



STATE OF KNOWLEDGE

Moose | golo, mooswa



Fort Nelson First Nation Liard Basin Monitoring Initiative

March 2019

ACKNOWLEDGEMENTS

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"[w]e are stewards of the lands and our teachings guide the ways we control, manage and protect our territory. The health of the territory relies on our voice and our actions."

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STATE OF KNOWLEDGE: **MOOSE | GOLO, MOOSWA**

Fort Nelson First Nation *Liard Basin Monitoring Initiative*

March 2019

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PHOTO: RYAN DICKIE

CONTENTS

**ABOUT THE LBMI, FNFN GUARDIAN PROGRAM,
AND STATE OF KNOWLEDGE SERIES4**

INTRODUCTION8

THE IMPORTANCE OF MOOSE FOR FNFN 10

 Moose Use.....10

 Nutrition and Food Security12

 Ecological Role of Moose14

 Seasonal Habitat Use.....15

 Mortality.....16

MOOSE IN FNFN TERRITORY 17

 Habitat Suitability.....17

 Moose Population, Population Health and Trends.....19

 Pressures on Moose23

MOVING FORWARD IN MOOSE MANAGEMENT AND MONITORING 30

 Moose Management30

 Moose Management Recommendations33

 Moose Monitoring Needs.....36

 The Future37

REFERENCES 38

About the LBMI, FNFN Guardian Program, and State of Knowledge Series

THE FORT NELSON FIRST NATION (FNFN) Liard Basin Monitoring Program (LBMI) State of Knowledge series of documents are designed to provide FNFN, the public, industry, and government with information about conditions on the land and waters in FNFN territory, and to the extent possible, how these have changed and may in the future change further.

This information constitutes a meaningful current conditions set — a baseline — against which future change can be compared, to see if the health of FNFN territory is improving or getting worse. From this knowledge, action can be designed to protect our lands, waters, and resources.

State of Knowledge documents published to date or forthcoming are:

- The LBMI Year 1 State of Knowledge report, published in 2017, including information up to 2016 on seven key FNFN values (shown at right);
- Beaver State of Knowledge report (August 2018);
- This Moose State of Knowledge report (March 2019);
- Caribou State of Knowledge report (May 2019); and
- FNFN Watersheds Report Card (April 2019).



Each of these documents is available on the web or can be accessed by contacting the FNFN Lands and Resources Department at 1-250-774-6313.

Starting in 2019/2020, responsibility for the FNFN State of Knowledge series will transfer over to FNFN's fledgling FNFN Guardian Program. Additional State of Knowledge themes, including a greater focus on water quality and quantity, will be forthcoming in coming years. Existing State of Knowledge reports will be updated on an as needed basis, to track change over time.



BACKGROUND

FORT NELSON FIRST NATION MEMBERS are Dené and Cree People of the Land and Rivers. We have lived in north-eastern British Columbia since time immemorial. Our community members have actively retained our cultures, including our languages and our connection to and knowledge of the land. FNNF joined Treaty 8 with the Crown in 1910, an agreement that affirmed FNNF's rights to use our territory and pursue our ways of life.

We envision a future in which FNNF and our members are re-established as the primary stewards of our lands and resources, empowered to protect our rights and ecological and cultural values, and where our territory sustains future generations with healthy air, land, food, and water. The Liard Basin Monitoring Initiative, the FNNF Guardian Program, and this report all have a role to play in achieving this vision.

Between 2016 and 2019, the FNNF Lands and Resources Department, with support from Natural Resources Canada, completed the three-year pilot Liard Basin Monitoring Initiative (LBMI). The focus in Year 1 of the LBMI was on identifying priority FNNF values in its territory, which covers all of the Liard and Hay River Watersheds in BC. An image of northern BC Treaty 8 territory and the 52 sub-watersheds in it is provided in Figure 1 on the next page.

FNNF members identified moose, known as golo in the Dené language and mooswa in Cree, as an important cultural and ecological value. Given the role of moose as the primary harvested and consumed animal by FNNF members, by weight, it is one of the most important values. In Year 1 of the LBMI, existing information on moose was examined by looking at community information (for example, from prior Indigenous use and knowledge studies) and publicly available scientific information sources. The status of the population health of moose, their distribution and preferred habitat, and pressures they face, were all subject to the assessment. Equally important, gaps in monitoring information and management practices were identified, which led to additional data collection and analysis on moose in Years 2 and 3 of the LBMI.

In Years 2 and 3 of the LBMI, ground-based monitoring was initiated by FNNF's fledgling Guardian Program, to document the relative density of moose across seven study areas within FNNF territory. The goal of this initial work was to evaluate whether hunting pressure in key hunting areas corresponds with decreases in moose density. These monitoring efforts were developed to promote the incorporation of Indigenous knowledge and science in making management decisions for moose. Ground-based moose monitoring did see a relationship between hunting pressure and moose density, with lower moose density observed in areas classified by FNNF knowledge holders as having high hunting pressure. A report on moose ground-based surveys was developed by the FNNF Lands and Resources Department in December 2018.¹

FNNF members identified moose, known as golo in the Dené language and mooswa in Cree, as an important cultural and ecological value.

PHOTO: RYAN DICKIE

1 FNNF and the LBMI Team (2018b); contact FNNF Lands and Resources Department for a copy.

6



An FNFN Guardian Program Handbook was also developed as part of LBMI Year 3 initiatives to support FNFN Guardians in their continued ground based monitoring of moose. Moose pellet surveys were conducted at the July 2018 FNFN Culture Camp, with winter track surveys occurring at the 2019 Winter Culture Camp.

In the coming years, FNFN Guardians will continue to monitor moose in our territory. The FNFN Lands and Resources Department will use the information from this program to explore the influence of other factors on the health of moose, such as industry, drying of moose licks, and climate change. Future monitoring activities may include moose winter drone surveys and moose hunter effort surveys.

The results of this state of knowledge work on moose are provided herein. This report is one of several FNFN state of knowledge reports on cultural and ecological values in FNFN territory. Part of FNFN's mandate as stewards of the land is not merely to collect Indigenous and scientific knowledge, but to disseminate it in appropriate ways, to inform our decision-making and that of other parties like our Treaty 8 neighbours, industry, and government.

Monitoring work related to moose management continues to be developed as part of FNFN's Guardian Program. Together with industry and other levels of government, FNFN seeks to promote a continued healthy and natural role for golo / mooswa in our territory.

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Fort Nelson First Nation Guardian Program

The Fort Nelson First Nation Guardian Program is a community-based monitoring program for FNFN's territory, in the Liard and Hay River Basins in BC. The program is founded on FNFN cultural and ecological values, incorporating our Indigenous knowledge and scientific methods for the purpose of protecting our territory against all threats to our pristine air, land, food, and water.

GUARDIAN PROGRAM

We envision a future in which FNFN and our members are re-established as the primary stewards of our lands and resources, empowered to protect our rights and ecological and cultural values, and where our territory sustains future generations with healthy air, land, food, and water.

GUARDIAN PROGRAM GOALS

- To better understand the current state of and trends of our cultural and ecological landscape;
- To re-establish FNFN members as stewards of the land by making them the primary developers and implementers of this monitoring and stewardship program;
- To understand and respond to ecological change and its causes (including climate change and industrial development) in time to make a difference; and
- To enable informed decisions about human activities and land use in our territory.





INTRODUCTION

FNFN envisions a future in which the Nation's inherent rights to protect, manage and conserve their lands and resources according to their own laws are respected and upheld. Moose are an integral part of FNFN culture, and critical to the continuity of FNFN's way of life.

PHOTO: RYAN DICKIE

FNFN'S MEMBERS ARE DENÉ AND CREE PEOPLE, with cultures that are centred on a deep connection to the Land. Our members have actively retained our cultures over time, against many obstacles. Many generations of FNFN men, women, and children have lived and thrived in the Liard and Hay River watersheds of north-eastern BC. Our members have always been, and continue to be, hunters and gatherers from the rich muskeg in the east to the mountains in the west of our territory. Our members' knowledge of our territory developed as generations moved around the land with the seasons and animals that sustained our way of life and livelihood. We are the "People of the Land."

FNFN members rely heavily on moose (golo in Dené; mooswa in Cree) for sustenance, clothing, and crafts. Moose represent the bulk of harvested meat for FNFN, especially as other food animal populations like caribou have declined. Hunting and processing moose bring family and the community together. Moose meat is shared with elders and others in the community who are unable to hunt. Every part of the moose is eaten or used for other cultural purposes (FNFN 2017b).

FNFN envisions a future in which the Nation's inherent rights to protect, manage and conserve their lands and resources according to their own laws are respected and upheld. Moose are an integral part of FNFN culture, and critical to the continuity of FNFN's way of life.

