



Medzih Action Plan



Fort Nelson First Nation
Boreal Caribou Recovery Plan

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Acknowledgements

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Preface

In recent years we have been unable to harvest caribou sustainably due to decreasing population levels and diminishing habitat. We intend to reverse this trend.

WE, FORT NELSON FIRST NATION (FNFN), are People of the land and the rivers and have lived in our territory in northeastern British Columbia since time immemorial.

We are also Treaty people. Treaty No. 8 affirms our Aboriginal Rights and Title to our lands, and our Nation-to-Nation relationship with Canada confirms our mutual responsibility to protect our shared Treaty rights and responsibilities *“for as long as the sun shines, the grass grows and the rivers flow.”*

We recognize the need to balance economic security with respect for our way of life, culture, and inherent connections to the lands, waters, and animals that sustain us. We are protectors of this land and providers for our families. We have a strong presence in our territory that we are determined to maintain. We are knowledge keepers, building on our ancestors’ knowledge and modern science to balance industry and traditional economies in our lands.

Until recently, our people harvested caribou throughout our territory for countless generations. Historically, boreal caribou provided us with sustenance, clothing, tools, utensils, snowshoes and other necessities important to our physical and cultural survival. In recent years, however, we have been unable to harvest caribou sustainably due to decreasing population levels and diminishing habitat. We intend to reverse this trend. To achieve this goal, a number of key actions need to be undertaken.

These actions are outlined below in the Medzih Action Plan: Fort Nelson First Nation’s Boreal Caribou Recovery Plan.

Chief Dickie



Summary for Decision-Makers

Why Fort Nelson First Nation Developed its own Medzih Action Plan

BOREAL CARIBOU ARE A SPECIES that exist across Canada but the vast majority of the boreal caribou in British Columbia are found in the Liard watershed basin, within Fort Nelson First Nation (FNFN) territory.

Members of FNFN have historically harvested caribou throughout their territory for countless generations. FNFN Elders explain that they always used caribou in a variety of ways, including for sustenance, clothing, making snowshoes and bedding out of the hides and making utensils. FNFN members describe seeing caribou in old forests, muskeg and other low-lying areas, including the Maxhamish area, Deer River, Kotcho Lake, and around other lakes and rivers.

FNFN Elders and harvesters say that caribou are increasingly rare in the Liard River basin and that sightings of caribou have declined over the last 10, 20, and 30 years. Many of their sightings and experiences with harvesting and using caribou took place when they were children. FNFN Elders express concern about caribou populations and health. In particular, many of them talk about the effects of seismic lines, roads and industrial sites that disturb caribou and make it easier for predators to access caribou habitat. Community members also note the increasing presence of predators in important caribou areas, including wolves and bears, as a reason for declining caribou populations.

As a result, FNFN members have voluntarily stopped hunting caribou because the populations have dropped too low. This moratorium has not been led by the Lands Department or imposed by Chief and Council, but rather is something that hunters decided to take on themselves. While no FNFN members currently report hunting caribou, they would very much like to harvest them once again, if and when the herds rebuild to a point where sustainable harvests can resume.

FNFN embraces both the right and the responsibility to protect boreal caribou and to ensure that caribou remain on the landscape to support the future health and well-being of the people and the ecosystems with which they are inextricably linked.

FNFN embraces both the right and the responsibility to protect boreal caribou and to ensure that caribou remain on the landscape to support the future health and well-being of the people and the ecosystems with which they are inextricably linked.

PHOTO: KATHERINE CAPOT-BLANC

The impetus for FNFN action is two-fold:

- First, the clear trend that boreal caribou have significantly declined and continue to do so. Caribou were historically distributed throughout and also further south of Fort Nelson territory and roamed in a largely unbroken distribution across the boreal and taiga plains. Today, numbers are very low and continue to decline, with animals occurring in fragmented and isolated ‘herds’ or ranges, and caribou are extirpated from their former southern distribution. The vast majority of boreal caribou remaining today are in FNFN territory.
- Second, although significant amounts of effort—time and money—have been spent on boreal caribou, FNFN community members have very little faith in the existing management systems intended to protect and recover caribou populations. In 2012, the Federal Government released a Recovery Strategy under the federal Species at Risk Act (SARA) for boreal caribou, which set clear targets for what would be needed to move towards caribou population recovery and the role First Nations would play in accomplishing this objective.¹ FNFN supports this strong, clear direction. The province has the responsibility to implement this federal direction. Since 2010, the Province of BC has released draft boreal caribou ‘implementation plans,’ and available science has increased over this time period. Yet, on the land, little or nothing has changed for the better for caribou as a result of provincial work. Industrial development has continued without planning for caribou habitat, and while some land use thresholds are identified in the most recent draft Boreal Caribou Recovery Implementation Plan (BCRIP) (BC MOE and MFLNRO 2017), none of these thresholds demand immediate land use change. Like its predecessors, BC’s most recent caribou plan continues to allow degradation of conditions for caribou on the land into the future. FNFN has written a brief overview of the technical failings of current federal and provincial approaches to caribou recovery, to support the need for this Medzih Action Plan (FNFN 2017).



FNFN community members have very little faith in the existing management systems intended to protect and recover caribou populations.

PHOTO: KATHERINE CAPOT-BLANC

Fort Nelson First Nation has repeatedly tried to engage both provincial and federal agencies regarding concerns for caribou recovery, as required by section 9.1.2 of the Federal Recovery Strategy, but little substantive action has occurred. FNFN is therefore left with no option but to develop their own recovery strategy for this cultural and ecologically iconic species.

FNFN supports economic development — but not at the cost of the loss of an iconic and culturally important species. **Put simply, the state of boreal caribou is an indicator that all is not well in the lands and waters of Liard River basin.**

FNFN advocates for an ecosystem management approach to development — which could make it possible to develop industry that support stable economic opportunities in this vast watershed, while also improving the probability that caribou will continue to exist on the landscape of their grandchildren. To tread this path, some hard decisions must be made. **Fort Nelson First Nation is ready to make these decisions.**

¹ Section 9.1.2 “Aboriginal Involvement” of the federal Recovery Strategy.

Goals

- Recover caribou populations to self-sustaining levels, and with sufficient resilience to allow subsistence hunting by FNFN, in accordance with their Treaty Rights.
- FNFN's desired timeframe for habitat and population recovery is within one human generation — 20 years. As a result of the pace of development and rate of decline of boreal caribou, one generation of FNFN members is already partially disconnected from this species, and further generational loss must not be allowed to occur. In addition, caribou populations are small and vulnerable, with little resilience. Caribou may not survive a longer time period of attempted recovery.
- Recover to a historic spatial distribution of caribou, based on traditional knowledge and science. Ensure that local populations are not isolated (i.e., there is a continuous distribution and movement of animals) between ranges. Expand caribou distribution towards the south and maintain linkages to north and east.
- Allow industrial development within FNFN territory that is compatible with these goals, and that supports stable and long-term FNFN and non-First Nations' community wellbeing.

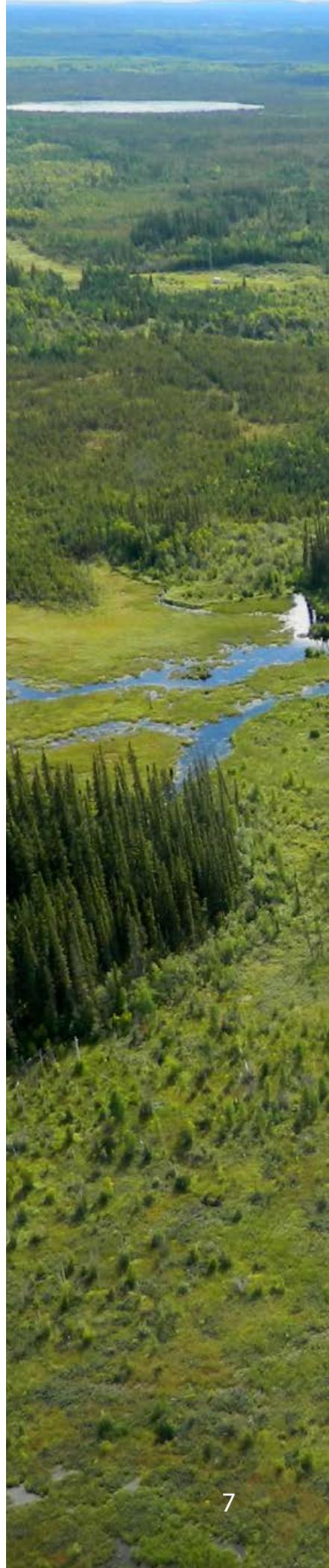
Medzih Action Plan Protects Critical Habitat

FNFN's Medzih Action Plan (MAP) is founded on the principle that spatially identified and protected habitat is paramount to boreal caribou recovery — it is the failure on the part of British Columbia to adequately identify and protect critical habitat that has allowed boreal caribou habitat to continue declining since the first Boreal Caribou Implementation Plan was introduced in 2011.

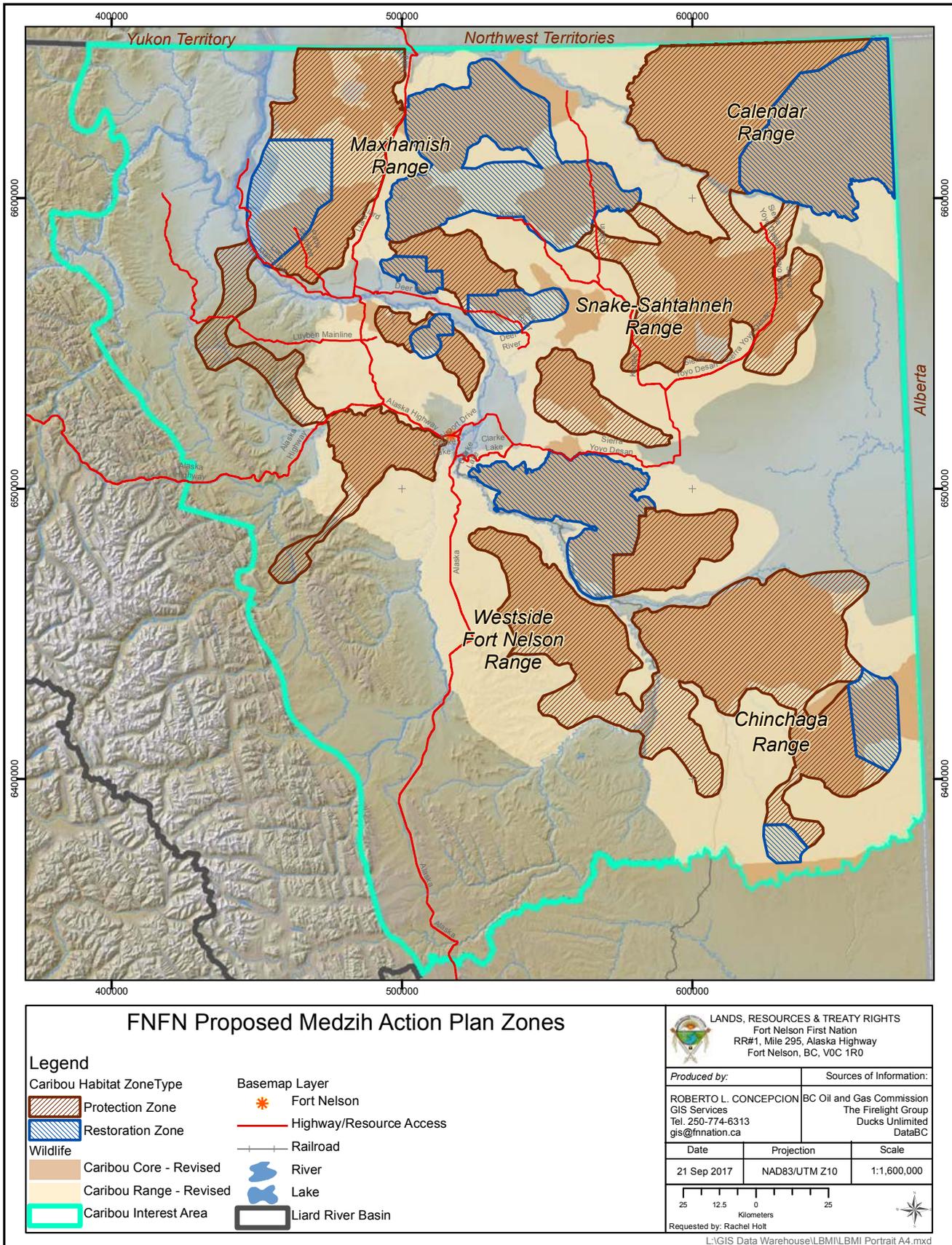
To that end, FNFN have identified and mapped two types of zones within boreal caribou habitat: Protection Zones and Recovery Zones (Map 1). Together, this set of zones cover about 65% of each range as identified in the 2012 Recovery Strategy (ECCC 2012). FNFN expects that this first set of zones will be modified and refined, but that the general magnitude of Protection and Restoration Zones will need to remain similar in order to effectively recover caribou populations.

While spatial protection to prevent further degradation is the founding principle of the MAP, FNFN also recognizes that other measures are required to stop the decline of boreal caribou across the territory. The full suite of strategies is listed below. The remainder of the report provides the rationale and methods for FNFN's identified strategies, and is supported by maps and more technical detail in Appendices.

PHOTO: KATHERINE CAPOT-BLANC



Map 1. FNFN Medzih Action Plan proposed protection and restoration zones



Strategies

1. Action is needed now to reduce existing pressures on boreal caribou

- Spatially identify core Protection Zones² (PZ; Map 1) and immediately implement a moratorium on any additional industrial disturbance within these areas. Protection Zones are areas with the biophysical features that are preferred by caribou. They currently have a lower level of development, and tend to be areas prioritized by caribou today based on limited telemetry data. These Protection Zones would contribute to the legal protection of critical habitat as required by SARA. **Timeline: Refine and implement Protection Zones identified in this document immediately.**
- Spatially identify Restoration Zones³ (RZ; Map 1), and plan how and in what order these areas will be restored to meet federal recovery goals within FNFN's stated timeframe of one generation.⁴ Restoration Zones are located where there is limited intact area within a range, and are of sufficient size to add additional habitat to Protection Zones to result in likely caribou recovery. **Timeline: Refine and implement Restoration Zones identified in this document immediately.**
- Undertake active functional and ecological restoration of the legacy footprint on the landscape — particularly linear corridors — in Protection and Restoration Zones to exceed the minimum 65% undisturbed target, within one generation. **Timeline: Develop and implement restoration actions (6 months).**
- Establish a fund from the province and industry with existing tenure in caribou habitat to allow immediate functional and ecological restoration of caribou habitat on legacy development areas. **Timeline: Work with parties to examine options (6 months).**
- Prevent industrial contamination of caribou and other species on the landscape, by requiring fencing on all facilities where interaction with industrial pollution could occur. **Timeline: Implement immediately, starting with Protection and Restoration Zones.**

2. Create a positive habitat trend within caribou distribution

- Establish a moratorium on further tenure sales in all FNFN Protection and Restoration Zones, and including all parcels currently deferred through updated provincial Resource Review Areas.⁵ **Timeline: Implement immediately.**

2 The BC government has identified spatial ranges and cores. However, these areas are not 'protected' from additional disturbance and were not developed with any traditional knowledge input from FNFN, nor are spatial recovery areas identified.

