

“These Trees Have Stories to Tell”

Linking Denésgliné Knowledge and Dendroecology in the Monitoring of
Barren-ground Caribou Movements in the Northwest Territories, Canada

by

Kelsey Lynne Dokis-Jansen

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Department of Resource Economics and Environmental Sociology in the Faculty of
Agricultural, Life and Environmental Sciences
University of Alberta

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ABSTRACT

Grounded in an Indigenous methodological framework and using dendroecology as a scientific assessment tool in combination with oral history analysis, this thesis assesses changes to caribou movement patterns in the traditional territory of Lutsel K'e Dene First Nation (LKDFN), Northwest Territories, Canada. This approach was used to explore ways in which scientific methods can be used within an Indigenous research framework. This approach shows that Indigenous ways of knowing can set the basis for identifying the important research questions and methods, and that appropriate and complimentary scientific methods can be used to build upon that framework. I draw from methods of natural and social science disciplines including Participatory Action Research (PAR), ethnography, community-based research, participant observation, and dendroecology (tree-ring analysis). I worked with elders and harvesters to document oral histories about caribou movement patterns and augmented their observations and stories with information from dendroecological assessment techniques. This thesis provides a framework for those seeking to conduct ecological research by drawing linkages between Indigenous knowledge systems and scientific methods. I use the specific example of broadening our understanding of caribou movements by combing oral history narratives and dendroecology, however, the lessons learned could be applied across a wide range of disciplines. This research project is not only about asking questions related to the impacts of resource development to the community of Lutsel K'e and the caribou on which they depend, it also demonstrates that Indigenous communities can embrace and implement scientific methodologies while remaining grounded in our own Indigenous knowledge systems and practices.

PREFACE

Some of the research conducted for this thesis forms part of a long-standing research collaboration between Lutsel K'e Dene First Nation and Dr. Brenda Parlee, the lead collaborator at the University of Alberta. The dendroecology analysis referred to in Chapter 3 was carried out by our research assistant Christina Leinmueller, with the assistance of Benoit Gendreau-Berthiaume, Dr. David Hik from Biological Sciences and with use of equipment, software and lab space provided by Dr. Ellen MacDonald in the Department of Renewable Resources at the University of Alberta. Chapter 4 and the concluding analysis in Chapter 5 are my original work, as well as the introduction and literature review in Chapters 1 and 2. Chapter 3 of this thesis will be developed into a journal submission and the results and discussion sections were a collaborative effort between Dr. Parlee and myself. I was responsible for the data collection and analysis as well as the manuscript composition. Pete Enzoe, Dennis Drygeese, Jasmine McCallum, Damien Kailek assisted with the dendroecology sample collection and site assessments. Dennis Drygeese, Terrie Enzoe, Pete Enzoe and Dr. Parlee assisted in the collection and analysis of oral history interviews.

DEDICATION

“Place gives us identity.....Place links present with past and our personal self with kinship groups. What we know flows through us from the ‘echo of generations,’ and our knowledges cannot be universalized because they arise from our experience with our places. This is why name-place stories matter: they are repositories of science, they tell of relationships, they reveal history, and they hold our identity.”

- Margaret Elizabeth Kovach

p. 61 in *Indigenous Methodologies: Characteristics, Conversations, and Contexts*

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CHAPTER 1. INTRODUCTION

1.0 Introduction

The past few decades of research on barren-ground caribou (*Rangifer tarandus groenlandicus*) has been prompted by concerns about declining populations and increased resource development in the Canadian North. Much of the ecological research on caribou population change has shown that this species experiences cyclical patterns of population decline and renewal that are influenced by both natural and anthropogenic stresses (Boulanger et al. 2011, Johnson et al. 2005, Nishi et al. 2010, Vors and Boyce 2009).

Given the complex nature of fluctuations in population and range-use for barren-ground caribou herds, it is necessary to draw from diverse sources of knowledge as we develop caribou management policies. Current, biologically focused research on the state of barren-ground caribou is primarily based on data gathered from aerial population surveys and satellite collar locations (Boulanger et al., 2011; Nishi et al., 2010). While these sources of information are valuable at painting a broad picture of caribou abundance and movement patterns, gaps remain in formulating a deeper understanding of change, particularly at the local scale. The role of Indigenous knowledge in filling these gaps is legislated and is increasingly recognized as an invaluable tool in understanding long-term trends and natural range of variation from a holistic, ecosystem-wide perspective where conventional, western approaches may be limited.

This thesis is grounded in an Indigenous methodological framework (Smith 1999). This approach highlights the importance of traditional knowledge to understanding many

aspects of social and environmental change. I also consider how scientific methods can also be useful within an Indigenous methodological framework. This work has used dendroecology methods in combination with ethnographic work (oral history interviews) to assess caribou movement patterns in the traditional territory of Lutsel K'e Dene First Nation (LKDFN) in the Northwest Territories. This approach was used to explore ways in which scientific methods can be used within an Indigenous research framework. I draw from the following methods including: Participatory Action Research (PAR), ethnography, community-based research, participant observation, and those used in conservation biology including dendroecology. Through 2011-2014, I was able to develop a greater understanding of the opportunities and challenges of linking traditional knowledge and science within the context of an Indigenous research framework as well as develop new insights about how caribou movements may be changing as a result of increasing resource development in the arctic.

2.0 Theoretical Framework

This work was informed by two overarching theoretical frameworks: (1) Traditional Knowledge and its role in contemporary resource management and community resilience and (2) Cultural Landscapes with links to concepts around sense of place, place-based knowledge generation and experiential learning. By building upon overlapping and cross-disciplinary theories I intend to find links between different ways of knowing.

3.0 Research Purpose and Objectives

The broad interest of the research was to understand how traditional knowledge and scientific methods might be useful for understanding changing patterns of caribou

movements. I came to this project with the expressed interest of better understanding how Indigenous knowledge systems can be better considered in contemporary resource management and environmental monitoring and intend to address that question in subsequent chapters. This work was driven by questions that I had about how to engage in the research process as an Indigenous person. How can research be conducted *with* and *by* Indigenous people while working within the structure of the western academy? Is it possible to link Indigenous ways of being and doing in western research contexts, and specifically with established scientific methods? To address this I approached this work with principles of Indigenous community-based research within an Indigenous research framework that honours Indigenous ways of being and doing and sought to address three specific objectives as presented in this thesis:

1. Determine, through case study research involving dendrochronology and oral history methods, how research involving Denésqliné knowledge and science can be linked to learn more about the social, cultural and ecological significance of regions valued as caribou habitat and by Lutsel K'e Dene First Nation (Chapter 2)
2. Link data from dendroecology and oral history research to develop a better understanding of how barren-ground caribou and Denésqliné use of *?edacho kue* has changed over the last 150 years (Chapter 3-4).
3. Discuss implications of the research for Lutsel K'e Dene First Nation's involvement in monitoring and management of barren-ground caribou (Chapter 5).

4.0 Thesis Outline

There are multiple audiences for this thesis; this chapter will provide a clear outline of the thesis and give context for how the work developed by presenting a brief narrative of the last four years. Chapter 2 reviews existing literature on traditional knowledge of caribou

movement in the Northwest Territories with a specific focus on Denésq̓liné knowledge. Chapters 3 reviews the methods used in this research and will be developed into a journal submission. Chapter 4 will also be developed into one or more journal submissions and presents oral history findings and results from dendroecology analyses. Chapter 5 will make concluding comments about the thesis. In addition to the academic audiences that will be the focus of the papers for future publication I am writing for my family, members of the Lutsel K'e Dene First Nation as well as other young Indigenous researchers who are focusing on the connection between Indigenous knowledge and scientific inquiry, specifically around research questions related to the land.

I want to make brief mention about the mixture of first person narrative and the standard academic third person reporting style of writing used throughout this thesis. When I write in the first person I am speaking more directly about my personal experience – which I see to be an Indigenous way of story telling and I am locating myself in the research process. When I speak in more general, third person terms I am referring more broadly to the thesis research in the context of the larger body of research around caribou movement and Indigenous methodologies. In some instances I use the term ‘we’ and here I am referring to collaborative work with members of LKDFN and with my supervisor Brenda Parlee. Where I have used the first person narrative I am clearly indicating that it is my personal opinion or story – the lens through which I have interpreted the work and my place in it.

5.0 Who are you and why are you here? Decolonization and Research as Rediscovery

The first time I travelled to Lutsel K'e I had no idea what to expect, I had never been farther north than Fort McMurray, Alberta, had never been to a Dene community, had never been on a bush plane and I had never led a research project – there were a lot of firsts. Perhaps the most important first was how I would explain what I was doing there, what this project was about. When I first met my now close friend Gloria Enzoe, she very pointedly asked me “who are you and what are you doing in my community?” This question I realize now is the most important question a researcher must answer when starting a new research relationship and that the answer has little to do with the project itself– I realized that the most important thing to tell people was who I was, to tell my own story.

I am Kelsey Dokis-Jansen, *Anishinaabe* from Dokis First Nation in northern Ontario. I was born and raised in Alberta, mostly growing up in Hinton, in the foothills of the Rocky Mountains. I spent my summers at Dokis with my family where I learned to swim, fish and work, to be part of the small community of our family – helping when help was needed and resting when the work was done. I learned from the places that I grew up and from my family and communities. As I entered my late teens and started noticing the nuanced interplay between development and other land uses, I began to ask questions about the land and the impacts caused by human activity – these questions led me to seek higher education and I eventually found myself in Lutsel K'e under the premise of contributing to ongoing work on the monitoring and management of barren-ground caribou.

In retrospect, it feels as though I did something wrong by academic standards, I followed my intuition about how to go about this work without seeking specific guidance from the methodology literature. I inherently followed my inner voice and knowing; that I needed to do my work and live my life in a good way, with respect and humility, something I now recognize to be embedded Anishinaabe teachings. Although I had read numerous articles about caribou, traditional knowledge, the challenges faced in this kind of work it was not until I began see and experience things for myself that I could truly understand them and personally relate to the literature.

This journey has brought increased clarity for me on many levels, one of which is the realization that my own way of being is *an Indigenous way of being*. It was not until I became more engaged with the history and practices of other communities that I was able to see that what I had experienced in my own family up to that point was paralleled by the kinship practices and protocols of other families and that there were indeed, fundamental differences between Indigenous and non-Indigenous family and community relations. Our way of relating to one another and our deep connection to our home territory of Dokis, although never explicitly discussed, was the foundation of our strong kinship network and the value we as a family place on returning there every year. The recognition of the similarities in the way of being and the ease with which I was able to relate not only to people in Lustel K'e but also to other Indigenous peers and colleagues made clear to me the embedded cultural values within my own family who had seemed 'detached' from our traditional lifestyle, language and even our own community as we

had never lived there full time but only visited in the summer months as a ‘vacation’.

Deeper questions around what it means to be Indigenous, Ojibway, Anishinaabe, First Nations, status or non-status had not received much of my attention until I began down this path of research and rediscovery.

6.0 Indigenous Methodologies

The broad methodology throughout this project was grounded in Indigenous ways of being and doing, both Anishinaabe and Denésgliné. Upon reflection of my own actions, as I made my way through this research journey, I see embedded Anishinaabe principles of *Mino Bimadiziwin* (Living the Good Life) and the Seven Grandfather Teachings of *Gwekwaadiziwin* (Honesty), *Dbaadendiziwin* (Humility), *Aakwade’ewin* (Courage), *Nbwaakaawin* (Wisdom), *Mnaadendimowin* (Respect), *Debwewin* (Truth) and *Zaagidwin* (Love). Beyond that imbedded practice I see the connections between my own cultural teachings and Denésgliné values tied to *Dene ch’anié* (Dene Way of Life), principles that I see as a common thread that tie Indigenous peoples together around the world. It is these ways of being and doing that have guided this work. I have listened to the stories, both in formal interviews and informally as I spent time in the community, I have listened to these stories and reflected about my role in this work, what can I contribute, how can I do work that will support what people are already doing, how can I share my skills and knowledge in exchange for all that is being shared with me? This is the foundation on which this work was built. I have used other methodological tools in the documentation and analysis of information compiled but with every piece of work it has been important for me to come back to the driving questions around my purpose and role to ensure I am

on track and to continually seek guidance from my family, elders and knowledge holders in Lutsel K'e and my support system at the University including my supervisor and peers.

7.0 Research Progression

I began this project in May of 2011 when I was hired by my supervisor, Brenda Parlee, as a summer research assistant to work with LKDFN on existing traditional knowledge work and begin project scoping. I spent that first summer getting to know people in the community and working in the Wildlife, Lands and Environment Office. A project focused on digitizing the many existing audio and video recordings, associated transcripts and maps from previous studies was in the beginning stages; well at least the beginning stages of this iteration. Over the last two decades LKDFN has partnered with a number of different researchers to document the knowledge of their elders and other knowledge holders. There had been other attempts to create a digital database that had been somewhat successful, many of the tapes and files had associated metadata and were organized in a way that they could be found. There were not digital copies of the audio and video and the risk of losing those recordings promoted band administrators to seek funding for the *Traditional Knowledge Archive Project*. Part of Brenda's contribution to this project was sending me for part of the summer to help where I could and begin to see how a project on changes to caribou movement might fit into ongoing work.

I met Jeanette Lockhart and Bradley Abel, the two summer students working on the Archive Project as well as the project manager Micki Honkanen. Together with Tracey Williams, a long time resident of Lutsel K'e who had worked on a number of projects related to the collection of elders' stories of the land, we assessed the task of digitizing

thousands of audio and video files. This type of work is almost exclusively contracted out to digitization experts but there was a strong desire and need to keep the work in the community. Working on this project gave me clear understanding of what types of interviews had been completed, how work in Lutsel K'e was done, and it gave me an idea of the complex challenges the community faced in managing data, obtaining training for staff and making information accessible to community members. During this first summer I conducted scoping interviews with Brenda and elders about how a project on caribou movement and caribou trails as an indicator of change might be conducted.

The next four years involved returning to Lutsel K'e to conduct interviews, continue work on the Archive Project, attend the annual Spiritual Gathering (a week-long community trip to *Desnethche* in August), and to coordinate and attend on-the-land camps. When I initially started working with Lutsel K'e I had been taking some conservation biology courses that focused on using mapping and computer modeling software to map animal habitat, movement patterns and identify areas for conservation. I was intrigued by this method but saw that most projects did not use the knowledge of Indigenous communities in their models. Early on in my thesis work it became apparent to me that the way *traditional knowledge* was discussed in much of the academic literature very much pitted it against western science but that there were also a number of examples where both knowledge systems were being used to answer ecological research questions.

Because I had come from an environmental science background I continued to look for western methods that had been used to understand caribou movement patterns. When I became aware of a study that used trample scars on black spruce roots growing across caribou trails to gauge caribou abundance I wondered what people in Lutsel K'e might think about that approach. I found out that previous research by Brenda and Lutsel K'e elders had identified caribou trails as important indicators of caribou movement and there might be a good opportunity to explore the dendroecology method. At the most basic level, dendroecology uses tree-ring analysis to attach a time period to some kind of ecological phenomenon by assessing variations in annual growth rings. In this instance, the ecological phenomenon is caribou migration and samples of tree roots are taken from caribou trails where passing caribou have trampled the roots and caused a scar to form on a growth ring; by cross-sectioning the sample and determining the date of scar formation it is possible to determine relative caribou range use over time. I thought this seemed like a very interesting way to answer questions about how caribou have been affected by recent industrial development and that there was a good opportunity to involve youth and elders in identifying sample locations, documenting site conditions and collecting and analyzing samples.

8.0 Conclusion

My experience as a young researcher has been a struggle at times – there are many questions and challenges that I have grappled with. Feelings of inadequacy, of not knowing what to do and wanting to do work that actually means something have often kept me from moving forward. The further in the process I get the more I realize that this is not a unique struggle, this is the research process, this is academia and perhaps one

should only worry if they are not asking these questions of themselves. I have realized that as much as *Indigenous knowledge*, or *traditional knowledge* or whatever term used, is more of a process, or way of looking at the world, so is research, or at least it is at this stage in my career. Research is a lens through which we see the world – it allows us to ask questions about what we think is going on and use whatever tools are at our disposal to address those questions. The most important product from my masters has been the ability to work through this process and learn how to ask valuable questions, how to incorporate different approaches to answering those questions and to recognize that a very small number of people will ever read much of what I spend a significant amount of time thinking and writing about, but that it is still a very worthwhile exercise.

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CHAPTER 2. LITERATURE REVIEW

Traditional knowledge research of caribou movement in the Northwest Territories

1.0 Theoretical Context and Setting: Interdisciplinarity in the Study of Denésq̓liné Knowledge of Caribou Movements

Interdisciplinary research has become a growing area of interest and study. Many of the most complex social and environmental issues require multiple lenses of inquiry to more fully understand their meaning and significance. This is true in environmental sociology and many new areas of sociological inquiry including studies on risk and resilience. This research aimed to cross several conventional academic boundaries including approaches related to the social and natural sciences and between western science and Indigenous knowledge. This work also aimed to cross boundaries between northern communities and southern research institutions as well as negotiated the complex and nuanced boundaries between Anishinaabe and Denésq̓liné knowledge systems. By grounding this work in two theoretical frameworks (1) focused on *traditional knowledge* and its role in contemporary resource management and community resilience and (2) focused on *cultural landscapes* with links to theories around *sense of place* I attempt to make these connections between many disciplines and ways of knowing.

This effort to cross boundaries was particularly useful in understanding Denésq̓liné experiences of changes to barren-ground caribou populations and movement patterns. Over the past few decades scientific research has shown that barren-ground caribou

(Rangifer tarandus groenlandicus) herds experience cyclical patterns of population decline that are influenced by both natural and anthropogenic stresses (Johnson et al. 2005, Vors and Boyce 2009, Boulanger et al. 2011, Nishi et al. 2010). Involving local Indigenous communities in the monitoring of population trends and the management of caribou is a high priority for governments and communities as part of co-management agreements and because of the long-standing connection between the Indigenous peoples of the North and caribou.