FNFN has a commitment and obligation to care for and protect the rights, lands, waters, animals, and whole ecosystem for future FNFN generations. FNFN members have been observing moose population decline in their territory for roughly 40 years, and moose are no longer present or are present in very limited numbers, where they were once plentiful. This is driven by a number of factors, including but not limited to:

- Habitat loss from the cumulative effects of industry;
- Increased predation from wolves and bears;
- Over-hunting aided by increased roads and linear corridors;
- Increased hunting pressure on large bulls; and
- Impacts to moose health, including increased tick loads and contamination from feeding/drinking water near industrial sites (FNFN 2017b).

With these factors, the increase since the early 2000s in industrial development in FNFN territory, hunting and predation pressure, and anticipated landscape level effects of climate change, there are legitimate concerns about future conditions for moose. The need to develop strategies to protect wildlife for current and future generations has become paramount.

This document summarizes the findings of recent work by the FNFN and LBMI related to monitoring, management recommendations and state of knowledge reporting for moose in FNFN territory. This document and associated work is grounded in FNFN Indigenous-knowledge (IK) and has been informed by a number of studies involving FNFN IK (FNFN 2017a, FNFN 2017d; FNFN 2018a; FNFN and the LBMI Team 2018b).

Funding dependent, annual FNFN-led monitoring of moose abundance and distribution within FNFN territory aims to address the following goals:

- Track trends in moose abundance and density over time, ideally at culturally relevant scales (e.g., traplines within areas of high, medium and low density hunting pressure);
- Correlate pellet group surveys with FNFN hunter survey results;
- Evaluate the impacts of other factors, such as habitat loss and industrial development;
- Assess other quantitative measures that could be used as a proxy for hunting pressure, such as the number of hunters parked along main roads in the 2019 hunting season;
- Confirm the locations of critical winter habitat for moose in priority areas, such as important hunting areas for FNFN community members;
- Continue to incorporate Indigenous and local knowledge in monitoring programs and management decisions; and
- Develop a moose habitat suitability model (planned for 2019-20) and track changes in moose habitat over time.



FNFN members have been observing moose population decline in their territory for roughly 40 years, and moose are no longer present or are present in very limited numbers, where they were once plentiful.

AERIAL PHOTO OF MOOSE AT MOOSE LAKE: RYAN DICKIE

This document is part of a broader initiative by FNFN to use its Guardian Program to monitor moose in FNFN territory and promote sustainable moose populations over the long term.

The sections that follow outline the cultural and ecological context of moose and moose management in FNFN territory, summarizing relevant aspects of moose ecology, regional moose habitat suitability, population health and trends, pressures, and moose management and monitoring principles.

Overall, this State of Knowledge report provides critical information to help understand existing trends along with what gaps exist in our knowledge about moose population health and abundance in FNFN territory from an Indigenous knowledge and a scientific perspective, which in turn becomes critical information to inform monitoring and management planning.



THE IMPORTANCE OF MOOSE FOR FNFN

Moose Use

Moose are critical to the physical and cultural survival of FNFN, providing members with sustenance, clothing, and other necessities:

“we usually used moose for everything, used moose hair for insulation in his shoes, great grandpa wore pointed moccasins and had moose hair in them.” (Interview, FNFN 2017d)

Moose hides continue to be used for clothing, with winter hides being the best for this purpose due to their thickness (FNFN 2017d).

Every part of the moose is eaten or used for other cultural purposes, even the spinal fluid and hooves. The fresh meat is eaten, and the dried meat is preserved, bones are used for tools, the hair for insulation, hides for crafts and textiles like moccasins and mitts, bait for fish, food for dogs, and internal organs for food and various functional uses (e.g., stomachs for packs) — nothing is wasted. Lighting candles made of moose grease is an Indigenous method used by FNFN members to send prayers to the Spirit World. The FNFN are river people, and moose-skin boats for traveling on water across the territory were used to access hunting areas and other culturally important areas (RELAW 2017).

Moose represents the bulk of harvested meat for FNFN, especially as other animal populations such as caribou have declined. For many FNFN members, moose is their primary harvested meat:

“Sometime people like their caribou meat but us we mostly eat moose.” (Interview, FNFN 2017d)

“Eat more moose — always eat moose.” (Interview, FNFN 2017d)

“Ate moose? Yeah, all my life.” (Interview, FNFN 2017d)

Older FNFN members are concerned that FNFN youth may not be eating enough moose, especially as it was an important part of their own childhoods (FNFN 2017d).

**“Sometime
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MOOSE HIDE BEING PREPARED
FOR TANNING, PHOTO: RYAN DICKIE

Hunting and processing moose bring family and the community together: it is central to building community in FNFN. A successful hunt was often celebrated with community members holding picnics and sharing meat (FNFN 2017d). Moose meat is shared with elders and others in the community who are unable to hunt or have been unsuccessful in their hunting attempts.

"Grandmas got first choice." (Interview, FNFN 2017d)

"My brother and I would get out there quite a bit, and a lot of times we will go out and shoot a moose or an elk or something like that and we will just bring it here and donate it. There is a lot of elders that do not have that hunter there that will bring them the food." (Interview, FNFN 2017a)

Fall is the best time to process meat as it is too soft to do so in the spring.

"Can't make dry meat in spring time, meat gets too soft. Fall time is good because there's muscles in the meat." (Interview, FNFN 2017d)

Making dry meat is important for families to have access to moose meat throughout the year.

"We live on moose meat sometimes we get a moose in fall it helps us to live. When we live in the bush we get as much as we want to make moose hide, dry meat." (Interview, FNFN 2017d)

The importance of moose in the social economy of FNFN cannot be separated from the animal's importance to the structure and continuity of FNFN culture. Harvesting a moose is a celebration of life and connection to land in every instance, and a right of passage for youth:

"You know, hunting, the ability to hunt isn't just going out there and shooting a moose. It's everything that's involved with that. I'll use as an example my maternal grandmother was left as a widow with five young ones living off the land. And, let's see, my mom tells a time when her oldest brother shot a moose and there was so much celebration and there was ceremony because it was a rite of passage, because he was no longer a boy. He was a man now and he could provide for the family. And from that, you know, you share them. You totally respect the moose. You take everything from the moose. You use all the moose and you share." (FNFN v. ARWM, et al., 2013, Respondent: Dickie, K., p. 82, lines 30-46)

The onset of the fireweed bloom indicates the beginning of moose hunting season, and the best time to hunt is from Fall to January when moose are at their fattest. The season also determines whether bulls or cows are hunted. FNFN members note that bulls are usually hunted in early fall, while cows are hunted in late winter or spring as their meat is more tender at that time. As members are concerned that the population is declining many have stopped their hunting of cows (FNFN 2017d).

A large amount of moose meat was dried in the fall season, to ensure a plentiful winter supply. Moose snares were a common way of hunting moose in the past and some Elders have said that moose caught by snare tasted better (FNFN 2017d).

FNFN members report that successful moose hunts occur much less frequently than in the past, when members could get a moose whenever they went out hunting. One member in 2017 recounted that for the last two years they hadn't been successful in hunting moose and had to go to the store more often and ask the community for help.



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PHOTO: RYAN DICKIE

Nutrition and Food Security

The availability of moose plays an important role in FNFN food security, as it is the most frequently consumed game species by weight. It is also a vital component to FNFN health. FNFN members and community understand that being healthy involves all aspects of mental and physical wellness, and nutrition is a major component of health. Indigenous food such as moose meat provides FNFN with access to nutritious food to maintain a healthy diet and culture.

However, with declines in moose in FNFN territory, hunters are having a much harder time getting moose meat, and with an increase in water and air contamination the real and perceived quality of moose meat is at risk. Members have reported seeing white spots on the liver and other organs and brown lumps or blotches on lungs. When moose have these irregularities members will not eat them. Checking the organs for sickness and or contamination have become a part of hunting for members:

"Every time he looks inside the stomach to see if anything is wrong, heart, liver."
(Interview FNFN 2017d)

"See people leave moose because of some type of sore in them." (Interview FNFN 2017d)

"Open up the heart cut the tip off, there [are] little muscles in there is how you know. That's how I know it's a healthy animal. My dad taught me that I never shot that I make sure the fur is healthy and you can tell a moose is sick, head is hanging low and skinny and don't bother it." (Interview FNFN 2017d)

A decline in country food sources, such as moose meat, from reduced (and less healthy) game populations has led to a greater risk of FNFN members' perceived contamination of country foods, reduced willingness to harvest, and reduced FNFN member population health, through poorer diets with greater emphasis on store-bought foods.

"Fifty years ago, we never get sick, we always eat animal, lean meat, don't get sick. We in the bush hunting and wet — we never catch cold. You buy meat from the store and your stomach gets sick, because too much fat in there. Yesterday, I cook pork chop, so much grease in the frying pan. Years ago, we never got sick." (Interview FNFN 2012)

The replacement value of moose meat versus store bought meat is an important consideration for FNFN members, given the health benefits of country food and the high store-bought food costs and lower income of the majority of FNFN members in comparison with the non-indigenous population of the Fort Nelson area. Before the introduction of foreign and store-bought foods, the FNFN were practically disease-free — "because we ate our traditional diets and prepared our food in our own way" (RELAW 2017).

