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Caribou Mountains Critical Ungulate Habitat and Traditional Ecological Knowledge Study: A GIS Analysis

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Caribou Mountains Critical Ungulate Habitat and Traditional Ecological Knowledge Study

A GIS Analysis

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ABSTRACT

The south central and south eastern escarpment of the Caribou Mountains in northern Alberta is part of the traditional lands of the Little Red River Cree Nation and Tallcree First Nation (LRR/TC). In this study I documented traditional ecological knowledge (TEK) of LRR/TC elders, hunters, and trappers on local critical wildlife habitat, in particular for moose, caribou and bison. My database comprises information on key ecosystem and wildlife relationships, impacts of human and natural disturbances, and human-environment relationships as understood by First Nation TEK experts.

The central plateau of the Caribou Mountains is important summer and winter habitat for local woodland caribou. In summer, caribou and moose cows retreat to the lakes with their calves in order to escape wolf predation. In winter, the caribou forage on caribou lichen and horsetail plants on the central plateau. In spring, the southern slopes of the Caribou Mountains are of particular importance to woodland caribou, which migrate there to escape the hard snow crust conditions on the central plateau and to feed on tree lichen. The south-eastern part of the Caribou Mountains is home to a unique herd of wood bison, the Wentzel Lake herd. So far, all animals from this herd that have been tested for diseases, have tested negative. Wood bison in Alberta are not protected under the Wildlife Act, and currently this herd faces hunting pressure by outside outfitters and trophy hunters. Local TEK experts observed behavioural differences between the three different bison herds in the project region. The Mikkwa herd particularly differed from the other two herds. TEK experts observed that the animals of the Mikkwa herd are smaller in size and have different habitat preferences than the other two herds.

According to the contributions of traditional ecological knowledge to this study it is likely that any logging activity on the south-central and south-eastern slopes of the Caribou Mountains will seriously negatively affect the local woodland caribou and wood bison herds.

In this study I found the local traditional ecological knowledge to be holistic and rich in information about ecosystem and wildlife relationships. I recommend the incorporation of this knowledge in local management decision-making by actively involving local knowledge experts.

ACKNOWLEDGEMENTS

I would like to thank the Little Red River Cree Nation and the Tallcree First Nation for inviting me to conduct my fieldwork in their communities.

I gratefully acknowledge the Sustainable Forest Management Network for providing the funding for this project. The Department of Renewable Resources provided additional support by granting the author several tuition fee scholarships.

Special thanks to Chief Johnsen Sewepagaham for his support at all stages of this research. The support of the consultants Jim Webb, Vern Neil, Tim Gautier, and Ron Leframbois was of major importance to this project. I would like to remember the late Richard Dumaine for his fast and unbureaucratic help whenever I needed it. Little Red River as host Nation not only allowed me to use band charters for much needed transportation but also covered my accommodation.

And of course a special massî to the elders, hunters, counsellors and other community members who agreed to help me in achieving my research tasks. Because of confidentiality reasons I cannot name each person here, but please be assured that I am very thankful for the knowledge and time everyone contributed to the study – without them there would be no project. I would especially like to thank Paul Tallcree, Bradley Tallcree, Lester Nanooch, Lori Blessé, and Malcolm Auger for the very informative and rewarding field-trips.

Of particular importance to the success of the data collection was the work of the liaisons Celestan Nanooch, Leslie-Jo Laboucan, Andrew Nanooch, Lori Blessé, Fern D'Or, and John Dumas. I greatly appreciate their help, support and advice. I also like to thank the Kayas College, especially Bryant Johns, for all the support I received during my stays in Fox Lake.

There are many more people that made my field summer a success. I would like to thank the many individual people that invited me into their camps at Little Red River and Grouard, or welcomed me into their houses. Some people went to great length to help me understand the depth of the local culture.

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SFMN Aboriginal co-ordinator Marc Stevenson provided valuable advice and much support especially during the early stages of this project. I am very thankful for that.

The creation of the maps involved the expertise of many people. Timberline Forest Inventory Consultants provided the digital base maps and granted me access to their facilities for digitization of my field data. Ramona Sewepagaham assisted in the digitization, which I greatly appreciate. Special thanks to Guido Langen, Mark Cooney, Brian Morrison, and Chris Hempel, who provided their expertise whenever an emergency required help. The final analysis and

creation of the maps was done in the University of Alberta Spatial Analysis Systems laboratory. Rick Pelletier from the Department of Renewable Resources provided valuable information and solutions that helped to make the analysis much more efficient.

Several University of Alberta scientists provided important feedback on my wildlife data: Dr. Robert J. Hudson, Department of Renewable Resources (ungulates), Shelley Pruss Department of Renewable Resources (canines), Dr. Noble Donkor, Department of Renewable Resources (beaver), and Piotr Weclaw (caribou and wolves). Dr. Milton Freeman provided very helpful advice especially during the planning phase of this project. Finally, I would like to thank Dr. Naomi Krogman for her excellent supervision, her great support, and her kind encouragement.

INTRODUCTION

The south-eastern escarpment of the Caribou Mountains in northern Alberta is currently slated for oil/gas exploration, mineral exploration, and logging. Apart from seismic lines and some logging activities, this area is relatively undisturbed and contains critical habitat for local populations of moose, caribou, and bison. In the past, all three ungulate species were of particular importance in the local Aboriginal subsistence economy. Due to the decline in caribou and bison populations most local hunters report observing a voluntary hunting moratorium for these two species. Today, the local subsistence meat demand is primarily covered by moose. An increasing hunting pressure by outsiders and an expanding Aboriginal population contributes to the local fear that wildlife harvests may not be sustainable. In order to secure the future of the local subsistence economy, the Little Red River Cree Nation and the Tallcree First Nation (LRR/TC) would therefore like to ensure sustainable populations of all three ungulate species through appropriate environmental management practices.

The aim of this study is to document local traditional ecological knowledge on critical habitat, seasonal patterns of habitat use, and local distribution and movement of moose, woodland caribou, and wood bison. Currently, only very few documents on wildlife research in the Caribou Mountains exist. Hohn and Burns (1975, 1976) documented birds and mammals for the plateau region of the Caribou Mountains. The Boreal Caribou Research Program collected radio telemetry data for woodland caribou in the Caribou Mountains (World Wildlife Fund Canada 1999). Recently, Gates et al. (2001) completed a report on bison movement and distribution in Northern Alberta, which also includes information on the Caribou Mountains region. Currently, University of Toronto M.Sc. student Sarah Derrane studies the effects of logging on caribou and moose population sizes in the region.

The concept for the Caribou Mountains Critical Wildlife Habitat and Traditional Ecological Knowledge Study was jointly developed between the LRR/TC, the Sustainable Forest Management Network (SFMN), and university researchers. It was jointly decided to develop methods that rely on the knowledge of LRR/TC traditional ecological knowledge experts (i.e., local people with a detailed knowledge about the land). SFMN emphasized the importance of including data on natural and human disturbance and forestry issues. At a community meeting in March 1999 in Fox Lake community members expressed concerns about the practices of outside trophy hunters and the impact of logging on the environment. As a response, the project expanded to incorporate information on these topics.

Our database now comprises information on key ecosystem and wildlife relationships as understood by First Nation TEK (traditional ecological knowledge) experts. The main objectives were to: a) to develop a critical wildlife habitat database based on TEK; b) to convert the data into GIS format and to analyze the data in combination with existing GIS data bases; and c) to provide forest management recommendations based on the interview and map data provided to me by the TEK experts.

The results of this study contribute to ecologically and culturally sustainable resource management. They include references to the importance of critical seasonal habitat for specific ungulate species, and the effects of disturbances -- information that will aid in the planning of resource extraction.

The traditional knowledge experts involved in this project contributed unique observations and insights, which open new doors for future research. Personally, I believe that the biggest contribution that this research has to offer lies in the creation of awareness towards the environmental knowledge that still exists in Northern Alberta's Native communities. Local hunters and trappers are often overlooked when it comes to decision making over local resource use. A traditional knowledge study like this bears the risk that local knowledge can become separated from the knowledge keepers. I would like to emphasize that this report needs to be seen as an attempt to summarize the knowledge that elders, hunters, and trappers contributed to this research project. It does not replace the details in insight that direct dialogue with the knowledge experts can provide. By involving local knowledge experts as legitimate stakeholders, better planning of culturally and environmentally sustainable resource management for all groups interested in the boreal forest is possible.

BACKGROUND

In co-operation with LRR representatives it was determined that I would focus on the traditional lands of the Little Red River Cree, situated in North-Central Alberta. The Little Red River Cree are divided into three communities: John D'Or Prairie (with a population of ca. 700), Fox Lake (Population ca. 1200), and Garden River (Population ca. 500). The first two communities are situated on reserve lands north and south of the Peace River, whereas Garden River is located in Wood Buffalo National Park and has no reserve status. Until the late 1950s and early 1960s many LRR members led a fairly traditional lifestyle of hunting and trapping, and a majority of people lived in cabins on their trap lines. In the 1950s and 1960s the federal government strongly encouraged LRR members to move to settlements on newly established reserves in Fox Lake and John D'Or Prairie. This change in location brought about a major change in lifestyle where people had to adapt from an independent family unit lifestyle where they lived in a remote place and made decisions quite freely, to a more restrictive community lifestyle where decisions were often mediated by a modern administration.

The traditional lands of the LRR Cree are situated in the Peace River Lowlands and are mostly part of the boreal mixedwood ecoregions, which are dominated by aspen, balsam poplar, and white spruce (Figure 1). Occasional jack pine stands and tamarack ridges are also present. The LRR traditional lands further include the south-western area of the Caribou Mountains, which is classified as a boreal subarctic ecoregion and is dominated by black spruce on the plateau (Figure 1, medium green) and a white spruce zone along the southern rim of the mountains (light green). The Mountains contain zones of discontinuous permafrost and are rich in lakes. All of the

traditional lands are rich in rivers and streams, and a patchwork pattern of muskeg makes transportation difficult in the warm seasons.