3 Development is permitted within Restoration Zones at a mitigation ratio of 10:1 (see Strategies), and elsewhere in caribou habitat at a mitigation ratio of 4:1.

4 The Federal Recovery Strategy states a recovery timeline of "reasonable, gradual increments every 5 years." The provincial Implemental plans do not outline how or when this requirement will be met.

5 Provincial RRAs have been updated to better reflect caribou distribution; however, a map is currently unavailable and it appears that not all untenured area are included.

Protection Zones are areas with the biophysical features that are preferred by caribou. They currently have a lower level of development, and tend to be areas prioritized by caribou today based on limited telemetry data.



Restoration Zones are located where there is limited intact area within a range, and are of sufficient size to add additional habitat to Protection Zones to result in likely caribou recovery.

PHOTO: KATHERINE CAPOT-BLANC



FNFN expects that this first set of Protection and Restoration Zones will be modified and refined, but that the general magnitude of zones will need to remain similar in order to effectively recover caribou populations.

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- Examine options for voluntary tenure trading or tenure returns to reduce immediate pressures on Protection and Restoration Zones, and to promote industrial development in less critical areas for caribou; this strategy applies to all industrial activities. *Timeline: Work with parties to examine options (6 months).*
- Promote gas and forestry development in less critical areas for caribou (outside Protection and Restoration zones), with a minimum of a 4:1 mitigation ratio. *Timeline: Implement immediately.*
- Require any future development in Restoration Zones to adhere to a mitigation ratio of 10:1 to promote more rapid recovery of large intact blocks of habitat, and to promote development patterns that avoid priority restoration areas. *Timeline: Implement immediately.*
- Require any future development outside Restoration Zones⁶ (and within caribou habitat⁷) to be permitted with a mitigation ratio of 4:1. Development within local fine-scale habitat features for caribou should not be permitted. *Timeline: Implement immediately.*
- Develop finer-scale habitat mapping to ensure that restoration actions are employed most efficiently in Protection and Restoration Zones. Focus restoration on areas that are spatially adjacent to Protection Zones to gradually improve these areas for boreal caribou. *Timeline: use zones identified in this document to further develop fine-scale restoration priorities (6 months).*
- Spatially plan potential forest harvest areas and fire management priorities across all caribou areas with a goal to identify and spatially maintain large patches of intact habitat over space and time. Develop and implement stand level best management practices to maintain caribou values in harvest areas. *Timeline: use zones identified in this document to further develop fine-scale restoration priorities (12 months).*
- Model rate of habitat recovery, including uncertainties, to understand timeframe for recovery. Where timeline goals (one generation) are not met, increase restoration activities accordingly. *Timeline: 12 months.*

3. Improve population trends for at risk local populations

- Contemplate the need and logistical possibilities to employ methods to increase calf survival through year 1 of life (fences, maternity penning in critical areas). *Timeline: 12 months.*
- Confirm Wolf Management Zones in areas with very high wolf densities and large pack sizes.⁸ Employ traditional approaches to predator control, if and when all other protection mechanisms are in place (i.e., PZs and RZs are implemented). *Timeline: 12 months.*

⁶ No Development is permitted in Protection Zones.

⁷ All areas within and between current ranges, and bounded by the outer extent of current ranges and provincial borders.

⁸ FNFN members identify Deer River / Kiwigana area and Clarke Lake / 61 road as potential areas for Wolf Management Zones.

4. Change the Management Paradigm

- Approach land management using a framework that errs on the side of caution for the ecosystem, including caribou. Where science wavers, ensure decisions are precautionary as set out in the federal Boreal Caribou Recovery Strategy. *Timeline: Implement immediately.*
- Ensure protection of critical habitat meets the SARA definition — i.e., it is legal and permanent to avoid triggering the federal safety net. *Timeline: Implement immediately.*

5. Monitor

- Continue to monitor caribou population parameters to understand population dynamics and trends. *Timeline: ongoing.*
- Employ monitoring strategies to ensure functional success of restoration before additional disturbance is allowed in any critical habitat areas. *Timeline: Develop monitoring strategy and Implement immediately.*
- Investigate restoration potential in fens and treed bogs and other wet ecosites — favourable habitat for caribou, which are very prevalent in FNFN territory but are notoriously difficult to recover appropriate vegetation. *Timeline: ongoing.*
- Continue to gather and compile FNFN traditional knowledge about habitat use and distribution for caribou, to fine-tune this Action Plan. *Timeline: Develop strategy and Implement immediately.*
- Identify additional critical assumptions and ensure appropriate monitoring or sensitivity analysis. *Timeline: ongoing (6 months).*

6. Build a Stable Economic Future

- Create a task force between FNFN, the provincial government and industry to identify barriers and opportunities to ensure economic development in FNFN territory leads to economic stability. The current boom / bust approach to development does not lead to social well-being, and promotes a dichotomy between jobs and the environment that has unacceptable outcomes for environmental values and people, jobs and communities. *Timeline: Implement within 6 months.*

FNFN has developed Goals and Strategies, supported by traditional knowledge, science and map products that aim to move significantly forward to resolve the issue of declining boreal caribou in the short and long term, and to begin to work towards a sustainable economic future in the Liard.

FNFN looks forward to working with the provincial, federal governments and other parties to implement this plan in the immediate future.

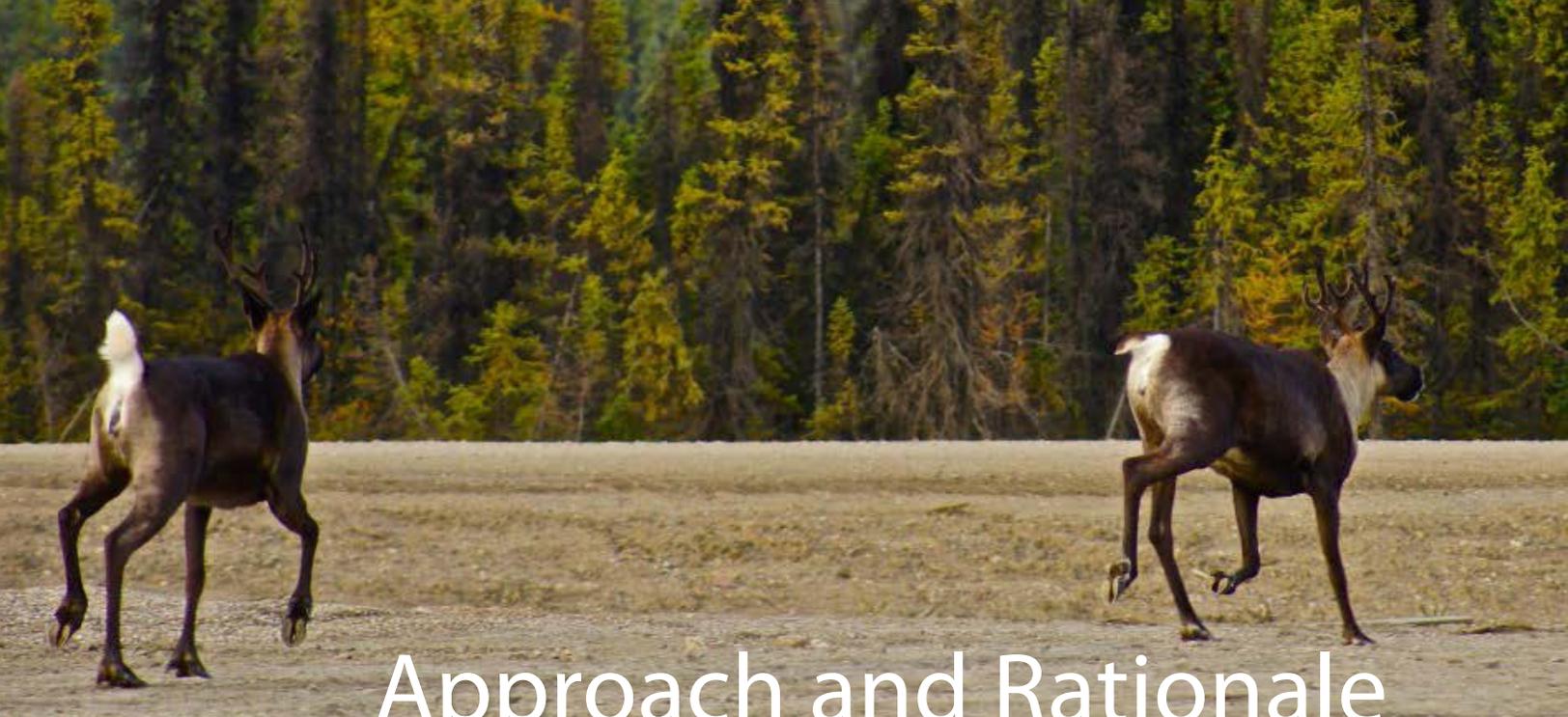
KEY POINTS

There are similarities between this plan, and that of the provincial government.

However, the key difference is that this FNFN Medzih Action Plan requires immediate action to protect high priority caribou areas, and prioritizes restoration within high use, high impact zones. The 2017 BCRIP does not specifically protect any habitat from industrial development, nor does it identify priority areas for restoration.

Additionally, this MAP calls for immediate generation of a fund to restore the legacy footprint, rather than waiting for future development to deal with historic damage.

PHOTO: KATHERINE CAPOT-BLANC



Approach and Rationale

Boreal Caribou and Fort Nelson First Nation People

Historically, major river and mountain systems may have provided some level of barrier to caribou movements, but in areas where boreal caribou are undisturbed they tend to be distributed across the whole landscape, without large gaps between used areas.

TRADITIONALLY, FNFN FAMILIES used cabins and nomadic lifestyles to follow and hunt caribou — a major protein source. Historically, major river and mountain systems may have provided some level of barrier to caribou movements, but in areas where boreal caribou are undisturbed they tend to be distributed across the whole landscape, without large gaps between used areas. This is not to say that there are not preferred habitats, but historically, boreal caribou likely moved widely across the whole landscape of the boreal ecosystem and are known to have been found as far south as Peterson's Crossing (~30km north of Fort St John) within the space of the last century (Leech et al. 2016). Treaty 8 Nations to the south of the Liard watershed basin have seen a longer and more intensive history of development in their areas, and boreal caribou are now extremely rare in their areas of interest. The provincial and federal governments are not working to restore boreal caribou across this historic range, and without much more definitive management measures boreal caribou risk being extirpated over their remaining range in BC.

Today, all the remaining boreal caribou in BC fall within the Treaty 8 boundary, and the vast majority of these are within the Liard watershed Basin.⁹ Historic numbers of boreal caribou in this region are not specifically known; however traditional knowledge suggests that caribou were historically distributed across the entire boreal forest portion of the Liard watershed basin, and in significantly larger numbers than are found today. A rough estimate based on an extrapolation of population density estimates suggests a population of possibly ~5500 animals across their former range.¹⁰ Today there is a minimum population estimate of ~728 animals remaining in BC (Culling and Cichowski 2017).

9 Only the Milligan core of the Chinchaga range is outside the Liard watershed Basin territory, and is not addressed spatially within this Medzih Action Plan.

10 Density of caribou in the 'cores' = 8.4 caribou/ 100km² (DeMars and Boutin 2015). Extrapolation of this density across today's caribou ranges, and assuming a 50% larger historic range leads to a rough estimate of ~5500+ caribou historically.

During interviews conducted for a 2017 Restoration Study, FNFN community knowledge holders consistently identified a precipitous decline in boreal caribou over the last several decades. In areas where boreal caribou were consistently observed in the past, knowledge holders have observed an abundance of lichen — but no caribou. Knowledge holders link this decline to increased industry, increases in predator populations and increased access for predators into wet, muskeg areas that are important areas of refuge for boreal caribou, especially during the calving season. Community members also worry about health and contamination of individual caribou.

My whole trapline is muskeg or swamp, you see caribou there. There is lichen (white lichen in the muskeg) there, it is their main food source. Lots of lichen on the trapline, but no caribou anymore. (2017 FNFN restoration interviews)

There are several FNFN members who directly hunted caribou in their lifetime or who recall their parents hunting caribou. Those that remember hunting caribou talk about hunting them in the winter, between November and January, and report hunting as many as 4-5 each year for a family of 5 (2017 FNFN restoration interviews). Caribou had important cultural uses in addition to sustenance, including the use of their hide as sleeping blankets, and to make babiss (a component of snowshoes; 2017 FNFN restoration interviews).

Fort Nelson First Nation promotes recovery of boreal caribou populations that are both self-sustaining, but are also sufficiently resilient to support Fort Nelson First Nation and Treaty 8 subsistence hunting.

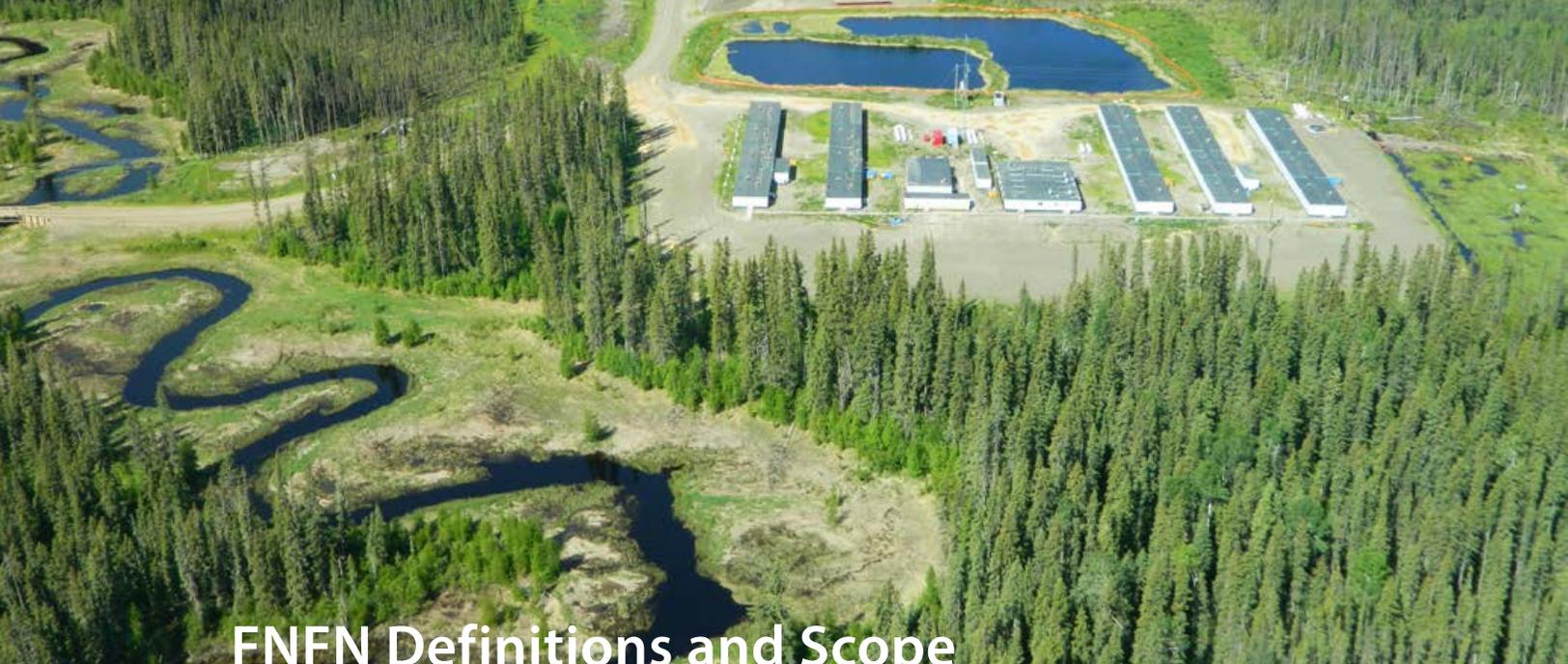
The ongoing isolation of 'ranges' should be halted, and recovery across the historic range of caribou promoted.

