DISTRIBUTION PATTERNS AND GENERAL BIOLOGY OF WOODLAND CARIBOU BASED ON COLLECTION OF LOCAL AND TRADITIONAL KNOWLEDGE IN NORTH-CENTRAL SASKATCHEWAN

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By

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ABSTRACT

Woodland caribou are listed as a threatened species in Saskatchewan. The need for contemporary data is paramount for conservation of this species. There has been a dramatic increase in the number of threats to woodland caribou: forestry and logging, road development and expansion, mineral exploration and other long term changes to the landscape. Despite previous research effort, the current distribution and critical habitat of woodland caribou in north-central Saskatchewan is still poorly understood. Drawing upon the knowledge of a selected target group, interviews have been conducted to attain local and traditional knowledge on woodland caribou. Local knowledge has been used to identify key information about woodland caribou critical habitat and ecology in the north central region and more remote areas. Through the objectives of this research we have been able to identify current and historical abundance patterns; adult and calf biology; predator prey interactions; human activity on the landscape and potential effect on woodland caribou ecology; and weather/fire patterns and the potential effect on woodland caribou distribution. The significance of this type of research is critical in understanding woodland caribou biology in northern and remote areas. In addition, this project recognizes contributions and involvement of Aboriginal peoples in academic and government research initiatives.

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1. INTRODUCTION

Declining woodland caribou (*Rangifer tarandus caribou*) populations across Canada have led to the classification of woodland caribou as a threatened species (COSEWIC, 2002). During the 1970's, there was a peak for licensed hunting of woodland caribou in Saskatchewan, followed by a sharp decline, suggesting a population decrease of woodland caribou in these areas (Rock 1992). In central Saskatchewan, the population of woodland caribou has been of special concern for both government and industry. Current population estimates are about 4000 individuals (Bergerud 1974; Arsenault 2003). A recovery plan for woodland caribou is underway in Saskatchewan. However, there are certain elements that are essential for planning their recovery such as current distribution and fundamental biological parameters in certain areas that remain unclear. In addition to documentation of these parameters, government agencies and researchers concerned with planning and recovery of woodland caribou will need to increase their efforts to have Aboriginal participation. As discussed in this section, we will gain an understanding of how this project and its methodology can contribute to the recovery and management for woodland caribou.

1.1 Woodland caribou, a species at risk

1.1.1 Factors affecting abundance

There have been ongoing debates on factors that regulate woodland caribou populations. Two major theories are prominent in early literature. Limited food availability in certain years has been shown to affect both reproduction and recruitment of woodland caribou (Thomas 1982; Cameron *et al.* 1993). In contrast, wolf (*Canis*

lupus) populations have been shown to be a dominant limiting factor for woodland caribou (Holleman and Stephanson 1981; Bergerud and Elliot 1986; Bergerud and Ballard 1988; Schwartz and Franzmann 1989; Seip 1992; Rettie and Messier 2000). When moose (*Alces alces*) populations increase, wolf populations can also increase, although wolves have a strong preference for woodland caribou (Holleman and Stephanson 1981; Bergerud and Ballard 1988; Schwartz and Franzmann 1989). It has been suggested that in Saskatchewan, predation is the main limiting factor for woodland caribou (Rettie and Messier 1998).

1.1.2 Factors affecting distribution

Currently, the distribution of woodland caribou in Saskatchewan has been studied extensively in some areas but is poorly understood in others (Trottier 1988; Rettie and Messier 1998; PAGC unpublished data). Distribution of woodland caribou may be dependent on a number of factors such as: habitat selection and range (Rettie *et al*. 1997; Rettie and Messier 1998; Rettie and Messier 2000; Rettie and Messier 2001); avoidance of insects (Downes *et al*. 1986; Walsh *et al*. 1992), snow cover (La Pierre and Lent 1977; Brown and Theberge 1990) and summer thermal cover (Schmitz 1991; Schwab and Pitt 1991; Demarchi and Bunnell 1993). These factors contribute to woodland caribou distribution, and ultimately, shaped their evolution on the boreal landscape.

1.1.3 Woodland caribou ecology

Ecosystems have many species interacting together and with their environment. Over evolutionary time we can expect that a population can persist in an ecosystem

despite widespread natural disturbances. Some ecosystems are thought to be stabilized through a mechanism where weak interactions dampen strong interactions between the consumer and resources (Odum 1953). This can be understood in terms of an example, such as forest fires on the landscape. Forest fires can range in size and severity in the Boreal forest. A number of small fires can reduce the potential for many large fires to occur, giving the ecosystem a type of long term "stability" or ability to return to some steady state. Ecosystems are changing and dynamic but the types and intensity of each disturbance applied to an ecosystem will determine whether the ecosystem can return to some steady-state (Holling 1973; Orians 1975; Pimm 1984, Ludwig, Walker and Holling, 1996).

In central Saskatchewan, forest fires represent one source of natural disturbance (Rowe 1970; Rowe and Scotter 1973; Marles 1984; Bergeron *et al.* 2004). However, forest fires are becoming less frequent in the boreal forest possibly from a combination of fire protection and climate change (Bergeron *et al.* 2004). New disturbances such as logging and habitat loss or alteration may have negative implications for woodland caribou in central Saskatchewan (Trottier 1988; Rettie and Messier 1998). There is evidence that species guilds are dramatically different up to 28 years after logging activity (Hobson and Schieck 1999; Schieck and Hobson 2000). Forestry practices have evolved, to minimize negative effects on woodland caribou, by shaping cut blocks to emulate natural forest fire. Cumulative effects of disturbance at the landscape level will have important implications for woodland caribou recovery and management. In cases where there is a loss of ecological resilience in woodland caribou habitat, the habitat may take longer to recover.

At a glance, there are many parameters regarding the ecology of woodland caribou and their habitat that may contribute to their declining numbers. In northern Saskatchewan, woodland caribou have co-evolved with all types of disturbance on the landscape, but the ecological factors affecting them are rapidly changing.

1.2 Changes to the landscape

Small groups of woodland caribou thrive in large tracks of undisturbed forest, and the movement of these small groups is driven by predator avoidance (Rettie and Messier 2001). The small groups may move between areas in the summer and winter using migration routes known as corridors. Increased demands for resources have led to increased land use and development, also known as anthropogenic changes. Anthropogenic changes to the landscape affect woodland caribou behaviour as they avoid developed areas, limiting movement and access to their prime habitat (Cameron *et al.* 1992; Dyer *et al.* 2001). One study suggested that the declining population of woodland caribou in certain areas was related to logging activity (Trottier 1988). An increased number of roads and changes to the landscape have certain negative implications for woodland caribou habitat, which becomes fragmented, altered or lost (Ferguson and Gauthier 1992, Mallory and Hillis 1998, Gray 1999, McLoughlin *et al.* 2003). Individual woodland caribou have been shown to avoid these anthropogenic developments (James and Stuart-Smith 2000; Smith *et al*. 2000; Dyer *et al*. 2001). There is also an indication that wolves benefit from road development or linear corridors (James and Stuart-Smith 2000). Within 2-3 decades, woodland caribou populations in Saskatchewan decreased dramatically. In contrast, the relationship between Aboriginal people and woodland

caribou population has existed for many generations (Marles 1984; Kendrick and Lyver, 2005).

1.3 People and caribou

1.3.1 Summary of people and culture

In northern Saskatchewan there are two Aboriginal groups: Cree and Dene. Northern Saskatchewan has maintained a low density of human populations and the majority of northern communities are spread out over the landscape. Lands defined as First Nation reserves only represent a small portion of the traditional lands. The traditional lands include large tracts of land and associated watersheds, vital to First Nations for subsistence trapping, fishing and hunting and provide potential sources of income. Even fewer in number are the Métis communities in the province; these communities are often associated with the establishment of the original fur trading routes in northern Saskatchewan. Lands, water, air and fire are elements that sustain all life. The elements and all living things are connected in a delicate balance. Elders use oral history to demonstrate these connections.

> Oral history preserves traditions, transfers knowledge and records events (OTC 1992).

The link between natural world and the Creator is the basis for these cultures and the way of life.

The access to natural resources often raises conflicts between families living off the land and mining or exploration companies. Job opportunities and the chance at a good paying career are not an option for most people in the north. Many families rely on their knowledge of the land to provide income through activities such as trapping, outfitting

and fishing. This lifestyle is not easy and the families endure many hardships (Bouchard 2006). The market value in the fishing and fur industries is very low but it continues as a way of life. For insurance purposes, the monetary return is so low that trapping is not considered an income. The national and local economy profit is too low to be considered a source of income (M. Brown, unpublished 2007). In addition, increased exploration and encroaching industrial activities near their communities or on their traditional lands may limit the types of resources available to northern families. Trapping and fishing have persisted, as a result of the transmission of knowledge, which makes it valued within the community. These activities are part of the dynamic culture of the north and the cultural significance makes it valuable, not the economic gain (M. Brown, unpublished 2007). Natural resources are important at a local level to support local economies, but to a larger extent the resources also support local culture, transmission of knowledge and inherent rights to practice their spiritual beliefs.

Elders seem to have an increased sense of urgency for promoting conservation within their traditional lands, so that their cultural activities may continue for future generations.

> I got my education and this is where I found a career I guess you can call it. I have all the knowledge from the land, that I have learned from my parents and my uncles and my grandparents; They have taught me a lot and this is what I am trying to pass on to the young people that do come here [his trap-line]. I teach back home [Chief Moses Ratt School] I teach both Cree language and culture. I have a lot of knowledge in that area, so I am a graduate of the north. (Henry Ratt, Morning Lake Interview, 2006)

Aboriginal people are known to be reliant on caribou for many resources including food, tools and hides (Thorpe, Hakongak, Eyegetok, and the Kitikmeot Elders 2002). Northern communities and the elders have an important role in participating and collaborating in

woodland caribou recovery efforts. Any loss of animals in the ecosystem is a great concern for them and could be devastating to an Aboriginal community, their cultural and their way of life.

1.4 Woodland caribou recovery

1.4.1 Stakeholders

As indicated earlier, COSEWIC has listed woodland caribou as a threatened species across Canada. A number of jurisdictional governments are involved in a steering committee to develop a national strategy for the boreal population of woodland caribou (Environment Canada, 2005). As a result of the Species at Risk Act (SARA) which was developed in 2003, each province also has a responsibility to develop a strategy or management framework to address concerns regarding extirpated, endangered or threatened species within their province (Saskatchewan Environment, 2007). In an ongoing process, a group of stakeholders within the province is developing a framework to assess the current status and biology of woodland caribou to promote conservation and recovery, where:

> In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of the species' persistence in the wild…A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. (Environment Canada, 2005)

There are biological knowledge gaps on woodland caribou and the intention of the Saskatchewan Woodland Recovery Team is to address these knowledge gaps by initiating woodland caribou research. Another role of the working group is to incorporate

long- and short- term strategies. These strategies are aided by developing partnerships with other organizations, industry and other agencies interested in woodland caribou recovery. These partnerships should lead to a better understanding of woodland caribou but also potentially reduce negative impacts on the woodland caribou populations.

1.4.2 Aboriginal participation and consultation processes

As a stakeholder, Aboriginal groups have a special interest to participate in recovery efforts. Under federal jurisdiction, there are legal implications that may affect First Nations and their inherent treaty rights, with respect to a species at risk. In the case of woodland caribou, as with other species at risk existing on First Nations lands, the need for stewardship and awareness has been recognized. The Federal Government initiatives have opened lines of communication within First Nations communities through programs such as the Habitat Stewardship Program and the Aboriginal Critical Habitat Fund. Through these programs, researchers must include Aboriginal participation in research and adds to the consultation process.

1.5 Rationale

1.5.1 Defining knowledge

Traditional Ecological Knowledge (TEK) is a large body of knowledge which spans many generations and can be critical for adaptive management (Berkes, Colding and Folke 2000). Evaluation of the term TEK can be extensive due to the amount of publications and is out of scope for my research; therefore I chose the preceding definition for my purpose and objectives. TEK is an attribute of societies with historical

continuity in resource use practices (Wensel 1991; Dei 1993; Williams and Bains 1993; Wensel 1999; Thorpe *et al.* 2002; Yukon Fish and Wildlife Branch 2003; Battiste 2006:111; Menzies and Butler 2006; Battiste 2008). In comparison, adaptive management is based on spatial and temporal scales of human interventions (Berkes, Colding and Folke 2000). TEK is recognized as knowledge transmitted orally through participation in cultural activities (Wensel 1999; Thorpe *et al.* 2002; Yukon Fish and Wildlife Branch 2003).

There are many cultural aspects that are specific to each Indigenous group, so in regards to my research I have devised an example to clarify TEK. To contextualize this definition we can imagine a Woodland Cree woman preparing a woodland caribou hide, in her first language she can best explain what she is doing to prepare the hide and the meat. Cree prepare woodland caribou hides with specific treatments; this type of information is considered TEK. The way woodland caribou are to be hunted, the way to skin the animal and how to process the hide and make bone tools are information that is learned through the teachings of community elders and within the family unit.

Figure 1 – Woodland Cree will prepare woodland caribou hides with specific techniques. This type of information is considered TEK. The way woodland caribou are to be hunted, the way to skin the animal and how to process the hide and make bone tools are all information that is learned through elders and family (Bonnie Hamilton, Photo by Naomi Carriere at Potato Lake 2006)

In this example, we can understand how the Woodland Cree use their first language to describe the process of preparing hides and therefore how first language and First Nations culture are critical within the definition of TEK. Transmission of this type of knowledge

is most evident when participating in an activity such as trapping or hunting and subsequent food or hide preparation.

The collection of TEK involves interviews and documentation of elders and their knowledge through recordings, transcriptions and translations. Once this knowledge is collected there is a shift in the type of knowledge it becomes, and this can be sensitive and Indigenous people can lose the control and context of this knowledge (Wensel 1999; Battiste 2007; Kovach 2009). Due to the sensitive nature and the uncertainty of data handling, sharing and intellectual property involved with TEK related research, I had made a clear and definite choice to focus on Local Knowledge (LK).

Local Knowledge, a fundamental element of TEK, includes species identification and taxonomy, life histories, distribution and behavior (Berkes, Colding and Folke 2000). LK is based on the observations of resource users and can provide a snap shot of current or recent ecosystem structures. LK is very different from TEK in focus. Where TEK is closely linked to culture, LK is linked to an activity such as trapping and the observations made while doing the activity. To contextualize this example we can create a scenario where a woman is describing a story of her and her family and how they came across woodland caribou during trapping season. As their family will do every year, a woodland Cree woman and her family travel by snowmobile to their trapline and come across a number of woodland caribou on the lake. She and her family decide to shoot one of the woodland caribou. As soon as the family prepares the meat and hide, the woman begins to gain LK about the location of the herd, season, general woodland caribou activity (wintering area, corridor or calving area; explained more in section 2), and parasite load, health based on body fat, sex, and approximate age of that particular woodland caribou.

Figure 2 – As a woodland Cree woman processes the meat and hide she begins to gain LK. LK includes the location of the herd, season, caribou activity (wintering area, corridor or calving area; explained more in section 2), and parasite load, health based on body fat, sex, and approximate age of that particular caribou. (Photo taken at Stanley Mission Culture Camp Naomi Carriere, 2006)

This knowledge base increases each time they travel on the land, when participating in activities such as trapping, fishing or hunting. As we can imagine, language and cultural values are not necessarily inherent in this type of knowledge, as people who practice these types of activities do not necessarily have to be First Nations or Métis. Currently, First Nations hunters are the only group eligible to hunt woodland caribou on traditional lands for subsistence purposes.

When people gain a sense of the land and animals through LK, they also tend to implement small scale management schemes. The family we described in our LK example (through consistent annual trips to the trap-line), most likely had previous knowledge about the group of woodland caribou they came across. The same group of woodland caribou travels through their trap-line in the month of May to get to the spring calving area. The family can take advantage of this knowledge by timing their trip to the trap-line to coincide with the woodland caribou herd migration. Transmission of this type of knowledge is still shared with family members and potentially other people in the community who are trustworthy. LK is valuable and it can be "risky" if disclosed to youth or inexperienced trappers, hunters or fishers who may use the information to

overharvest. Having a true understanding of the two types of knowledge will provide insight into the differences in LK and TEK and potential discrepancies between accessing knowledge in a community.

1.5.2 LK and TEK vs. western science

By definition Biology or "the study of life" is a very broad topic. Since this project began, there has been ongoing debate about the relevance of an interdisciplinary project linking the humanities in a biology department. Biology researchers often collaborate with colleagues outside of the department of biology to make their results valuable and biologically meaningful. We will now explore the rationale of this type of project within the specifics of biology.

In order to aid conservation planning in an ecosystem, some academics have turned to TEK (Schmink, Redford and Paddock 1992; Gadgil, Berkes and Folke 1993; Ferguson and Messier 1997; Ferguson, Williamson and Messier 1998; Berkes 1999; Ferguson and Messier 2000). Academics in collaboration with provincial biologists are open to the idea of collecting and incorporating LK and TEK in order to understand broad scale ecological processes in biology, climate change and, ultimately, the application of this knowledge to game management.

This project is interdisciplinary. The methods for collecting data relate to ethnozoology or anthropology (Section 2). However, the overall project objectives are biological in nature. The one outstanding obstacle is the fact that the data is qualitative; however the results can be applied to knowledge gaps and complement previous biological research. Qualitative research more broadly relates to a large field of study

which can includes a holistic and broad understanding of research objectives and knowledge (Miles and Huberman, 1994). As the focus of my research relates to woodland caribou and their ecology, it is important to indicate that the information that is gained by the methods relates more to biological concepts. To verify the biological nature, I make reference to Section 2 and 3 of this thesis, the results are biologically meaningful. The goals and objectives were designed to address significant knowledge gaps within the woodland caribou recovery strategy. In addition, collaborations and links are going to be made with other woodland caribou research in the province. In conclusion, the origins of this project have been developed through collaborations between academics within the biology and anthropology departments at the University of Saskatchewan, and across provincial and federal government jurisdictions.

1.6 Objectives

The first objective of this study is to document the current and historical distribution of woodland caribou in north central Saskatchewan. For comparative purposes, we will include areas where industrial activity such as logging is absent and areas where logging has occurred for several decades.

The second objective is to document LK about critical habitat of woodland caribou. The LK held by trappers includes knowledge about the activity of woodland caribou on their trap-lines. Woodland caribou activities could include locations important for woodland caribou migrations (on a road), seasonal habitat use, feeding, calving, escaping insects, and escaping wolf predation.

The third objective is to document local knowledge about the quality of the food or food availability. There may be differences in areas with no logging activity compared to areas that have been logged over several years. Trappers, as primary resource users, will have important observations and impressions about the nature and level of cumulative land use impacts on woodland caribou habitat.

The fourth objective is to document historical and current patterns of human-use within the study area, in order to identify changes that could impact woodland caribou. Improved access, changing land use, and evolving hunting practices may contribute locally to declines in woodland caribou.

The fifth objective is to document LK with respect to predator-prey interactions between caribou and wolves, and to assess the cumulative impacts of logging and other human-caused disturbance on such interactions. The density of wolves may be affected by increased disturbance and this information is not fully understood.

The last two objectives will be pursued beyond the scope of the Masters project, but will validate the importance of this type of project to engaging Aboriginal and resource users in recovery planning. The sixth objective is to involve the Aboriginal and resource users in recovery planning through discussions about the results of this project. Future integration of the results or recommendations can be used for conservation and future research by various agencies such as Saskatchewan Environment. The seventh objective is to contribute to the analysis of all information collected to recovery planning in such a way as to afford greater protection of the species; and to showcase the relationship between First Nations people and northerners have with regard to woodland

caribou; and to provide logging companies and other industries with practices or innovations that would have a minimal impact on woodland caribou.

2. METHODS

2.1 Combining knowledge

This research project is inter-disciplinary, combining methods and research from three different paradigms. Not only are we combining the two paradigms of "western science" and "traditional knowledge', but also incorporating a third paradigm "anthropological methodology". In order to combine paradigms to complete this project it is critical to understand that the biology of woodland caribou as addressed in this study is the unifying theme.

The first paradigm is biological in nature or the "western science paradigm." The "western science" paradigm has very specific research guidelines, objectives and outcomes. The research methods make use of rigor, repeatability, and reliability of the information. The theories, discussions and conclusions of research are highly useful in the larger picture of related research and topics within the field. No one paper builds a theory; each research project is designed to fill a knowledge gap that leads to a better understanding of the entire knowledge base.

The traditional knowledge paradigm is still in the process of being defined, making it more complicated to research. The fundamental definition of "traditional or local knowledge" is a very dynamic idea, with more relevance to a local population. Therefore, it is important to note that the idea of collecting local knowledge is the best approach, leading to an understanding of woodland caribou at a local level.

2.1.1 Limitations

In practice, there are limitations in applying the western science paradigm to woodland caribou recovery and research. For example, the availability of funding restricts the duration and type of research that is feasible. In most cases woodland caribou populations are studied for 2 – 3 years. The research is restricted to certain locations (grid patterns of some surveys), sometimes picked at random (potential calving areas based on habitat matrix), and the results are not necessarily a true model of the real world, but the "best estimated guess" rule. Most research is conducted with strict objectives and is therefore more focused in on one particular aspect of woodland caribou ecology. In many cases, woodland caribou research is adopted from out of province as a surrogate to reduce redundancy and lack of funding opportunities. Such limitations of biological studies are well known.

In summary, there has been caribou research in Saskatchewan, but many questions remain regarding woodland caribou in northern and remote areas of the boreal forest. These are the knowledge gaps. One way of helping to fill those gaps is to ask the people who know this area the best, i.e. the people who live and work there on a daily or seasonal basis, such as the trappers and elders. In order to collect local knowledge, from trappers and elders, the scientific approach may not be appropriate. You would not be able to develop a questionnaire or interview with biological terminology for trappers and elders, as they will have trouble interpreting questions and formulating answers. Science has a certain language and reasoning that is foreign to a trapper or elder. Elders may not be familiar with the idea of our biological terms such as populations, abundance and

Global Positioning System (GPS) locations. In order to develop a methodology that would work, we have to turn to anthropology.