Natural disturbance, especially through fire, is an important factor in the cycle of environmental changes in northern Alberta. Lewis (1982) documented the importance of aboriginal burning practices for the maintenance of prairies in Alberta's North. The suppression of aboriginal burning is starting to alter the landscape. It seems that now large summer fires have severe destructive impacts due to the long-term fuel build-up. Human disturbance (e.g. roads, seismic lines, and cut blocks) have also started to alter the landscape since the 1950s. Despite its remoteness, the region of the Caribou Mountains is severely fragmented. Agriculture, oil and gas exploration, forestry, and transportation networks are the biggest contributors to habitat fragmentation in the project region.[1] To provide an insight into the scale of habitat fragmentation in Alberta's North I would like to refer to Alberta Environmental Protection (1998) data for the Boreal Forest Natural Region (BFNR). The BFNR covers approximately 52.35 % of the province, most of it situated in Northern Alberta. By 1997, 88,588 oil and gas industry-related wells had been drilled in the BFNR, and as of 1996, a total of 73,102 km of pipelines were covering the region. From 1979 to 1995, an estimated 4,971 km^2 of boreal forest was cleared for cutlines. Based on an average width of 8 m for a cutline, the actual total length of cutlines is much higher. A total of 3,360.35 km^2 of forest was logged between 1966 and 1997. The closeness of the continent's most northerly farm community, La Crete, further contributes to the loss of forest due to conversion of crown land into farmland.

The Little Red River Cree Nation communities are based on a mixed economy where subsistence still plays an important economic role. Moose is the preferred hunted animal. Ducks, geese, bear, rabbit, beaver, muskrat, spruce grouse, and fish are part of the regular diet of many families. Trapping is maintained on a small scale, and many people also gather berries, herbs like wild mint, and medicinal plants at the appropriate seasons.

There are considerable differences in lifestyle between the generations. The majority of the older generation (50 and older) grew up on the trap line and spent a large part of their lives on the land. Their grandchildren in contrast grew up in a reserve community with satellite television and moderate modern comfort. Changes in lifestyles coincided with the collapse of the fur market in the late 1970s, leading to a situation where many families almost instantly shifted from a trapping lifestyle on the land to a welfare lifestyle on the reserve. This development is reflected in changing relationships between people and the land. Although many young people try to uphold many values of the older generation they do not have as strong a relationship with the land as do the older generations. Under current economic conditions the young generation is not able to make a living off the land. It can therefore be assumed that values and priorities are beginning to change between the generations.

[1] For more details on natural and human disturbance in the Caribou Mountain region please see Figure 2.

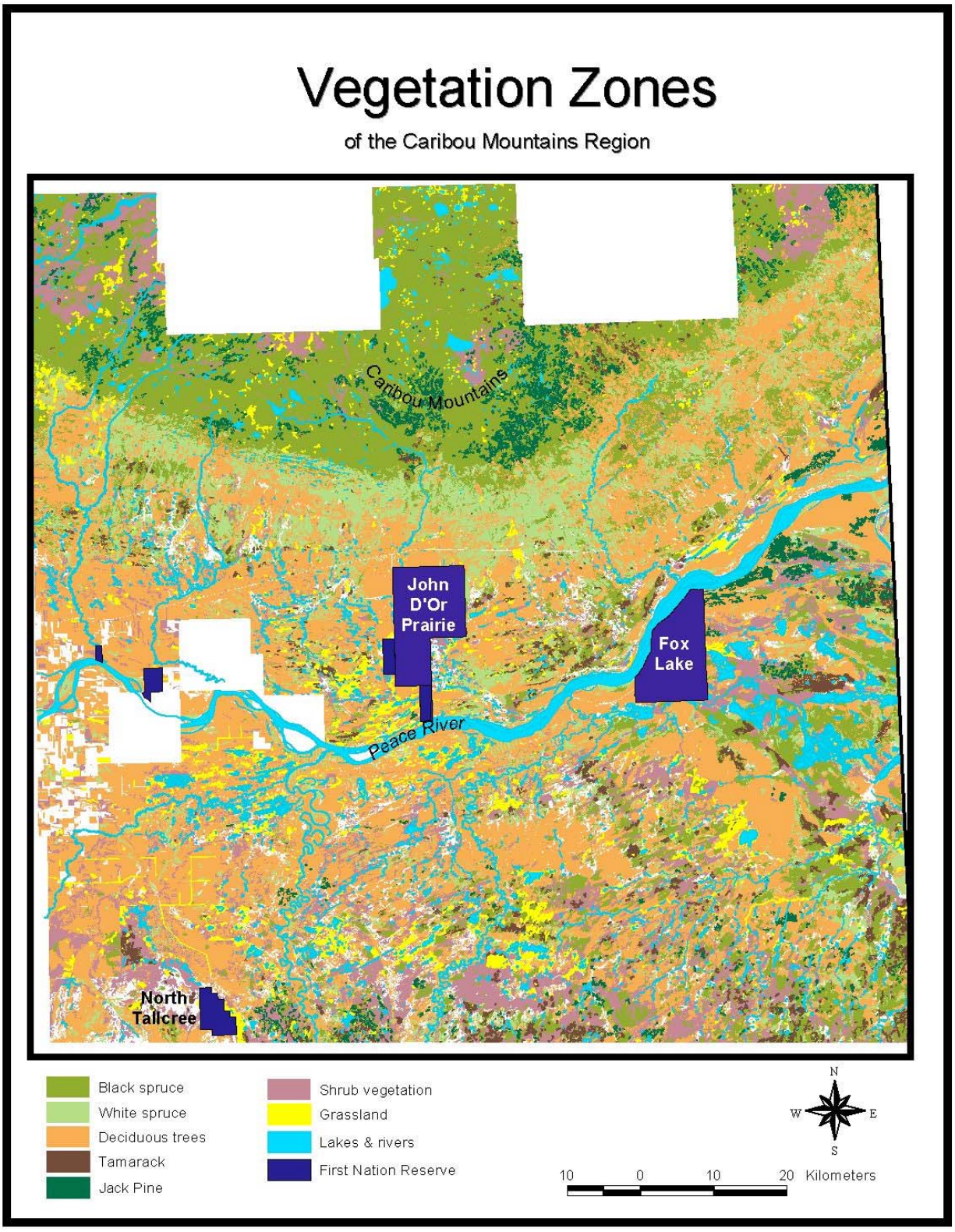

Figure 1: Vegetation zones of the Caribou Mountains region

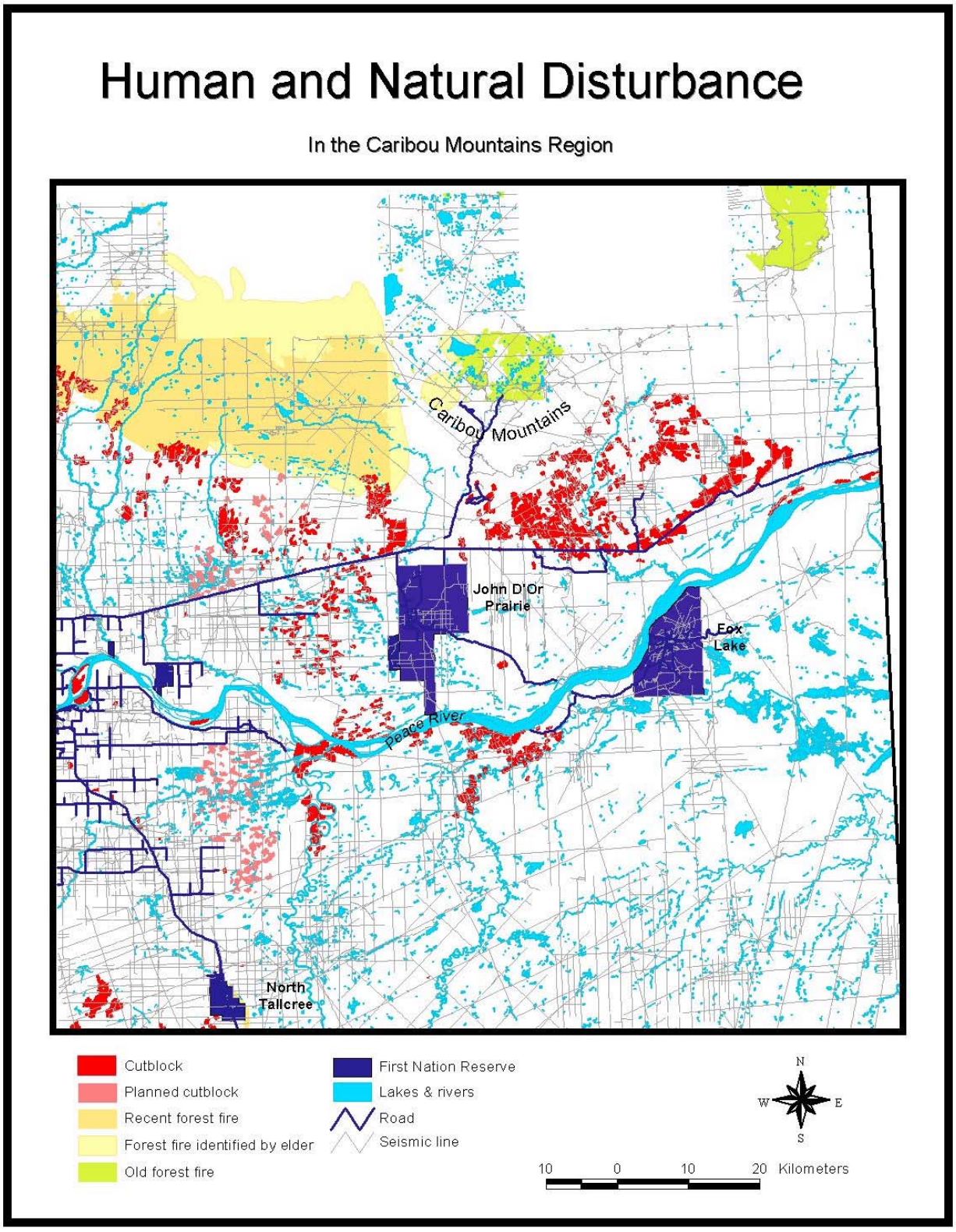

Figure 2: Human and natural disturbance in the Caribou Mountains region

METHODS

Research in Aboriginal/First Nation communities differs in some ways from related research in mainstream Western societies. Issues of patience, cultural awareness, and knowledge of the proper protocol make a significant difference in the success of a project. Generally, this type of research requires a lot of time, both in the planning and in the fieldwork stage.