FNFN believes that the entire historic range of boreal caribou must be considered potential caribou habitat for the future — and should be managed to be in sufficiently good condition to support healthy populations of caribou and all other species, including humans.

Terminology

The province and the federal governments do not use the same terminology with respect to species at risk management. For example, the federal government uses “critical habitat,” while the province does not. This makes the application of legal tools at best confusing, and at worst paralyzing or obfuscating (see ECCC and BC 2017; Gorley and Holt 2017).

FNFN believes that the entire historic range of boreal caribou must be considered potential caribou habitat for the future — and should be managed to be in sufficiently good condition to support healthy populations of caribou and all other species, including humans. In this document, FNFN identifies areas to be immediately prioritized for protection (Protection Zones), and areas to be prioritized for restoration (Restoration Zones) (see Map 1). These are not analogous to the cores identified by the province, although there are significant areas of overlap. These zones can be modified with additional inputs, but must be sufficient to meet the federal 65% disturbance threshold within each range, within a generation, and must actively prevent further deterioration, and actively improve habitat condition for significant areas of caribou habitat for any hope of success to be realized.



FNFN Definitions and Scope

PHOTO: KATHERINE CAPOT-BLANC

Medzih Medzih is the Dene word for caribou. In this document, we use it interchangeably with caribou or boreal caribou for ease of reading.

Protection Zones (PZ) Areas that have the biophysical features preferred by caribou, currently have a lower level of development, and are most often used by caribou today based on limited telemetry data. A preliminary set of PZs are identified in this document. No further development is to be permitted in protection zones to ensure degradation of core habitat ceases immediately. There may be a need for priority restoration in PZs, even though overall they are the least disturbed areas of the landscape.

Restoration Zones (RZ) Areas that have the biophysical features preferred by caribou, but today have a high level of disturbance. Some of them are still used by caribou based on the available limited telemetry. Additional work is required to determine where priority restoration actions should occur within the preliminary RZs identified.

Together, the Protection and Restoration Zones constitute a minimum area of ‘critical habitat’ as identified in the Federal Recovery Strategy. Critical habitat may not be limited only to these zones. FNFN expects that fine-tuning of these zones would be necessary but overall these should exceed 65% of the EC ranges. The zones will also need to respond to the ‘expected unexpected,’ e.g., fires, movements of animals, available new information. FNFN also expects further refinement of the identified spatial zones to manage for economics; however, no further habitat degradation should occur while refinement or implementation is underway.

Wolf Management Zones FNFN does not support the approach the provincial government has typically used for wolf management. However, FNFN may support focused wolf management in specific areas that have high densities of wolves and large pack sizes, based on information provided by members and supported by science. Humane and culturally appropriate approaches to wolf management must be employed.

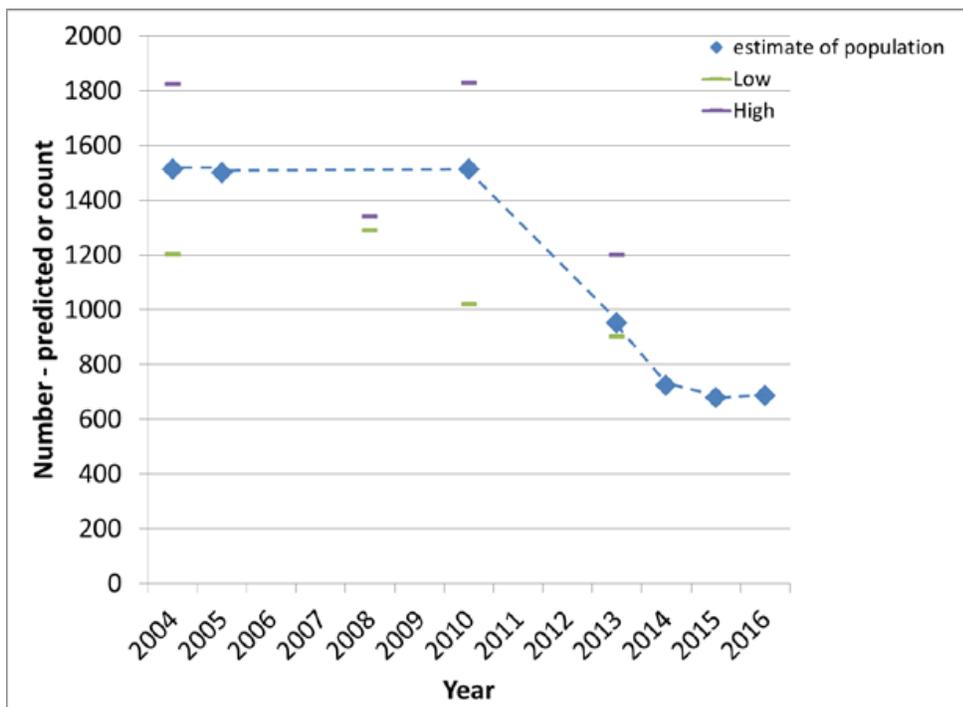
Geographic scope This plan covers all caribou ranges that fall within the Liard watershed, including all of the Maxhamish, Calendar, Snake-Sahtenah, and Westside Fort Nelson Ranges, and a portion of the Chinchaga Range.

Population Status: An Urgent Situation

A summary of the estimates and counts of boreal caribou in BC is shown in Figure 1. These data have been compiled from the wide range of monitoring and reports produced primarily by and for the Province of BC (Appendix 5).

Figure 1. Boreal caribou population trends in FNFN territory

Recent provincial data on boreal caribou population trends in FNFN territory. Data prior to 2013 are 'estimated,' whereas data from 2013 forward are minimum population counts (Appendix 5 shows data sources).



"The boreal caribou population estimate is 1,290–1,340 caribou" —BCIP 2011

"A minimum of 728 Boreal Caribou currently reside in the northeast of BC" —BCIP 2016 and BCRIP 2017

Between the 2011 and the 2016 BC draft Implementation Plans, the numbers of caribou apparently declined by half — from an estimated level of ~1400 animals to a minimum of 728 animals in 2016. The two draft BC Implementation Plans — 5 years apart — each report these quite different numbers as the population of boreal caribou without commenting on the notable drop in numbers and whether the change is believed to be significant or not. This approach constitutes presenting information in the form of a "sliding baseline" and is a significant concern to Fort Nelson First Nation.¹¹

In 2017, the Province of BC released a science update (Culling and Cichowski 2017) that provides a thorough summary of caribou science and a more thorough reflection of recent population trends. However, the 2017 BCRIP in some cases continues to make optimistic

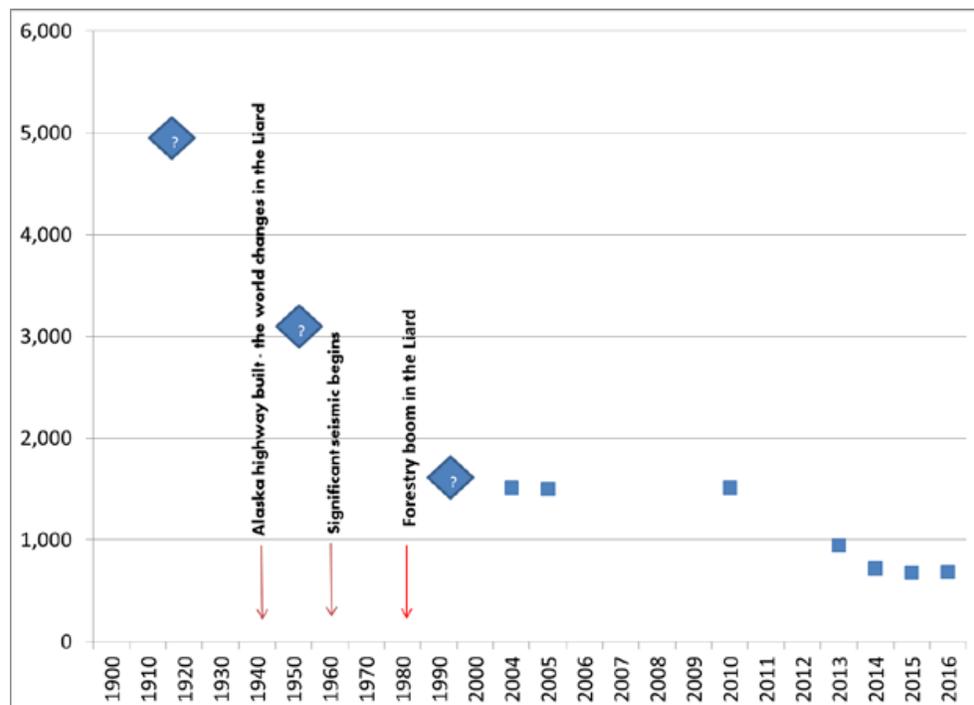
¹¹ Note that the 2004 population figure is an estimate based on aerial surveys; the 2013-16 population figure is the total number of caribou observed based on collared caribou. The 2013-2016 average likely underestimates the caribou numbers; the 2004 figure may overestimate the numbers. Despite these concerns about directly comparing numbers, the declining population trend is clear, and aligns with traditional knowledge-based observations from FNFN community members.

claims about range level population status based on a somewhat selective interpretation of available recent data.¹²

Both traditional knowledge and western science point to historic numbers being significantly higher than current numbers, and to a distribution of caribou that is much more widespread than it is today. A true representation of caribou decline is much more likely to be represented by something similar to Figure 2.

Figure 2. Boreal caribou population trend over time

Schematic of the potential shape of the boreal caribou population trend over an ecologically meaningful timeframe. The small squares represent estimated and observed recent data (see Figure 1). The large diamonds represent guesses about earlier population numbers based on recent density estimates of boreal caribou from cores.¹⁰ FNFN is not claiming to know the exact historic numbers nor the shape of this curve, but both traditional knowledge and science-based density estimates suggests this is a reasonable representation of true trends over time. (Note the change in units on the bottom axis).



Fort Nelson First Nation believes that claiming the population is stable, or arguing over the exact number of boreal caribou present today is unhelpful to caribou recovery. FNFN believes it is much more relevant to acknowledge that the real population decline is likely considerably more significant than trends reflected in the provincial government's documents, especially when considered over an ecologically and culturally relevant timeline.

¹² For example, Appendix A of the BCRIP 2017 discounts a single low year, but does not discount the single high year for lambda, and suggests that the population is stable based only on the last 3 years of data rather than a more likely trend based on known longer term declines. FNFN does not believe that this is a precautionary interpretation of available information.

Mechanisms of Decline

The causes of boreal caribou population declines have been widely discussed, and are known to include a number of mechanisms, most of which are linked to landscape disturbance (Witmer et al. 2005; EC 2012; Wilson 2015; Culling and Cichowski 2017). Increased direct mortality is considered the primary mechanism of decline. Climate change, and possibly larger cyclical patterns for caribou may also occur, but there is little consensus on these factors, how they may operate and what the long-term implications are.

What is agreed upon (BCRIP 2017) is that the primary mechanisms for decline are increased mortality for both adults and particularly young caribou, caused by:

- a) an increased number of predators in the landscape (numerical predator response). Predator populations (wolves primarily) are maintained above historic levels by the increased number of other prey on the landscape (e.g. moose).¹³ These other ungulates are responding to increasing areas of early seral habitat created by forestry, increasing fire due to climate change, and possibly the changing climate itself, which is allowing animals to move further north.
- b) An increase in predator accessibility or access to caribou in the landscape (functional predation response) due to the linear features that allow predators to access the landscape differently than historically, and prevent caribou from finding safe refuges, particularly for calving.

Environment Canada identified a relationship between disturbance and likelihood of population persistence in the federal Recovery Strategy (EC 2012). This relationship has been used by Environment Canada to identify the requirement to maintain 65% of each caribou range ‘undisturbed’ — with the assumption that this will lead to a 60% probability that the population will be self-sustaining.

Environment Canada estimates that maintaining 65% undisturbed habitat leads to a 60% probability of populations being self-sustaining — and therefore a 40% probability that the population will not be self-sustaining (Environment Canada 2012).

Fort Nelson First Nation believes that 40% probability of loss of caribou is an unacceptable risk — particularly since caribou are an indicator of functional landscapes for the boreal forest.

The 65% threshold should therefore be considered a high-risk threshold that should not be approached in any areas important for caribou.

Currently, all the boreal caribou ranges and the vast majority of cores in BC are over this high-risk threshold (EC 2012; Culling and Cichowski 2017; Table 1¹⁴). Yet current provincial approaches do not prevent further disturbance in these areas.



The causes of boreal caribou population declines have been widely discussed, and are known to include a number of mechanisms, most of which are linked to landscape disturbance.

PHOTO: KATHERINE CAPOT-BLANC

¹³ In addition, the prey base and huge population fluctuations of beaver over the last century likely interacts with other additional prey to contribute to apparent competition. Moose numbers should not be assumed to be the only alternate prey base in modeling exercises.

¹⁴ The ‘new’ Westside Fort Nelson range has a lower disturbance level than the original individual ranges (see Table 1).

In addition, other factors may be changing and contributing to negative population trends in boreal caribou. Health and condition information for individual caribou is very limited due to only very recent scientific monitoring. There is some evidence that both health status (presence of disease) and body condition may both be factors of concern for these caribou (Culling and Cichowski 2017), and this would be predicted given increasing stress on the population caused by habitat loss, degradation and fragmentation, and also by changing conditions caused by climate change. To date, these factors are being monitored, but are not considered to be the primary mechanisms for decline.

Caribou has insect on them, when you cut the throat of the caribou you see worms about an inch big, yellow in color. Hives on the hide too. (2017 Restoration Interviews).

Trends over time in Fort Nelson First Nation Territory



PHOTOS: FNFN LANDS ARCHIVE

Around 1900 — when Treaty 8 was signed — there were no roads, no seismic, no well sites, no forestry, no pipelines or transmission lines in the Liard watershed basin, and caribou were an important hunted species. Today there is a diffuse network of a wide range of disturbance types across almost the entire Taiga Plains portion of the Liard. Different areas of the Liard are affected by different types of disturbances, and to different extents today. For example, the three major shale basins — the Horn, the Liard and the Cordova — have very different histories of development (FNFN State of Knowledge Report 2017, in preparation).