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ECOLOGICAL KNOWLEDGE OF MOOSE

MOOSE ARE THE WORLD'S LARGEST DEER, and are found throughout North America, Europe and northern Asia. There are seven sub-species of moose world-wide, four of which are found in North America (DuTemple 2001). According to the BC Ministry of Environment, Lands and Parks (now Ministry of Environment and Sustainability), as of the year 2000 moose were the most widely spread ungulate in British Columbia (although absent from coastal regions), with a population of approximately 170,000 and were most abundant in northern British Columbia (BC Ministry of Environment, Lands and Parks or "BC MELP" 2000).

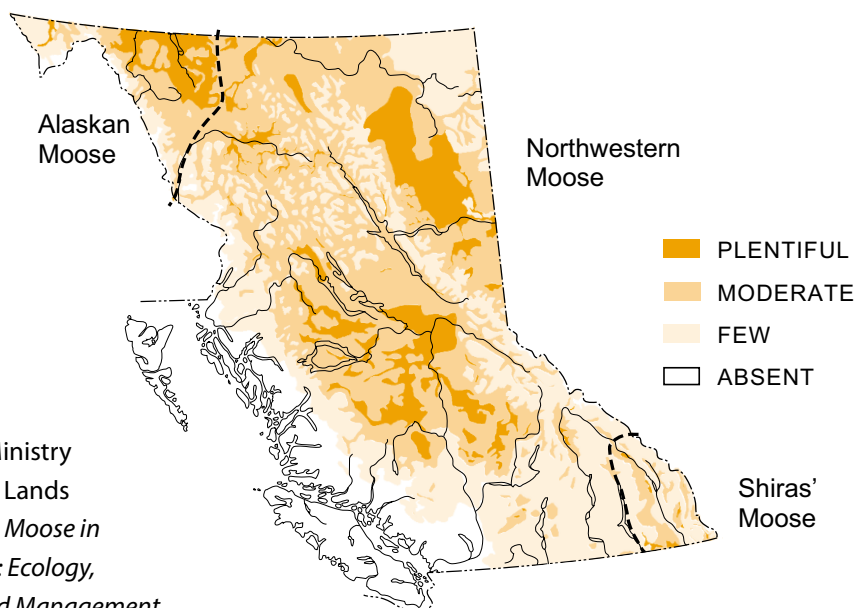
The Northwestern Moose (*Alces alces andersoni*) sub-species are found throughout FNFN territory, in the Liard and Hay River Basins. Their seasonal home range rarely exceeds five to 10 square kilometres (km²), but their annual home range may be much larger. These ungulates, unlike others, are typically solitary and do not defend territories. Occasionally, groups of moose can be seen at mineral licks; however, there is no social structure to these groups. During the mating season, moose commonly form small groups of eight to ten individuals (BC MELP 2000).



The Northwestern Moose (*Alces alces andersoni*) sub-species are found throughout the Liard Basin of BC, all of which is within FNFN territory.

PHOTO: RYAN DICKIE

Figure 2. Distribution of moose in British Columbia



Map from B.C. Ministry of Environment, Lands and Parks. 2000. *Moose in British Columbia: Ecology, Conservation and Management*.

Ecological Role of Moose

Moose serve as an important protein source for large predators such as bears, wolves and cougars and scavengers. They are also selective consumers of trees and shrubs and as such impact the structure of vegetation on the landscape.

MOOSE TRACK, PHOTO:
FNFN LANDS AND RESOURCES

Moose can have a significant impact on their environment. Their interactions with other species can be direct or indirect, positive or negative. Urination, defecation and providing predators with meat are an important part of the nutrient cycle in habitats that ungulates like moose occupy (Hobbs 1996). Moose serve as an important protein source for large predators such as bears, wolves and cougars and scavengers. They are also selective consumers of trees and shrubs and as such impact the structure of vegetation on the landscape. Moose are generalist herbivores and their preferred plant species includes red-osier dogwood, cottonwood, paper birch, aspen, high-bush cranberry, false box, and subalpine fir (BC MELP 2000).

The impact moose have not only depends on the intensity of browsing (how much they consume) but also the environmental context in which it occurs. Positive or negative impacts may occur for nutrient cycling, vegetation productivity, and plant community succession depending on the soil and vegetation structure and attributes, and the complex interactions between moose and their environment (Hobbs 1996).

Indirectly, moose may cause changes in vegetation that lead to changes in other species (i.e., invertebrate and bird species diversity and nesting density) (Berger et al. 2001).



Seasonal Habitat Use

The word moose comes from the Algonquin dialect and means 'he strips or eats off', which describes the way moose strip branches and shrubs while foraging. Besides foraging on ground cover and tree leaves and buds, aquatic plants, such as pond weed, water lilies and algae, make up a large portion of moose diet in the non-winter months. Moose can be seen in aquatic environments with their head completely submerged as they feed on roots and tubers (Promack 1992).

Moose distributions are greatly influenced by climate. In the winter snowfall limits their range extent, and in the summer high temperatures are the greatest factor (Kelsall and Telfer 1974). These factors influence how moose use habitat across seasons.

Winter Habitat Use

During the winter, moose need 20 kg of food per day to meet their energy demands. To meet this requirement, they feed on highly concentrated food such as dense browse stands along rivers and wetlands, and in burns, logged areas, and in the sub-alpine. Winter forage includes willows and red-osier dogwood. Moose also strip bark from willows and poplars in winter. Important winter habitat includes:

- Coniferous forests;
- Riparian areas (LeResche et al. 1977);
- Mixed forests and shrublands (LeResche et al. 1977); and
- Burns and harvested area (Eastman 1974; Forbes and Theberge 1993).

In the winter, habitat preference is greatly influenced by snow characteristics and canopy closure. Winter range for moose is considered to be the most limiting habitat for this species, particularly when snow is deep. Forests with dense canopy cover provide shelter and lower snow depths for easier movement; however, these habitats tend to have lower forage availability (Eastman 1974). Snow depths of less than 40 cm are preferred and depths greater than 60 cm impede movement (Coady 1974). Moose movement can be severely restricted by prolonged duration of high snow levels, which can lead to high levels of wintertime mortality (Modafferi and Becker 1997). Forested riparian areas provide a combination of low snow depths and abundant browse (Ardea Biological Consulting 2004).

Spring Habitat Use

Spring ranges provide moose with a chance to recover from the winter, offering abundant early-greening browse. Sedge meadows are important habitats in spring, as sedges are among the first plants to emerge from dormancy. Wetland habitats of spruce and sedge meadows provide abundant high-quality foraging areas during the spring and early summer (Lemke 1998). Calves are born in late May to June and stay with the mother until the following spring (BC MELP 2000). An important characteristic of calving habitat for cows is the cover of riparian willow to minimize the risk of predation, during and after birthing (Lemke 1998).



During the winter, moose need 20 kg of food per day to meet their energy demands.

PHOTO: RYAN DICKIE

Summer Habitat Use

In the summer, moose are susceptible to heat stress in areas without shade or water (Kelsall and Telfer 1974). During this time, they seek lakes and wetlands that offer cooler temperatures, less insect pests, and nutritious forage (Kelsall and Telfer 1974). Aquatic plants such as horsetail, burweed, and submerged pondweeds are important in the summer. Moose also eat the new leaves on a variety of shrubs and herbs in summer (BC MELP 2000).

Fall Habitat Use

In British Columbia, the mating season (rutting) for moose begins in September and lasts into November. By fall, the average bull weighs 450 to 500 kg (BC MELP 2000). Antlers reach full size by September; the velvet then dries and is rubbed off against trees (BC MELP 2000). Moose shed their antlers in November or December after the rut.

Cows become sexually mature at a year but usually conceive for the first time as two-year olds. From then on, females usually produce one calf every year (BC MELP 2000; Simkin 1974). Their life expectancy is 20 years on average, and maximum fecundity occurs at the age of 10 or 11 (Peterson 1974).

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MOOSE RUNNING AT MOOSE LAKE – AERIAL PHOTO TAKEN DURING SURVEYS: MAT MURRAY

Mortality

Natural causes of moose death are predominantly from predation events and starvation. Moose predators include grizzly and black bears, wolves and cougars. Human-caused mortality is from hunting and vehicle collisions (BC MELP 2000). Predators are primarily responsible for high calf mortality in the interior of BC, leading to low calf to cow ratios compared to other regions (Kuzyk et al. 2015). A study of radio collared moose in BC revealed that 49 per cent of moose mortalities were caused by predators, 23 per cent from health-related causes, 17 per cent from hunting, and 4 per cent from natural causes (Kuzyk 2016).