One of the major aims of this project was to develop the methodology for the documentation of Little Red River Cree TEK in co-operation with the current keepers of this knowledge. This was based on the view that TEK is a knowledge system existing in its own right[2] where knowledge keepers have their own preferred methods of knowledge communication. The development of a methodology that treats both Western scientific knowledge and traditional knowledge as equal knowledge systems requires an open approach that is not centred around Western scientific methodology. This differs from the common methodological approach to conventional studies that tend to utilize Western social scientific methods to document TEK in order to satisfy academic norms and standards. Methods mostly applied in TEK research are the semi-directive interview[3] and participant observation. While these methods do overlap with Aboriginal ways of knowledge acquisition, they, however, also differ to a certain degree. In order to document TEK in a culturally appropriate way, the traditional knowledge experts needed to have central input to the development of the research methodology. Meetings with LRR chief, council members, elders, hunters, and trappers were held in March and May 1999, where key elders informed me about their preferred methods of knowledge transfer. Their recommendation was that knowledge transfer out on the land was the most culturally appropriate way for them to communicate their knowledge, rather than an indoor interview situation.

Adaptive Methods for the Context

My open and flexible approach to methodology allowed me to reach my data collection goals despite a variety of problems that I encountered. The first challenge was to adjust the project to a reduced budget. The reduced budget primarily affected my mapping component, which changed from a field mapping approach to an interview-based mapping approach. I focused on gaining a qualitative set of map data through the accounts of the traditional knowledge experts. TEK experts contributed 15 map overlays on critical wildlife habitat.

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[2] Augustine (1997, p. 2) argues:
"In the same way that occidental science does not define itself in relation to TK [Traditional Knowledge], TK needs not authenticate itself according to the criteria of occidental science. TK exists in its own right, and its intrinsic validity stems directly from survival techniques used by generations of Native Americans. These techniques have been used in harmony with the land and other living entities, and have avoided creating serious ecological damage."

[3] Huntington (1997) provides an interesting insight in the effectiveness of this method for documenting TEK.

Chief Johnsen Sewepagaham and the late band manager Richard Dumaine recommended excellent local liaisons to us. The liaison is central for the success of this kind of work. A liaison introduces the researcher to the informant or participant in a culturally appropriate way and a liaison mediates between the researcher and the informant or participant. The liaison is also crucial as a translator for the researcher to communicate with predominantly Cree speaking informants. Given I paid the liaisons on an hourly basis, the liaisons had to juggle accommodating my interests to meet other TEK experts within their own work schedules.

Overall, the data collection became a combination of knowledge sharing and transfer out-on-the-land where possible, and indoor interviews where necessary.

Physical relocation of the computer that contained the Little Red River/Tallcree *Lighthouse Database* (an integrated data management system), and a band decision to abandon Lighthouse in favour for *ArcView* (a Geographic Information System) was responsible for some delays in planning this component. On 17 September, 2001 Dr. Naomi Krogman and I met with Little Red River representatives Jim Webb, Tim Gautier, and Ron Leframbois to discuss the digitization of map data. We were granted access to LRR Cree forestry inventory data through Timberline Forest Inventory Consultants. An arrangement was made in which Little Red River Cree intern Ramona Sewepagaham assisted me in the digitization of the map overlays. The digitization and transfer of electronic data commenced in early October and lasted for two weeks. The final analysis and completion of maps was done in the University of Alberta Renewable Resources' Spatial Information Systems laboratory between November 2001 and April 2002.

Data Collection

In my collection of interviews on critical wildlife habitat (in general with an emphasis on the Caribou Mountains), traditional knowledge experts contributed detailed observations on specific animal species, their behaviour, food choices, and habitat preferences. TEK experts guided me to related issues. For example, many interviews contain interesting details about the relationship of people with the land and the animals, environmental changes and their attributed causes, and environmental effects from forestry activities.

In total, I spent three months in the Little Red River communities, from June 15 - September 14, 1999. During this time 20 traditional knowledge experts were actively involved and contributed their knowledge. Transcripts were made of 24 interviews, out of which 15 were recorded on tape and 9 were documented by taking written notes. The transcription of each tape took on average 9-10 hours. All together it added up to over 185 pages of written interview transcripts. Many participants also marked areas of critical wildlife habitat on 15 map overlays. These overlays contain observations on animal sightings and tracks at certain times of the year.

On different occasions traditional knowledge experts chose to communicate their knowledge on wildlife out on the land. Several field trips were made into the southern and south-eastern edges of the Caribou Mountains, as well as a fieldtrip from Garden River to Big Slough and one

fieldtrip to the area south-west of Garden River. In total, I spent nine days with TEK experts on the land.

On August 2, 2001 Dr. Krogman and I held a workshop at Fox Lake, where 11 elders, hunters and trappers participated. After informing the participants about the progress of the project, we were able to clarify our understanding of the traditional knowledge map data and to gather more in-depth information on ungulate distribution and habitat use in the region.

Data Transfer and Analysis

For the analysis of my data I chose two different approaches:
1. An analysis of interview transcripts with the help of the qualitative data analysis program QSR NUD*IST, and
2. An analysis of interview data and map overlay data with the help of the GIS ArcView.

Working with QSR NUD*IST
For the data analysis I used the qualitative data analysis program QSR NUD*IST (Non-numerical Unstructured Data Indexing Searching and Theorizing). She developed a coding system based on two theme groups: 1) Wildlife, and 2) Free Categories. The wildlife theme group holds data on ten specific animals, three animal pairs, and one category with rarely mentioned species. The wildlife theme contains all information on specific animals, including habitat and behavioural information, as well as Aboriginal use of particular species. The Free Categories include all major theme groups (12 in total) that emerged from the interviews, like human-animal relationships, specific resource conflicts, and human and natural disturbance. She applied this coding system to all 24 transcripts, with multiple codings being the standard. An interview passage on wolf predation on bison, for example, was placed in the 'wolf' and 'bison' folders as well as into the 'predator-prey' folder.

For the production of the maps I concentrated primarily on the analysis of the ungulate data. For further details about my other data sets please see our first report (Schramm & Krogman 2001).

Following the coding process, the interview information on each wildlife category was condensed to its essential information. These condensed data sheets were reviewed by several wildlife specialists to ensure that I addressed new and unusual information.

Working with ArcView
Timberline was able to provide two digital data sets. The first data set (referred to as the Footner data set) contains information about Forest Management Areas F2, F5, and F7; the second data set (referred to as the Little Red River data set) contains information for F3, F4, F6, and parts of F2 and F5 (see Figure 3). No data were available for F10 and Wood Buffalo National Park. Both data sets contained Alberta Vegetation Inventory data, as well as data on rivers, lakes, administrative boundaries, and more. The data sets, however, were not organized in the same way and thus finding relevant data was a tedious undertaking. Figure 3 shows a simplified model

on which data sets exist and were or were not available. The circle represents the area covered by my own data. The uneven boundaries on the maps resulted from the data limitations of the two digital data sets.

At Timberline, my map overlays were digitized in ArcInfo according to ungulate species. My data include information on F10 and Wood Buffalo National Park. I chose to include this information because the data will return to the band, and the band may wish to complete the maps once AVI data for F10 is available and comparable data for Wood Buffalo National Park is accessible.[4]

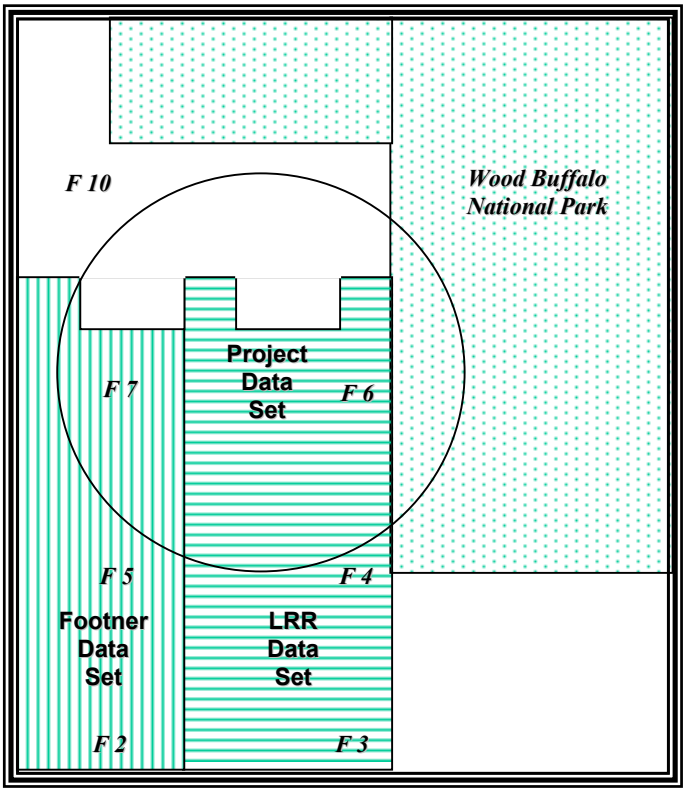

Figure 3: Simplified model of data sets

In the GIS analysis, I combined the Footner/LRR data sets with information from my interviews and my map overlays in order to produce maps that visually explain the information the traditional knowledge experts gave to me. Five ungulate maps were produced: two caribou maps, two bison maps, and one moose map. The reason for the uneven number is that caribou and

[4] The Park possesses three digital data sets: Landsat MSS vegetation map, WBNP Biophysical Inventory, and Timberbeth 408. The Timberberth 408 data set seems to be the most compatible to the ones used in this study. Information on Wood Buffalo National Park digital data sets was provided by Christina Kaeser (e-mail correspondence April 30, 2002).

bison are herd animals that live in definable territories, which made it easy for participants to draw herd information on map overlays. Moose, in contrast, travel alone or in pairs, and do not stay in a particular territory. I consequently gathered fewer map overlay data on moose.

In a first step, I created maps that are based on the map overlay data. These maps contain lines and polygons that show the distribution of herds, as well as single events. In a second step I produced maps that contain some information of the first set, added by information that was provided in the interviews. In the field situation, participants drew polygons on map overlays that identified particular general or seasonal habitat. On other occasions they chose not to draw the information – mainly when it was a generalized observation that covered a large range. For example, the information that caribou cows stay close to the lakes on the plateau in summer was clear without needing to be marked on the map overlays. In the GIS laboratory, I included this information by putting a buffer zone around the plateau lakes.

The Nature of the Data

Traditional knowledge studies like this provide a 'snapshot' in time and should not be used as final and ultimate results. The reason lies in the dynamic nature of the data, which changes as the knowledge keepers and the environment change. In this study I used the term TEK as defined by Martha Johnson (1992, p. 4), "A body of knowledge built up by a group of people through generations of living in close contact with nature." TEK includes: a) a system of classification; b) a set of empirical observations about the local environment; and c) a system of self-management that governs resource use. "The quantity and quality of traditional ecological knowledge varies among community members, depending upon gender, age, social status, intellectual capability, and profession. With its roots firmly in the past, traditional ecological knowledge is both cumulative and dynamic, building upon experiences of earlier generations and adapting to new technological and socio-economic changes of the present" (Martha Johnson, 1992, p. 4).