As part of their involvement with the management of the Bathurst and Beverly caribou herds, Lutsel K'e Dene First Nation (LKDFN) has identified a need to monitor and record traditional knowledge of caribou movements and identify synergies and conflicts between their own conclusions and those of biologists and resource managers. Scientific studies have shown that caribou movement in the winter is variable and dependent on seasonal changes in climatic conditions and forage availability (Case, Buckland, and Williams 1996), information that has been long known to Dene communities across the region. This provides impetus for monitoring approaches that incorporate local knowledge of caribou movements from harvesters and elders who share an intimate knowledge of caribou and are engaged in land-based activities that provide them the opportunity to observe changes to movement patterns, population and herd health.

The co-evolution of people and caribou in the circumpolar north results in a profound spiritual, physical and cultural connection between these human groups and the caribou herds that they have depended on for millennia (Russell, Kofinas, and Griffith 2007). The

knowledge of caribou movement and population of the Denésgliné people in particular is supported by oral histories, accounts from early explorers and within the archaeological record (Kendrick, Lyver, and Nation 2005). The knowledge held by local hunters and elders is verified within the socio-ecological structures of the community and provides insights into the movement patterns and population dynamics of local herds that cannot be accounted for by conventional monitoring approaches which rely heavily on the expertise of non-local biologists, aerial population census data, spatial data and satellite collar locations. Through the retelling of oral histories and continued observation by contemporary hunters, community members gain a broad understanding of both the historical and modern patterns of caribou population movement and health (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005).

2.0 Traditional Knowledge, Indigenous Knowledge or TEK? Some Definitions

In the first sections of the thesis I speak broadly about *Indigenous knowledge*, from my perspective as *Anishinaabekwe* (an Ojibway woman). I understand Indigenous knowledge to be a complex interrelationship between Indigenous peoples and the animate and inanimate world. Embedded in our knowledge systems and cultural practice is an understanding of how species interact, how our behaviour and actions affect other species and the spiritual realm. Indigenous knowledge is our way of life and connection to *the land* –all that is living and non-living – and how we use that way of life and connection to develop a broad understanding of how to survive. In this context I refer to survival in of course the most literal sense of the word, we see the knowledge and skills required to meet our most basic subsistence needs, I do however also refer to the emotional, intellectual and spiritual survival of our people – it is in this way that I try to understand

contemporary Indigenous knowledge and try to overcome some of the problematic arguments around words like *traditional* which seem to imply that our knowledge systems are some historical relic incapable of change or adaptation (Berkes 1999). I do however sometimes use the term *traditional knowledge* as I speak broadly about the field of research that focuses on understanding the knowledge of elders and land users, as it is the commonly accepted terminology still being used in the context of caribou management in the Northwest Territories and elsewhere in Canada. The term traditional ecological knowledge or TEK is also commonly used, but is often highlighted as being restricted to only the knowledge related to the western discipline of ecology and so is not used here. In the results and discussion sections I speak more specifically to *Denésqliné knowledge*, culture, and perspective as it relates to caribou movement patterns around the Artillery Lake area and more broadly to the connection between the Denésqliné people and caribou.

3.0 Why Study Traditional Knowledge?

The study of traditional knowledge has been a growing area of research interest in the last number of decades (Berkes 1993, 1999). Globally, the recognition of the value of traditional knowledge and the rights of indigenous peoples have been highlighted through various processes including, the United Nations Declaration on the Rights of Indigenous Peoples (United Nations 2008), the Bruntland Commission (Bruntland Commission 1987) and the United Nations Convention on Biological Diversity, Section J (United Nations 1992). Many scholars have emphasized the value of knowledge that is generated from a direct interaction with the land that has evolved over hundreds, if not thousands of years (Berkes 1998, Johannes 1991). In the context of building resilience in socio-

ecological systems, traditional knowledge has garnered growing attention (Gomez-Baggethun et al. 2012). Land-based cultures have developed in-depth knowledge, practices and social institutions to respond and adapt to socio-ecological change to ensure their survival throughout history (Berkes, Colding, and Folke 2003). Many have highlighted that under conditions of uncertainty and change, traditional knowledge can help to strengthen the capacity of human societies to deal with environmental shifts (Colding, Elmqvist, and Olsson 2003, Turner and Berkes 2006).

This recognition of the value of traditional knowledge has led to the creation of legal and ethical frameworks that require the inclusion and consideration of traditional knowledge, particularly in Canada's northern regions (Parlee 2012). The Government of the Northwest Territories developed a Traditional Knowledge Policy in 2005:

“The Government of the Northwest Territories recognizes that the Aboriginal peoples of the Northwest Territories have acquired a vast store of traditional knowledge through their experiences of centuries of living in close harmony with the land. The Government recognizes that aboriginal traditional knowledge is a valid and essential source of information about the natural environment and its resources, the use of natural resources, and the relationship of people to the land and to each other, and will incorporate traditional knowledge into government decisions and actions where appropriate” (GNWT 2005)

While the impetus for the inclusion and consideration of traditional knowledge exists, there are challenges for which practical solutions remain elusive.

3.1 Challenges in Linking Traditional Knowledge to Science in Natural Resource Management

There are many challenges, both theoretical and practical, to be considered when linking traditional knowledge with modern resource management and environmental monitoring.

Many scholars argue that it is important to view traditional knowledge as a process of knowledge generation and ‘way of life’ as opposed to a pool of classified data that can be drawn from, interpreted and applied in the same way as western, scientific data sources (Wenzel 1999, Agrawal 2002, Rose 2005). There are basic incompatibilities in the conceptual frameworks of western, science-based resource management and those of Indigenous belief, value and practice (Christensen 2006) that must be acknowledged when working towards the use of traditional knowledge in these western contexts.

3.1.1 Epistemological Conflicts

The use of metaphor, analogy and story in general, by Indigenous knowledge holders can result in a disconnected understanding of traditional knowledge on the part of government and industry representatives (Nadasdy 1999). The holistic way in which elders and hunters describe their concerns can be difficult to comprehend for individuals more familiar with a Euro-Canadian ways of communication regarding one specific project or issue (Nadasdy 1999, Ellis 2005). These conceptual barriers contribute not only to difficulties in basic communication, but also to the efficacy and validity that traditional knowledge is allotted within a given project or decision-making process (Nadasdy 1999). Often traditional knowledge is viewed as anecdotal, experiential accounts that do not necessarily bare any factual basis grounded in the replicable scientific method that is generally accepted within Euro-Canadian culture (Nadasdy 1999, Davidson-Hunt and O’Flaherty 2007). Nadasdy (1999) also argues that the integration of traditional knowledge into resource management is less about the technical feasibility of doing so, but more about the intense differences in cultural paradigms and ways of knowing between aboriginal communities and Euro-centric governments and industries.

3.1.2 Power Dynamics and Politics

The hierarchical, bureaucratic systems that dominate resource decision-making in Canada serves as the foundation for policies and procedures for resource management inherently limit the ways that traditional knowledge can inform decision making. The rules and policies of these bureaucratic management frameworks are not often in line with Indigenous knowledge systems and governance structures, resulting in the marginalization of traditional knowledge in the decision-making process (Nadasdy 1999). Marginalization can take place for a number of reasons, but is often a result of incompatibilities in knowledge systems, particularly when traditional knowledge does not conform to western ways of knowing and confirm already established scientific knowledge. Many scholars argue that there is a basic lack of political will to uphold traditional knowledge systems with equal or greater weighting than scientific knowledge because of the associated loss of power around decision-making (Nadasdy 1999).

3.1.3 Intellectual Property

Another key consideration in the study and application of traditional knowledge in resource management is the need to respect the intellectual property rights of knowledge holders (Stevenson 1996). Wenzel (1999) describes the common practice of southern researchers coming north, conducting research and rarely returning to the community with results. Although it is becoming more common for communities to be included as authors of academic work there is still concern in many areas about the removal of knowledge from the community, how that knowledge is interpreted and presented, and whether or not any substantive changes will be made based on those research findings. It

is becoming increasingly important for research to reflect community needs and focus on building local capacity to utilize research findings in a way that benefits local people.

3.2 Denésqliné Knowledge

The ontological perspective of the Dene people is grounded in traditional subsistence activities including hunting, trapping, fishing and berry picking that are based on a harmonious relationship between people and nature, particularly with the animal world (Smith 1998). The use of stories to convey deeper spiritual meaning and life lessons are common in the Dene Way of Life (Lutsel K'e Dene First Nation 2001). The passing of these stories as well as the teachings of traditional skills and ways of understanding the world are central to the holistic perspective of the Dene people. By learning and interacting with the land, people have been able to survive in the often harsh conditions of the Canadian sub-arctic. Sharing and community support are talked about by community members as a central component to their way of life and contribute to their sense of community well-being (*Dene ch'anié*). This is demonstrated through the common practice of meat sharing when one family harvests, for example, a moose, the meat is offered to other community members and in particular elders who may be unable to hunt for themselves.

For the Lutsel K'e Dene, stories and traditional knowledge about caribou are central to the community's socio-economic and cultural well-being because of the long-term subsistence and spiritual relationship with caribou (Lutsel K'e Dene First Nation 2001). The people understand their reciprocal relationship with the caribou through their beliefs that the people are descended from the caribou.

“Our stories tell us that we Denéshliné are descendants of the caribou. We call caribou etthen in our language, and we also use the word etthen for stars. We believe the caribou come from stars. My grandfather told me they come down from the northern lights, so I know that when I see the northern lights there will be caribou in the area. This makes me happy because caribou are our main source of food.” (Enzoe 2010)

Lutsel K'e has undertaken a number of traditional knowledge studies since 1984 that document the stories of the elders and the peoples' relationship to the land (Lutsel K'e Dene First Nation 2001). There is recognition by the elders that the community's relationship to the land is different now than from in the past and that documenting their knowledge and stories will allow future generations to maintain their cultural and spiritual connection to their land (Lutsel K'e Dene First Nation 2001).

The elders tell stories to teach their people about love and respect for the land, as well as protecting it, as you would an 'old lady' (Lutsel K'e Dene First Nation 2001). This is exemplified by the deep spiritual power held by the land and in particular, in stories about *Ts'akui Theda* (The Lady of the Falls), also known as Parry Falls (Lutsel K'e Dene First Nation 2001). This place was historically used as a gathering point for the people, in more recent times the community organizes a spiritual gathering each year to reconnect with each other and the old lady and continue to hunt in the fall and winter in the area. The stories tell of her care for the people and ability to heal them when they are in need (Lutsel K'e Dene First Nation 2001).

Many elders also talk about the spiritual journey that the caribou make to return to the people and how spiritual locations are places the people go to help them know where the

caribou will be found (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005). The stories of *Ts'akui Theda* in particular, say that when the people do not know where the caribou are they can visit the old lady and the steam rising from the water will go in the direction of the caribou (Parlee et al. 2005). There are many other stories tied to the land around *?edacho kue*, in the context of Denésq̓liné knowledge of caribou movement it would impossible not to talk about these places and to visit them to hear and understand these stories.

3.2.1 Denésq̓liné Knowledge of Changes in Caribou Movement Patterns

The following sections summarize the key drivers of change to caribou movement patterns identified through review of existing research conducted in collaboration with LKDFN since 2000. The research carried out with LKDFN involved elder interviews, recording of oral histories, hunter interviews and surveys, participant observation, workshops and site visits to key harvesting areas and cultural sites. The four major themes identified were, 'Spiritual and Cultural Influences', 'Habitat Quality', 'Forest Fires' and 'Industrial Development'. Many of the above-discussed challenges associated with traditional knowledge study were overcome through community directed research, local ownership of research findings and strong relationship building between researchers and community members.

3.2.1.1 Spiritual and Cultural Influences

Themes related to cultural practices in caribou harvesting and the spiritual connection between human beings and caribou are recurrent throughout the oral histories of the Lutsel K'e Dene. Stories about the connection between the caribou and the people are

talked about in many of the oral history accounts (Kendrick, Lyver, and Nation 2005, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005). One quotation in particular highlights one of the beliefs about these connections:

“When you skin out the head of the caribou you will find writing on its forehead. No one can actually read this writing. However, in the past some elderly women would say it meant “wherever the people are, that is where the caribou will go.” The caribou would always eventually migrate towards the people. That is what they said was written there.” (MC, 2000 in Kendrick et al. 2005:181)

Many elders talk about the spiritual journey that the caribou make to return to the people and how other spiritual locations are places the people go to help them know where the caribou will be found (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005). The stories of the ‘Old Lady of the Falls’ in particular, say that when the people do not know where the caribou are they can visit the old lady and the steam rising from the water will go in the direction of the caribou (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005).

Cultural practices and beliefs are also central to the Denésgliné understanding of caribou movement. As with other animal species, it is believed that caribou are a gift and if they are not harvested, they will leave the people. It is also believed that lack of respect and disregarding the protocols and rituals of harvesting will result in unsuccessful hunting because the caribou will make themselves unavailable to the people (Kendrick, Lyver, and Nation 2005). Stories of times when disrespect was shown to the caribou come up time and again in the oral history accounts cautioning future generations of the

implications of such behaviour. Kendrick et al. (2005) identify nine key ways the people show respect to caribou:

- i. *“using as much of the animal as possible;*
- ii. *removing the tip from the caribou heart;*
- iii. *sharing meat with community members;*
- iv. *not beating or poking the caribou with a stick;*
- v. *not chasing caribou down with snow machines and running them to exhaustion;*
- vi. *women not being involved in the hunting process while menstruating;*
- vii. *women not stepping over the caribou’s blood or the hunters’ equipment;*
- viii. *treating the meat and animal products with respect once they are inside the home (i.e., not having blood on the floor or letting meat go bad), and*
- ix. *not leaving animal remains (e.g., bones) lying around outside.”*

Elders attribute some changes in the location of caribou wintering grounds around Lutsel K’e to recent violations of these rules (Kendrick, Lyver, and Nation 2005).

3.2.1.2 Habitat Quality

Habitat quality is influenced by a number of different factors and serves to represent a number of natural processes that impact caribou movement patterns and population.

Lyver and LKDFN (2005) showed both seasonal and intra-seasonal variation in caribou body condition that is a direct impact of the quality and quantity of available food sources. The purpose of this study was to determine if hunter interviews would provide the same information as field observations of caribou body condition as a measure of both individual and herd health. Lyver and LKDFN (2005) found that field observations and hunter interviews conducted shortly after hunting excursions were very similar and recommended hunter interviews as an efficient alternative to expensive field monitoring.

3.2.1.3 Forest Fires

Many elders and harvesters in Lutsel K'e also report increased frequency and severity of fire. The implications for caribou are significant as their primary source of food, lichen, takes many decades to regenerate after a burn.

“Forest fires are more severe now than in the past. In the past there were so many caribou, but now there are not as many because of the forest fires. Forest fires also kill a lot of the wildlife like insects, birds, and small furbearing animals. A lot of things have gone. There were not as many forest fires in the past” (ML, 2000 in Kendrick et al. 2005: 181).

Parlee et al. (2005) also cite elders' concerns about increases in fire, some believe that this a natural cycle, others that the increases in intensity and severity are not normal.

“Regarding the forest fires, some scientists say it's good for new growth. But do you know what the caribou eat? If the lichen burns, it will take over 100 years for the plants to grow back. Some scientists say these forest fires are good, but it's not like that for us. There never used to be so many forest fires. I have never before seen a forest fire started by lightning. We look after the land and we respect the land and the animals” (PM, 2000 in Parlee et al. 2005:34).

This elder is also linking concepts of how respect for the land and animals is key to Denésgliné worldview.

3.2.1.4 Industrial Development

Increasing resource development is a growing concern for the community members of Lutsel K'e and is one of the key reasons for much of the traditional knowledge study in the region. All of the traditional knowledge studies discussed here were undertaken either in direct response to increased development or to provide information relevant to

broadening our understanding of the impacts of industrialized development, particularly diamond exploration and extraction. Kendrick et al. (2005) cite one elder's concerns:

“The mines are on the caribou migration route. For me the way the caribou migrate is different. It takes longer for the caribou to migrate to the tree line now that the mines are there. It was not like that before. The caribou used to come to the bush very quickly. It is taking longer for them to come to the trees” (JF, 2000 in Kendrick et al. 2005:183).

Parlee et al. (2005) present oral accounts of the historical, strategic planning and group organization that led to successful caribou hunts over extensive areas and highlight the significance of key water-crossing sites. This 2005 study examined how the Lutsel K'e Dene historically predicted caribou movement to optimize harvest and how mineral development has affected caribou migration. One of the major findings was the concern about road construction and how this will impact the caribou:

“No matter what you do, caribou will be affected by these mines and roads. The only way to not affect the caribou is to have no mines and roads. If there is a mine, there will be roads. And if you have a road, there will be trucks on it. If they put it through, you can't stop everything for the caribou. But maybe that is what the caribou need” (PC, 2001 in Parlee et al. 2005:35)

4.0 Cultural Landscapes

The second theoretical framework that provides context to this work examines *cultural landscapes* and links to theories about *sense of place* as a lens through which we can understand complex socio-ecological systems and sites of key cultural and ecological significance. There are many academic disciplines that have sought to better understand

the connections between culture, spirituality and physical places including anthropology, archaeology and ethnoecology to name only a few. The notion of a cultural landscape is highlighted in archaeological inquiry as a way to understand the important cultural meaning tied to places and archaeological features, often as a way to interpret archaeological evidence that has little context without the input of traditional knowledge (Stewart, Keith, and Scottie 2004).