MOOSE IN FNFN TERRITORY

Habitat Suitability

Moose use every ecosystem type in FNFN territory, from the high alpine in the west to the valley bottoms. Moose browse on shrubs and deciduous trees found in recently burned and disturbed areas and use aquatic/wetland areas and mineral licks during the spring and summer. FNFN Indigenous knowledge indicates that, year-round, moose prefer old forest stands, areas near moose licks (except in winter when they are covered in deep snow), willow stands, and river and stream bank (riparian) areas. A summary of key habitat features by season identified by FNFN Indigenous knowledge (IK) is provided in Table 1. Future habitat suitability research will use FNFN IK to identify and map suitable moose habitat by watershed and sub-watershed in FNFN territory.

Table 1. Key habitat features for moose by season identified by FNFN IK

Winter <ul style="list-style-type: none">• Poplar and willow habitat• Forest with dense canopy• Sloughs with willow• Sub-alpine• Dense browse stands	Spring <ul style="list-style-type: none">• Rivers/sloughs/lake habitat and islands provide important calving areas• Riparian willow habitat• Wetland habitats of spruce and sedge meadows• Spruce stands
Summer <ul style="list-style-type: none">• Wetlands, swamps, lakes and beaver ponds are important foraging habitats• High elevation	Fall <ul style="list-style-type: none">• Mating occurs along rivers and lakes



FNFN Indigenous knowledge indicates that, year-round, moose prefer old forest stands, areas near moose licks (except in winter when they are covered in deep snow), willow stands, and river and stream bank (riparian) areas.

PHOTO: RYAN DICKIE

Winter Habitat Use in FNFN Territory Identified by FNFN Knowledge Holders

FNFN Indigenous knowledge indicates that in winter moose take cover in poplar and willow habitat to avoid wolf predation. Old forests with dense canopy cover provide shelter and lower snow depths for protection and ease of movement (FNFN 2018a). Sloughs with willow and good forage are also used in the winter. Moose scrape their teeth on sap in poplar (aspen) trees in the winter months.

In the winter, moose will use forests with older, larger trees for warmth and to avoid deep snow packs (FNFN 2017b). FNFN members recognise that intact old forest stands are important habitat for shelter and cover from predators. Riparian habitats within the Liard River Valley with good foraging availability and cover are high quality winter habitat for moose. Wintertime aerial surveys support this with their finding of 42 per cent of moose sighted in riparian habitat and 33 per cent in upland forest (FNFN 2018a).

Spring Habitat Use in FNFN Territory Identified by FNFN Knowledge Holders

FNFN Indigenous knowledge indicates that in spring moose are commonly found in recently disturbed or burned areas. In early spring moose go into spruce stands when the snow is crusty. At this time new antlers start to grow. Cows take cover to hide from predators and move to rivers/sloughs/lakes to give birth. Islands are particularly useful for calving to avoid predation by bear and wolves. Tick infestations are at their height from March to May.

Summer Habitat Use in FNFN Territory Identified by FNFN Knowledge Holders

FNFN Indigenous knowledge indicates that moose fatten up in the summer months. They forage in swamps for dog willow and similar to spring are found in recently disturbed or burned areas. Moose find more vegetation to eat at lakes in the summer. Cows eat aquatic plants and roots to help produce milk. Moose are also susceptible to predation by bears in areas where berry abundance is high.

Fall Habitat Use in FNFN Territory Identified by FNFN Knowledge Holders

FNFN Indigenous knowledge indicates that in the fall moose go to water after bears go to den. Moose like to be near a large source of water in the fall and to use them to get away from the bugs. Mating occurs along rivers and lakes. In late fall, moose also seek out moose licks. Moose have a healthy fat layer in the fall.



“Can’t make dry meat in spring time, meat gets too soft. Fall time is good because there’s muscles in the meat.”

Moose Population, Population Health and Trends

Provincial Moose Trends

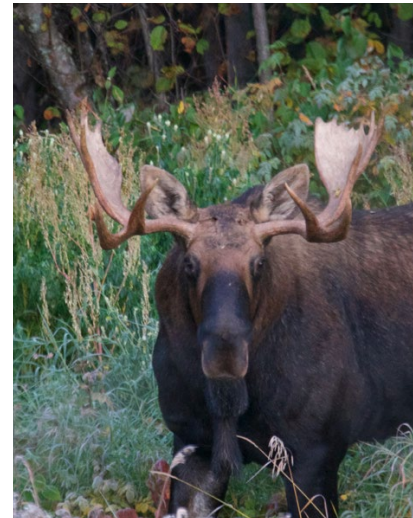
Based on a comprehensive study of hunting effort and wildlife surveys conducted across 31 game management zones (GMZs) in which moose hunting is permitted in British Columbia, moose populations declined by 29 per cent over a 20 year period, from 1996 to 2015 (Kuzyk et al. 2018). The declines have accelerated in the last 10 years of that period: from 2006 to 2015, moose populations declined in 22 of the 31 GMZs studied and the overall rate of decline was 32 per cent. Over the entire 20-year period of the study (1996 to 2015), licensed harvest of moose in BC declined by approximately 50 per cent, even though hunting effort remained about the same. The study suggests that the lower moose harvest is due to the reduced availability of moose across much of BC.

These results support the observations of First Nations and stakeholders, who have reported declining local population trends for moose for the past decade and expressed concern about the increased effort required to catch moose in many areas of BC (Gorley 2016, Kuzyk 2016). There is generally no consensus on the cause of the declines, suggesting a combination of factors that vary from region to region (Gorley 2016). However, the 2018 analysis points to predation pressure on both cows and calves as the major immediate factor causing moose populations to decline (Kuzyk et al. 2018). It is worth noting that predator population sizes and success rates are highly influenced by other factors (for example, degraded habitat, climate change, and road access).

Northeastern BC and FNFN Territory Moose Trends

To understand moose population trends, it is important to understand the different scientific metrics used by biologists and the government. Several measures are used to determine the health of moose populations:

- **Density** calculates the number of moose per given area (e.g., 1.85 / km²) with a lower density meaning that there are less moose in a given area.
- **Bull to cow ratios** or the proportion of bulls to cows in a population can affect cow pregnancy rates or conception timings thereby altering birth rate. In areas with low moose densities (below 0.2 moose / km²), 50 bulls for 100 cows is generally considered to be the minimum threshold.
- **Cow to calf ratio** or the proportion of cows to calves can help gauge the birth rate or recruitment, which is the proportion of new calves to adults. A positive recruitment rate means more calves are being born and or surviving while a negative recruitment rate could indicate high levels of predation or low birth rates. Generally ratios of 25 calves for 100 cows indicate a stable population (Bergerud and Elliot 1986).



FNFN members have noted overall declines in the moose population and health status in their territory over the past 40 years, including the complete disappearance of moose from some areas where they were once abundant.

PHOTO: RYAN DICKIE

FNFN community members are concerned about moose health and population numbers in FNNF territory. FNNF members have noted overall declines in the moose population and health status in their territory over the past 40 years, including the reported disappearance of moose from some areas where they were once abundant (FNNF 2017a). For example, FNNF members note that the Sierra Yoyo Desan (SYD) road cuts through prime moose habitat that is important for community subsistence, but currently, moose are on the point of extirpation in this important community area. Other areas where moose were previously abundant and now are hard to find include:

- South SYD;
- North SYD;
- Luyben road;
- Kiwigana road;
- Tsinha Lake;
- Kahntah;
- Fontas; and
- Buckinghorse.

“There are more people that come up here because they see it when they are opening it up. Oh, look at all these moose. So, if you have got a thousand people from northern BC that see all this game, maybe fifty of them come up, that is quite a few non-resident hunters.”

PHOTO: RYAN DICKIE

“Just from when I was younger, in my teens, you could go out, drive an hour, and pretty well know you are going to get a moose. Now, you go out there for three or four days and you might see one. It is not worth shooting a cow moose. That just affects the population. So, it is more challenging, likely because... the area is more accessible through industry. There are more people that come up here because they see it when they are opening it up. Oh, look at all these moose. So, if you have got a thousand people from northern BC that see all this game, maybe fifty of them come up, that is quite a few non-resident hunters.” (RELAW 2017)



Recent research from northeastern BC shows different population structures and moose densities depending on the area surveyed. Availability of different habitat types, and levels of habitat disturbance and fragmentation, along with other factors such as browse availability and predators, are likely to influence moose density and population structure. Thorough monitoring coverage of important moose habitat is needed to gauge baseline moose densities and population structure across FNFN territory, and such surveys need to be repeated frequently to estimate population and recruitment trends.

The province is divided into nine regions and 225 management units (MU) for game management. Much of FNFN territory lies within the Peace–Liard Region (7b). Routine surveys of MUs occur every five to 10 years to estimate moose density and population structure. Recent moose population surveys within FNFN territory are summarized in FNFN (2018a) and in FNFN (2018b), and are reported again below, in Table 2.