Today, there is a diffuse network of disturbances across the entire range of BC's boreal caribou. Using Environment Canada's 2012 statistics, of the (now five) ranges, all ranges are well over 35% disturbed, and all cores are over 35% disturbed with the exception of Paradise Core. One range (Westside Fort Nelson) was not evaluated at the time of that analysis (Table 1).

In addition, all but one of the very large ranges is above the high-risk density of linear disturbance identified by Antoniuk (2006) of 1.6 km/km^2 , with some entire ranges far above this threshold (e.g. Snake-Sahtaneh at 7.1 km/km^2), and some cores within them at even higher densities (e.g. the Tsea Core within the Snake-Sahtaneh range has a linear density of $\sim 15 \text{ km/km}^2$).¹⁵

Are Conditions Improving for Caribou Habitat today?

The level of strict protection in the Taiga Plains is very low. In the area covered by caribou ranges in the Liard watershed, a total of about 1% has 'protected area' status (Table 1).

There are extensive areas of Ungulate Winter Range (UWR), and Wildlife Habitat Area (WHAs; Table 1), which were located with respect to known high quality habitat locations (Goddard 2009), though it was originally noted that the total area identified was considered insufficient to protect core caribou habitat since it was limited by the timber supply cap (Goddard 2009). The 'no harvest' and 'conditional harvest' terminology does not entirely

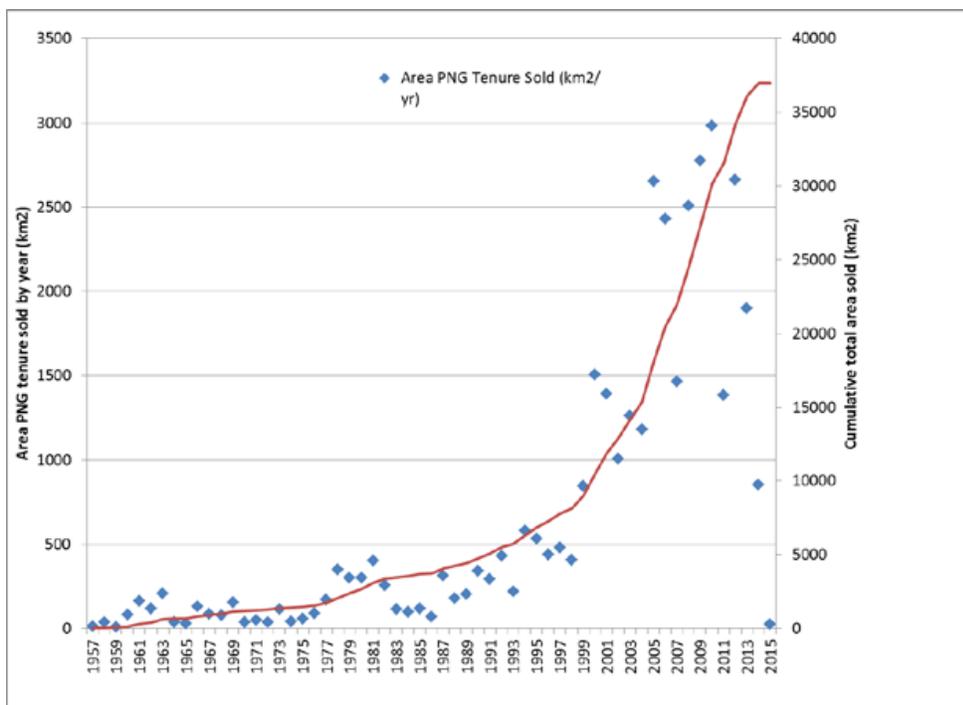
¹⁵ Based on FNFN internal analysis, September 2017.

accurately reflect what activities can occur within these zones, because designations apply primarily to forestry rather than the entire industrial footprint. Gas development is unaffected by the designation unless it causes a material adverse effect,¹⁶ and because there is significant discretion with how the designations are enforced (ECCC and BC 2017; FNFN 2017).

At the same time, petroleum and natural gas (PNG) tenure has been sold in caribou habitat at an ever-increasing rate. Figure 3 shows the sale of PNG tenure over time, the vast majority of which overlays caribou ranges in the Liard watershed.

Figure 3. Sale of petroleum and natural gas tenure

Annual sale of PNG tenure (dots; left Y-axis), and cumulative total area sold (red line; right Y-axis), by year.



Petroleum and natural gas (PNG) tenure has been sold in caribou habitat at an ever-increasing rate.

PHOTO: KATHERINE CAPOT-BLANC

In 2011, the province of BC designated Resource Review Areas (RRAs) which had a lifespan of 5 years, and which were intended to prevent further sale of tenure in important areas for caribou. These have since been ‘shifted’ to better reflect caribou use areas.¹⁷ However, since PNG tenure in much of the caribou ranges has already been sold, and the RRAs do not prevent activity within these zones (just no new tenure sales), RRAs do not improve the situation for caribou today—though they do potentially prevent it from becoming increasingly worse in the future if more tenure is sold in critical areas. Map 2 shows the current spatial distribution of Active PNG tenure in boreal caribou habitat, based on publicly available provincial data.

¹⁶ A difficult test to employ since it is linked to fine-scale habitat features that are not yet mapped.

¹⁷ A new map of RRAs is unavailable from the province, though they note that caribou core areas may now be off-limits for further tenure sales.

Map 2. Spatial distribution of active PNG tenure in caribou habitat today

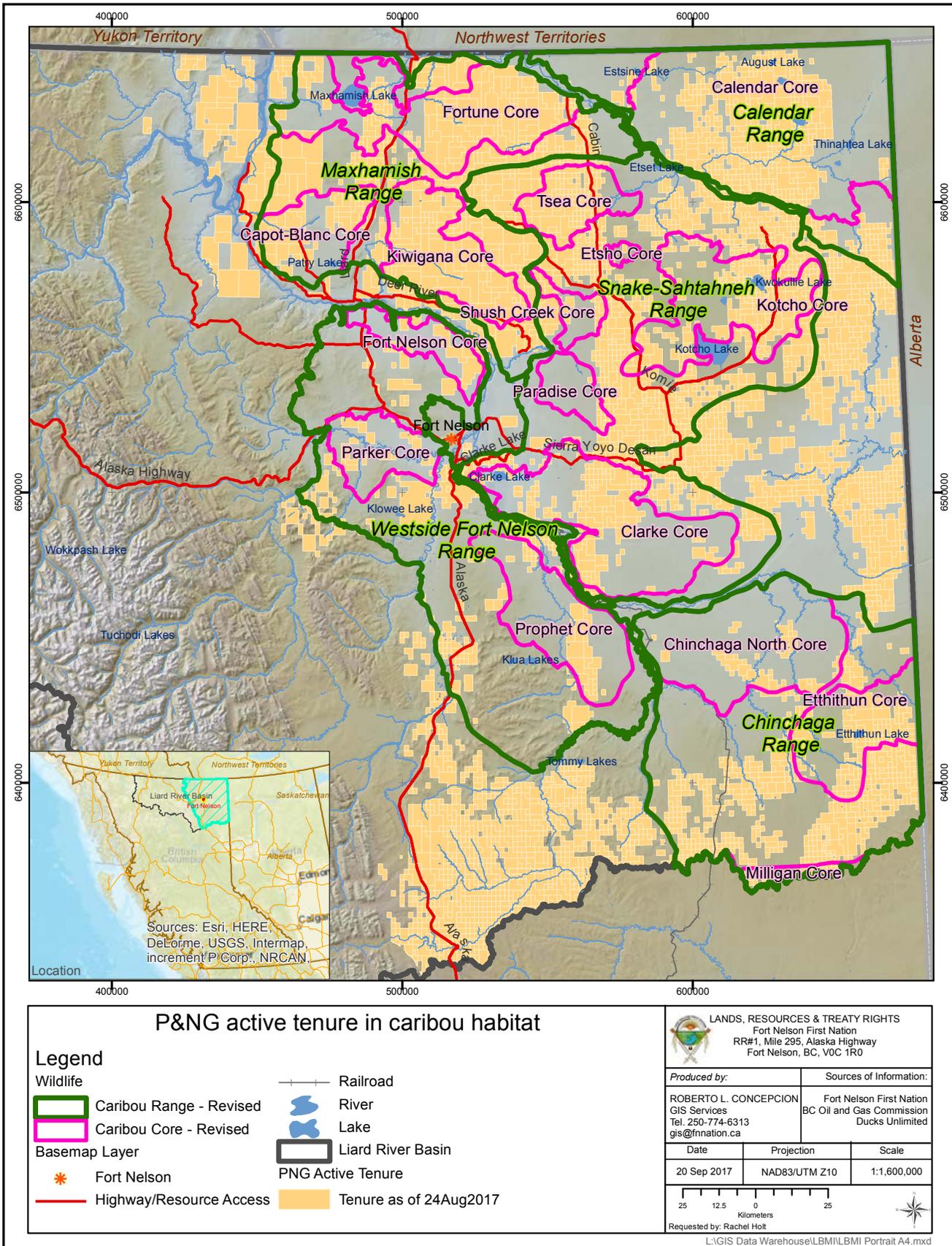


Table 1. Statistics for caribou ranges in FNFN territory

For each range and core, the table shows the percent of the area in each of the following categories: disturbance level (from EC 2012 for ranges, and from FNFN analysis for cores), % full protection (protected area), % in Wildlife Habitat Areas, and % in Ungulate Winter Range. Only the protected area designation effectively prevents industrial activity within caribou habitat.¹⁸

Range	Core	Disturbed ^a	Protected	Active tenure ^b	UWR – conditional	UWR – no harvest	WHA – no harvest
		%					
Calendar		61	3.8	47	59	29	0
	Calendar	(59)	4.7	51	65	30	0
	not core		0.0	31	34	26	0
Chinchaga		76	0.2	36	10	0.6	2
	Chinchaga North	(26)	0	13	-	0	0
	Etthithun	(53)	0	55	58	0	9
	Milligan	(81)	3.9	49	10	1	1
	not core		0.2	41	23	1	1
Maxhamish		58	3.5	70	42	18	0.1
	Capot-Blanc	(58)	0	59	69	30	0
	Fortune	(50)	6.7	69	67	27	0
	Kiwigana	(60)	0	94	73	27	0
	not core		3.7	65	6	5	0.2
Snake-Sahtaneh		87	0	56	5	31	24
	Clarke	(70)	0	37	15	50	31
	Etsho	(51)	0	23	-	93	93
	Kotcho	(65)	0	59	10	75	55
	Paradise	(35)	0	11	23	77	75
	Shush Creek	(96)	0	44	-	48	7
	Tsea	(93)	0	81	5	62	62
	not core		0	62	0	5	6
Westside Fort Nelson		-	3.4	20	10	3	0
	Fort Nelson	(43)	0	36	0	0	0
	Parker	(43)	0.3	22	16	13	0
	Prophet	(47)	1.2	21	11	6	0
	not core		4.6	19	10	1	0

a: Bold numbers for ranges from EC 2012 (none are available for Westside Fort Nelson because this range was established after the 2012 Recovery Strategy was published). Numbers in parentheses for cores from FNFN analysis using EC assumptions as closely as possible.
b: Note that where active tenure is greater than 35% of the area, recovery to 65% undisturbed will not be possible using current provincial approach, as existing tools do not prevent further disturbance, nor promote immediate recovery. This is the case for 4 of 5 ranges (shown in grey), and for many of the provincial cores (lighter shaded grey).

18 Resource Review Areas are not totaled in this table because a map of the revised RRAs is unavailable from BC at this time.

Although extensive measures appear to be in place, there is little actual protection for caribou habitat, and ongoing industrial development continues to degrade habitat beyond the 35% disturbance threshold identified by Environment Canada.

An opportunity has arisen due to low gas prices to ‘take a breath’ and develop spatial plans to ensure ongoing development does not further threaten boreal caribou populations. This work should be undertaken simultaneously with ensuring the future industrial activity is undertaken in a manner that promotes stable, long-term social wellbeing in the northeast.

Planning for Effective Caribou Habitat

“Boreal caribou are distributed broadly throughout the boreal forest. They require large areas comprised of continuous tracts of undisturbed habitat rich in mature to old-growth coniferous forest, lichens, muskegs, peat lands, and upland or hilly areas. Large areas with suitable quality habitat allow boreal caribou to disperse across the landscape when conditions are unfavorable (e.g. natural fire disturbance, anthropogenic disturbance) and to maintain low population densities to reduce their risk of predation.” — Environment Canada 2012

Although very large sums of money have been spent on caribou research, neither the provincial nor federal governments of Canada have provided a map of critical habitat to be protected, nor linked spatial recovery decisions to such a map. In fact, the lack of agreement between the two levels of Canadian government about what constitutes identification and sufficient protection of ‘critical habitat’ is a significant cause for concern, and leads to gaps in the potential efficacy of protection strategies (ECCC and BC 2017; Gorley and Holt 2017).



Habitat selection by animals has been a topic of debate in ecology for many decades (Lack 1933). For populations living in undisturbed ecosystems, comparing used habitats to the distribution of available habitats provides information on whether animals choose or avoid some habitats over others. The best studies are long-term (multiple decades) in length to reflect choices over a range of usual and unusual circumstances. In the case of species of conservation concern, determining preferred habitats is more difficult, especially if the landscape is recently altered and if animal fitness is low (i.e. individuals may be making poor choices). Scientists do not know whether animals are altering their behaviour to reflect current / changed risks, nor which landscape and local level choices result in the best survival for individuals and their offspring.

Fort Nelson First Nation asserts that any area of high value habitat within caribou ranges should be protected. As a starting point, habitat that is least disturbed and used by caribou are the highest priority for protection from any new disturbance and have been identified as Protection Zones. High value areas that are already highly disturbed must be spatially prioritized for restoration (Restoration Zones). Through measures to protect and restore these areas, FNFN's Medzih Action Plan meets Environment Canada's requirement to protect critical habitat within boreal caribou ranges.

What is high value caribou habitat?

Caribou habitat quality is known to be affected by a complex array of factors, including the underlying ecosystem, distribution of habitats across the landscape, predator density and predator efficiency (Culling and Cichowski 2017). Yet, the fundamental issue is relatively simple: caribou use certain types of habitats — in particular, at the landscape scale, in all seasons — treed bogs, poor fens, coniferous uplands. They avoid areas covered by deciduous-dominated swamps and some uplands. At a finer scale, caribou use areas that are hard to access or have escape terrain, such as groups of small lakes for calving. Caribou also use lakes in winter for travel, but tend to avoid lake shores at other times of year.

The presence of predators does not negate the underlying habitat value, but it does make the habitat a more 'risky' place to be. Caribou are assumed to have evolved habitat selection decisions to avoid areas with a higher density of predators. However, whether caribou continue to assume that certain habitats are 'safe,' or whether they effectively shift their habitat use based on today's predation risk is unknown. This makes identifying 'high quality' habitat based on current distribution of animals a somewhat tenuous approach.