Anthropological methods juxtaposed to biological methods have an "inverse relationship". Classical anthropological methods are exploratory in nature. Often human subjects are the focus. A researcher is expected to immerse and learn about the subjects' way of life, ways of knowing and ultimately gain insight to local knowledge. So the focus of this research project is not to explore or examine the trappers and elders' knowledge, but to gain access to the observations and local knowledge about caribou that they have gained through their lives in the boreal forest. This knowledge can be captured in order to fill the knowledge gaps on woodland caribou ecology where no or very little biological research has been conducted. In essence, the methodology remains exploratory.

2.2 Consultation with target groups

The first step in the methodology was to define the target group. The target group was selected based on the idea of adding rigor. In order to add rigor, we have to select a target group that is knowledgeable regarding the boreal forest. The two areas of concern we will address are current local knowledge and historical knowledge of woodland caribou. The people that best fit this criteria are the trappers and elders who have lived out on the trap-lines historically and those that are still active trappers.

2.2.1 Lac La Ronge Indian Band and Métis Nation of Saskatchewan

The ethic background of a trapper can fall under First Nations, Métis or non-aboriginal. We selected the Lac La Ronge Indian Band as a target organization and the

Métis Nation of Saskatchewan (Northern Region 1) to start a consultation process. These organizations are located in La Ronge. Consultation is a loose term in this research project, as the goal for consultation was to raise awareness and gain consent for the research project, objectives and possible outcomes. Each organization was approached through letters and telephone calls. I asked the contact persons about attending a meeting. When I was selected to attend a meeting I presented my research objectives and methods. Once the question period was complete I requested to pass a motion supporting the research (this would be found in the minutes of related meetings). In each case the motion was passed with enthusiasm.

2.2.2 Northern Trapper's Association and trapping blocks

Additional target organizations for the consultation process included the Northern Trapper's Association (NTA), which is the umbrella organization for all active trappers. NTA has one representative from each Fur-Conservation Areas (FCAs), located in northern Saskatchewan. Each FCA has a trapper's association where all active trappers are represented by an elected governing body (president, vice-president and secretary-treasurer). Concerns at the local trapper's association are brought to the larger AGM where a motion can be passed onto the appropriate government body. I gained the support of the organization at the initial AGM through a motion, which was passed. In subsequent years, I attended and presented updates regarding my research and results.

Trapping blocks are structured in such a way that each trapping block must have a president, vice-president, secretary and treasurer. Each trapping block must have an annual meeting to decide membership. Conservation officers are invited to attend so that

trappers can purchase their annual trappers licenses. Trappers concerns can be addressed at the annual meeting and motions that are carried will be taken to the NTA or the provincial government. The number of memberships varies in each area and is based on the number of trap-lines that have been established. Trap-lines that are established within each zone must be maintained by a family group. The area and knowledge of each trapper therefore is very specific and is based on established family trap-lines.

2.3 Study area

As previously stated there are major concerns about human activity and other large scale disturbances in the boreal forest. Using this information the selection of the study area became apparent. In areas surrounding La Ronge, there are two major disturbances. South of La Ronge Lake, there have been a large number of forestry operations, with Weyerhauser forming the largest Foresty Management Agreement (FMA). There are a few smaller FMA's held by small scale foresters such as the Zelinski brothers. Over the past 60 years, north of La Ronge, there have been several large scale forest fires.

The study area had been selected to include the Lac La Ronge Traditional Lands, which includes the communities of La Ronge, Hall Lake, Sucker River, Stanley Mission, Grandmother's Bay and Brabant (Figure 3). The area includes locations where forestry operations have occurred for more than 30 years (N-5 Pipestone and N-6 Little Hills). The study area also includes locations where there have been large scale forest fires (N-5 Pipestone, N-6 Little Hills, N-9 Stanley Mission, N-8 Churchill-Foster, N-7 Sucker River, N-78 Foster Lakes and N-79 Fisher River).

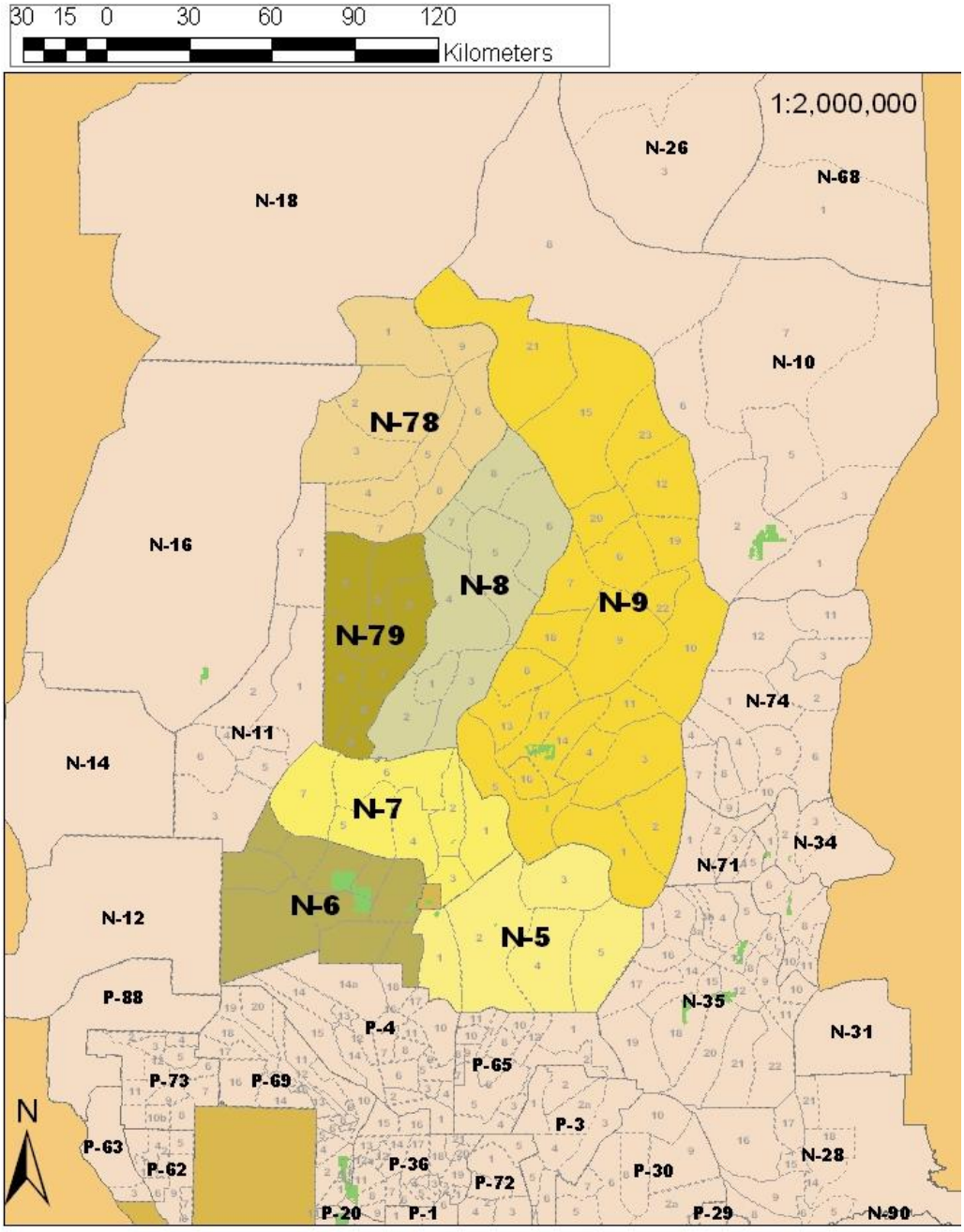

Figure 3 – Study area has been selected to include 7 fur conservation areas (N – 5, N – 6, N – 7, N – 8, N – 9, N – 78 and N – 79) and the boundary of the Lac La Ronge Indian Band traditional lands (locations of the Lac La Ronge reserves are the green polygons).

2.4 Participant selection

2.4.1 Report of the Royal Commission on Aboriginal Peoples

One of the most important documents regarding my research was by the Royal Commission on Aboriginal Peoples (RCAP) in 1996. The report was sponsored by Indian and Northern Affairs Canada (INAC), the federal government agency responsible for working with First Nations. The entire report looks at the history of First Nations people, from Time Immemorial. Appendix E: Ethical Guidelines for Research provides "guidelines or 'best practice'" based on several principles. As a result of this report, it is mandatory to have an understanding of the meaning of capturing knowledge consent of participants. With these guidelines, two major documents were drafted to ensure protection of participants and safeguarding the information: a Memorandum of Understanding (MOU) and consent forms.

2.4.2 Memorandum of Understanding

The consultation process led to collaboration with many different organizations, the Saskatchewan Government, the Federal Government and the University of Saskatchewan, as well as industry partners such as the Prince Albert Model Forest. Using RCAP guidelines I drafted a Memorandum of Understanding. The purpose of the MOU is to clarify which organization is completing the research, define guidelines for access to research results and clearly states which organization "owns" the data or knowledge (Appendix 2, Memorandum of Understanding). The idea of intellectual property will not be discussed in this thesis, but has bearing on the justification of a MOU.

2.4.3 Consent forms

As part of the requirements set out by RCAP, it is the duty of the researcher to gain consent of each participant (Appendix 2, Consent form). Due to the sensitive nature of completing an interview, the interviewee has rights and should be informed of those rights:

- No pressure to participate
- The ability to withdraw
- Confidentiality is maintained

Each participant is debriefed about the research, types of questions and significance of the research. At that time the participant is asked to sign the consent form and date it, in the presence of a witness.

2.4.4 Transcript release forms

As a part of the interview process it is pertinent to record the information in such a way to capture the thoughts, discussion and knowledge while avoiding misinterpretation. To do this I elected to record each interview (Sony digital recorder). In two cases I had access to a video-camera. As a result of this type of media, it was also necessary to ensure the participants signed a release form (Appendix 2, Transcript release form).

2.4.5 Selection of translators and effective training

Language is the fundamental way we communicate with the rest of the world. Effective communication between the researchers and each participant can only be done in the language of the participant. So the ideas, questions and conveying of information

must be done in Cree, English or a mixture of both languages. Language is complex and there is a definite link between the way a person communicates and the community that person originates. The language of the Cree people is defined by three basic characteristics, the dialect, the tempo, the accent and mannerisms.

In the study area we have defined the first language is Woodland Cree, which has a “th” dialect. So, for example, if they want to say “me” it translates to “nitha”. My first language is called Swampy Cree, which uses the “n” dialect, so I would say “nina”. There is a third dialect in the Plains Cree and they use the “y” dialect, translating “me” as “niya”.

In addition to the dialect differences, there are variations in the speed of the speaker. The Woodland Cree are well known to be the fastest Cree speakers. The Plains Cree have a medium tempo and Swampy Cree have a slow tempo. The last character of the language is the accent which is very difficult to describe, but has to do with the way that certain people in certain communities will prolong certain words/syllables in a sentence, especially apparent in the last words of the sentence.

The language characters are important to understand when selecting translators. The ideal translator is someone from the community. They are familiar with the dialect, accent and tempo. This will reduce the risk of miscommunication and potential loss of information. In some cases, it was not possible to have a trained translator from the community; in that case I had to rely on a summer student, fluent in Plains Cree.

2.4.6 Key informants

During the consultation process many people offered assistance or provided references to people who would be good translators or contacts with the communities. These contacts are referred to as key informants. The role of an informant was to provide translation, reference to elders or someone who can navigate. In some cases, an informant is also able to provide insight into aspects about social etiquette, community dynamics, and historical information. Without the help of a key informant, time and effective research is not possible.

2.5 Collection types

There are three general anthropological methods to collect knowledge. The first and least beneficial to our study is the questionnaire. With this format, a large number of questions are scaled and that can be mailed or completed over the telephone or in person. The questionnaires are specific and result in a binary answer; YES/NO or some type of scale such as AGREE/DISAGREE and so on. This was the least appropriate, since it does not allow the interviewee to elaborate or go into detail about the questions or topic.

2.5.1 Focus group

The first method employed in this study was the focus group, which is most effective as an exploratory approach. Focus groups work well in cases where very little known about the subject (Ervin 2000). A focus group is designed to have 3 – 6 participants (Kruger 1994; Grenier 1998; Ervin 2000). If there are more participants, the

group dynamics change, and information can be overlooked (Grenier 1998). Translators and transcripts may become hard to manage.

The benefits of small focus groups are that the resulting discussions allow participants to exchange information, corroborate or correlate answers. Comments from one participant may trigger memories and discussion from others in the group (Ervin, personal communication, 2005). In a focus group, members are deliberate in the information they discuss, which provides reliability of the information and reduces the amount of deception, extrapolation, and accuracy of the information (Grenier 1998).

2.5.2 Interviews

The second method used was the interview. The interview is effective with very knowledgeable participants, but has drawbacks (Grenier 1998). Interviews were conducted at the elders' house, and were less formal. Elders often have a lack of mobility and they simply can not attend meetings due to physical disabilities or have no transportation. Their health and safety is a major concern. To ensure elder participation, home-visits were arranged. When doing home visits it is important to realize the research is often conducted in a less controlled manner. There may be other people present and they are invited to participate in the discussion. These can include the spouses, children and other family members within the household. There can be unexpected visitors that stop by the household while the interview is in progress. There may also be background distractions and family dynamics that affect communication and dialogue.

2.5.3 Lines of questioning

The format of the focus groups and the in-home interviews were the same (Appendix 2, Agenda). A "line of questioning" or framework was developed based on the objectives of the research (Miles and Huberman, 1994). A "line of questioning" is to be as broad as possible; this is beneficial for two reasons. The interviewer is allowed to explore further the knowledge of the interviewee. The interviewee is allowed the freedom to direct the conversation and elaborate on local and traditional knowledge they are most familiar with. As the discussion progresses, it is pertinent for the interviewer to guide the line of questions to allow thorough exploration of knowledge and increase the flow of information.

2.5.4 Themes

Based on the objectives of this study, the lines of questioning resulted in a flow of information that can be categorized into the following themes:

1. Locations and ranges of woodland caribou (see mapping exercise)
2. Abundance of woodland caribou
3. Life-cycles and ecology
4. Predator-prey interactions
5. Human activity on the landscape and effects on woodland caribou
6. Weather

Based on the experience of each participant, certain areas were covered more thoroughly and other areas uncovered no relevant information. This method is a mixture of anthropological methods which include the semi-structured interview and local histories (Grenier 1998)

2.5.5 Mapping exercise

During interviews and focus groups, it is sometimes difficult to describe processes such as location or range of woodland caribou in words. Often people have to convey the physical dimensions of woodland caribou range. In order to convey the knowledge accurately people need to refer to maps, or participatory mapping (Grenier 1998); however it was necessary to record those physical dimensions, by using over-head transparencies and permanent markers. Each over-head transparency was labeled with the date and participant ID.

2.6 Transformation of data and archiving

After the interviews and focus group meetings the recordings were filed and downloaded to a computer program called Digital Voice Editor 2. Each file was saved according to the Participant ID and date. Each interview or focus group had one file created, which transformed the audio file to the written language in two stages. The first is the transcription of the English portions and second was the transcription and translation of the Cree portions. This was the first step in transforming the interviews and focus groups into "data" in the form of local knowledge.

2.6.1 Transcription

In order to analyze the knowledge within each interview or focus group, a file was created in the format of a word document transcription. The transcriptions were done in two parts; first the audio files were manually converted to a word document by transcribing English portions. Word documents were formatted to include: Participant ID,

date, length of interview. The files were formatted in order to maximize efficiency; each comment was tagged with a time (min:sec) and participant ID. This would help to locate specific comments in the audio file where potential problems arose, such as unclear comments or if a translator was to find specific locations for Cree portions.

2.6.2 Translation

In many interviews and focus groups sessions, there was a mixture of Cree and English. Each Cree comment was transcribed in English, with a time and participant ID. The written Cree language at this time does not have a standardized format that is accepted by all Cree users. The written format for transcription used is called Roman Orthography, and it uses the English spelling system to transcribe phonetically (Burnouf 2008). Roman Orthography uses the English language, so the Cree words are spelled using the English alphabet.

2.7 Isolating data from each file

Once all files were created (i.e. transcriptions and translations) there were hundreds of pages of "raw data". The next step was to manually go through each interview and isolate information based on specific themes. This type of analysis is similar to accepted qualitative approaches also called "clustering" (Miles and Huberman 1994). The information was kept in the words of the speaker, which reduced the chance of misinterpretation, loss of accuracy or intention by the speaker. It was also important to isolate other pertinent information regarding the comment, such as time of year and location.

2.7.1 Tables

The isolated LK was formatted to fit in a table (see Appendix 1). Based on the knowledge that was isolated, there are different applicable headings. If local knowledge was indicated in separate interviews it is also reported, i.e. the number of times woodland caribou have been identified at a particular location has been stated in 4 separate interviews, it may reflect on the importance and significance of this location.

2.7.2 Mapping locations

Two types of information were converted into a Geographic Information System (GIS) and displayed in a map. The first was a point location map using lake locations, where participant had indicated a woodland caribou observation (Appendix 1). In many cases, these locations were stated by a participant without further details. The local knowledge may have included a woodland caribou sighting with no year or abundance value.

The second map type was created using the mapping exercise data (over-heads created by participants during an interview or focus group). The information from each overhead was transformed into ArcView GIS 3.2 as a polygon. In some cases, additional information was provided for each polygon, but not included, i.e. time of year woodland caribou are observed in this location. Some polygons were wintering areas, some were calf sightings and some indicated patterns of caribou movement and the years they were observed. The local knowledge and observations provided by the interviewee was modeled using GIS, however, due to the sensitive nature of the information, not all details were included.

2.8 Updating participants

Correspondence was used to update the participants about the status of my research project. The correspondence contained several documents including copies of the transcribed files and the maps (ArcView GIS polygons). Participants, who provided data during the mapping exercises, were given an opportunity to review the maps and verify the information was correct. Ongoing communication is important, and helps reduce inaccuracy. During these updates, all participants received copies of their consent forms and transcription release forms. I also provided letters to give them an idea of how long it would take for the project to be completed. My contact information had changed three times from initiation to completion of my project, so providing participants with accurate contact information was also imperative.

3. Results

3.1 Interviews

A total of 44 participants were interviewed. There were two types of interview formats: in-home interviews (IH's) and focus groups (FG's).

A total of 18 IH were completed between February 2006 and August 2006 (Appendix 1, Table 1). Thirteen of 18 IH had a single participant. Five of 18 IH had two participants. In cases where there were two participants, either the wife or a child played a secondary role in the interview, confirming dates and woodland caribou sightings provided by the primary interviewee. Translators were present during the IH's allowing the interviewee to speak in their first language, woodland Cree.

There were 5 focus groups (FG's) conducted in March 2006 (Appendix 1, Table 2). FG 1 and FG 2 were conducted on the Lac La Ronge Indian Reserve at Kitsaki Hall. There were three participants in FG 1 and five participants in FG 2. FG 3 was conducted in Stanley Mission at the Band Office and there were five participants. There were three participants in FG 4, conducted in Sucker River at the Band Hall. There were five participants in FG 5, conducted on the Lac La Ronge Indian Reserve at Kitsaki Hall. All FG's had a translator present except in one case. There was no translator available at FG 4, in Sucker River. The FG 4 was recorded and translated at a later date.

3.2 General woodland caribou sightings

General woodland caribou locations were mentioned during interviews with reference to lakes, rivers and creeks, roads, and highways. At these locations, the

interviewee did not indicate any special woodland caribou activity, so the locations are classified as general sightings.

A total of 62 lakes were identified with at least one woodland caribou sighting (Appendix 1, Table 3). Certain lakes were identified more than once, as general woodland caribou sightings, during independant interviews (Figure 4). Morning Lake was named on four separate occasions, so it has the highest rank (R = 4). Besnard Lake, Lac La Ronge, Nemeiben Lake and Macoun Lake were named on three separate occasions (R = 3). Big Island Lake, Clam Lake, Cree Lake, Egg Lake, Foster Lake, Hickson Lake, High Rock Lake, Hives Lake, Hunter's Bay, Peter Lake and Trade Lake had been named twice (R = 2). All other lakes were named once (R = 1).

A total of 15 rivers and creeks were identified in reference to general woodland caribou observations (Appendix 1, Table 4). Churchill River was identified in two different interviews (R = 2). All other rivers and creeks were identified in one interview (R = 1).

A total of 15 locations were identified as locations were woodland caribou were observed either crossing the roads or highways or as tracks (Appendix 1, Table 5). Pinehouse junction was identified in two different interviews (R=2). All other locations were indentified once (R=1).