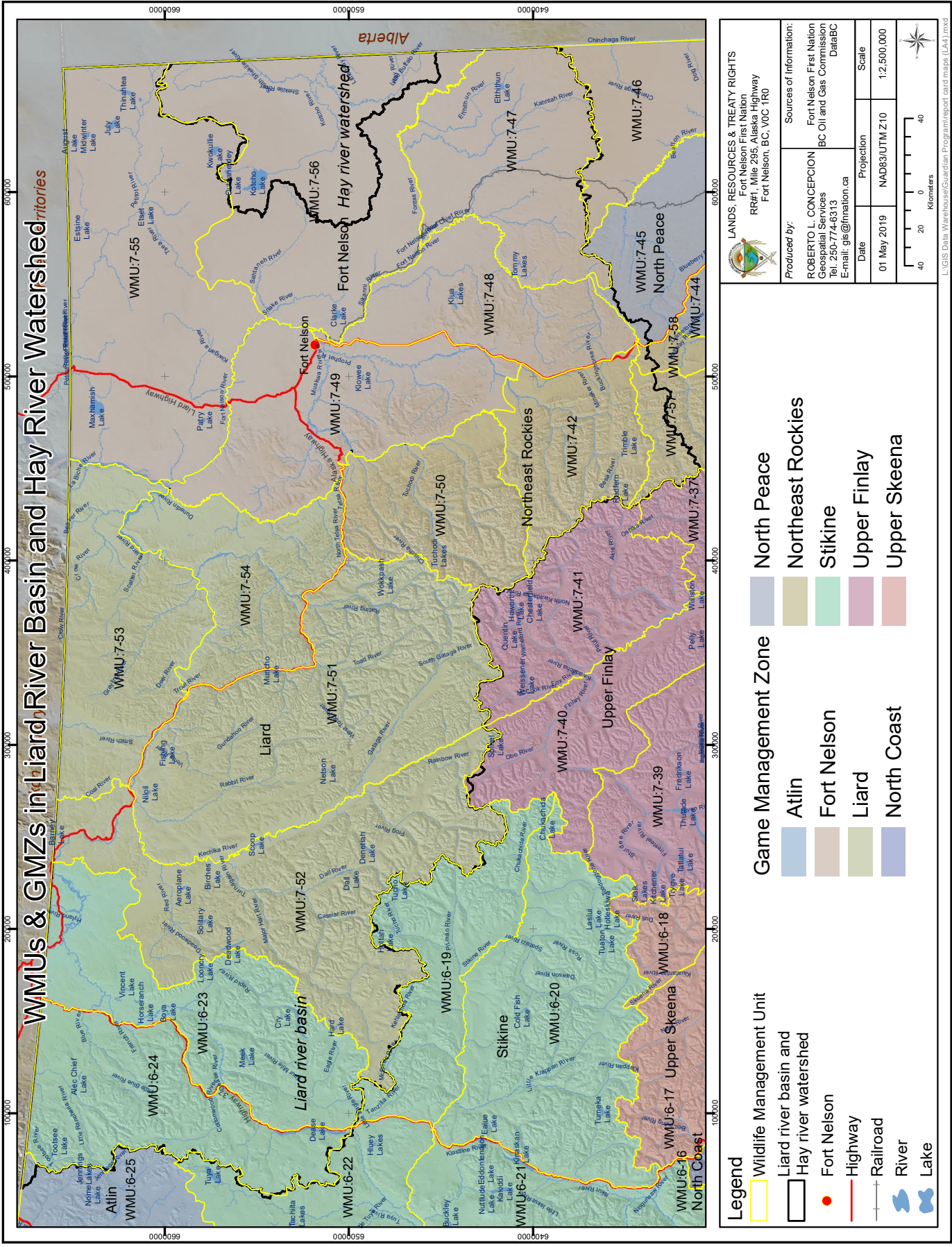
Table 2. Comparison of recent moose surveys within FNFN territory

Area (management unit)	Density (moose per km ²)	Calves: 100 cows	Bulls: 100 Cows	Year	Method	Reference
MU 7-42	0.24 ± 0.033*	12 ± 2.7*	44 ± 9.9*	2015	Stratified random block	Lirette 2015
MUs 7-55, 7-56, 7-47, 7-48	0.104 (0.080– 0.136) ⁺	45	54	2016	Distance sampling	Webster and Lavallee 2016
MU 7-49	0.14 (0.11–0.16)**	23 (18-30)*	51 (42-61)*	2016	Distance sampling	EDI 2016
MU 7-55, and portions of MU 7-49, 7-56	0.12 (0.10–0.14) ⁺	32	72	2010	Distance sampling	Thiessen 2010
MU 7-48	0.12 (0.03–0.55) ⁺⁺	55 (33–77) ⁺⁺	27 (17–37) ⁺⁺	2013	Distance sampling	McNay, Webster, and Sutherland 2013
MUs 7-55, 7-56, 7-47, 7-49, 7-46	0.10 (0.08–0.12) ⁺	51 (41–60) ⁺⁺	60 (43–76) ⁺⁺	2013	Distance sampling	McNay, Webster, and Sutherland 2013
MU 7-47	0.04 (0.03–0.06)**	9 (2–17)**	64 (35–92)**	2007	Stratified random block	Rowe 2008

⁺ Reported with 95% confidence interval ^{*} Reported with 90% confidence interval

Generally, moose population trends in FNFN territory are unclear. There is a need to conduct more regular surveys of the MUs in FNFN territory at a scale relevant to FNFN's use of the area, to determine population trends within key hunting areas using repeated, standardized methodologies (FNFN 2018a).

Figure 3. Wildlife Management Units (WMUs) and Game Management Zones (GMZs) in the Liard and Hay River Watersheds



Pressures on Moose

FNFN Community Concerns

FNFN community members believe that the declines in moose population are a result of cumulative impacts from:

- Habitat loss due to industrial development;
- Increased predation from wolves and bears;
- Increased human hunting pressure; and
- Decreased moose health due to contamination from feeding/drinking water near industrial sites (FNFN 2017d; FNFN 2018b).

FNFN members have noticed that old forest stands, which are important habitat for moose, are suffering from the effects of clearcutting forestry practices, and land clearing for industry:

"...it was the most populated moose areas. We could literally go back there and shoot one whenever you needed it, a moose. Now you go back there and you would be lucky if you see one." (Interview FNFN 2018b)

Industrial Development

There has been extensive development of the oil and gas industry in FNFN territory, and its regulation by the Province of BC via the BC Oil and Gas Commission, has not addressed the cumulative impacts of rapid change to the landscape that these industries have caused. According to FNFN members, developed areas push moose out of important foraging and calving area, through habitat loss, noise and light disturbance (FNFN 2017d, FNFN 2018b):

"[Moose] population is getting forced out of areas by opening all these pipelines, access where native/non-native hunters have easy access to get them." (Interview FNFN 2017d)

Linear Features

Linear features such as roads and seismic lines are often used by moose for travel and foraging, and their attraction to these features has been found to be seasonally dependant (FNFN 2018b; Silver 1976; Dickie et al. 2016; Laurian et al. 2012). With increased roads there comes other negative impacts such as:

- Road kills and injuries;
- Loss of habitat;
- Increased hunting pressure;
- Habitat fragmentation;
- Wildlife harassment;



"We could literally go back there and shoot one whenever you needed it, a moose. Now you go back there and you would be lucky if you see one."

PHOTO: RYAN DICKIE

Linear features such as roads and seismic lines are often used by moose for travel and foraging.

SEISMIC LINES AND OTHER LINEAR DISTURBANCE IN FNFN TERRITORY, PHOTO: FNFN LANDS AND RESOURCES



- Altered predator-prey relationships;
- Altered wildlife behaviour; and
- Contaminant emissions (Daigle 2010).

FNFN members have observed traffic-caused displacement and mortality of moose from certain areas, causing FNFN members to travel longer distances to find better hunting areas. An increase in excessive external hunting pressure by non-FNFN moose hunting is attributed by FNFN members to an increase in access to hunting areas via industrial roads. FNFN members are concerned that they will soon not be able to hunt where they normally do, if at all. FNFN members have noticed an increase in moose mortality related to road kills (FNFN 2017d; FNFN 2018b):

“Moose are really scarce now. One thing we noticed on 317 [Road] was they were getting hit, every time we go up there we see one that’s been hit.” (FNFN 2017d).

