Plan targets these corridors for access management.

Forestry road construction peaked in the Quesnel TSA between 1980–87. There is approximately 0.1 km/km² of roads and trails in the Itcha-Ilgachuz subpopulation range. Such low-speed roads do not present a threat through road mortality for caribou. This is low and although not a threat to caribou recovery unto itself (Dyer et al. 2002), however, as was evident in 2002, the road network is encroaching up to the boundary of Itcah Ilgachuz Park (Youds et al. 2002 Map 12). Road management and use planning is key.

4.2 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).

4.2.1 WOLF MANAGEMENT

Wolves are an important, year-round caribou predator. Caribou populations in northern British Columbia were shown to decline when wolf densities were 9–10/1000km² but increased at wolf densities from 1–4/1000km² (Bergerud and Elliot 1986). For this reason, target wolf densities that would enable caribou recovery are set to 6.5/1000km². 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.

A wolf track survey was conducted in the heart of the Itcha-Ilgachuz subpopulation range during 2009–10 (Davis 2009). Highest wolf track densities were found in regions with high deer and low caribou track densities, but there was no consistent positive relationship between wolf and prey densities. An attempted aerial survey of wolves in and around the Itcha-Ilgachuz Mountains in 1999 was unsuccessful due to large expanses of heavily forested terrain, limited open waterways in which to track, and poor survey conditions (Roorda and Dielman 2007). There are no recent data on wolf densities in this area (Davis and Fogarty 2017).

There is a wolf hunting season with an annual limit of 3 wolves per hunter in the management units within and around the Itcha-Ilgachuz subpopulation range (Youds et al. 2011). Average yearly harvest is reported as 18 wolves over the 8 year period from 2002–2009, but these numbers are considered to be minimum counts as not all animals killed are reported (Youds et al. 2011). A no bag limit hunt (NBL) was initiated in the western portion of the whole management unit in 2011, in response to ranchers' and First Nations' concerns.

A wolf control program has been able to reduce wolf density for Mountain Caribou recovery in the Quesnel Highland Planning Unit (Roorda and Wright 2012). Helicopter net-gunning combined with ground trapping using leg-hold traps have been successfully used. Surgical sterilization of dominant wolves (Spence et al. 1999) has also been effective to reduce wolf recruitment while maintaining current stable pack territories (Table 3 in Roorda and Wright 2012)."

4.2.2 COUGAR MANAGEMENT

Cougars are not common in the Itcha-Ilgachuz caribou subpopulation range, but they are present (Spalding 1994). In British Columbia, particularly in the south (Wittmer et al. 2005a), cougars are a significant caribou predator. Cougar densities respond positively to deer density, and as deer densities climb, so will cougar densities. However, in northern British Columbia, there are only rare reports of cougar predation on caribou.

4.2.3 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.

There are 44 traplines that are either entirely or partially within or bounding on the Itcha-Ilgachuz range. Operators have the potential to remove caribou predators as part of their licences.

4.3 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.

Ungulates in this area segregate by habitat (Davis 2009). Mule deer tend to occupy Douglas fir stands (Armleder et al. 1994), moose select spruce forests (Baker 1990) and caribou are found in lodgepole pine stands (Youds et al. 2002).

4.3.1 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.

Moose populations in the eastern area of the Itcha-Ilgachuz subpopulation range are declining significantly (McNay et al. 2013). A 2017 winter survey found 0.17 moose/km² which is below average for Game Management Zones 5C and D (0.34 moose/km² (1994-2017 data) and a 30% decline from 2003 numbers (Davis and Fogarty 2017). A 2012 winter moose survey in Hunting Zone 5-12 that covers the heart of the Itcha-Ilgachuz range also recorded a declining population, down from 0.58 moose/km² in 2002 to 0.23 moose/km² in 2012 (O'Bryan 2012). In British Columbia, a low moose density is considered for populations below 0.2 moose/km² (Moose Management Technical Team 2015).

No targeted moose management has occurred in the Itcha-Ilgachuz caribou subpopulation range since 2002 (Youds et al. 2011). Moose hunting continues under a limited entry hunt in the Cariboo region, and thus can be managed from year to year through the number of licences drawn.

4.3.2 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.

In the range of the Itcha-Ilgachuz caribou subpopulation, white-tailed deer are absent or rare. Aerial surveys report very few white-tailed deer observations (0.001/km survey; Davis and Fogarty 2017). Mule deer are the second most abundant ungulate observed (Davis and Fogarty 2017) but at densities far less than those of moose (51 mule deer observed vs. 230 moose). Deer management to prevent apparent competition with caribou does not occur in this region.

4.3.3 OTHER

Elk, like moose and deer are wolf prey and could potentially facilitate apparent competition with caribou (see above). However, elk are not observed in aerial surveys of the Itcha-Ilgachuz caribou subpopulation.

4.4 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.