The original caribou ranges (Culling et al. 2004) were intended to encompass "*sufficient space to allow for periodic shifts in areas of activity due to local depletion of forage resources, disturbance, or stochastic events such as wildfire*" (Culling and Cichowski 2017). Core areas were defined as having "*high capability and suitability based on general habitat requirements (treed peatlands, terrestrial and arboreal lichen forest base) and documented caribou occurrence*" (Culling and Cichowski 2017). British Columbia recently updated the range boundaries (Wilson 2014). Traditional knowledge has not been incorporated into the delineation of these boundaries — and traditional knowledge tells of a wide distribution of caribou across the landscape, and to the south of the existing ranges.

Fort Nelson First Nation supports the use of new information — but is concerned by moving of ranges and cores based on a perpetually changing landscape that may affect where caribou are in any given year, while not identifying spatial areas for protection and recovery of habitat. **After extensive science to determine the location of important caribou habitat — identified as ranges and cores by the province — there are no areas identified as critical habitat, and more importantly, there are no areas identified as off-limits to further development, or for habitat recovery.**

Models have been developed to help identify high value caribou habitat. In Alberta, a Resource Selection Function model (RSF) has been developed by scientists on behalf of the Government of Alberta, but the model itself is held by the Government of Alberta and not released for use. In British Columbia, a habitat model has been created that identifies high value spring calving areas (DeMars and Boutin 2014; 2015) and the results are publicly available (Appendix 2).¹⁹ In Saskatchewan, a habitat ratings table model was created for the boreal caribou in that landscape (Arsenault 2014); this model links Ducks Unlimited Enhanced Wetland Mapping²⁰ ecotypes to their general value as caribou habitat. FNFN has used the habitat ratings table from Arsenault, modified to reflect the boreal landscape of the Liard, to generate a potential habitat map (Appendix 1).²¹

Traditional knowledge is also available from First Nations communities to the south of Fort Nelson. For example, important seasonal caribou habitats were identified by Blueberry River First Nation knowledge holders, including the importance of bogs, poor fens, and treed fens for calving; mature coniferous stands (spruce/pine) with abundant terrestrial lichens for winter habitat; and south facing slopes with early green-up for use in late winter/early spring (Leech *et al.* 2016a).

A Doig River First Nation traditional ecological knowledge study (Leech *et al.* 2016b) also identified seasonally important boreal caribou habitat areas, including noting that calving habitat was primarily nutrient rich and nutrient poor fens with some treed bog identified as important as well. In winter, mature spruce and pine stands were identified as important, and knowledge-holders also identified peatlands, the margins of waterbodies, and areas of early green-up (e.g., south-facing slopes) as important sources of spring forage. Lakes provide refuges from heat and bugs in summer, and Doig River First Nation members noted these were important predator escape areas. In addition, the importance of maintaining the ability of caribou to move through the landscape was noted since all the herds were likely historically connected.

Using traditional knowledge and available science, FNFN has created spatial habitat maps to identify Protection and Restoration Zones for boreal caribou in the Liard basin.

FNFN has had to take this step, since neither the provincial nor federal government has created a specific spatial map of critical habitat, nor identified what areas are required to be protected in order to halt the ongoing decline of boreal caribou in this landscape.

19 Report and model outputs available on BC OGRIS website: bcogris.ca/boreal-caribou/projects/complete

20 Ducks Unlimited. January 2010. "Fort Nelson Project Enhanced Wetlands Classification User's Guide." 63 pp. Ducks Unlimited, Inc., Rancho Cordova, California. Prepared for: Ducks Unlimited Canada; Encana; The PEW Charitable Trusts; U.S. Forest Service; U.S. Fish and Wildlife Service (NAWCA); Imperial Oil, Devon Energy Corporation, and the Canadian Boreal Initiative.

21 FNFN observes caribou in upland deciduous and conifer forests, at least at some times of year. Additional work will be undertaken to further understand the use of higher structured forests by this species. However, at this time, the original habitat ratings table for upland forests was not modified for this iteration of planning.

FNFN Caribou Protection and Restoration Zones

FNFN have identified spatial Protection and Restoration Zones for caribou. This approach meets the approach for range planning outlined by the federal government and SARA. FNFN used the following methodology:

- Build a base habitat capability map; based on Arsenault 2014 habitat ratings table and linked to the Ducks Unlimited Enhanced Wetland Mapping (DU EWC) product (Appendix 1);
- Overlay fires and cutblocks less than 40 years, if not already reflected in the DU EWC data;
- Overlay the base habitat capability map with a series of disturbance maps that identify the density of disturbance features on the landscape;²²
- Overlay with DeMars and Boutin (2015) RSF model on habitat calving suitability (Appendix 2);
- Overlay with caribou telemetry data — while acknowledging the limitations associated with these data;²³
- Identify Preliminary Protection Zones: these areas have high capability habitat, and / or high quality calving habitat today, relatively low industrial footprint, and / or high caribou use today. Preference was given to areas within provincial core areas, as these were already identified as high quality habitat zones by the provincial caribou experts (Map 1; Table 2);
- Identify Preliminary Restoration Zones: these areas have high capability habitat and / or high quality calving habitat, high industrial footprint and often have high caribou telemetry density. Preference was given to areas within provincial range areas — and in some cases, connection zones between ranges were identified. In addition, information on restoration potential (Appendix 3) was used to identify higher priority areas for restoration (Map 1; Table 2).



22 This was an investigatory exercise, to identify what features underlay the buffered disturbance map, since the buffering can visually mask actual differences in disturbance footprint on the ground.

23 Only a relatively small proportion of caribou are collared (~120 of 700+ animals), and they are often collared in groups, so telemetry data reflect caribou in certain locations. In addition, the telemetry points are heavily biased to individual caribou — for example 14 individual caribou (11% of the subset) generated 33% (40,000 of 120,000) of the telemetry points, with each of these caribou having more than 2000 telemetry locations, primarily over a two-year period. Conversely, 80 collared caribou had less than 1000 telemetry points each, and these equally represent around 42,000 of the data points. The message from these examples is that although the new efforts to understand caribou population and distribution are a positive step and have yielded interesting results, care must be taken to avoid depending too much on the data. In particular, the data show repeated use of particular animals in particular locations to date, but do not show the full picture of habitat use and distribution by boreal caribou in the Liard watershed.

Table 2. Protection and Restoration Zones Extent by Range

Percent of total area of ranges identified as preliminary Protection and Restoration Zones in this plan.

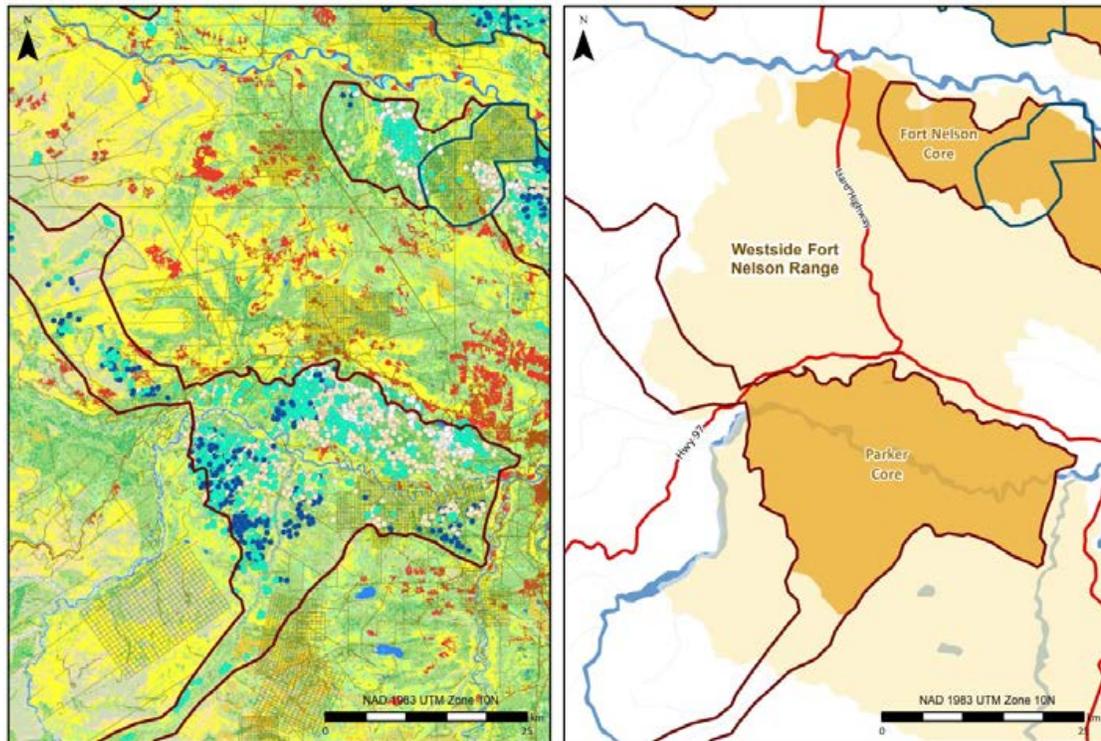
Region	Area (km ²)	Protection zone (%)	Restoration zone (%)	Total
Calendar Range	5380	40.1	39.8	79.9
Chinchaga Range**	8315	46.1	7.4	53.6
Maxhamish Range	7767	33.5	38.1	71.6
Snake-Sahtaneh Range	12293	37.3	22.3	59.6
Westside Fort Nelson Range	8658	35.6	1.5	37.0

**This area represents the section of the Chinchaga range that is within the Liard Basin watershed.

Map 3 provides an example of how the information listed above was used to define these zones within a subset of the area considered for the FNFN Medzih Action Plan. For example, within the original Fort Nelson core there is high concentration of telemetry points, but very different underlying habitat condition. This leads to the FNFN proposal to split the area into a Protection Zone (where current habitat condition is high and should not be degraded by new disturbance) and a Restoration Zone

Map 3. Example area for protection or restoration

Example area to show how FNFN's MAP uses habitat ratings, telemetry, and landscape disturbance (shown on left) to refine existing cores and identify potential connectivity corridors (shown on right) for Protection (outlined in red) or Restoration (outlined in blue).



(where high density of linear disturbance exists). In the Parker core area, the FNFN proposal is to identify a Protection Zone largely over the existing core habitat, but to also connect the area to adjacent zones where telemetry shows caribou moving across the landscape (see proposed connectivity arms added to the Protection Zone).

Recovery Potential for Caribou Habitat

To restore caribou: manage wolves; identify priority areas and keep industry out until caribou numbers increase; stop opening so much area; look into bear removal in areas with high bear numbers (target bear tags to caribou areas to remove bears); give people opportunity to trap wolves in high wolf/caribou areas (2017 FNFN restoration interviews).

Recovery of caribou habitat can mean a variety of things. In general, the human footprint does not ‘destroy’ caribou habitat in the way that draining a wetland destroys habitat for frogs. In contrast, the human footprint tends to leave habitat generally intact, but changes the density and / or efficiency of predators in that habitat, thereby increasing risks for caribou in a landscape with an apparent abundance of habitat. Recovering effective habitat therefore requires an understanding of the mechanisms of risk, and how to reduce those risks.

Forest harvesting creates habitat for alternate prey and therefore increases risk by supporting additional predators. New forest harvest blocks should not be permitted in Protection Zones, and should only be allowed in Restoration Zones with mitigation ratios applied. In addition, stand level options to maintain caribou values within block boundaries throughout the range of boreal caribou should be developed and implemented. In forest management, there is a requirement for industry to return an area harvested to tree cover — with at least similar ecological attributes to those in the original forest stand. It is estimated that harvested areas pose a potential threat to caribou until they are about 40 years old (EC 2012²⁴). In addition, harvesting of upland forests can remove lichen food sources for some period of time, but in general caribou populations are not thought to be limited by availability of food; rather they are limited by the availability of predator-free foraging opportunities.

The linear disturbances associated with PNG disturbances — particularly seismic lines and roads — allow increased access to the landscape by predators. But there has been no requirement for any restoration or recovery of land disturbed in this way by industry. The natural rate of ‘restoration’ or recovery of seismic lines and roads varies widely, depending on the type of disturbance. Older style bladed ‘cat’ cut lines have very limited recovery of native vegetation, even after many decades, due to the loss of soil from the line. Newer ‘low impact seismic’ may be hand cut, and very narrow, with little ground disturbance. These lines may start to recover vegetation within a relatively short time period (a decade or two). Key factors that influence ‘recovery’ include the local ecosite conditions — for example very wet sites (which are very common in this landscape) may have extremely limited or no recovery at least within a century (Lee and Boutin 2006). In addition, the orientation of the line (north / south versus east / west) affects line recovery rate, as does specific width, and use of mulch (e.g. Golder Associates and Explor 2016).

Natural fires also create conditions for alternate prey species, and sometimes cause loss of lichen. Predation risk in naturally burned stands is thought to be reduced to ‘natural’ levels at around 40 years; however, a natural burn is often much more patchy than a clearcut area, and as such, the areas mapped

24 Note that the 2017 BC RIP suggests lower figures of 20-25 years.

as fires less than 40 years may have more 'safe' habitat than would appear from the mapped outer boundary.

A central question is to ask what constitutes successful 'recovery'. Functional restoration — removing sight lines for predators, or creating debris to limit movement — is potentially relatively rapid in its effectiveness. On the other hand, ecological restoration — restoration to original habitat of the type surrounding the cut line — will likely be most effective for broad ecological goals in the long-term, but will generally take longer to achieve reductions in predation efficiency. In practice, approaches that provide short-term functional restoration, combined with long-term ecological restoration where required, should be prioritized.

The Federal Recovery Strategy (EC 2012) requires restoration of habitat 'over reasonable gradual increments every 5 years' (page 42), to a minimum of 65% undisturbed. For caribou ranges with >65% undisturbed, the Recovery Strategy requires the level of undisturbed habitat to be maintained above this minimum.

It is clear that an aggressive suite of management options will be needed to recover caribou before populations decline further. In Alberta, modeling showed that a combination of coordinated landscape-level restoration in addition to preventing any future footprint in high value caribou areas would have the greatest incremental benefit to caribou compared to other approaches (Alberta Landscape Team 2009; Ray 2014).



It is clear that an aggressive suite of management options will be needed to recover caribou before populations decline further.

FNFN Recovery Modeling

The provincial and federal governments have not provided estimates for when they expect caribou habitat to be recovered. One particular failing of the existing BCRIP (2017) is that the only active recovery of caribou habitat is tied to further development — linked to a mitigation ratio of 4:1 when new development occurs (BCRIP 2017). As a result, FNFN has undertaken its own modeling to examine how recovery may play out for the different caribou ranges and cores, through the development of three scenarios:

- "EC Everything Stops" scenario: Uses Environment Canada's recovery timeframes; assumes no new development and that recovery of all existing infrastructure starts immediately. This scenario provides minimum possible recovery times.
- "FNFN No Additional Development – Fire Recovers" scenario: Uses recovery timeframes modified by FNFN based on observed recovery in the field; assumes no additional new development and allows fire effects to disappear from the landscape. The scenario allows existing infrastructure to 'live out its lifespan' and then recover.
- "FNFN No Additional Development – Static Fire" scenario: As above (#2) but assumes that fires are held static at current levels and locations.