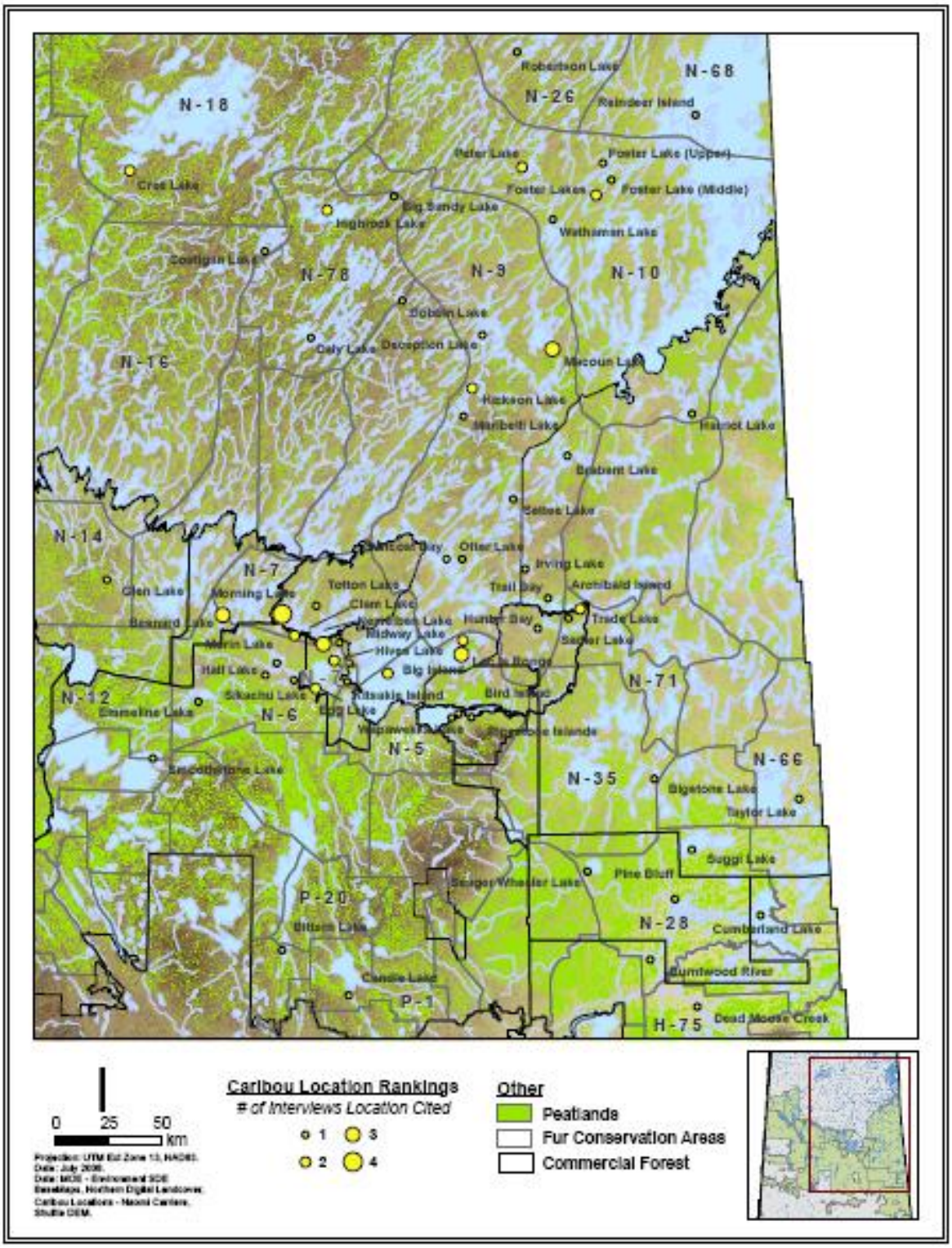

Figure 4 – Lakes identified as general woodland caribou sightings. The ranking system is based on the number of times the lake had been identified in separate interviews. The lakes range in rank (R) from 1 to 4. Woodland caribou locations with Rank 1 occurred (n = 46), Rank 2 occurred (n = 11), Rank 3 occurred (n = 4), and Rank 4 occurred (n = 1).

3.3 Woodland caribou activity and locations

The following locations were identified as locations where woodland caribou activities are known. The activities include calving areas, wintering areas, and corridors. A total of 11 locations were indicated as woodland caribou calving areas (Appendix 1, Table 6). Nemeiben Lake and Wapawekka Lake were identified in two successive interviews (R = 2). All other locations were named once (R = 1). A total of 3 locations were indicated as woodland caribou over-winter areas (Appendix 1, Table 7). All woodland caribou wintering area were named in one interview. A total of 9 locations were identified as woodland caribou corridors (Appendix 1, Table 8). All woodland caribou corridors were identified in one interview.

3.4 Woodland caribou ranges and sightings through mapping exercises

The mapping exercises resulted in 38 woodland caribou ranges and sightings (Figure 5). Two types of polygons were indentified by interviewees. Thirty-six polygons are represented by white/purple cross hatching and indicate general woodland caribou herd ranges or sightings. The transparency of each polygon allows more than one polygon to be visible in the same area. This approach allows the recording of representative locations that were indentified as woodland caribou ranges or sightings more than once. Two polygons are represented in solid green and indicate woodland caribou calving grounds (Figure 5). Calving grounds were identified at Morning Lake and Wapawekka Lake.

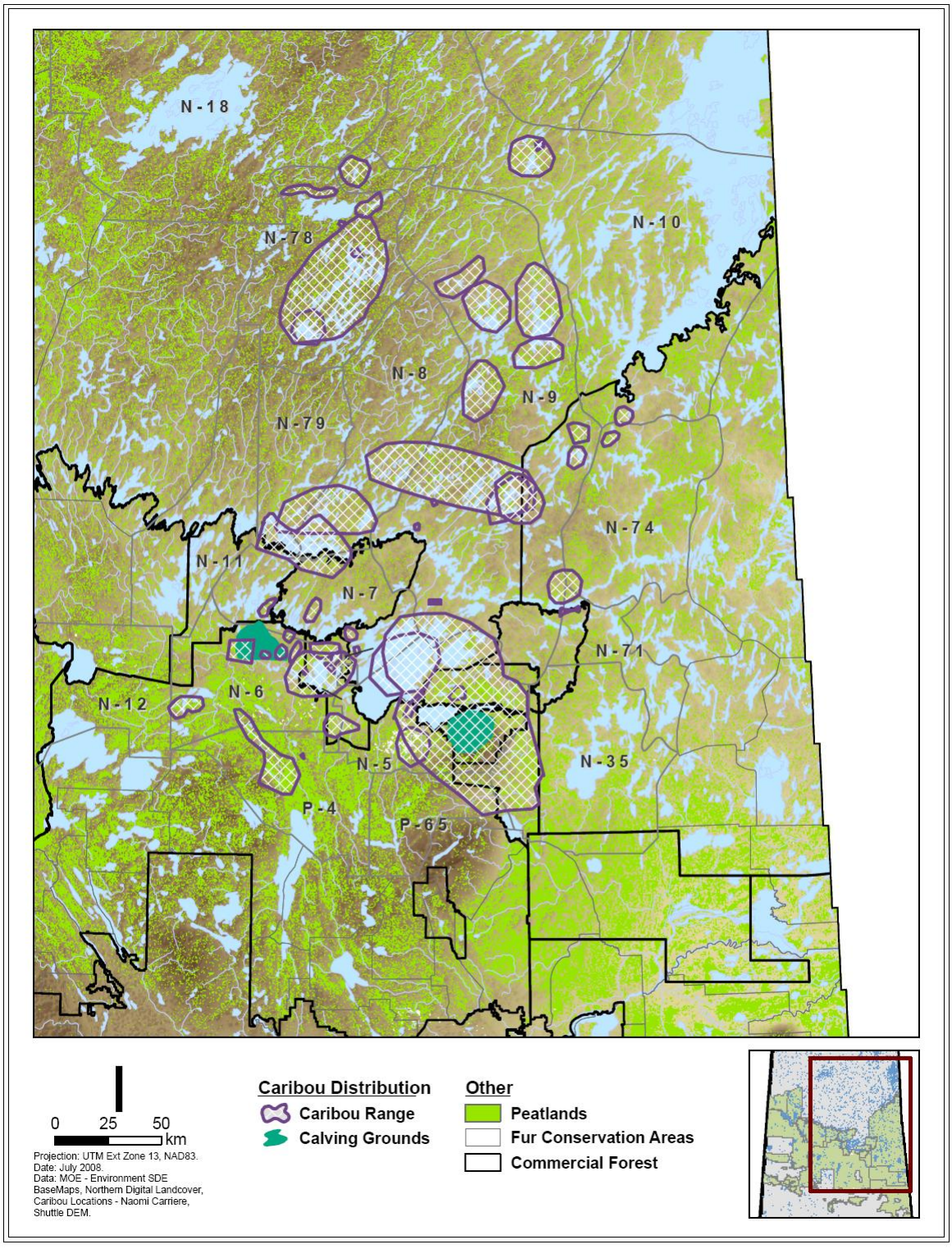

Figure 5 – Woodland caribou ranges, sightings and calving areas. Woodland caribou ranges and sightings have a white polygon with purple cross hatching (n = 36). Woodland caribou calving grounds have a solid green polygon (n = 2).

3.5 Woodland caribou abundance

Three woodland caribou distributions maps were generated through FG's and IH's, where the interviewee was able to describe location, abundance and give an approximate year for the sighting (Appendix 1, Tables 9 – 11). In cases where a woodland caribou abundance was given as a range (minimum-maximum numbers in the herd), the average number was used for the flags in Figures 6 – 8. It should be understood that the maps that were generated do not include all caribou sightings, only those that could be quantified.

3.5.1 Woodland caribou abundance, prior to 1975

A total of ten woodland caribou herds were identified with location and abundance (Figure 6), using LK from Table 9 prior to 1975 (Appendix 1). The woodland caribou herds were identified at Robertson and Settee Lake area and Hunter Bay area (N = 2, 26 – 35 caribou), Cumberland Lake and Morning Lake (N = 2, 16 – 25 caribou), Morning Lake (N = 1, 11 – 15 caribou), Nemeiben Lake and Wapawekka Lake (N = 3, 6 – 10 caribou), and Rabbit Lake and Foster Lake (N = 2, 1 – 2 caribou).

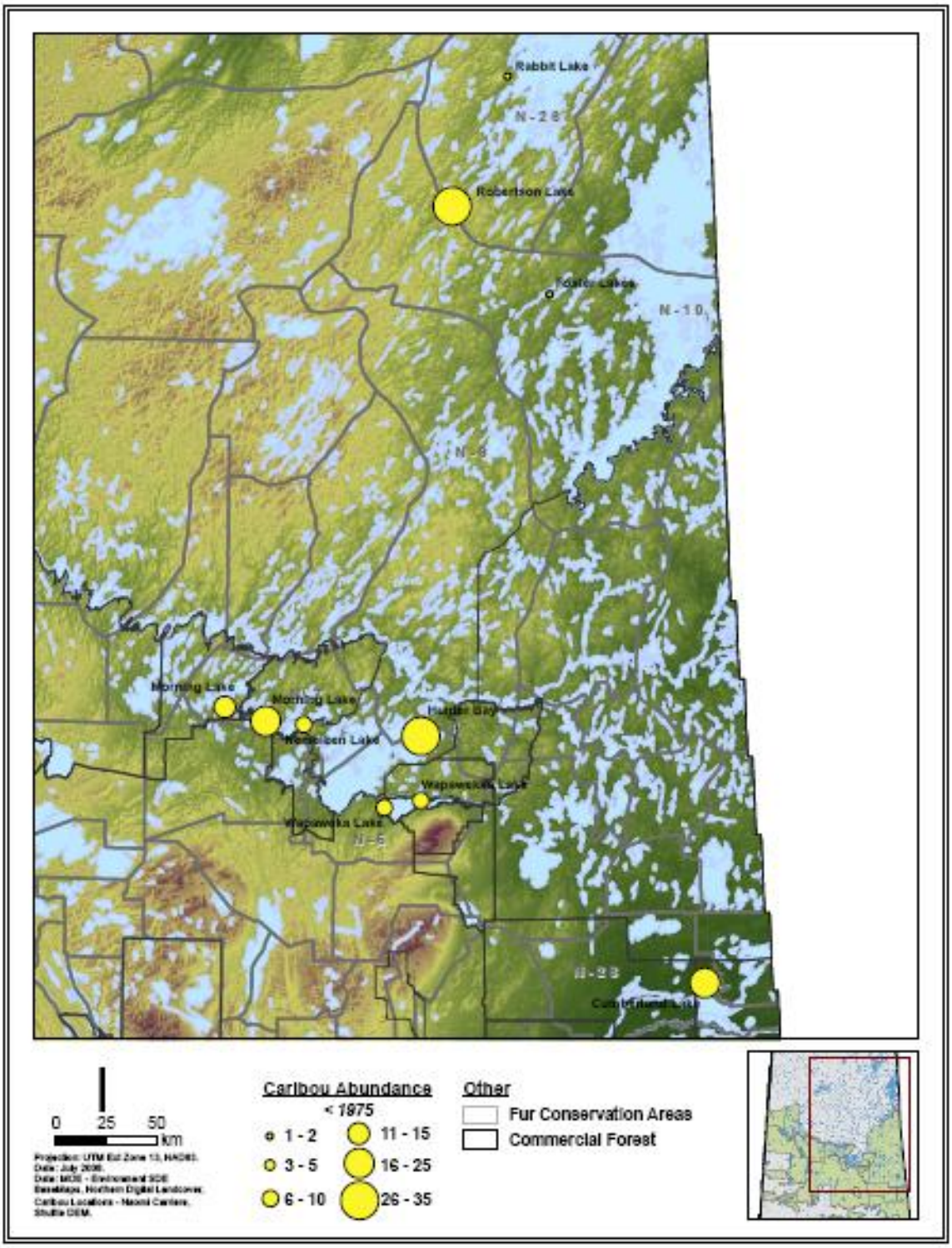

Figure 6 – Woodland caribou herd locations and abundance prior to 1975. Woodland caribou herd abundance from Table 9 (Appendix 1), corresponds to circle size. There are 2 caribou herds with 26 - 35, 2 caribou herds with 16 - 25, 1 caribou herd with 11 - 15, 3 caribou herds with 3 – 5, and 2 caribou herds with 1 – 2.

3.5.2 Woodland caribou abundance, between 1975 and 2001

A total of eighteen woodland caribou herds were identified with location and approximate size of the herd (Figure 7), based on sightings between 1975 and 2001 (Appendix 1, Table 10). Herds were identified at the following locations, 1 caribou herd at Big Sandy Lake with 26 – 35 (not included in the map, due to insufficient GIS data), 3 caribou herds at Irving Lake, Lac La Ronge, and Suggi Lake with 16 – 25, 3 caribou herds at Highways Camp, North of La Ronge, and Hunt Lake with 11 – 15, 3 herds at Key Lake Mine, Brabant Lake and Sikachu Lake with 6 – 10 caribou (orange), 4 caribou herds at Highrock Lake, Pine Bluff, Dobbin Lake and Foster Lakes with 3 – 5, and 4 caribou herds at Deadmoose Creek, Wapawekka Lake, Shadd Lake and Points North with 1 – 2.

3.5.3 Woodland caribou abundance, between 2001 and 2006

A total of twenty-seven woodland caribou herds were identified with location and abundance (Figure 8), using LK from Table 11 (Appendix 1) between 2001 and 2006. Woodland caribou locations are as follows, 1 caribou herd at Pasfield Lake with 26 – 35, 2 caribou herds at English and Wadin Bay area and Weyakwin and Montreal Lake area with 16 – 25, 3 caribou herds at Peter Lake and Reindeer Lake with 11 – 15, 7 caribou herds at Macoun Lake, Hickson Lake, Maribelli Lake, Besnard Lake, Highways Camp, Totten Lake and Nemeiben Lake with 6 – 10, 6 herds at Waterbury Lake, Besnard Lake, Sikachu Lake Road, Highways Camp, La Ronge and Trail Bay with 3 – 5 caribou (yellow), and 8 caribou herds at Lamp (or Lampin) Lake, Costigan Lake, Kettle Falls, Irving Lake, Morning Lake, Nemeiben, Lac La Ronge, Reilander Creek with 1 – 2.

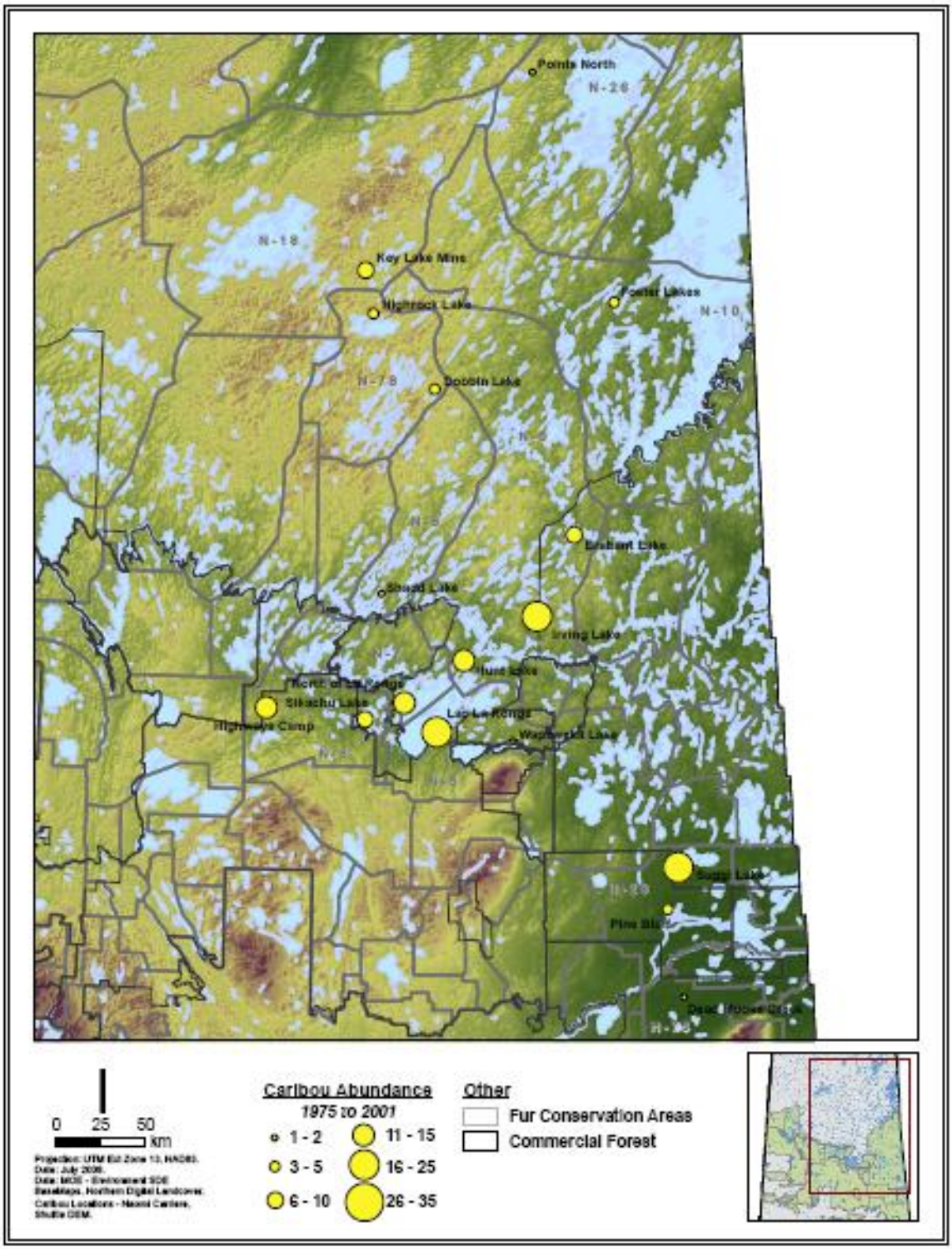

Figure 7 – Woodland caribou herd locations and abundance between 1975 and 2001. Woodland caribou herd abundance from Table 10 (Appendix 1) corresponds to circle size. 1 caribou herd with 26 – 35, 3 caribou herds with 16 – 25, 3 caribou herds with 11 – 15, 3 caribou herds with 6 – 10, 4 caribou herds with 3 – 5, and 4 caribou herds 1 – 2.

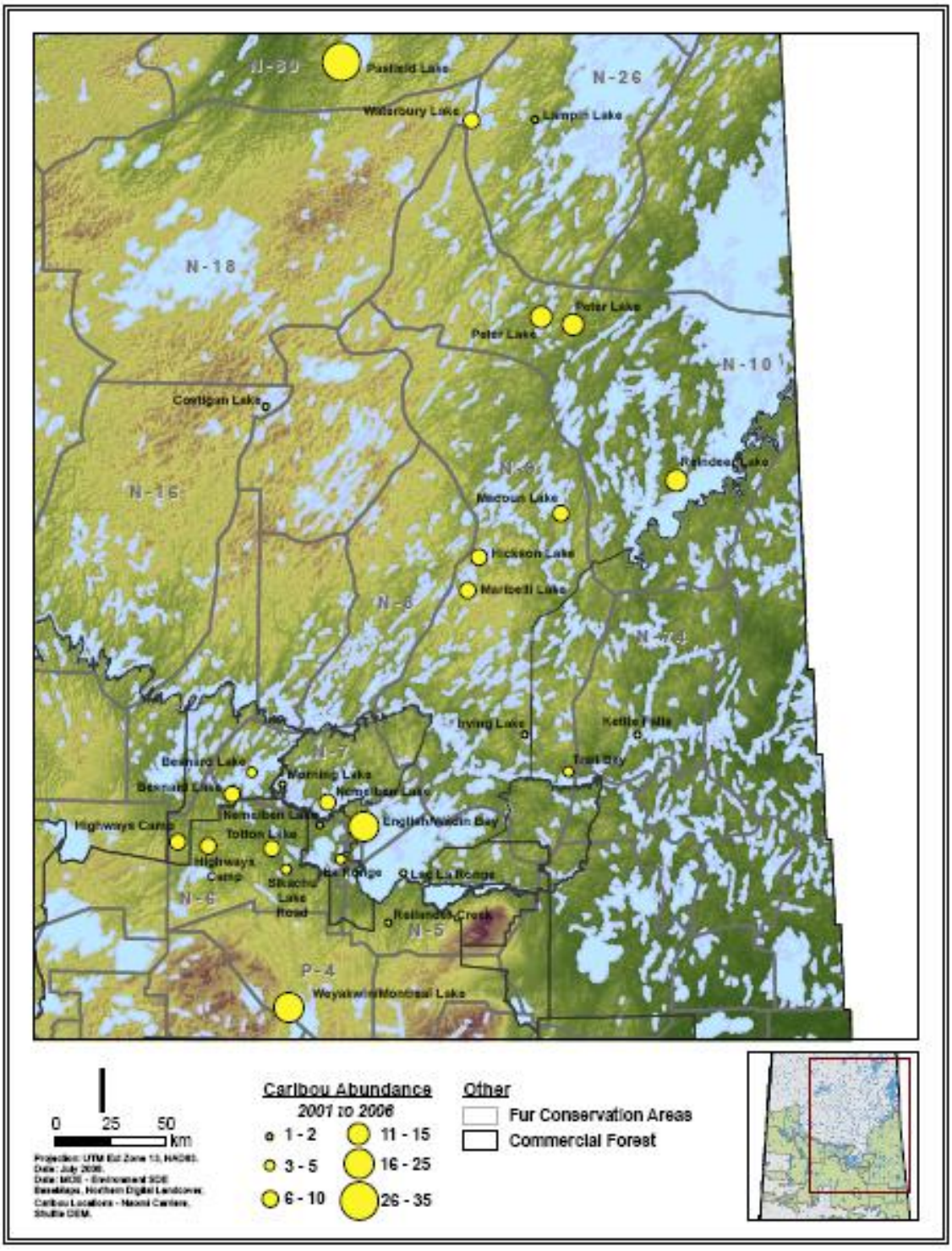

Figure 8 – Woodland caribou herd locations and abundance between 2001 and 2006. Woodland caribou herd abundance from Table 11 (Appendix 1), corresponds to circle size. The locations of the woodland caribou and abundance include 1 caribou herd with 26 – 35, 2 caribou herds with 16 – 25, 3 caribou herds with 11 – 15, 7 caribou herds with 6 – 10, 6 caribou herds with 3 – 5, and 8 caribou herds with 1 – 2.