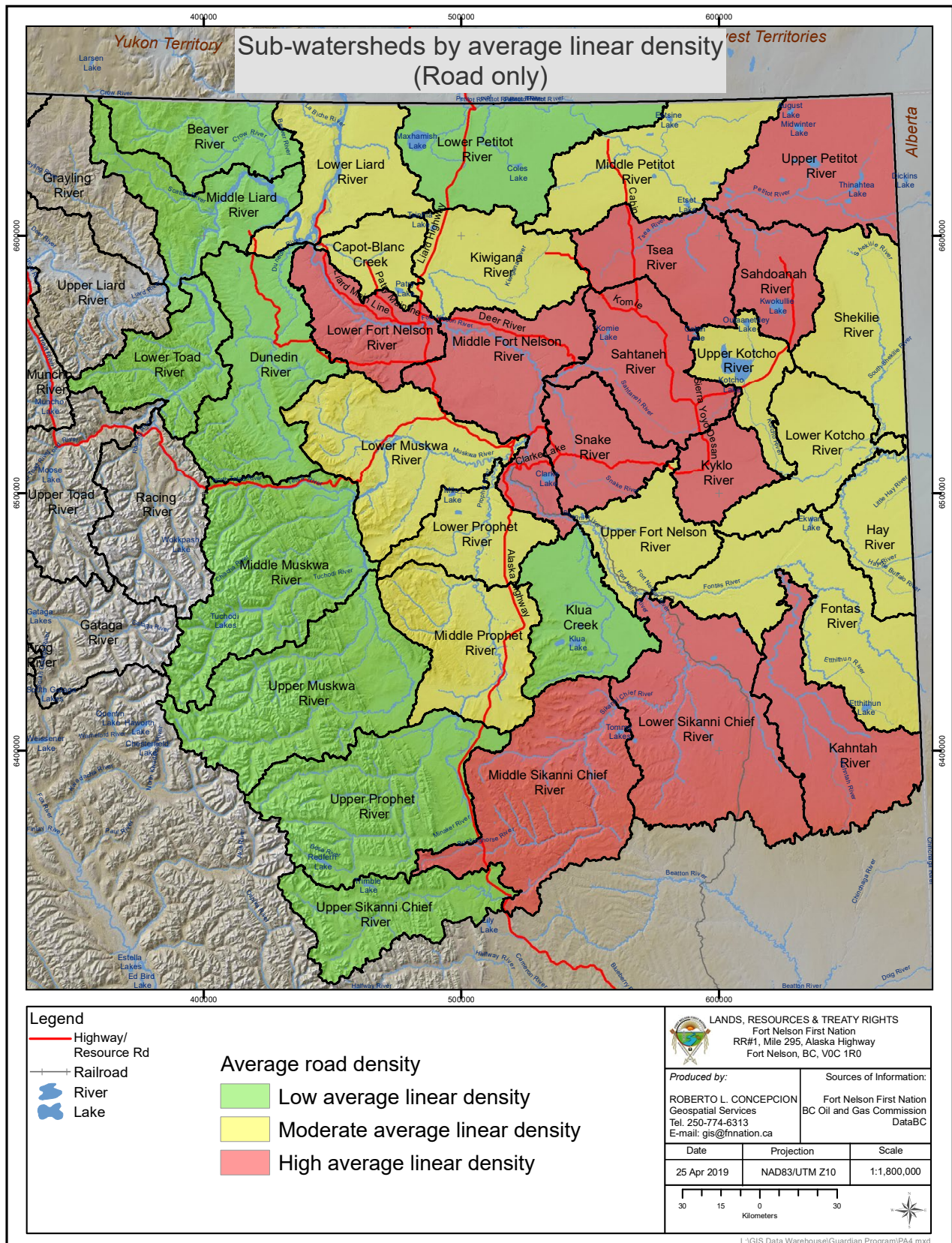
Moose are attracted to roads in the winter for the salt, increasing risk of vehicle collision mortality (FNFN 2018b).

Road densities greater than 1.2 km/km² have been found to negatively affect ungulate populations by promoting wolf access and movement (GOABC 2016). This metric has been used for impact assessment of industrial developments in BC, as well as directing the federal caribou recovery strategy (Environment Canada 2012) in habitat enhancement and predator control initiatives. In Nova Scotia, moose populations were negatively impacted when road density exceeded 0.6 km/km² (Beazley et al. 2004). We are unsure how this threshold applies in FNFN territory, but the relationship between road density and access for hunting is clear: more roads will increase hunting pressure. In FNFN territory, 11 of the 52 watersheds assessed have road densities between 1.16 and 2.44 km/km² (Figure 4; FNFN 2019).² Under these circumstances, any increase in hunting pressure and predation pressure is very likely to result in a population decline.

² As noted in FNFN 2019 (the Watersheds Report Card), roads are by no means the only linear disturbances in FNFN territory, where large networks of seismic lines and pipelines crisscross some areas of the landscape. In some watersheds, total linear disturbance densities are higher than 9 km/km². However, it is hard to know how and where these linear features are continuing to have an ecological effect, because that depends so much on recovery of the vegetation — along seismic lines in particular. The analysis has focused on road density for that reason.

Figure 4. Subwatersheds in the more developed portion of FNFN territory showing average linear density (roads only)

Red = 1.16 - 2.44 km/km²; yellow = 0.73 - 1.12 km/km²; green = <0.73 km/km².



An increase in excessive external hunting pressure by non-FNFN moose hunting is attributed by FNFN members to an increase in access to hunting areas via industrial roads.



Industry road cut through wetland. PHOTO KATHERINE CAPOT-BLANC

Hunting Pressure

"All the places that people like to go hunting are getting hunted out. Once one person hears of a good moose hunting place everyone goes there and it gets hunted out."
(FNFN 2018b)

Roads are leading to easier access to moose for hunting, and this is causing them to be forced out of areas where they are normally found (FNFN 2018b). In response to concerns over the increase in linear features and associated increased hunting pressure throughout the territory, a recent study was conducted by FNFN (2018b) to investigate the relationship between hunting pressure and moose population density in discrete areas within FNFN territory.

In this study, FNFN piloted an approach for estimating the relative density of moose within the territory, using ground-based moose pellet surveys conducted in seven study areas within the territory. The study's purpose was to determine whether ground-based monitoring could be used to show differences in moose densities across the territory, to provide further evidence for the need to reduce hunting pressure or introduce other moose management areas in places where FNFN community members have observed steep declines in moose numbers (FNFN 2018b).

FNFN selected seven study areas for this research, each centred on a linear feature (road or river) that provides people with access into the area: South Sierra Yoyo Desan (SYD) Road, North SYD Road, Elleh Creek, Luyben Road, Highway 317 north of Luyben Road, Fort Nelson River, and Snake River. Using a focus group approach, FNFN worked with community members to characterize the hunting pressure in each of the study areas.

Over the course of several weeks, teams of trained FNFN technicians conducted ground-based pellet group surveys in each of the seven study areas, along transects that were 300 m in length. A total of 54 locations were surveyed in summer 2018. Moose pellet group abundance was compared among the study areas based on hunting pressure and the density of linear features. The findings of the study support FNFN community members' observations that areas identified as having high hunting pressure have lower moose density, and areas with lower hunting pressure have higher moose density.

Based on the observed pellet group numbers and input received from community members, the findings of this work so far suggest the need for measures to reduce hunting pressure along Luyben Road and the southern portion of the SYD Road. At the same time, measures should be taken to ensure that this pressure does not simply shift to other areas. **The findings speak to the need for specific management measures to reduce hunting pressures in areas of FNFN territory that are identified as having local moose population declines.**



Moose pellet group abundance was compared among the study areas based on hunting pressure and the density of linear features. The findings of the study support FNFN community members' observations that areas identified as having high hunting pressure have lower moose density, and areas with lower hunting pressure have higher moose density.

PHOTO: FNFN LANDS AND RESOURCES DEPARTMENT

Moose Health

Moose health may be impacting populations, and in the Horn River geological basin of FNFN territory in particular, is considered by FNFN members to be at significant risk due to the effect of the oil and gas industry. The smell, taste, appearance and potential health effects of country foods are suspected as FNFN members notice changes in the quality of moose meat and report finding many sick moose in recent years. Moose measles and liver fluke are among the diseases encountered in recent years by hunters (FNFN 2018b).

"I shot a moose and couldn't eat it. The liver was dotted up with white spots and when I cut down the middle the whole inside was infected with blisters filled with yellow fluid. Now we have to check all the animals carefully before we eat them." (FNFN 2017a)

Other health risks community members have highlighted are parasites and herbicides. Frequently, hunters are noticing high tick loads on moose, which were not noticed as much decades ago:

"I try not to shot moose in the summer and spring cause too many ticks. Not a pretty site with them covered with ticks. It seems like they all get it, in the spring you can really see it." (FNFN 2017d)

Members have also expressed concern about the use of herbicides and pesticides, applied with broadcast spraying techniques, and the potential effects of these chemicals on moose health.

Water and Air Contamination

The contamination of water sources from industrial development and its effect on the quality and quantity of wild game is a major concern for FNFN members. Some members have reported illness from eating contaminated meat and drinking contaminated water. Contaminated snow that industrial operators clear into roadside ditches, herbicide management of invasive plants along roadsides, road building, and industrial spills and by-products from vehicle traffic are all identified contributors to the contamination of water sources. Several members had experiences of animals found with unnatural cysts, growths, “pus” and bad-tasting or mushy meat, which they attributed to water contamination (FNFN 2017c). FNFN members are concerned about their exposure to toxins related to moose consumption as important moose habitat such as wetland and riparian habitats are being treated with herbicide.