The values that people place on specific geographic locations are tied to many key cultural, spiritual and ecological drivers (Lewis and Sheppard 2005). This is an extremely western academic lens through which we can seek to understand the nuanced power and significance of key places for the Denésqliné. From an Indigenous worldview the land has a more innate or intrinsic quality, Julie Cruikshank attempts to describe this by using the term sentient, “a sentient landscape that listens and responds to human activity” (p. 142 Cruikshank 1997). This idea that land can have agency is not commonly accepted in western worldview but the teachings from many Indigenous cultures draw out this notion that the land responds to human behaviour. Thinking about the land as being alive or having a spirit is not a foreign concept to Indigenous knowledge holders, particularly because ‘the land’ is not restricted to the physical ground that we stand on, concepts of ‘land’ in many Indigenous knowledge systems are more holistic and comprise the complex and nuanced interrelationships between the physical, biophysical and spiritual. In Anishinaabe teachings we are taught that we ‘learn from the land’, as we are ready to receive knowledge it is revealed to us (Davidson-Hunt and Berkes 2003).

4.1 Caribou Crossings as Sites of Ecological and Cultural Significance

Key water-crossing sites serve as the ideal location to gather information about population, timing of migration, caribou body condition and direction of travel (Parlee et al. 2005). These crossing sites have been historical gathering places because of the significant increase in caribou use during migration periods (Kendrick, Lyver, and Nation 2005, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005) and are also rich in cultural history as evidenced by the stories and spiritual power of these places in Denésqliné knowledge systems.

The most important sites are well known by the Denésqliné and many continue to be utilized in contemporary harvesting strategies (Kendrick, Lyver, and Nation 2005) and continue to be visited as part of contemporary cultural and spiritual practice. Large water bodies serve as barriers to caribou movement as herds are unlikely to cross large, open expanses of water and tend to cross in areas of shallow water and irregular shorelines. In this respect, key water-crossing sites can be viewed as natural ‘corrals’ that funnel caribou to the narrows of large water bodies at a small number of sites across their range, a theory highlighted within the scientific literature and also within the oral histories of the Denésqliné. There is not a distinction made between the cultural value and the ecological value of these places in Denésqliné worldview.

5.0 The TK-Science “Debate” in Caribou Management

There is synergy and conflict between the perspectives of community elders and hunters and those of government managers and biologists around caribou abundance and migration pattern. In general, there is consensus that caribou tend to avoid areas of

industrial development and high levels of human activity (Kendrick, Lyver, and Nation 2005, Vors and Boyce 2009, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005). The impacts to southern, woodland caribou (*Rangifer tarandus caribou*) populations can be seen as a cautionary tale for the barren-ground caribou in the North if development is not managed appropriately. Habitat fragmentation through the development of extensive road networks in the southern boreal forest, allowing for increased human and predator access to woodland caribou coupled with loss of old growth forest has caused significant population decline in this southern subspecies (Vors et al. 2007, Johnson et al. 2005). There has been some disagreement between community perspectives and those opinions of managers and biologists regarding the driving factors behind changes to barren-ground caribou herds. These conflicting opinions have historical roots and can be traced back to the first caribou conservation strategies proposed and implemented by federal and territorial governments in the early 1900's (Sandlos 2007).

The observations from early explorers and biologists in the North saw Indigenous harvest strategies as wasteful and terms like 'wanton slaughter' were commonly used to describe what outsiders saw to be unnecessary, but what Indigenous peoples knew to be required for survival (Sandlos 2007). These early observations informed the first legislation governing management of ungulate species in northern Canada including caribou and bison (Sandlos 2007). Harvest restrictions were met with strong opposition from local people who had relied upon the migrating caribou populations for centuries and knew population fluctuation to be linked to natural variability, spiritual connection and

dynamic relationships between people and animals (Sandlos 2007, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005).

In more recent years, government managers and biologists have begun to seek a more cooperative approach to wildlife management in the North through co-management agreements and emphasizing the need to include Indigenous knowledge in management and monitoring strategies. The impetus for such agreements comes largely from legislation (NWT Policy on Traditional Knowledge) and comprehensive land-claim settlements (Government of Canada 1984, 1993) that require local community involvement. Despite these requirements and extensive rhetoric around collaborative work, the dominant view of government managers and biologists focuses the conversation about management approaches for caribou population in decline on aboriginal overharvest. There is little evidence however that aboriginal harvest is higher now than at any time in the past (Parlee et al. forthcoming) and communities point to other driving factors including increased industrial activity as a key concern.

6.0 Conclusion

In order to examine questions around changes to caribou movement in the Northwest Territories this thesis will be grounded in a number of theoretical contexts and use interdisciplinary approaches from cultural anthropology, Denésgliné teachings, traditional knowledge study and incorporate western scientific methods.

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CHAPTER 3. METHODS

“These Trees Have Stories to Tell”

Linking Denésqiné Knowledge and Dendroecology Methods in the Monitoring of Barren-ground Caribou (*Rangifer taradus groenlandicus*) Movements in the Northwest Territories, Canada

1.0 Introduction

The contribution that Indigenous knowledge can make to caribou management and monitoring is increasingly recognized as valuable across the circumpolar north. Wildlife biologists and other researchers are increasingly embracing the value of knowledge that local land-users and elders bring to the identification of key research locations, local social and ecological contexts, animal behaviour, long-term trends in climate and insights into the seasonal and inter-seasonal variation in species distributions (Gagnon and Berteaux 2009). However, this valuable contribution of local knowledge holders is not always explicitly acknowledged as being a contribution to the research process and in the development of caribou management practice and policy beyond the mention of including or considering traditional knowledge in these processes. This paper presents a model for northern wildlife research that acknowledges local, traditional, Indigenous knowledge at the forefront and seeks to build western, scientific inquiry around the local understanding of the ecosystem, with the ultimate goal of strengthening the local capacity to assess and adapt to changing environmental conditions. Traditional knowledge is seen as a way of life, a way of being, doing and of seeing the world – in order to meaningfully include Indigenous knowledge in land and resource management, researchers and managers must challenge themselves to see outside of their own worldview and

acknowledge the assumptions that that worldview brings to their interpretation of the perspectives of traditional knowledge holders and what knowledge is deemed *legitimate*.

1.1 Literature Review

There is a considerable amount of literature available that addresses the complexities of traditional knowledge work, particularly as it relates to addressing resource management problems. There tends to be a spectrum of viewpoints regarding the *integration* of Indigenous knowledge in contemporary resource management. On the one end is the perspective that Indigenous knowledge systems and scientifically-based, western knowledge systems are too opposing in their fundamental epistemological frameworks and that the very notion of trying to *incorporate* Indigenous knowledge into western management comprises the integrity of that knowledge as it is removed from its cultural context (Nadasdy 1999, Agrawal 2002). Others argue that the fundamental principles of knowledge generation within scientific and Indigenous knowledge systems are more similar than this worldview analysis indicates (Moller et al. 2004, Berkes, Berkes, and Fast 2007). The process of observation, verification and legitimization of ecological phenomenon is common to both scientific and Indigenous understanding of the natural world. Many indigenous peoples would argue that Indigenous knowledge *is* science; that both knowledge systems seek to understand the world and our place, as humans, in it. Indigenous peoples often contend that their innate way of being, doing and seeing the world provides an intuitive sense of ecological phenomena and how human beings are interwoven into such natural patterns. The challenge in linking Indigenous knowledge and scientific research is in navigating the divide between these two worldviews to produce knowledge outcomes that are respectful of the knowledge, its cultural context,

the intellectual property rights of individuals and communities and can be useful to communities in contemporary management and monitoring contexts.

Despite settled land-claims and co-management agreements for the inclusion and/or consideration of traditional knowledge in caribou management planning and monitoring it often remains unclear how to implement these policies on the ground. Existing caribou management strategies rely heavily on quantitative, scientific data from satellite collars, aerial population census data and computer modeling to predict animal movement and to identify key habitat areas and migration corridors (Vors and Boyce 2009, Boulanger et al. 2011, Vistnes and Nellemann 2007). These approaches are the cornerstone of the biological study of animal movement and population and are valuable tools for broadening our understanding of the dynamic aspects of landscape ecology and are also valuable as communication tools through the production of maps and scenarios of future development or natural environmental change. There are however many practical challenges with gaining reliable census data and aerial populations surveys are acknowledged as having large margins of error (Parlee, Caine, and Manseau 2014, forthcoming).

Community elders and harvesters are often weary about the accuracy of satellite collar data and although collar locations are often used to provide general understanding of annual migration timing there is high degree of skepticism around the use of collar locations of only a few animals to represent the movements of an entire herd, often numbering in the 10's of thousands, particularly because there are beliefs that the collared

animals behave and are treated differently by the rest of the herd and are often reported as being in poor health (Spak 2005). Much of the current management approach for barren-ground caribou herds is based primarily on data obtained and modeled from satellite collar data and the knowledge of caribou movement and population from local, Indigenous communities is not always acknowledged as being valuable or legitimate until it can be *proven* by this scientific data. With this challenge in mind it is important to find ways to better document local knowledge about caribou movement and population health and to better engage with local communities.

1.2 Project Background

Previous research and information collected during scoping interviews identified the importance of caribou trails, or *etthën hutl'a* and *etthën kun*, as an important sign of caribou activity in the fall and winter, as well as *etthën ekëlué* (old caribou trails) as the basis for understanding historical changes in caribou movements (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005b). Trampling scars can be found on black spruce (*Picea mariana*) roots intersecting these caribou trails at valued timber stands near caribou crossings known as *ts'u ?aze di ?asj*.

Given that some tree roots in this region have been aged to older than 100 years, it is possible to develop a historic record of caribou activity in these areas, which is uniquely relevant to our understanding of caribou movements over time and in relation to disturbance in the region. This western-scientific approach has been used by others in the region and in northern Quebec to examine caribou trail-use as a proxy for understanding relative population abundance and involves analyzing these trampling scars on black

spruce roots (Morneau 1998, Zalatan 2006). Zalatan et al. (2006) were able to identify long-term abundance data on barren-ground caribou through analysis of such trampling scars along the treeline in proximity to Lutsel K'e and referred to oral history information from the Tlicho gathered through the West Kitikmeot Slave Study (Dogrib Treaty 11 Council 2001) for verification of the dendrochronology and climate data. Although this oral history information from the Tlicho elders who participated in this study is helpful in understanding regional influences and relative abundance patterns across the NWT, it does not account for the more site-specific knowledge of the Denésqliné people of Lutsel K'e who have historically lived, travelled and hunted in the study area most frequently.

2.0 Methods

2.1 Study Area

The community of Lutsel K'e is the northernmost of all Dene communities in Canada, located on the East Arm of Great Slave Lake (62°24' N, 110°48'W), approximately 200km. east of Yellowknife in the Northwest Territories (NWT). Lutsel K'e is the only permanent settlement in the East Arm region of Great Slave Lake, home to approximately 350, predominantly Denésqliné people (Statistics 2010). Lutsel K'e is a member of the Treaty 8 Akaitcho Territory Government. The five Akaitcho Treaty 8 First Nations are in ongoing negotiations with the territorial and federal governments to settle a comprehensive land-claim agreement for the region. There are a few outfitter camps and fishing lodges in the region, however, use is relatively limited due to the remote nature of the area and the lack of any roads connecting the region to the territorial capital of Yellowknife. The major industrial land use is mineral resource development in the form of three operating diamond mines in the area around Lac de Gras (64° 69'N, 110°61'W),

approximately 250km. north of Lutsel K'e. Diamond production has become the dominant form of resource development in the NWT with the annual value of production rising from approximately \$606 million to over \$2 billion from 1999 to 2010 (Statistics 2010).

The Denésgliné people have lived in the region since time immemorial. Since the mid 1990's, development in the region has had significant effects on the land, wildlife, water and fish. The health of the land contributes significantly to *Dene ch'anié* (community well-being) and as the rate of resource development increases people are becoming extremely concerned about the impacts of those extractive activities on their way of life (Parlee 2007). There are immediate concerns around the status of aquatic and terrestrial resources in areas surrounding abandoned mines, exploration sites and new mining projects, and deep worry about long-term sustainability of these resources for future generations (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005a). In order to address some of these concerns about how to protect the land and resources LKDFN entered into formal negotiations with Parks Canada as they work towards establishing a national protected area, *Thaidene Nene*, or the Land of the Ancestors; the core area of LKDFN traditional territory as shown in Figure 1. Prior to European contact, the Denésgliné people were the most widely travelled and populous of the Northern Athapaskan groups (Smith 1998). Historical evidence of land-use and occupancy that parallels variation in range and movement patterns of barren-ground caribou movements is verified through oral histories of Tlicho, Denésgliné, and Inuit elders as well as early explorers (Smith 1998). Although the community's knowledge of human-caribou

relations and caribou ecology plays a less significant role now than in the past, there is recognition of its role in spiritual well-being, cultural identity and in contemporary caribou management (Kendrick, Lyver, and Nation 2005).

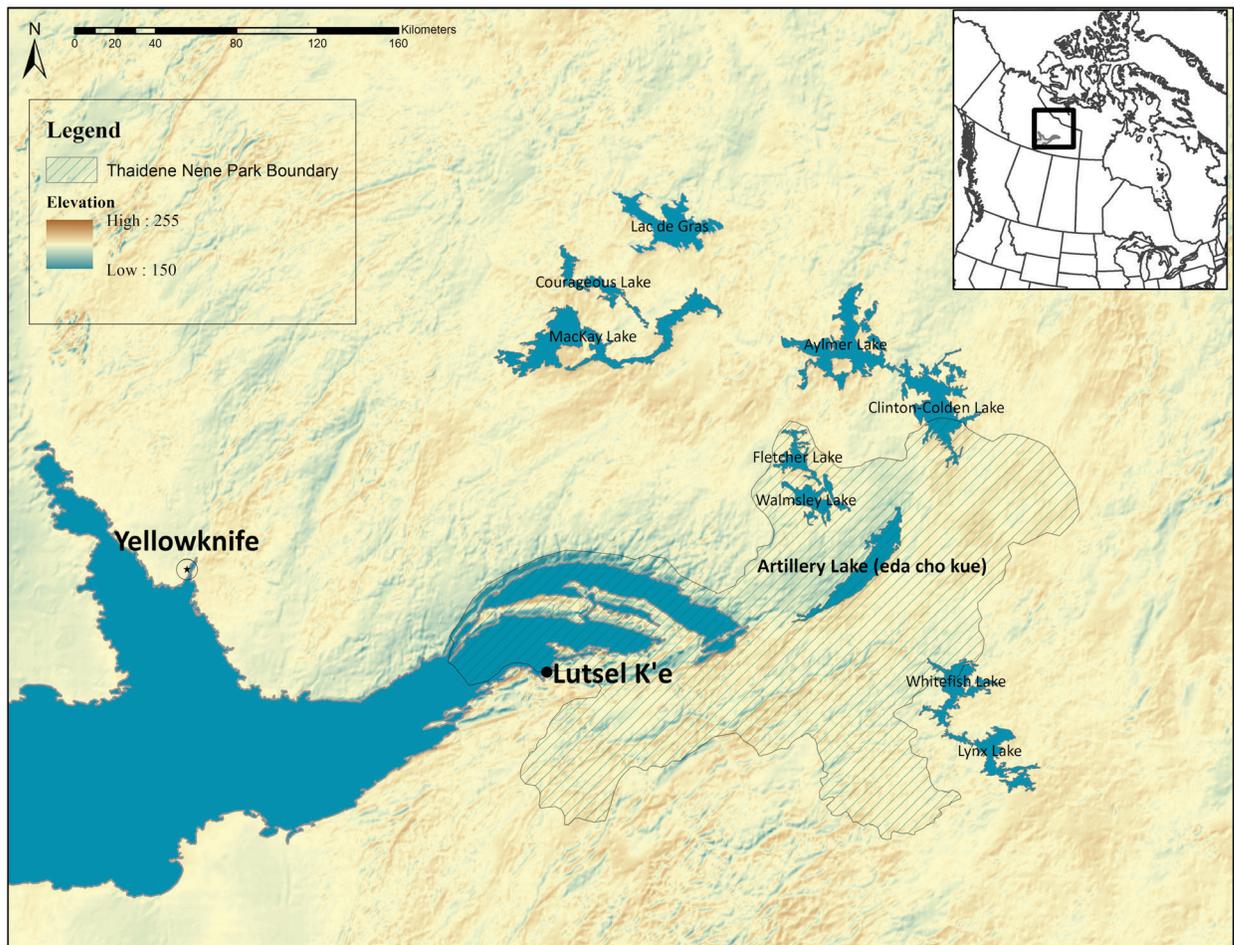


Figure 1. Study area showing Thaidene Nene Boundary.

From a strictly ecological perspective, the traditional territory of the Lutsel K'e Dene First Nation is part of the Taiga Shield Ecological Region as defined by the GNWT and includes the Low Subarctic (LS) and High Boreal (HB) Ecoregions. The LS is a transitional zone between the High Subarctic and the boreal forest. Moving south, tundra

is replaced by forested areas dominated by lichen woodlands of jack pine (*Pinus banksiana*) and black spruce (*Picea mariana*) and stands of paper birch (*Betula papyrifera*) or dwarf birch (*Betula nana*) indicative of recently burned areas. Lichen is the predominant winter food source for barren-ground caribou and is known to be a key predictor of caribou distribution. The landscape is also dominated by many small lakes, generally less than 500 hectares in area, as well as bare, rocky outcrops characteristic of the geologic formations of the Canadian Shield. The mean annual winter temperature in January ranges from -26 to -29°C across the region while mean annual precipitation is evenly distributed evenly between rain and snow and ranges from 230-430 mm. Other large mammalian species in the area besides barren-ground caribou are wolves (*Canis lupus*), moose (*Alces alces*), grizzly bear (*Ursus arctos horribilis*), black bear (*Ursus americanus*), and muskoxen (*Ovibos moschatus*).