Traditional ecological knowledge data are primarily observational. People constantly observe wildlife movements and changes in the environment, whether they are travelling, hunting, or working. Certain biases are attached to these data. These biases are related to travel routes, preferred hunting seasons, access to lands, as well as the age, lifestyle and occupation of the observer. In the Caribou Mountains, for example, seasonality of observations has changed somewhat due to changes in lifestyle. In the past, trappers used to stay in their cabins on their traplines during fall, winter, and early spring, mainly because the pelt of furbearers is in prime condition then. The Caribou Mountains are difficult to access in summer, thus most trappers do not stay there during summer months. With the introduction of fire fighting in the Caribou Mountains, local fire fighters now gain access to the region during summer and increase their summer observations. Also, observations are linked to human travel corridors and activity. Consequently, much of the knowledge is derived from traveling by boat on major rivers and creeks, driving a vehicle on a road, or using a skidoo or quad on a seismic line.

The knowledge on particular subjects varies across the communities. Participants who have herd animals such as bison and caribou on their traplines tend to know the most about these species. I found that participants were comfortable admitting if they had no particular detailed knowledge about a particular animal. These participants would refer me to people who they considered experts on the issue. During the field season, a number of names were frequently mentioned. These experts tended to provide very detailed observations. The peer recognition increased my confidence in the observations of these experts.

Access to land limits the ability of individuals to gather information. This is particularly evident along the border to Wood Buffalo National Park. Generally, only hereditary LRR Cree residents of Garden River are allowed to hunt in the Park. LRR residents from Fox Lake and John D'Or Prairie, even though they are also descendants of the original inhabitants of the region, are excluded from this privilege. As a result, information on animal movements often end along the border – which becomes visible on my map overlay data.

There are many people with particular knowledge in the three communities. However, not every knowledge keeper is willing to talk to a researcher. During the beginning of the field season some residents of Garden River were concerned that I might be an environmentalist and chose to not participate in the study, due to their perceived impact that environmentalists had on the fur market in the early 1980s. Near the end of the field season, this perception seemed to change. However, bad weather conditions made it impossible to return to the community. Consequently, this project includes limited data on the region west and north of Garden River.

RESULTS

As expected, the data set is very holistic and leaves different paths for reorganization and interpretation. In this report I organize data according to animal species in order to make it particularly applicable for forest managers and wildlife scientists.

Caribou

During my field season, LRR Cree traditional knowledge experts identified two types of caribou on their traditional lands: woodland caribou (Figure 4, green, gray, and brown information) and barren ground caribou (Figure 4, light purple). To our surprise, elders at the workshop in Fox Lake identified a third type – the large caribou (Figure 4, pink).

Most informants described a residential woodland caribou population in the plateau region of the Caribou Mountains, and the very rare occasional migration of barren ground caribou to the south central region of Wood Buffalo National Park (last observed in the early 1950s). One participant mentioned regular sightings of barren ground caribou in the south-western part of the Caribou Mountains (Figure 4, single event No. 2) and one participant remembers that his father talked about seeing them in the northern parts of the Caribou Mountains. Those participants who

mentioned barren ground caribou clearly distinguished them from woodland caribou by size. In the local Cree language the term "atihk" (caribou) refers to the woodland caribou. The term "atikahos" (the small caribou) is used to describe the barren ground caribou.

The residential woodland caribou population can be found throughout the whole central plateau region with the exception of large burned areas. TEK experts, however, identify patterns of seasonal regional preference. In early spring the caribou migrate from the plateau to the southern rim of the Caribou Mountains, where they stay in the white spruce zone (Figure 5, light green). The snow on the plateau is deeper than in the surrounding southern region. Spring melting produces a hard ice crust on top of the snow, which makes foraging and walking hard for the animals. At the southern rim, the snow tends to be softer and thaws faster, thus allowing easier access to food. While staying on the south side, woodland caribou feed on spruce tree lichen (*Usnea spp.*). In April they start moving back to the plateau.

During summer, the areas around the lakes of the plateau are of particular importance. Cows retreat there with their calves to have an easier escape from wolves. They stay near the water in areas with small willows and caribou lichen. To visualize this information, I selected a 1 km zone[5] around the plateau lakes (Figure 5, purple). In fall and winter, under snow conditions, caribou stay on the plateau around the Eva Lake region and feed on a particular plant from the horsetail family (*Equisetum spp*.).

One participant mentioned that his father had told him about caribou calving grounds west of Margaret Lake where the bush is very thick and dominated by small spruce trees and muskeg (Figure 4, light green, diagonal stripes). During the same season the males feed in an area further to the east from the calving grounds (Figure 4, light green, horizontal stripes). According to this old account, males and females separated during calving season.

Generally, the herd sizes are between 3-4 animals and up to 7-10 animals on some occasions. One trapper, who is now in his 70s, saw a herd of about 40 caribou at Margaret Lake when he was 15 years old. The same trapper observed a herd of about 1000 animals near Eva Lake around 1960 (Map 3, single event No. 1). He shot an animal and the herd stampeded off with a big noise. The trapper is sure that these were woodland caribou – he points out that he would have noticed the difference in size if the herd had been comprised of barren ground caribou. After this sighting he never saw a big herd like this again. This trapper also obtained information from another trapper who mentioned that this very large herd migrated from, and then subsequently back, to British Columbia[6]. The observation of large woodland caribou herds in the Caribou Mountains could be explained by the occasional migration of mountain caribou into the region. The sporadic sightings of barren ground caribou could be linked to the Beverly-Qamanirjuaq

[5] The zone (GIS: buffer) was created after consultations with elder M. Auger who noted that a caribou cow and calf are still able to outrun a pack of wolves over the distance of 1 km.

[6] This corresponds with radio telemetry data obtained by the Boreal Caribou Research Program, which shows an overlap of telemetry points between North Alberta's mountain caribou and the woodland caribou of the Caribou Mountain herd (World Wildlife Fund Canada 1999).

herds, which are known to occasionally migrate into north-eastern Alberta. If occasional migration of a large number of outside caribou into the Caribou Mountains occurs, this may affect the availability of slow growing caribou lichen to the non-migratory local woodland caribou population. Moreau and Payette's (2000) approach to determining fluctuations in caribou populations by examining debarking lesions (trampling scars) could provide an interesting approach for future research in this area.

Many informants pointed out that caribou left an area after the construction of roads and seismic lines, and logging activities started. They reported caribou also continue to avoid cut blocks. Before the road to Garden River was built, caribou were occasionally seen near John D'Or Prairie. As mentioned earlier, caribou habitat is negatively affected by fire. The fire of 1995 (Figure 5, yellow) destroyed large parts of important caribou spring habitat in the white spruce zone of the south-western Caribou Mountains. Logging activities have further destroyed large parts of this habitat to the south and east of the Caribou Mountains. Currently, the largest white spruce zone area still directly connected to the plateau is a small patch north of John D'Or Prairie around Foggy Tower, which due to its composition of old spruce trees, is likely slated for logging in the near future. Loss of this remnant spring habitat will likely force woodland caribou into staying on the plateau during early spring, thereby decreasing the availability of their food resources. Woodland caribou are rarely seen south of the Peace River. However, hunters from Fox Lake recall an incident where a caribou once was observed near Fox Lake (Map 3, single event No. 3).

At the workshop in Fox Lake, elders mentioned a third, larger type of caribou. They reported there used to be a herd of these caribou south-east of Fox Lake, near Birch River, however, no hunter has seen them for a long time (Figure 4, pink diagonal stripes). These caribou are described as being as big as elk or even moose, and they are white-greyish-blue in colour. The elders noted that hunters still encounter this type of large caribou near Lesser Slave Lake

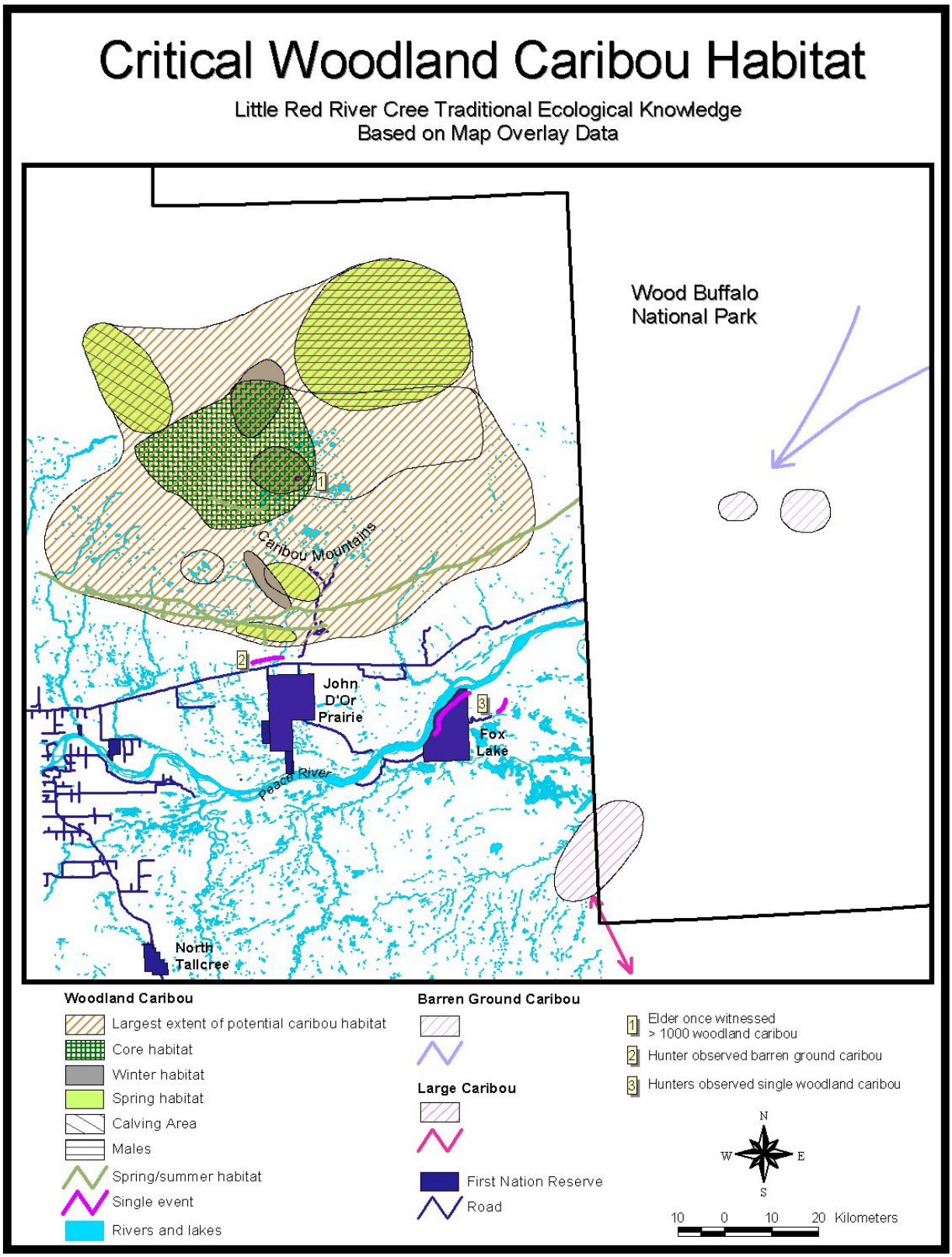

Figure 4: Critical woodland caribou habitat based on map information provided by Little Red River Cree TEK experts