4.4.1 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. 2016a). 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 are two maternity pens operating in British Columbia (Revelstoke, Moberly) and one in the Yukon (Chisana) (Hayek et al. 2016a, Seip and Jones 2016). But there is no maternity pen in the range of the Itcha-Ilgachuz caribou subpopulation. Population trends and surveys indicate that this population suffers from low calf recruitment (5.7% vs. the 15% required for population growth or stability see above). Rough calculations using 2014 population estimates suggest that maternity penning in the Itcha-Ilgachuz range would have to add 22 successful recruits to the population to boost recruitment from 5.7% to 15%. Assuming 27% mortality of calves released from the pen (Seip and Jones 2016), 30 calves would have to be born in maternity pen to achieve the desired recruitment. Experience from West Moberly and Revelstoke suggests that this would require the capture and penning of at least 32 pregnant females to be successful.

4.4.2 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. 2016a).

At one time, the Itcha-Ilgachuz subpopulation was considered to be a candidate herd to donate females and males to a captive breeding program that would support other, more imperilled populations. There is currently no captive breeding program in operation, although Parks Canada has been planning one ahead of policy considerations (Szkorupa 2001, Baer 2010, Jasper National Park 2012, Hayek et al. 2016b). Given the changing status of this subpopulation, it may not longer be appropriate as a donor herd.

4.4.3 TRANSLOCATION

Translocation is the reinforcement of small populations by moving animals directly from a sustainable population (Hayek et al. 2016a). 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. 2016a).

There have been no translocations to or from Itcha-Ilgachuz caribou subpopulation range.

4.4.4 OTHER

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

caribou population is critically low (Boutin and Merrill 2016, Cornwall 2016, Hebblewhite 2017, Proulx and Brook 2017).

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

4.5 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. 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.

There is little available information on stewardship and outreach for caribou in the Itcha-Ilgachuz subpopulation range.

4.6 RESEARCH

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.

In the range of the Itcha-Ilgachuz caribou subpopulation, key questions include target caribou densities in areas where animal numbers have dropped below threshold numbers, identifying local sources of caribou mortality (McNay and Cichowski 2015), potential efficiency of intensive management approaches (predator management, population reinforcement) (Hayek et al. 2016a), effective buffer widths for critical habitat protection (Robinson et al. 2010) and alternative prey numerical responses to disturbances of different size and type.

4.7 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.

Key elements of the caribou program in the Itcha-Ilgachuz subpopulation range include: maintenance of collared animals for population and recruitment estimates, regular caribou population survey, predator (wolf) distribution and movement monitoring of the natural and human disturbance footprint.

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.

As the Itcha-Ilgachuz caribou subpopulation recovers, the effects on other wildlife populations should be monitored. Baseline data for moose and deer are available through regular census'. Wolf and bear numbers and distributions are less well known.

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. 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.

In the range of the Itcha-Ilgachuz caribou subpopulation, there are limited commercial activities. Forestry was at its peak in the 1990's, mining operations are either very localized or exploratory and there is no oil and gas activity. Moose hunting is popular in this area. Access and declining moose populations are concerns for hunters as well as issues for caribou conservation. These overlapping values will require consultation, partnering and mindful management. Recreational snowmobiling is also a popular activity, overlapping to a large extent with hunting. Again, careful management of recreational snowmobiling that considers elements of caribou recovery will be required to enable coexistence.

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.

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Below is a list of communities in and adjacent to Itcha-Ilgachuz 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:** Ulkatcho Nation, Tai Del Del (Alexis Creek) Nation, Lhoosk'uz Dene Nation, Nazko Nation, Nuxalk Nation, Xení Gwet-in Nation

Local: Nazko, Anahim Lake, Nimpo Lake, Charlotte Lake, Chilanko Forks, Alexis Creek

Regional: Cariboo Regional District, Fraser Basin Council, Prince George, Quesnel, Williams Lake, BC Rural Network

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

Protection: Western Canada Wilderness Committee, BC Spaces for Nature

Commercial: **Hunting and Trapping:** Itcha Mountain Outfitters, , Lehman Creek Outfitters, Blackwater River Outfitting, British Columbia Trappers Association, Guide Outfitters Association of British Columbia, BC Wildlife Federation (Antoniuk et al. 2016)

Accommodation and Guiding: Escott Bay Resort, Rainbow Mountain Outfitting, Six Mile Ranch (Itcha Ilgachuz Mt. Outfitters)

Forestry (Active licences to cut): Tolko Industries, Uwe Schieferstein, Tsi Del Del Enterprises, Kenneth Dyck, Rudolf Riegner, Brian Vaughan, Nimpo Lake Community Association, Cariboo Regional District, Patricia Jorgenson, David Jorgenson, Ministry of Transportation and Infrastructure, West Fraser Mills, New Gold, RJX Explorations

Forestry (Woodlots): E. Schuk Contracting, Randy Brink

Agriculture: BC Cattlemen's Association, Cariboo Cattlemen's Association, North Cariboo Agricultural Marketing Association (Riversong Farm, Nazko)

8 RECOMMENDED ACTIONS

8.1 SHORT TERM (WITHIN 6–12 MONTHS)

[place holder] (activity, budget)

8.2 MEDIUM TERM (WITHIN 12–24 MONTHS)

[place holder] (activity, budget)

8.3 LONG TERM (WITHIN 24–48 MONTHS)

[place holder] (activity, budget)

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