3.6 Woodland caribou life stages and ecology

There were six categories that fell under woodland caribou life stages and ecology. Woodland caribou health, movements and migration, food and food quality, calves and calving grounds, habitat, and population trends (Appendix 1 – Tables 12 – 17).

3.6.1 Woodland caribou health

Twenty-seven LK descriptions were made with regard to woodland caribou health (Appendix 1, Table 12). Four types of LK were identified with regard to woodland caribou health; parasitic worms (n = 7), ticks (n = 3), poison (n = 3), and lumps/growths (n = 2). Other LK identified includes woodland caribou observed in good health (n = 8) and woodland caribou in poor health (n = 1).

3.6.2 Woodland caribou movements

Two types of LK were described with regard to woodland caribou movements. Seasonal woodland caribou movements, these include woodland caribou migration routes and corridors (Appendix 1, Table 13a). Diurnal woodland caribou movements or woodland caribou movements, these include local knowledge where no seasonal information was given (Appendix 1, Table 13b).

Local knowledge descriptions with regard to woodland caribou routes and corridors were identified through the interviews (Appendix 1, Table 13a). These routes are classified as winter migration routes (n = 7), spring migration routes (n = 2), fall

migration route (n = 1), spring-winter migration routes (n = 2) and spring-fall migrations routes (n = 1).

Local knowledge descriptions with regard to woodland caribou diurnal movements were identified through the interviews (Appendix 1, Table 13b). The diurnal movements were separated into two sub categories. Normal patterns in woodland caribou behaviour were diurnal patterns that have been identified consistently year after year by the interviewee (n = 16). Certain woodland caribou diurnal patterns seem to be changing so those were classified as changing behaviour (n = 10).

3.6.3 Woodland caribou food and food quality

Local knowledge descriptions were made with regard to woodland caribou food and food quality (Appendix 1, Table 14). Three food sources were indicated for woodland caribou and include the following: moss and lichens (n = 6), muskeg run-off (n = 3), brush (n = 1), low quality (n = 7), and high quality food (n = 1).

3.6.4 Woodland caribou calf biology and calving grounds

Local knowledge descriptions were made with regard to woodland caribou calf biology and calving grounds (Appendix 1, Table 15). These description include the physical area woodland caribou use as calving grounds (n = 6), predator avoidance (n = 6), number of offspring (n = 2), and respect for animals during the calving season (n = 1).

3.6.5 Woodland caribou habitat and quality

Local knowledge descriptions were made with regard to woodland caribou high

quality habitat (HQ) and low quality habitat (LQ) (Appendix 1, Table 16). High quality habitat included jackpine stands (n = 3), muskeg (n = 3) and small lakes (n = 1). Low quality habitat included disturbed areas (n = 3) and rocky low muskeg (n = 1).

3.6.6 Woodland caribou population trends

Local knowledge descriptions were made with regard to woodland caribou population trends (Appendix 1, Table 17). Population trends included extirpated (n = 5), declining (n = 3), recovering (n = 3), and comparative pre-logging and post-logging woodland caribou abundance (n = 1).

3.7 Predator and prey interactions

3.7.1 Wolves

Forty-nine LK descriptions were made with regard to wolf predations, and general wolf biology (Appendix 1, Table 18). Local knowledge of wolf interactions with woodland caribou included general descriptions (n = 13), woodland caribou-kill sites (n = 2) and people who have never observed a woodland caribou kill site (n = 2). Wolf interactions with other ungulates include barren-ground caribou (*Rangifer tarandus groenlandicus*) (n = 2), moose (*Alces alces*) (n = 10) and white tailed deer (*Odocoileus virginianus*) (n = 5). Local knowledge descriptions made with regard to general wolf biology, included pack size, population trends and migration routes (n = 15).

3.7.2 Other predators

Four additional predator species were identified through the interviews. These included black bear (*Ursus americanus*), cougar (*Puma concolor*), wolverine (*Gulo Gulo*) and Canada lynx (*Lynx canadensis*) (Appendix 1, Table 19). Black bear, cougar, and wolverine were identified as a species that prey on woodland caribou (n = 6). Black bear, cougar and Canada lynx were identified as species that prey on moose (n = 4). General comments with regard to black bear, cougar and Canada lynx were also identified (n = 9).

3.7.3 Prey species

Local knowledge of other ungulate prey species was also identified through the interviews (Appendix 1, Table 20). General biology regarding diseases, locations, and behavior for ungulate species included moose (n = 9), barren-ground caribou (n = 6) and white tailed deer (n = 1).

3.8 Human activity

3.8.1 Logging activity, road development and expansion, and access

Certain human activities were described as having a negative effect on woodland caribou (Appendix 1, Table 21). Activities included road development, tourism, logging activity, snow mobile traffic, which were thought to cause changes in woodland caribou migration (n = 8), increase human access and traffic into woodland caribou habitat (n = 8), influence food abundance or quality (n = 3), decrease woodland caribou populations (n = 3), and impact woodland caribou calving or mating (n = 2).

Forestry and logging activities were identified as one major type of disturbance that have impacted woodland caribou within the study area. Two maps were generated

using LK of woodland caribou locations identified in Table 3 (Appendix 1), and LK of woodland caribou ranges and calving grounds identified in Figure 5. The maps incorporate LK of woodland caribou to identify distribution in relation to disturbed and undisturbed habitat types (Figure 9 & 10). Due to lack of data for small lakes and islands in the study area, some locations were not identified through GIS queries. Figure 9 overlays woodland caribou locations in relation to cutblock and commercial forest data, and road development. Figure 10 overlays woodland caribou ranges and calving areas in relation to cutblock and commercial forest data and peatlands.

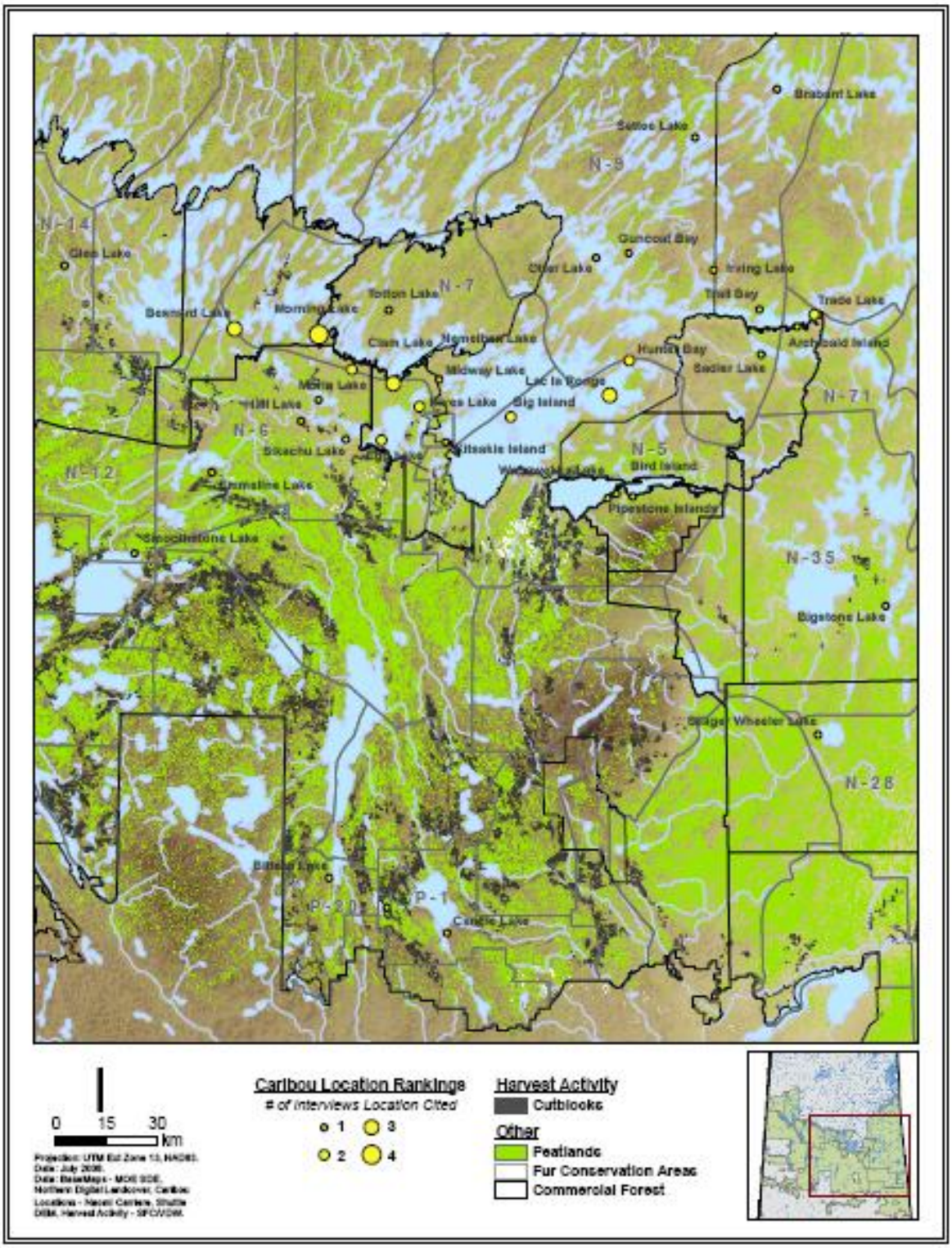

Figure 9 – Woodland caribou locations (Appendix 1, Table 3), in relation to location of cutblocks (dark grey), commercial forest (outlined in black) and provincial forest (green). Thirty seven locations were flagged based on the number of times woodland caribou locations were indicated in separate interviews (R). Rank 4 (n = 1), Rank 3 (n = 3), Rank 2 (n = 6) and Rank 1 (n = 27).

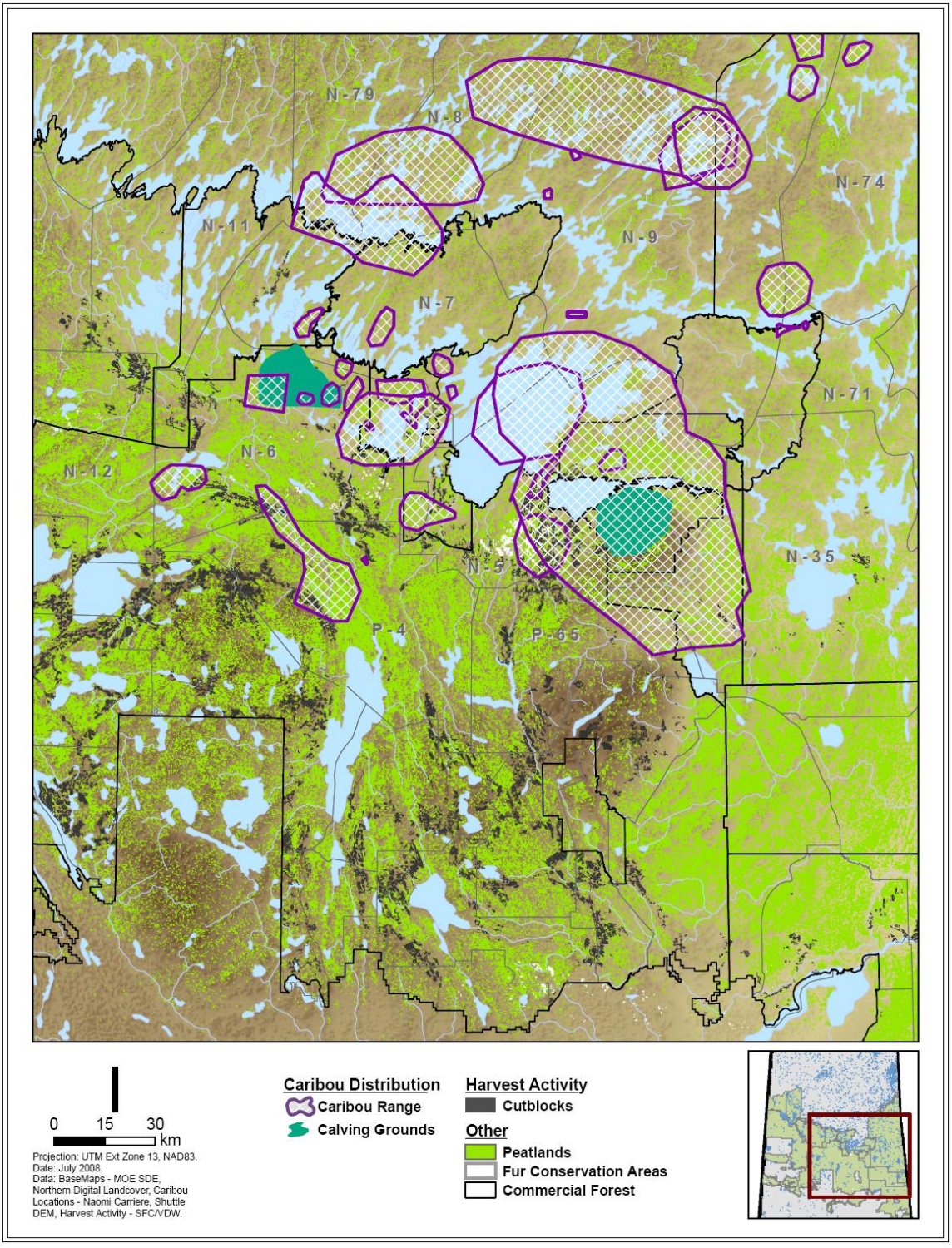

Figure 10 – Woodland caribou ranges and calving grounds (Figure 5), in relation to cutblocks are the dark grey polygons, peatlands are the lime green polygons, and commercial forest are outlined in black. Woodland caribou ranges are outlined in purple and have white cross hatching (n = 36) and calving grounds are the dark green polygons (n = 2).

3.8.2 Mining and exploration

Industry, mining and exploration may impact woodland caribou in three ways as identified through the interviews (Appendix 1, Table 22). The effects of this type of human activity on woodland caribou included disease or pollution (n = 3), forced migration of woodland caribou out of their normal range (n = 1), and potential for poaching (n = 1).

3.8.3 Hunting

Four types of concerns were identified when discussing LK of historical licensed hunting and subsistence hunting, both historical and current (Appendix 1, Table 23). Concerns included ethical concerns about hunting relative to historic licenses and current subsistence hunts (n = 7), conservation with regard to historic subsistence hunts (n = 4), and cultural loss as a result of dwindling woodland caribou populations (n = 4). Two other types of concerns were identified as way to explain the loss of woodland caribou. These concerns included predators (n = 2) and natural cycles and fluctuations (n = 1).

3.9 Climate

Through the interviews, LK of the importance of water and precipitation was identified (Appendix 1, Table 24). The types of LK related to water quality and water level (n = 6), woodland caribou diet (n = 3), insects (n = 3), and predators (n = 2).

Three types of weather were identified, and the possible effects on woodland caribou and other ungulates were discussed (Appendix 1, Table 25). In cases where the winters were warm, this could result in woodland caribou death due to increased insects

and a lack of food (n = 3). When the winters are cold, the woodland caribou can survive (n = 1). When there is lots of wind, woodland caribou might be affected by predators (n = 1).

Fire and spruce budworm LK was identified through the interviews and focus groups (Appendix 1, Table 26). Local knowledge of forest fires included, fires and spruce budworm that occurred within the last ten years (n = 8), fires that occurred ten to twenty years ago (n = 1), fires that occurred twenty to thirty years ago (n = 3), and fire that occurred fifty to sixty years ago (n = 2). Two maps were generated to assess correlations between forest fires and woodland caribou locations (Figures 11 & 12), using LK of woodland caribou locations (Table 3) and the woodland caribou ranges and calving sites (Figure 5).

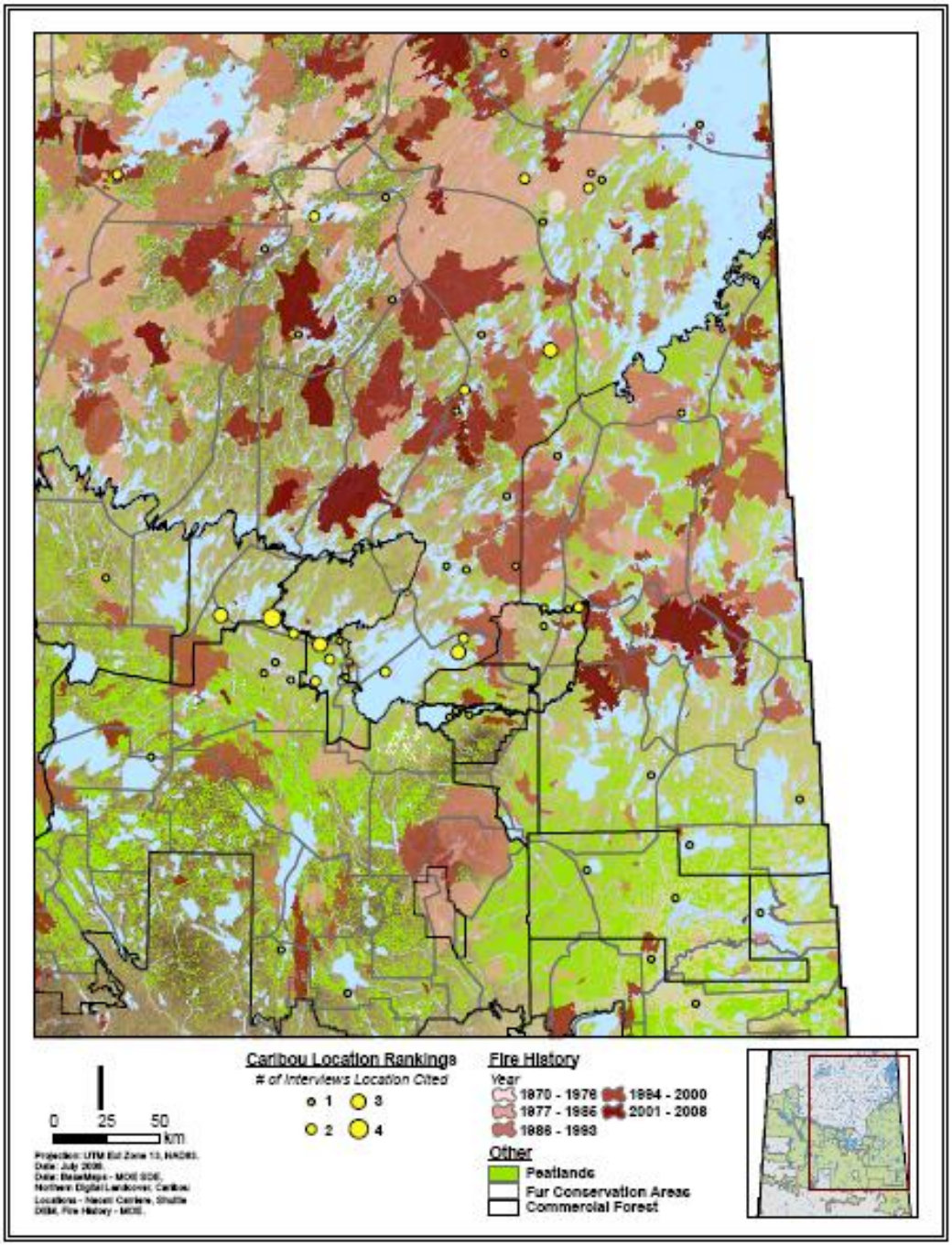

Figure 11 – Local knowledge of woodland caribou locations (Table 3) and the location of forest fires in the study area. The forest fires are separated based on the year, five classes are used. Woodland caribou locations based on the number of times indicated in separate interviews, Rank 4 (n = 1), Rank 3 (n = 4), Rank 2 (n = 6) and Rank 1 (n = 40).