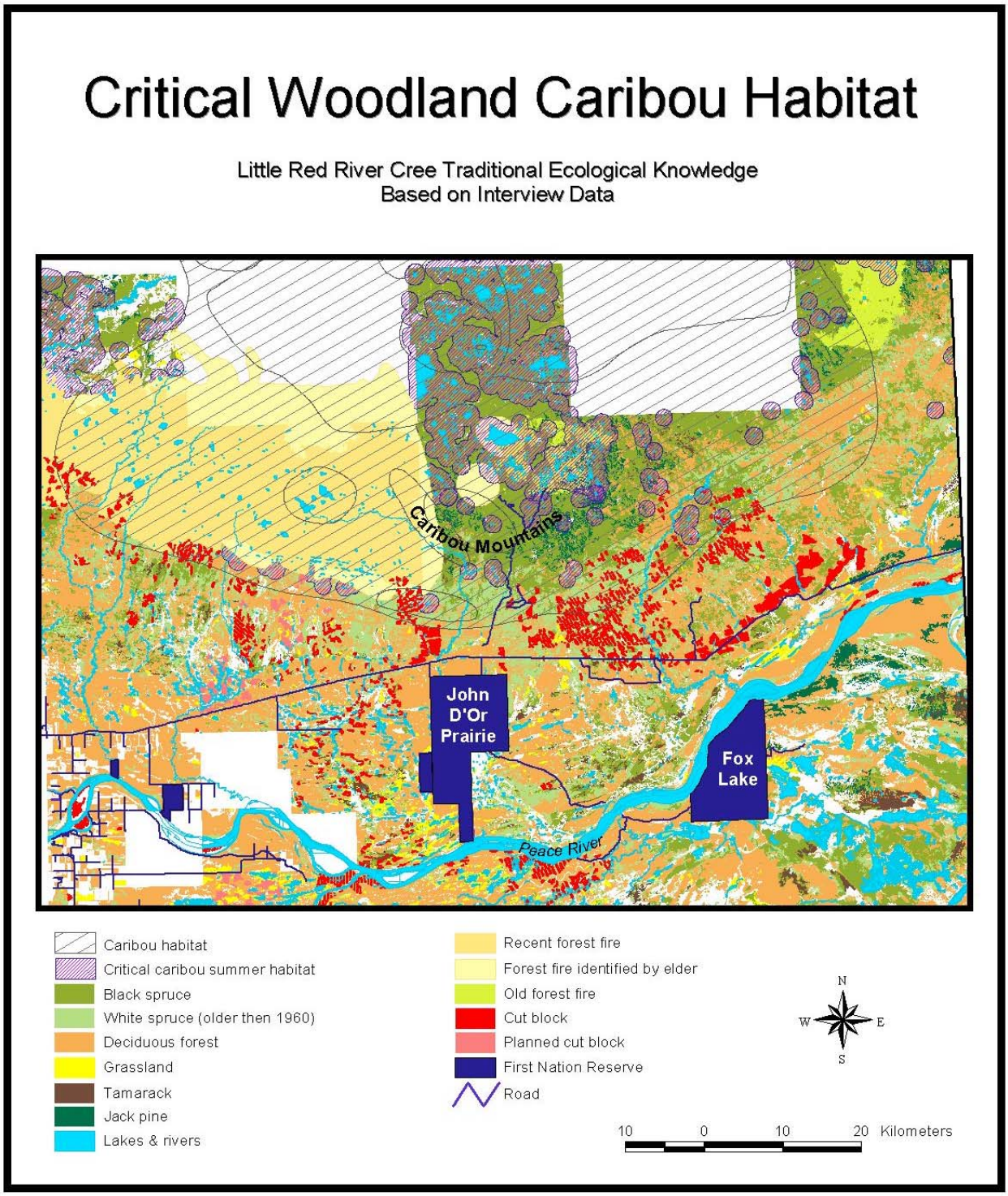

Figure 5: Critical woodland caribou habitat in the Caribou Mountains based on descriptive information provided in Little Red River Cree TEK expert interviews

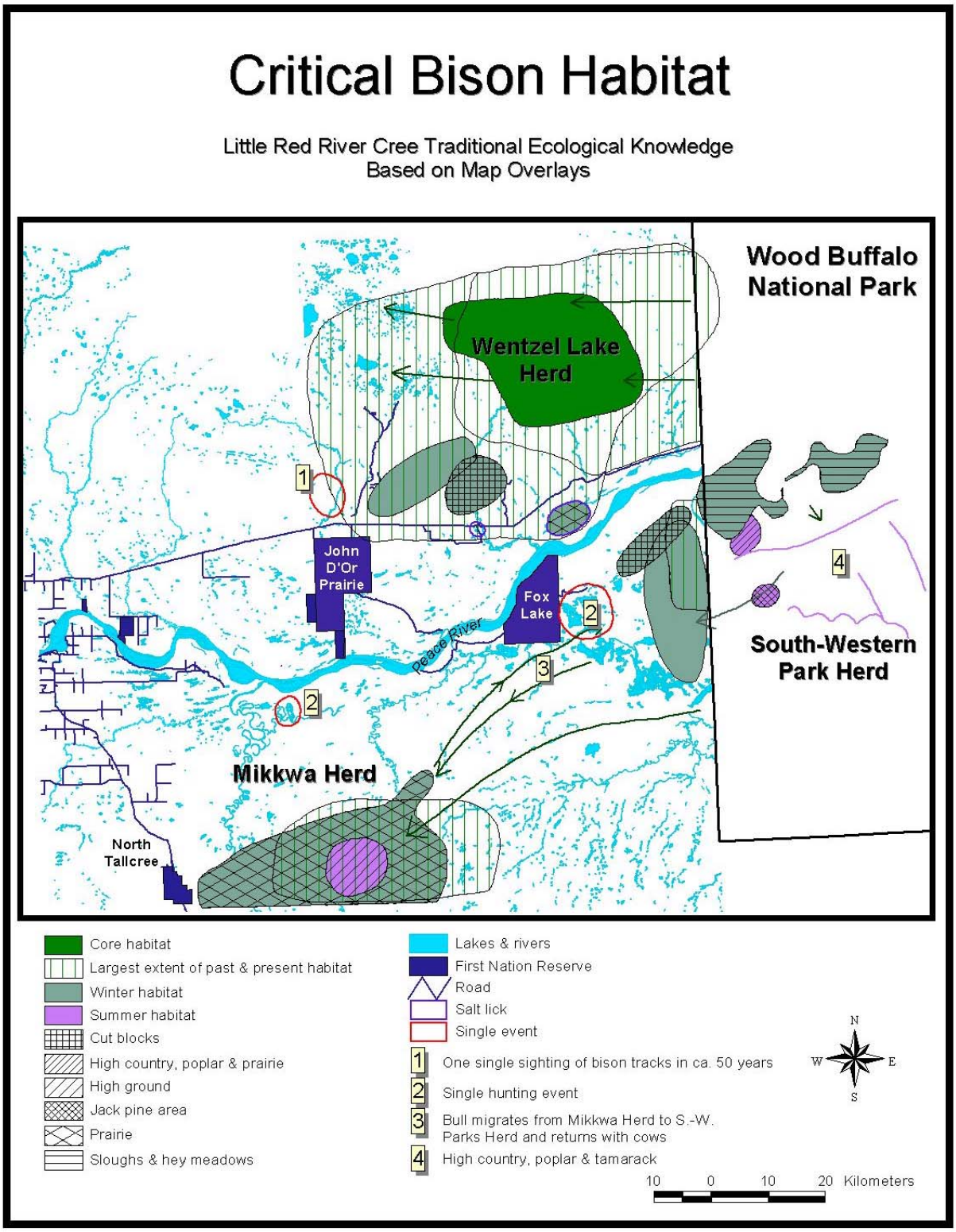

Figure 6: Critical bison habitat in the Caribou Mountains region based on map information provided by Little Red River Cree TEK experts