2.1.1 Artillery Lake

Fieldwork was conducted in 2012 and 2013 at two key caribou-crossings at the north and south end of *?edacho kue* (Artillery Lake), a site of particular ecological and cultural significance. The very translation of *?edacho kue* indicates the importance of the area, *?edacho* meaning **big caribou crossing**, *?edacho kue*, **lake of the big caribou crossing**. In 2012, our research group travelled to the north end of *?edacho kue* to *kasbe deze* (Ptarmigan River) in conjunction with the LKDFN Fall Caribou Hunt. This visit focused on scouting caribou trail sample locations, collecting oral histories of the Artillery Lake area and providing training and education for local youth. In 2013, a smaller group travelled to *?edacho tlazi* (Timber Bay) at the south end of the lake and this visit focused

on collecting samples and observing the current condition of caribou trails at this key crossing site.

2.2 Interviews

Between August 2012 and April 2014 nine elders and four harvesters were interviewed in one-on-one interviews, group interviews, on-the-land interviews and group workshops compiling over twelve hours of recorded narratives. Participants were selected based on recommendations made by Chief and Council, the Wildlife, Lands and Environment Committee and under the guidance of Dr. Parlee, Dennis Drygeese and Terrie Enzoe. Dr. Parlee has maintained an ongoing research relationship with LKDFN over the past 19 years and also lived in the community for 5 years during which time she came to know all potential participants very well. Dennis Drygeese and Terrie Enzoe have also participated in extensive community-based research during this period as translators and community researchers. When gathering knowledge of ecological phenomenon it is important to find individuals who have spent significant amounts of time in particular areas and who have an intimate knowledge of the environment gained through on-the-land activities. Participants were selected by the following criteria:

- Elders who have previously lived, travelled/hunted in the Artillery Lake area;
- Harvesters who currently harvest caribou in the Artillery Lake area;
- Male or female of any age (older than 18 years) who meet one of the above 2 requirements.

Initial scoping interviews were conducted in the community to help guide the development of the research questions and approach. Semi-structured interviews were

conducted in peoples' homes and during a 7-day field camp at *?edacho kue* in 2012. The interviews were recorded using audio and/or video with the assistance of an LKDFN community researcher. This documentation is not only for research purposes but, more importantly, as part of the ongoing effort to preserve and archive the community's knowledge in a digital data archive. These on-the-land interviews document in-depth information about historical trail-use, caribou behavior and the cultural/ecological significance of key caribou crossing sites.

2.3 Dendrochronology Sampling and Analysis

During the 2012 trip to *kasbe deze* (Ptarmigan River) at the north end of *?edacho kue* (Artillery Lake) our research group visited a number of black spruce stands in the barrenlands to assess the condition of caribou trails and gain the elders' insights about how to identify good areas to collect samples with trample scars and other caribou trail locations in the Artillery Lake area. During on-the-land interviews at these locations it was identified that an intensive sampling program at *?edacho tlazi* (Timber Bay) at the south end of the lake would be most appropriate if we were looking to collect a large number of samples as there are many more trees. Due to limitations on time, resources and inclement weather we were unable to travel to the south end of the lake during the 2012 trip.

In the fall of 2013 we returned to *?edacho kue* with a smaller group and collected 50 samples around *?edacho tlazi*, Figure 2 shows the location of the sample site relative to sampling conducted by Zalatan et. al. in 2006. Targeted sampling was required, we travelled on foot through black spruce stands sampling opportunistically when roots were

identified along caribou trails as shown in Figure 3. Obvious signs of scarring such as exposed xylem and resin accumulation were used to identify samples following previously established methods (Zalatan 2006). We also sampled roots that had no outer indications of scarring. All roots sampled were at the ground surface and did not require removal of thick surface vegetation or soil. One root section, at least 2.5cm. in diameter and between 15-30cm. in length per tree was taken in each area with heavily used caribou trails.

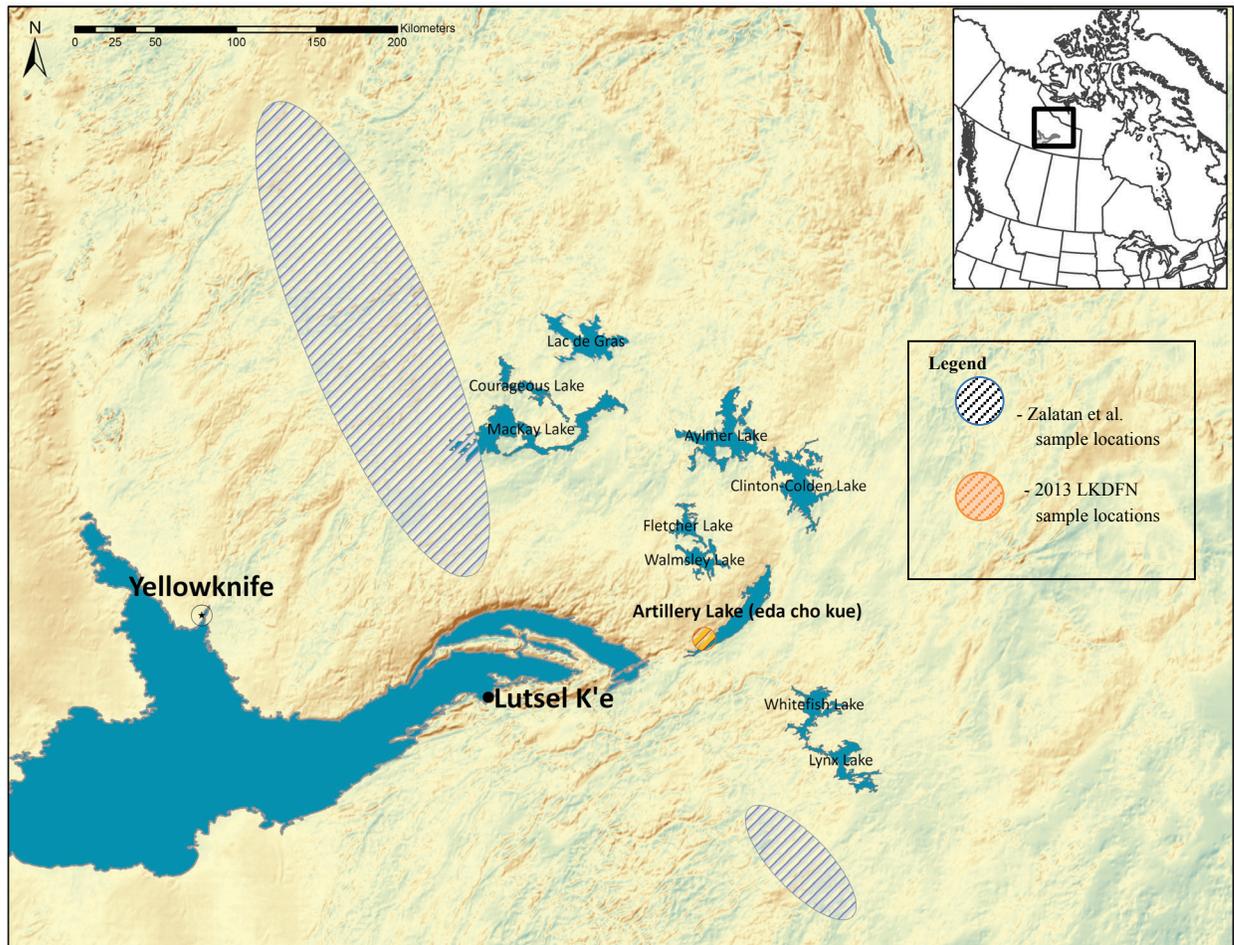


Figure 2. Samples location relative to Zalatan et al. (2006) sample locations.



Figure 3. Site and dendroecology sample photos from *?edacho*.- Top left (caribou trail with black spruce roots growing across); top right (caribou trail with black spruce roots growing across); middle left (caribou trails facing towards *?edacho*); middle right (cutting black spruce root sample); bottom left (drying samples before storing in paper bags for transport); bottom right (identifying caribou trampling scars in the lab at the University of Alberta).

Samples were stored in paper bags as shown in Figure 3 and transported to labs at the University of Alberta campus where they were dried in a 60°C drying oven for 96 hours to ensure all moisture was removed and the samples would not rot. Each sample was then cross-sectioned with a minimum of four cuts using a table saw, ensuring a perpendicular cut was made. Each cross-section was polished using progressively finer sandpaper (220, 320, 400, and 600) using an industrial sized belt-sander. Samples were then scanned at between 2400-6400 dpi (dots per square inch) using a high-resolution scanner. The software program CooRecorder 7.5 (Cybis Elektronik & Data 2013b) was used to carefully cross-date and measure each sample. The software program CDendro 7.5 (Cybis Elektronik & Data 2013a) was used to convert the gross tree-ring widths for each year into normalized values by dividing the growth of each year by the average growth of the two preceding years (function “P2Yrs” of the CDendro software). Trampling scars were identified visually as shown in Figure 4 and dated using the chronology developed with CDendro. Once the date of scar formation was identified the scar frequency distribution (10-yr age classes) was calculated to represent the relative level of caribou activity in the area (Morneau 1998).



Figure 4. Example of cross-section showing caribou trample scars. (1) 1912, (2) 1926, (3) 1945, and (4) 1970

3.0 Results

A key component of research conducted with LKDFN has always been to provide opportunities for local people to be involved in research projects and to gain skills and knowledge that will result in broader community ownership of the research agenda and to increase *Dene ch'anié* (community well-being). In order to meet our commitments to the community to provide such training and skills development, the project sought to include youth, elders and community researchers in a number of different ways.

3.1 Training in Data Digitization and Management

During the scoping and historical review phase I worked with two local summer students and the project manager of the Wildlife, Lands and Environment Department's

Traditional Knowledge Archive Project. This project aims to digitize and make available through a user-friendly interface, the vast oral history and traditional knowledge information that has been documented by LKDFN over the last twenty years. My role was to help in the development of a data digitization strategy and data management system and to train the local summer students to carry out this work.

3.2 Traditional Knowledge / Science Elder & Youth Camp

In the fall of 2012 we collaborated with LKDFN to hold a combined research and ecological-monitor training camp in conjunction with the Fall Community Hunt at Ptarmigan River, at the north end of Artillery Lake. We were able to bring eight youth, six elders, six hunters, and six camp workers from LKDFN to attend the camp. We also invited two University of Alberta ecologists with specializations in arctic ecology to assist in the development and delivery of an ecological-monitor training program. The camp had three main goals: (1) document oral histories of caribou movement at Artillery Lake and scout caribou trails for sampling as part of the research project; (2) provide opportunities for inter-generational knowledge transmission on-the-land; and (3) provide land-based training for youth in the principles of ecological monitoring and Indigenous knowledge of the land.

3.3 Field Research Camp

In the fall of 2013, I travelled with Community Researcher Dennis Drygeese, Hunter/Guide Pete Enzo and Youth Community Researchers Jasmine McCallum and Damien Kailek to Timber Bay (*?edacho tlazi*) to conduct intensive tree-root sampling and survey this key-crossing site for signs of recent caribou activity. Coordination with

the Fall Community Hunt was not possible due to weather and financial limitations and so this smaller group went with the focused intent of gathering enough samples to provide data outputs that would show broad trends in caribou use of the area over the last century. The intensive one-on-one training provided to the youth helped to further develop their skills in on-the-land travel and ecological monitoring techniques including sample design, GPS operation, navigation, field safety and hunting skills.

3.4 Academic Conference Presentation

In 2013, I attended the ArcticNet Annual Scientific Meeting in Halifax, NS. Funding was secured to bring Jasmine McCallum, one of the Youth Community Researchers who participated in the 2013 sample collection field-camp to attend the conference and co-present on the project. An opportunity to see the breadth of arctic research going on in Canada coupled with the chance to get up and share her story is an invaluable experience for a young woman with obvious aptitude for land-based work. Jasmine continues to work for her sixth consecutive year as a Nihatn'i Ranger (Watcher of the Land), travelling the East Arm of Great Slave Lake, greeting visitors, sampling fish and water and documenting a wide variety of environmental observations while honing her skills in the Dene Way of Life.

3.5 Sample Analysis Workshop

In April of 2014 we travelled to Lutsel K'e to hold a workshop focused on verifying interview themes and statements and to present the preliminary scar frequency data from the caribou-trail tree root samples from *?edacho tlazi*. We presented images of the scanned cross-sections that showed scarring and discussed with the elders what their

conclusions were about what would have been going on in the region during each time period to develop an oral history time-series of caribou-use at *?edacho kue*.

3.6 Student Field Trip to the University of Alberta

In June of 2014, the LKDFN School scheduled a junior high/high school field trip to Edmonton, AB. I assisted in developing the itinerary with school administrators to tour local museums and other attractions with a focus on science education. The students also came to the University of Alberta campus for two days to tour many of the labs and collections on campus, the Faculty of Native Studies, Department of Physical Education and Recreation and the Aboriginal Student Services Centre. Aboriginal student enrolment at universities remains low and many barriers exist for Indigenous youth who want to attend university, particularly those from remote communities. This visit was intended to break some of the psychological barriers about how intimidating university can be and to show the students the vast support network they would have access to if should they decide to pursue post-secondary education at the University of Alberta.

4.0 Discussion

4.1 Lessons Learned: Linking Indigenous Knowledge and Dendrochronology in Lutsel K'e

Throughout the project the goals and commitments made with the community were continually reevaluated. Through this reflection, key themes were developed that are meant to guide community-based, ecological research that seeks to link Indigenous ways of knowing and doing with western, science-based approaches to research. The following

sections summarize our specific experience related to each lesson learned and Table 1 provides a more general overview of guiding principles that could be adapted to future research projects.

4.1.1 Social License and Government License

In addition to getting permits from the Aurora Research Institute and ethics approval from the University of Alberta, authority to carry out the project was given through traditional decision-making processes in Lutsel K'e including Chief and Council as well as consulting with active harvesters who make up the Wildlife, Lands and Environment Committee and the local Elders' Committee. It was key to spend additional time in the community to build relationships and gain broader community support for the research project as links could be made to ongoing community work and goals. This is often considered common practice for researchers working with and near First Nations communities but often tends towards research that is more focused on socio-economic, political or cultural research questions. Strictly ecological or geological questions, for example, are often seen by researchers as disconnected from the community; the land can be viewed by an outsider as being 'empty', this is not the case and the intimate knowledge and authority over what type of research is conducted in the community's traditional territory should be acknowledged and respected.

4.1.2 Link to Community Goals

Additional time spent in the community also allowed me to identify ongoing community projects that I could contribute to. The *Traditional Knowledge Archive Project* was a key project that not only provided invaluable local context to better understand the oral

histories but also allowed greater insight into the data management challenges and needs of the community. Collaboration with the Nihatn'i Dene (Watchers of the Land) environmental monitoring program also gave me the opportunity to link the outcomes of our caribou monitoring research with broader community goals around holistic monitoring of the land and resources in *Thaidene Nene* (The Land of the Ancestors). Contributing the growing body of knowledge housed in the community that serves as the foundation for community led conservation and management was a key focus of this project. Goals around youth engagement, training and education were also important as we developed our research program and are discussed in more detail in following sections.

4.1.3 Ecological and Social Context

Elders are able to provide a broader understanding of the ecosystem including patterns of caribou movements in fall and winter months. We recognize the importance of listening to the whole story – as in thinking holistically – an elder talking about many issues including other species or stories from the past is their way of explaining this bigger picture. Through interviews, we gained understanding of many ecological phenomenon including caribou herds mixing in this southern area of the range, historical data about caribou use of critical habitats (e.g., avoidance of burned areas, use of key water crossings), interrelationships with other species such as moose, which has been observed to be increasing. Ecological conditions are interconnected with socio-economic and cultural dimensions of change; for example, the community's views of changes in caribou movements are embedded in the socio-cultural view of caribou as important to

their individual and collective identity and a critical component of their traditional economy. Some of this traditional knowledge was previously documented by / with Lutsel K'e (Kendrick, Lyver, and Nation 2005, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005b) and informed our approach and interpretation of the oral history and dendrochronology outcomes.

4.1.4 Study Site Identification at Regional and Local Scales

Previous research (Parlee et al. 2005) and initial scoping interviews with elders identified *?edacho kue* (Artillery Lake) as a key water-crossing site and an area with a high concentration of caribou trails indicating high caribou activity relative to surrounding areas. Regionally, Artillery Lake is a core area because the sheer size of the lake and its location in the overlapping ranges of the Bathurst and Beverly herds (Gunn 2011). Elders recognize this area to be of cultural and ecological significance as evidenced by the place name (lake of the big caribou crossing), the long-term occupancy/use of the area and the deep spiritual connection through stories and legends. Again, it seems common for researchers to seek guidance from elders and knowledge holders about important areas although this is not always explicitly acknowledged as 'traditional knowledge'. There are deep and layered meanings and stories attached to particular places that become more evident when we truly listen to the stories and spend time travelling on the land with knowledge holders.

4.1.5 Respecting the Land

Appropriate sampling and travel protocols for respecting the land are also important. We asked permission from the elders to carry out the work and followed cultural protocols

including ‘paying the land’ a concept based on the reciprocity of the human and non-human relationships of the ecosystem. Opening and closing our days with a prayer giving thanks for safe travel and the opportunity to be together and to share knowledge is also central to adhering to local cultural protocol. We followed established methods for taking small samples of tree roots so as not to harm the tree itself and took care to leave the sample locations as we found them, replacing any disturbed vegetation or soil. Elders cautioned us about disturbing caribou trails and at each sample location we ensured there was no sign of our activity. We also left little sign of our use of camp locations, removing all garbage and preparing the camp for those who will be there next, likely hunters from Lutsel K’e out in the winter hunting caribou.