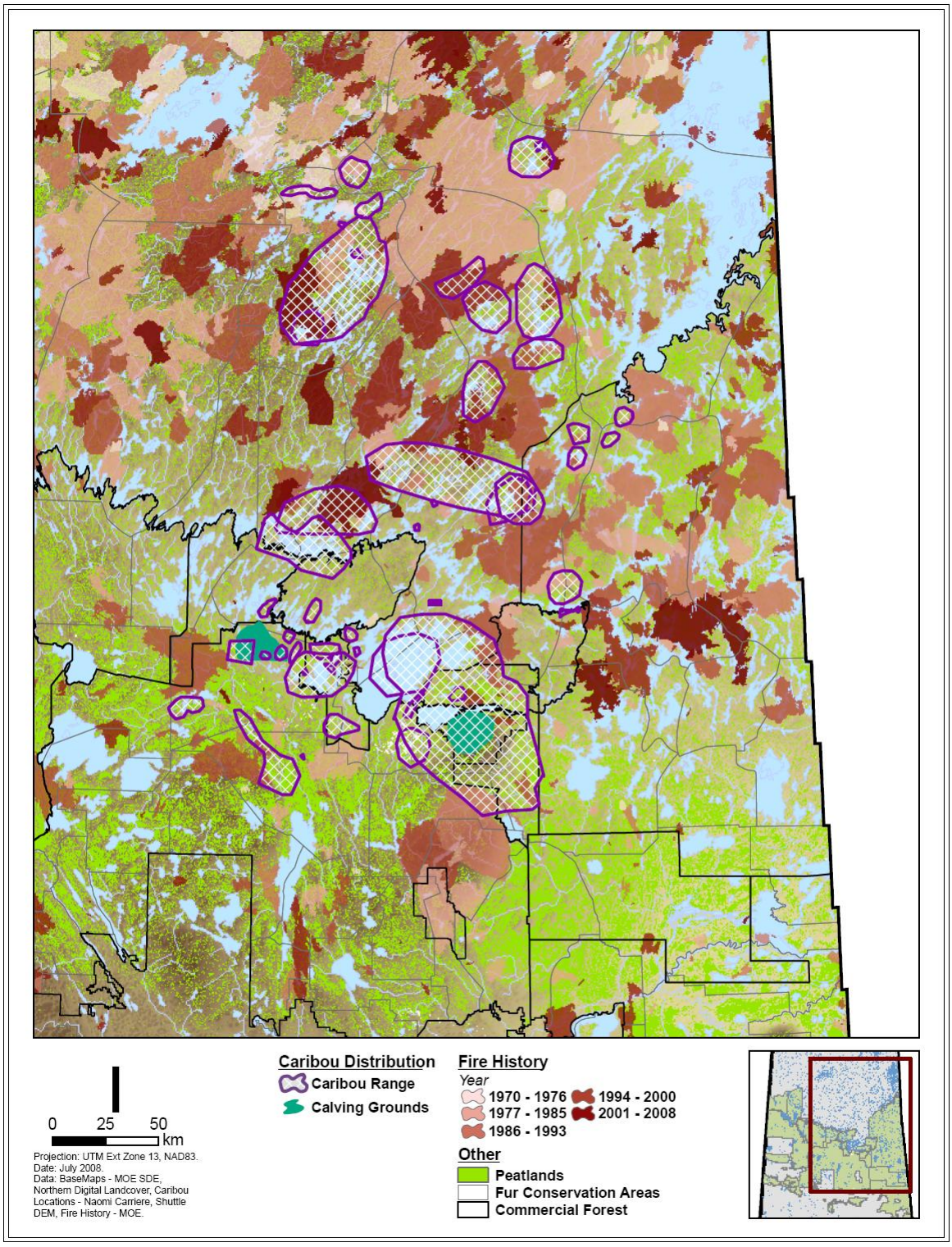

Figure 12 – Local knowledge of woodland caribou ranges and calving locations (Figure 5) and the location of forest fires in the study area. The forest fires are separated based on the year of fire, five classes are used. Woodland caribou ranges are outlined in purple and have white cross hatching (n = 36) and woodland caribou sights have a green polygon (n = 2).

4. DISCUSSION

4.1 Summary of participants

There were similar numbers of participants for the in-home interviews (n = 23, Appendix 1, Table 1) and the focus groups (n = 21, Appendix 1, Table 2). The format of the methods allowed a number of variations in analysis. Each variation would result in the emphasis at two different levels: the method level (focus group and interview) and the participant level.

4.1.1 Variations in analysis

Qualitative methods allow a wide array of analysis (Miles and Huberman 1994). Many variations in analysis and reporting could be applied to qualitative research and I would like to clarify my results and reporting. First I could separate the information based on the method of collection. The results could be summarized under separate headings and effectiveness of each method could be determined, based on the amount of local knowledge collected. As I assumed that each method had benefits and drawbacks, this type of analysis was not necessary.

The second variation in analysis would involve the in-home interview local knowledge and compiling it with the focus group local knowledge. There is one drawback to this methodology. It becomes apparent when recording a comment such as woodland caribou location or other information reported in a focus group. If there are five people present in a focus group and all five people agree with a comment, the observation only counted as one, because it may be hard to determine all those in agreement (some agreement is suggested through body language or gestures not recorded

in the audio files). So, unless the methods take this uncertainty into account by verbally suggesting consensus during the focus group, there is no way to determine which comments truly had consensus. Consensus would indicate that if there is a statement proposed by one of the participants, all of the members of the focus group are in agreement with that particular statement. So in future analyses it could be important to denote statements that have consensus, during the focus group session. Consensus could have implications in map symbols and columns in the result tables, increasing accuracy and reliability of the comment. The use of a focus group promotes reliability of the information, by implying consensus is reached, if participants do not disagree with a statement. When a disagreement is determined, the information is negotiated and discussions lead to consensus. For example, when a participant promotes a statement regarding an event such as a major fire, but is not sure when it happened. The participant may state they can't recall the exact year, which leads the group to a discussion and ultimately the group reaches some type of consensus on the date of that event.

The idea of participants reaching consensus is highly significant but like all methods has certain drawbacks. If a group reaches consensus, it increases accuracy or reliability of the information. The drawback to getting consensus is that not all participants in a focus group session will have knowledge on the comment. So returning to our example, if we have five participants in the focus groups and three discuss and arrive at consensus, there is a significant result as they have relevant experience on the topic. By getting the other two participants to provide consensus is irrelevant and it may add error or inflate the importance.

The third variation in analysis would be to analyze data at the participant level. Each participant would be analyzed and counted as one regardless if they participated in an interview or a focus group. Each participant's comment counts as one and this would provide the true estimate of how many times a comment was made or the "true count", (as opposed to "rank", which was used in the results). "True count" would be appropriate in scenarios where consultation and rigor are important, which is highly significant when working with quantitative data. To determine the true rank of each comment requires additional analysis of the data. When creating files, it would be necessary to isolate from each focus group what comments were made by each participant. It would increase the difficulty of analysis, as most conversations would have a certain group dynamic and direction. In many cases, the participants may give verbal agreement or simply provide a gesture to indicate they agree with the comment. This cannot be assessed at a later time, unless each meeting is video taped. Since we are considering the results exploratory and qualitative, true count is not necessary.

Focus groups are exploratory in nature and have increased potential for revealing information. If true count is an objective then there is potential drawbacks to using focus groups. First, the interviewer will be expected to explore ideas and discussion, increasing the number and variety of comments. In addition, the analysis would not be standardized between focus groups, as group dynamics are always different based on a number of factors: dominance of individuals, time of day, men and women, community relationships, etc.

Compare this context to one-on-one interviews where the interviewer is in control of the conversation, leading to more defined outcomes. In this case, the

interviewer has an opportunity to standardize a line of questions. The analysis of the data based on the line of questions would be simplified, because there is only one participant per interview.

In summary, I can conclude that focus groups and in-home interviews can potentially be used for two different research purposes. The focus groups can be used in an exploratory way or to identify consensus of information. This is most beneficial when there is little background information or when consultation and consensus are required. The in-home interviews (one-on-one) can be used when knowledgeable participants have been identified (through key-informants or through the focus group sessions) and in cases where background knowledge has already been identified. The data can provide true rank leading the researcher to specific information.

4.2 Woodland caribou locations

4.2.1 Lakes, rivers and creeks

One of the first questions asked of the participants was "where did you see caribou?" The areas that were indicated as woodland caribou locations included 62 lakes and 19 rivers or creeks (Figure 3, Appendix 1, Table 3 & Table 4). Some locations had higher ranks, such as Morning Lake, Besnard Lake, Lac La Ronge, and Nemeiben Lake and the Churchill River. Although the number of times the location was mentioned may be valid to report, due to the lack of knowledge of woodland caribou in our study area, all locations will be considered equally valuable. Some areas are less travelled and remote hence less people would have an opportunity to observe woodland caribou, (most notable in the N – 78 and N – 9 FCA).

All of the woodland caribou observations refer to lake or river locations each symbolized as a point on the maps created (Figure 4). I noted two patterns of dispersion, a preference for lakes and peatlands. The first is a superficial pattern that suggests woodland caribou prefer lakes. From the interview data, participants qualified that caribou were most frequently observed in the vicinity of lakes. The caribou preferred landscapes dominated by lakes (n = 62) over rivers and creeks (n = 19).

The second pattern of dispersion indicates a preference for landscapes dominated by peatlands (Figure 5). This dispersion correlates with other scientific data that suggest woodland caribou inhabit open peatlands and treed peatlands within our study area (Rettie and Messier 2000). Preference for a combination of peatlands and lakes may indicate woodland caribou select habitat for two reasons, predator avoidance and food selection (Rettie and Messier 2001).

4.2.2 Calving areas

Through the interviews, eleven locations were identified as potential woodland caribou calving areas (Appendix 1, Table 6). The majority of woodland caribou calving locations were associated with lakes or islands (n = 10) compared to river locations (n = 1), suggesting that the woodland caribou prefer lakes or islands over riverine habitat for calving. Through the mapping exercise two woodland caribou calving locations were identified, Morning Lake area and Wapawekka Lake area (Figure 5). Habitat selection relates to predator avoidance and access to food (Appendix 1, Table 15). It is important to note the lake locations indicated through the interviews and the mapping exercise indicate general locations that include adjacent peatlands and islands. Our data has been verified

by previous studies which suggest the woodland caribou do not show site fidelity and need larger tracts of habitat (Rettie and Messier 2001).

4.2.3 Wintering areas

There were only three locations identified specifically as wintering areas. Hickson Lake, Hunter Bay and "the Big Island" (the latter two locations occur on Lac La Ronge Lake, Appendix 1, Table 7). Wintering areas are critical habitat for woodland caribou between the rut and the calving season. Although there were only three locations identified they can be defined as critical woodland caribou habitat. Wintering locations relate to the persistence of the species in areas of anthropogenic change (Schaeffer 2004).

4.2.4 Corridors

There were nine locations indicated as woodland caribou corridors (Appendix 1, Table 8). It is difficult to determine what patterns emerge from this data. There could be a number of movements that are connected but much more work needs to be done to determine the true patterns. Churchill River is the most northern location. There has been some directional information provided by participants. Where participants observed what direction the woodland caribou were travelling. The lack of data is result of two flaws in our methodology. First, in the focus group sessions, there was an unplanned selection of participants, resulting in participants that could be from any of the seven FCA's. There was no way to determine the knowledge base at any given meeting. If we were specifically looking at woodland caribou movement patterns, it would be necessary to isolate key participants that have knowledge about the same "herds" or groups of

woodland caribou. Second, there were no other sources of movement data to compare against the participant reports. Caribou movements could have been monitored using a method of "ground truthing". The significance of this approach would be that we are going beyond the level of local knowledge to consider a type of community knowledge or consensus at a larger landscape scale, and then verifying that knowledge with scientific methods. There is still debate regarding the use of scientific methods to verify local and traditional knowledge, since "truthing" biases the scientific method over all other sources of knowledge (Lyver et al. 2009).

4.2.5 Roads and highways

Woodland caribou were observed crossing major roads and highways (n = 19, Appendix 1, Table 5) and this type of movement can have negative implications. First, woodland caribou from previous studies were thought to avoid linear man-made features on the landscape (Dyer *et al.* 2001). If roads intersect migratory corridors, this might limit their movement or result in changing migration patterns (Appendix 1, Table 21). Second, as there is vehicle traffic on these roads, it can lead to a potential for hunting or poaching (Appendix 1, Table 21). Third, the caribou may be accidentally hit by vehicles. Fourth, tourism might be adding to the stress on caribou (Appendix 1, Table 21).

4.2.6 Mapping exercises

The maps developed from the mapping exercises (Figure 5 and 9), correlate with the sightings for woodland caribou (Figure 4). This approach gives a broader understanding of the overall pattern of dispersion. There were a number of ranges that

overlapped, indicating more participant knowledge of caribou in these geographic areas. Two areas were indicated as calving areas. All other sites were general ranges. Assessment of landforms within these ranges also indicates a woodland caribou preference for areas of low relief and peatland areas near large lakes.

4.3 Woodland caribou abundance

The changing patterns of distribution and abundance become apparent in the time series maps (Figures 6 to 8; Appendix 1, Table 9 to 11). Historically, reports of woodland caribou group sizes were comparatively large to medium-sized (no less than 6 individuals), except for a few individuals scattered near Rabbit Lake and Foster Lakes, in the northern part of their provincial range (Figure 6; Appendix 1, Table 9). All other reports were of very large herds. This may be indicative of some type of source and sink population dynamics, where source populations have more births than deaths and sinks have more deaths than births. One source population had been observed at Robertson Lake and one in at Lac La Ronge Lake. With 7 smaller potential sink areas in surrounding regions.

Between the years of 1975 to 2001 (Figure 6), the abundance of woodland caribou was reported to be significantly altered. There appeared to be 2 source areas of woodland caribou, at Irving Lake and Lac La Ronge Lake. A wealth of local knowledge from other parts of provincial range indicated another source of caribou near Suggi Lake. From the data set, I postulate 12 smaller groups that are potential population sinks during this period.

Between the years of 2001 to 2006 (Figure 7), again there was a shift in the abundance of woodland caribou, with large source populations in two locations: Pas Field Lake and the English Bay/Wadin Bay area (Lac La Ronge area). Participant interviews also shed light on another potential source population located at Weyakwin near Montreal Lake. Twenty smaller potential sink populations were also postulated in the study area during this time period.

The reported number of source populations of woodland caribou within the study area was consistent across the years.. The abundance of caribou within source groups appears to have decreased when comparing historical (n = 75 at Hunter Bay, and n = 45 at Robertson/Settee Lake) and contemporary (n = 30 at Pas Field Lake, and n = 20 at Wadin/English Bay) reports of group size. The number of potential sink populations also appears to have increased. Over time, the trends indicate an increasing prevalence of smaller groups of caribou across their distribution within the study area, and possibly elsewhere. From 2001 to 2006, large group sizes were more common in the northern part of the study area.

In conclusion, more inquiry would be needed to verify abundance of potential source and sink populations. However, the results of this portion of the research are quite interesting. The idea of getting some type of historical data on woodland caribou in our study area is not possible by any other methodology and has been used in previous research (Ferguson *et al*. 1998). The significance of the changing patterns of dispersion can relate to a number of factors. Changes can include landscape disturbance, changes in the number of predators and increased human activity (Appendix 1, Table 21 to 26). The result of such changes to woodland caribou ranges can have negative impacts on the

genetics of the herds, such as low genetic diversity and survival (McLoughlin *et al.* 2004).

4.4 Woodland caribou ecology

4.4.1 Disease, parasites and health

Bot flies (Order *Diptera,* family *Oestridae*) and warble flies (*Hypoderma tarandi*) in woodland caribou were reported by study participants (Appendix 1, Table 12). It is unclear whether there is a health risk for woodland caribou infected with a parasite. There is speculation that parasite infections result in significant weight loss, reduction in pregnancy, and shifting migration patterns to avoid infections from adjacent ungulate species that share the parasite (Hughes *et al.* 2009). Despite this recent report another paradigm suggests mortality of the host does not benefit the parasite, and this is based on the evolutionary relationship between parasite and host, (Slansky 2006). Participants also indicated that certain parts of the anatomy may not be eaten if woodland caribou have fly larvae and other parasitic worms are visible. Ticks were observed, but participants indicated that they were not abundant. Moose have so many ticks, that they will lose their hair. It is unclear why ticks affect moose more then woodland caribou, but it could be a result of their habitat preference (Hughes *et al.* 2009). Cancer and poisoning were also reported and could be the result of some type of industrial pollution. Although there were some health concerns, most people indicated that the health of the woodland caribou was good.

4.4.2 Woodland caribou movements

The movements of woodland caribou tend to be less predictable compared to historical reports (Appendix 1, Table 13a & 13b). Areas where woodland caribou are expected to be at certain times of the year are no longer reliable predictions. No speculation was made by the participants. Based on previous studies the changes can be the result of increasing predation, lack of safe corridors (changes to the landscape), or caribou are simply shifting their locations (Rettie and Messier 2000; Rettie and Messier 2001). It is also important to note that woodland caribou need access to ice on the lakes in winter months (Rettie and Messier 2000).

4.4.3 Food and food quality

Four important food sources were reported: lichen and moss, brush, and muskeg water (Appendix 1, Table 14). Previous research suggests lichens are the primary food source (Rettie *et al.* 1997; Johnson *et al.* 2001). The quality of food sources for woodland caribou was reported as diminishing, either due to low quality because of disturbance or overgrazing by woodland caribou. As food of the woodland caribou is limited in certain areas (slow growing and slow to regenerate), access to mineral rich water is a significant part of their behaviour and diet in spring. One key informant (someone that did not participate in the interviews), mentioned that woodland caribou in the winter time are found to lick the salt. The limited availability of habitats and quality of the food sources can have an impact on behaviour of woodland caribou. Limitations in food or food quality for woodland caribou can lead to potentially risky behaviours in winter that can lead to increased mortality through predation, hunting, or being struck by a vehicle.

4.4.4 Calving

Although calves of woodland caribou were not observed, a number of habitat types for calving were described, based on local knowledge of tracks and other signs (Appendix 1, Table 15). Three contributing factors might account for the lack of calf sightings. First, people may not able to observe woodland caribou during the calving season, which is thought to occur in April-May-June. At this time of the year, most places are inaccessible by land due to melting snow and unsafe ice conditions. Second, traditional teachings do not permit people to go into areas where calves are born, out of respect. Third, woodland caribou calves are so camouflaged, that people may be in calving areas but are unable detect them.

Woodland caribou calving locations and related movements in certain areas is still poorly understood in this area. The movements and behaviour and habitat selection can be the result of environmental factors and females disassociating from other females to reduce calf mortality (Rettie and Messier 2001). Therefore, when looking at the size of the areas that were indicated as woodland caribou calf locations, the ranges were very large and most likely included several females and their calves (Figure 5).

4.4.5 Habitat selection

Based on the report about habitats, woodland caribou need access to water (Appendix 1, Table 16). All of the reported habitat types, except for jack-pine stands, were near water muskegs and lakes. Water is important to woodland caribou for escaping heat, insects and predators. Forest cover such as peatlands may be a secondary habitat

preference (Rettie and Messier 2000); primary habitat preferences include locations close to water or particular water bodies (Figure 5).

4.4.6 Population trends

Overall, reported caribou population trends suggest that people are observing fewer numbers of woodland caribou now than in the past (Appendix 1, Table 17). In most cases, population levels were indicated to be extirpated or declining. Many of those interviewed, in their life time, have observed a severe woodland caribou population crash. The loss of woodland caribou from areas is due to a combination of factors such as logging activity (Rettie and Messier 1998), calf predation and lower recruitment (Rettie and Messier 1998), hunters (Trottier 1988) and forest fires up to 25 years post fire (Fisher and Wilkinson 2005). Even with a small increase in the number of woodland caribou, people are optimistic that they will once again see the great herds from their childhood. The elders' belief is that low number of woodland caribou is part of the natural cycle, and the large herds will return.

4.5 Predator and prey interactions

The impact of wolves on the woodland caribou population is apparent by the number of comments (Appendix 1, Table 18). Wolf populations are reportedly increasing. Wolves target woodland caribou calves, this supported by previous research (Rettie and Messier 1998). It is thought that certain times of the year favor predator movement and migration. Ice and crusty snow conditions on a lake for example can increase the rate of movement. If wolf packs are increasing in numbers, there are two

possible explanations. First if the wolf population is increasing it must be supported by a healthy population of prey items available, such as woodland caribou. Prey-availability is a limiting factor for wolves and more prey items available would support a wolf population increase. The second explanation is a significant decrease in the amount of hunting and trapping contributing to wolf mortality. This second scenario can be supported from our data, as many indicated that trappers are not able to trap as much as they used to due to a number of factors. The cost of trapping is increasing and the interest in the trapping lifestyle is significantly declined. Lack of interest in trapping is the result of increasing gas prices, increasing cost of equipment and maintenance and low fur prices. Prices are so low that trappers are not expected to make a profit and they are lucky if they can break even. Combine all these factors with changing and unpredictable weather conditions making travel unsafe. The new trappers and youth that are going out to maintain trap-lines do not have the skill to trap wolves. Many trappers have suggested it is this lack of trapping effort that has allowed the wolf population to increase and be maintained at high levels.

4.5.2 Other predators

Very little information is known about the effect of other predators on woodland caribou (Appendix 1, Table 19). Predator and prey interactions mainly focus on large carnivores like the wolf. Our study, suggests that black bears, cougars, and wolverines are also woodland caribou predators. Previous research has speculated the effect of black bear predation on calves and results in low survival rates (Rettie and Messier 1998). It

would be valuable to design additional research to study the effects of other predators on the woodland caribou population, as there is no scientific information on this relationship.

4.5.3 Prey Species

There "other prey species" that overlap with woodland caribou range in our study area (Appendix 1, Table 20). There is well-documented relationship that suggests moose and woodland caribou inhabit adjacent areas, with minimal overlap (James *et al.* 2004). According to our results, during a wolf hunt the woodland caribou have a fighting defense and wolves must expend more energy per kill. In addition woodland caribou are much smaller then moose, leading to smaller energy gains from this type of kill.

Interestingly, there were several discussions regarding the overlap of woodland caribou ranges, with the barren-ground caribou range. Physical descriptions of both species were made, based on size, color and taste of the meat. One report was made regarding an intermediate species with a white diamond on its neck. These hybrids were thought to be of intermediate size and range directly south of the barren-ground herds and northern part of the woodland caribou range (west of Reindeer Lake). Traditional knowledge on the "separation" of the two species was identified by a few of the participants. However, no follow-ups were made to seek this information, since it was not an objective.

4.6 Human activity

4.6.1 Logging, road development, road expansion, and access

There were reports of the effects of logging operations on woodland caribou (Appendix 1, Table 21). The effects of changing the landscape can lead to disorienting the woodland caribou, deflecting their movements, destroying food sources, and abandonment of calving areas. Based on the caribou ranges that were indicated through the mapping exercises, the logging activity appears to be adjacent to woodland caribou ranges (Figure 10). Based on Figure 10, there is significant evidence to suggest that woodland caribou ranges have shifted shortly after disturbance. And caribou have moved to adjacent areas that remain undisturbed. However, more inquiry would be necessary to indentify historical caribou ranges prior to disturbance and compare this to their current range. To do this we would need to include trapping blocks where logging activity has been most prevalent such as P - 4 and P - 65.

A secondary effect of logging activity is road development and lack of mitigation, and the fact that the roads remain long after the logging activity has finished. This provides access to tourists in previously remote areas, increasing traffic by snowmobilers and hunters. Increased access to woodland caribou is a major concern, as some of these areas have already been heavily impacted, making this a cumulative effect.