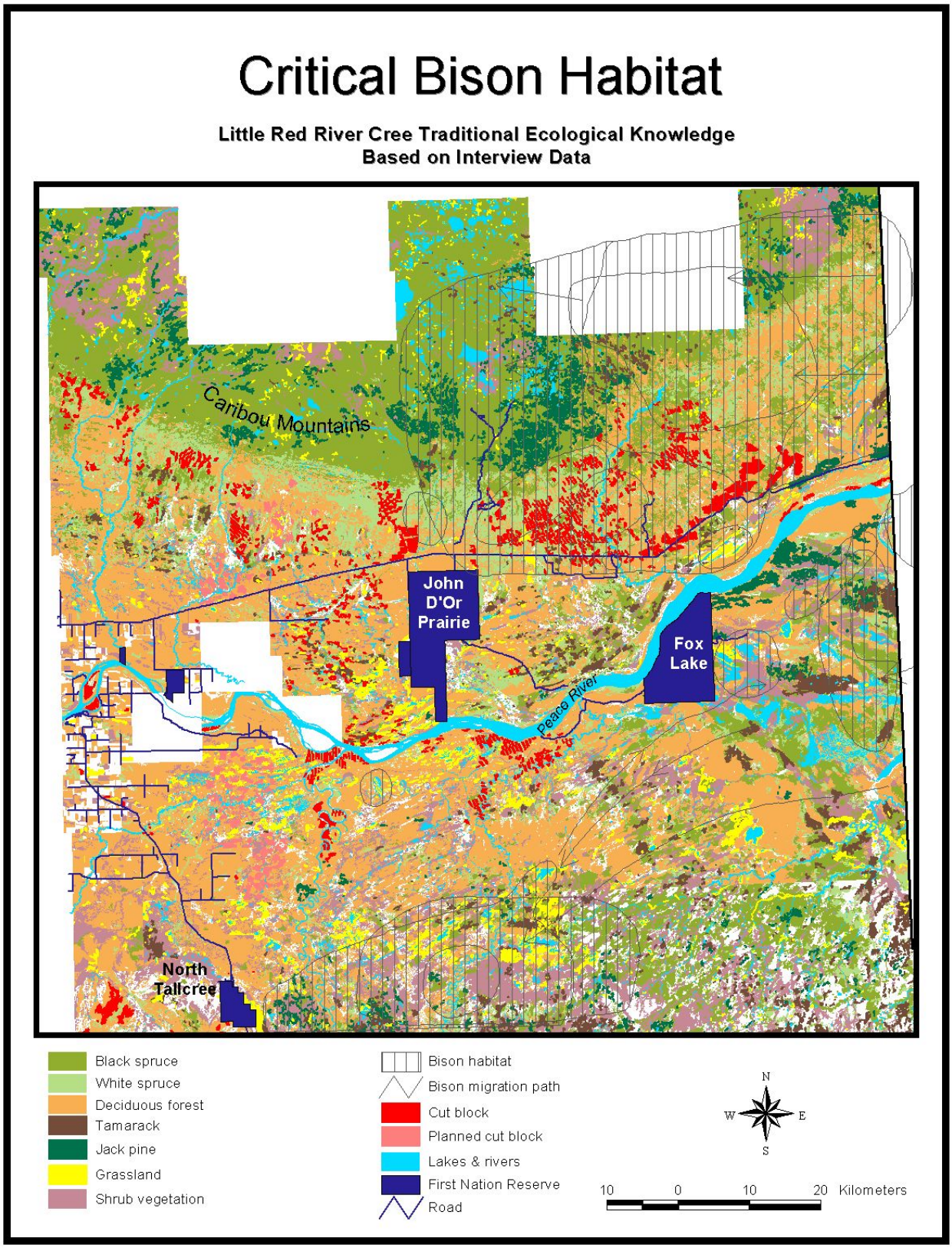

Figure 7: Critical bison habitat in the Caribou Mountains region based on descriptive information provided in Little Red River Cree TEK expert interviews

Bison

In this study, LRR Cree traditional knowledge experts provided information on three bison herds on their traditional lands (Figure 6). The *Wentzel Lake herd* is situated on the north side of the Peace River outside of Wood Buffalo National Park on the south-eastern side of the Caribou Mountains. Although estimates for this herd can be as high as 110 animals (Gates et al. 2001), the local bison monitor never counted more than 26 animals in a herd. The *Mikkwa herd* is situated on the south side of the Peace River between the Mikkwa (Little Red) and Wabasca Rivers. Local observations state that there are currently about 60 animals in this herd. The third herd (here referred to as the *south-western Parks herd*) is also situated on the south side of the Peace River in the south-western corner of Wood Buffalo National Park. During the summer, up to 100 animals have been counted.[7]

The LRR Cree participants distinguished the Wentzel Lake and Park herds from the Mikkwa herd through behavioral and morphological differences. The Mikkwa herd has more plains bison characteristics. These bison are smaller than the animals of the other two herds and not as husky in conformation. The Mikkwa herd tended to stay in open areas, whereas the Wentzel Lake bison (which were referred to as wood bison by the participants) tended to stay in forested areas and include feed like caribou lichen and willows. One participant compared the foraging behavior of the Wentzel Lake Herd to that of moose.

Generally, the bison of the Wentzel River and Park herds tend to stay on higher ground during the summer. They frequently stay in prairie patches, meadows and cut blocks to feed on green grass[8]. In winter, the Wentzel Lake herd stays around small lakes, dry creeks, and old beaver dams because hay[9] tends to be plentiful there. The south-western Parks herd tends to stay on jack pine, tamarack and poplar ridges during summer, and moves into the hay meadows along the Peace River in the winter. A TEK expert from Garden River observed that the animals from this herd feed on tree lichen and caribou lichen in winter. The importance of caribou lichen in winter was confirmed by the local bison monitor for the Wentzel Lake herd. The use of tree lichen by this herd has not been observed. He reported that the importance of caribou lichen in winter for the Wentzel Lake herd is related to unavailability of hay. Heavy snow causes hay to break over

[7] The herd information and location data of this study generally corresponds with results from the Gates et al. (2001) report. The report further includes a bison movement corridor model. The model is primarily based on a greenness map (derived from a phytomass or Leaf Area Index from Landsat data), topographic data, and distance to water. The prediction of the model in regard to movement corridors for the Mikkwa and south-western Parks herds correspond with observations TEK experts contributed to this study. The results of this study, however, do not support Gates et al.'s prediction that bison north of the Peace River are highly likely to move through the settlement of John D'Or Prairie. The calculations for Gates et al.'s bison movement corridors are based on the density of least-resistant pathways and do not consider bison avoidance of human hunting. TEK experts participating in this study, however, emphasized that human hunting pressure was the most important factor in limiting the range of the Wentzel Lake herd.

[8] The term 'grass' is used by participants in a broad sense and includes other graminoids such as sedges.

[9] Informants use the term 'hay' to refer to dry grassy forage. This differs from the agricultural definition of 'hay', which means cut and dried grass. In this report, hay refers to grassy forage naturally dried due to seasonal influences.

and freeze to the ground, which makes it difficult for bison to reach. Under these conditions it is easier for bison to forage on lichen, which still stand up underneath the snow cover. There is also a difference in snow texture associated with lichen and hay communities. The hay meadows are usually covered by deep hard snow formed through snowdrift. Caribou lichen growing in spruce habitat has a lighter and softer snow cover because much of the snow is intercepted by the spruce trees and the environment is sheltered from wind, making it easier for bison to forage. Another interesting foraging observation comes from an account for the south-western Parks herd where animals from this herd break open muskrat houses to feed on the hay that was used to build them. This leaves the muskrats without shelter in winter and could lead to negative impacts on local muskrat populations during that season.

The main calving season of the Wenzel Lake herd seems to be from May to early June. The local bison monitor, however, observed young calves throughout the year.

Local TEK experts observed that the construction of the road to John D'Or Prairie and Garden River in the early 1970s impacted bison migration behavior. Before the road, the bison used to regularly come to the prairie patches near John D'Or Prairie. They also would frequent some salt licks and prairie patches between the Wentzel and Lawrence Rivers (Figure 6, blue circles). The increased hunting pressure from the road has changed this behavior. TEK experts reported that the bison now very rarely leave the Caribou Mountains.

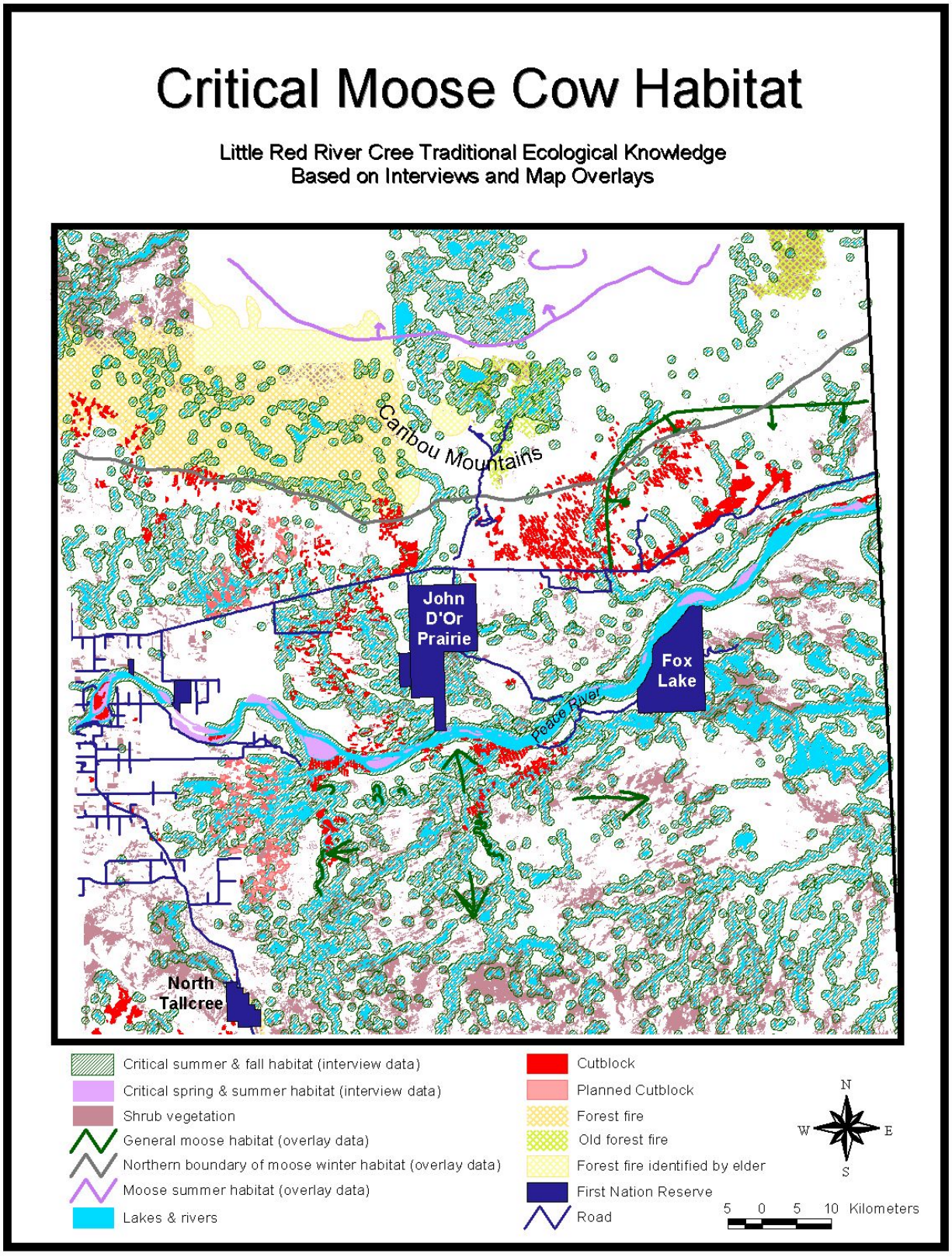

Figure 8: Critical Moose Cow Habitat based on descriptive and map information provided by Little Red River Cree TEK experts

Moose

Moose can be found throughout the traditional lands of the Little Red River Cree. Main areas are in the Mikkwa – Wabasca Rivers region including the area west of Fox Lake. This region is rich in sloughs and little lakes and provides moose habitat year round. Moose in the Caribou Mountains region show seasonal changes in habitat preference. Moose habitat choices follow the seasonal cycle in which availability of food and protection from predators seem to be the major influencing factors.[10]

Several elders have observed that bull moose will choose their summer range in March and April, where they tend to stay throughout the summer in order to build body reserves for the rut.