4.1.6 Camp-based Fieldwork Approach

Conducting interviews on-the-land is widely recognized to be a key component to good traditional knowledge research, the place-based nature and cultural context of the knowledge being shared requires such an approach. It is this premise coupled with the community’s desire to continue to engage youth in land-based, cultural activities, higher education and training and connecting with their elders that provides the impetus to follow a camp-based model for fieldwork. In order to meet these objectives the 2012 camp focused on ecological-monitor training and capacity building with eight youth with the assistance and guidance from two arctic ecologists from Dr. David Hik’s Arctic Ecology Lab at the University of Alberta. The afternoons were then open for youth to engage in traditional hunting and subsistence activities, learning to hunt, fix meat and

hides and perhaps most importantly, learning how to read the land and travel in the barrens.

4.1.7 Co-Interpretation of Results

With goals around co-production of knowledge and research *with* and *by* -- not *for* or *on* the community, we sought to gain the input of elders and harvesters as we looked to interpret the findings of the oral histories and the dendrochronology data. We held a workshop where we discussed in a group setting the interpretation of elders comments during their one-on-one interviews to clarify the context in which they made certain statements and ensured that our interpretations were indeed a reflection of their perspective and knowledge. We also brought a number of enlarged photo prints of the tree-root cross-sections that showed caribou trampling scars to assist in explaining the methodology further and to gain insight about the initial scar frequency data we were seeing. We discussed the timing of caribou abundance and scarcity in relation to scar frequency data to assist us in interpreting what we were seeing in the dendrochronology record. The tree-ring data and images also served as a tool for initiating discussion about events that have happened in the past 100 years, increasing the depth of oral history documentation.

4.1.8 Knowledge Transfer

We sought to communicate the outcomes of our research in a number of different ways that would be relevant to community members. The use of video and photo documentation allowed us to make a slideshow of the ecological-monitor training camp

held in 2012 at Ptarmigan River, this was shared with the community at an open meeting and it was suggested that this initial video be built upon as a good research communication tool. Community newsletters with photos and short descriptions of the work have also been submitted and a presentation was made to the elementary, junior high and high school students at the Lutsel K'e Dene School. Another key focus of knowledge transfer is not about the researchers communicating what we deem to be important but the provision of the opportunity for elders to share knowledge with youth, achieved through on-the-land knowledge transfer at the camps. A final review of the thesis will be conducted and a final community report and press release will be made available to the leadership, the school and local wildlife and land management offices

Table 1. *Guiding Practices* for linking Indigenous knowledge and science that could be applied to future research projects

| Practice | Description |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Social License & Government License | Territorial / university licensing and ethics are important but community approval and meaningful involvement is the key to a successful project. Approval by Chief and Council, working with Elders and community members to define research goals and approaches in an ongoing and iterative process. Determine the appropriate protocols, as each community is unique. |
| Contribution & Links to Community Goals | Scoping work to determine community needs and how to best collaborate. Employ a 50/50 work model while in the community, 50% of the time working on community projects, training, capacity building, and just getting to know people and 50% on formal research activities. Training and capacity building should be a central component of the research program. |
| Describing the Ecological and Social Context | Elders and land-users are able to provide a broader understanding of the ecosystem. Listening to stories in formal research activities and also through attending community events or having tea or assisting elders provides invaluable context for interpreting interviews and statements made by research participants. |
| Study Site Identification (Regional & Local) | Elders inform the researchers' understanding of the local geography, ideal camp locations, sites of significance to the research questions and the most appropriate methods for safe travel. It is common for local guides to be hired by many researchers, we propose a model that explicitly acknowledges the value and role Indigenous knowledge plays in the success of fieldwork in remote northern study areas. |
| Respecting the Land / Respecting Cultural Protocol | Seeking guidance about local cultural protocol is key; again, each community is unique. Offering tobacco or conducting opening ceremonies or prayers are common ways to show respect and acknowledge our place and role. Find out what is the best approach – working with a community researcher/translator allows the researcher to learn about local protocol. |
| Camp-based Fieldwork Approach | This inter-generational model is becoming widely accepted as the go to method for community-based work. Providing opportunities for on-the-land experiential learning with elders and youth is a key area of focus. Finding ways to make the research relevant to current challenges in the community and using research as a vehicle to engage youth in cultural and educational activities is mutually beneficial for the researcher and the community. |
| Co-interpretation of Results / Knowledge | All too often researchers come into the community, present a proposed work program, take a number of samples or conduct interviews and people never seem to remember them returning with results. It may be the case that the researchers do return and make a presentation but due to lack of broader engagement in the entire research process and local ownership over the outcomes, people do not make any personal connection to the work and it loses much of its meaning at the local level. |
| Knowledge Transfer | There are valuable mechanisms for knowledge transfer; the mechanism in science is to publish in academic papers and present in academic conferences, however, the primary audience for the research is the community. Traditional knowledge emphasizes the intergenerational nature of knowledge production and transfer so elders-youth dynamics are key for a successful project. Additionally it is important to provide communication materials that are useful to the community, whether it be for policy decisions for leadership, education tools in the school or resource management recommendations for local managers – there should be a tangible output at the community level beyond academic publications. |

5.0 Conclusion

There will always be components of Indigenous ways of knowing and being that will not lend themselves to interpretation through a scientific lens and vice versa. Indigenous communities are in a position where they are tasked with balancing cultural practices and worldview with the modern day challenges of policy-making, resource development and conservation. Finding ways to negotiate the fine line where these knowledge systems and worldviews meet provides knowledge outcomes that are both practical and culturally relevant. Science can become a tool to engage with communities instead being something that alienates people. Instead of scientific methods and data being the focus, the goal becomes reciprocal learning between the researcher and the elders, hunters, youth and community in general. If the researcher can separate themselves from their methods or approach and truly listen to what people say, watch what they do and find ways to help, the outcomes of the work would not only be more meaningful to the community but to the researcher as well – not only in terms of knowledge outcomes but also on a personal level.

Despite a significant presence of published literature on the value and importance of Indigenous led research initiatives, much wildlife / environmental research is still conducted and communicated *to* communities instead of being conducted *with* and *led by* communities. The wealth of knowledge held by elders and hunters about the land, the animals, behavior and movement patterns is unparalleled by scientific understanding of these ecosystems. Approaching our work with humility allows us to see this and truly begin to learn about these places. Making the space for Indigenous research, finding ways

to support what is already going on in the community and stepping aside when there are community driven ideas about how to approach the work is the way forward. This project has been about the interconnection of stories and finding links. After we interviewed elder Madeline Drybones at the Artillery Lake Camp in 2012, we asked her what she really thought about this dendrochronology business and looking at tree root scars. She thought for a moment and said, “Yes this is a good idea; those trees have stories to tell”.

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CHAPTER 4. RESULTS

Denésgliné oral history of caribou movement at *Edacho kue* (Artillery Lake) and scar frequency data from dendroecology analysis

1.0 Introduction

The past few decades of research on barren-ground caribou (*Rangifer tarandus groenlandicus*) has been prompted by concerns about declining populations and increased resource development in the Canadian North. Much of the ecological research on caribou population change has shown that this species experiences cyclical patterns of population decline that are influenced by both natural and anthropogenic stresses (Boulanger et al. 2011, Vors and Boyce 2009, Johnson et al. 2005, Nishi et al. 2010). Caribou management plans have been developed across the North and aim to include broad perspectives from both governments as well as local Indigenous communities.

Given the complex nature of fluctuations in population and range-use for barren-ground caribou herds, it is necessary to draw from diverse sources of knowledge as we develop caribou management policies. Current, biologically focused research on the state of barren-ground caribou is primarily based on data gathered from aerial population surveys and satellite collar data (Boulanger et al. 2011, Nishi et al. 2010). While these sources of information are valuable in painting a broad picture of caribou abundance and movement patterns, gaps remain in formulating a deeper understanding of change, particularly at the local scale. The role of Indigenous knowledge in filling these gaps is not only required through co-management agreements ((BCMPC) 2004) and settled land-claims (Government of Canada 1984) but is recognized as an invaluable tool in understanding

long-term trends and natural range of variation from a holistic, ecosystem-wide perspective where conventional, western approaches may be limited.

1.1 Caribou Crossings as Important Sites

The literature on Denésq̓liné knowledge of caribou movement has highlighted that key water-crossings hold considerable ecological and cultural significance (Kendrick, Lyver, and Nation 2005, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005b). Key crossing sites have been historical gathering places because of the significant increase in caribou use during migration periods (Kendrick, Lyver, and Nation 2005, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005b, Williams and Gunn 1982) but also because of the deep spiritual connection to these places. The most important sites are well known by the Denésq̓liné and many continue to be utilized in contemporary harvesting strategies (Kendrick, Lyver, and Nation 2005). Large water bodies serve as barriers to caribou movement as herds are unlikely to cross large, open expanses of water and tend to cross in areas of shallow water and irregular shorelines (Williams and Gunn 1982). In this respect, key water-crossing sites can be viewed as natural 'corrals' that funnel caribou to the narrows of large water bodies at a small number of sites across their range, a theory highlighted within the scientific literature and also within the oral histories of the Denésq̓liné (Williams and Gunn 1982, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005a).

1.2 The Research Context

The purpose of this paper is to present oral histories from Lutsel K'e elders and harvesters around changes to caribou movement in the Artillery Lake area, specifically at

key-water crossings, to build upon the existing body of published literature on caribou range-use and population health in the region (Kendrick, Lyver, and Nation 2005, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005b, Lyver and Lutsel K'e Dene First Nation 2005). We provide site-specific oral history documentation about the Artillery Lake area and relative caribou range-use over the last 100 years. Traditional knowledge research of caribou movement thus far has been relatively general and overarching, focusing on global population trends (Vors and Boyce 2009), regional / herd level dynamics (Nishi et al. 2010) or focused on the broader expanse of Denésqliné traditional territory (Kendrick, Lyver, and Nation 2005). The oral history analysis presented here is intended to focus on the site-specific scale which remains a gap in the literature and aims to present some specific spatial and temporal information about shifts in caribou range-use at Artillery Lake area, as shown in Figure 5.

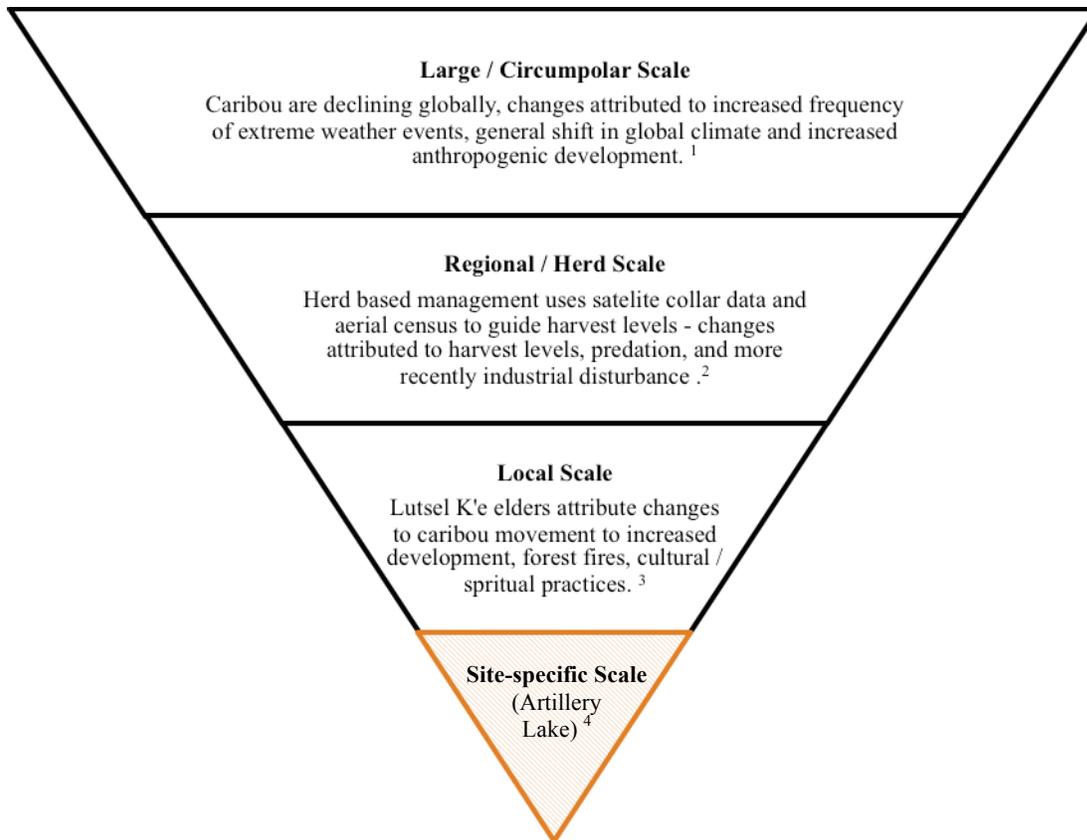


Figure 5. Conceptual framework depicting how this work fits into the existing literature on the state of caribou in Denésq̓liné traditional territory. 1. Globally (Vors and Boyce 2009). 2. Regionally (Boulanger et al. 2011, Nishi et al. 2010) 3. (Kendrick, Lyver, and Nation 2005) 4. This study.

2.0 Literature Review

2.1 Indigenous Knowledge in Caribou Management

Despite the long recognized need and desire to include Indigenous perspectives in caribou management, Indigenous knowledge is often viewed as anecdotal, experiential accounts that do not necessarily bare any factual basis as it is not perceived to be grounded in the replicable scientific method generally accepted within Euro-Canadian culture (Davidson-Hunt and O'Flaherty 2007, Nadasdy 1999). Although there tends to be a general recognition that Indigenous knowledge is valuable, when it comes to using that knowledge or the perspectives of elders and hunters in contemporary decision-making

there tends to be an apprehension about relying on *mere observations* people have made. All too often the stories and observations of elders and other knowledge holders are viewed as subjective accounts that are not seen as valid until they can be *proven* by a western- scientific method that is seen to be objective. Scientific approaches however, are also open to broad interpretation, in the ecological sciences there are not hard and fast rules for understanding dynamic systems and in recent years there has been acknowledgement that reductionist thought may limit our ability to understand and respond to complex ecological change (Ludwig 2001).

There are arguments to be made about the objectivity of scientists themselves, there is a lack of acknowledgement in scientific training and education that everyone comes to the table with a set of biases and assumptions that will impact the outcomes of their research. The western tendency to relate numerical value to fact, something upon which we can make informed decisions, may be one of the central challenges in reconciling Indigenous thought with scientific approaches as it pertains to caribou management.

Another underlying tension that prevents the meaningful inclusion of Indigenous knowledge in caribou management is linked to the history of colonization and the perception that Indigenous peoples and cultures are primitive or uneducated, and incapable of self-governance or management. The basic notion that if Indigenous people could only *understand, integrate, become educated* or whatever term describes the adoption of a western worldview, continues to dominate the broader Canadian narrative of how to reconcile our differences or to *achieve consensus* on complex issues - a term

that seems to represent Indigenous peoples agreeing with non-Indigenous solutions. Although the terminology is vastly different from 150 years ago there is still seems to be ‘an Indian problem’ in this country as non-Indigenous interests related to the development of natural resources or the management of wildlife continue to be met with opposition from Indigenous communities.

3.0 Methods

3.1 Study Area

Lustel K’e, formerly Snowdrift, is the most northerly Chipewyan-speaking Dene (Denésgliné) community in Canada, located on the East Arm of Great Slave Lake approximately 200km east of Yellowknife in the Northwest Territories. The community is only accessible by plane, boat or snowmobile with a population of approximately 350 people. The people of Lutsel K’e only began settling in the community around the 1950’s and 60’s and had previously lived and travelled across large expanses of the region following migrating caribou herds and living in small villages or encampments on the East Arm and at Artillery Lake.

Prior to European contact, the Denésgliné were recognized to be the most widely travelled and populous of all northern Athapaskan language groups with movement that mirrored migrating caribou herds (Kendrick 2005). Despite the more settled lifestyle in recent years, many Denésgliné people continued to hunt, trap, fish and otherwise travel across large distances of their traditional territory, often travelling in areas spanning from

Yellowknife east to the Thelon and from Alymer Lake in the north to Nanacho Lake south of the current town site.

The Artillery Lake area and the Lockhart River that flows from Artillery Lake into the East Arm of Great Slave Lake have been the core of Denésq̓liné territory for thousands of years and these places are deeply intertwined with individual and community identity and spirituality (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005a). Oral history accounts and archeological evidence show that people have been hunting for caribou at Artillery Lake since at least 3000BCE (Macneish 1951; Noble 1981 (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005a). Many Denésq̓liné stories, including “The Lady of the Falls” and “How the Bear Stole to Sun” are suggestive of Denésq̓liné knowledge of the area dating back to post-glacial periods (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005b).

3.2 Research Approach

Local Denésq̓liné protocols guided this work in the collection, analysis and interpretation phases. In 2011, prior to officially beginning the work for this thesis a summer was spent living and working in Lutsel K'e to conduct project scoping and to get to know people and the broader work that was being undertaken in the community. Kinship is a key component in conducting this type of work in a good way and the time spent in the community over the last four years has significantly contributed to the quality of work that has been achieved. Frankly, it is difficult to imagine how someone could complete this kind of project in a shorter amount of time and truly be given the opportunity to reflect in a meaningful way on what is being shared and the complex challenges that the

community is facing. A 50-50 work model was used, spending about half the time on work that was beneficial and ongoing in the community and half on formal research activities including interviews, camps, workshops and meetings. Table 2 summarizes time spent engaging with LKDFN around the research for this thesis since 2011.