4.6.2 Mining and exploration

Very few comments were made regarding the effect of the mining and related industry on woodland caribou (Appendix 1, Table 22). A previous report of toxicology on ungulate species has been well-documented in our study area and across the province

(Thomas and Gates 1999). The possible link between radioactive pollution in plants, caribou and humans is a major health concern. Caribou organs such are liver and kidneys are a major source of radio-nuclides. If a person has a diet of 100g per day for one year, the chance of getting a fatal cancer is 4.25 in 100,000 (Thomas and Gates 1999). If the diet was to include 1 liver and 10 kidneys the rate will double to 8.5 in 100,000 (Thomas and Gates 1999). In my study area the two types of mines, the Anglo-Rouin Mine (Copper) and Bingo (Gold) and Jolu Mines (Gold-Mill), so relevant information about the impact of these mines will be important to disseminate to the public.

4.6.3 Hunting

There were two types of hunting reported, historical licensed hunting and subsistence hunting by First Nation hunters (Appendix 1, Table 23). My objective was to address current subsistence hunting, since the historical hunts ceased more than two decades ago and can no longer be influenced by this report.

The most significant aspect of this topic is that the ethics of subsistence hunters is changing. Subsistence hunting was a necessity for people living off the land. The elders remembered times of starvations, no welfare and no money to purchase supplies, bullets and shells were rationed over the winter. At that time, people took what they needed to survive. The most disheartening comments by elders were that they do not see youth participating in respectful hunting. The youth may or may not hold the valuable knowledge regarding natural cycles, ecology and respect for the animals. This type of knowledge governed how many animals could be taken in a particular area, and when hunts were to take place. When youth do not have this knowledge or disregard this

knowledge it leads them to shoot now and ask questions later, at times killing all animals in a herd, male or female. This is was a major concern brought forward by the elders.

4.7 Weather

4.7.1 Water and precipitation

Different weather conditions were reported resulting in changing behaviour of woodland caribou (Appendix 1, Table 24). Woodland caribou need access to lakes, river and creeks to escape predation and insects and ticks and to access mineral water. In the winter snow depth has an impact, although the woodland caribou physical anatomy allows them to run in deep snow to escape predators, snow depth and type affect their access to food (Mayor *et al.* 2009). In the summer muskegs can flood, resulting in a loss of access to food and habitat.

4.7.2 Temperature, seasons and wind

In northern latitudes growing seasons are very short and experience extreme fluctuations in temperature. Recently changes in these seasonal patterns have been a major concern for woodland caribou (Appendix 1, Table 25). Woodland caribou can survive cold temperatures and this does not threaten their population. Although if there is an increasing amount of warm weather in the winter this means they will have more ticks. Although it was mentioned before that woodland caribou do not have many ticks, the prevalence of ticks may increase. There have been reports of unsafe ice conditions. With the woodland caribou relying on ice for winter corridors on lakes, rivers, and creeks

earlier open water or black ice will create more potential for mortality due to drowning. Based on reports of early springs or shorter winter there was speculation that it could have potential impacts on calving success. Wind is also indicated as having an effect on woodland caribou behaviour, however, no other information is known regarding this phenomenon.

4.7.3 Fire and spruce bud-worm

Forest fires in northern Saskatchewan are part of the natural cycle of regeneration and for many people and cultures it is a sign of re-birth and cleansing. The severity and unpredictable nature of forest fires is something that can never be controlled by people and the devastation lasts for many years. Woodland caribou along with many other species will be consumed, suffocate or simply move out of these areas (Appendix 1, Table 26). It takes many years for woodland caribou to return in abundance to these areas, up to 25 years (Fisher and Wilkinson 2005). In Figure 12, the locations of the woodland caribou ranges illustrates that fires occurring from 1970-1993 can over-lap with woodland caribou ranges. However, statistical analysis would be required to verify woodland caribou preference for burned vs. un-burned habitat. Overall, the trends seem to indicate that the ranges consist mostly of burns over 38 years old, as our data dates back to 1970.

The fires are not always negative, since in the summer these areas are nutrient rich and most likely provide food sources. The behaviour of woodland caribou in burned areas suggests they travel around these areas, but do not range within burned areas. Forest

fires will continue to have a combination of negative and positive effects on the woodland caribou population.

The presence of spruce budworm (*Choristoneura fumiferana)* in Saskatchewan has sparked controversy. In extreme cases certain municipalities had intensive spraying programs to help control the populations. According to this research project, the effects of spruce budworm may not be as negative as previous research might suggest, with our study suggesting a 7-year renewal cycle was followed by a population explosion of small mammals such as American marten (*Martes Americana)*. However there was no information regarding the potential impact of spruce budworm on woodland caribou. However, according our research mild winters and early springs favor insect populations. With the onset of climate changes, earlier spring, short and mild winters, might lead to increased out breaks spruce bud-worm.

4.8 Recommendations

4.8.1 Action regarding logging roads

The negative effect of logging roads on woodland caribou has been well documented, (as referenced in the introduction). Although reclamation is attempted, problems still persist. Once roads have been made, people continue to use them. Based on the findings of this report, many improvements could be made regarding the planning and design of roads to minimize impacts on woodland caribou.

Recommendations 1.1:

Monitoring programs for the access roads can been issued. With a permit system issued to trappers and other designated used such as outfitters or reputable tourism

camps. Restrict the access of hunters, tourists and other trappers, unless consent has been provided by the current users in writing. These roads should be monitored and regulated strictly in order to give woodland caribou a chance to repopulate. Reduced traffic might allow woodland caribou to continue movement within their natural range.

Recommendations 1.2:

Build contact lists that can be used to bring together foresters, road planners, engineers and local elders and trappers in each Forestry Management Agreement (FMA). The contact list can be used to help facilitate consultation processes when there are plans to build logging roads in new FMA's. If there are planned road expansion projects in existing FMA's the elders and trappers can be contacted and consultation can be done respectfully. The consultation process can give builders an opportunity to develop new road network plans that would make sense locally to plan low impact road development with very little impact on current woodland caribou migration routes or calving areas.

4.8.2 Action regarding the potential pollution

Animals eat medicinal roots and herbs, therefore the animals we eat are also considered medicine; this is a teaching from our elders. If the food they are eating is no longer healthy it is a major concern for people and human health. In order to deal with this concern I have two scenarios are possible to address this matter. It is important for newly commissioned mines to contact and consult local trappers and their associations to examine potential impacts. In cases where a mine has been decommissioned over a long period of time and there are still concerns, there must be a clear process in place by the Provincial Government department to deal with issues that arise. Contaminated

ecosystems and food chains would directly affect the local people who are subsistence hunting, all year round. Other boreal forest users, such as summer and winter recreationalist are also at risk. Tourism would be affected, tainting the image of the pristine north. If action is taken to rectify this matter, the province would become a leader in management of the boreal forest ecosystem and also in community relations.

Recommendations 2.1:

If there are health known health risks from contamination through long term persistent organic pollutants (POP's) and highly reactive biohazards or carcinogens (cancer-causing agents) that information should be communicated back to the community. There should be education about the hazardous and benign effects of contaminants on their environment. Not all contamination has a direct effect on the health of local people. Education of the general public is critical, in Cree, Dene and English. The best option to educate the most people regarding this matter is through press releases or a short informative commercial on Missinippe Broadcasting Corporation (afternoon Cree and Dene programs) and on Canadian Broadcasting Corporation (North Notes).

Recommendation 2.2:

There should be a monitoring program at the University of Saskatchewan, sponsored by mining corporations to test possible contaminated sources of meat. Currently there is no long-term program set-up to effectively monitor anomalies found in subsistence kills. This monitoring program could involve College of Veterinary Medicine and possibly the College of Medicine. The health of northern peoples should be the number one priority regarding this matter.

4.8.3 Action regarding the knowledge to hunt

There are some school programs that educate youth about how to hunt and trap. But the words and teachings of the elders are not always respected. There is one program in La Ronge called the trapper training programs, one of the drawbacks to this program is the youth spend minimal time with the trappers and elders. Youth are not able to learn everything in one week. There needs to be more time and over longer periods of time with the same group. When the elders speak about such concerns and nothing is done it is a tragedy against their culture and Mother Nature. These are the elders that hold the knowledge and the respect, their words should spark action.

Recommendation 3.1:

To address the elders concerns about the decline of woodland caribou due to hunting I propose that communication is initiated by the Lac La Ronge Indian Band and the Métis Nation to inform their members about the critical status of woodland caribou. Access to certain areas is increasing, and results in hunting of woodland caribou in previously remote areas. If there was some reduction the amount of hunting in these sensitive areas the woodland caribou might be able to return to healthy population levels.

Recommendation 3.2:

To address the elders concern regarding the ethics of subsistence hunting, I propose that effective educational programs are developed for youth about the status of woodland caribou. This can be incorporated into the culture camps that are already in place in each community. The educational programs could involve a number of youth that are selected to go on a woodland caribou hunt. While on the hunt the elder could be directed as to what aspects to teach the children. This interaction with the elders, could

involve teaching traditional knowledge of ecology, woodland caribou biology or the hunt. Hopefully this will lead the youth to a better understanding of the meaning of the hunt and respect for the animal that is being hunted, the woodland caribou.

4.8.4 Regarding the safety issues in predator territory

Trappers and elders have a respect for wolves and their ecological role. Many elders and trappers are aware of the nature of wolves. They believe that wolves are never tame, they kill prey and they are capable of attacking humans. The behaviour of the wolves and stories the trappers have shared almost give a sense that wolves intentionally seem to intimidate trappers and dogs. Many people indicated they carry a gun at all times to protect themselves, when they go into wolf territory, especially when some packs are reported to number over 50. This could raise a valid concern about the safety of trappers, tourists, exploration crews and outfitters in these regions. The knowledge of trappers is not being utilized regarding wolf packs and population levels in key areas.

Recommendation 4.1

A trapping program should be initiated and funded by the Provincial Government to pay salary and incurred cost for trappers to trap and hunt wolves in key areas. The key areas should be determined by consultation between the provincial biologists and local trapping blocks. The trappers who would be funded to target wolf packs in trapping block zones designated on two levels. First level would be wolves that pose a risk to human safety. Second level would be wolves that pose a risk to woodland caribou populations. The trappers must be active members of their trapping block association and trap within

the boundaries of the potential wolf pack ranges as determined through the consultation process.

4.8.5 Regarding the biological methods of locating woodland caribou calving sites and other knowledge gaps

Historical methodology of locating woodland caribou and understanding the ecology of woodland caribou is at times very difficult. Many studies face problems regarding time budgets, short field seasons and lack of funding or expensive equipments costs. Many knowledge gaps still exist such as locating calving areas. New projects could require the researchers to monitor the movement of pregnant females through less invasive methods. Collaring pregnant females or helicopter surveys might be too stressful, and should require some type of advisement by local elders.

Recommendation 5.1

Many researchers can access funding through research programs that incorporate the use of local and traditional knowledge, working with species are at risk and working with First Nations and Métis. One very important recommendation is that researchers consider the use of trappers and hunters local knowledge if such groups exist in their study area. The trappers with trap-lines within the study areas could be included in the projects and paid honorariums (or some type of salary) to do short term monitoring of woodland caribou movements, calving site locations and identifications. The documentation of these projects could include the delivery of equipment such GPS units (minor training), disposable cameras to record tracks, record sheets that indicate relevant information (standardized). The concerns elders and trappers have with regard to the

sensitive nature of calving is a valid concern. Potential impacts of helicopter surveys and satellite collars, even students and researchers manually going into woodland caribou habitat is not fully understood. The trappers already utilize these areas and they have an unmatched experience and respect for the animals they seek.

4.9 Final conclusions

4.9.1 Strengths and weakness

The purpose of the research was to combine many aspects of research to help identify knowledge gaps in woodland caribou research. There were five research objectives; locations, predator/prey, food and food quality, calving, weather and climate, and changes to the landscape and the effect on woodland caribou. The open exploratory methods resulted in more information than expected including woodland caribou behaviour and ecology. The strengths of this research include

- The amount of knowledge gained (not all data was included).
- Location specific knowledge of woodland caribou.
- Shifting patterns were identified in caribou abundance. In the absence of data or where no data exists, LK is one way to document historical data.
- The use of first language in interviews.
- The significance of the consultation opportunities that have been identified that link industry, government and local people.

The weaknesses of this research are

- Language barriers exist. Converting English and biological concepts into Cree requires language experts. At times, a translator is useful, but the amount of knowledge they have regarding some of these concepts is limited; it would be advantageous to work with language experts on developing the line of questions so that the language barrier is minimized.

- The use of a translator is not effective, unless they have previous experience in the interview process; the amount of training, linguistics and translator knowledge confounds the rapport between all people present; the translator is the person responsible for effective communication to the elder and back to the interviewer.

If there is a lack of communication between the interviewer and the translator one can not proceed with the line of questions effectively.

- The information needs to be completed in several steps. The component I focused on in this research project was to develop the methodology for consultation, participant selection, interview and focus group standardization. The first is the exploratory interviews, the next steps would be ground truthing and the final step would be validating the knowledge (going back to participants to verify the information is correct). The last two components were not possible due to limitations in funding and time.

4.9.2 Validation from elders and participants

The validation from elders was an ongoing process throughout my research project. At every meeting and presentation, the elder's comments were acknowledged. When the report is complete and the thesis has been defended, copies will be sent to the participants. This communication back to the people who participated is critical. As I have learned through my project, getting people to come to a meeting is very difficult to organize, so each participant will be sent their own copy to review. They can learn about the entire process, I may have only spent 1-2 hours with them over the past three years but it will give them an opportunity to see how their information and knowledge contributed to the entire research project. I hope that this will give them validation and recognition of their importance to the academic world. I know that they have a vested interest in their environment, their culture and each one envisions that trapping will continue to occur for themselves and their children.

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APPENDIX 1 – SUPPLEMENTARY RESULTS

Table 1 – In – home interview participant identification number, home community, trapping blocks, and date of interview.

Interview ID	Home community	Trapping block	Date (yy/mm/dd)
IH1_1	Sucker River	N-8 Churchill River	06/02/13
IH2_2	Sucker River	N-7 Sucker River	06/02/13
IH3_6	La Ronge	N-5 Pipestone	06/03/05
IH4_17	Stanley Mission	N-9 Stanley	06/03/09
IH4_18	Stanley Mission	N-9 Stanley	06/03/09
IH5_27	Hall Lake	N-6 Little Hills	06/06/20
IH6_28	La Ronge	N-7 Sucker River	06/06/26
IH6_29	La Ronge	N-7 Sucker River	06/06/26
IH7_30	Stanley Mission	N-9 Stanley	06/06/27
IH8_31	Hall Lake	N-6 Little Hills	06/06/29
IH9_32	Cumberland House	N-28 Cumberland House	06/07/01
IH10_33	Stanley Mission	N-9 Stanley	06/07/04
IH10_34	Stanley Mission	N-9 Stanley	06/07/04
IH11_35	Stanley Mission	N-9 Stanley	06/07/04
IH11_36	Stanley Mission	N-9 Stanley	06/07/04
IH12_37	Hall Lake	N-5 Pipestone	06/07/12
IH13_38	Hall Lake	N-6 Little Hills	06/07/12
IH14_39	Hall Lake	N-6 Little Hills	06/07/12
IH15_40	Brabant	N-9 Stanley	06/07/20
IH15_41	Brabant	N-9 Stanley	06/07/20
IH16_42	Brabant	N-9 Stanley	06/07/20
IH17_43	Sucker River	N-7 Sucker River	06/07/22
IH18_44	Sucker River	N-8 Churchill River	06/08/30

Table 2 – Focus group meeting participants with identification number, home community, trapping block, and date of focus group.

Interview ID	Home community	Trapping block	Date (yy/mm/dd)
FG1_03	La Ronge	N-78 Foster Lakes	06/03/02
FG1_04	La Ronge	N-5 Pipestone	06/03/02
FG1_05	La Ronge	N-5 Pipestone	06/03/02
FG2_07	Sucker River	N-7 Sucker River	06/03/08
FG2_08	Sucker River	N-8 Churchill River	06/03/08
FG2_09	Brabant	N-9 Stanley Mission	06/03/08
FG2_10	La Ronge	N-9 Stanley Mission	06/03/08
FG2_11	La Ronge	N-9 Stanley Mission	06/03/08
FG3_12	Stanley Mission	N-9 Stanley Mission	06/03/09
FG3_13	Stanley Mission	N-9 Stanley Mission	06/03/09
FG3_14	Stanley Mission	N-9 Stanley Mission	06/03/09
FG3_15	Stanley Mission	N-9 Stanley Mission	06/03/09
FG3_16	Stanley Mission	N-9 Stanley Mission	06/03/09
FG4_19	Sucker River	N-7 Sucker River	06/03/14
FG4_20	Sucker River	N-8 Churchill River	06/03/14
FG4_21	Sucker River	N78- Foster Lakes	06/03/14
FG5_22	La Ronge	N-5 Pipestone	06/03/27
FG5_23	La Ronge	N-5 Pipestone	06/03/27
FG5_24	La Ronge	N-5 Pipestone	06/03/27
FG5_25	La Ronge	N-7 Sucker River	06/03/27
FG5_26	La Ronge	N78- Foster Lakes	06/03/27

Table 3 - Lakes identified as general woodland caribou sightings. The rank is based on the number of times the lake had been identified in separate interviews. Where R – 4 indicates the location was identified in four separate interviews, and R – 1 was identified in one interview.

Location	Rank	Location	Rank
Morning Lake	4	Giles Lake	1
Besnard Lake	3	Glen Lake	1
Lac La Ronge	3	Guncoat Bay	1
Nemeiben Lake	3	Hall Lake	1
Macoun Lake	3	Harriet Lake	1
Big Island	2	Hunt Lake	1
Clam Lake	2	Irving Lake	1
Cree Lake	2	Kitsaki Island	1
Egg Lake	2	Kingston Lake	1
Foster Lakes	2	Lamp Lake	1
Hickson Lake	2	Maribelli Lake	1
High Rock Lake	2	Midway Lake	1
Hives Lake	2	Mole Lake	1
Hunter's Bay	2	Morin Lake	1
Peter Lake	2	Otter Lake	1
Trade Lake	2	Pas Field Lake	1
Archibald	1	Pipestone	1
Big Sandy Lake	1	Rabbit Lake	1
Bigstone Lake	1	Reindeer Islands	1
Bird Island	1	Robertson Lake	1
Bittern Lake	1	Saddler Lake	1
Brabant Lake	1	Seager Wheeler	1
Candle Lake	1	Settee Lake	1
Costigan Lake	1	Sikachu Lake	1
Cumberland Lake	1	Smoothstone Lake	1
Daly Lake	1	Suggi Lake	1
Deception	1	Taylor Lake	1
Dobbin Lake	1	Totten Lake	1
Emmaline Lake	1	Trail Bay	1
Foster (middle)	1	Wapawekka Lake	1
Foster (upper)	1	Wathaman Lake	1

Table 4 - River and creeks where woodland caribou have been observed. Ranking system indicates locations identified in two separate interviews R – 2 and locations identified in one interview R – 1.

Location	Rank
Churchill River	2
Bow River	1
Burntwood Creek	1
Churchill River (where there are Falls)	1
Deadmoose Creek	1
Geikie River	1
Insect Hill	1
Johnson River	1
Kettle/Kennel Falls	1
Lonely River	1
Meeyomoot Creek	1
Montreal River	1
Pine Bluff (adjacent to a river)	1
Rabbit Creek	1
Reilander Creek	1
Sucker River	1
Two-forks River	1
Wapawekka Rivers	1
Wathaman River	1

Table 5 - Roads and highways where woodland caribou have been observed to cross the road. Rank indicates locations identified in two separate interviews R – 2 or identified in one interview R – 1.

Location	Rank
Pinehouse Junction	2
Anglo-Ruoin Mine Road	1
Besnard Lake (junction road)	1
Bigstone Road (between the highway)	1
Corrections	1
Far Reserve	1
Hall Lake (junction)	1
Highway 165 (east of Highway 2)	1
Highway (mile 8)	1
Highways camp	1
Key Lake (Airport runway)	1
Key Lake Road	1
Little Hills Road	1
Nemeiben Lake road	1
Sikachu Lake/Road	1

Table 6 - Woodland caribou calving area locations. Rank indicates locations indentified as calving grounds in two separate interviews R – 2 and locations indicated as calving grounds in one interview R – 1.

Location	Rank
Nemeiben Lake	2
Wapawekka Lake	2
Besnard Lake	1
Clam Lake	1
Deception	1
Foster Lakes	1
High Rock	1
Hives Lake	1
Lac La Ronge Lake	1
Macoun Lake	1
Sucker River	1

Table 7 - Woodland caribou winter areas.

Hickson Lake
Hunter's Bay
Big Island

Table 8 - Locations where woodland caribou are observed to travel on specific migration routes (corridors) every year.

Bigstone Lake
Churchill River
Creighton Junction
Don Allen Ski Trails
Egg Lake
Hunter's Bay
Morning Lake
Nemeiben Lake road
Wapawekka Hills

Table 9 - Woodland caribou herd location, abundance prior to 1975. The table is based on interviews where woodland caribou herd locations, year and abundance were identified.

Identification ID	Location	Group size	Year
FG1	Wapawekka Lake	5	about 1955
FG1	Wapawekka Lake	5	over 50 years ago
FG1	Foster Lake	1	over 30 years ago
FG1	Nemeiben Lake	5 to 6	historically
FG3	Robertson/Settee Lake	40-50	25-30 years ago
FG3	Hunter's Bay	50-100	historically
FG3	Rabbit Lake	2	historically
FG4	Morning Lake	11	35 years ago
IH9	Cumberland Lake	7 to 40	about 35 years ago
IH17	Morning Lake	20 to 30	Historically

Table 10 - Woodland caribou herd location, abundance and year of observation, between 1975 and 2001. The table is based on interviews where woodland caribou herd locations, year and abundance were identified.