According to these experts, the moose calving season begins in early May and can stretch into late June. During this time the cows stays close to water. They retreat to river islands (Figure 8, pink) or stay near lakes, beaver dams, sloughs, or large rivers and creeks. The main reason for this habitat selection is to provide the cows and their calves with an easy escape from wolves into the water. During summer, moose will feed on willow leaves, high bush cranberry, saskatoon and other berry bushes, dogwood as well as lily root and long green feathery aquatic plants (translated from Cree as "weeds in the water") from the lakes. For moose, the lakes provide additional relief from biting insects, which are particularly aggressive during June and July. To show the importance of this summer habitat, I selected a 500m zone around all larger water bodies[11] (Figure 8, dark green hatched zones).

TEK experts explained that in September the mating season begins. The cows are still near water (especially near beaver dams and sloughs), where they now are joined by the bulls. During fall (September to November) moose will move to dryer, higher ground. From mid-October to February the cow stays in thick brush that contains substantial windfall. This is another predator avoidance strategy since the long legged moose can step easily over windfall, especially during a wolf attack. The wolves, in comparison, are slowed down by the obstacles. In winter, moose diet mainly consists of brush tips and brown leaves. From January to mid March they prefer to browse in tamarack and willow stands.

During February and March moose generally stay in thick brush, partly for forage, but also to get relief from moose ticks, which have their greatest impact on moose at that time. The rubbing of the brushes gives the moose some relief from ticks. In April, when the snow starts to thaw and is ice crusted, moose are particularly vulnerable to wolf predation. While moose break through the

[10] The traditional knowledge data in this study are very similar to Cynthia Pyc's (1998) results for Garden River. This is not surprising since we worked with the same First Nation and to a certain degree probably with the same TEK experts.

[11] The buffer was created after consultations with elder M. Auger. The distance of 500m was chosen to depict the spatial connection of suitable habitat.

crust, wolves can still run on top of it. All year round moose are attracted to areas with willow stands, like cut blocks, although they tend to utilize cut blocks most during the early fall.

Ungulate Diseases

When asked about diseased caribou, TEK experts stated that they had never encountered any, pointing out that caribou are very healthy animals.

Likewise, TEK experts stated that they rarely find indicators of diseases in bison. This is mainly due to the aboriginal hunting strategy, which avoids animals in bad physical shape and older animals that are at higher risk of disease. At the workshop in Fox Lake we were left with the impression that local hunters do not see visible effects of diseases like tuberculosis and brucellosis in local herds, and they find the animals generally to be healthy. They were, however, quick to point out that the captive bison in the Fort Vermilion experimental farm were very skinny and seemed to be in poor condition. At the workshop it became clear that the elders were very concerned about anthrax. The subject of anthrax brought up a discussion over the anthrax vaccinations conducted in the 1960s and early 1970s in Wood Buffalo National Park. Apart from the documented problems of overdosing bison during early vaccination, TEK experts claimed that the vaccine negatively affected the bison in the Park and continues to do so. Some TEK experts link the beginning of the vaccination program to a start of decline in bison numbers. People who have access to bison meat from inside and outside the Park claim that the meat of the unvaccinated Mikkwa herd is much leaner and healthier to eat than that of the Park animals that were exposed to vaccinations. Although the conclusions about the effects of vaccinations can be debatable, they nevertheless show the deep concern that local TEK experts have over management decisions that include handling of wild animals.

According to one informant, residents from Garden River found moose hunted in the oilrig areas near Red Earth to be diseased. They described big cysts (about 3 cm in diameter) in the lungs, chests and breasts. This could be an indication of the presence of tuberculosis or wolf tapeworm (*Echinococcus*). We brought up the subject at the workshop in Fox Lake, but none of the participants were able to confirm it. One elder from Garden River remembered that in the 1970's he found several skinny moose with pus in their lungs. Another participant mentioned that in the 1960's he shot a moose near Birch River that had worms in most of its tissue, even in the tongue.

Participants offered the explanation that after the mating season in the fall, bull moose are more vulnerable to sickness. They attributed this to injuries moose may acquire during rival fighting, which might affect 1 in a 100 males. The injured animals tend to have internal injuries that can lead to pus in the injured places. The fighting during mating is aggressive. TEK experts reported that some bulls will even attack their own cows – sometimes they injure their mates because they are so possessive. Generally native hunters only observe sick animals when they happen to come across them. They do not deliberately go and look for them.

Human and Natural Disturbance

All TEK experts agreed that human and natural disturbances greatly affect local animal populations. Their concern was not only for ungulates but often focused on smaller animals such as squirrel and rabbits, or on furbearers such as marten, lynx, or beaver.

Moose

Although disturbances generally drive animals away from the affected area, human and natural disturbance affect moose, caribou, and bison in different ways. Moose tend to leave an area during the time when the disturbance occurs. They, however, benefit from feeding on early successional plants and tend to utilize a burn site or a cut block for the first 1-5 years after the disturbance occurred. Participants pointed out that linear disturbances such as roads and seismic lines ultimately have a negative impact on local moose populations because hunters increasingly use them for hunting.

Caribou

In contrast, both natural and human disturbances have negative effects on the local woodland caribou. Caribou will leave the area affected by a fire. They return to the area the year after to see if some of the caribou lichen patches survived. In case of severe fire, caribou lichen habitat is lost for decades. The successional plants are mosses that are of little value to caribou. In the Caribou Mountains, the large fire of 1995 severely affected large parts of the caribou spring range in the white spruce zone. Several TEK experts observed that caribou avoid cut blocks for years. They reported that the combination of fire and logging in the white spruce zone along the southern escarpment of the Caribou Mountains has lead to a dramatic decline in caribou spring habitat, leaving only a small area around Foggy Tower. One participant observed that caribou frequently travelled on seismic lines on his trapline. However, several participants mentioned that the building of the road to John D'Or Prairie caused the caribou to retreat into the Caribou Mountains.

Bison

Many elders likewise pointed out that the building of the road to John D'Or Prairie and Garden River was the main disturbance that has impacted the Wentzel Lake bison herd. In the past, the local bison population in the Caribou Mountains used to be much larger. Since the road was constructed and seismic lines were built, the access into the area drastically increased the hunting pressure on the herd. As mentioned earlier, the construction of the road in the 1970's influenced bison migration. Prior to the road being built, the bison would migrate between the Caribou Mountains and the prairies to the south, regularly visiting saltlicks near the Wentzel River crossing and occasionally migrating as far as John D'Or Prairie. The increase in human hunting pressure from the road led the herd to retreat into the mountains. This decrease in bison range likely affects the bison particularly in late winter and early spring. During this season the snow can still be deep in the Caribou Mountains, and an ice crust makes foraging difficult for the animals. At the same time, the southern exposed prairie patches tend to have considerably less snow cover and much of the hay is even visible above the snow. Later in spring, the prairies

would also be among the first areas with fresh grown grass. The loss of this important spring habitat means that bison now must invest much more energy to gain less forage at the end of the winter. Bison, however, utilize cut blocks for the grasses that grow there.

Forestry Practices

Elders reported that some animals that follow early plant succession created by fire and logging might be more plentiful relatively shortly after the event (1-3 years). Mice and rabbits, for example, will return shortly after a fire and feed on the fresh grass and leaves. Their return will lead to an increase in marten in the area.

Many participants observed negative long-term impacts of logging on their traplines. TEK experts observed that beaver moved in after spruce trees have been logged close to creeks, and have consequently flooded an area. One TEK expert, who holds a trapline in Wood Buffalo National Park, relates changes in water table to clear-cut logging.[12] He noticed that the sloughs dried up in the areas where logging had occurred. There were no trees to hold the water, and no shade. This affected waterfowl (ducks and geese), as well as muskrats, which have declined in numbers since the sloughs dried up. The sloughs are also important to muskrats that move into the sloughs in summer, where they have their young. During this season muskrats predominantly feed on cattail. In winter, when it freezes, they move back to deeper lakes. One participant held that the logging would not have had such a big impact if the forestry company had left the trees around the lakes and creeks.

The same participant also noticed that the logging company left behind considerable amounts of cut timber on the ice. When the ice melted, the trees jammed up the local creek, all the way down to the Peace River. Before the logging occurred, the trapper was able to travel the length of the creek by canoe. Today, half of the creek is blocked. He believes that the Park seems not interested in cleaning up the effects of logging near this previously navigable creek.

Generally, participants observed that logging destroyed habitat for animals. Many TEK experts emphasized that logging destroyed food and shelter habitat for squirrels, and caused lynx and marten to leave the area.

Of particular concern to many participants was the negative effect of logging on medicinal plants. Medicinal plants are gathered in undisturbed places, away from people and trails/roads.[13] If disturbed or destroyed through human disturbance the site will be permanently lost to the person who uses the plant. Some plants are very difficult to find and loss of a plant site is a deep personal loss for the individual user.

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[12] In the Northern Rivers Basin Study many First Nation participants relate the changes in water table in Wood Buffalo National Park to the effects caused by the Bennett Dam (Bill et al. 1996). This view is also shared by Metis elder Frank Ladouceur (1990).

[13] Research results on local medicinal plants, including a regional vegetation inventory for parts of the Caribou Mountains are soon to be expected from Department of Biology M.Sc. student Leslie Monteleone at the University of Alberta.

Many participants believe that tree planting is a good attempt to limit the damage caused by logging. Most insist though, that the habitat will never be the same as it was before logging commenced. They also believe that planted trees are potentially weak, and vulnerable to disturbance, whereas naturally regenerating trees placed in the landscape by the Creator, are reported to be strong and long lasting.