“I’m most worried about the water because it’s a part of us. I saw a bull moose drinking from a waste sump, they only put a snow fence around it. Animals could just climb right over. They should have something strong to keep the animals away and protected.”
(FNFN 2017a)

Like water quality, air quality is diminished by industry. The effects of chronic hydrogen sulphide exposure are a potential cause of wildlife morbidity and mortality as well.

FNFN are concerned about their exposure to toxins related to moose consumption as important moose habitat such as wetland and riparian habitats are being treated with herbicide.

PHOTO: RYAN DICKIE



Wolf Predation

Wolves are a common predator of moose, and landscape disturbance and modification appear to be facilitating the increase in their population. FNFN members report the wolf population has grown significantly in some areas of FNFN territory, and so have wolf pack sizes (FNFN 2017d). Large wolf packs of 18 to 20 individuals are commonly seen in recent years — and a pack of 30 wolves was documented by one community member. Previously, packs were more commonly about five to eight individuals (FNFN 2017d). Community members have also observed that wolves are coming in closer to the community (FNFN 2017d).

FNFN members link the increase in moose mortality from wolf predation to the increased amount of seismic lines and other linear disturbance (e.g., roads, trails and skidoo trails) in FNFN territory. One member reported seeing wolf tracks chasing moose down cut lines (FNFN 2017d). FNFN members also associate increased wolf predation of moose with road density in moose habitat areas, as wolves are using roads to hunt more successfully.

Climate Change Impacts

As discussed above, moose rely on specific habitats for various needs, such as foraging, shelter and shade, calving and cover from predators. A change in climate brings changes to the environment, ecosystems and relationships between species.

The effects of climate change are a major concern for community members, and the first hand evidence and experience of climate change is being seen within the lifetime of many community members (all the observations below are from FNFN 2017d). Community members are seeing less snow and warmer temperatures in winter, creeks do not freeze up as well as they did, and recent years have been much windier. Knowledge holders recall that in the past, winters brought four feet of snow and temperatures of -30 and -40 for months and now there is less snow, and cold temperatures persist for weeks rather than months. Now rain is seen in the winter, and the snow and ice melt much faster than it did before. Summers are bringing droughts and hotter weather. Temperature increases may lead to heat stress in moose, a reduction in critical wetland habitat, and higher parasite loads. FNFN members and the nation as a whole are concerned about altered animal migration patterns or changes in seasonal ranges in response to climate change.

FNFN members are also concerned about climate changes influence on relationships between species. FNFN members are concerned about the presence of elk in moose habitat and what the impacts may be. Elk, a newcomer to FNFN territory, were seen for the first time in the '60s, and some community members suspect that elk may be pushing the moose out by competing for habitat. FNFN members have seen elk and moose together in areas, especially along rivers (FNFN 2017d). Increases in white-tailed deer and subsequent observations of cougar also seem to be linked to climatic shifts.



Now rain is seen in the winter, and the snow and ice melt much faster than it did before. Summers are bringing droughts and hotter weather.

PHOTO: RYAN DICKIE

A photograph showing two individuals from behind, walking through a lush green field towards a dense forest. They are wearing high-visibility safety vests with reflective yellow and orange stripes. The person on the right is also wearing a blue beanie and a red bag. The sky is overcast with grey clouds.

MOVING FORWARD IN MOOSE MANAGEMENT AND MONITORING

Animals have a right to our respect, and a right to clean water and safe food. Over-hunting and wasting meat or animal parts goes against Indigenous practice and Dené and Cree beliefs and values.

FNFN MOOSE SURVEYS 2018,
PHOTO: ASH MORRIS

Moose Management

Indigenous Management

Our ancestors believe, “if we care for the land, the land will care for us” (FNFN 2015, p. 38). Animals have a right to our respect, and a right to clean water and safe food. Over-hunting and wasting meat or animal parts goes against Indigenous practice and Dené and Cree beliefs and values. Only taking as much as you need for yourself, your family or to share to prevent starvation ensures there will be enough food for future generations.

“The old people say if you kill a moose and continue to kill more if it is not needed, the next time you are hungry there will be no place for you to hunt.” (FNFN 2001, p. 2)

FNFN understand that in order for our nation to both continue its reliance on the land, and to thrive, certain ecological standards must be maintained, such as healthy water for drinking and safe food to harvest.

As knowledge keepers of the land, our ancestors and current members have a number of management practices to maintain ecological standards. Practicing a cyclic existence in harmony with nature, maintaining berry patches, and ensuring no waste or overkill of animals ensures that the land and animals, and our interaction with the natural world, remains healthy. When our lands are impacted by development, and our animals and waters are unclean, we know the balance our members strive to practice has been threatened (RELAW 2017).

BC Provincial Government Management

The BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC FLNRORD) is responsible for the management of moose in BC. The management goal for moose in BC is to ensure moose are maintained as integral components of natural ecosystems throughout their range and to maintain sustainable moose populations that meet the needs of First Nations, licensed hunters and the guiding industry in BC (BC FLNRORD 2015).

Moose management levers outlined in the Provincial Framework for Moose Management in BC include hunting regulations, First Nations harvest regulations, predator management, access management, habitat enhancement and protection, environmental assessment and mitigation (BC FLNRORD 2015).

An annual allowable harvest (AAH) is the number of moose allowed to be harvested by resident and guided hunters each year. It is determined by modelling the maximum sustainable benefit of moose, a derivative of maximum sustainable yield — how much hunting a population can support without negatively affecting the population over time. To calculate AAH, the Province of BC monitors the annual harvest of moose by resident, non-resident hunters, and First Nation harvests, which are then used to set the AAH. However, this method of setting the AAH is not without limitations, as First Nation harvest estimates are largely unknown, thus provincial calculations could be underestimated by up to 40 per cent (BC FLNRORD 2015).

The spatial scale for provincial moose management is the game management zone (GMZ). Population objectives for moose in BC are post-hunt ratios of bull to cows above a minimum threshold of 30 bulls for every 100 cows; where densities are less than 200 moose/1000 km² (or 0.2 moose/km²), a ratio of 50 bulls to 100 cows is desired. Calf to cow ratios must be over 25 calves per 100 cows for a sustainable hunter harvest. The management of these objectives determines allowable harvesting (BC FLNRORD 2015).

The currently used provincial-level moose management plan has not been effective in mitigating moose population declines across the province due to the highly varying ecological conditions supporting different moose populations. Given this context, regional action plans for moose management show more promise of an effective approach (BC FLNRORD 2015).

In response to the provincial management shortcomings, the province of British Columbia, Treaty 8 First Nations, the Kaska Dena Council and Tsay Keh Dené Nation have been collaboratively developing a Peace-Liard Moose Management Plan for the Fort Nelson GMZ; one of five GMZs in the Peace-Liard Region. At the time of writing of this report, the development of the management plan has stalled at the implementation stage.

Hunting Regulations

In FNFN territory, the open season for bull moose hunting varies by provincial management unit (MU), but the bag limit for all MUs is one. The open hunting season for bulls takes place between August 23 and 31, and from September 1 to October 31 the hunting of bulls is allowed with additional restrictions in place (MU 7–42 to 7–58; Government of BC 2018).

The currently used provincial-level moose management plan has not been effective in mitigating moose population declines across the province due to the highly varying ecological conditions supporting different moose populations.

Protection

With moose populations in decline and a management system that is not adequate to prevent or reverse these trends, moose habitat protection is crucial. Moose habitat is currently provided some protection in British Columbia (e.g., through the designation of Ungulate Winter Range); however, habitat management is not consistent, and objectives can change with industry priorities and land status. While parks, ecological reserves and recreation areas offer protection for habitat in some specific locations, the majority of the province is non-protected Crown land, and the most important moose habitat is associated with lower elevations typically within the timber harvest land base.

Under government regulations, important habitat areas may be designated as Ungulate Winter Range or a Wildlife Habitat Area. However, the allowable cumulative area of designated habitat must not exceed 1 per cent of the mature timber harvesting land base, and the designated areas are designed to integrate industrial development and habitat management rather than necessarily prioritize protecting the habitat and species within it (GOABC 2016). FNNF's position is that improved protection must be put in place in key areas of FNNF territory, using measures that apply equally to all industries and prevent any incursions from being approved in these areas.

At this time, the only protection measures that meet these requirements in FNNF's territory are provincial and federal parks and ecological reserves, as well as, to a lesser extent, the Muskwa Kechika Management Area. Most of these types of protection measures are found

With moose populations in decline and a management system that is not adequate to prevent or reverse these trends, moose habitat protection is crucial.



Importance of Moose Lake

In FNNF territory, critical hunting areas for moose currently have little to no habitat protection. FNNF members highly value the area of Moose Lake and have identified this area as vital moose habitat.