Identification ID	Location	Group size	Year
FG1	Big Sandy Lake	30-40	within 10 years
FG1	Wapawekka Lake	1 or 2	within 10 years
FG1	Key Lake Mine (airport runway)	7	within 10 years
FG1	Points North (Key Lake road)	1	within 10 years
FG1	Shadd Lake	1	1990
FG2	Lac La Ronge Lake	15-20	over 10 years ago
FG3	Hunt Lake	11	1980's
IH4	Irving Lake	15-25	1998
FG5	North of La Ronge	10 to 12	about 15 years ago
IH7	Dobbin Lake	3	over 15 years ago
IH7	Foster Lake	3 to 4	about 20 years ago
IH7	High Rock	3 to 4	about 20 years ago
IH8	Highways Camp	14	about 25 years ago
IH8	Sikachu Lake	7	about 13 years ago
IH9	Deadgoose Creek	1	about 25 years ago
IH9	Suggi Lake	20 to 25	15 to 25 years ago
IH9	Pine Bluff	4	15 to 20 years ago
IH16	Brabant Lake	7	within 15 years

Table 11 - Woodland caribou herd location, abundance and year of observation, between 2001 and 2006. The table is based on interviews where woodland caribou herd locations, year and abundance were identified.

Identification ID	Location	Group size	Year
FG1	Reilander Creek	1	about 2003
FG3	Lac La Ronge Lake	1	2005
FG3	Waterbury Lake	5	2005
FG3	Weyakewin/Montreal Lake	20	2004
FG3	Wadin Bay/English Bay	20	2004
IH4	Irving Lake	1	within 5 years
IH4	Kettle Falls	1 to 2	within 5 years
FG5	Costigan Lake	1	2001
FG5	Lampin Lake (Lamp Lake)	1	about 5 years ago (2001)
FG5	La Ronge	3 to 4	about 5 years ago (2001)
IH7	Peter Lake	3 up to 19	2003
IH7	Pas Field Lake	30	2006
IH7	Hickson Lake	7 to 8	2003 or 2004
IH7	Maribelli Lake	7 to 8	2003 or 2004
IH8	Highways Camp	5	2006
IH8	Highways Camp (Corrections)	6	2006
IH11	Trail Bay	3	2004
IH15	Peter Lake	10 to 20	2004 to 2005
IH15	Reindeer Lake	10 to 15	2005
IH16	Macoun Lake	3 to 10	2003
IH17	Besnard Lake Road	2 to 4	within 5 years
IH17	Sikachu Lake Road	2 to 4	within 5 years
IH17	Besnard Lake Road	8	2001
IH17	Morning Lake	2	2005
IH17	Nemeiben Lake (Sucker Lake)	1	2003
IH17	Nemeiben Lake (Sucker Lake)	8	2001
IH17	Totten Lake	9	2005

Table 12 – Woodland caribou ecology. Local knowledge of woodland caribou health, parasite, ticks, poison, growths, and other comments relating the health of woodland caribou.

Interview ID	Health	Local knowledge
IH2	Parasites	Certain years worms will appear in nostrils of caribou.
IH6	Parasites	Caribou are infected by worms but don't die from them.
IH6	Parasites	Worms dig into the skin, once they are in the skin or fur, they can't be removed.
IH6	Parasites	Worms yellow in color and the smaller then the diameter of a Q-tip and inch in length, get them in the spring as worms live in the brain and in the fall they turn into flies.
IH11	Parasites	In the spring time one of calves had worms in the brain.
IH15	Parasites	When his brother in-law killed that caribou they found worms in the head and they were green.
IH18	Parasites	Wolves and caribou are affected by the same parasites.
IH6	Ticks	Ticks will drive the caribou to the ice in the spring when the snow melts; the spring is when the ticks are the worst.
IH8	Ticks	In the spring is when caribou have ticks there are not many, not like moose; Moose lose their hair when they go into the muskegs, caribou don't do that.
IH17	Ticks	He has observed on caribou to have ticks, but only in one spot.
IH12	Poison	Possibly getting sick from certain plants.
IH15	Poison	Seven years ago a caribou fell into a tailing pond and died from the tailings, it was poisoned.
IH15	Poison	The last year they got a caribou and it did not taste like caribou.
FG2	Lumps/ growths	A lone caribou was found to have lumps between the nose and brain.
IH18	Lumps/ growths	There was a calf shot once that had lungs growing out of its rib cage.
FG2	Healthy	One caribou was taken from a group of 10-20 and it was found to be healthy.
FG4	Healthy	Caribou have lots of marrow in their bones.
FG5	Healthy	Excellent body condition of the caribou that was killed at Costigan Lake, it had lots of fat.
IH8	Healthy	It has been a while since they have hunted caribou, when they did the caribou were healthy.
IH11	Healthy	The caribou killed for subsistence were healthy.
IH15	Healthy	The caribou killed at Harriet Lake was in good health.
IH16	Healthy	The caribou are in good shape and fat.
IH17	Healthy	Caribou are always healthy.
FG2	Unhealthy	Lone caribou are more likely to be in poor health or diseased.

Table 13a - Ecology of woodland caribou movement. Local knowledge of seasonal woodland caribou migrations routes and corridors.

Interview ID	Season	Local knowledge
IH2	Winter	Certain times of the day the caribou move out into the lake.
FG1	Winter	Spent in the hills and on islands.
FG4	Winter	Caribou used to go out on the ice and it's been awhile since this has been observed.
IH8	Winter	They start moving north in December, near Christmas time.
IH11	Winter	The caribou were traveling south in the winter.
IH14	Winter	Winter is the only time to track caribou.
IH17	Winter	1-4 caribou near Besnard and Sikachu walked through a logging cut, and they were not tracked again all winter, so they remained in the area they went to.
FG5	Spring	In March the caribou begin to come out onto the ice, "sun bathing".
IH16	Spring	The caribou from McCoun Lake crossed to some island.
IH7	Fall	They have observed caribou traveling in through a burned area in November just before freeze-up.
FG4	Spring/Winter	11 caribou observed out on the ice.
IH14	Spring/Winter	They are tracked around the portages and the highway every winter and spring.
FG1	Spring/Fall	Woodland caribou are on the move.

Table 13b - Ecology of woodland caribou movement. Local knowledge of diurnal woodland caribou behaviour or changing patterns of behaviour.

Interview ID	Category	Local knowledge
FG5	Behaviour	Caribou travel on a trail, one behind the other.
IH6	Behaviour	Some herds of caribou are about 20.
IH6	Behaviour	The caribou stay in groups all year round, some form different groups.
IH6	Behaviour	There are always odd single caribou.
IH6	Behaviour	Caribou hesitate crossing a road.
IH7	Behaviour	"herd" would include 30 individuals.
IH7	Behaviour	Caribou groups will always be on the move in a small radius.
IH7	Behaviour	They will scatter around.
IH8	Behaviour	They observe caribou traveling north.
IH8	Behaviour	If caribou travel through popular and pine area, they don't stay long.
IH8	Behaviour	When hunted, if you shoot one caribou the others don't run away.
IH12	Behaviour	They move across roads, often to find food like the white moss.
IH13	Behaviour	Caribou go down to the river and along the shoreline.
IH13	Behaviour	Near his cabin there are lots of caribou, and they travel back and forth.
IH15	Behaviour	The Dene people know caribou can travel 50-60 miles a day.
IH17	Behaviour	They like walking; they walk and walk and walk constantly moving, similar to the barren ground.
FG3	Changing behaviour	Limited areas for migration routes.
FG3	Changing behaviour	Certain individuals will herd up and migrate, others will stay behind.
IH5	Changing behaviour	They are not returning to some areas, they may be moving to another location.
IH7	Changing behaviour	Woodland caribou are moving into new areas, shifting might be due to changes in the food chain and water quality.
IH14	Changing behaviour	Figures that like moose, the caribou are moving north.
IH15	Changing behaviour	The caribou from up north are coming down south.
IH16	Changing behaviour	When there are fires the caribou came north.
IH17	Changing behaviour	The morning lake area was the main migration route for the caribou to travel between the south and up north up to the Foster Lakes, this migration has not happened now for years, he was only 6 the last time the migration took place, after that logging activity began.

Table 13b (continued) - Ecology of woodland caribou movement. Local knowledge of diurnal woodland caribou behaviour or changing patterns of behaviour.

Interview ID	Category	Local knowledge
IH17	Changing behaviour	The caribou that are wondering around indicated the place they were born is no longer usable, now they are forced to look for a new territory.
IH18	Changing behaviour	Caribou used to go down as far south as Montreal Lake.

Table 14 - Ecology of woodland caribou. Local knowledge of food and food quality.

Interview ID	Food/quality	Local knowledge
FG1	Moss/lichen	Eat reindeer moss and old man's beard
IH3	Moss/lichen	The white moss is very important food source
IH4	Moss/lichen	Caribou eat lichens and white moss
IH4	Moss/lichen	White moss is slow growing
IH6	Moss/lichen	"wapiskamkwa" that is what there called caribou moss. That is what they eat.
IH11	Moss/lichen	The caribou that were tracked were in thick forest, mixed spruce and jackpine. These forests have both moss and lichens
FG2	Muskeg run-off	Woodland caribou will eat the brown slush on the ice where the marsh water is emerging
FG4	Muskeg run-off	Caribou go out onto the ice and drink the yellow water (snow), this phenomenon has been rarely observed recently
FG5	Muskeg run-off	When they travel on the lakes, the caribou dig through the snow to get the yellow snow/ice water.
FG1	Brush	Eat brush similar to moose.
FG3	Low quality	Loss of food source.
IH4	Low quality	There is not much food for the caribou to have large numbers like barren ground caribou.
IH4	Low quality	The woodland caribou have to keep moving to look for food, they eat everything.
IH6	Low quality	They follow their food, where the food is easier to get at.
IH6	Low quality	They will stay in an area that has food, but do not linger in that area, they will continually move.
IH14	Low quality	On the jack pine ridges there is less moss from clear cutting.
IH14	Low quality	When there is clear cutting the caribou leave the area.
IH13	High quality	The caribou on his trap-line, have lots of food.

Table 15 - Ecology of woodland caribou. Local knowledge of woodland caribou calf biology and calving grounds

Interview ID	Description	Local knowledge
IH4	Physical area	The calving grounds are in the same place every year, the scrap away the bark and there are packed trails.
IH4	Physical area	When they are with calves, they stay near water and muskeg.
IH11	Physical area	Calving areas could be the muskegs, where there are many fallen trees similar to where moose have their young, on islands.
IH12	Physical area	Calves are born in April-May, along rivers in the grass.
IH15	Physical area	The calving areas are in the bush, they have no muskegs.
IH17	Physical area	Calving areas tend to be on islands or high ridges, where the white caribou moss grows.
FG1	Predation	Born without scent, difficult for wolves to detect them when they are hidden in the bushes.
FG2	Predation	Calves are quite big when they leave their natal area.
FG2	Predation	Vulnerable to wolves and bears.
FG3	Predation	Vulnerable to predation.
IH11	Predation	Calves are not observed, they are already very solid.
IH17	Predation	Survival strategy is to have calving grounds in the cliffs and rocky area and on small islands so they can jump into the water to escape wolves and other predators.
IH6	# of offspring	They mate in July and August and have one offspring between May-June, unheard of to ever see twins.
IH6	# of offspring	The single offspring maybe part of the reason they are so low in numbers, if they lose their young in that year, that's it.
IH17	Respect for offspring	People don't observe the caribou calves, because they don't want to disturb them. They don't' kill animals at certain times of the year to let them reproduce. He has never observed a calf.

Table 16 - Ecology of woodland caribou local knowledge of habitat (forest type), high quality (HQ) and low quality (LQ).

Interview ID	HQ/LQ	Forest type	Local knowledge
FG2	HQ	Jackpine	Jack pine stands with caribou moss are important habitat for caribou.
IH8	HQ	Jackpine	They over winter in the muskeg areas feeding on moss in jack pine stands.
IH14	HQ	Jackpine	Muskegs, jack pine ridges and along rivers, creeks, lakeshores and islands are important habitats.
FG5	HQ	Muskeg	In the summer the caribou stay in the muskegs because those muskegs were cold.
IH12	HQ	Muskeg	Muskeg areas are important.
IH13	HQ	Muskeg	In the summer time the caribou live in the open muskegs.
IH15	HQ	Small lake	Caribou are found near these little lakes.
IH4	LQ	Disturbed	When a fire goes through, the caribou have to go to a more sheltered area.
IH14	LQ	Disturbed	It will be important to conserve the land and other areas for the caribou.
IH15	LQ	Disturbed	There used to lots of caribou in between Southend and Stanley Mission, since the forest fires (6 years ago), the caribou left the areas near Stanley Mission, they are now mostly in the northern area near Southend.
IH17	LQ	Rocky/low muskeg	Caribou don't like rocky muskeg and low muskeg.

Table 17 - Ecology of woodland caribou. Local knowledge of population trends

Interview ID	Trend	Local knowledge
IH11	Extirpated	There used to be quite a few in the Trade Lake area, now there are none, since a fire.
IH12	Extirpated	The caribou are disappearing. They might be affected by human hunters or no food for the caribou.
IH13	Extirpated	Observed 5-6 caribou near a little creek. They are gradually disappearing due to the wolves.
IH14	Extirpated	The number of caribou is less then in the past, the last time he observed a caribou was 15 years ago.
IH15	Extirpated	There are no caribou at Brabant.
IH11	Declining	There used to large groups of them out on the lake.
IH15	Declining	There were lots of caribou. Now they are getting to be less numerous since the forest fires.
IH16	Declining	In the 70's there were lots of caribou and lots of wolves it the area.
IH8	Recovering	There used to be high number of caribou, there is less now but the numbers are coming up slowly.
IH14	Recovering	They are coming back in numbers but not too many.
IH17	Recovering	He has observed more caribou activity than he has in the last 30 years in that one area.
IH17	Pre-logging	The caribou migrate through the lakes into the big muskeg, in the spring during early freeze-up 20-30 caribou would come through Morning Lake.
IH17	Post-logging	Only two caribou have been tracked in Morning Lake.

Table 18 – Predator and prey interactions. Local knowledge of wolf-ungulate interactions.

Interview ID	Prey species	Local knowledge
FG1	Woodland caribou	Caribou move to islands for calving (to escape this predator); No observed remnants of a kill; During trapping season, susceptible to predation after the rut they are injured.
FG2	Woodland caribou	Prey cycles will affect many animals and cause their population to crash - rabbits, ptarmigans, foxes, dogs and caribou.
FG3	Woodland caribou	Move to isolated islands to have their calves, to escape wolves. Wolf tracks observed following adults caribou in winter. Prey on caribou; Observed wolf tracks chasing adult caribou, but no kill observed
FG5	Woodland caribou	If attacked by wolves, the caribou are able to defend or use escape tactics by jumping and kicking actions
IH4	Woodland caribou	They used to be few in each pack; Now they are in large packs and there is less for them to eat.
IH4	Woodland caribou	They are the main predator for the caribou.
IH6	Woodland caribou	Main predator for the caribou; When chasing caribou or deer, the wolves will chase the prey to areas where other wolves are waiting, and then the next one continues the attack and chase.
IH8	Woodland caribou	The main predator of woodland caribou; They used to travel through his trap-line every year at the same time, but they are gone now.
IH9	Woodland caribou	It only takes one wolf to bring down a caribou; Wolves chased caribou near town, the caribou escaped and returned to its territory, the north end of the lake; it was found later, killed by the wolves; Wolves have an easier time hunting caribou in spring, when the snow is crusty, caribou will fall through and wolves don't punch through the snow.
IH11	Woodland caribou	If there are no caribou, it might be related to the over-populated wolves.
IH16	Woodland caribou	Wolves can have a negative effect on caribou.
IH17	Woodland caribou	The largest predator of caribou, deer and moose. The location of the denning areas is almost the same as caribou but not quite.
IH18	Woodland caribou	The wolves prey on caribou.
FG4	Woodland caribou-kill	Three locations of caribou kills had been observed.

Table 18 (continued) – Predator and prey interactions. Local knowledge of wolf-ungulate interactions.

Interview ID	Prey species	Local knowledge
IH17	Woodland caribou-kill	There is a location where he encounters caribou killed by wolves.
IH7	Woodland caribou-no kill	Never observed a wolf killed woodland caribou.
IH14	Woodland caribou-no kill	No wolf-killed caribou carcass observed.
IH7	Barren-ground caribou	The three packs were heading north and another trapper tracked these packs as well; These packs were observed heading northwest through the Geikie River area; These packs were observed moving north in December (2002-2003); One explanation for the large wolf packs is they are thought to migrate up to meet the barren ground caribou herds.
IH9	Barren-ground caribou	Wolf tracks in the spring indicate they travel north, heading to the calving grounds of the barren ground caribou, north of Pelican Narrows. Tracks number up to 50 wolves heading north; there are lots of communities that have observed the wolves traveling north to the barren ground territory.
FG1	Moose	Remnants of a wolf kill are observed.
IH2	Moose	One pack, (range 15-20 individuals) seasonal movement from North (Churchill River) to Clam Lake; Last occurrence (date), pack of 16 killed a moose, Clam Lake; Observed wolf kill on Clam Lake.
FG2	Moose	Prey upon moose calves.
FG2	Moose	A lone wolf can bring down a moose when the snow is deep this allows wolves to walk on top of the snow, moose can not, so the wolves catch up to them.
FG2	Moose	In December (after the rut), wolves do not eat Bull Moose, they are too skinny.
FG4	Moose	Calves on islands to escape the wolves.

Table 18 (Continued) – Predator and prey interactions. Local knowledge of wolf-ungulate interactions.		
Interview ID	Prey species	Local knowledge
FG5	Moose	In a moose hunt the older wolves are waiting in an opening and the younger wolves chase the moose to the older wolves; Once the Alpha male or Female has the moose they won't let go and younger wolves will begin to attack and "chew-up" the moose; Once a moose has been subdued by wolves it can't easily throw off the wolves; In another case there were two wolves chasing a bull moose. The bull moose was too strong for the wolves so they would take turns attacking (sometimes pulling out chunks of fur), but never able to bring down the moose. They continue the attack until they wear out the big Bull Moose. The moose doesn't have time to eat or rest. The carcass of the moose was observed in a nearby muskeg and it took about week or two to bring down the moose.
IH9	Moose	Wolves will kill moose and only eat the guts and leave the rest for the crows, like sport killing, in the spring; Wolf tracks were observed in a straight line for 30 miles, by the end of the day they kill a moose; Wolves are observed to kill moose that are 1 ½- 18 months old; They try to run away from wolves; Dry willows are important for moose, they use the dry willows to try and hear wolves approaching.
IH16	Moose	In the 70's there were lots of wolves, 5 were chasing a moose at a portage; 5-10 wolves cached a moose at a portage.
IH17	Moose	The largest predator of caribou, deer and moose.
FG1	White tailed deer	Remnants of a wolf kill are observed.
IH9	White tailed deer	Fight back during a wolf chase, this was observed 4 times and the deer always lost.
IH11	White tailed deer	They have killed off all the deer.
IH14	White tailed deer	Observed a wolf-kill.
IH17	White tailed deer	The largest predator of caribou, deer and moose; There are few deer, because they are easy for wolves to pick off; The only refuge they have is the lake.
FG2	General	Lone wolves are more likely to be in poor health or diseased.
FG2	General	A wolf bite can poison an animal.
FG2	General	Wolves when chasing prey, they follow the animal until they tire it out.
IH4	General	It is hard to trap wolves.
FG4	General	Six or seven wolves in a pack.

Table 18 (Continued) – Predator and prey interactions. Local knowledge of wolf-ungulate interactions.

Interview ID	Prey Species	Local knowledge
FG5	General	Wolves have a tough time killing caribou, they can really kill moose.
FG5	General	Alpha male and alpha female will have about 4 pups every year, so 6 in packs.
FG5	General	Wolves can go ten days between meals.
IH7	General	There were large packs 3-4 years ago; Packs ranged from 50 and 75 individuals and one the smaller pack had 28; Wolves will move 100's of miles in a typical year; They return to the same areas every year at particular times.
IH9	General	Wolves take turns when pursuing prey; Wolves will come around line cutters and they have trails facing the cutting; In a wolf encounter, two boys were able to scare off 7 wolves, the wolves came up to 50 yards of the boys; In a second event wolves came up to the boys and were bumping the husky dogs, and circle the cabin and howling for one night, the wolves never killed any of the dogs; In another incident an elder had gotten in between wolves in pursuit of a deer, they chased the elder into his cabin and bumped the husky dogs; they didn't fight or kill the dogs; Wolves will wait in the brush and ambush prey in the summer, animals use the brush to take off the black flies, and the areas they use are the lakeshore and forest edges; Some wolves stay and have their pups, and the ones that go up north return south or they would starve.
IH11	General	The main predator; There are lots of them; They are difficult to trap, they are smart and know where traps are set; When the snow is deep the wolves don't have a hard time catching prey; There are lots of wolves in the Drinking Lake area.
IH12	General	Wolves in packs of 2-4; Wolves have been taking pups from trappers cabins.
IH13	General	People are tracking a lot of wolves on the roads; There are lots of wolves near his trapline.
IH14	General	14 wolves were tracked, but this is not that many.
IH17	General	There are lots of them, nobody traps them anymore, and their pelts are not worth it; They are nocturnal; they don't come out during the day; They are starting to increase in numbers, because of the lack of trappers trapping them; Wolves have come into his camp in the summer and fall looking for food; There was a wolf attack at his brother's camp, where the wolf bit the dog, the dog later died.

Table 19 – Predator and prey interactions. Local knowledge of other predator species

Interview ID	Predator species	Prey species	Local knowledge
FG1	Black bear	Woodland caribou	Caribou move to islands for calving; When they leave the islands bears can get them.
FG3	Black bear	Woodland caribou	Potential caribou predator.
IH17	Black bear	Woodland caribou	The other major predator of caribou, especially caribou and moose calves.
IH11	Cougar	Woodland caribou	Potential predator of caribou.
FG1	Wolverine	Woodland caribou	When they leave the islands (they are susceptible to this predator).
IH15	Wolverine	Woodland caribou	Kill caribou and beavers when they haul their logs.
FG1	Black bear	Moose	Observed swimming to moose carcass.
FG2	Black bear	Moose	Prey upon moose.
IH12	Cougar	Moose	Kill moose.
IH12	Cougar	White tailed deer	Killed by cougars.
FG1	Canada lynx	Moose	Good swimmer in the river and lake; Observed to swim towards drowned moose carcass.
IH17	Black bear	General	There are lots of bears and they keep trying to feed on the garbage; They are shot if they become too tame; They can go into cabins and break everything.
IH6	Cougar	General	They may be in the area, but they are hard to find or see.
IH8	Cougar	General	Observed near Smoothstone River; They have large tracks and can jump up to 14 feet.
IH11	Cougar	General	There used to be cougar in the Keg Lake area.
IH12	Cougar	General	Tend to stay in areas where there is lots of pine and small spruce and creeks.
IH15	Canada Lynx	General	He trapped a lot of lynx on his trap-line.