Methods and results from both models are shown in Appendix 6, and recovery curves for each range from the “FNFN No Additional Development – Static Fires Scenario” is shown in Figure 4.

Figure 4. Estimated recovery of caribou ranges

Using the FNFN No Additional Development – Static Fires scenario.
See Appendix 6 for additional details.

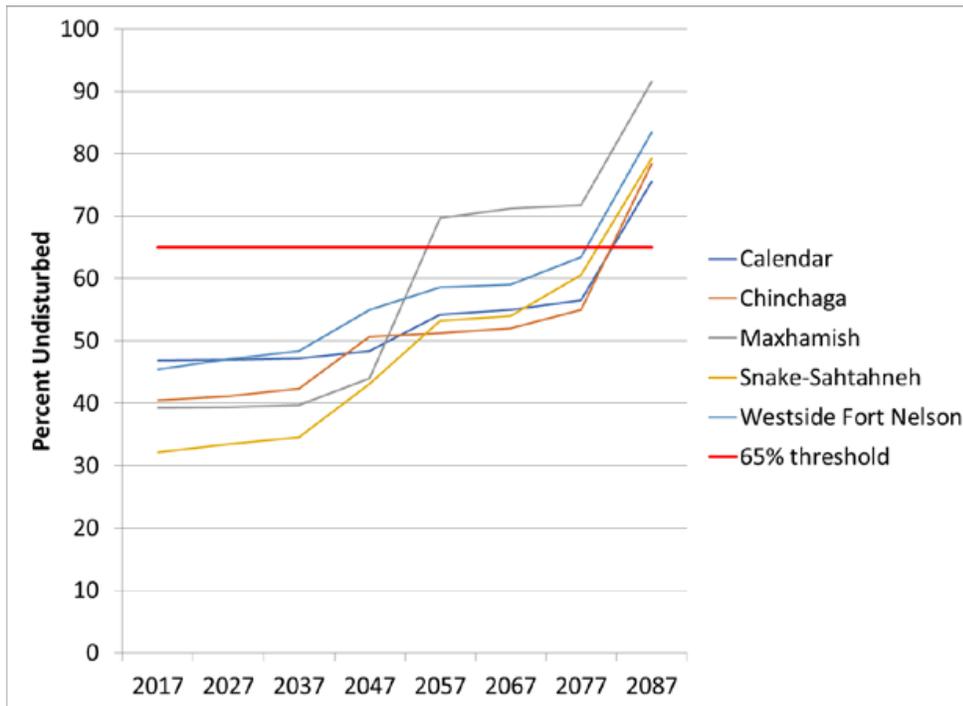


Figure 4 shows the potential different trajectories of the ranges, with the most rapid recovery to ‘65% undisturbed’ for the Maxhamish range, which surpasses the 65% undisturbed line in decade 2057. The other ranges, although they start at different levels of disturbance, all cross the disturbance threshold of 65% in the same decade — 2087.

The lifespan and recovery inputs for this scenario are informed by available information, but are not intended to be ‘correct.’ The results from the modeling, however, are helpful to understand the level of risk in different ranges and cores, and to identify areas that could potentially provide intact habitat more quickly. The province has not provided any similar estimates on recovery to date to guide recovery planning for boreal caribou.

FNFN believes this type of recovery modeling provides useful information to help prioritize areas for immediate restoration actions, and to provide information on how long an effort will be required to ‘recover’ areas for caribou without significant intervention to mitigate historic disturbance

Mitigation of Future Development

None of the recovery scenarios modeled by FNFN include future industrial development. However, FNFN assumes there will be future development in the Liard watershed basin, and promotes that there should be an 'offset' rule to mitigate the effects of that future development on caribou habitat that reflects the level of risk on the landscape.

The BCRIP (2017) identifies an offset rule for additional future disturbance, but the details are unclear, it does not appear to be mandatory, and most fundamentally, the efficacy of such an approach is not clear from the literature.²⁵ Effects such as uncertainty about recovery on certain ecosystems, the effect of time-lags for recovery, and lack of information on the functional effectiveness all lead FNFN to require a much more precautionary mitigation ratio than 4:1. FNFN recommends a mitigation ratio of 10:1 in Restoration Zones, and a mitigation ratio of 4:1 in the lower priority caribou areas.

The extent of longer-term future pressures will depend primarily on the degree of further expansion of the oil and gas sector in the Liard watershed. While activity levels have slowed recently with the gas price downturn since 2011, the Horn River and Liard gas basins in particular remain highly prospective and valuable shale gas deposits: in multiple scenarios of development of a viable BC LNG sector, for example, extensive additional disturbance will be expected in the shale basins within the broader Liard watershed.²⁶

There is every expectation that the level of disturbance in FNFN territory will rise, possibly dramatically, as gas prices increase in the future. There is a time-limited opportunity now for planning, while development is on hold. But FNFN cannot rely on future development to fuel recovery of the legacy of past development.

There is an immediate need for industry and the province to provide funding today to deal with the legacy footprint.

Future footprint can be offset using a mitigation ratio that reflects the level of risk (4:1 in lower value areas; 10:1 in Restoration Zones).

Although some work has begun on what may constitute 'success' from a recovery perspective, determining the specifics of what can be deemed successful restoration will require more work — and will be tied to future monitoring in this landscape.

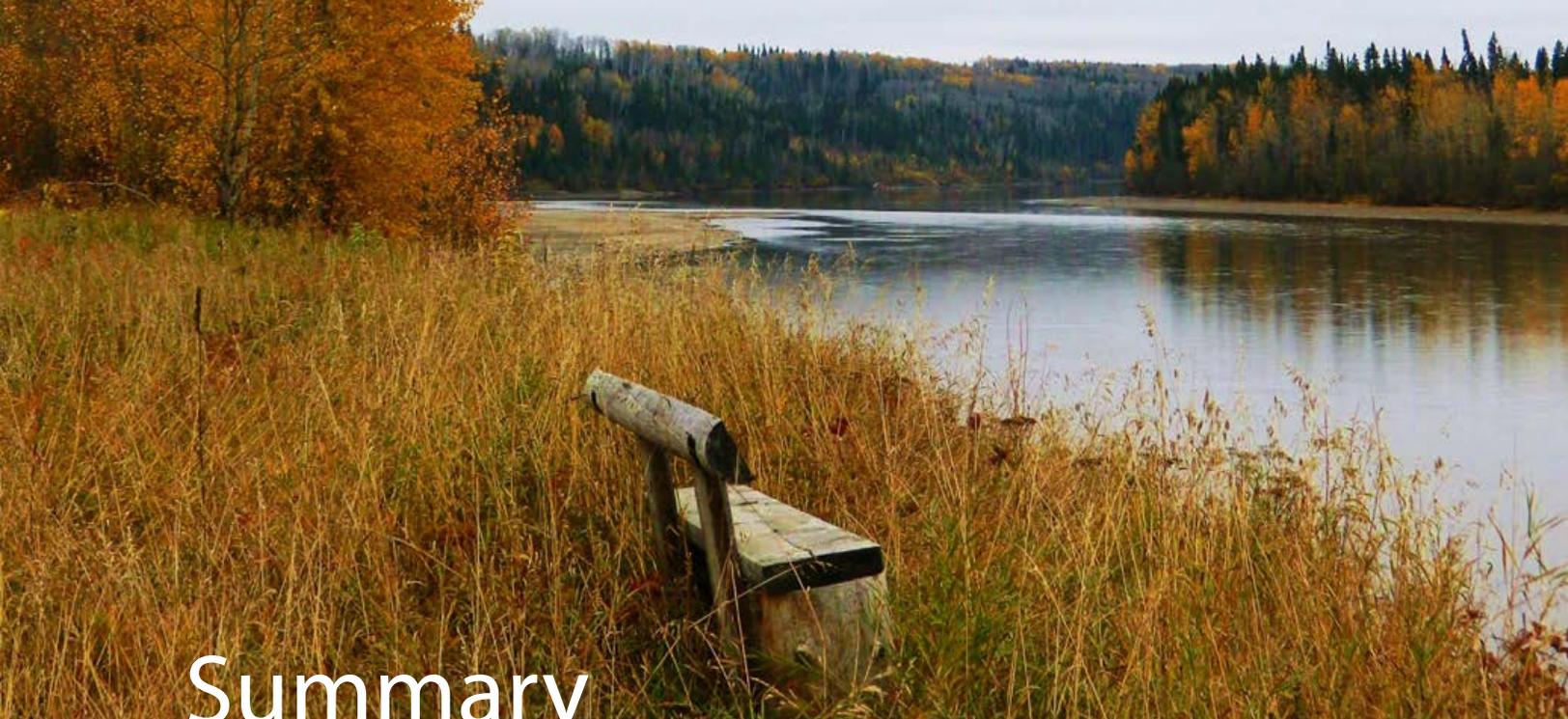


There is every expectation that the level of disturbance in FNFN territory will rise, possibly dramatically, as gas prices increase in the future. There is a time-limited opportunity now for planning, while development is on hold.

PHOTO: KATHERINE CAPOT-BLANC

²⁵ In forest management, cutting trees in the hope that future trees will grow faster is termed the allowable cut effect. In the case of caribou, the province is allowing additional future disturbance before mandating recovery of past disturbance. FNFN is calling this the "allowable disturbance effect."

²⁶ FNFN's *Fueling Change* study (MacDonald 2014), established a likely conservative estimate range of between 1,635 and nearly 21,000 additional kilometers of linear disturbance (roads, seismic, and pipelines) to fuel the LNG sector over its first 20 years in the three primary Liard watershed shale gas formations.



Summary

FNFN has significant concerns about the efficacy of existing recovery and protection approaches for boreal caribou. FNFN does not believe sufficient actions are being taken on each of these required areas (FNFN 2017).

FNFN believes that adoption of this Medzih Action Plan can meet the legislated requirements for boreal caribou under SARA, if the plan is adopted and legislated in a co-governance fashion by the province of BC.

FNFN's Medzih Action Plan includes protection for at least 65% of boreal caribou ranges in the Liard River watershed, and meets the legal requirements for habitat protection under SARA.

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Effective boreal caribou population recovery requires a number of strategies:

- Immediate protection of existing areas used by caribou that have a relatively low predation risk as indicated by low disturbance density. This has the potential to stabilize the current negative population trends. These critical areas must not be disturbed until other intact areas are restored.
- Recovery of the landscape to a functional condition that restores the ability of caribou to employ their life-history strategy of avoiding predators:
 - A reduction in predator accessibility in the long-term by restoring linear disturbances in key areas, and preventing new linear disturbance in critical areas.
 - A reduction in carrying capacity for predators in the long-term by managing habitat in key areas to reduce alternate prey. This requires spatial planning of future timber harvest, and fire suppression in priority areas.
- Interventions such as predator control or maternal penning to increase survival of caribou populations in the short to mid-term while the two above factors occur. These interventions may be required in some populations, but requires full implementation of the above strategies to be in place.

In this Medzih Action Plan, FNFN has:

- Summarized the state of boreal caribou in British Columbia, and concluded that very high levels of decline have occurred in the last century. A summary of protection mechanisms show the population to remain at very high risk. This negatively impacts FNFN's ability to meaningfully exercise their Treaty Rights. **There is an urgent and immediate need to reverse this trend.**
- Summarized the state of caribou habitat mapping — and concluded that although efforts are being made to incorporate science information into complex models, no implementable map of critical habitat has been generated by the province or the federal government. **Immediate spatial identification of Protection and Restoration Zones is needed, and FNFN has taken this step.**
- Summarized the state of existing protection mechanisms for boreal caribou. Currently levels of protection that would meet the Federal SARA requirements for critical habitat are very low. BC is clearly not in compliance with SARA. **The FNFN Medzih Action Plan can bring this region into compliance, by identifying habitat areas for immediate and real protection, and meeting requirements for range planning for boreal caribou by the October 2017 deadline as outlined by Environment Canada.**

There are hundreds of pages of documents that discuss the decline of caribou across Canada, yet the lack of concrete action on the ground to prevent the disturbance actions that lead to decline, are symptomatic of the common mentality to resource management at play today (Kennett 2006). Kennett identifies that acknowledgement of limits is a huge part of the resource management battle. Societies typically 'want it all' and fail to acknowledge that decline of nature is the inevitable outcome. After acknowledging limits, identifying and then implementing those limits is key. As long-term land stewards, with both rights and responsibilities, Fort Nelson First Nation demands real action to prevent the loss of caribou, and believes this is possible in parallel with moderated and planned economic development.

FNFN has developed goals and strategies, supported by traditional knowledge, science and map products that aim to move significantly forward to resolve the issue of declining boreal caribou in the short and long term, and to begin to work towards a sustainable economic future in the Liard.

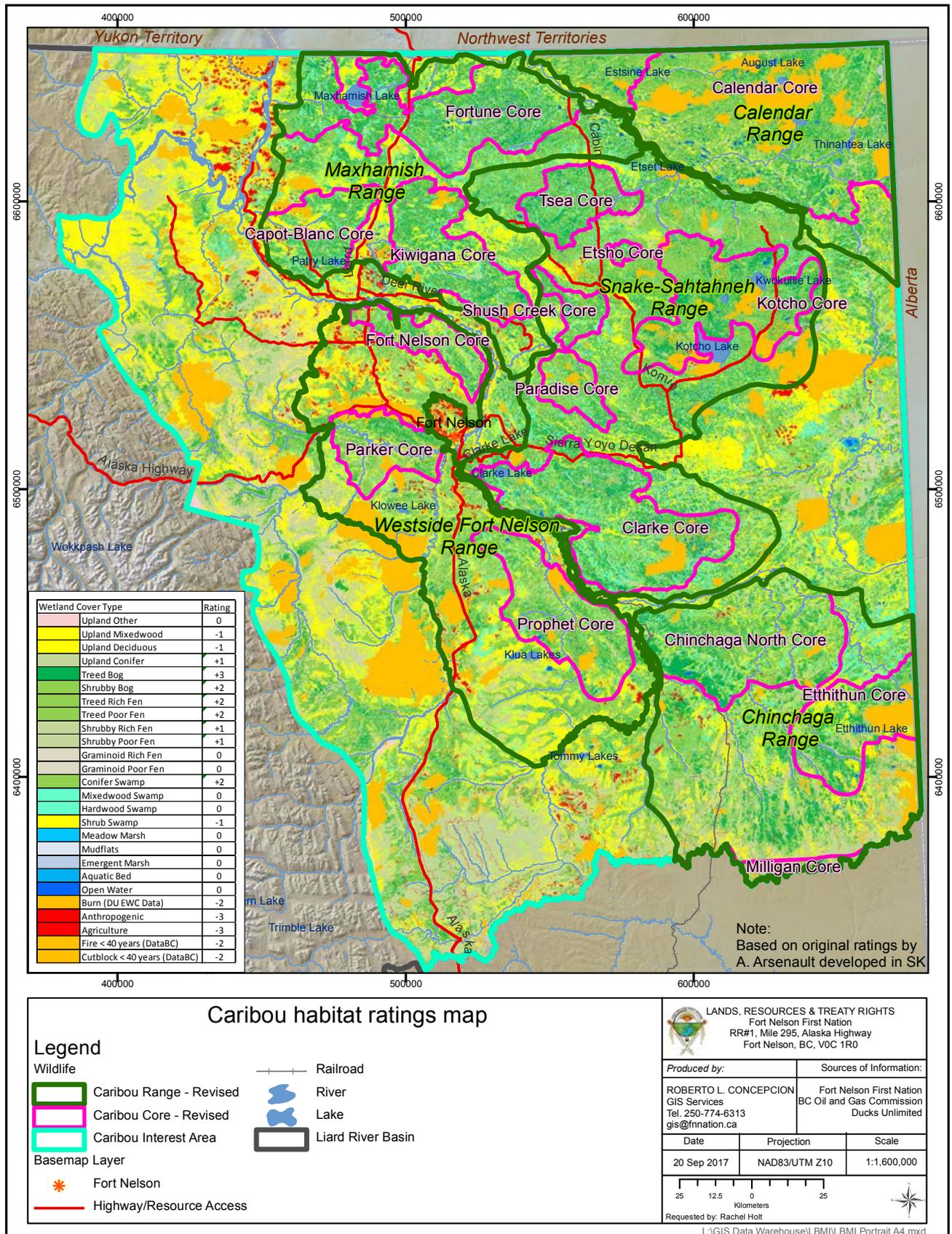
FNFN looks forward to working with the provincial, federal governments and other parties to implement this plan in the immediate future.