Finally, at the workshop in Fox Lake, participants pointed out that certain logging practices, like scarification, limit their ability to travel by skidoo.

Noise and exhaust odours

Many participants reported observations that noise and exhaust/gas smell drives animals away. In Fox Lake, for example, one participant noticed that birds, such as robins, have disappeared from the community but can still be found 6-10 miles around the community. He attributes the disappearance to noise and gas smell. Another participant from Fox Lake noticed that he seldom hears wolves these days, compared to a time when traffic and noise were not so frequent. Two participants noticed a negative effect of skidoo exhaust on plants and animals. Red voles, for example, were twice observed to die on the spot after attempting to cross a fresh skidoo trail. TEK experts reported that the smell from a fresh skidoo trail would drive moose away from the trail. The exhaust of skidoos, they maintained, also causes plants to die, mint in particular. The grass on frequented skidoo trails is brown and looks as if it has been burned. One TEK expert believes that animals do not like to feed along skidoo trails because the pollution affects the taste of the leaves.

Pollution

Many participants regard wild meat as a healthy, uncontaminated food source. Consequently they are very concerned about pollution and contamination that occurs during industrial operations, or the use of pesticides in forestry and along roadsides.

MANAGEMENT IMPLICATIONS

Important Wildlife Management Considerations

In light of the focus of the study on critical ungulate habitat in the Caribou Mountains I propose a number of wildlife management considerations.

Due to its white spruce stands, the southern slopes of the Caribou Mountains contain the most valuable timber resources in the Caribou Mountains region, and logging activities have already affected large areas in the region. According to the contributions of traditional ecological knowledge to this study it is likely that any logging activity on the south-central slopes of the Caribou Mountains will seriously affect the local woodland caribou herd. I emphasised earlier the importance of the south-central slopes for caribou in the spring, when they migrate from the

central plateau to the slopes to feed on tree lichen, and when conditions on the plateau are still harsh. Logging of these last remaining old growth white spruce stands will not only deplete a vital food source necessary at the end of the difficult winter season, but the noise may also cause caribou to stay away from adjacent unspoiled areas. Although the central plateau is currently not so much at risk from logging activities, it is necessary to emphasize its importance as woodland caribou habitat throughout most of the year. The areas around the lakes are critical habitat during the summer for calf protection from wolves (the same applies for moose). During winter, the same areas seem to provide important parts of the winter diet.

The south-eastern slopes of the Caribou Mountains are critical for the survival of the Wentzel Lake wood bison herd. Due to the impacts of the construction of the road to John D'Or Prairie and Garden River this herd has already retreated into a fragment of its original range. Logging activities on the south-eastern slopes might not directly affect local bison habitat in the immediate future; it will, however, increase access roads for outside trophy hunters and thereby possibly further endanger an already vulnerable herd.

While moose also have been observed to respond to human activity by leaving the area, moose tend to benefit from the presence of early successional plants in cut blocks. Although moose will very likely frequent cut blocks, it is possible that moose populations might actually decrease due to increased hunting pressure due to easier access via logging roads.

Many TEK experts emphasized the importance of the Peace River zone for moose. During spring and early summer, cows and calves will stay on the river islands to avoid wolf predation. Bulls and cows will also frequent the river zone at the beginning of the rutting season. The river zone is also very important for black bears in August/September when they feed on berries to prepare for hibernation. One hunter from Fox Lake believes that logging activities near the Peace River has caused wildlife to leave the area to move further away from the river, making it more difficult for Fox Lake residents to meet their subsistence needs.

Logging activity for spruce is also scheduled for the area west of the southern part of the western border of Wood Buffalo National Park. One local trapper explained that spruce trees in that region grow as small spruce islands, which provide an important shelter for local animals. He fears that logging of these small spruce islands will leave local animals without any shelter habitat.

Considerations for the Management Process

In their study on the effectiveness and potential of the Caribou – Lower Peace Cooperative Forest Management Board, Treseder and Krogman (2000) noticed a low rate of participation by First Nation members in the process. Although First Nation members might be at a disadvantage when it comes to some of the skills identified as desirable for effective participation in the Management Board, the results of the present study suggest that First Nation traditional knowledge experts have detailed (and often unique) knowledge of local environmental processes

and the effects of management decisions on local ecosystems, which would qualify them for a direct involvement on the Board.

As mentioned earlier, a traditional knowledge study like this can create awareness for the wealth of knowledge still found in Alberta's boreal Aboriginal communities. Such a study, however, risks separating the knowledge from the knowledge experts. A direct and visible involvement of First Nation TEK experts in a multi-stakeholder setting like the Caribou – Lower Peace Cooperative Forest Management Board would create even greater appreciation of the contributions First Nations could make to the co-management process. Many of the contemporary elders have worked as loggers, forest fire fighters, tree planters, or on seismic lines, and have a general understanding of forestry practices. A fieldtrip and practical workshop process in co-operation with forestry companies could provide First Nation members with more insight into the technical knowledge used in forest management. It would also provide foresters working in the region with the opportunity to learn more about the relevance of the forest to First Nations people and their culture. As official First Nation representatives in the process, the direct involvement of elders may strengthen the currently existing Nation-to-Nation negotiation process with the Provincial government.

The outside recognition by the non-native community of the value and importance of local traditional ecological knowledge would likely also have a positive effect on First Nation communities in that it could inspire young people to learn more about their traditional knowledge, leading to stronger cultural identity and greater self-esteem.

SUGGESTIONS FOR FUTURE RESEARCH TOPICS

One of the original goals of this project was to generate research questions. In the following I would like to suggest a variety of bio-scientific and social-scientific research questions that arose from this study.

Bio-Scientific Research Topics

Caribou

TEK experts witnessed the occasional formation of large woodland caribou herds in the past. In this context it would be interesting to explore whether mountain caribou or barren ground caribou occasionally migrate into the Caribou Mountains. Research on this issue is important because large non-residential herds would possibly have a long-term impact on caribou habitat, in particular on the slow-growing caribou lichen – and thereby endanger the food supply of the resident woodland caribou population. It might be possible to confirm this observation with dendrochronological research.

[14] Treseder (2000), and Treseder and Krogman (2000) also proposed an emphasis on culturally-sustainable management as a strategy for the Caribou-Lower Peace Cooperative Forest Management Board.

Caribou avoidance of bison range

A local TEK expert observed that woodland caribou in the south-eastern Caribou Mountains avoid an adjacent bison range even though the food resources in this area should be attractive to caribou. A study of this phenomenon could increase knowledge about caribou habitat selection.

Moose

The observation of diseased moose near the oilfields north of Red Earth generates some questions. Are moose around oilrigs more vulnerable to disease? Are moose affected by TB or wolf tapeworm? If it is TB, would the presence of TB in moose not question the claimed benefits of proposed bison eradication proposals? If it is wolf tapeworm, is there a correlation between drilling activity, increase in wolf populations, and spreading of the wolf tapeworm?

Bison

The observed morphological differences between the Mikkwa herd and the other two herds (Wentzel Lake and south-west Parks herds) raises a number of questions. Geographically, the Mikkwa herd is probably among the herds furthest away from the original plains bison release site at Hay Camp within the Park, nevertheless, it seems to be the herd with the strongest plains bison characteristics in the whole region. It seems unlikely that this herd can be directly linked to the plains bison release because the other herds that are closer to the release site all show dominance of wood bison characteristics. Elders at the workshop in Fox Lake stated that the Mikkwa herd has always been in its current location and that exchange of animals between the Mikkwa and south-western Parks herd is a regular occurrence. Currently, very little is known about this herd. The TEK expert observations could potentially lend support to Valerius Geist's (1991) theory that wood and plains bison are actually ecotypes.[15] It could also raise the question if this herd might be a remnant plains bison herd that so far has been overlooked.

The observation of bison feeding on muskrat houses in winter supports the view of bison as a keystone species in the Wood Buffalo National Park ecosystem. So far, the role of bison in controlling muskrat populations has not been studied and could provide for an interesting research study.

[15] In the past, the area between the Wabasca and Mikkwa Rivers used to be dominated by sedge meadows and/or prairie (the term used by participants). Tibeyimisuw (Jimmy Meneen), a North Tallcree elder who passed away in 1990 when he was over 100 years old, remembered 'the land between the Wabasca Lakes and his North Tall Cree Reserve when it "used to look like prairie – there were no trees" ' (Meili 1991, p. 59). Little Red River Cree environmental consultant Vern Neil observed a similar trend when he compared recent and older aerial photographs of the region. He noticed a 40-60% loss of herbaceous habitat to willow succession. Neil attributes the alterations to changes in the local water table, caused by the construction of the Bennett Dam (Vern Neil, personal communication, May 2002).

Social-Scientific and Interdisciplinary Research Topics

Aboriginal principles of natural resource use and management

Many First Nations are increasingly involved in local natural resource management and harvesting. The LRR/TC First Nations manage local timber resources and are stake-holders in planning activities in Wood Buffalo National Park. In order to secure the future of the local subsistence economy, it can be a promising approach to learn more about local aboriginal principles of natural resource use and management in order to develop culturally-sustainable resource management plans. Learning about these principles would include research on local systems of social control, harvesting ethics, human-environment relationships, and how these systems could be applied in a modern planning process.

Social impacts of bison disease management

In the final report for the Bison Research and Containment Program, Jane Chisholm (2001, A6-109), Wood Buffalo National Park, identifies research needs for 'socio-economic impacts of management options'. In my research, elders often opposed handling of, and interference with wild animals. I was left with the impression that local residents were much more concerned over anthrax than over the presence of TB and brucellosis in wild bison populations. They also seemed to be more concerned about the lasting impacts of anthrax vaccinations and the influence of industrial pollutants on the wild populations. I would propose the necessity of a formal cultural impact assessment that would determine how the proposed bison eradication and re-introduction program would culturally, spiritually and economically affect local aboriginal communities in and around Wood Buffalo National Park.

How to network different areas of traditional knowledge use in a community

Many First Nations, like the Little Red River Cree and the Tallcree have a strong traditional knowledge base that includes areas like ecology, environment, health, education, and social as well as spiritual needs. I believe that First Nations will benefit from the direct incorporation of traditional knowledge in their overall management strategies since it would allow for a strong input of local values and priorities. Communities could benefit from research that would focus on how to better disseminate and coordinate these different areas of traditional knowledge use in a community, and make TEK information easily accessible to residents who want to learn more about it, or use it for Band education purposes.

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