Table 2. Summary of time spent working with Lutsel K'e during project.

| Date | Task | Description |
|-------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Summer 2011 | Project Scoping / Community Project Work | Worked on ongoing projects, assisted in developing work plans for the <i>Traditional Knowledge Archive Project</i> and conducted preliminary reviews of existing studies and scoping interviews with elders. Attended annual Spiritual Gathering in <i>Desnethche</i> |
| Summer 2012 | Initial Oral History Interviews | Conducted preliminary interviews with elders and hunters. Assisted with <i>Traditional Knowledge Archive Project</i> Attended annual Spiritual Gathering in <i>Desnethche</i> |
| Fall 2012 | On-the-land Research/Hunting/Training Camp | Coordinated a 7-day field camp at Artillery Lake in conjunction with LKDFN Fall Caribou Hunt. Brought youth and elders together to deliver youth training in ecological assessment and traditional knowledge. Also scoped caribou trail and crossing locations and conducted semi-structured interviews at Artillery Lake. |
| Winter 2013 | Follow-up Interviews | Conducted follow up and verification interviews with elders and hunters who were interviewed in the summer and fall of 2012. Assisted with <i>Traditional Knowledge Archive Project</i> |
| Fall 2013 | Timber Bay Camp | Travelled to <i>?edacho tlazi</i> (Timber Bay) with four community researchers to document site conditions at this key crossing. |
| Spring 2014 | Elders Workshop | We held a verification workshop with the elders to summarize key themes from the oral history analysis. Assisted with <i>Traditional Knowledge Archive Project</i> Attended annual Spring Carnival |
| Summer 2014 | LKDFN School Trip to Edmonton | Hosted nine junior high and high school students and two teachers from LKDFN on the University of Alberta campus for two days. |
| Fall 2014 | Attended Caribou Technical Meetings with LKDFN | In October of 2014 LKDFN requested that I sit in as a technical advisor to some Bathurst/Bluenose East Management meetings. This experience allowed me to further understand the context of Denésoliné knowledge in the larger regional picture of caribou management. |
| Summer 2015 | Final Thesis Presentation | In July of 2015 I visited Lutsel K'e and discussed the final results with members of the Wildlife Committee, Chief and Council and elders and youth who participated in the project. |

3.3 Elder /Harvester Interviews

Between August 2012 and April 2014 nine elders and four harvesters were interviewed in one-on-one interviews, group interviews, on-the-land interviews and group workshops compiling over twelve hours of recorded narratives. Participants were selected based on their intimate knowledge of the Artillery Lake area, since many elders have passed on, it was also necessary to review existing traditional knowledge documentation from the last 20 years of study that has been done with and by LKDFN. This review also informed the development of interview questions and guiding documents. We conducted individual semi-structured interviews, on-the-land interviews and a group verification workshop over a three-year period. In addition to building upon the existing LKDFN knowledge base, this project aimed to increase the capacity of the LKDFN to monitor environmental change resulting from diamond mine development. The research approach followed that defined in previous collaborative research undertaken by the LKDFN. This involves several key steps:

- a) Guidance by Elders' Committee
- b) Hiring and training of local personnel
- c) Initial scoping interviews
- d) In-depth interviews with Elders and harvesters
- e) Verification interviews with Elders and harvesters
- f) Reporting back to Elders' Committee and Chief and Council

An extended stay in the community provided more context and time on-the-land for me to interpret stories and observations of elders and harvesters through informal conversation. This additional time spent in the community also allowed reciprocal

sharing of stories about the land and in this story telling allowed the building of trust and a common understanding of worldview.

Interviews were carried out in five phases to ensure that requirements for collaborative research with LKDFN were met as shown in Figure 6. *Phase 1: Review of Existing Traditional Knowledge*, included a comprehensive review of published and unpublished traditional knowledge work from Lutsel K'e related to caribou population change and movement patterns. *Phase 2: Oral Histories Interviews*, included interviews with elders and caribou harvesters, providing some contextual understanding of individual interviewees' life experience and knowledge of particular geographic areas based on their lived experiences and those experiences of their parents and grandparents passed through oral tradition. *Phase 3: Caribou-Landscape Interaction Interviews* identified more specific knowledge from interviewees about the influence of landscape features on caribou movement and observed changes to caribou movement over the last number of decades. *Phase 4: Site-Specific Caribou Crossing Interviews*, focused on key questions about site-specific characteristics and signs of caribou activity observed during on-the-land interviews at Artillery Lake. Finally, *Phase 5: Interview Themes* allowed for the review of all interview transcripts, associating statements within broader themes common among responses.

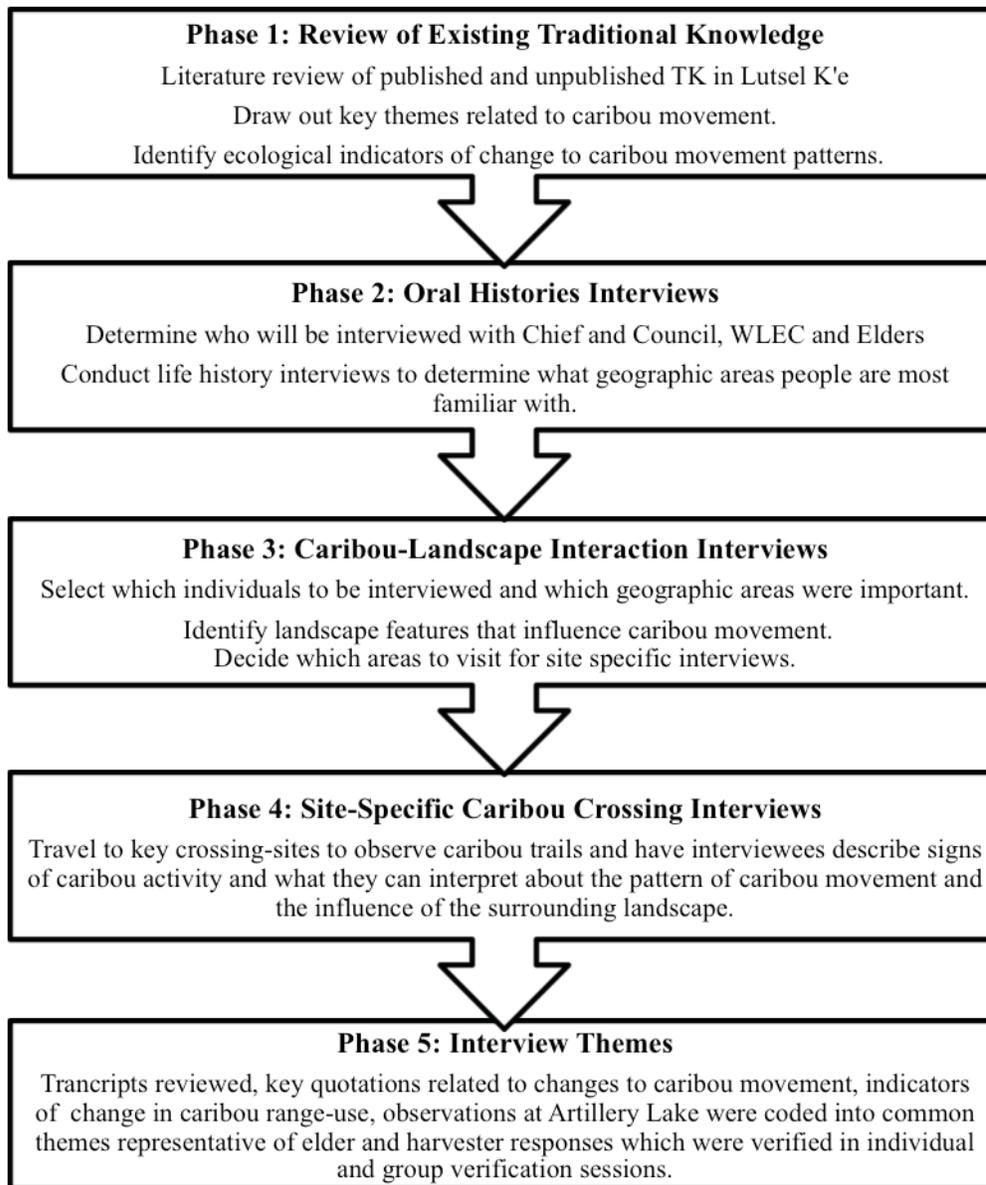


Figure 6. Conceptual framework of interview methods in documenting oral histories related to changes to caribou movement at *?edacho* (Artillery Lake).

4.0 Results

The narratives shared by elders and harvesters about changes to caribou movement at Artillery Lake reflect the historical and contemporary importance of the area and also indicate that recent shifts are outside what would be considered the normal range in

variability. The main themes drawn out from formal interviews, informal conversations and time spent at Artillery Lake are divided into three broad categories: (1) *Importance of Artillery Lake*, (2) *Observed Shifts in Range-use*, (3) *Ecological Indicators of Change*. Sub-themes are also discussed in these sections that support the broader narrative provided by the interviews.

4.1 Importance of Artillery Lake

Many elders and harvesters began by defining the significance of *?edacho* – as being a key to Denésgliné understanding of caribou movement. People have always been able to find caribou at Artillery Lake and there are important protocols for respecting caribou at these sites of cultural and ecological significance. Madeline Drybones, Pierre Marlowe and Jim Fatte comment on the recent changes to caribou movement and importance of *?edacho*:

“There's always caribou on (?edacho kué) Artillery Lake before no matter what time of the year.”

(Madeline Drybones, 2012)

“Caribou always traveled on their trails before, now it's changed.”

(Pierre Marlowe, 2012)

“Yeah it was just, the camp right here. We used to kill caribou right there, they just swim across, that's where they gather. There is always caribou there (?edacho).”

(Jim Fatte, 2012)

It is important to note that elders citing that caribou could always be found caribou at ?edacho no matter what time of year, they are referring to the times during the year when caribou are in area, namely the fall, winter and spring. Not disturbing caribou trails or leaving signs of human activity at important crossing sites is also mentioned in a number of different ways. Pierre refers to the construction of a building near ?edacho that resulted in caribou avoiding that crossing. The cabin was eventually removed from this location.

“There was always caribou and they crossed there (?edacho) and another place called (tthe t’o). That’s why you don’t build cabins by the crossings. They use to cross here but Alex za built a cabin there and the caribou stopped crossing there.”

(Pierre Marlowe, 2012)

Elder, Madeline Catholique shared stories about how other human activities will impact caribou use and identifies how sensitive caribou are to odours produced by human use including smoke and gas.

“Animals don’t like smells of things they don’t recognize like diesel and smoke from camps. Caribou have sensitive nose even around here there’s lots of gas on the ground from ski-doo’s caribou don’t like that.”

(Madeline Catholique, 2013)

4.2 Observed Shifts in Range-use

Elders in Lutsel K’e have been talking about the impacts that mines will have on caribou for many years. The interviews conducted for this study continued to identify this

concern and the more recent observations of a shift in over-wintering location to areas further north and east than historical locations. These observations support those initial concerns from elders about mines disrupting the migration route. Hunters have also observed that caribou are spreading out and travelling in smaller groups compared to in the past and there is less observed use of some of the traditional routes (*?edacho*).

“Yeah they cross right here, ?edacho, and well that’s how, that’s where people used to go there for hunting, just wait for them... they just spear them right here, but none of that happened right now, caribou have moved further east...global warming or there’s too much noise...from the mining companies, the muskox were there for hundreds of years and all of sudden they find them in the bush.”

(Joseph Catholique, 2012)

This comment from Joseph also highlights the integrated nature of Denésqliné knowledge, when talking about changes in caribou use of *?edacho* there is a link made to observed shifts in the distribution of other animal species including muskox. The shift in muskox distribution is particularly significant as there are no accounts in Denésqliné oral history of muskox venturing as far south as has been observed in recent years also noted by Madeline Drybones:

“Muskox would mostly stay up at Thelon River; they never came down to Artillery Lake before. When I was young I use to shovel snow high as this tent, just to get wood, my daughter and me, by the time I was done it’s nighttime. When there was no caribou people would go for muskox on the Thelon River.”

(Madeline Drybones, 2012, Ptarmigan River)

Other observations of changes to climatic patterns and the northerly advance of the treeline are linked to changes in caribou range use, here Pete Enzoe describes the north-easterly shift in the use of key crossing sites from the East Arm of Great Slave Lake (Pike's Portage) to Ptarmigan River at the north end of Artillery Lake:

“Before they used to pass here eh? [ʔedacho]. Yeah, now they keep moving [further north and east]. Yeah a long time ago it used to be here [kache], and it used to be here [further east of Pike's Portage], here [further east], here [ʔedacho], and now its here [Ptarmigan River]. And then the trees growing too, way back when I was growing up the trees were far apart and now it's growing thicker. Yeah the climate is changing.”

(Pete Enzoe, 2012)

Many hunters also discussed the reduced group size that caribou travel in during fall and winter and attribute this and other ecological impacts to industrial disturbance.

“Yeah...for the caribou its, caribou are further east all the time, sometimes they are scattered all over, you don't expect them, but all of sudden they are there. Smaller groups like 10-15 like that, sometimes 2 or 3, it's never been like that before, all the mining companies, they disturb them. Disturb the muskox and the caribou.”

(Joseph Catholique, 2012)

Although previous study focused on the many different factors (i.e. forest fires, spiritual/cultural influences and food availability) that influence caribou movement, the outcomes of these interviews were far more focused on the impacts of mining development as the key driver of recent shifts.

“It only started after they built that mines up north there, Ekati and Diavik. That's the only time it started you know, going all over. Like

they were sick for a while for a good maybe 6-7 years, I notice that because I'm a hunter. But now you don't see that, the bad things that was on them before. Even under the skin, yeah. But now I don't see too much of that, they probably know not to go around the mines anymore or something. They are smart animals, I know that, only one thing happen[s] to them and then they never go back there. You would think that the next one would go there, no I think they've got one mind..."

(Eddie Drybones, 2013)

4.3 Ecological Indicators of Change

Previous work with LKDFN has identified key ecological indicators including individual animal body condition, abundance and diversity of key species, water quality and levels, and vegetation distribution (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005a). These indicators have enabled the Denésq̓liné to understand and share complex information with one another about changes on the land for generations (Parlee, Manseau, and Lutsel K'e Dene First Nation 2005a). Caribou trails have been identified as a key indicator of changes to caribou movement in previous study but the results documented in this study provide an additional layer of site-specific detail.

4.3.1 Caribou Trails

Prior to the last 10-15 years *?edacho*, recognized to be one of the most frequently used crossing sites, was known to have large and heavily used caribou trail networks.

Madeline Catholique relates the width of a well-used trail to the tracks from a 4-wheel ATV (approximately 3.5 feet).

“You can see it in the barrens some trails are wide as a 4 wheeler.”

(Madeline Catholique, 2012)

During the 2013 field visit to ?edacho it is obvious that the trails have not been used much in the last 10-15 years, the vegetation is growing thick over the trails and there are not recent signs of caribou activity at a place that has been the core hunting area for the community in both historical and contemporary contexts. Other elders also talk about the signs of caribou trail use and how that has changed during their lifetimes.

“I know that a caribou trail used a lot will wear the roots down; they even had trails in the sand ridges, now nothing.”

(Madeline Drybones, Ptarmigan River, 2012)

“There’s all kinds of caribou trails but there’s one main road that they all use. The caribou know it.”

(Pierre Marlowe, 2012)

Joseph and Madeline Drybones also point out how caribou trails can be used a sign of caribou activity and again link the observed changes to increased industrial activity:

“Around that place we were at [Ptarmigan River] for caribou, like I said there always been caribou there before the mine has taken place, there is less caribou [now]. That’s probably why the caribou trail you seen was not used as much. Maybe a few will go by, because they are all spread out, they get split up.”

(Joseph Catholique, 2013)

“Caribou trails in winter time are like trails on the land [in summertime] in the muskeg, some caribou trails you can’t see, vegetation has grown on some of the trails that means it’s not being used much. All year round there is caribou around Artillery Lake. It used to be like that. And now the mines are sitting on the caribou trails.”

(Madeline Drybones, Ptarmigan River, 2012)

Madeline talks specifically about her observations at a mine site and the changes in caribou use over a two-year period:

“Around Diavik area we walked around on the land ... Two years later I went back, there were no caribou, they made their trail elsewhere, they are moving further north.”

(Madeline Drybones, Ptarmigan River, 2012)

4.3.2 Other Ecological Shifts

Elders and hunters note other ecological changes that are linked to changes in caribou movement patterns. The key changes mentioned by many community members in formal interviews but also in informal discussion is treeline advancement in the barrenlands,

shrub encroachment in the bush and a southerly range shift of muskox herds. These observed shifts are understood in an integrated way are linked to climatic shifts.

“Its all cuz of the noise, see, like you know even though time to change too, you know animals change too from all this noise I guess, its not as quiet as it used be. Like, you are connected to the land as an animal, like for example muskox, muskox is one of the very...you know muskox has always been there, its from millions of years ago. And all of sudden they start moving south and all that.”

(Joseph Catholique, 2013)

4.4 Dendroecology Results

Initial analysis of the dendroecology data from the 50 samples taken from ?edacho shows a similar data output to the results from the 2006 study by Zalatan et al. with sample locations to the northwest and southeast of Artillery Lake as shown in Figure 7. Given the relatively low number of samples in our study compared to the 2006 work it is encouraging to see this level of consistency, leading to the conclusion that the samples are a good reflection of caribou use of ?edacho during the time period represented (1985-2013).