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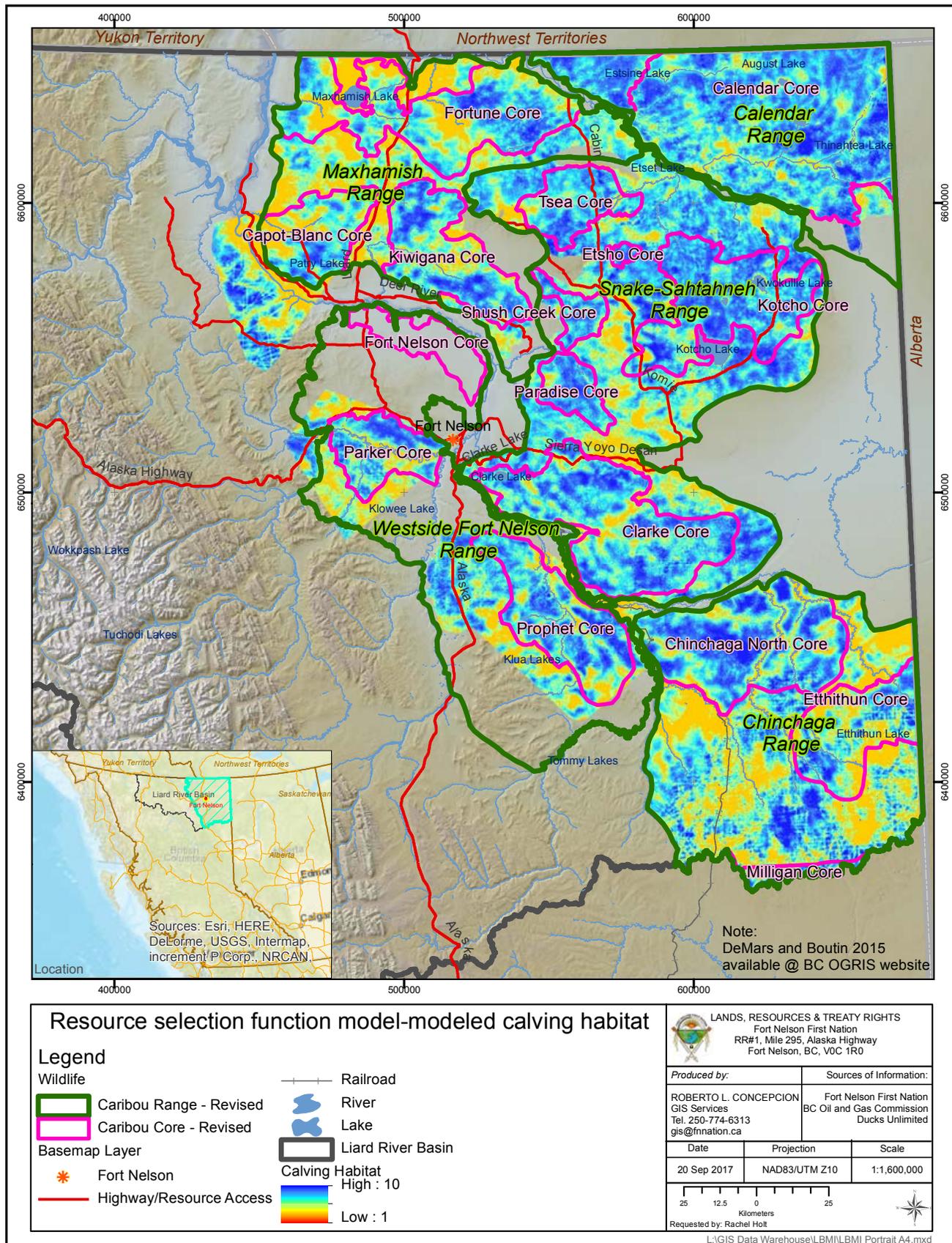
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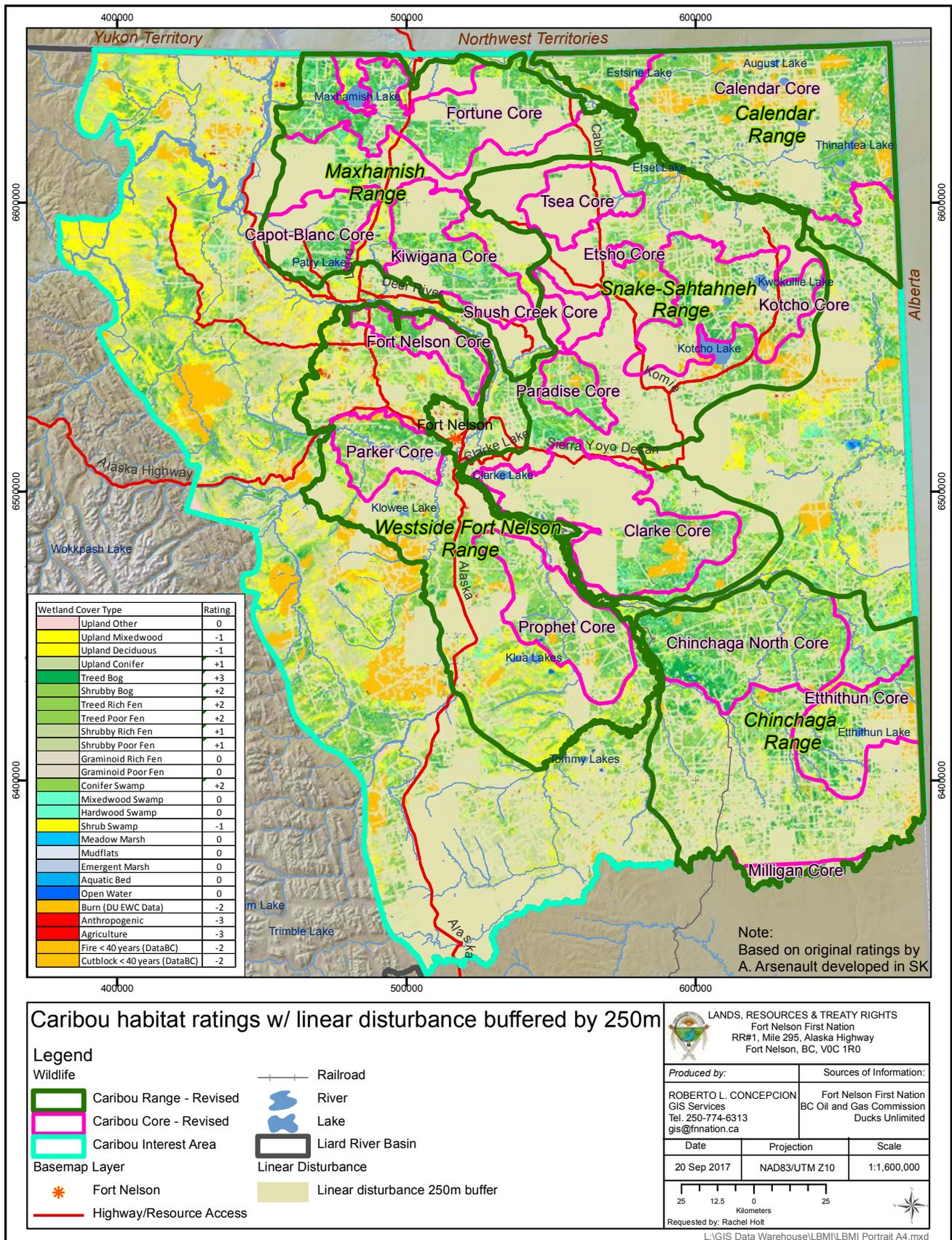
Appendix 1. Caribou habitat ratings map. Based on Arsenault (2014) habitat ratings table and Ducks Unlimited Enhanced Wetland Mapping.



Appendix 2. Resource selection function model. Modeled calving habitat (DeMars and Boutin 2015). Available from BC OGRIS website.



Appendix 3. Caribou habitat ratings with linear disturbance buffered by 250 m as per Environment Canada (2012).



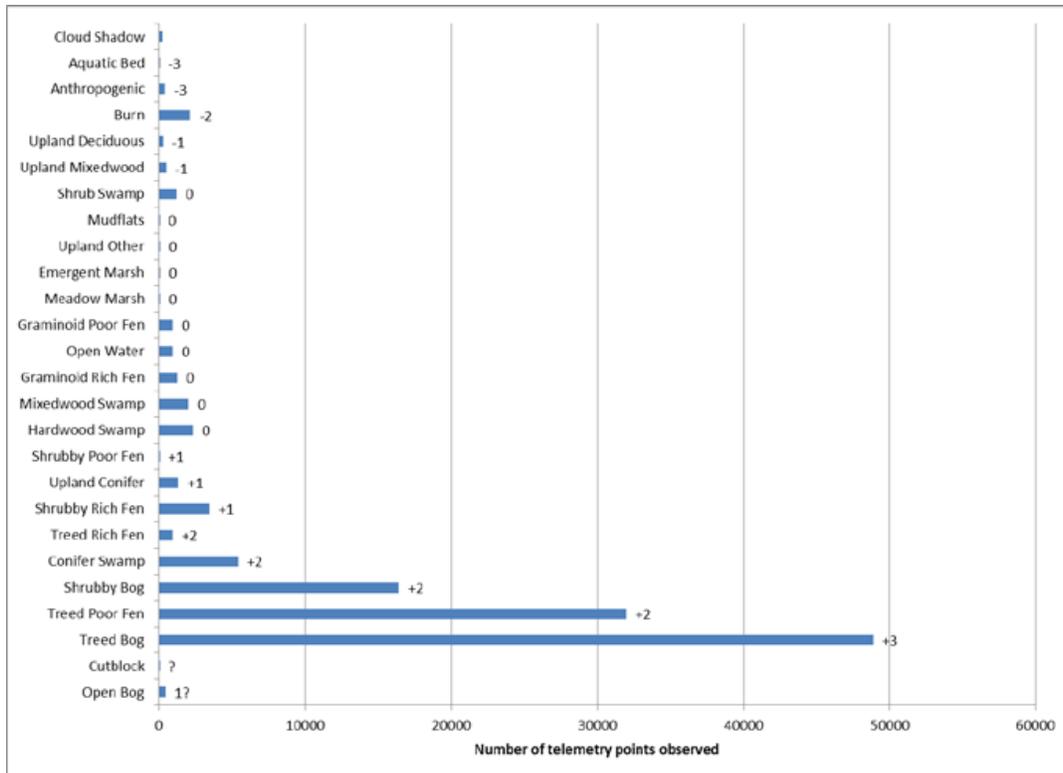
Appendix 4. Creating a Habitat Map for Boreal Caribou

Table 3. Habitat ratings table for base map

This ratings table was developed by Arsenault (2014) in Saskatchewan, and links the Ducks Unlimited Enhanced Wetland Classification map to caribou habitat preferences. 'Upland pine' is a different system in the Liard, and thus FNFN reduced the habitat score from +3 to +1 for that ecosystem.

Ducks Unlimited Enhanced Wetland Covertypes	Caribou Preference Rating	Caribou Habitat Characteristics
Upland Pine	+3 (+1)**	Lichen-rich mature (>40 yrs old) upland pine for annual forage, predator avoidance, low mortality risk, spatial separation from higher density cervid populations.
Upland Other	0	Matrix
Upland Mixedwood	-1	Low (conifer dominant) to High (deciduous dominant) predation risk
Upland Deciduous	-1	High predation risk
Upland Conifer	+1	Predator avoidance, low predation risk, spatial separation from higher density cervid populations.
Treed Bog	+3	Lichen-rich annual foraging habitat, predator avoidance, low mortality risk, spatial separation from higher density cervid populations.
Shrubby Bog	+2	Seasonal forage (spring, summer, calving), predator avoidance, low predation risk, spatial separation from higher density cervid populations.
Graminoid Bog	+1	Predator avoidance, low predation risk, spatial separation from higher density cervid populations.
Treed Rich Fen	+2	Calving habitat and foraging habitat
Treed Poor Fen	+2	Calving habitat and foraging habitat
Shrubby Rich Fen	+1	Calving habitat and foraging habitat
Shrubby Poor Fen	+1	Calving habitat and foraging habitat
Graminoid Rich Fen	0	Matrix
Graminoid Poor Fen	0	Matrix
Tamarack Swamp	+2	Winter foraging habitat, predator avoidance, low predation risk, spatial separation from higher density cervid populations.
Conifer Swamp	+2	Winter foraging habitat, predator avoidance, low predation risk, spatial separation from higher density cervid populations.
Mixedwood Swamp	0	Low (summer)-moderate (winter) predation risk
Hardwood Birch Swamp	0	Low (summer)-moderate (winter) predation risk
Shrub Swamp	-1	Low (summer)-moderate (winter) predation risk
Meadow Marsh	0	Predator avoidance
Mudflats	0	Moderate-high predation risk
Emergent Marsh	0	Predator avoidance
Aquatic Bed	0	Predator avoidance
Open Water	0	Insect relief, winter travel
Burn	-2	High predation risk (burns <40 yrs old)
Anthropogenic Influenced	-3	High predation risk
Agriculture	-3	No habitat

FNFN looked at how caribou used habitats in relation to their availability on the landscape (unpublished analysis), and found no evidence to change the ratings table as outlined by Arsenault. FNFN has therefore used the proposed habitat ratings table as published, with the exception of the upland pine ecosystem that is a lichen dominated system in Saskatchewan, but is a mix of upland forest types in the boreal forest of the Liard.