Table 20 - Local knowledge of other ungulate prey species.

Interview ID	Prey species	Local knowledge
FG1	Moose	Calves vulnerable to ticks.
FG2	Moose	Known to have their calves on islands; One moose was found to have pus on the lungs.
IH3	Moose	Affected by the worms as well.
FG4	Moose	A low number of moose in certain areas.
IH6	Moose	Mating season for the moose is late fall and they can have twins; Moose are hit hard by tick in the spring and will get skinny.
IH14	Moose	There are some moose (near his trap-line).
IH16	Moose	There are moose near his cabin.
IH17	Moose	He shot a moose, the hide looked unhealthy, the liver was unhealthy, the meat was unhealthy, it was full of pin worms, and he gave the meat to resources; Moose carry ticks all the time, when the water opens they wash them off.
IH18	Moose	There used to be lots of moose 7-12 in the same little area, now you are lucky to see 2 around the same lake.
FG3	Barren-ground caribou	Smaller then the woodland caribou with a larger rack; They traveled south near Churchill River.
IH4	Barren-ground caribou	In 1946 the caribou came to Irving Lake.
FG4	Barren-ground caribou	Would make appearances out on the ice near Rottenstone Lake; BG Caribou will go out on the lake at certain times of the day and when there under certain ice conditions.
IH7	Barren-ground caribou	Sensitive to forest fires (observed tracks before fire of 82).
IH15	Barren-ground caribou	There used to talk of barren ground caribou (60 years ago) reaching La Ronge, woodland caribou follow the small ones back up north, that is what the old people thought from this area; It is believed that the woodland caribou left with the barren land 50 years ago.
IH18	Barren-ground caribou	Would come down to Reindeer Lake, numbers in the 1000's.
IH18	White tailed deer	The deer are being pushed north because of all the human activity, snowmobiles and logging.

Table 21 - Human activity. The effects of logging activity on woodland caribou including road development and access to remote areas.

Interview ID	Effect on caribou	Local knowledge
FG1	Migration	Wapawekka (WEST), caribou used to travel in these areas, they are now going into the narrows; After roads are made woodland caribou avoid these areas; Forestry and related economics are seen as taking priority over species conservation; people want to see the priority reversed.
IH2	Migration	Caribou corridors, historical migration routes are no longer used.
FG2	Migration	After logging activity, caribou will disappear from those areas; the caribou will migrate out of the area looking for food.
FG4	Migration	Since clear cutting many of the areas no longer have caribou.
FG5	Migration	Forestry machinery makes too much noise and this has a negative effect on woodland caribou, it will drive caribou out to more quiet areas; The corridors that are left behind after logging operations are being used by all the animals forced out of the clear-cut.
IH8	Migration	Seen large groups of caribou before the highway came through his trap-line (1971-72); In areas of logging, caribou will vanish; Humans are the biggest threat to woodland caribou; It will be important for us to manage the forest and the resources to save caribou.
IH17	Migration	Since the logging activity the caribou have lost their habitat and are scattered all over, their migration routes were depleted, they are more vulnerable; Given the opportunity, he does not hunt caribou to let them regain some of the area not being disturbed by logging.
IH18	Migration	The logging activity chases the caribou farther north.
IH2	Access	Snow machines have a negative impact; People chasing after them to take pictures has a negative effect.
FG2	Access	Access into caribou habitat is increasing and also places more pressure on moose and caribou.
FG3	Access	Snowmobiles in La Ronge area out on islands might be affecting the caribou; Easy access to the caribou herds.
FG5	Access	Recreational snowmobile traffic is increasing and people travel through certain areas all night long; In certain areas people find it easier to access their trap-line since roads have been built.
IH12	Access	Vehicles and traffic might be affecting the caribou.
IH13	Access	There are lots of snowmobiles this could be affecting the caribou.
IH16	Access	He observed some canoers chasing a moose out of a portage.

Table 21 (continued) - Human activity. The effects of logging activity on woodland caribou including road development and access to remote areas.

Interview ID	Effect	Local knowledge
IH18	Access	You don't see animals out on the ice anymore, because of all the snowmobiles, the caribou are north because of this; Human activity has something to do with the caribou disappearing, the logging and the mining activity and snow machines.
FG3	Population decline	Certain areas have lost between 50-100 caribou.
FG5	Population decline	The roads built during the forestry operations will increase activity of predators with a noticeable increase in both human and wolf use of the roads; The logging roads should be closed down after the logging is finished.
IH17	Population decline	The most dangerous thing for caribou right now is the logging activity; it is disturbing their migration routes that they have used for thousands of years, they wander unknown territory, they end up in your front yard or on wolf territory.
IH3	Food	Logging will kill the white moss, an important food source for the caribou.
FG2	Food	After logging activity, caribou will disappear from those areas; the caribou will migrate out of the area looking for food.
FG4	Food	Clear cutting is affecting the food and the calving areas for caribou.
IH2	Calving	Affects calving grounds, mating grounds.
FG4	Calving	Clear cutting is affecting the food and the calving areas for caribou.

Table 22 - Human activity. Local knowledge on woodland caribou and the effects of mining, pollution, and exploration.

Interview ID	Effect on caribou	Local knowledge
FG2	Disease or pollution	People/companies/outfitters are responsible for cleaning their area, so animals do not become reliant on garbage as a source of food.
IH15	Disease or pollution	3 dead swans were found at a tailings pond.
IH18	Disease or pollution	Diamond drillers often leave their empty containers, some of this ends up in the lake; the water caribou drink maybe contaminated; Contaminated lakes have abnormal fish; Business owners operating near these lakes will not disclose information, with the fear of losing valuable tourist appeal.
FG1	Forced migration out of area	Wapawekka Lake (Winter), caribou have been observed to inhabit new areas; Drilling on ice scares caribou away from Wapawekka Lake, forces them further back to the narrows.
IH18	Poaching	People with exploration companies will shoot caribou they come across while snowmobiling.

Table 23 - Human activity. Local knowledge on historical licensed hunting and current and historical views of subsistence hunting by First Nations hunters.

Interview ID	Concerns	Local knowledge
IH3	Ethical	People's ethics about hunting are changing; some people see five animals and shoot all five; some people will lie about how many they take; Views of caribou are they are "stupid" they don't run away when one is shot, this makes them vulnerable if people want to shoot many animals.
FG3	Ethical	People are not able to talk openly about caribou, or locations; When hunting caribou was licensed, only the tongue was taken.
FG5	Ethical	There has been a noticeable change in the way people hunt; Certain people can kill a large number of animals and not have a conservative approach, they don't think about the future; There is some concern that treaty rights are more important than conservation of the species. Several examples exist for the hunting of moose in different areas. You don't go on to someone else's land to hunt; you hunt only on your own traditional land, that's what the intention of treaty rights were to elders.
IH8	Ethical	Ethic of hunting is changing, hunters tend to shoot animals as they see them, they don't think about protecting them or managing them.
IH16	Ethical	People have a negative impact on caribou; They heard of someone killing 3 caribou.
IH17	Ethical	A group of 8 caribou crossed and never came back; two possible explanations for the caribou not returning, they don't want to come back or they are being killed up north.
IH18	Ethical	Young hunter these days don't recognize what they are looking at; in the winter you have to know how to recognize male and female, when they drop their horns, this one guy had killed 3 cows, and they had 5 young ones, for a total of 8 moose killed at once.
FG1	Conservation	Comment on the way beaver were trapped until there were none left; They came back and they were managed properly, we can do the same thing for caribou, manage them; Traditional hunting methods are a way to teach conservation to children and grandchildren, "take what you need for today, and let them repopulate".
FG2	Conservation	Aboriginal hunters only take what they need for food.
FG4	Conservation	When people hunted traditionally, they needed it; they didn't hunt all the time.

Table 23 (continued) - Human activity. Local knowledge on historical licensed hunting and current and historical views of subsistence hunting by First Nations hunters.

Interview ID	Concerns	Local knowledge
FG5	Conservation	Trapper's ethics are to conserve the resources on their trap-line, always leave something behind.
FG4	Cultural loss	People used to like making the caribou hides; Women participated in hunting of many different kinds of animals; Women and children would participate in the hunt for caribou when they were observed out on the ice; Bone marrow is enjoyed after a kill; Caribou hair would be used to make harnesses and collars for the dog teams; The outer skin of the caribou hide would be scraped off and fed to the dogs or freeze it.
IH13	Cultural loss	It is hard to travel in the muskegs, but people use snowshoes to travel there in the winter.
IH17	Cultural loss	During the migration, there was a sense of excitement when the caribou were migrating through, his parents would only take 1 or 2; The hunting way of life is disappearing; even chicken hunting and fishing are being lost.
IH18	Cultural loss	He used to snare caribou with his dad; if you go along the rapids and find the game trails, that is the place they used to set snares, the horns would get caught and they would shoot it with a .22 rifle; In summer people rely on all kinds of food, bear, porcupines, and with beaver and muskrat, we would eat these in the spring and fall, if they really needed food in the summer, they would take a caribou while they were swimming.
FG2	Predators	People tend to blame caribou/moose kills on wolves, but they [hunters] only kill what they need to feed themselves; Aboriginal hunters observe many wolf packs as a result of fewer trappers; this puts more pressure on both moose and caribou.
IH18	Predators	Trappers don't take wolves as much anymore.
FG2	Cycle or fluctuations	Hunters and predators are not to blame, certain years many animals will die as part of a cycle.

Table 24 - Weather factors. Local knowledge of water and precipitation.

Interview ID	Importance relating to caribou	Local knowledge
FG2	Water quality or level	Acid rain might be affecting the animals.
FG3	Water quality or level	When there is lots of slush, caribou stay in the bush.
IH6	Water quality or level	When the snow gets really deep the caribou move to higher ground where the snow is blown off and where the white moss is.
IH8	Water quality or level	Water quality has changed significantly since.
IH9	Water quality or level	Floods can have a negative impact on caribou; If it floods their muskeg and the caribou have to concentrate in one area.
IH17	Water quality or level	Climate change has been caused by humans.
IH2	Diet	Shovel snow to eat the brown slush.
FG2	Diet	Brown slush water is important for caribou.
IH3	Diet	Yellow slush from the creeks is important. The caribou will dig at the snow to drink the water.
FG1	Insects	Lots of water means lots of mosquitoes and flies, but the caribou survive.
IH6	Insects	The caribou can walk on ice and deep snow, they are big hooves compared to their body weight, and in the spring when the snow is gone they go out and lay around the ice because of their ticks.
IH8	Insects	Even in hot weather, as long as caribou have access to water they can escape bugs, muskegs are critical to woodland caribou survival.
FG2	Predators	Certain snow conditions favor wolves bringing down large prey.
IH17	Predators	Water and islands are important for survival and escaping predators for all prey species, moose, deer and caribou; Over the winter the animals don't have the open water; they must outlast and outrun them to survive.

Table 25 - Weather factors. Local knowledge of warm or cool winters and wind.

Interview ID	Weather type	Effect on caribou	Local knowledge
FG1	Warm	Death	Drowned moose from unsafe ice conditions.
IH2	Warm	Insects	Warm winter means more ticks.
IH11	Warm	Lack of food	Climate change might be affecting the [woodland] caribou, with mild winters, lack of food and lack of shelter.
FG1	Cool	Survival	Cold temperatures, caribou can survive.
IH6	Wind	Predators	When it is windy they [woodland caribou] follow the wind, they run really fast as if they are running away from something.

Table 26 - Weather factors. Local knowledge of fire and spruce budworm.		
Interview ID	Years since fire	Local knowledge
FG3	Current – 10	Current forest fires and dry conditions in the forest; Caribou will go around areas that have been burned or leave the burned area; Areas that have been burned by fire have no food for caribou.
IH4	Current – 10	Fires destroy the white moss.
FG5	Current – 10	The spruce bud worm killed all the spruce buds, which are food for the squirrels which affect the number of marten since marten rely on squirrels for food; The cycle began 7 sevens prior to 2006.
IH6	Current – 10	If a fire goes through an area, caribou will leave.
IH7	Current – 10	Kemp Lake was the last big fire (post fire 5 years); Johnson's Lake was burned out right to Reindeer Lake. Back burns will do more damage then good, it burns a lot of territory, animals and wildlife; Animals either suffocate, burn or move out of the area. Fire fighting methods with lots of ground crews fighting fires during the night; Methods of firefighting rely mainly on pilots and water bombers, it is not efficient.
IH11	Current – 10	Certain areas will have no fires for a long time.
IH14	Current – 10	Thick smoke affect caribou.
IH18	Current – 10	Both logging and fire have something to do with pushing the animals up north.
IH16	10 – 20	After the forest fires near Hall Lake, it is unclear of where the caribou are; Forest fires have a negative affect on caribou; After the forest fire, there are no more fur-bearing animals.
FG3	20 – 30	Fire in the 80's, last ten years, they have not returned.
FG5	20 – 30	(Post-fire 25 years) - A 1981 forest fire swept through his trap-line, there seems to be greater amount of diversity; In old spruce stands there is only woodpeckers and ants, after a fire, moose like the newly burnt areas; Numerous rabbits and lynx are beginning to come back, chasing after rabbits.
IH7	20 – 30	(Post fire 25 years) - Still no caribou have returned to these burned areas; There used to be small groups 2-4 individuals.
FG5	50 – 60	(Post-fire 60 years) - In the 1940's forest fire swept through La Ronge, it has been sixty years and the trees are still not that big; The effects of fire can be related to effect of clear cutting, it takes a long time before trees come back, the diameter of the trees after many years is still small and that's why it is so important to trappers to stop clear cuts; Forest fires kill off the caribou moss and it takes many years for it to grow back.

Table 26 (continued) - Weather factors. Local knowledge of fire and spruce budworm.		
Interview ID	Years since fire	Local knowledge
IH15	50 – 60	(Post fire 50 years) - There used to be lots of wolves and caribou since a big fire 50 years ago there are no wolves or caribou. The moose are now beginning to return; Since there have been so many forest fires, there are no animals around.

APPENDIX 2 – FORMS AND DOCUMENTS

MEMORANDUM OF UNDERSTANDING

Between

University of Saskatchewan,

Agency 1

and

Agency 2

Date

Background:

Naomi Carriere is a student at the University of Saskatchewan wishing to carry out a study of woodland caribou. She would like to work with aboriginal and other people who are members of Trapping Blocks on the traditional lands of the Lac La Ronge Indian Band. Naomi believes that people on the land have a wealth of knowledge about woodland caribou and believes that she can help to ensure that their knowledge is passed on by having it written down and mapped.

The participants who would be involved in this project each belong to one of seven Trapping Blocks within the traditional lands of the Lac La Ronge Indian Band, and are members of the Band. The agencies involved in this project include the University of Saskatchewan, Environment Canada, Saskatchewan Environment and the Prince Albert Model Forest. The University of Saskatchewan is providing a unique opportunity for partnership between the scientific community and First Nations and Métis groups through collection of local knowledge. Environment Canada has a Canada-wide mandate to foster stewardship of woodland caribou as a Species at Risk through its Habitat Stewardship Program. Saskatchewan Environment is a government agency, responsible for the conservation and recovery of woodland caribou including many levels of management decisions in the study area of Lac La Ronge. Prince Albert Model Forest Inc. has a mandate to create partnerships between the Forest Industry and First Nations, and to promote forestry practices that are ecologically sound. One goal of the current research is to build communication (stewardship) links between schools, First Nations, Métis, Industry and Government.

As collaborators on the collection of Local Knowledge, the participants will be requested to share information, and agencies involved will be required to handle the collected information according to a specified protocol (see Agreement) that is respectful of the participants. The purpose of the protocol is to respect the rights of participants to control the use of contributed information by all agencies and the general public, encourage on-going communication with the participants, and protect participant anonymity and to prevent the mistreatment of the collected information. The rights of First Nation and Métis groups shall be acknowledged and respected throughout the duration of the study. In addition, any information shared by a participant should not be used alone to make management decisions that affect First Nations and Métis hunting and trapping activity and areas. Willing participants should also be invited to take part in creating strategies for

woodland caribou and habitat conservation. Finally, the information collected will be used to further strengthen the relationship between First Nations, Métis, government, industry, and schools.

Agreement:

In order to promote partnerships between the government, industry, First Nations, Métis and Universities and a responsible exchange of information the agencies agree to the following:

1. The agencies within the MOU and any representatives of those agencies will not collect, alter, use, disclose or distribute any information provided by participants without the prior written permission and approval of participants and their Trapping Blocks, and the Lac La Ronge Indian Band.
2. The agencies within the MOU and any representatives of those agencies will not be allowed to disclose personal information of participants or the activities of the participant.
3. The agencies within the MOU and any representatives of those agencies will respect First Nations Treaty and Métis subsistence rights to the land and information disclosed by participants will not be used to impinge upon those rights.
4. The information collected and approved for release by participants will be saved on several types of media; paper, audio and CD. These files will not be accessed, copied, published, or referenced without the written permission of representatives of all four agencies within this MOU.
5. The participants, their representatives, and the agency signing this MOU, will have access to the dissemination of the final report (in addition to representatives from the Lac La Ronge Indian Band, Métis Local and Trapper's Block-FCA's). Any information that is to be disseminated beyond these agencies (within this MOU) must have written permission from representatives of all agencies within this MOU.

This MOU can be altered at any time with mutual agreement of all parties.

Signatures:

Principle Investigator:

_____

Name
Position
Address
Phone number
Email Address

Department Head, University of Saskatchewan

_____

Name of Department Head/ or Academic Supervisor
Position
Address
Phone number
Email Address

For *Agency 1*

_____

Name of contact
Position
Agency
Address
Phone number
Email address

For *Agency 2*

_____

Name of contact
Position
Agency
Address
Phone number
Email address

Woodland Caribou Distribution – Aboriginal Stewardship Project Consent Form

I, _____ of the Hamlet/Town of _____, have been asked to participate in the Woodland Caribou Distribution - Aboriginal Stewardship Project, by Naomi Carriere. I have been informed and understand the objectives of the project and consent to being interviewed for the project.

- I have received a copy of the consent form:

□Yes □No

_____ _____

Date Participant

_____

Researcher

_____

Witness

Woodland Caribou Distribution- Aboriginal Stewardship Project -Transcript Release

I, _____ from the Town/ Hamlet of _____ have provided consent to Naomi Carriere to record an interview and information on woodland caribou. I will also release all rights to the interview and any materials that come out of the interview process. I understand that the interviews and materials will be used for the purpose of conservation.

_____ _____

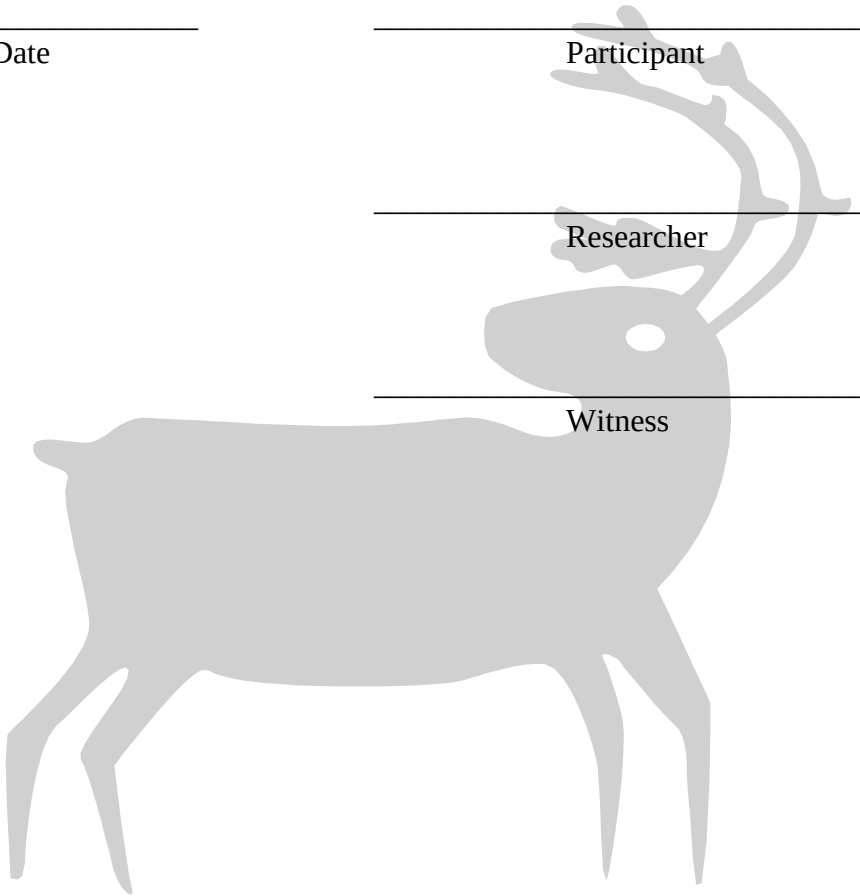
Date Participant

_____

Researcher

_____

Witness



Woodland Caribou Distribution – Aboriginal Stewardship Project
Agenda

Date
Time
Location

Opening prayer and Grace

Introductions

1. Name and trapping block,
2. Tell me about yourself
3. How long have you been a trapper or been going out to the trapline?

Discussion group

1. Where do you see woodland caribou?
    a. Has this changed over time?
2. What do the caribou look like? What is their health? Good or poor
    a. Why?
    b. Has this changed over time
3. Where do caribou have their calves?
    a. What happens to the calves when they are born?
    b. Do they eat the same food as the adults?

4. What kills caribou?
    a. What are the names for these?
    b. Are there lots of these types of kills?
    c. Has this changed over time?

5. What can cause a danger for the caribou?

6. What is important for conserving woodland caribou?

Gifts and closing prayer