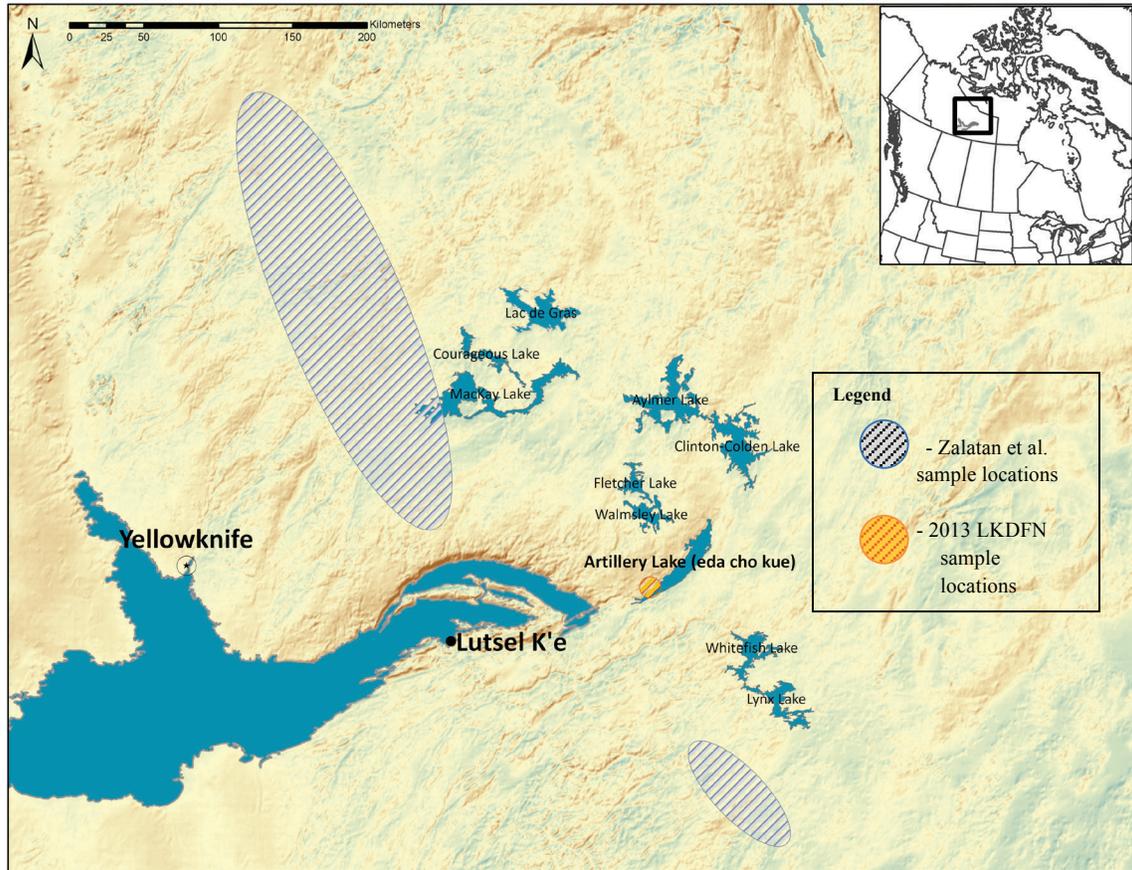


Figure 7. Samples location relative to Zalatan et al. (2006) sample locations.

Figure 8 shows the relative scar frequency from samples collected at *edacho* compared with the relative scar frequency of the samples collected in the previous study. There are similar patterns of increases and decreases in caribou range use between the two studies. There are specifically noted decreases around the 1930's and the 1970's and increases in the 1950's and 1990's. This further supports what knowledge holders from communities across the region have cited to be key periods of population increase and decline over the last hundred years.

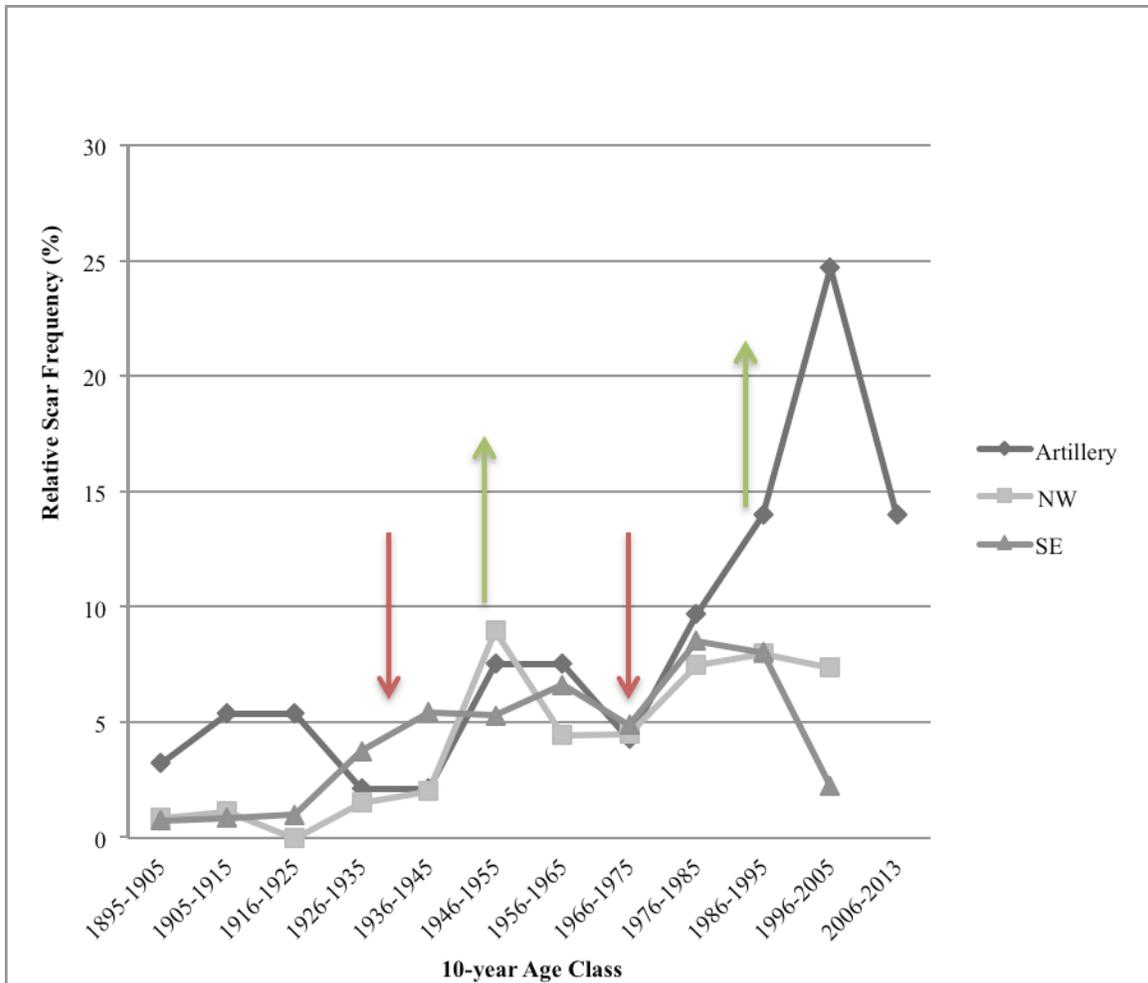


Figure 8. Relative scar frequency (%) by 10-year age class showing samples from Artillery Lake (n=93), and Northwest (n=947) and Southeast sites (n=1044) estimated from Zalatan et. al. 2006.

The oral history results from this study also provide very specific citations of noted increases and decreases that are linked to the dendroecology outputs from firsthand experience and also through stories passed down by through oral history. As noted by one hunter, Eddie Drybones, his father had told him about a time in the 1930's when caribou were scarce around Artillery Lake:

“Do you remember years ago, you probably don’t even know.... before me, the government put out poison for wolves

because caribou was running so low, so they [wolves] killed all the caribou. It might happen again, lots of wolves now. Yeah that was to bring the caribou back up. Back then my dad used to tell me those stories they used to run into wolves in 30 or 40 in a pack, you can't go close to them. That was in 1930's. I wasn't even born then, but just through those stories."

(Eddie Drybones, 2013)

The scanned images of the tree root cross-sections were used as tools for promoting discussion of historical contexts of caribou movement by elders and hunters. An example of time-specific comments made during interviews linked with visible trample scars in Figure 9 shows how dendroecology can be used to engage people in conversations about ecological phenomena. By looking at the tree ring record we can begin to have in depth conversations about what was happening on the land and with the people during those time periods.

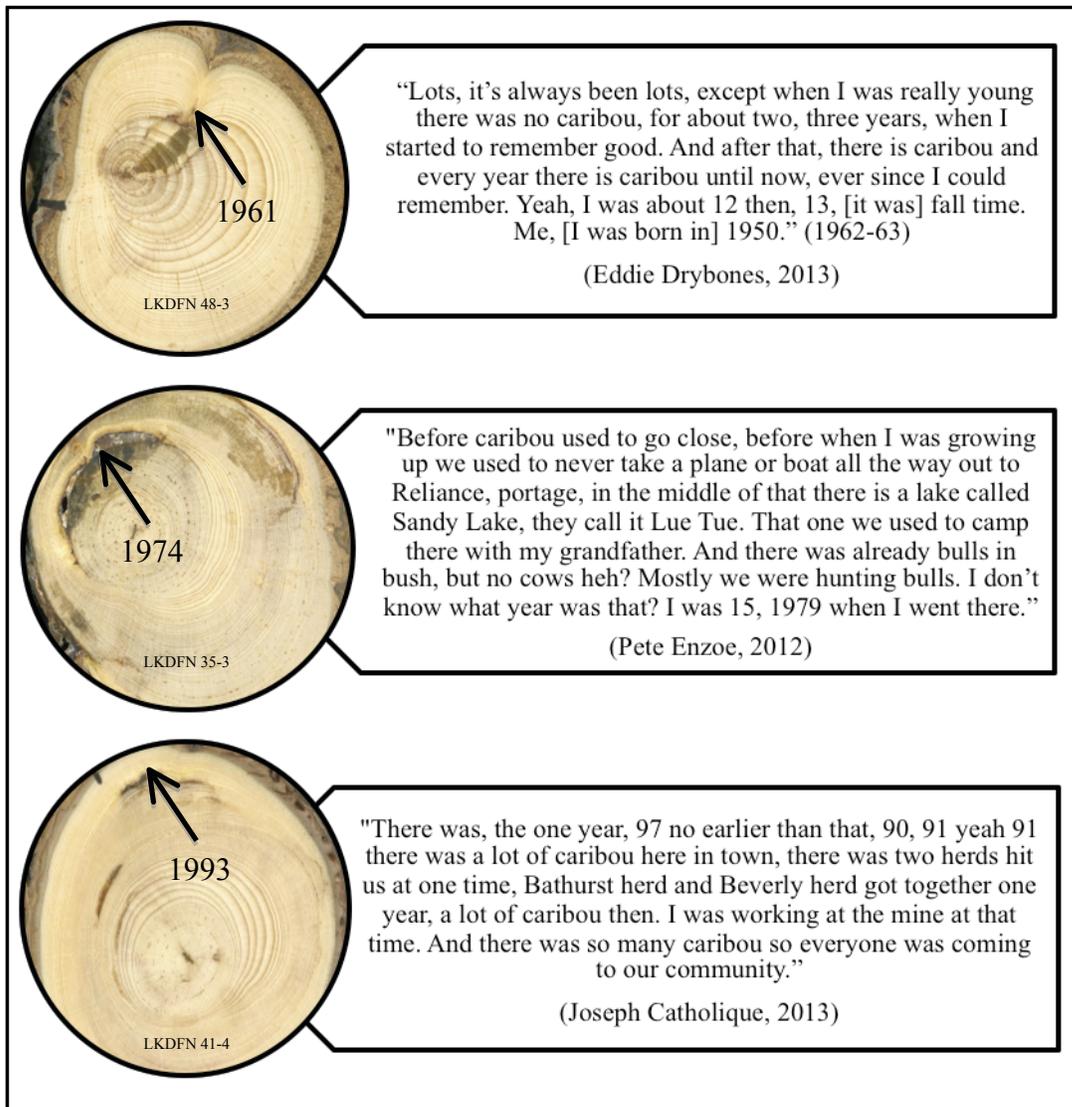


Figure 9. Examples of time-specific hunter’s knowledge shown with visible trample scars on scanned images of trampled black spruce roots from *P. edacho*.

5.0 Discussion

Research on caribou abundance and movement patterns is working to build theories about how and why caribou are changing their migration patterns and what key factors drive fluctuations in population. Factors of key concern are climate change, industrial development, human behaviour and predator populations. There are some conflicting ideas about the difference between range shift and population decline. From my

conversations with elders and hunters there is not a distinction made in Denésqliné understanding of caribou – when the population declines the range contracts and so the observations in range shift are often linked to decline in numbers. When we look at Artillery Lake as the core of the Bathurst and Beverly herd ranges we can understand why the Denésqliné core hunting zone has been in this region– even in times of scarcity people would be likely to find caribou there; however the interviews presented here indicate that this core area is shifting. The stories from the elders are in general consensus that this current shift in movement is outside the normal range of variability from a Denésqliné perspective and is a result of mine development in the last two decades.

5.1 Strengths of Indigenous Knowledge Systems

5.1.1 Place-based Experiential Learning

One of the core components of how we understand Indigenous knowledge is linked directly to the land and specific places. Elders understand ecological shifts in a holistic way, as being connected to the places and people who are part of the stories – this is then one of the fundamental differences between western approaches that view the human as separate from the system, the objective observer. The embedded laws and practices that exist in the stories from elders and hunters are inherently tied to place, which is linked to concepts around holistic understandings of ecological phenomena.

Experiential learning relates to one’s ability to truly understand complex interactions. I believe that you cannot really understand the stories from elders and hunters until you are on the land and in these places. The foundation of Indigenous ways of being and

transferring knowledge is through lived experience. There are Anishinaabe principles around how we come to understand new things, how the land reveals knowledge to us on our journeys in this life, when you are ready to receive that knowledge it will be revealed (Davidson-Hunt and Berkes 2003).

5.1.2 Integrated Knowledge

Elders and hunters are noticing changes in an integrated way – distinctions are not made between individual animal health, herd health, population or movement patterns, these concepts cannot be separated in Denésgliné understanding (Kendrick, Lyver, and Nation 2005, Parlee, Manseau, and Lutsel K'e Dene First Nation 2005a, Spak 2005)

5.1.3 Influence of Industrial Development

Previous research has identified industrial development as a key driver to changes in caribou movement patterns:

“The mines are on the caribou migration route. For me the way the caribou migrate is different. It takes longer for the caribou to migrate to the tree line now that the mines are there. It was not like that before. The caribou used to come to the bush very quickly. It is taking longer for them to come to the trees”

(JF, 2000 in Kendrick et al. 2005:183)

The findings presented here further support the concerns reported by elders and hunters in Lutsel K'e over a decade ago and demonstrate the observed changes that people predicted would happen with increased development activity in the region.

5.2 Linking Denésq̓liné knowledge and Dendroecology

The dendroecology results presented here add to the growing body of evidence that supports the traditional knowledge on historical caribou population and movement. The stories and observations from Lutsel K'e elders and hunters are linked to the dendroecology record of caribou trample scars from Artillery Lake as shown in Figure 9.

6.0 Conclusion

This chapter was meant to present, in a clear way, the oral history, stories and observations from Lutsel K'e elders and hunters so that this knowledge might make a meaningful contribution to the broader understanding of caribou movement patterns in the region. By providing robust documentation of the knowledge of elders and hunters from the Lutsel K'e Dene First Nation it is intended for Denésq̓liné knowledge to be acknowledged in current caribou management and monitoring strategies.

Sometimes the interviews or parts of the interviews are more about the sharing of stories between elders and the translator who is most often close kin – the community researcher is given this opportunity to become so well versed in their own knowledge – going on the land, listening to these stories over many years of research within a wide range of research topics. The research becomes the vehicle for intergenerational knowledge transmission in all phases, data collection, verification, analysis and final reporting in the community. It is important to link research activities to strengthening local Indigenous governance and capacity.

The link with the dendroecology methods and results is mostly focused on how scientific assessment techniques can be used as tools to engage community members in conversations about ecological phenomena. Dendroecology in particular can help to focus conversations around specific time periods. The combined outputs that include photos of caribou trample scars with hunter and elder knowledge can also serve as a communication tool with younger generations about the oral histories in a tactile way.

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CHAPTER 5. CONCLUSION

1.0 Summary

The research was based on four years of collaborative research with Lutsel K'e Dene First Nation. The work involved a secondary literature review and review of unpublished traditional knowledge research conducted by LKDFN over the last 20 years. Primary research activities included oral history interviews, dendroecology sampling and analysis and youth engagement on-the-land through camps that combined research activities and training in scientific methods and traditional knowledge with researchers, hunters and elders.

The research was interdisciplinary, drawing on multiple methods and tools from the natural and social sciences. The goal of the research was to broadly address questions around how Indigenous/traditional knowledge can be better considered in the management and monitoring of barren-ground caribou, particularly in light of concerns around increased development in the region.

I approached this project with the desire to carry out the research in a framework of Indigenous Research. I was particularly interested in engaging in research as a decolonizing process and better understanding how the research process can honour Indigenous ways of being and doing. The guiding principles behind this approach were focused on the following questions:

- Is it possible to do research *with* and *by* Indigenous people while working within the structure of the western academy and using scientific approaches?
- Is it possible to link Indigenous ways of being and doing in western research contexts?
- How can community-based research honour principles of Indigenous Research?

These questions have been partially answered through my experiences throughout this project. I have come to understand that Indigenous ways of being and doing cannot be separated from the research process at a personal level. I am still encountering challenges in navigating the cross-cultural boundaries between the western academy and research in the context of Indigenous knowledge and community-based approaches. I have also become more aware of the additional cross-cultural boundaries that exist between my own cultural understandings as Anishinaabe and the Denésq̓liné knowledge systems that I have been seeking to better understand. In an ideal world Denésq̓liné people would be sole authors of work around Denésq̓liné knowledge systems. At this stage in my career I see the opportunities I have had to work within another Indigenous cultural context to be invaluable and although there are clear differences in ways of understanding and cultural protocols there are also clear synergies in the fundamental ways of being that form the foundation of relationship, reciprocity and kinship.