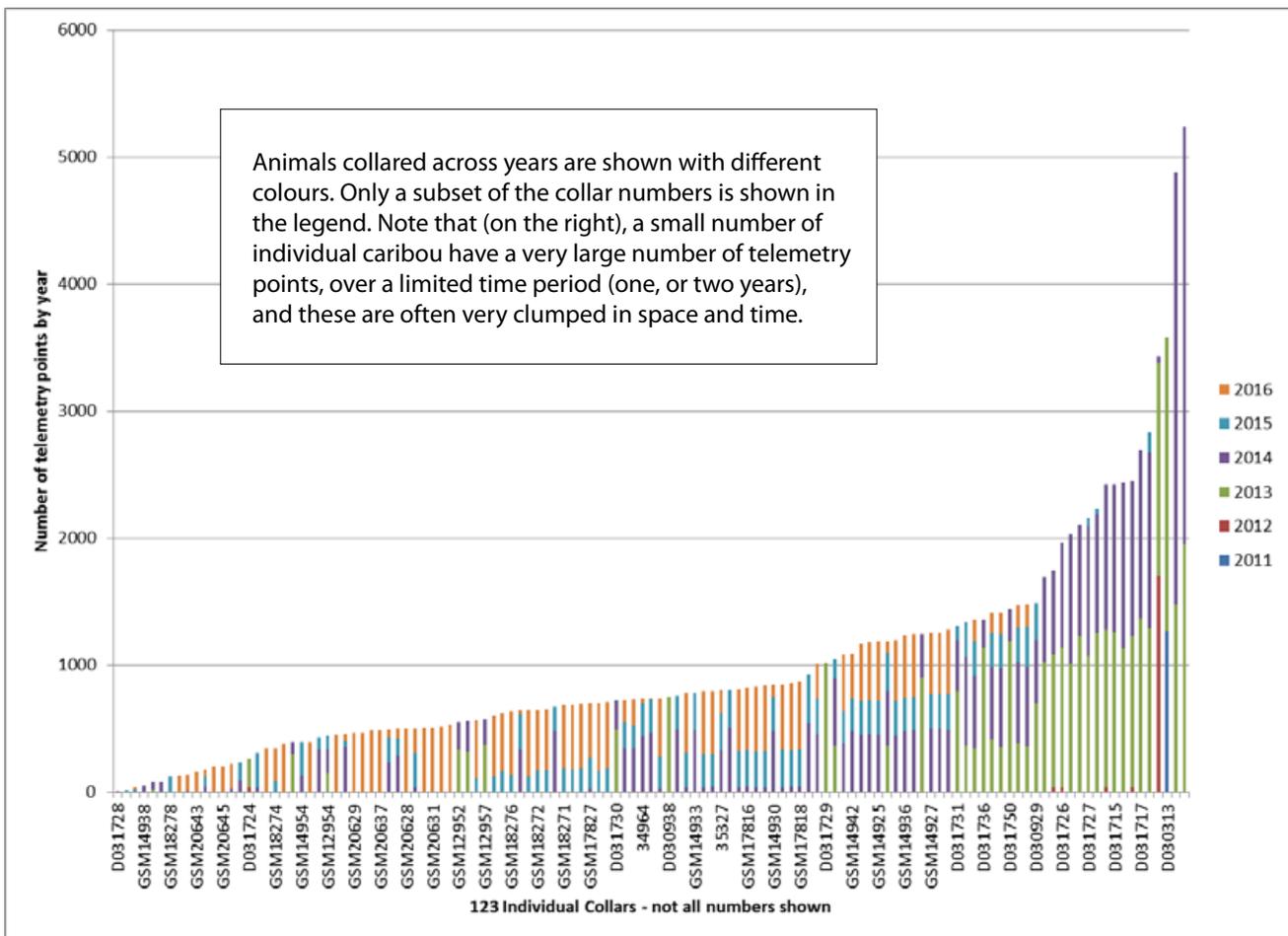
The graph above shows the relationship between the caribou telemetry points from the last 6 years, and the habitat ratings proposed by Arsenault (2014), confirming that, as a general pattern, there is good correlation between these telemetry points and the habitat ratings table, though this also reflects the availability of habitats on the landscape. Note that in applying the Arsenault model to this landscape, we downgraded the 'upland conifer' designation from +3 (Arsenault 2014) to +1 – to reflect the increased uncertainty about the diversity of conifer systems in this landscape. However, it is important to note that traditional knowledge and recent field observations by community members, identifies that caribou do use large structured spruce and deciduous stands in this landscape, and preliminary analysis of forest cover (VRI) data also shows a presence of caribou in stands with leading species of black and white spruce and larch. These stands are not yet highlighted in the base mapping, but should be managed for while planning cutblocks in Restoration Zones and elsewhere within caribou ranges.

FNFN also notes that although the additional telemetry data are very useful, they must also be interpreted with caution. First, a limited subset of caribou is collared (~10% of the population), and not across the entire distribution of caribou. Additionally, the telemetry points are highly skewed towards a limited subset of animals, as noted in the text of the MAP.

Figure 5. Number of telemetry points for 122 individual caribou with collars since 2011

It is clear that a very limited subset of caribou dominates the dataset – for example 14 individual caribou generated 40,000 of the 120,000 telemetry points – with each of these caribou having more than 2000 telemetry locations each primarily over a two-year period. Conversely, 80 caribou had less than 1000 telemetry points each, and these equally represent around 42,000 of the data points.

The recent new efforts to understand caribou population and distribution are a positive step which FNFN supports. However, care must be taken to not extrapolate beyond the data’s usefulness. In particular, the data show repeated use of particular animals in particular locations, but do not show the full picture of habitat use and distribution by boreal caribou in the Liard watershed basin.



Appendix 5. FNFN summary of population numbers from a variety of reports since 2004

Year	Minimum count/ estimate of caribou	Source of information	Comments
2004	1512 (1201-1823)	BCIP 2013 Report of 2012-2013 collar deployment, p. 23	Population estimate.
2004	1,500	Interim oil and gas guideline, July 2004, Culling et al. 2004	Population estimate; see document page 4 for more information.
2008	1290-1340	Caribou Science update, 2010; MOE 2008 data	Population estimate.
2010	1,018- 1,827*	July 12, 2010 MOE; projected caribou populations'	* Range data from 'July 12, 2010 MOE; used to provide low estimates vs. high estimates.
2010	1,512	RRA Performance measures 2012, p. 7 (MOE 2010)	Population estimate.
2013	952	From REMB field activities webinar series	
2013 (?)	900- 1200	FNFN_BCIP Oct 28, 2014 powerpoint presentation	Note that this number is higher than the other 2013 recorded amount.
2014	723	From REMB field activities webinar series	
2015	678	From REMB field activities webinar series & '2015 BCIP Annual Report' p. 18	
2015 (March)	669	BCIP-2015-05 Restoration toolkit rollout presentation, p. 29	Recruitment averaged 15 calves: 100 cows.
2016	728 or 686	2016 BCIP Annual report, p. 14	Total caribou observed. Total min. count for BC in 2016 was 686; adding in caribou that travel between NWT and AB makes 728.

Appendix 6. Caribou Habitat Recovery Modeling

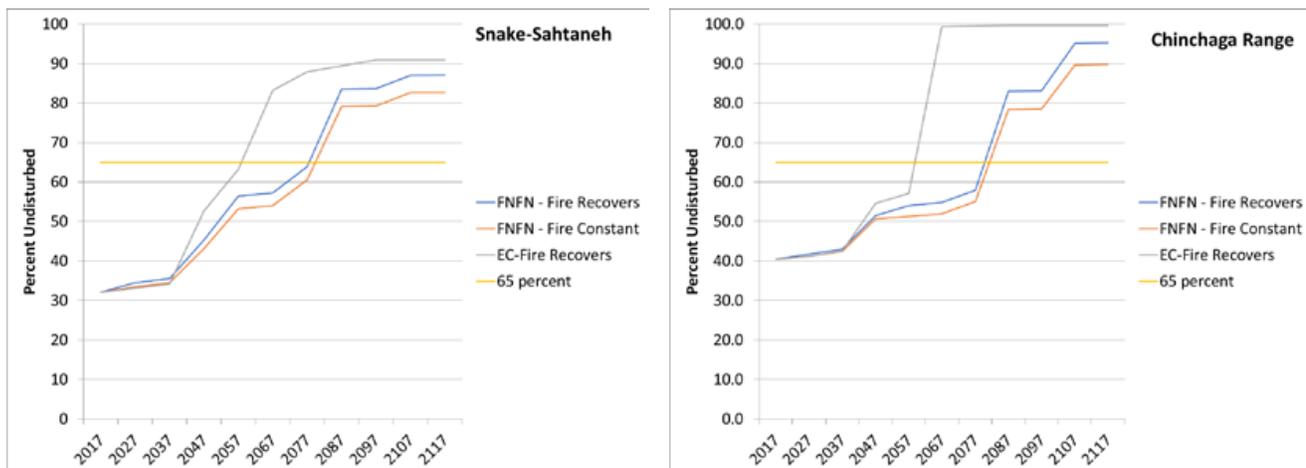
Three scenarios were investigated, to examine how different areas of caribou range may recover, and the extent to which different assumptions about recovery affect the outcomes.

Scenario 1: “EC Everything Stops” uses the Environment Canada 2012 recovery assumptions for individual disturbances, and assumes that everything starts to recover immediately (i.e., roads / well pads / other industrial infrastructure). This is a very optimistic scenario since much of the infrastructure is in use and will not start to ‘recover’ until it is decommissioned. Fires also ‘recover’ in this scenario, and disappear from the landscape in 40 years or less.

Scenario 2: “FNFN No Additional Development Scenario – Fires Recover” estimates lifespan of the infrastructure (e.g. 40 years for roads), and revises recovery times based on FNFN field experience. In this scenario, fires recover and disappear from the landscape, allowing individual ranges with fires today to recover. No new fires are started in this model. This is clearly not a realistic assumption, but allows local areas with high fire now to recover.

Scenario 3: “FNFN No Additional Development Scenario – Static Fires” estimates lifespan of the infrastructure (e.g. 40 years for roads), and revises recovery times based on FNFN field experience. Fires remain located on the landscape and do not recover. This scenario slows recovery on areas with fires today, but maintains the percent of the landscape that is <40 years old due to fire as a constant.

None of the scenarios has any additional disturbance from 2017 into the future.



FNFN is developing further analyses of these scenarios for different regions, based primarily on the FNFN assumptions, which FNFN believe to be more realistic than the Environment Canada recovery assumptions. FNFN assumptions on recovery times are available from the FNFN Lands Department.

The output from the recovery exercise provides a variety of different types of information, which will be used to further prioritize areas for restoration activity. This work can also be used to examine the importance of different assumptions, and how different areas may recover under different approaches. Additional details are available from FNFN (in preparation).

Disturbance Recovery Modeling for Caribou Cores and Ranges: GIS Methodology

All identified disturbance data layers were downloaded and assembled in a geodatabase and analyzed in a combination of ArcMap 10.5 and ArcGIS Pro 2.0 software applications.

Each province-wide disturbance dataset was clipped to a generalized polygon that encompassed all caribou ranges and cores to reduce file size and increase the processing speed during later stages of the analysis.

Attribute data for each clipped dataset was examined to determine the most relevant Environment Canada (EC) recovery estimate as well as the date that recovery began or will start in the future. The recovery start dates were based on any appropriate date field available, such as harvest date for forestry cut blocks, completion date for seismic lines, or the tenure expiry date for crown land tenures. If no reasonable recovery start date could be identified, the current year (2017) was used. For the EC recovery estimates, the assumption is that recovery begins as of the current year for disturbance features without a defined past or future recovery start date.

Fort Nelson First Nation (FNFN) produced their own recovery estimates based on the different categories of disturbance, as well as different types of disturbance within those categories. For example, different seismic line clearing techniques were allocated different recovery estimates. Also, for disturbance features without a defined past or future recovery start date, FNFN assumes these features, such as roads, will continue to be used for many years before recovery begins. Such continued use is incorporated into the FNFN recovery estimates.

Once the recovery start date, the most appropriate Environment Canada recovery estimate, and the FNFN recovery estimate were added to all features in all datasets, all disturbance data was merged into one master disturbance dataset. First, all point features were merged together into one dataset and then buffered by 250 meters (as per the federal Recovery Strategy; EC 2012). The same procedure was applied to all line features. All polygon disturbance data layers except for current and historical fire perimeter data were merged together and buffered by 250m. The three resulting buffered datasets (points, lines, and polygons) were then merged together, the result of which was then merged with the unbuffered fire perimeter datasets. The resulting dataset represents all disturbance data buffered to approximate the EC approach for calculating areal disturbance, and is the dataset used in the disturbance recovery exercise outlined below.

To carry out the disturbance recovery modeling, eleven columns were added to the attribute table of the master disturbance dataset. The first new column represents time zero, which in this case is 2017. The next 10 columns represent 10-year intervals over the next 100 years (Year 10, Year 20, Year 30, Year 40, etc.).

This dataset with the new columns was then duplicated. In one of the duplicates, each of the 11 columns were populated as "Disturbed" or "Recovered" based on the Environment Canada recovery estimate and recovery start date of each individual disturbance feature. In the other version of the dataset, the 11 new columns were populated as "Disturbed" or "Recovered" based on the Fort Nelson First Nation recovery estimates and the recovery start date. At this point the FNFN version of the dataset was again duplicated. In the duplicate FNFN version, all fire disturbances less than 40 years old were classified as "Disturbed" for all time steps in the model. This decision was made to represent that although fires will recover over time, new fires will appear on the landscape. By not allowing fire disturbance to recover, it assumes the rate of new fires will offset the rate of fire disturbance recovery and this disturbance will be represented in the area calculations of the model. What this assumption does not consider, however, is the spatial

rearrangement of fire disturbance over time. The resulting three versions of the master disturbance dataset (the EC version and the two FNFN versions), were used to calculate the areal disturbance within each caribou range and core at 10-year intervals over the next 100 years.

To calculate the area of disturbance, each version of the dataset was first intersected with the caribou ranges and the cores, respectively. The resulting six data layers contain only disturbance features within the caribou ranges/cores, with the name of the relevant range/core associated with each disturbance feature.

The calculation of areal disturbances at each time interval was an iterative process that was repeated for each version of the model, which had to be repeated for both the EC and FNFN data intersected with ranges and the data intersected with cores. Ultimately, the process was repeated six times: EC version for ranges, EC version for cores, FNFN version with fire recovering for ranges, FNFN version with fire recovering for cores, FNFN version with fire constant for ranges, and the FNFN version with fire constant for cores. The procedure was to filter the data that was intersected with the caribou ranges/cores to only include "Disturbed" features at the time interval of interest. Once filtered, the dissolve tool was applied to combine all disturbance features into one large polygon for each range/core. Dissolving the data like this prevents overlapping disturbance features from being counted twice in the area calculation. The result of the dissolve tool is a new data layer for the time interval of interest that contains only one disturbance polygon feature per caribou range/core. The area of each of these disturbance polygons per range/core was calculated in square kilometers using the coordinate system NAD 1983 UTM Zone 10. This process of filtering for only "Disturbed" features, dissolving into single polygons, and then calculating areas was repeating for each time interval for each version of master disturbance dataset intersected to both caribou ranges and cores.