To protect moose and moose habitat in this area, members would like to both restrict industry and development and control hunting.

FNNF is working towards protection for this important area.

MOOSE LAKE, PHOTO: MAT MURRAY

in the mountainous area of the territory to the west, while the east and north of FNFN's territory are largely lacking in effective protection measures. FNFN's (2019) Watershed Report Card quantifies the amount of meaningful protection at the subwatershed level within FNFN territory. More than half of the subwatersheds in FNFN's territory have less than 5.7 per cent protection, which is well below targets considered adequate for ecological representation (FNFN 2019), and far below Canada's 17 per cent target for terrestrial ecosystems. Even more concerning is that overall, **less than one per cent** of the muskeg region in central to eastern FNFN territory is functionally protected area, a fact that is made more critical with recognition that this muskeg region is the one facing the greatest pressure from industrial development (FNFN 2017b).

Moose Management Recommendations

FNFN members are experts when it comes to understanding wildlife and our territory — “[w]e are stewards of the lands and our teachings guide the ways we control, manage and protect our territory” (FNFN 2015, p. 19). The health of the territory relies on our voice and our actions (RELAW 2017).

FNFN's concerns for moose populations and moose critical habitat guide our recommendations for moose conservation, including habitat protection, hunting regulations, and limited predator management in some areas. FNFN is keen on seeing more moose critical habitat being protected from development; these areas include important forage areas and calving grounds near water, river valleys and swamp lands. Although pregnant cows were sometimes hunted in March, current opinion is that cows should be left alone to protect the population.

Wolves are believed to be having a large impact on the moose population (FNFN 2017d). FNFN members have observed that wolves kill calves and the weak generally, and by taking too many calves they negatively affect population recruitment. In interviews conducted in March 2017 as part of the FNFN's federally funded Traditional Ecological Knowledge-Traditional Use Study, and in December 2018 as part of FNFN's caribou study, FNFN members have suggested that the nation should initiate wolf management in the territory, targeted at areas where wolf populations are observed to be high. Based on community input, high priority areas for wolf control are Elleh creek, Clarke Lake road, and areas immediately south of the Fort Nelson reserve. FNFN members believe that targeted wolf control will help both moose and caribou populations. Members have also recommended that wolf control should be conducted in accordance with FNFN cultural values and perspectives, to ensure that wolf pelts are properly cured and used. The community's perspective in favour of some limited wolf control in FNFN territory must be balanced with concerns that a wolf cull may not be effective for improving ungulate populations unless a large percentage of the wolf population is removed, and control measures are sustained over a long period of time. FNFN's position has generally been that wolf control should only be done if habitat protection and restoration is being conducted concurrently (FNFN 2017d).



FNFN members are experts when it comes to understanding wildlife and our territory. The health of the territory relies on our voice and our actions.

PHOTO: RYAN DICKIE

A recent study done by FNNF on ground-based moose surveys suggested the need for measures to reduce hunting pressure along Luyben road and the southern portion of the SYD Road, and to a lesser extent along Highway 317 and in the Elleh Creek area. At the same time, measures should be taken to ensure that this pressure does not simply shift to other areas. The findings of this study highlight the need for management measures at smaller spatial and temporal scales than the level of the Management Unit (FNNF 2018b).

A study done by FNNF (2018a) on ungulate distribution within Hay River subwatershed lands tenured for oil and gas exploration to Harvest Operations Corp., recommended five over-arching management actions to promote the conservation of moose in FNNF territory:

1. Habitat Enhancement

- Apply habitat restoration treatments for linear features in areas that exceed linear disturbance thresholds.
- Prioritize forested riparian areas for habitat restoration.
- Improve forage availability and nutritional value in cutblocks and other disturbed areas by planting browse species and using appropriate brushing techniques.
- Avoid herbicide use and instead use brushing to control shrub growth.
- Replant of native species in operating areas.
- Use wildlife fencing around all produced water pits to prevent moose from drinking at these locations.
- Institute a noise ban during the calving and rutting seasons to mitigate the disruption of these important life stages.

FNNF members believe that targeted wolf control will help both moose and caribou populations. Members have also recommended that wolf control should be conducted in accordance with FNNF cultural values and perspectives, to ensure that wolf pelts are properly cured and used.

PHOTO: RYAN DICKIE



2. Habitat Protection

- Develop a habitat suitability model for FNFN territory, based equally on Indigenous knowledge and local scientific knowledge, to identify priority areas for moose habitat protection measures in both the mountains and the muskeg.
- Implement strong protection measures for priority areas (old forest and riparian areas that are in close proximity to forage habitat).
- Avoid forest harvesting and industrial development within 300 m of all rivers and lakes.
- Apply a maximum threshold of 1.2 km/km² for linear corridor development at a subwatershed scale; target 0.6 km/km² for road density at the same scale.
- Protect key moose habitat features such as mineral licks, old growth stands, wildlife movement corridors, and calving areas.

3. Reduce Hunting Pressure

- Implement improved road access management measures (e.g., road closures) to protect moose and other animals and relieve external hunting pressure in some areas.
- Institute a moratorium on hunting in high hunting pressure areas.
- Reduce moose meat wasting by non-FNFN hunters; a program to connect FNFN with guides/outfitters/trophy hunters to pass on unwanted meat.
- Protect cow moose through appropriate hunter education.
- Consider limited predator control in areas identified as having unnaturally high wolf populations, based on FNFN observations.

We recommend a combined yearly monitoring program that combines pellet surveys with hunter effort surveys over the same areas, preferably within identified FNFN hunting areas (e.g., family-held traplines and/or communal hunting areas).

4. Monitoring and Adaptive Management

- Monitor moose populations over time at scales of relevance to FNFN hunting. We recommend a combined yearly monitoring program that combines pellet surveys with hunter effort surveys over the same areas, preferably within identified FNFN hunting areas (e.g., family-held traplines and/or communal hunting areas).
- Identify critical winter habitat areas and prioritize those areas for protection.
- Identify industrial areas used by moose and implement management actions to avoid contamination in those areas.

5. Data Management and Reporting

- Working collaboratively with the Ministry of Forests, Lands, Natural Resource Operations and Rural Development to assist in the improvement of the Annual Allowable Harvest, which may help to reduce hunting pressure by non-resident and non-indigenous hunters.

Moose Monitoring Needs

Moose are a critical food source for FNFN community members and a high priority concern. Despite their long-standing presence and importance in the region, there is limited baseline information on moose population density and trends in FNFN territory. In general, we need to better understand how moose populations respond to local moose management in order to develop more effective practices that align with FNFN values.

Some moose monitoring is occurring in the Liard and Hay River Watersheds/FNFN territory by the province, industry, and university researchers, but there are important information gaps related to:

- Population trends and reproductive success and calf survival;
- Moose distribution and habitat condition;
- Causes of moose death and population declines; and
- Effects of road density on First Nations subsistence hunting and potential strategies for managing road access.

The FNFN Guardian Program is spearheading more intensive and extensive monitoring of moose populations in FNFN territory to promote sustainable moose populations over the long-term and fill information gaps by:

- Establishing a population baseline for the region;
- Investigating moose relative population numbers within key study areas in FNFN territory; and
- Documenting potential factors associated with population declines.

By monitoring moose populations and collecting associated data (on hunting, moose movements, disease, and contamination), FNFN hope to address and include cultural and ecological indicators of moose population trends into a moose management action plan.

Potential cultural indicators include:

- Number of moose harvested by FNFN members in key moose hunting areas;
- Percentage of successful hunting trips;
- Number of FNFN families getting moose meat;
- Level of non-Indigenous hunting competition;
- Presence of disease and other moose health concerns;
- Level of potential contamination from unfenced industrial sites;
- Level of herbicide spraying in key hunting areas; and
- Number of actively-used mineral licks.

Ecological indicators for moose include: population trends in local areas; population distribution; intact movement corridors; and predation rates (FNFN 2017b).



The Future

"Using knowledge that was passed along through thousands of years, we have had a close understanding of this land, and in particular the behaviour of our traditional game, moose and beaver. At one time, this was the knowledge that sustained us, and ensured our survival. Hunting and trapping is not only the traditional way of feeding Fort Nelson First Nation families — it is also a cherished way of life." (RELAW 2017)

FNFN envisions a future in which the Nation's inherent rights to protect, manage and conserve their lands and resources according to their own laws are respected and upheld. FNFN members require healthy populations of game in preferred harvesting areas to support the meaningful practice of FNFN's treaty rights. Moose are an integral part of FNFN culture, and critical to the continuity of FNFN's way of life. FNFN members note that the maintenance of Indigenous economy and access to good, productive hunting grounds is fundamental to community well-being and subsistence.

"And that's important to us that we will be able to always be able to access the land, manage the land and continue to have our...to do our traditional way, you know, protect our spiritual sites, still travel the rivers, still eat the moose." (FNFN v. ARWM, et al., 2013, Respondent: Gale, S., p. 84, lines 42-47)

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