The fundamental drive behind my interest in the study of ecology and environmental change has been grounded in my desire to understand the function of the natural world from a position of understanding and embracing Indigenous knowledge systems. As a

young researcher who is both *Anishinaabekwe* (an Ojibway woman) and a descendant of Dutch immigrants I have spent my life seeking to better understand my own Indigenous identity, the history of my community and family and the larger history and role that Indigenous communities can and should play in contemporary issues of resource management. My path as a researcher has lead me to question my own identity and seek to understand the history of my family, community and the history of Indigenous communities across Canada. In this way, this research project is not only about asking questions related to the impacts of resource development to the community of Lutsel K'e and the caribou on which they depend but more importantly addresses questions of how Indigenous communities can embrace and implement scientific methodologies while remaining grounded in their own Indigenous knowledge systems and practices.

Key Indigenous scholars including Linda Tuhiwai Smith in her 1999 book, *Decolonizing Methodologies: Research and Indigenous Peoples* have identified the need for Indigenous approaches to research because of the complex and often negative history between outside western researchers and Indigenous communities (Smith 1999). There has been less written about the specific and practical ways that Indigenous approaches can be applied in the context of wildlife management and monitoring. This work sought to address that gap by providing clear examples of how northern ecological research can take an approach that is grounded in local, Indigenous knowledge systems.

It has become evident over the last four years of study that included conversations with community members, family members, other researchers and students, that despite recognition that Indigenous perspectives are valuable and required, there continues to be dismissal of the Indigenous knowledge that does not conform to western ways of understanding. By using the specific example of monitoring changes to caribou movement using Denésgliné knowledge, supported by a western scientific approach like dendroecology, I have identified some ways Indigenous knowledge and scientific research can be linked in ways that honour Indigenous ways of knowing and being – specifically those associated with Lutsel K’e Dene First Nation’s socio-cultural connections to *?edacho kue*.

Within this context of Indigenous Research, the thesis was focused on three core objectives:

1. Determine, through case study research involving dendrochronology and oral history methods, how research involving Denésgliné knowledge and science can be linked to learn more about the social, cultural and ecological significance of regions valued as caribou habitat and by Lutsel K’e Dene First Nation (Chapter 2)
2. Link data from dendrochronology and oral history research to develop a better understanding of how barren ground caribou and Denésgliné use of *?edacho kue* has changed over the last 150 years (Chapter 3-4).
3. Discuss implications of the research for Lutsel K’e Dene First Nation’s involvement in monitoring and management of barren-ground caribou (Chapter 5).

1.1 Linking of Indigenous Knowledge and Science

The linking of traditional knowledge and science has been researched extensively, often highlighting the challenges to working with knowledge systems that are opposing at

fundamental levels of epistemology and cultural approach. By linking deeper ecological and socio-cultural understandings at key caribou crossing sites this work has provided a specific example of how traditional knowledge and science can work complementarily. In this study we were able to weave together stories from two different worldviews and use science as a tool to increase the depth of the oral history conversations. First, we have stories from the elders and hunters about caribou range use, broadly but also at the site-specific scale. Secondly, we have stories from the trees that tell us about caribou use from an ecologic perspective and also help to draw out even more time-specific stories from knowledge holders.

The Denésgliné knowledge perspectives presented from oral histories inform the socio-cultural and ecological understandings of important places, in this instance the key caribou crossing at *?edacho*. The dendroecology informs not only ecological understanding of changes to caribou movement but also provides an opportunity for traditional knowledge to more deeply examined compared to ecological data alone. People know these places at deep spiritual levels and the ‘love of the land’ that Denésgliné often refer to is linked to this deep connection to place and the power of this spiritual connection and meaning for people that transcends the more practical questions being addressed by this work.

1.2 Insights about Barren-ground Caribou and Denésgliné use of *?edacho kue*

Oral history findings from Lutsel K’e demonstrate local understandings of caribou range use and movement shifts around the Artillery Lake area. There has been a noted decline

in the use of *?edacho*, a crossing that has been key for the caribou and Denésqliné people for thousands of years. Many elders noted that there has not been a time in the past when caribou could not be found at *?edacho* during key times of migration. Elders and hunters were asked what changes they had observed in caribou use of Artillery Lake in their lifetimes. They discussed many interconnected themes and observations including changes to the distribution of other species including moose and muskox and other ecological shifts including shrub encroachment at and above the treeline. Preliminary results from the dendroecology analysis support the oral history accounts of caribou use of *?edacho* and show similar patterns of relative abundance and scarcity of caribou as a more in depth dendroecology study in the region (Zalatan 2006).

1.3 Implications for Denésqliné Monitoring and Resource Management

For better or worse science tends to legitimize traditional knowledge. Despite the fact that people have been telling these stories about the impacts to caribou from resource development for a long time, by using scientific tools to support the traditional knowledge of Lutsel K'e elders and hunters we are able to illustrate some key observations and concerns that become more accessible to those working within western knowledge frameworks. In this way science can be a tool in the context of a traditional knowledge study to understand changes to caribou movement. A tool for conversations with elders and hunters about time-specific oral histories and a tool to help communicate traditional knowledge to the scientific community.

2.0 Theoretical Links

Traditional knowledge is often described as a way of being or doing, a way of life, not as a pool of classified data that can be drawn upon (Agrawal 2002). We can only learn and understand these teachings through lived experience and in the places that the stories are bound to. As Debroah McGregor notes in her assessment of working with traditional knowledge in resource management: "... at its most fundamental level, one cannot ever really "acquire" or "learn" TEK without having undergone the experiences originally involved in doing so." (McGregor 2008). The fields of ethnobotany and ethnoecology more broadly have highlighted the value of indigenous knowledge in the identification of species, habitats and have been able to increase western understanding of ecological processes (Turner, Deur, and Mellott 2011). The important of place to contextualizing these stories and knowledge is foundational in indigenous worldview, in order to truly understand the meaning behind particular stories we must be in the places that are referred to. In Euro-Canadian worldview there is meaning to physical places because humans attach that meaning. Indigenous worldview tells us that those landscapes have value, importance and spirit outside of our own perceptions and that we only perceive those lessons when we are ready.

3.0 Next Steps

This research addressed broad questions about Indigenous research and the role of Indigenous knowledge in resource management but also looked at Denésoliné knowledge of changes to caribou movement at Artillery Lake. Although the focus of formal research activities was on this specific question there was a great deal of other information shared

during interviews and time spent in the community over the last four years. The information contained in this thesis and subsequent publications is the information that elders and hunters have shared with the expressed interest that their knowledge be shared with others so that Denésqliné perspectives can be better considered in current caribou management and monitoring.

Chapter 3, focused on the methods used in this research and will be developed into a journal publication for an interdisciplinary audience working in fields of arctic science, wildlife and resource management. Chapter 4, the presentation of oral history information will also be developed into a journal submission and the dendroecology data coupled with time-specific oral histories will be developed into a third submission to a journal that focuses on the links between ecological study and human systems. A summary report has been completed for Lutsel K'e Chief and Council and the Wildlife, Lands and Environment Committee for their use and a final presentation of the outcomes of the research was made in the community. A short press release about the research for radio broadcast was requested as well as a compilation of the many photos and video clips into a video summary of the project that can be housed in the community. In addition to compiling the best photos and videos, all of the project documentation including reports, recordings, and transcripts have been added to the community's *Traditional Knowledge Archive* so that it can be catalogued and accessed by community members and local managers.

4.0 Concluding Remarks

Indigenous perspectives continue to be marginalized in the context of resource management in northern Canada despite settled land-claims and co-management agreements. Western approaches are allotted more legitimacy and the bureaucratic structures that frame wildlife management often inherently exclude Indigenous knowledge. While attending some technical workshops this past fall that aimed at building consensus around management actions for the declining Bathurst and Bluenose East herds I was struck that the conversation happening around the table was the exact same conversation that seems to have been happening about caribou for at least the last 50 years. This research has shown that by using science as a tool to engage people in conversations about what they already know is going on out on the land, knowledge outcomes can be produced that answer interesting research questions but also provide local people with ownership of that knowledge so there is no need for the researcher to get the community on board with the findings; the findings already belong to the people.

One of the fundamental concepts in Dene knowledge of caribou is that you can never really know caribou, that caribou have their own mind. The very concept of researching caribou, of managing or trying to understand them in the detail that biologists seek is not respectful or even possible in Dene knowledge systems. That being said, Dene people do recognize that *human behaviour* needs to be managed to ensure that the caribou will continue to return to the people and they have clear ideas about what changes could be made, including restrictions on development and exploration activity and the continuation of traditional and respectful hunting practices. The economic and political agendas of

territorial and federal governments have always been at odds with the continued relationship between Dene people and land in the north. There are not clear or easy answers of how to resolve these challenges in the short term. The most important thing for me is to see Indigenous youth be proud of who they are, to recognize the power of the knowledge and legal principles that exists within our communities and families so they can become empowered, strong leaders; imagining a future where Indigenous knowledge forms the foundation of our relationship with the land not only for Indigenous people but for all calling this land home.

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APPENDIX I – Consent Form & Information Sheet

CONSENT FORM

Denesoline knowledge of caribou-landscape interactions, caribou trail-use and applications for contemporary ecological monitoring

| | Yes | No |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Do you understand that you have been asked to be in a research study? | <input type="checkbox"/> | <input type="checkbox"/> |
| Have you read and received a copy of the attached Information Sheet? | <input type="checkbox"/> | <input type="checkbox"/> |
| Do you understand the benefits and risks involved in taking part in this research study? | <input type="checkbox"/> | <input type="checkbox"/> |
| Have you had an opportunity to ask questions and discuss this study? | <input type="checkbox"/> | <input type="checkbox"/> |
| Do you understand that you are free to leave the study at any time, without having to give a reason? | <input type="checkbox"/> | <input type="checkbox"/> |
| Has the issue of confidentiality been explained to you? | <input type="checkbox"/> | <input type="checkbox"/> |
| Who explained this study to you? _____ | | |
| I agree to take part in this study: Signature of Research Participant _____ (Printed Name) _____ Date: _____ | | |
| Signature of Witness _____ <i>Only required if you anticipate that your participants will be unable to read the consent for themselves. If so, an impartial witness (i.e. not associated with the study team) must be present during the entire informed consent discussion and is witnessing that the participant understood what was discussed.</i> I believe that the person signing this form understands what is involved in the study and voluntarily agrees to participate. Signature of Investigator or Designee _____ Date _____ | | |

Study Coordinator: Kelsey Jansen Phone Number(s): 780-691-5626/780-492-9633
Principal Investigator(s): Dr. Brenda Parlee Phone Number(s): 780-492-6825

INFORMATION SHEET**Denesoline knowledge of caribou-landscape interactions, caribou trail-use and applications for contemporary ecological monitoring***Research Coordinator:*

Kelsey Jansen
University of Alberta
Department of Resource Economics and Environmental Sociology
1-11 Pembina Hall
Edmonton, AB
Canada T6G 2H8
Office (780) 492-9633
Cell: (780) 691-5626

Principal Investigator:

Dr. Brenda Parlee, Canada Research Chair
University of Alberta
Department of Resource Economics and Environmental Sociology
507 General Services
Edmonton, AB
Canada T6G 2H1
Office (780) 492-6825
email: brenda.parlee@ualberta.ca

Why am I being asked to take part in this research study?

You are being asked to participate in this study because you are knowledgeable about the area around Artillery Lake (*Eda Cho Kue*) and have in the past or currently lived on the land in that area, hunting and observing potential changes to the environment. Specifically we are interested in learning about:

- **Your memory of time spent around the north end of Artillery Lake.**
- **Your knowledge of caribou abundance and change in the population and migration patterns of caribou around the north end of Artillery Lake.**
- **Your understanding and knowledge of how to interpret signs of caribou use in an area and specifically what you notice about caribou trails and what that can tell you about where caribou will be found year to year.**

Before you make a decision, a researcher will go over this form with you. You are encouraged to ask questions if you feel anything needs to be made clearer. You will be given a copy of this form for your records.

Why is this research being done?

I am a student at the University of Alberta and a non-status Anishinaabe from the Dokis First Nation in northern Ontario. I am studying environmental science and the connection between people and the environment in a program called Risk and Community Resilience. My main interests are in:

- the role on indigenous knowledge in resource management and environmental monitoring
- how traditional knowledge systems can integrate scientific principles of ecological assessment and monitoring to produce culturally relevant information to be applied in meaningful resource management decision-making at the community level and beyond.

Resources for this study are being provided by Social Sciences and Humanities Research Council of Canada, Diavik Diamond Mines, Aboriginal Affairs and Northern Development Canada, The Canadian Circumpolar Institute, The Wildlife Conservation Society, The Canadian Northern Studies Trust.

What is the reason for doing the study?

The study hopes to acquire insights on how the knowledge of Lutsel K'e elders and harvesters can contribute to the community's understanding of changes to caribou movement patterns as a result of increased diamond mine development in the region. Final outcomes of this study will be used to develop a set of 'indicators' to be added into the Ni hat'ni Monitoring Framework.

What will I be asked to do?

You will be asked to either participate in a semi-directed interview lasting approximately 0.5 to 2 hours at a venue and time of your convenience. This narrative interview will touch on three main themes:

- Your time spent living, harvesting or travelling around the north end of Artillery Lake;
- Your understanding of relative abundance of caribou in the area at the north end of Artillery Lake in past and in more recent years;
- Your understanding of what factors influence the changes to caribou movement; why are the caribou found in difference places over time?

Ultimately, we are interested in learning about the changes that you have observed in where caribou are found now and in the past, specifically around Artillery Lake. What is the reason for these changes and how can the Ni hat'ni 'monitor' continued change in the future?

What are the risks and discomforts?

There are no expected risks or discomforts that may result from the study.

What will you need to do?

You will sit with an interviewer (Kelsey Jansen) and you are free to tell her anything about your life and experience that you think is relevant to the study.

What are the benefits to me?

You will receive a \$100 honorarium to compensate you for your time.

Do I have to take part in the study?

You do not have to participate in the study, and you can stop the interview anytime.

Will my information be kept private?

In addition to your story, we would like to record your first and last name, your phone number, and date of birth. Your name and other personal information will not be shared with any other person or organization. All of your information will be kept private and secure. We will use a coding system to indicate what you said for any quotations used in publications unless you would like to have your full name included. No data relating to this study that includes your name will be released outside the research team or published by the researchers without your consent.



Resource Economics and Environmental Sociology
Faculty of Agricultural, Life and Environmental Sciences

What if I have questions?

If you have any questions about the research now or later,
please contact:

Kelsey Jansen
5-15 General Services Building
Edmonton, Alberta, Canada T6G 2H1
Tel: 780.492.4225
Fax: 780.492.0268
Rural.Economy@ualberta.ca
www.re.ualberta.ca
Tel: (780) 492-9633
Cell: (780) 691-5626

OR

Dr. Brenda Parlee
507 GSB
Department of Resource Economics and Environmental Sociology
Faculty of Agricultural Life and Environmental Sciences
Faculty of Native Studies
University of Alberta
Tel: (780) 492-6825
Fax: (780) 492-0268

APPENDIX II – Interview Guides

Caribou Movement-Landscape Interviews – August/September 2012

Kelsey Jansen Master's Thesis Project as part of Caribou Monitoring

Interview Questions /Themes

1. How did people know where to find the caribou in the olden days?
2. Why do caribou move the way they do around this area? (Artillery Lake (*edacho kue*) /Whitefish Lake) How does the way the land looks affect how the caribou travel (eskers, shape of shoreline, type and amount of trees, etc.)?
3. Artillery Lake is an important site for people and caribou – are there other sites like this that have been important for caribou for a long time?
4. What sorts of changes have you noticed in the places where caribou travel?
 - a. Last 5 years
 - b. Last 10 years
 - c. Last 15 years
 - d. Before the mines
5. Are the mines affecting the places caribou go?
6. Are there other things that people are doing or that happen naturally that are affecting where the caribou go?
7. Do caribou always go to *edacho kue*? (can people always find caribou in that area?) Do you remember a time in the past when the caribou were not there? Why might this be?
8. Do people look at caribou trails to tell if an area is important for caribou?
 - a. What do you call a caribou trail?
 - b. Is there a different word for old caribou trails and new/less used ones?
9. Is this place a good spot for a cabin to be built? Will it also be good for a field camp (like the Fire Effects Camps that were done before – training youth in TK and Science?)

Caribou Movement at Artillery Lake

Interview Questions

January 2013

KJansen

Semi-directed interviews will be conducted lasting approximately 0.5 to 2 hours at a venue and time of your convenience. This narrative interview will touch on three main themes:

- Your time spent living, harvesting or travelling around the north end of Artillery Lake;
- Your understanding of relative abundance of caribou in the area at the north end of Artillery Lake in past and in more recent years;
- Your understanding of what factors influence the changes to caribou movement; why are the caribou found in different places over time?

Ultimately, we are interested in learning about the changes that you have observed in where caribou are found now and in the past, specifically around Artillery Lake. What is the reason for these changes and how can the Ni hat'ni 'monitor' continued change in the future?

Guiding Questions

1. How would describe the land around Ptarmigan River? (site description)
2. Can you tell me about your time spent living, working, harvesting or travelling around the north end of Artillery Lake (Ptarmigan River)?
3. What do recall about times when there were lots of caribou or no caribou? When was that?
4. What do you think about the samples of tree roots we took?
5. Why do caribou use different areas from year to year? Can you tell where is the best place to find caribou?
6. What ways can the Ni hat'ni / Wildlife Committee monitor changes to caribou migrations?
7. Is there a way to say 'indicators' in Chipewyan?
8. Are there stories about the NHN?
9. What is the role of NHN in the future?
10. How do you see LK 'managing' or protecting the land in the future?